akina

Getting better can be fun.

Mai Watanabe

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ABSTRACT

Approximately 1.71 billion people have musculoskeletal conditions worldwide. To solve this problem, at-home physical therapy has been used as an effective treatment and rehabilitation. However, long term therapy on a daily or weekly basis is a great motivation challenge. I use several motivating concepts to provide additional options and personalized affordances to motivate individuals on a daily and long-term basis. I suggest several incentive tactics and strategies that can be employed in rehabilitation with this thesis and practice project. By using various experiments, design methodologies, and substantial research, I investigate several proposals to improve patient motivation during at-home physical treatment. The user can operate video games, interactive stories, and social media while performing therapeutic movements using a revolutionary technology connected to this application. This gamified interaction attempts to boost motivation for daily use while also assisting with self-perception of movement and progress.

ACKNOWLEDGMENTS

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PARTNER

I collaborate with Akina, which is a digital healthcare spin off project in the making that aims to develop solutions to support rehabilitation patients. The idea comes from the statistical numbers. Only 20% of physiotherapy patients maintain their daily exercise routine. This proves that patients struggle to keep up with their prescripted daily physiotherapy exercises. The reasons vary, but the Team of Akina focuses mainly on the lack of motivation the patients have. The main motivation that is currently in focus for the patients is to make progress and to get better. Akina wants to help these patients to gain back their health by offering visual and dynamic support that's provided an enjoyable and challenging environment. Their answer to this problem is an interactive software which entertains and reacts to patients during their exercise routine. At the moment they have a demo version where you can click 4 buttons. With one button you access a page where you can see yourself exercise and the quality of your execution, you can choose how a story continues by choosing the answers through 3 exercises, through the other button you enter a page where you can control a car racing game by doing 2 exercises, and in the last page you can scroll, swipe and like through instagram while doing exercises. Their goal is having a wide selection of xbox cloud games, interactive stories and social media with which the patient can interact with.

RESEARCH

2.1 BACKGROUND RESEARCH

2.1.1 What is Orthopedic Physical Therapy

Physiotherapy is a branch of the health professions that deals with the prevention, treatment and rehabilitation of patients suffering from congenital or acquired diseases or dysfunctions in the musculoskeletal, neurological and visceral spheres through a variety of therapeutic interventions, such as: physical therapy, manual/manipulative therapy, massage therapy, postural therapy, kinesiotherapy and others. The aim is to restore, maintain or promote health, and reduce or free the patient from pain.[1] There are different specialty areas in the field of physical therapy but the type of therapy we focus on for our project is orthopedic physiotherapy. This is because it is the most commonly used type of therapy. The goal of this field of therapy is to treat conditions affecting the musculoskeletal system, which consists of joints, muscles, bones, connective tissues, ligaments, and tendons. There are many injuries and conditions that affect the musculoskeletal system, for example post-operative conditions, tendinitis, bursitis, ligament or muscle strains and fractures. These conditions can cause pain, loss of strength and limited range of motion. Through a diagnosis of the patient's condition a physiotherapist can determine the appropriate movement diagnosis needed to create a treatment plan. The treatment includes therapeutic care and education. Patients get educated about their condition or injury to avoid further worsening or injuries. [2]

2.1.2 Definition of the Patients

Orthopedic Physical Therapy is the most commonly used type of therapy because it treats almost any condition or injury that affects the ability of movement and the quality of life. People who profit from this type of therapy are very diverse and come from different backgrounds and have individual motives. In the field of Orthopedic Physical Therapy there are specializations that go more in depth into a specific patient population.

This type of therapy can be a complementary or primary treatment for conditions such as arthritis, bursitis, cancer, frozen shoulder, knee instability, joint pain, limited range of motion, lower back pain, lyme disease, lymphedema, muscular dystrophy, parkinson's disease, plantar fasciitis, scoliosis, spinal tenosis, stroke, effects of pregnancy and childbirth and many more.

A sports physical therapist can assist athletes in moving correctly in order to avoid injuries. They can also aid in the recovery of athletes who have sustained sports related injuries.

A physical therapist that specializes in elders can assist their patients in improving their balance and preventing falls. They can also aid in the recovery of elderly adults who have had knee or hip replacement surgery, as well as the maintenance of strength and mobility as they age. [3]

The target group for Akina are patients between the ages of 18 and 65 with a musculoskeletal condition. The target group has been determined due to the statistical numbers that the research team of Akina has established. It has been found that musculoskeletal conditions and injuries are mostly common in people of the ages 15 to 65. (Figure 1)
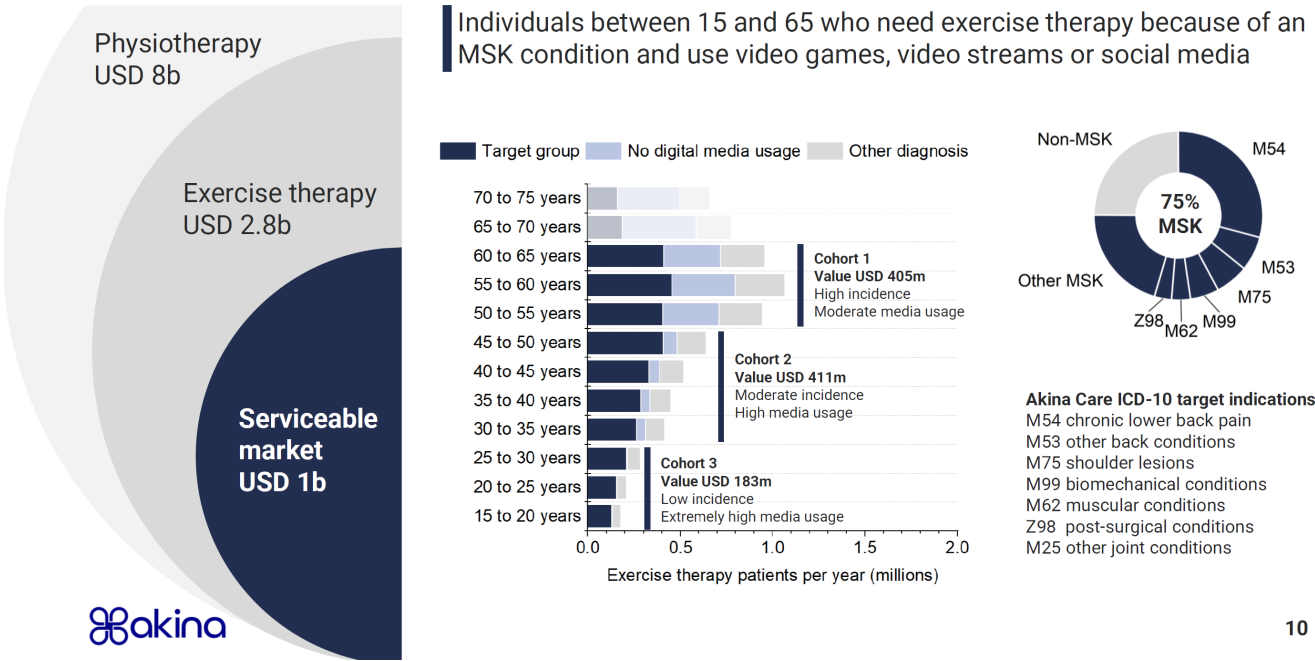
Figure 1. Age structure and ICD indications, Akina research Team

2.1.3 Current method

The therapeutic methods used in the field of Orthopedic Physiotherapy vary, depending on the condition of the patients. There are a wide variety of therapeutic modalities that can include exercises, usage of assistive devices and patient education. Treatments can have a passive modality or an active modality. Passive modalities mean that the physiotherapist gives the patient a treatment, for example massages, acupressure, heat packs, mobilization and machines like ultrasounds, interferential, TENS, laser, and traction. [3]

2.1.4 Active Modality Adherence

When a patient is required to do movement autonomously as part of their physiotherapy treatment, this is known as an active modality. This is the mode in which we're most interested. The term "active modality" refers to a patient's requirement to conduct exercises on their own, frequently on a daily basis. Patients who execute the exercises as advised are much more likely to achieve their goals and have a larger improvement in physical function.[4] A large number of patients follow their prescribed home program inadequately, according to research estimates. In general Musculoskeletal conditions non-adherence to a home exercise program has been found to be as high as 50-65 percent. [5] The patients mostly get a demonstration of the exercise plan in person and then get a paper with the written instructions (Figure 2,3), sometimes with images. Some patients use apps or online videos to help them remember how to execute the exercises correctly. After talking to
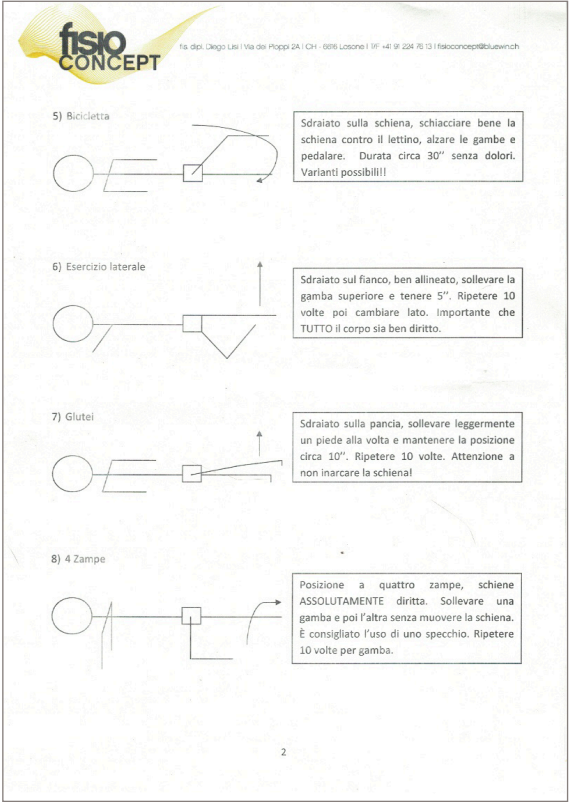
Figure 2. Instructions for a patient with back pain

Figure 3. Instructions for frozen shoulder. Facebook group "frozen shoulder support Group"

a physiotherapist specialized in sports physiotherapy, and manual therapy, he gave me an example of an exercise plan for a patient (Figure 4). It's an excel file which instructs the patient on what exercises they should to, how many of them and the goal of the exercise.

In 2015, a heterogeneous group of 29 patients with low back problems were studied to find out what the challenges were for adherence to home exercise programmes. [6] The patients interviewed in the study described a range of problems. Some patients felt overwhelmed by the number of exercises. Instead of the stated ten exercises, they would rather do only three to four. Patients gave up doing the exercises when they noticed an increase in pain when doing them or when they did not see any results. Some were afraid of making mistakes in the exercises if they did them alone because they feared more harm than good. The need for guidance and support was frequently mentioned. Some said they had difficulty with the exercise because they were bored. Patients who participated in this study also said they found it difficult to contact medical providers in emergencies. Some doubted that the therapy was effective. Constant discomfort and restricted movement can lead to despair for those affected, and they often lack a support structure. Patients in the study said that a personal coach, available at short notice if needed, and a support structure would help them to better persevere through therapy. Others said they needed a distraction, such as music or television, to keep them going through the exercises, while others said they preferred to distract themselves with video games. The video g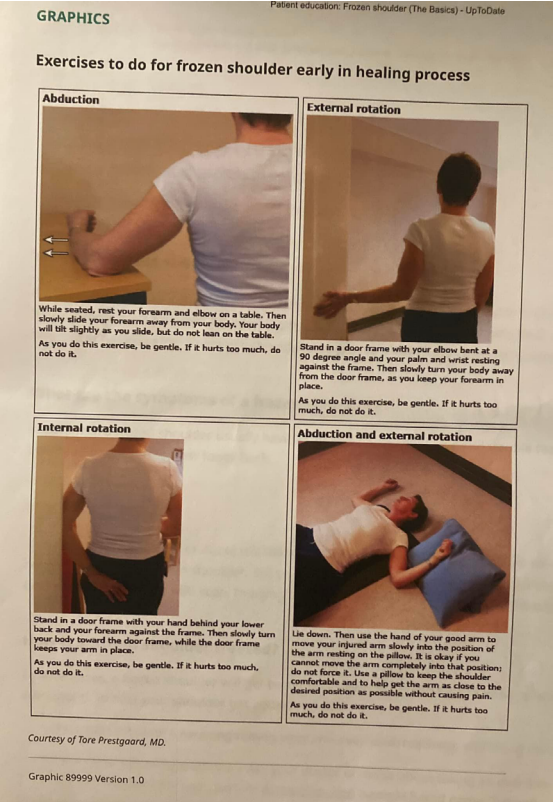ames were most appealing to the younger generation, while the older patients did not like the idea. Patients would also prefer a dynamic visual model over static photos or verbal instructions to help them correct their position. They also indicated that they needed feedback on their performance (correction, encouragement) as well as support from caregivers, communication with others dealing with the same condition, and reminders to exercise from real people rather than digital notifications. As digital services cannot replace actual encounters with healthcare providers, it is important to remember that while Akina can support a patient's recovery, it is not intended to be the primary treatment.

2.1.5 Akina AI Software

The Software developed for Akina is an innovative gamified therapy solution that involves video games that are controlled by the user's movements. Because of the ability of engagement during rehabilitation activities, this interface allows the patient to control a gamified training program with their body. The technology behind this movement-based interface includes a proprietary algorithm that translates live images from devices' cameras into commands. The software can deliver data captured via live video straight to the connected device for monitoring and assessment. The informa-

Programma allenamento personalizzato

	Massimale	Ripetizioni/carico	Serie	Pausa	Obiettivo
1. Squat isometrico	3'25"	2x2'44"1x2'54"2x2'44"	5	3-4 minuti tra 1 serie e l'altra	Qualità di contrazione/forza assoluta
2. (Squat isometrico alternativa)	3'25"	1x2'44"1x2'54"1x2'44"	3 o 4	1'-1'30" tra 1 serie e l'altra	Capacità recupero/ipertrofia/resistenza
3. Jump Squat	32	1x25/1x26/1x25	3 o 4	1'30"-2' tra 1 serie e l'altra	Resistenza/qualcosa di ipertrofia
4. (Jump Squat con 15-20 kg)	10 o 12	8 o 10	3 o 4	40"-1' tra 1 serie e l'altra	Capacità recupero/ipertrofia
5. Jump Lounge	18 per gamba	1x14/1x15/1x14	3 o 4	1'-1'30" tra 1 serie e l'altra	Capacità recupero/qualcosa di ipertrofia/qualcosa di resistenza
6. (Jump lounge con 10-15 kg)	10 o 12	8 o 10	3 o 4	40"-1' tra 1 serie e l'altra	Capacità recupero/ipertrofia
7. Squat monopodalico	23	1x18/1x19/1x18	3 o 4	1'30-2' tra 1 serie e l'altra	Resistenza/qualcosa di ipertrofia
8. (Squat monopodalico con 10 kg)	10 o 12	8 o 10	3 o 4	40"-1' tra 1 serie e l'altra	Capacità recupero/ipertrofia
9. Leg Curl (ischiocrurali)*	10 o 12	8 o 10	3 o 4	40"-1' tra 1 serie e l'altra	Capacità recupero/ipertrofia

*se trovi un posto tipo una ringhiera dove puoi legare il theraband mettiti sdraiato sulla schiena con un capo del thera alla caviglia, da gamba estesa o quasi tira verso il basso piegando solo il ginocchio. Regola l'intensità lasciando più o meno in tensione l'elastico.

Allenamento sull'arco della settimana

	Esercizi	Carico singolo allenamento
Allenamento 1	1, 7, 9	medio basso
Allenamento 2	4, 6, 8, 9	alto
Allenamento 3	2, 3, 5, 9	medio alto

Dopo ogni allenamento stretching per i vari gruppi muscolari (quadricipite, adduttori, ischiocrurali, gastrocnemio e soleo (polpaccio)). Tieni per 40" e se hai voglia falli un paio di volte.

Prova con il sacco da montagna con i kg proposti, regola il peso in base a quante ripetizioni massimali riesci a fare (dovrebbero essere idealmente 10).
Prendi l'80% delle ripetizioni e fai 3 serie. Attenzione ai dolori al ginocchio, devi sentire affaticamento ma non dolore. Se è il caso riduci il peso.
Inizia con serie da 3 dove la dicitura è di 3 o 4 e con le pause maggiori (es. 40"- 1' inizi con il minuto). Nella progressione vai a stringere prima le pause e poi aggiungi le serie.

