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LIVING WITH AN EXOSKELETON

Title:	Living with an Exoskeleton – Creating motivational structures for patients who train with an exoskeleton.
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ABSTRACT

We created motivational structures helping patients to train at home with Myosuit, an exoskeleton developed by MyoSwiss and aiming to support people suffering from weak leg muscles. Patients are normally challenged to keep up their motivation during everyday life, where they encounter medical setbacks and stressful daily routines.

The project «Living with an Exoskeleton» helps patients create a structure which brings the Myosuit training into their daily life. Patients can bind their exercises onto existing habits, set up training with other patients and develop a visualisation of how they want to feel while training. Our mobile application aims to ensure that Myosuit becomes an integral part of their life.

ACKNOWLEDGMENT

Our thesis has come to live through the engagement of so many amazing people. We experienced throughout the process a lot of support for which we want to show our gratitude.

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Special thanks goes to Gleb Koginov, Dr. sc. Kai Schmidt and Alejandro Sancho who besides the presentations, mentored us on a weekly basis.

A big thanks goes to all the patients who with their stories and inputs really made our process and our thesis meaningful. Their honesty towards us and taking their time, for conversations, workshops and testings.

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Last, we thank the two experts we talked to, Dr. Julia Weber and Dr. phil. Walter Bierbauer for discussing our concept and giving valuable inputs.

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1. GENERAL INTRODUCTION

The loss of the ability to walk is a drastic experience that affects everyday life, independence and the social environment. Finding your way in this new situation requires a lot of strength and effort. This is also bound to a tight and regular training. To support the body in this process, MyoSwiss, a spin-off of ETH developed an exoskeleton. The Myosuit helps patients with a walking disability in their training to improve mobility, stability and endurance. To make the first step towards a self-determined life.

Through our discussions, cultural probes and workshops with affected patients, the long-term motivation was repeatedly mentioned and identified as a problem. It is exactly this motivation that decreases over a longer period of time. Other things seem to be more important and the training with the Myosuit gets forgotten. Then even the best training device shows no effect without motivation and regular use.

Together with physiotherapists, patients and experts, we developed motivational structures to make it easier for patients to train even in their stressful everyday life. Through this user-centric and co-designing approach we developed, integrated and tested our tools together with the patients. The application links exercises to existing habits, plans training with other patients and creates a visualization of their positive attitude. Through that, we try to create new routines where training with the Myosuit is an integrated part of a patient's daily life.

2. PARTNER

The exoskeleton from MyoSwiss, called "Myosuit". (2021, May).
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In our bachelor project we worked with MyoSwiss as a collaboration partner. MyoSwiss is a spin-off from ETH Zurich. The start-up focuses on movement preservation for people suffering from muscle weakness in their legs. Their technology supports these people to be more independent in their everyday life activities. Together with engineers, designers and medical professionals, functions and designs are constantly being developed and improved.
Their first milestone is the Myosuit which impresses with its easy handling and light design. By focusing on soft robotics, the suit allows the patient to walk while still feeling comfortable and flexible.
The Myosuit covers a large patient segment. It is suitable for people who have a walking disability and want to improve their mobility, stability and endurance. The clinical picture can differ from patient to patient. The only requirement to be able to use the suit is a minimal residual function of the leg muscles.

During the duration of our project we had weekly mentoring sessions and regular progress presentations with MyoSwiss. We received great support from the entire Team and had a particularly close exchange with Gleb Koginov, Senior Mechanical Engineer at MyoSwiss AG, Dr. sc. Kai Schmidt, Co-Founder of MyoSwiss AG, Alejandro Sancho, Senior Software Engineer at MyoSwiss AG and Nadine Rüegg, Head Of Marketing at MyoSwiss AG.

3. RESEARCH

3.1 BACKGROUND RESEARCH: EXOSKELETON

3.1.1 History of Exoskeleton

Terminology

The term "exoskeleton" is based on the ancient Greek "exo" outside and "skeletós" dried body / mummy (Wikipedia-Autoren: Exoskelett (Maschine), 2021).

The exoskeleton is a mechanical device that often resembles the human body and is worn and controlled by a person. It is designed to support the user and is usually located close to the body in order to follow all movements simultaneously. As an interesting side note: The exoskeleton is a term that also occurs in other fields such as biology. This is the name given to organisms that have a passive protection or supporting shell (Herr, 2009)(Albrecht et al., 2017).