Figure 4. Instructions for a patient with rupture of the anterior cruciate ligament of the knee, Luca Paratore

tion is utilized to guide the therapy session in order to achieve the best results. Currently, a third person is required to set up the games for each patient separately, and so the patients are unable to complete this activity independently. Only 7 patients are currently benefiting from this technology due to these restrictions. The goal is for patients to be able to insert their own programs. A database of standard exercises for musculoskeletal conditions and injuries is required for this purpose. The service should replace the role of the third person who is now needed and engage with the patient so that they can work together on their recovery. The gamification and entertainment components are significant factors which might allow the patient to keep his motivation high to continue and complete the therapy, assuring the successful execution and adherence of the therapy.

2.1.6 Designing for Motivation

Motivation is an important aspect of rehabilitation and is commonly used as a predictor of success. Several factors can affect patient motivation and, as a result, enhance exercise compliance. Patients who perform their prescribed exercises on a daily basis recover considerably faster than those who do not. Chronic muskoloskeletal disorders or injuries are prevented, alleviated, or fully treated as a result of these methods. However, the repetitive nature of the exercises, as well as the fact that this treatment must be practiced on a daily basis, causes patients to lose motivation with time. Patients are more inclined to follow their treatment at home if it is entertaining, which has the added benefit of empowering people to take care of their own health, enhancing health literacy, and increasing patient engagement. [7]

2.1.7 Designing for Emotional Support

Chronic conditions have been linked to the onset of depression and anxiety symptoms. Anxiety and depression symptoms have been demonstrated in studies to impair patients' capacity to control their illness, quality of life, and overall health. The investigation of factors that may trigger anxiety and depression symptoms in chronic patients, while respecting their personalities and identifying other underlying causal factors, as well as the formation of a protective framework for those patients, are critical factors in allowing them to adjust their lifestyle to the limitations imposed by their disease while maintaining a high quality of life.[8]

There are many interventions that have been implemented to improve the psychological wellbeing of chronic patients. Recent re-

search has revealed a strong link between social and emotional support from others and improved health. Support groups can be very beneficial because of the gaps they can fill in patients' support requirements and the shared experiences within the group. In contrast to declining support from exhausted family and friends, one qualitative study in cancer support groups emphasized the distinctive function of such communities as sources of available companionship, information, and acceptance.[9] Some approaches, in addition to support groups, focus on teaching fundamental psychosocial skills and developing networks of support (e.g., cognitive behavioral therapy).[10]

2.1.8 Related Work

In health, mobile and wearable interfaces are becoming increasingly common, whether for simple monitoring or as rehabilitative interfaces. However, gaming-based physiotherapy interfaces are still uncommon, and related work on the subject is therefore limited. The topic of gamified physiotherapy is mostly discussed in research studies, but a functioning application is apparently still missing. Applications used in the field of physiotherapy consist mostly in assisting and instructing the users on their programm. Although exergames, which is gamified therapy, exist, they mostly focus on different subject mathers, such as fitness (for example the Wii Fit), ADHD (EndeavorRx) or Dementia (Dividat Senso).

Dividat Senso   Through a clinical study Eling de Bruin has found that cognitive motor training improves both cognitive and physical skills in dementia patients with severe cognitive impairment. Eva van het Reve, a former ETH Zurich doctoral student, PhD supervisor Eling de Bruin and another doctoral student have launched the spin-off project Dividat in 2013. The Senso training platform was born as a result of the development of fun activities to motivate people who were already suffering from physical and cognitive impairments to participate in training. A screen with game software and a floor panel with four fields that detect steps, weight displacement, and balance make up the platform (Figure 5). Users attempt to perform a sequence of actions with their feet as seen on the screen, allowing them to simultaneously train physical movement and cognitive function. Because the fitness game is also entertaining, it is simpler to persuade the subjects to practice on a regular basis. [11]

Gabarello   Gabarello is an extension of the Lokomat, which is a powered gait orthosis that automates the guiding of the legs of patients with walking disabilities on a treadmill. The system enables gait therapy for children and adults, relieving therapists from manual treadmill training (Figure 6). It also enables more efficient therapy. Gabarello uses the data gathered from the Lokomat to give an augmented feedback module to support patient motivation through challenging and interactive functional feedback in virtual environments.[12]

Physiotools

Physiotools has been named by a participant of my survey about patients of physiotherapy. Physiotools can be used by physiotherapists and patients. It has a database of exercises commonly used for physical therapy. The physiotherapist can create a client and assign them specific exercises, for every exercise a video and an editable text is available. The patient then has their exercise plan on their application (Figure 7). The patient can see what exercises he should do, how many and get instructions on how they are executed. The user has to manually insert the amount of exercise he has done to get feedback on how actively he has been exercising.[13]

Kaia Health

The app Kaia Health offers exercises against back pain and treatment for Chronic obstructive pulmonary disease (COPD). The smartphone camera placed in front of the user films the exercise sessions. A computer vision algorithm on the start-up's server compares the ideal of the exercise with the user's performance (Figure 8). She or he immediately receives suggestions for improvement.[14]
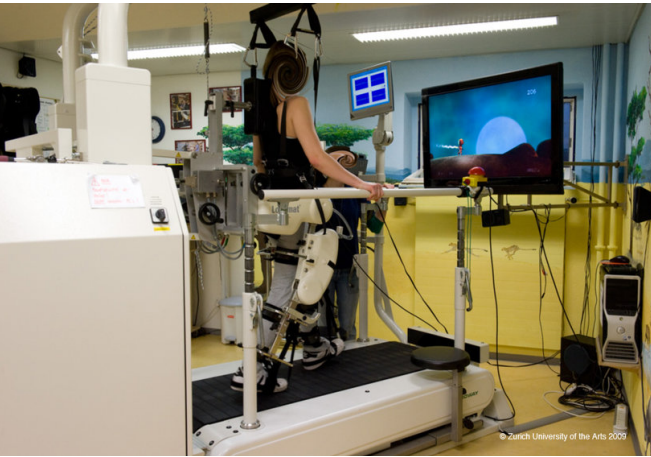

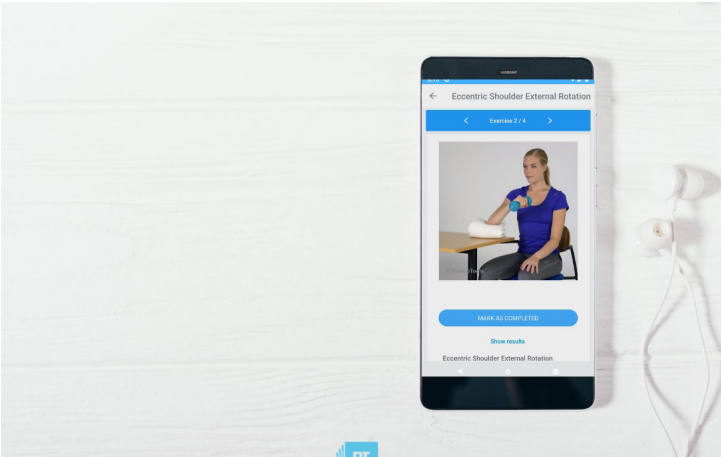
Figure 5. Dividat Senso

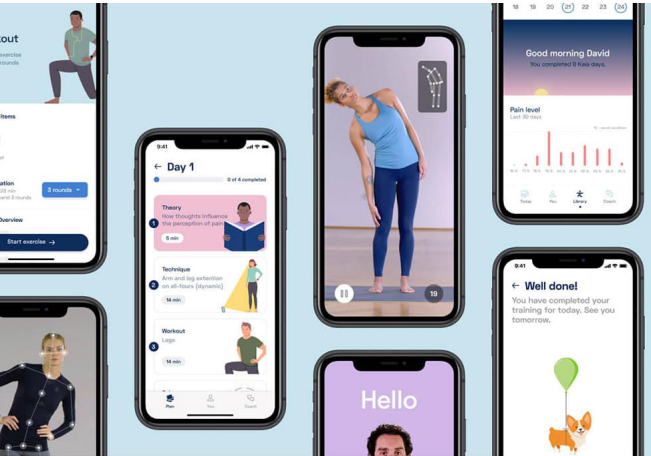Figure 6. Gabarello

Figure 7. Physiotools

Figure 8. Kaia Health

2.2 Research Question and Hypothesis

How might I design methods to help improve motivation during physical rehabilitation?

How can I guide and support the patient through the rehabilitation process?

How might I design methods that enable people to take control of their own health throughout rehabilitation?

2.3 Methodology for Investigation

2.3.1 Exchange

I aim to speak with professionals in the field of Orthopedic Physical Therapy in the context of active rehabilitation during my research period. First and foremost, I must comprehend what constitutes the prescribed physical therapy exercises that are used to rehabilitate various conditions by strengthening muscles and increasing balance or range of motion. I'm hoping to learn more about the rehabilitation activities and process by speaking with physiotherapists. In addition, I intend to interview people with musculoskeletal disorders or injuries in order to have a better understanding of their conditions and any treatments they have already attempted. I'd like to learn about their biggest challenges, both physically and psychologically, as well as their motivation and ambitions. I'll be able to propose the correct ways to reduce these difficulties by identifying their obstacles to adherence of the prescribed exercises.

2.3.2 Personas

I created different types of personas through talks with patients and physiotherapists. These personas have goals and characteristics that represent a larger user group.

Through interviews of patients I investigated behavior patterns, goals, skills, attitudes, and background information, as well as the environment in which the patient operates. I will add fictional personal details to ensure the anonymity of the participants. The information I gather from patients individually make up the qualitative data. Through quantitative data I will adjust the personas to make each of them more realistic. This method will help me to gain a perspective similar to the user. I might be able to better deduce what a real person requires by thinking about the needs of a fictional persona. The more I interact with user personas and view them as real people, the more plausible it is that they will be included during the design process and that I will want to develop the greatest product for them.

2.3.3 User Journey

The user journey assists me in better understanding the specific process that a patient goes through during rehabilitation. The sequence of activities assists me in determining my project's emphasis. By having an informal dialogue with patients of various diagnoses and ages, I will describe their journeys. The user journey should replicate the process that patients go through in real life, including their thoughts and feelings. The journey begins with a diagnosis, continues with a therapist consultation, and concludes with the patient's present condition. I will be confronting the user journeys with physical therapists, who usually treat the conditions the patients in question have, to understand if these experiences are less or more common and realistic.

Figure 9. Persona and User Journey of Julia

Left Panel (Alex)

SCENARIO

Alex, 48, works as a project manager at a large advertising agency. These days, he finds little time to exercise between the job and taking care of his two kids at home. For the past 5 years, Alex struggled with recurring episodes of lower back pain. He has tried physiotherapy at a local practice, then switched to a gym that had more flexible opening hours but was frustrated by the extra time for the commute. He is now looking to start independent physical therapy at home.

GOALS

He wants to feel more guided and less alone while exercising at home.

USER JOURNEY - PROCESS/PLATFORM   Alex

STAGES	DISCOVERY	INTENTION	DECISION	ACTION	POST-ACTION
USER ACTIVITY	Alex does some research to approach the physiotherapy at home alone and finds Akina. There he inserts the area of the body where he feels pain. The Algorithm suggests an exercise plan for him.	Alex is happy to see his exercise plan on the home page and all the possibilities he has with this application. This way he feels less alone and unattended.	He chooses to do the guided session.	He starts exercising by watching an instructional video on the left side of the screen. During the exercises he can see himself, the quality of the movement, the repititions and recieve live feedback.	After the session he can see the session summary. He is a bit confusing by some terms but overall happy to see how he has done.
GOALS	Guidance on exercising at home.	Start exercising with the guidance of Akina.	Do the exercises correctly.	Understand how the exercises work.	
OBSTACLES	Too many different applications.	Exercise plan not as accurate as with physiotherapist.	Not clear what that means.	Instructions unclear	Unclear data.
IMPROVEMENTS					Explanations or using different terms.

Figure 10. Persona and User Journey of Alex

Right Panel (Susanne)

SCENARIO

Susanne left as a partner at a law firm two years ago with the goal to travel the world. She has since spent time with friends in some of the most spectacular places in the world. About half a year ago, Susanne saw a doctor because of strong shoulder pain and swelling in the shoulder area. She was diagnosed with rotator cuff tendinitis and received painkillers. After resting the shoulder for some time, the swelling and pain disappeared. Since then, she started with gentle stretching and strengthening exercises for the shoulder.

GOALS

She downloads the application out of curiosity, but doesn't have any expectations.

USER JOURNEY - PROCESS/PLATFORM   Susanne

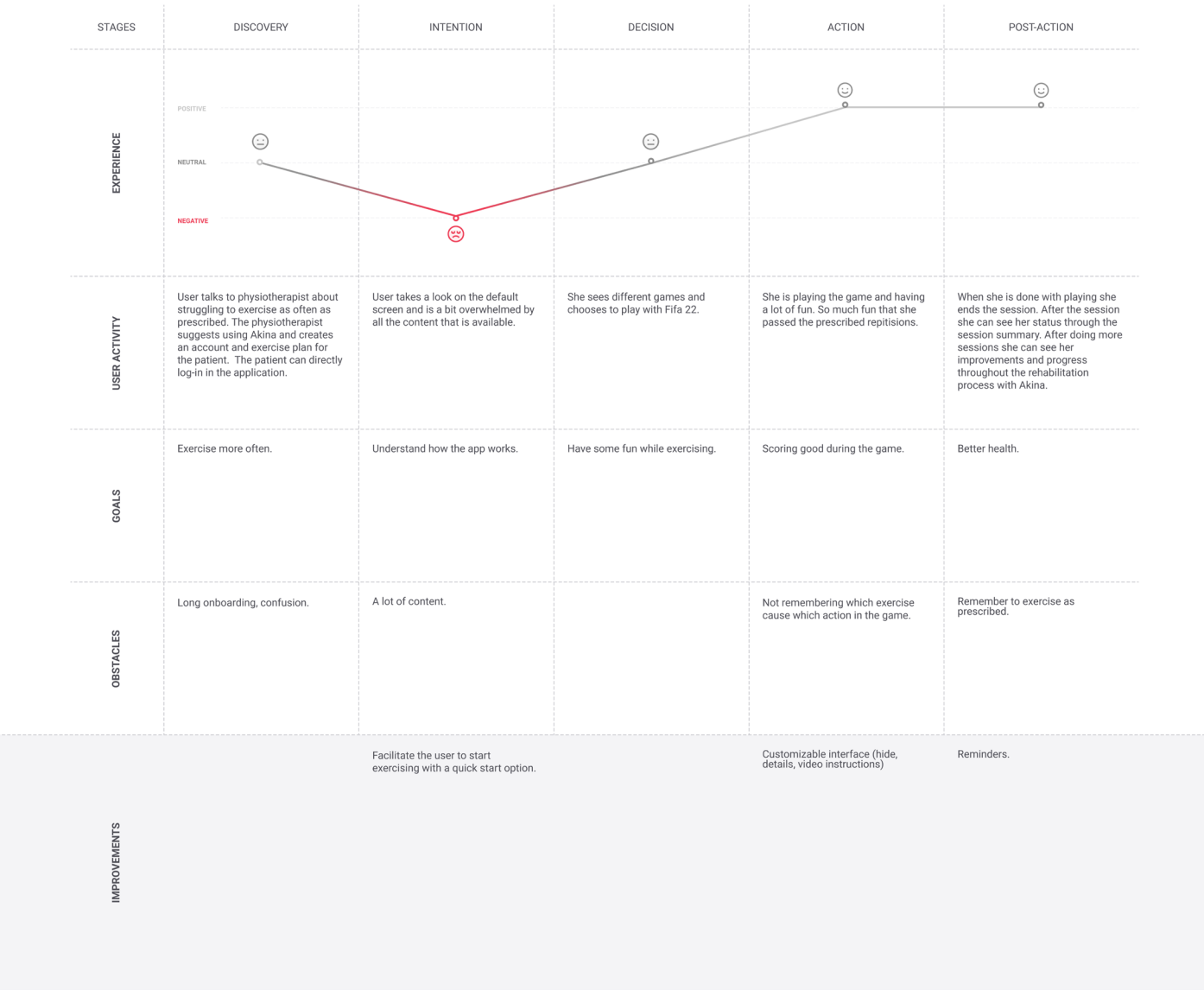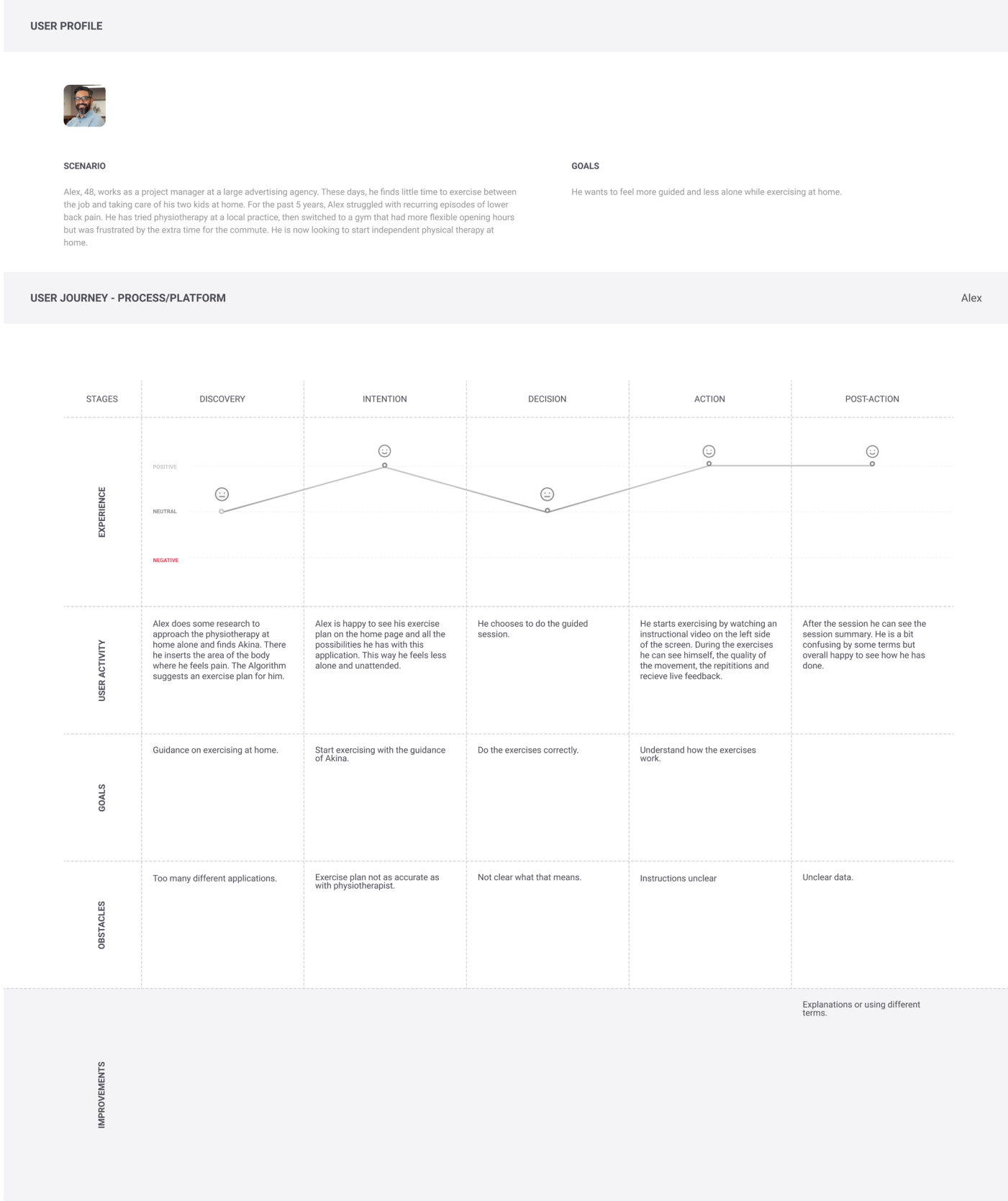| STAGES	DISCOVERY	INTENTION	DECISION	ACTION	POST-ACTION
USER ACTIVITY	Susanne was visiting her brother at his house. There she talked about her diagnosis and treatment. Her niece jumped in and told her about Akina. Susanne is not used to using digital tools, but she thought she might as well give it a go.	She downloads the application. There she inserts the area of the body where she feels pain. The Algorithm suggests an exercise plan for him. She is disappointed that these exercises do not correspond to the ones she got prescribed.	After the onboarding she comes to the homepage. She sees a lot of content and is a bit confused. She accidentally clicks something.	As she accidentaly clicked something she tries to get out of this screen.	After she managed to get out of the application, she never opens it again.
GOALS	Find out what Akina is about.	Start.	Understand.	Get out of the application.	Not using this app again.
OBSTACLES	Not used to digital applications.	Exercise not accurate.	Not clear what happens.	Too many elements on the screen.	-
IMPROVEMENTS	To benefit the most from this application it is best if the physiotherapists creates the exercise plan that patients can then use on their app. This way the therapy plan is more accurate for individual patients.	Simpler Interface.			

Figure 11. Persona and User Journey of Susanne

The personas have been useful to image different types of users who may encounter Akina. By having these personas I can imagine how their user journey would be while using our application and think about which parts could be challenging or frustrating during this process and in which parts they could be satisfied or surprised by the experience. With this method I could imagine which types of people may not enjoy using Akina. It is important to note that these are only assumptions. During the user test I can confirm whether these assumptions are truthful or false.

2.4 Motivation and Intended Contribution

My role as a designer is to act as a mediator between the Software and the patients, by facilitating a collaborative process in which everyone has a say in the outcome. The patients appear to struggle to complete the workouts that have been prescribed to them. Over time, patients' motivation to exercise weakens, and they only exercise when a physiotherapist is present; otherwise, they prioritize other activities over working on their health on their own. In addition, I look at not just what could benefit the patient while training, but also what the patient needs outside of the exercises. I rapidly understood that patients require supervision throughout their rehabilitation process, as well as the ability to see achievements and recognize that the therapy is genuinely benefiting them. Some patients are able to stick to their plans with ease, but they are the exception rather than the rule. Most patients find it difficult to adhere to their exercise routines due to boredom, insecurity, pain, a lack of guidance, and lack of results. Based on that, I'll try to find out how I can construct motivating structures that assist patients in incorporating the training into their daily lives, so that it becomes a natural part of their lives rather than a chore. How can they make training a habit that they enjoy rather than one that they have to do? I'll strive to grasp the patients' everyday lives, the meaning of their condition in their lives, their future visions, and the issues they encounter through observations, workshops, and talks. How can I, as a designer, build an experience that will help their entire rehabilitation or training period go more smoothly? I consider my role as listening to patients, testing some ideas, and developing concepts with them, evaluating their thoughts, how we can modify the service, and what helps and what doesn't.

CONCEPT

3.1 CONCEPT AND ANGLE

Background research and field research have made great contributions to the development of the concept. By being able to communicate with patients, observe them, and immerse myself in their routines, I was able to indemmise their point of view. I was able to understand the very important role of physical therapists, who due to time constraints cannot always offer what they would like to provide to patients and what patients would like to receive. With the service I want to offer I aim to reach the needs of the users and avoid certain situations that hinder their process of rehabilitation. First the physiotherapist can create exercise plans for their patients easily with Akina Create. Physiotherapists can search the exercises with filters and the search function, or use the smart assistant, and assign these to patients. With the smart assistant the physiotherapist can demonstrate the exercises in front of the camera, the data from the movement gathered through the webcam gets compared to the database of exercises existing in the back-end. If the exercise has been recognized the physiotherapist can define the repetitions or duration, and then go to the next exercise. The patient will receive this exercise plan on their device, where they have installed the application. When patients enter the app for the first time they will meet AkinaBot, they will talk to the patient to find out more about them, such as their hobbies or favorite movies. In this way the AkinaBot can offer the right content of entertainment. The AkinaBot will also ask the user what their main goal is, and after the user replies the bot will ask if this goal can be achieved with little steps. The user will be aware of the next step needed to reach their goal while using this application. If they achieved the first step, they will be moving on to the other, till they have reached the main goal. The AkinaBot will be there for the user during their whole journey, giving them feedback, complimenting them on their achievement and for any concerns the user has. The user can have a guided session, where they can compare their movement to the instructions on their side, see how much they have done or how much is left, and get feedback to correct their position. The users will get instructions right before they start a game, social media or interactive video. These instructions are related to the controls of the game/social media/interactive video. The user can play with other users who have the same condition or injury with the multiplayer mode.

3.2 FIELD RESEARCH

3.2.1 Qualitative Interviews

I conducted an interview with Luca Paratore. He is a physiotherapist who graduated from SUPSI with a specialization in sports physiotherapy, manual therapy and fascial manipulation. He also completed a three-year degree in Sports and Motor Sciences at the University of Turin. He has been practicing his profession since 2014.

In which specialization of physiotherapy do you work?
"I work mainly with the principles of sports physiotherapy and manual therapy."

What do you like most about your job? What causes you the most problems?
"What I like most about my job is the variability, the relationship with the patient and the continuous improvement of the knowledge and skills needed to identify the main problem and to plan a correct treatment plan.What causes the most problems is getting the patient to take an active role in the treatment and to take charge of their problem (by doing the exercises assigned or trying to change their behavior in daily life). The work of the physiotherapist is a teamwork between the caregiver and the patient."

How does a therapy plan look like?
"Generally, a therapy plan is divided into several parts. There may be an initial phase of passive therapy, then a warm-up to prepare for the activity, and finally active therapy with various exercises."

Is there a limited number of exercises that can be useful for different problems?
"In principle each exercise should be as specific as possible to the patient's problem, so there is no set of exercises that fits all. But each exercise can have multiple benefits, depending on how it is performed, different structures can be stressed and different higher control systems activated. For example, exercises aimed at improving strength in the lower limbs can serve multiple purposes: such as improving the quality of walking; partly, improving static and dynamic balance; and finally, improving endurance and ease in performing activities of daily living."

What methods do you use to communicate the exercise plan?
I personally give a sheet with a description of the exercises. They are then carried out together with the patient to correct the movement and make sure they have understood the task."

Do you use traditional methods or also digital tools?
"I mainly use traditional methods, occasionally I use my mobile phone to film the patient to show any compensations in movement, errors in the execution of the task, or simply to show improvement after weeks."

What kind of patients most need active therapy?
"Almost all patients need some part of active therapy, it brings many benefits. Usually we combine passive and active techniques to maximize the quality of care."

What kind of patients need passive therapy the most?
"Passive therapy is generally a good complement to active therapy (e.g. a patient with back pain might have muscle contractures or joint blockages as well as weakness of the stabilizing muscles of the spine. With passive therapy you try to release contractures (massage) or unblock joints (manipulation techniques, manual therapy). The patient is then actively worked on to strengthen the muscles and support the passive structures (ligaments, joint capsules). More generally, the patients most in need of passive therapy are dying patients or patients who have lost the ability to move parts of their body independently (neurological diseases, oncological diseases, spinal trauma, bone fractures in the first weeks after the event, etc.)."

How has your experience been with the implementation of prescribed exercises by patients?
"Patients often do not take an active role in dealing with their problem and therefore do not perform the prescribed exercises. They hope that the physiotherapist will "put them right" in the half hour allotted and do almost nothing themselves. Those who do the prescribed exercises (assuming they are correct) have a better course."

Do you know which methods your patients have used to do their exercises at home?
"They usually use a paper exercise sheet."

How do you evaluate the patients?
"I re-evaluate patients every week or when the clinical condition changes (e.g. if an inflammation, infection etc. comes out). I usually use as re-evaluation parameters the perceived pain (VAS scale), the quality of the motor movement that they initially reported as their main problem (e.g. one or a series of squats in the case of an elderly person who cannot get up from a chair, etc.) or the RoM (Range of Movement, how much painless movement of a given joint increases, e.g. after an operation)."

Are there certain situations in which patients are more motivated to do the exercises?
"What motivates patients most to do the exercises is whether they have a goal they want to achieve (e.g. to return home, or to go running or playing sports, etc.)."

Are there certain situations in which patients lose motivation?
"Patients lose motivation if the initially set goal is out of their reach. For example, a person who has been bedridden for a long time and wants to walk and live at home again. This is too ambitious and therefore frustrating because it cannot be achieved and the patient cannot feel his own improvement and loses motivation. In order not to lose motivation, it is possible to set the final objective but with sub-objectives, for example to regain the ability to sit, then stand, then walk and finally carry out activities of daily living, in this way the frustration caused by not being able to reach the proposed macro objective in a short time is limited."

Do most patients feel an improvement in their condition?
"If the objectives are set correctly and the steps to reach them are clear to the patients, they do perceive an improvement in their condition. Although sometimes you have to remind the patient where he/she started from (what his/her initial condition was like) and make him/her pay attention to his/her current condition to show the progress."

Do you have the impression that patients have discussed their difficulties and pain honestly with you?
"In general, yes. Being frank and honest is all to their advantage. But it is also up to the therapist to ask the right questions, to perform tests or active and passive movements to identify the cause of the pain and to observe how the patient behaves during the various movements."

How do you keep in touch with patients?
"Generally by telephone if they are outpatients. Or in person if they are in-patients in a clinic."

To understand the end users better I conducted interviews and surveys. The information I gathered ranges from their therapy programs to their personal experiences and struggles. In my survey I've received 12 responses so far. I also interviewed 3 people who participated in the survey to go more in depth into their personal experiences. The ages from the participants ranged from 20 to 35 years. 50% of the respondents were female, while the other 50% were male. Many participants were students or worked at the office. I also had participants who do manual labor, work in healthcare or are unemployed. All the participants are having or had physiotherapy to treat their conditions. The reasons for therapy vary, many went because of injuries they had suffered, others for conditions affecting the joints or muscles (for example surgery on the right ankle related to an accident, tendinitis, cervical hernia, back pain). Every condition listed required orthopedic physical therapy. This is because this type of therapy treats the most common conditions and injuries. I was surprised how many participants listed physical activity as their hobbies (for example football, snowboard, trekking), while others enjoyed hobbies that don't require physical strength such as fishing, reading, playing video games. All of the participants have been prescribed exercises from their

physiotherapist. On average the patients who participated in the survey have been prescribed 6 different exercises. The minimum amount of exercises is 1 and the maximum is 20 (Figure 12). The sessions last from 5 to 30 minutes, on average 18 minutes.
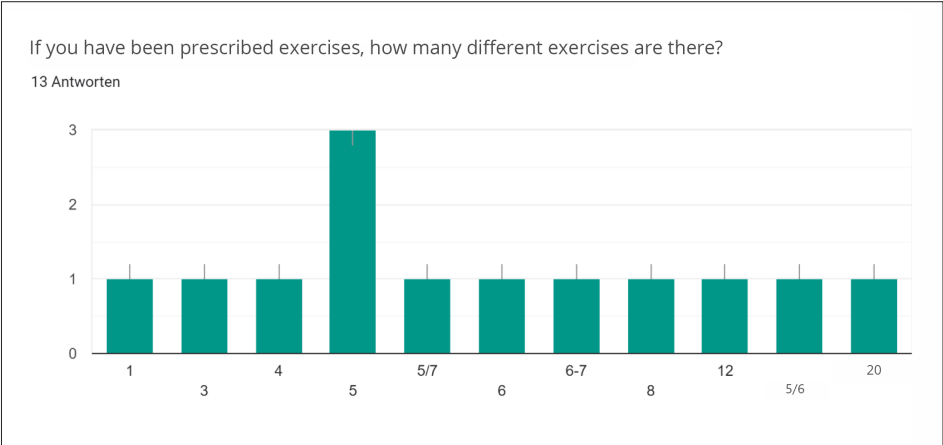

If you have been prescribed exercises, how many different exercises are there?
13 Antworten

Figure 12: Survey results on question "If you have been prescribed exercises, how many different exercises are there?"

Most of the participants should exercise everyday, two should exercise more than one time a day, the other two can exercise 2-3 times a week. 63,6% of the participants feel better after exercising, 18,2% said they feel worse, 27,3% said they don't notice a difference, the others said that it depends. 66,7% think that the therapy is helping them, 16,7% think it is not helping them and the other 16,7% don't know. 91,7% skips the exercises occasionally, that is the vast majority. The motives that were named were mostly laziness, tiredness, and lack of time. Other responses were pain and forgetness. The methods patients use to exercise is by memory, with paper instructions, with videos and lastly apps. The patients receive a demonstration of the exercises, so that they have a more accurate image than the paper instructions. Some are satisfied with the methods they use for exercising, others struggle to remember or understand the instructions. The effort, the time, the pain, the lack of guidance and the lack of results is what bothers the patients most. What patients miss is the results, guidance, remembering the exercises, fun, motivation and others. Patients would like to have something more interactive and see the physiotherapist at home.