Introduction into the history

Originally, the intended use of exoskeleton was for battle. The aim was to achieve a higher strength or faster movements. The first version of such an exoskeleton was "Yagn's running aid" by Nicholas Yagn in 1890. He attached two leaf springs to the side of the legs to improve the running speed of infantry. The idea was to absorb weight during ground impact and reinforce it during push-off. However, there is no record of whether this device was ever built (Albrecht et al., 2017).

In 1965, the U.S. The Department of Defence decided to develop a skeleton capable of lifting 682 kg. 5 years later they had completed an arm, but it alone had a self-weight of 750 kg and could lift just 341 kg. Because of that, the project was stopped (Bogue, 2009: 421)(Albrecht et al., 2017).

Further attempts and other projects followed until the first exoskeleton, without a military background, was developed by Yshiyuki Sankai in early 2000. "HAL" is the name of the suit and simplifies and assists workers in lifting heavy loads as well as be used during disasters (Bogue, 2009: 423)(Albrecht et al., 2017).

At the same time exoskeletons have often been used as objects in science fiction, fantasy movies and books. It doesn't matter if it's Colonel Steve Austin who, thanks

to implanted machine parts, becomes a cyborg and thus superhumanly strong (The Six Million Dollar Man, 1973-1978), Ellen Ripley who declared war on the aliens with her futuristic forklift truck (Alien, 1986) or Tony Stark who, with his full-body armor, can transform himself into a Marvel comic book hero (Iron Man, 2008). They all fascinated television viewers for a long time. Today, work is being done at full speed to turn this television fiction into reality (Strobel, 2014).

3.1.2 Myosuit

The Myosuit supports patients with different diagnoses and clinical pictures. It is suitable for people with movement restrictions in the legs who want to improve their mobility or want to have more stability and safety when walking as well as being more independent again. Currently, the suit is used at rehabilitation centres for short and long-term therapies and by a few patients already at home. Patients work with the suit as part of physiotherapy or for personal use to perform leisure activities like hiking. As the Myosuit stands out for its reduced design, it can only support the patient to a certain degree. It is important that the person still has a certain amount of remaining muscle function in the legs to be able to use it successfully. Despite this guideline, the suit can be used for many diseases, we present here two of the possible applications (MyoSwiss, 2021).

Multiple Sclerosis (MS)

The suit promises great success in neurological disease patterns and autoimmune diseases associated with fatigue or muscle weakness, a big representative in this area is MS.

Multiple sclerosis is a chronic inflammation of the central nervous system (brain and spinal cord). The patient's own immune system destroys parts of the nerve fibers that are significantly involved in the transmission of impulses. This leads, among other things, to symptoms of paralysis, muscles can no longer be coordinated properly or sensory signals cannot be transmitted correctly.

The first symptoms of MS usually appear between the ages of 20 and 40. MS is the most common neurological disease that leads to permanent disability in young adulthood (Monks - Ärzte im Netz, n.d.)(Deutsche Gesellschaft für Neurologie, 2019).

Worldwide, approximately 2.5 million people suffer from multiple sclerosis, and the annual rate of new cases has been increasing in recent decades (DMSG-Bundesverband, 2021). A cure for the disease is currently not available, but for some patients the course of the disease can be decelerated.

Studies show that physical activity and sports have positive effects on MS patients. The strength and endurance performance is improved and the sense of balance is strengthened. The release of serotonin (a hormone in the brain that controls mood,

sleep patterns, ect.) helps against fatigue and depression, two typical symptoms of multiple sclerosis (Tallner & Pfeifer, 2012: 162–169)(Imhof, 2014).
The Myosuit provides great added value to patients suffering from muscle fatigue and pain. It helps patients to stretch and stabilize the knee and effectively helps patients to exercise more, stand better and walk easier and longer. During stair training, the suit assists in pushing up and provides safety and strength that patients would not be able to achieve on their own (J. Breuer, personal communication, 04.02.2021).
Because multiple sclerosis is a neurological disease, we heard from our interviews with therapists that there is a direct correlation between emotional state and physical ability during exercise. Therefore, training with a stressed patient is significantly worse than with a motivated person. This can also change abruptly from one to the other during therapy, like an on/off switch. This connection does not occur as strongly in other diseases such as stroke or paralysis (O. Röder, personal communication, 05.02.2021).