3.2.2 Immersion

Through the interviews and surveys, I noticed certain patterns. For example, the thoughts and reasons why they do not exercise daily are very similar across participants. Since I want to understand their experiences I wanted to immerse myself in the routines of the patients. I decided to perform a set of exercises daily, with no distractions, and document my behavior and thoughts. I noted the day to day adherence and the time in which I exercised each day. I noted my thoughts before and during exercising. I wanted to understand the reasons why I skipped exercising when I did. I followed this program for 5 days. Here's what happened:

Day 1
Time: 10:13
On the first day of exercising I watched the exercise program and the amount of repetitions. I noted these down and started exercising. The stickmans didn't give enough of a clear description of the exercises, but from my memory I could remember how I should be moving. I placed the piece of paper in front of me so I could get directions. The paper often slipped away and I had to put it back up so that I could see it. This was annoying as it interrupted my routine. I hope that by the end of this week I know the exercises and repetitions by memory so that I don't need the instructions anymore.

Day 2
Time: -
On day 2 I already failed. It was a full day. I started the day with a long breakfast, then I went to lunch with a friend, after that I played a video game, cleaned the house and started working. Late in the evening I remembered that I should be doing the exercises. While having these thoughts I was working for my part-time job and I was physically tired from cleaning the house. I know it sounds like I'm making excuses but these were my motives in my mind which made me accept the fact that I won't be exercising. I felt disappointed that I failed already on the second day of the experiment. I made myself feel better by saying to myself that it is not that important and I'll do it tomorrow. I think a lot of patients feel this way as well when they skip exercising.

Day 3
Time: 22:48
I spent the day napping and working. I was very tired today. I started the day with a fast breakfast and then playing a video game. After that I started working for my part-time job and for school. Only in the evening did I remember that I should exercise. This time I managed to get up and reluctantly exercise. My only motive this time was that I didn't want to feel like a failure by skipping the exercises 2 times in a row. I said to myself that it only takes a few minutes. I knew what exercises I should do by memory a little better, but I feel that I executed them worse than on day 1. I think I did the exercises badly because the images of the instructions on day

1 were not clear in my head like they were on day 1. I just wanted to go to bed. I was proud that I managed to insert the exercises in my daily routine this time. After exercising I noticed that it really didn't take a long time and that it shouldn't be as difficult to do them every day.

Day 4
Time: 12:09
The fact that I started working for school early in the morning helped me to exercise right away. Since I am doing the exercises for my BA project and not for my health. I wasn't sure if I did the exercises correctly and if the time I invested doing them was enough. I filmed myself while exercising so that I could observe my behavior from a third perspective. I noticed that I stopped after each exercise to look at the instructions, this disturbs the flow of the routine. I didn't struggle to find the motivation to exercise this time. I personally think that exercising early in the day rather than in the evening really helps, so that I don't have to think about it for the rest of the day. This allows me to focus on the things I should be doing other than exercising.

Day 5
Time: 13:12
After a break from schoolwork I started exercising. I didn't really feel like doing exercise today, but I felt obligated to. I usually exercise in the living room, this time I went to another room because my roommate was home and I needed some privacy. Again I wasn't sure if I was executing the exercises correctly. I feel like I repeated the exercises more often than in the previous times. I placed the instructions in front of me on the table, it seems that 5 days are not enough to memorize the routine completely. After each day I forget more and more how the exercises work and the stickmans are not enough of an explanation for me.

My Impression
As I am reading the diary of the last 5 days I realized that it wasn't that difficult for me to exercise. Out of 5 days, I exercised on 4 of them, which is a quite good result. It would be more useful to extend this experiment further and try this method for a month or more. Due to time restrictions this is not possible. What was generally the case for almost every day besides day 1 is that I wasn't sure if I was moving correctly. I would have liked to see myself moving and to be able to compare my movements to the correct ones with a live demonstration. I was often tempted to play some music in the background, which would have possibly made me feel more entertained, but the rule I set to myself was no distractions, so that is what I did. One very important thing to consider: patients who struggle to exercise as prescribed suffer from painful symptoms caused by injuries or conditions, and in addition to physical symptoms many also suffer from psychosomatic symptoms. These factors affect adherence, obstacles that I did not experience during my immersion.

3.2.3 Participant Observation

For my research, I wanted to answer some questions that I have been asking myself. One of the methods I used is participant observation. I wanted to understand how a person with a musculoskeletal condition lives. I wanted to understand what he struggles with on a daily basis and what helps him feel better or supported.

I have been living with Matteo for 4 years now. He is a 30 year old man with a chronic condition which affects the joints. I have been observing him intentionally for the last 3 weeks, he doesn't know I did.

He usually wakes up from 8 to 10 am. In the past he liked to go to sleep really early and wake up early as well, typically 6 am. Now he struggles to do so, he feels very tired even if he sleeps 8 to 10 hours. He believes that this is due to his progressing chronic illness, which affects his joints. He believes this tiredness is connected to his condition. He saw others also feel very tired all the time on a digital support group.

This support group is on facebook for people with his illness. In this group people like him share experiences, vent and ask questions. Sometimes he asks questions himself, for example if people are experiencing the same symptoms as him, or if anyone has tried the medications he is about to try. There he saw that many people experience the same things as him, such as always feeling tired, feeling under the weather, having pain in the knees or other joints. Having this outlet, this community, really helps him. Sometimes he reads that someone has found his miracle cure, which makes him feel hopeful that one day he can find the cure that is a miracle for him. He could talk about his struggles to family members, partners or friends, but they can't really understand how this condition makes one feel.

In the past when he got up from bed he liked to immediately go for a walk. This helped him alleviate the pain, which is usually most intense in the morning. He doesn't do this anymore since he feels more and more tired the more time passes. As he works as a freelancer, he can choose when to work. The pain is often too intense to work and therefore he stays home. He feels down that he is not able to work. The constant aching also has its effects on his mood, making him feel irritated, angry, stressed or depressed.

I asked him almost daily if he has exercised already. Most of the time he said he didn't exercise. When I told him I did a self experiment where I tried to exercise every day, and after one day I already skipped my session, he felt relieved and less guilty for not exercising. I believe he felt attacked every time I asked this question, so I stopped talking to him about it. I only remember one time where he told me he had exercised, he said that he was so bored and didn't know what to do, and therefore decided to exercise. He doesn't seem to believe that the exercises actually help him.

There are certain things I said that he didn't like to hear, these questions or remarks should be avoided in person but also in digital tools. Instead of making people feel guilty for not exercising, praise and reward them every time they do exercise. Let them know how powerful exercising can be by showing success stories of others with the same condition or problem. Offer an outlet where people can express themselves and share experiences and struggles.

3.3 Findings

The exchange with patients and physiotherapists was truly insightful. Having a first and third person impression of the problem helped me get a view of a variety of factors that influence the lives of patients. Some prescribed exercises can be used for different conditions and injuries, while others are chosen specifically for each patient. When the physiotherapist prescribes the exercises to the patient, the physiotherapist will give the patient a demonstration on how to execute the exercises, and after that usually give the patient a paper with the instructions written on it. One thing I learned from the physiotherapist named Luca Paratore, which patients are not aware of, is that patients set their initial goals too high and therefore have unrealistic expectations. If the patient feels that it is impossible to achieve that goal they lose motivation. The progress during rehabilitation happens gradually over time, and consequently patients don't recognize what they achieve. There is a need to set realistic goals and remind the patients of their achievements. The lack of results is a problem patients have acknowledged in the survey and interviews, as well as the lack of guidance. Patients need to know what they are doing, if they are doing it right, if they are doing too much or too little and reminders. Some have mentioned how they would like to have a physiotherapist come to their home. Even though there are some people who feel motivated while exercising, the majority feels bored because of the repetitive nature of the exercise plans, some have mentioned they want to have more fun while exercising and would like some interaction.

A factor that I have noticed in the immersion and the participant observation is guilt. Guilt is an emotion similar to worrying or unhappiness, which occurs if you have done something wrong. Sometimes it occurs when you haven't done something. In this context the guilt comes from skipping the exercises which have been prescribed to a patient. The patient I have observed felt guilty every time I asked if he had done the exercises and he replied with "no", this may have felt like a direct attack on him. I also felt guilty during my immersion, when I skipped the exercises or when I was about to skip them. Since mental health issues are related to musculoskeletal conditions [8] it is important to communicate with

the affected people with kindness, and avoid any negative conno-
tation. That means to not punish a patient if they haven't exercised,
but praise and celebrate them if they do.

PROJECT DEVELOPMENT

4.1 Experiments

4.1.1 Bartle Taxonomy

The Bartle taxonomy of player types is a classification of video game players (gamers) based on their preferred actions within the game, as described in a 1996 paper by Richard Bartle. The term was initially used to characterize players of multiplayer online games such as MUDs and MMORPGs.

MUDs, more specifically known as multi-user dungeons, are a category of role-playing video games played over the Internet through the computer by multiple users. They are text-based games, where players interact with the world and other users by typing keyboard commands. Many users can connect to a multi-user dungeon at the same time.

An MMORPG (an acronym for Massively Multiplayer Online Role-Playing Game) is a role-playing video game, for computers or consoles, that is played simultaneously by several real people over the Internet, therefore called "online games". In MMORPGs, thousands of players can play together and interact with each other, playing customizable characters that evolve (acquiring skills, earning in-game currency, obtaining items and equipment, etc..) along with the persistent world that surrounds them and in which they are.

As of current times the Bartle Taxonomy can be applicable for single-player video games as well.

A character theory underpins the taxonomy. Achievers, Explorers, Socializers, and Killers are the four characters in this character theory. The X axis reflects choice for interacting with other players vs. exploring the world, while the Y axis represents preference for interaction vs. unilateral action in a quadrant model (Figure 13).

Achievers
Players that prefer to gain "points," levels, equipment, and other concrete measures of success in a game are known as "Diamonds." They will go to considerable lengths to obtain mere ornamental rewards.

The Achiever has a single-player appeal.
Every game that can be "beaten" in some way caters to the Achiever's play style by providing them with a goal to achieve. Achievers are drawn to games with a 100 percent completion rate.

The Achiever will respond to a multi-player appeal. One of the re-
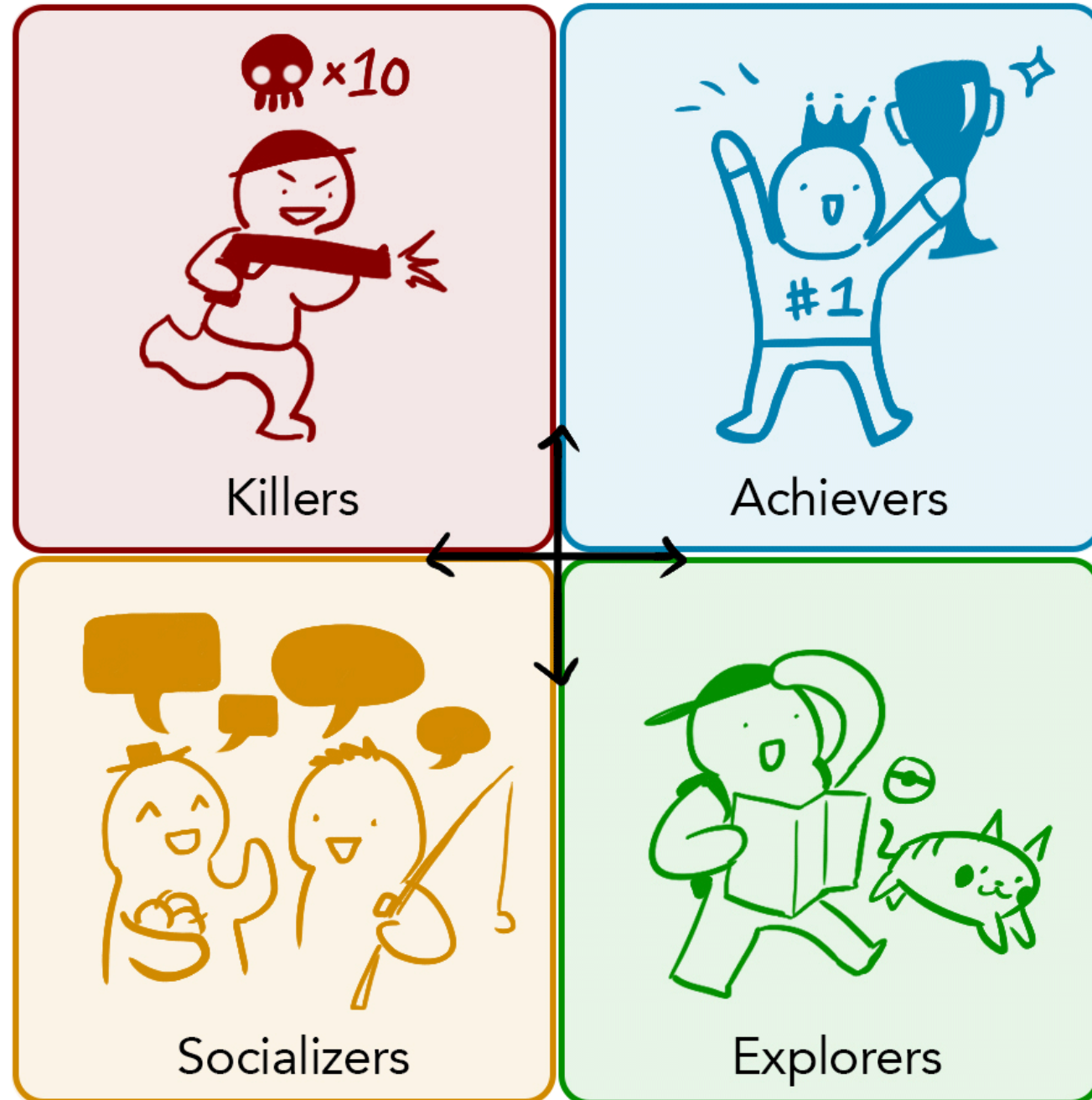
Bartle Taxonomy of Player Types

Figure 13: Bartle Taxonomy of Player Types, ONE37pm

asons that online gaming appeals to the Achiever is that it allows them to demonstrate their abilities and demonstrate their elite status to others. They value (or loathe) competition from other Achievers, and they rely on the Socializers to compliment them. The Gamerscore is used by Microsoft's Xbox Live to reward Achievers, who can earn points by completing challenging "Achievements" in the games they buy. They can then compare their performance to that of other gamers from across the world. [15]

Explorers

Explorers, also known as "Spades" because of their predisposition for digging, are gamers who want to explore new places and immerse themselves in the game environment. They are usually irritated by timed missions because they are unable to travel at their own tempo. [16]

The Explorer is attracted to single-player games. Because combat and gaining levels or points are secondary to the Explorer, they tend to gravitate toward games like Myst. In these games, the player is trapped in an unfamiliar environment, and the goal is to escape by paying close attention to detail and solving riddles.

The Explorer will frequently enrich themselves by learning as much as they can about the characters and places in the game.[16] Whereas an Achiever might forget about a gaming adventure fast, the Explorer will remember it fondly.

Explorers, on the other hand, will quickly become bored with any given MMORPG (Massively Multiplayer Online Role-Playing Game) once they have experienced its content. They will get tired of the game faster than other gamer types and will feel it is becoming a burden to play. [17]

Socializers

A large number of players choose to play games for the social aspect rather than the gameplay itself. These players are known as "Hearts" or "Socializers." Interacting with other players, as well as computer-controlled characters with personalities, gives them the most fun from a game.[18] They use the game as a means to meet people in-game and outside of it. Some socializers like assisting others for the sake of altruism, whereas explorers assist others in order to uncover previously undiscovered areas, and achievers or killers assist others in order to gain an extrinsic benefit such as points.

Because the Socializer's goal isn't so much to win or explore as it is to be social, there aren't many games that they love on their own merits. Instead, they play some of the more popular games in order to take use of the multiplayer options.

The gamer's association has partially shifted online since the emergence of the World Wide Web. Socializers are particularly enthu-

siastic about sharing their gaming experiences on web forums and social media. An example of socializers are video game streamers who connect with their viewers on streaming platforms such as Twitch or YouTube.

Killers
The term "Clubs" is an apt description of what the Killer enjoys doing. They prefer fighting other players over fighting planned computer-controlled opponents because they thrive on competition.[19]

Appeal to the Killer as a single player: Killers are more motivated by powergaming and crushing others than other player types. They're aiming for first place on the high score board or to beat another speedrunner's time.

Appeal to the Killer in a multiplayer mode: the Killer enjoys running amok on computer-controlled people and objects, but nothing compares to putting one's abilities against a genuine player-controlled opponent. The delight of being a Killer comes from a pleasant competitive mentality, for the most part.

Others are more concerned with power and the ability to inflict harm on others, or the thrill of the chase. "Ganking" or "owning," for example, is a process in which the Killer takes their strong character to a location where novice or lesser characters reside and kills them repeatedly.[20]

Player Interaction: an estimation of the reactions between the different types of players can be made if these archetypes are defined as stereotypical players and not to be assumed true.

Achievers see other achievers as rivals to be defeated (although this is typically friendly in nature, rather than cut-throat). Other achievers are respected because they are plainly exceptional, yet achievers frequently blame bad luck or a lack of time as reasons for not being as far along in the game as their peers.

However, achievers frequently collaborate with one another, usually to accomplish a challenging collective goal, and deep, durable friendships can emerge from these shared experiences, which may outshine those commonly established among people or other groups in intensity.

Explorers are sometimes seen as losers by achievers: persons who have had to resort to experimenting with game mechanics because they aren't good enough players. Exceptionally good explorers may be raised to the status of eccentric, similar to how users of huge computer installations see certain persons as gurus: what they do is worthless, but they're helpful to have around when you need to know something unusual quickly.

Erwin Andreasen and Brandon Downey created the Bartle Test

of Gamer Psychology in 1999–2000, which consists of a set of questions and a scoring formula based on Bartle's taxonomy. The "Bartle Quotient," which is calculated based on the answers to a sequence of 30 random questions in the test, totals 200 percent across all categories, with no single category exceeding 100 percent, is the result of the Bartle Test. The original test is not available anymore, but there is a newer version which I tried. The results: 80% Explorer, 53% Killer, 40% Socializer and 27% Achiever. Knowing the meaning of these categories I can say this is pretty accurate. I see the results of others who have participated in this test and the player type explorer seems to be the most common one, followed by killer, socializer and achiever. [21]

As I was talking to other people, to better understand what could motivate them, some mentioned that they would like to compare themselves to others to feel superior, while others said that having a ranking list would make them feel pressured. I believe the concept of the Bartle Test could be beneficial for the whole experience patients have with Akina. This type of information could be gathered in an onboarding quiz, and then suggest entertainment content specifically for that user and more importantly change the functions of Akina. Achievers and Killer need to see how much they have done and confront other players. Socializers get multiplayer games recommended and can have an exercise buddy to motivate each other, and explorers can just enjoy the games they want without any pressure.

4.1.2 Workshop

We had the pleasure to have a workshop with 13 physiotherapists from the Schulthess Klinik. After presenting the general concept of Akina we had a Q&A, where physiotherapists could clear uncertainties. After that we posed some questions to understand the process of a physiotherapist creating an exercise plan, what works for them and what bothers them.

Since they work at the Schulthess Klinik, they mostly use the clinics' applications: Schulthess Coach and Physitrack. Some patients also have the app and can see their exercise plan there. Other methods frequently mentioned where: printing the plan from the app, using drawings and filming or taking pictures of the exercises.

To create this plan together with the patient the physiotherapists need to understand what is in the capabilities of the patient, for example how intense and complex the exercises can be and the amount of time available. The physiotherapists and the patient decide on some goals to reach through this therapy. After deciding which exercises work there will be a one on one demonstration. The physiotherapist informs the patient of the necessity of the the-

rapy, on movement quality factors, the importance of the goals and dosage.

What works well in this process is: videos, reminders from app to patients, paper instructions are clear and done faster, with digital instructions it is good to see the exercises, through Physitrack physiotherapists are informed on the pain of the patient and questionnaires, quick finding exercises on the app, communication through app (patients leave comments), feedback in person, feedback through app, monitoring progress and working with milestones to get to the next level.

What bothers the participants most in this process is: the missing data, can't track progress, missing data of quality of movement, patients don't do exercises how they are supposed to, patients lack responsibility, patients don't insert how many exercises they have done, it is time consuming to find the right exercises, the exercises are not clearly defined, there is no possibility to personalize the exercises in the current app, it is not possible to add comments, paper documentations get lost, no motivation to perform exercises.

What they miss is: patients taking full responsibility for their health and know that rehab is good, having everything in one place (clinic system + app), control the patient, motivation, not applicable for older patients, quickness, easy handling time, tracking patients is time consuming, time consuming to change the exercises, favorites, hashtags for exercises, make sure patients get the key points correct, physiotherapist can prescribe digital tools such as Akina, patients rely too much on physiotherapists, learning on how to improve in the long run.

The data gathered from the workshop gave an insight into their work process, more specifically a process which can be made easier through our application. The key points are: physiotherapist decide together with the patients what goals and milestones should be achieved, it is important to communicate and give feedback with the patient outside of in praxis meetings, it is beneficial for the physiotherapist and the patient if the data from the sessions is shared, giving the patient the feeling of independent self-care and responsibility, and being able to personalize the exercises for each patient.

4.2 Prototype

4.2.1 Akina Create

I imagined the ways the application would be used from start to finish. Before a patient can use Akina, the physiotherapist must first create an account for them. After the physiotherapist creates the account, they have the patient with all the inserted details in their database. The physiotherapist then creates an exercise plan and assigns this to the patient (Figure 13). The methods to create exercise plans vary. First there is the manual version. Here the physiotherapists insert the parts of the body which are concerning. They then get to an overview of templates with exercises that are commonly used together to treat the concerning body parts. The physiotherapist can edit these templates and also choose from single exercises (Figure 15). They could also create their own templates. The program is customizable, which means that the physiotherapist can edit the description of the exercise, the repetitions, the durations and the amount of series, these are different for each patient.

The other method to create exercise plans is to use the smart assistant. There is a database of therapeutic movements in the software. The physiotherapist, instead of searching through the catalog of exercises, can just execute the exercise in front of the webcam with the smart assistant (Figure 16). The movements of the physiotherapist or patient are compared to the database of exercises, and if a corresponding exercise is found, the physiotherapist has to confirm whether or not that is the right exercise. This process can then be continued till all the right exercises are present. After this process the physiotherapist can edit every single exercise, as with the manual execution, and assign it to a patient.

If the patient agrees, some of the data gathered during the sessions will be sent to the physiotherapist (Figure 14). The data could be: the quality of the movement (range of motion and execution), the activity (frequency and amount of exercises done), the amount of pain suffered during exercising (on a scale of 1 to 10) or/and the borg scale (rating of perceived exertion on a scale of 1 to 10). The data can be really useful for the physiotherapist to have. Especially the amount of pain and the borg scale can determine whether to increase or decrease the training plan's intensity for the patient.

Another function the physiotherapist has is the ability to chat, call or video call their patients.
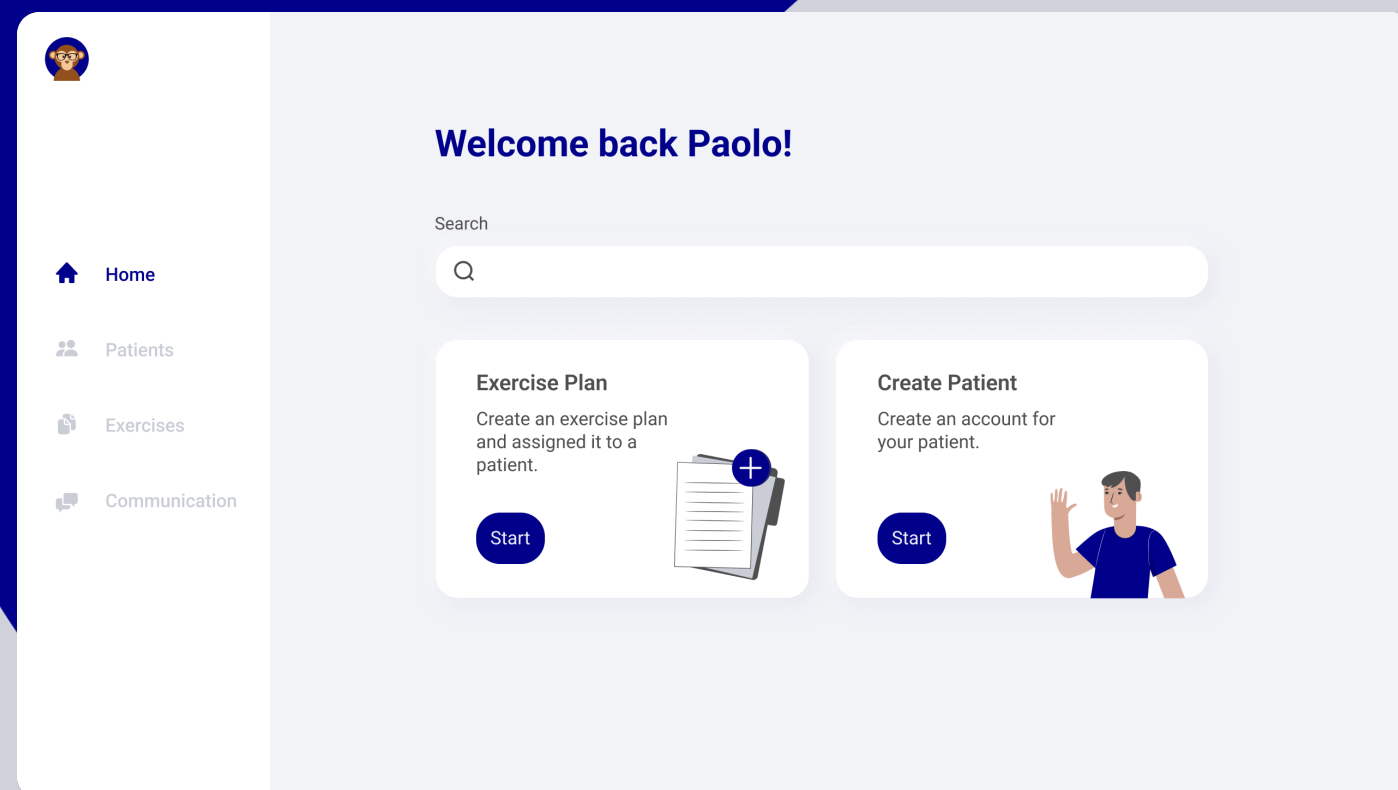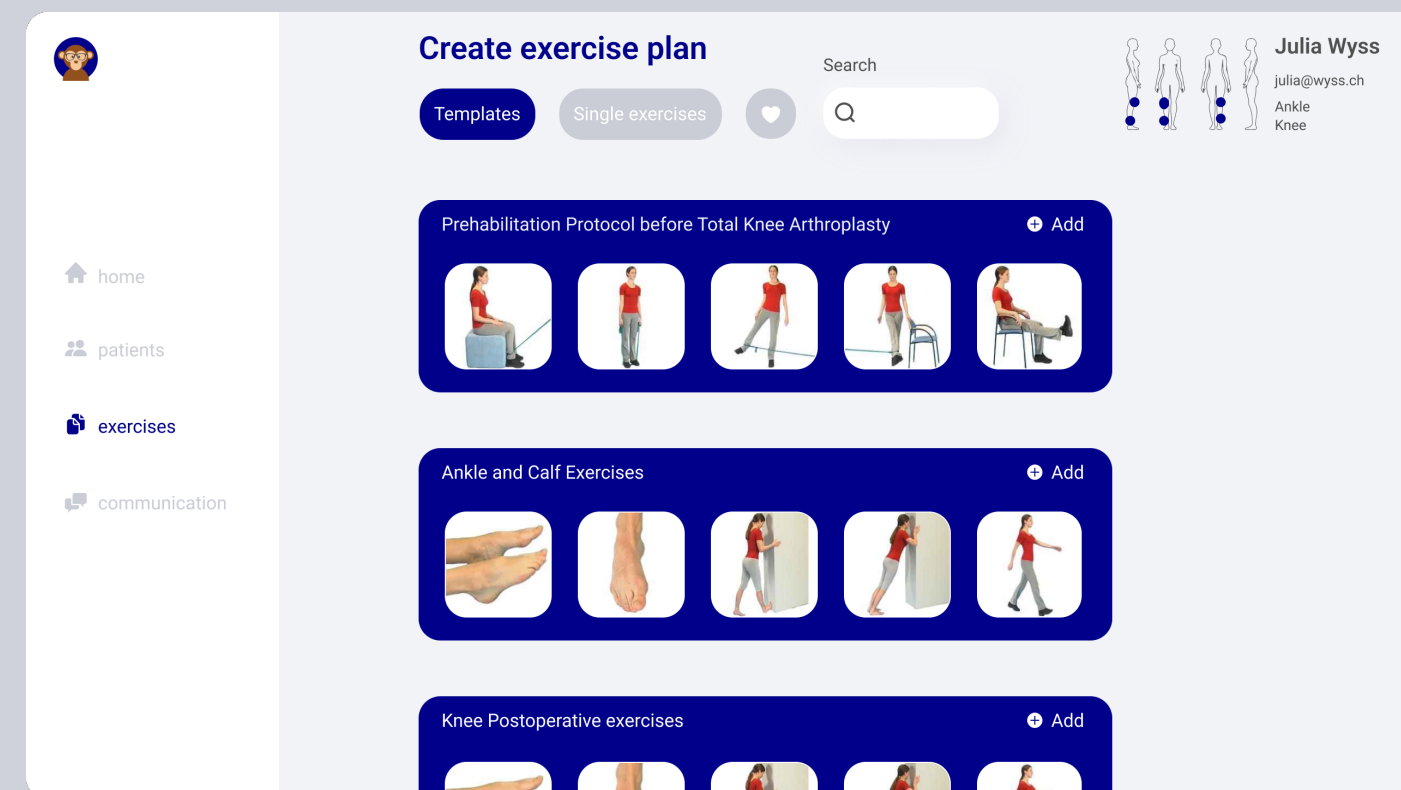
Welcome back Paolo!

Home

Patients

Exercises

Communication

Search

Exercise Plan

Create an exercise plan and assigned it to a patient.

Start

Create Patient

Create an account for your patient.

Start

Figure 13. Home page, Akina Create

Create exercise plan

Search

Templates | Single exercises

home

patients

exercises

communication

Julia Wyss
julia@wyss.ch
Ankle
Knee

Prehabilitation Protocol before Total Knee Arthroplasty   Add

Ankle and Calf Exercises   Add

Knee Postoperative exercises   Add

Figure 15. Manual Creation of Exercise Plan, Akina Create

Progress

Julia Wyss
julia@wyss.ch
Ankle
Knee

home

patients

exercises

communication

Adherence

Week

Pain

Week

Range of motion

95°

Borg Scale

Week
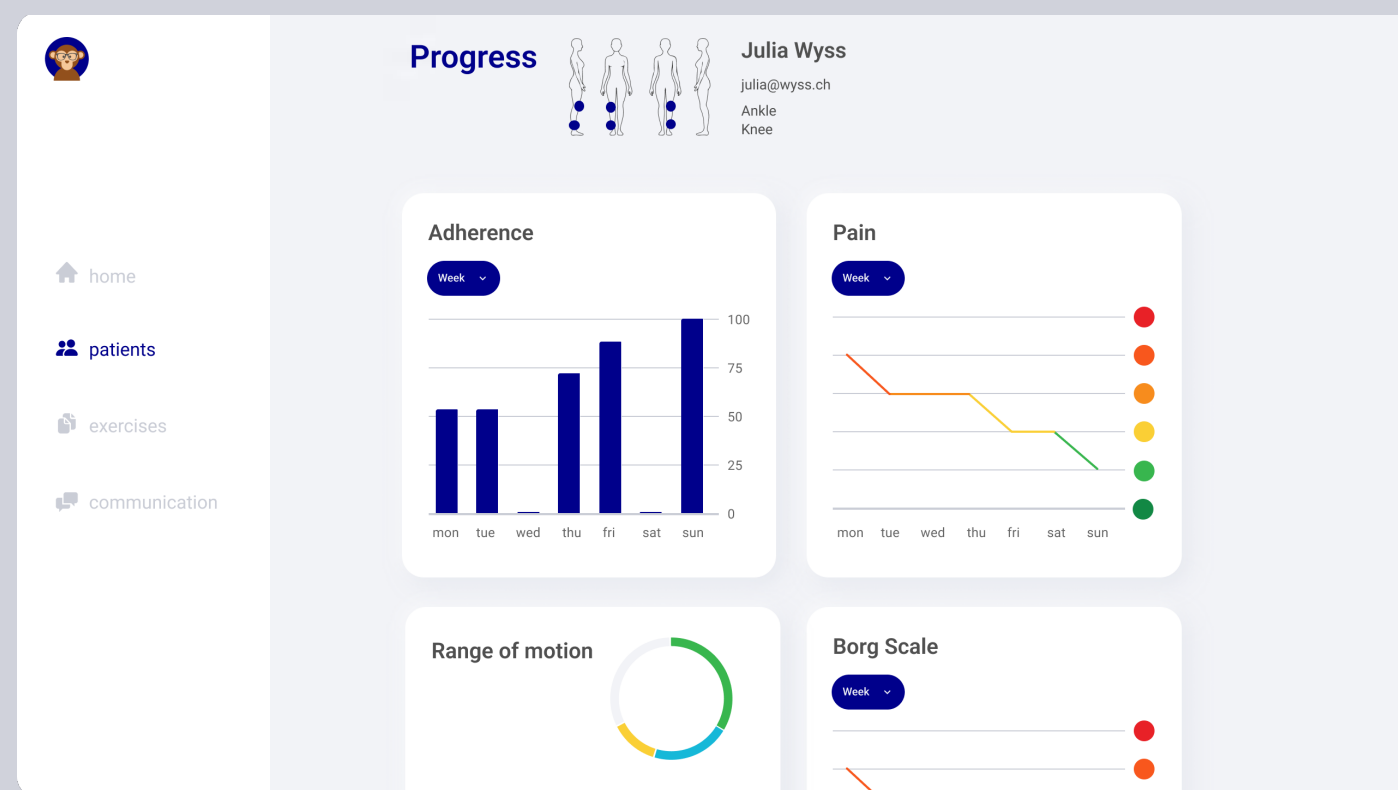
Figure 14. Progress of Patient, Akina Create

Smart assistant

home

patients

exercises

communication

loading...