Stroke patients
Furthermore, the training with the Myosuit can help in various accidents that result in paralysis, one of them, the stroke.
Strokes occur unexpectedly and can have severe consequences, such as disabilities of various degrees. The death of brain cells results in consequential damage such as paralysis, impaired consciousness or numbness. Particularly people of advanced age (65+) are at risk of stroke (American Heart Association, 2009: 15). Such an event poses the risk of the affected patient losing independence in everyday life (toppharm 2021).
Myosuit helps stroke patients train their walking ability during rehab with the functions they still have. An important issue is often the hyperextension in the knee. This serves especially in the initial phase as a compensation that the knee is locked and therefore passively secured. This method is used for the stance leg phase. For the therapist, however, it is important to teach the patient a functional training in which the patient should keep the knee slightly flexed and stabilize it through the quadriceps. Especially in this case the Myosuit is an important supportive tool, as it gives the patient confidence to keep the knee bent while taking a step forward with the unaffected leg. This training situation with the Myosuit provides support and safety so that the patient can work on functional training instead of compensatory training (continuing to train with hyperextension in the knee so that the muscles don't have to work)(J. Breuer, personal communication, 04.02.2021).

Function of the Myosuit
The Myosuit works on the same principle as a human muscle. The suit has motors in the backpack that tighten the cables to support the wearer's leg muscles and movements. For example, they can assist in getting up from a chair, climbing stairs

or ordinary walking. All this is done via sensors that detect and then support the wearer's movements. The strength of the support can be set individually and for each leg separately. This is important, for example, in the therapy of stroke patients with a paralyzed half of the body. The Myosuit is based on a novel concept that provides its wearer with an additional layer of wearable muscle to support their movements during activities of daily living. Soft components in the suit make it comfortable to wear and flexible in use.

When a user wears the Myosuit for the first time, the system calibrates to the movements, tries to understand them and then supports accordingly. The Myosuit adapts to the wearer and their movement patterns to provide individualized support (Schneider, 2019)(MyoSwiss, 2021).

Interactive parts of the Myosuit

In addition to the Myosuit itself, a small device is included on the suit that is the main communication between the patient/therapist and the suit. With this device you can make settings and switch to different profiles.

There are three support modes, but only two of them are regularly used by the patients. The first profile is needed to stand up and start walking. The second is the isometric mode and stabilizes the legs for optimal standing and balance training. The third profile would be for walking down the stairs, but the patients do not feel the support and feel insecure, so they use isometric profile as well in these scenarios. Finally, of course, there is the transparent mode, where no force is applied and the suit does not provide support.

The data is currently stored on an SD card inside the suit and is only processed by manual transfer to the computer. Through the web you can access a user platform and save the data there. On this platform all information is stored and can be compared. For the time being, the number of steps, the number of stairs, the number of rises, the step symmetry and the active hours are evaluated.

In addition to these two tools, there is also an exercise portal where exercises for the Myosuit are displayed and explained (MyoSwiss, 2021).

3.1.3 Medical aids as inspiration

In his book "Design meets disabilities" Graham Pullin explores how mainstream design can be inspired and changed by design for disabled people. As an example, he writes about the role of eyeglasses, and how they evolved from a medical necessity to fashion accessory/statement. He further questioned how other medical devices such as hearing aids or prosthetic limbs could become fashionable (Pullin, 2011).

Similar questions went through the mind of Liz Jackson, as it is written in the article "Designing for Disability" by Amy Merrick. Liz Jackson was diagnosed with

idiopathic neuropathy, which forced her to walk with a cane. A cane reminds people of their own mortality and Liz Jackson's goal was to create canes with which her clients would not feel ashamed of. As for herself her feeling towards the cane changed to a source of self confidence (Merrick, 2015). In the interview, which we conducted with an MS-Patient, she as well expressed her wish to use the Myosuit as a wearable which fascinates people because of its technological advancement and therefore, shifts the focus of her disease (Patient, personal communication, 28.01.2021).