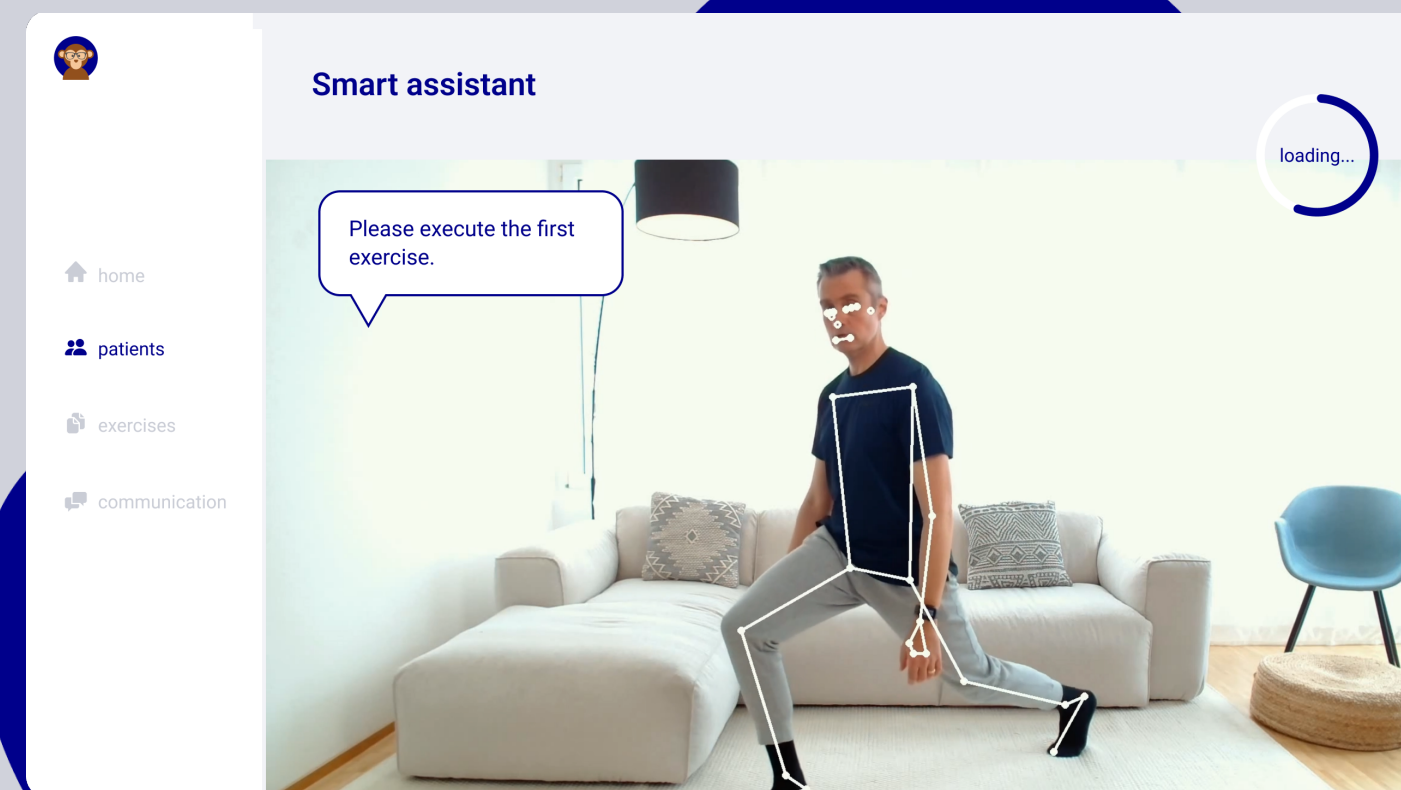Please execute the first exercise.

Figure 16. Exercise Creation with Smart Assistant, Akina Create

4.2.2 Akina Train

After the physiotherapist creates and saves the therapy plan for the patient on his app, the patient receives the program on their application. If the patient already has the application, and the training plans change, they will get informed about the conversion of the plan. If the patient is new to the application, the onboarding starts upon entering the default application. The first part of the onboarding, which can be skipped, is the bartle test (see p. 39). With this test it is determined which type of player the user is in percentage. Achievers or killers get recommended types of games which fit these types of players, as well as having a ranking list of who does more exercise while using Akina. The explorer types do not see a ranking list, and get recommended games which fit these types of players. The social player gets recommended more multiplayer or role playing games. These changes can be edited in the settings. After the bartle test they receive general instructions on the different parts and functions of the application.

When the user comes to the homepage they see an overview of the main functions of the application (Figure 18, 19). These include:

Program: In the homepage is a button, with illustrations of the exercise program prescribed to the user. If you click this button you will reach a page with your program, with a description provided by their physiotherapist, duration of the program and instructional videos (Figure 20). On the bottom illustrates the goal, divided in 3 steps, that the user has decided on together with the physiotherapist (Figure 21). These milestones make the goals seem more achievable, therefore increasing the motivation. Specific goals regarding the pain scale, amount of exercising, borg scale or range of motion, can be automatically reached just by exercising with the application, since the data gets gathered after each session.

Guided Session: There is another button on the homepage, if you click on it you get to the guided session. This guided session is similar to a session with a physiotherapist, but it is in digital, automated form. This page can be accessed also by the menu. The screen is divided in two, on one part of the screen is an instructional video of the exercises, and on the other part of the screen is the user. While exercising the quality of the movements gets calculated, if the percentage of quality is higher than 75% it gets counted as a repetition (Figure 22). While exercising the user gets occasional feedback on how to correct their position by the Akinabot. After the session the user sees a "session summary". Here they can see the overall summary of this session. The stats of this session get compared to previous sessions, and if there is progress, it will be highlighted by the Akinabot. This function is for the user who doesn't feel like playing games, but wants to exercise correctly.

Progress:
In the home page is a graph of how much exercise (completion, adherence) has been done in the last week, month or year. Once the user clicks it, the progress page appears (Figure 3). This page can also be reached by the menu. On this page the user can see the data gathered in each session about the pain scale, the borg scale, adherence and, depending on the patient, the range of motion regarding the concerning body part. Here the user can see how many sessions are left to get to the next level. The goal is that even small improvements, shown by data, put an emphasis on tangible results rather than the lack of perceived physical improvements.

Entertainment:
Lastly, after all these elements, come the entertainment options. As mentioned before (p. 31) due to the bartle test the first content gets recommended based on the percentages of the types of player. After some time of using the entertainment options, the algorithm adjusts these options for each singular user. One part of the entertainment option are games from the xbox cloud gaming with controls and intensity that fit the prescribed exercises. The games the user can play must work with the combination of the exercises and their characteristics. Main data for each exercise includes: ID, name, category (strength, balance, mobility, stabilization, stretching, posture control), base pose (sitting, standing, lying on floor back, lying on floor stomach, tabletop position, plank position, sitting on floor), moving joints (ankle, knee, hip, back, shoulder, elbow, core), primary and secondary plane (none, frontal, sagittal, transverse), intensity index, maximum repetitions per minute, average repetitions for minute (Figure 17). For example a game like Crash Bandicoot has the main action as jumping. The amount of jumps are usually between 20 to 50 a minute. Quadriceps sets would fit this type of game, since the repetition per minute are on average 33, and maximum 103. The exercise "sit to stand" would not work well since the average repetitions for minute are 13 and the maximum 32. The combination of exercises must work together to ensure an uninterrupted flow. For example, 3 exercises with 3 different base poses would not work together.

ID	name	category	base_pose	moving_joints	primary_plane	secondary_plane	is_lateral	is_static	intensity_index	max_rep_per_min	avg_rep_per_min
0	Sit to stand	[strength, balance]	sitting on chair	[ankle, knee, hip, back]	sagittal	frontal	0	0	26.2	32	13
1	Active single-leg stance	[strength, balance]	standing	[]	None	None	1	1	19.2	1	1
2	Climbing steps	[strength, balance]	standing	[ankle, knee, hip, back]	sagittal	frontal	1	0	15.5	39	15
3	Hip abduction	[balance, mobility]	standing	[hip]	frontal	None	1	0	23.2	65	15
4	Hip extension	[balance, mobility]	standing	[hip]	sagittal	None	1	0	26.0	60	27
5	Hip flexion	[balance, mobility]	standing	[hip]	sagittal	None	1	0	26.3	60	22
6	Side stepping	[balance, mobility]	standing	[hip, ankle]	frontal	None	1	0	15.0	43	16
7	Standing balance	[balance]	standing	[]	None	None	1	1	12.5	1	1
8	Sitting upright on chair	[mobility]	sitting on chair	[]	None	None	0	1	9.2	1	1
9	Sitting knee extension	[mobility, strength]	sitting on chair	[knee]	sagittal	None	1	0	11.2	56	19
10	Sitting knee flexion	[mobility, strength]	sitting on chair	[knee]	sagittal	None	1	0	17.7	64	21
11	Standing knee raises	[mobility, balance, strength]	standing	[knee, hip]	sagittal	frontal	1	0	20.7	59	18
12	Partial weight bearing	[balance]	standing	[ankle, knee, hip, back]	frontal	None	1	0	20.2	48	15
13	Quadriceps sets	[mobility, strength]	lying on floor (back)	[knee]	sagittal	None	1	1	10.2	103	33
14	Heel slides	[mobility, strength]	lying on floor (back)	[ankle, knee, hip]	sagittal	None	1	0	8.0	68	16
15	Straight leg raise	[mobility, strength]	lying on floor (back)	[hip]	sagittal	None	1	0	15.8	61	15
16	Bridging	[strength, stabilization]	lying on floor (back)	[knee, hip]	sagittal	frontal	0	0	23.4	86	21
17	Mini-squats	[mobility, strength]	standing	[ankle, knee, hip]	sagittal	frontal	0	0	26.5	51	18
18	Mini-lunges	[mobility, strength, balance]	standing	[ankle, knee, hip]	sagittal	frontal	1	0	28.8	56	27
19	Single-leg step ups forward	[mobility, balance, strength, stabilization]	standing	[ankle, knee, hip]	sagittal	frontal	1	0	18.7	58	22
20	Single-leg step ups lateral	[mobility, balance, strength, stabilization]	standing	[ankle, knee, hip]	frontal	sagittal	1	0	19.5	58	22
21	Calf raises	[strength, balance, mobility]	standing	[ankle]	sagittal	None	1	0	19.4	52	23
22	Back extensions	[strength, posture control]	lying on floor (stomach)	[hip, back, shoulder]	sagittal	None	0	0	19.2	65	26
23	Quad superman	[mobility, strength, posture control]	tabletop position	[ankle, knee, hip, back, shoulder]	sagittal	frontal	1	0	32.6	33	18
24	Dumbbell rows	[strength, posture control]	standing	[elbow, shoulder]	sagittal	None	1	0	19.9	55	24
25	Planks	[strength, posture control]	plank position	[]	None	None	0	1	26.0	1	1
26	Russian twists	[strength, balance, posture control]	sitting on floor	[hip, core, shoulder]	transverse	frontal	1	0	29.9	48	25
27	Torso side bends	[stretching, posture control, strength]	standing	[back]	frontal	None	1	0	15.0	45	24
28	Torso twist	[strength, mobility, stretching]	standing	[back]	transverse	None	1	0	15.8	49	23
29	Torso forward bow (good mornin	[strength, mobility, stretching]	standing	[knee, hip, back]	sagittal	None	0	0	20.1	38	18
30	Single-leg squat	[strength, mobility, balance, stabilization]	standing	[ankle, knee, hip]	sagittal	frontal	1	0			
31	Lower back rotational stretches	[stretching, mobility, stability]	lying on floor (back)	[hip]	frontal	None	1	0			
32	Pendulum exercise	[stretching, mobility]	standing	[shoulder]	frontal	sagittal	1	0			

Figure 17. database exercises, Giulia Minikus

Before each game, the user receives instructions on how the exercises affect the controls (Figure 24). During the game or with the other entertainment option the user can see themselves, the exercises with the percantage of movement quality and the repititions (Figure 25). The other entertainment options are interactive stories, interactive music videos, quizzes and social media. With the interactive videos the user can choose from a multiple choice question or action on the answer or how to continue. With social media the user can execute the typical actions one would make while using the apps, but instead of using the finger they exercise. For example if the user executes a squat it causes the action of scrolling through instagram, by doing side steps the user would swipe, and by doing lunges the user likes a post. After each session the user receives the session summary (Figure 26).

Telehealth: The telehealth page can be reached through the menu of the application. Here the user can contact their physiotherapist, the helpline and the Akinabot (Figure 27)WW. With the physiotherapist the user can chat, call or video call. The helpline is there 24h for any user wanting to express health concerns or emergencies. The Akinabot is there to clear some questions the user may have about the application.
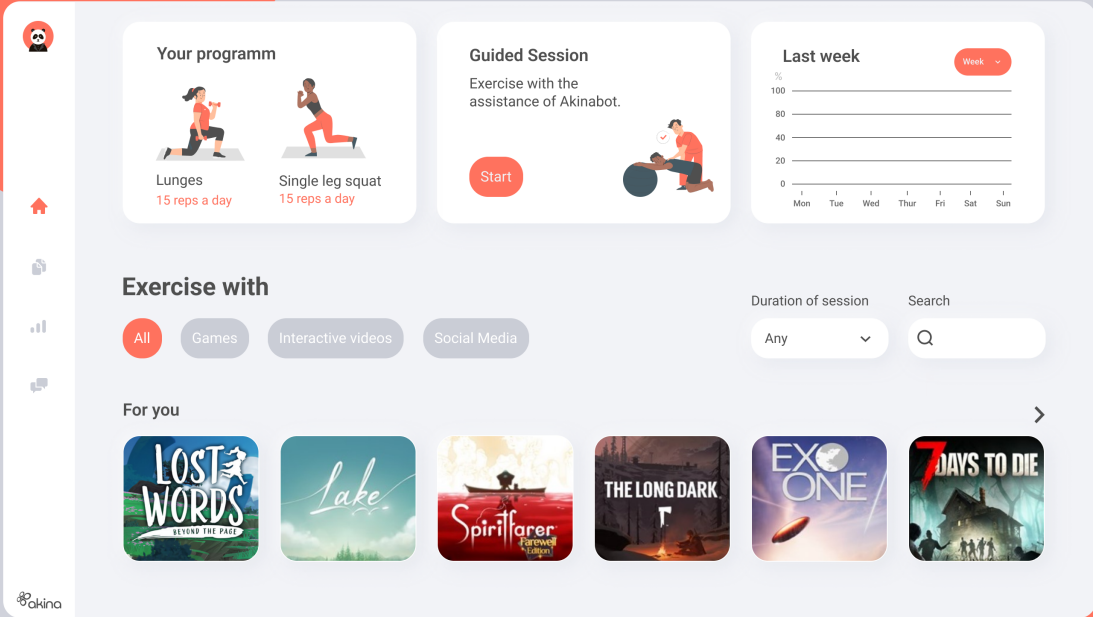

Figure 18. Homepage. Akina Train.

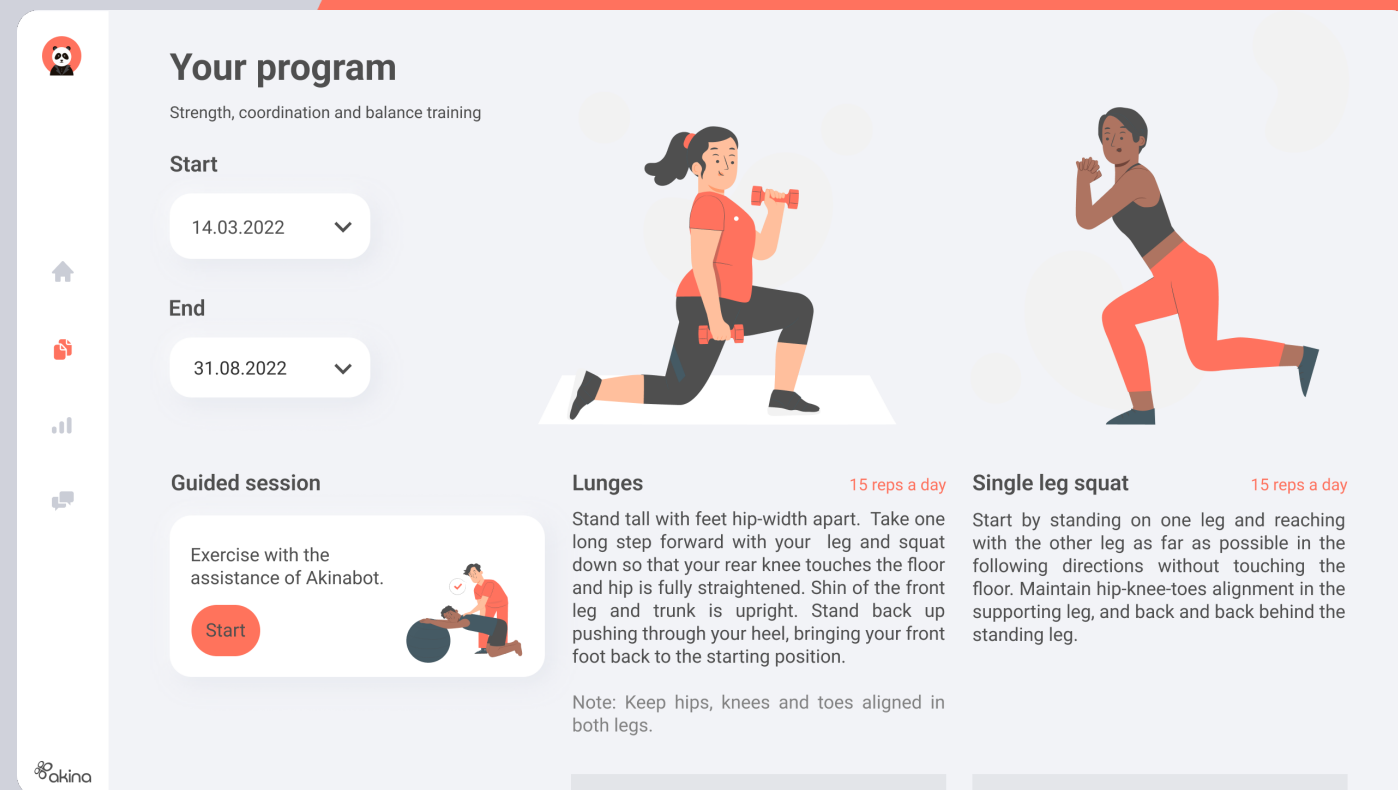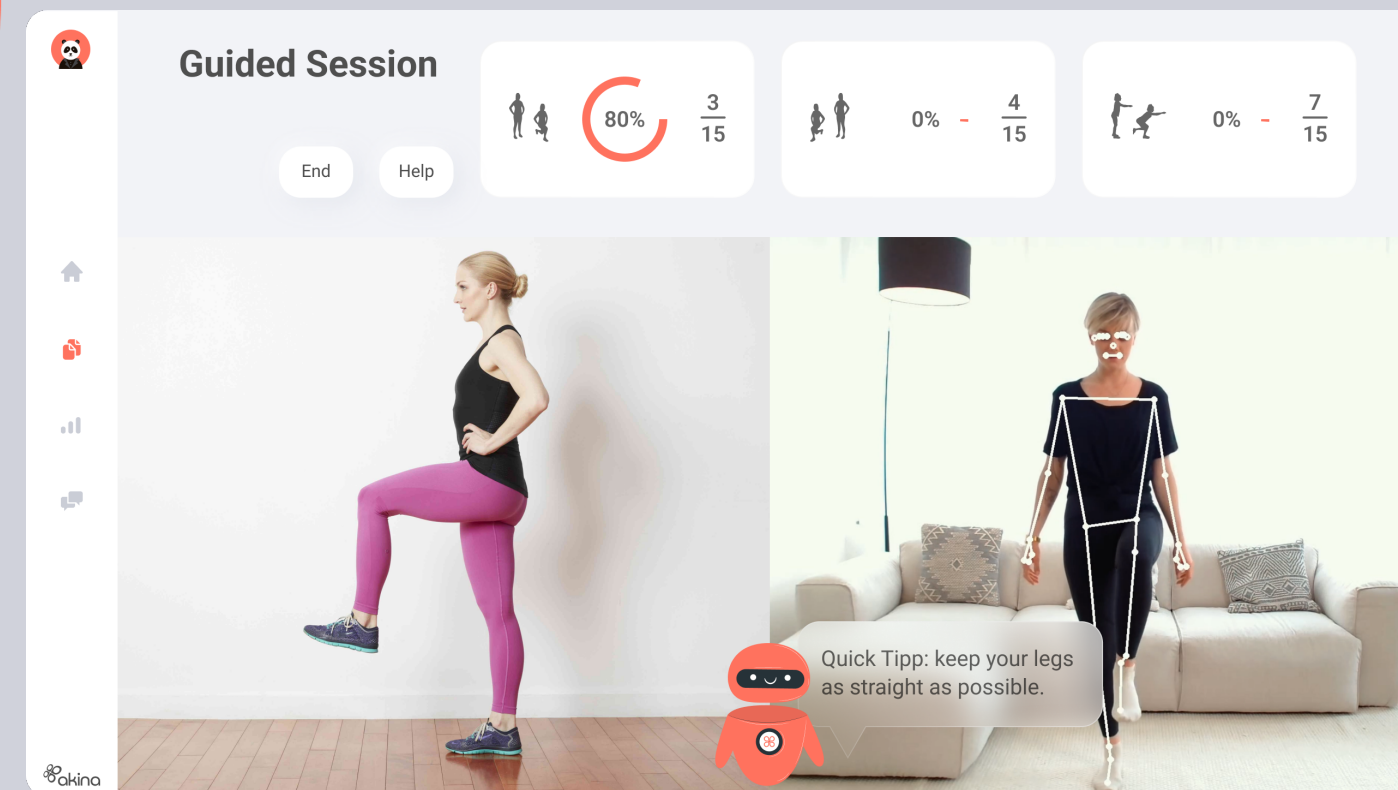Figure 19. Akina in use. Akina Train.

Your program

Strength, coordination and balance training

Start

14.03.2022

End

31.08.2022

Guided session

Exercise with the assistance of Akinabot.

Start

Lunges
15 reps a day

Stand tall with feet hip-width apart. Take one long step forward with your leg and squat down so that your rear knee touches the floor and hip is fully straightened. Shin of the front leg and trunk is upright. Stand back up pushing through your heel, bringing your front foot back to the starting position.

Note: Keep hips, knees and toes aligned in both legs.

Single leg squat
15 reps a day

Start by standing on one leg and reaching with the other leg as far as possible in the following directions without touching the floor. Maintain hip-knee-toes alignment in the supporting leg, and back and back behind the standing leg.

Figure 20. Program, Akina Train

Guided Session

80%   3/15   0% - 4/15   0% - 7/15

End   Help

Quick Tipp: keep your legs as straight as possible.

Figure 22. Guided Session, Akina Train

Goals

Play soccer again

Being able to jog

Range of motion for knee 100°

Milestones

Here you can find an overview of the milestones you and your physiotherapist have discussed to achieve your goal. You will reach your goal by following your programm.

Paulo Merlani

You can do it!

Figure 21. Milestones, Akina Train

How much you have done.
Week

Pain
Week

Range of motion

95°   max

90°   average

80°   min

Levels
Level

For a number of sessions you complete you can unlock libraries of games.

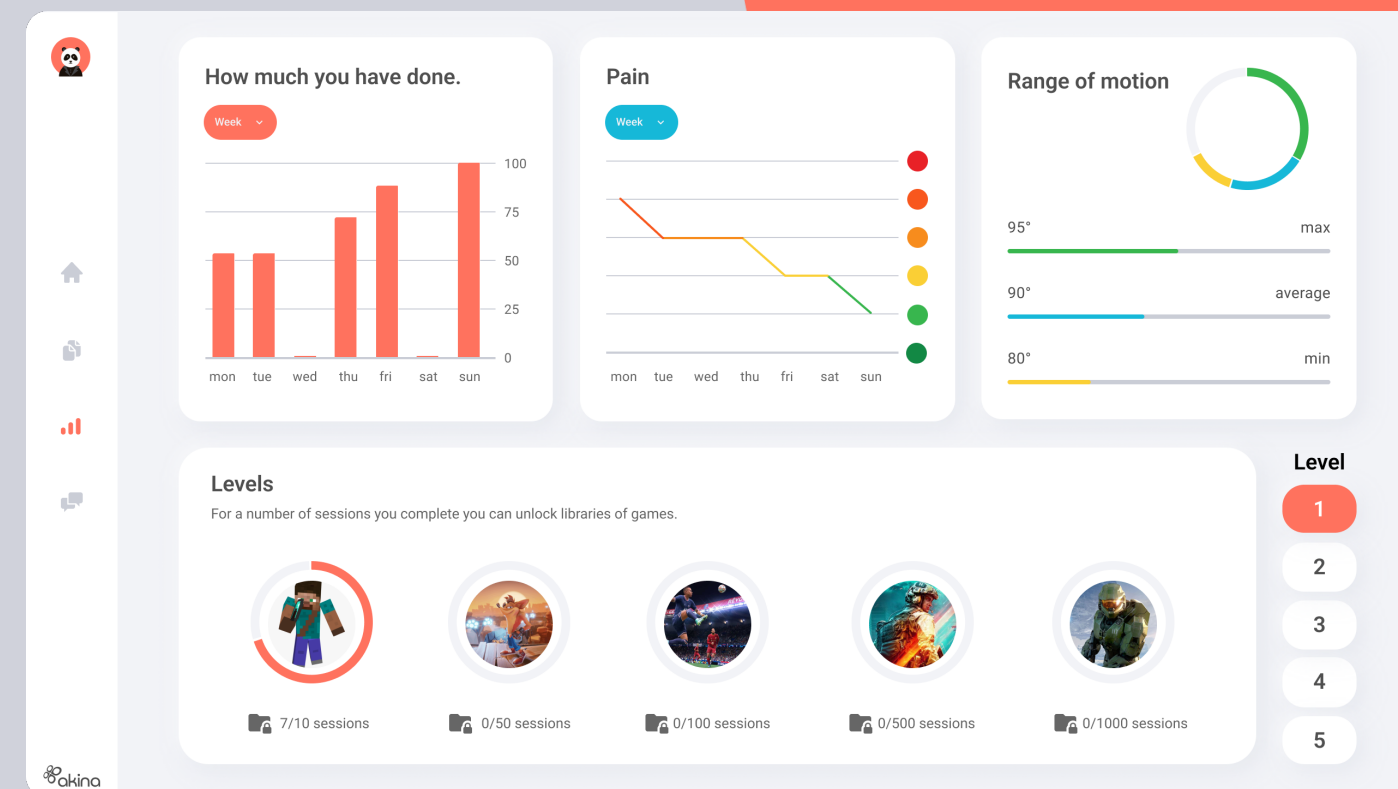7/10 sessions   0/50 sessions   0/100 sessions   0/500 sessions   0/1000 sessions

1
2
3
4
5

Figure 23. Progress, Akina Train
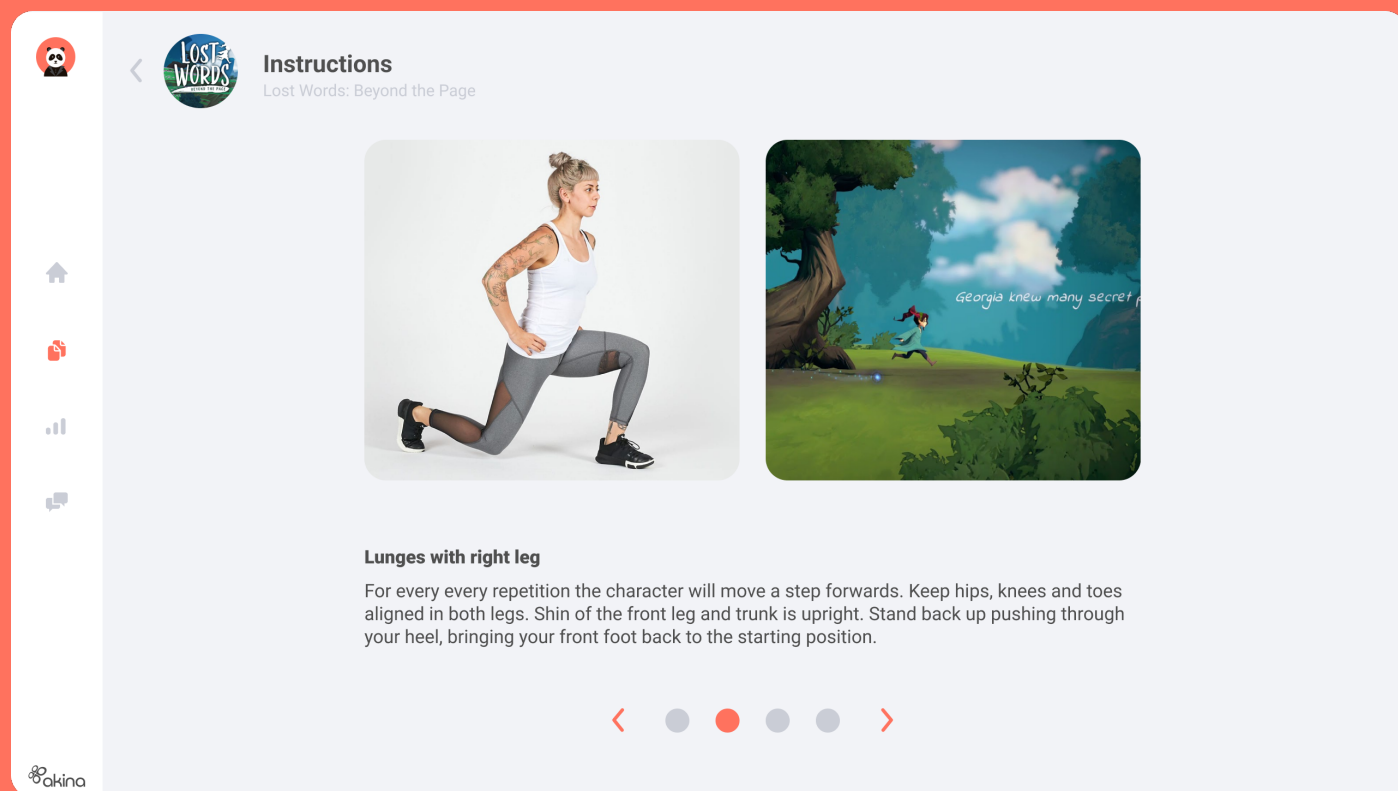
Figure 24. Instruction pre-game, Akina Train

Figure 25. Game, Akina Train
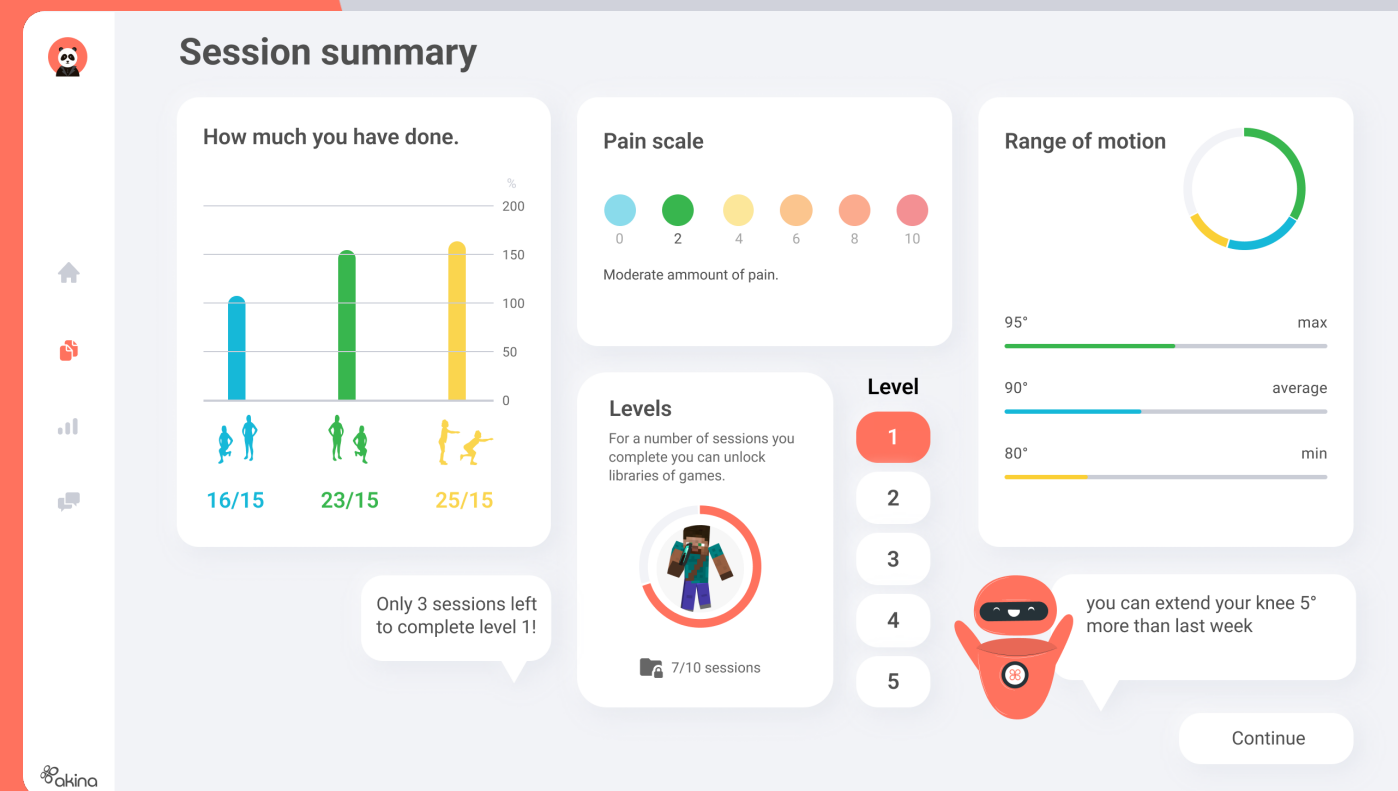

Figure 26. Session summary, Akina Train
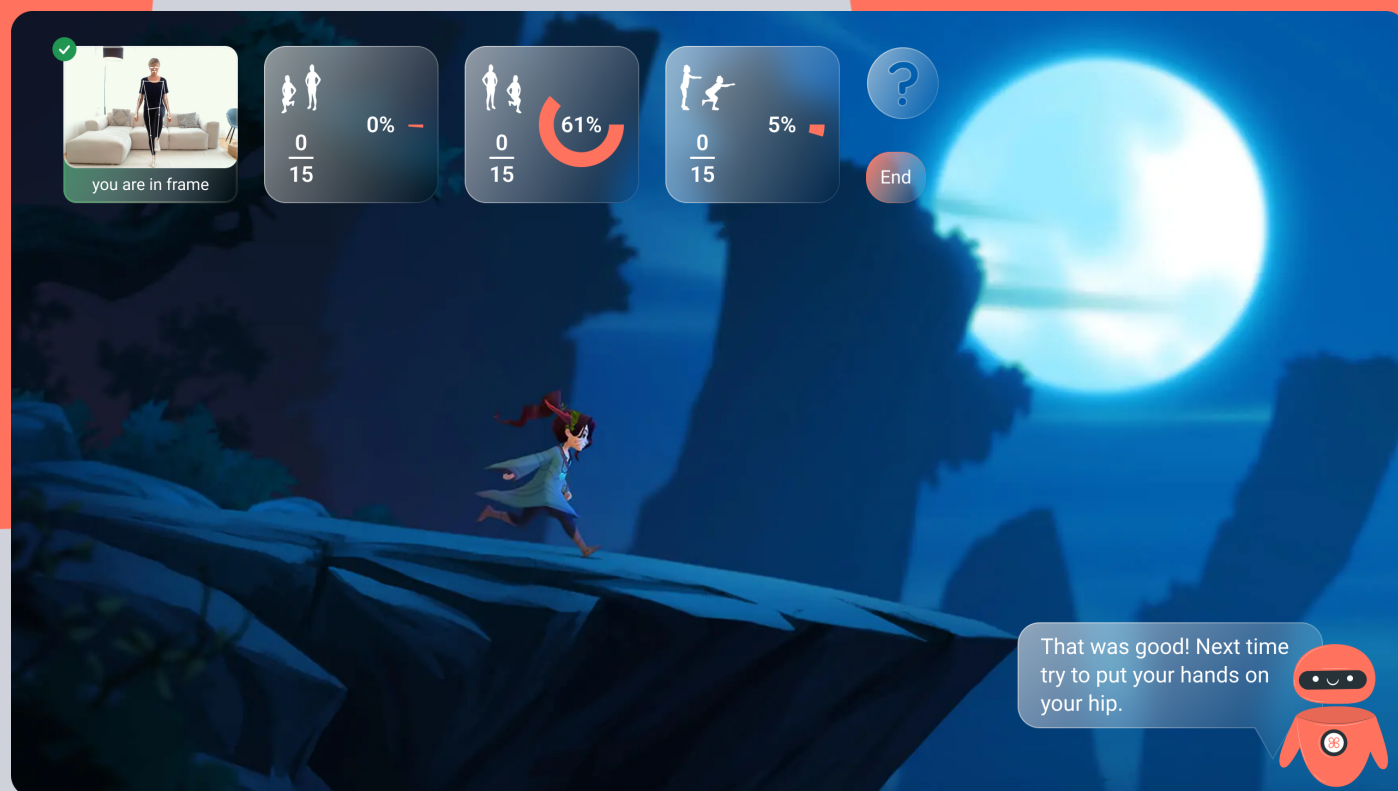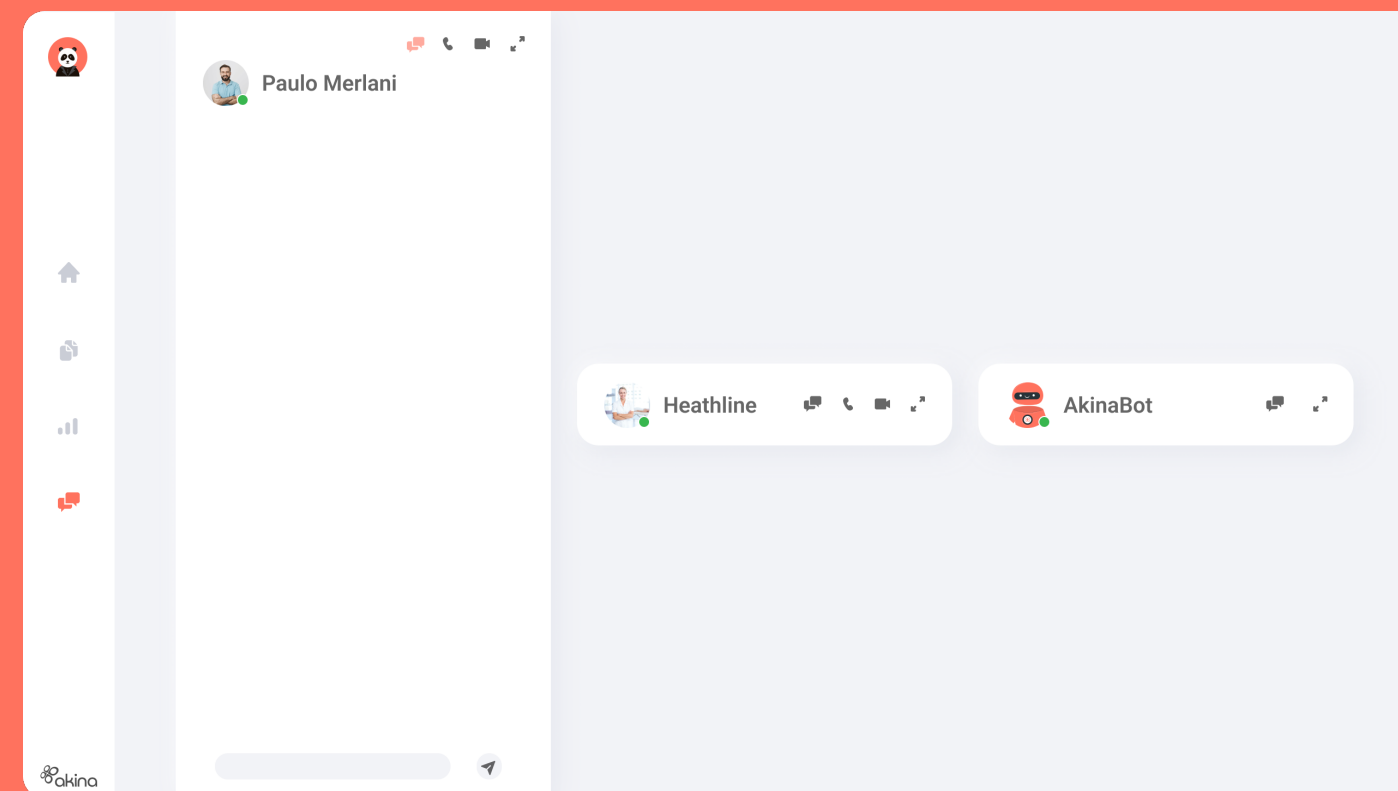

Figure 27. Telehealth, Akina Train

4.3 User Tests

I found it important to do some user tests with patients and physiotherapists who would use these applications to clarify the assumptions I had while ideating the user journey.
I had 3 user tests, with 2 patients and 1 physiotherapist.

The task I gave to the physiotherapist was to create an exercise plan. He used the manual version but later saw the smart assistant as well.

Physiotherapist

Test user: Florian   Test date: 23.05.2022

Activity	Time	Behaviors	User's thoughts	Success/Fail	Extent of success
Create exercise plan	~2m	User used the manual version of the exercise plan creation. The flow went easily and fast.	This is quite easy to do. There are some errors though. There are not only repetitions and duration, but also the series and breakes this should be included.	✅	4

Figure 28. User Test Physiotherapist

After the user test I gave him some questions to answer. Here are some answers.

How would you describe your overall experience with the product?

"I found it intuitive and quite clear. The series was missing and the end of the therapy plan can not be so clearly defined with a date. It really depends on the progress the user makes. If the pain scale is lower than 2 and the borg scale as well, then the therapy can increase in intensity, by doing more series or more difficult exercises."

What did you like the most about using this product?
"It's useful for people who don't have a lot of time. The fact that all the details and instructions are already available for each exercise."

What did you like the least?
"The breaks should be added. And the end of the plan should not be set by a specific time."

What, if anything, surprised you about the experience?
"I was surprised about the smart assistant, I find it pretty cool and can see myself using it."

What, if anything, caused you frustration?
"Nothing."

I had a user test with Alessia, who is a student in her mid twenties. The tasks I gave her are: complete the onboarding, play a game, make a video call with your physiotherapist.

Here are the results:

Patient

Test user: Alessia   Test date: 19.05.2022

Activity	Time	Behaviors	User's thoughts	Success/Fail	Extent of success
Onboarding	~3m	Reading the instructions	The text is a bit too small	✅	4
Start Game	5m	Filter unclear, while reading the instructions before the game the user clicks "skip" instead of the right slider.	I thought the skip button was meant for continuing, I didn't percieve the circles as interactive, range of motion in session summary is not clear, levels seem to be clickable	❌	2
Make video call with physiotherapist	3m	She tries to understand what the three options in the telehealth means, and understands which one should be her physiotherapist.	She sees the three option and thinks it is unclear with which one to talk to. She suggests that you can open the chat only after you have chosen with which one to talk to. The healthline needs to be more clear, for example "24h call med"	✅	3

I had the same interview afterwards as with the physiotherapist, but only regarding the patient's application.

How would you describe your overall experience with the product?
"Clear, not cluttered, accompanies you, not distracting."

What did you like the most about using this product?
"I like the colors, it's nice and the overall design."

What did you like the least?
"The interface during the game has a different design than the rest of the application."

What, if anything, surprised you about the experience?
"I was surprised about the flow, and how comprehensive it was."

What, if anything, caused you frustration?
"The data about the range of motion.
Confusion about the telehealth section, with whom I should talk to."

The last person I had an interview with is Matteo. He is a man in his

mid 30's and a freelance gardener. The tasks I gave him were the same as the one I gave Alessia: complete the onboarding, play a game, make a video call with your physiotherapist.

Patient

Test user: **Matteo** Test date: 29.05.2022

Activity	Time	Behaviors	User's thoughts	Success/Fail	Extent of success
Onboarding	~1m	Reading the instructions	Understands what is written	✅	5
Start Game	3m	Going through the instructions and read the text.	He liked the instructions at the start and would like to try play the game. He didn't understand what being in frame means. There need to be more levels if it is possible with the ammount of exercises.	✅	5
Make video call with physiotherapist	4m	Go to telehealth page. There he understands what the healthline means. He understands that the Akinabot would answer questions about health, but in reality it answers questions about the application. This part was not clear.	I personally would prefer to use the chat rather than a video call.	✅	4

I had an interview with him after the experience. Here are some thoughts:

How would you describe your overall experience with the product?
"I found the experience relaxed, intuitive, I saw the explanations and understood these, I understood what the different things do in the app. I would use this app, at least to see if I can work with it and if I like it."

What did you like the most about using this product?
"I liked the idea of having a selection of games to play, and the fact that I can unlock games by doing more sessions. I like the design and the colors, which makes it very homey and comfortable. And I would like to see the progress for myself, with the improvements."

What did you like the least?
"I didn't understand the range of motion, the degrees were not clear."

What, if anything, surprised you about the experience?
"If the games work with my exercises, that would be really impressive and surprising."

What, if anything, caused you frustration?
"Nothing."

4.4 Flow Efficiency

There were moments where too many options, that had similar functions to the other options, were confusing. For example during the instructions before the game there was the option to skip this step or see the other part of the instructions. The skip button was mistakenly perceived as the continue button. This made me realize that it is more beneficial to always see the instructions before the game, instead of skipping these by mistake. Another case of options that were too similar is in the telehealth page. Here it would be beneficial to make the differences between the three (physiotherapist, healthline and AkinaBot) more clear.

After making some minor changes on the interface, based on the user tests results, I started to conclude the project.

CONCLUSION   **5.1 Contribution**

I hope to open up some new insights on motivating tactics in rehabilitation with my thesis and BA project. I learnt a lot about motivation perception during this process, and I feel that human motivation cannot be solely activated by rewards systems and external pressure to complete a task, especially when the work has a direct impact on someone's health rehabilitation. Finding a way to make a daily activity joyful and enjoyable, on the other hand, might stimulate someone's intrinsic motivation and the desire to continue doing it more frequently.

Gamification is frequently used in health-care solutions to increase patient motivation and interest. In fact, games appeal to a wide range of consumers and are easily accessible thanks to mobile technology, attracting a diverse range of players.

Many other digital health-care solutions help the patient to exercise and keep him on track. But this process is often manually done and it doesn't have the flow to exercise continuously.

Akina contains a lot of content, a lot of possibilities, but it is simultaneously intuitive and easy to use. In fact, contrary to many health-care applications, this one is particularly shaped for each single user with the entertainment they like. It has a big impact on the therapeutic aspect, with the possibility to gather data and show the progress to the user but also to the physiotherapist, who can use this data to change the therapy plan. It is automated, the user has to do hardly anything but exercise, to keep track of their progress. Motivational structures such as levels to unlock more games, rankings and milestones motivate the user further other than the fun they have while using games, interactive videos and social media.

It is not only useful for the user, but also for the physiotherapist, who can see the live progress of the patient, and easily create, decide, and change the therapy plan when needed.

It incorporates the allrounder cycle of physical therapy. From the very start to the end, and repeat.

5.2 Learnings

With this project, I was able to examine and learn about a topic that I would not have otherwise explored. I learnt a lot of new things about physical therapy and the impact at-home physical treatment has on rehabilitation that I didn't know before. Throughout the course of this study, the topics of therapy and motivation were both fascinating to investigate. After completing this project, I am confident that I will remember the amount of new information I gained, whether from self-research or from the several patients, physiotherapists, and researchers I was fortunate enough to meet.

5.3 Future Steps

As I have come to the end of the Bachelor Project I realized I have laid down concepts on how the solution would be, but for me the project is not finished yet. I feel that there are many more possibilities, fine tuning and variations that could be included after a group of users has utilized the application for some time. For the future I wish to expand the application, to fit different scenarios of users, and have broader user testing and further iterations. One small thing that I would like to add as well are sounds for the microinteractions, as many game software have these included in their interface.

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