3.1.4 Designing for disabilities

In the article "Designing for Disability Justice: On the need to take a variety of human bodies into account" Matthew Allen discusses that often design does not take the diversity of human bodies into account. Sara Hendren a professor at Olin College maintains that one of the reasons that designing for disabilities is often neglected, is because it is not seen as something exciting but rather as a check-box, one should not forget (Allen, 2021).

„I think the biggest barrier, of course, is the limited imagination that standards tend to create. Because it's a checklist and a liability matter, the rhetorical framing of disability gets subsumed under that logic: a cloud over the excitement of a project, or a 'don't forget' matter of inclusion." (Allen, 2021). She argues that the circumstance that one has to hold on to standards can limit creative thinking and become too straight forward.

However, she also explains that standards are still important. She mentions as an example the International Symbol of Access as a successful example of standardization. It is a recognizable sign that brings attention to ramps and in addition to this it signalizes and protects spaces and seating for people who need to be near a fire exit or a bathroom.

Another reason for the neglection of the topic of accessibility in designs pointed out by a historian, Hamraie. He explains that in the past little effort has been done to enable disabled people to become designers (Allen, 2021).

3.1.5 Importance of mobility

In their paper "Impact of skeletal complications on patients' quality of life, mobility, and functional independence" Costa et al. explain how skeletal complications have an impact on the quality of people's lives. Patients who have SRE (Skeletal-related events) are often not able to perform basic tasks in everyday life. Further, they experience increased feelings of depression and anxiety (Costa et al., 2007: 880). On the information portal site of Professional associations and special-

ist societies for psychiatry, child and adolescent psychiatry, psychotherapy, psychosomatics, neurology and neurology from Germany and Switzerland, they write about the impact sport and mobility has on psychological treatment. The article shows that sport increases confidence, self-initiative and steers against fatigue (Neurologen und Psychiater im Netz, 2001).

3.1.6 Usage of exoskeleton

For people who suffer from loss of mobility, movement is a crucial aspect to regain strength and health. The study "Activity-based training with the Myosuit: a safety and feasibility study across diverse gait disorders" of Journal Neuroscience points out that the Myosuit improves mobility and the speed of a patient's walk. In their study they investigated how the Myosuit impacts the rehabilitation process in therapy. It supports the patient while walking and as a result the therapist does not need to support the patient constantly during the training (Haufe et al., 2020).
In the book „Wearable Robotics Challenges and Trends" Arun J. emphasizes that exoskeletons show a lot of potential for the field of rehabilitation because they provide over-ground mobility. Further, in 2017 they predicted that exoskeletons are going to augment human performance for both non-disabled and disabled people (Arun, Rymer, 2016: 21).

In the Journal of NeuroEngineer about "Exoskeletons and orthoses: classification, design challenges and future directions" Hugh Herr writes about exoskeletons and the future of mobility. He points out that during the 20th century investigations in human-mobility were primarily focusing on wheeled devices. Only little effort went into the investigations of anthropomorphic exoskeletal technologies, but that seems to be changing for the 21th century as two automobile companies Toyota and Honda have begun their research in this area. In their view the potential lies in augmenting mobility in a way for elderly, physically challenged persons and to discover mobility in a new way (Hugh, 2009: 7-8).
For patients who suffer with MS, the training with the exoskeleton is safe and feasible, however, the current technologies could still be designed more user friendly (Chan et al., 2009: 19).

In the Journal of NeuroEngineering and Rehabilitation, Hugh Herr sees different upcoming design challenges in the area of exoskeletons. The torque and power of an exoskeleton are factors which make it hard to augment the movement of patients.
Further, there could be some sort of kinetic information exchange between the wearable and the nerves of a patient. Lastly, the interface design can be improved to be more comfortable and effective to the human body (Hugh, 2009: 6-7).

3.2 RESEARCH QUESTION AND HYPOTHESIS

01

How can we create a motivating environment based on habits in daily structures?

02

How can we guide the patient through the rehabilitation process in a more intimate way?

Annotations to the research questions:

For both of us the whole field of health design is completely new and we have in addition to this never interacted with people who use an exoskeleton to train. Thus, it was important for us to get to know the patients, their problems, hopes and aspirations.

As we talked to the patients, we were surprised to hear that they struggle with their long term motivation, despite the innovative technology of the exoskeleton.

This sparked our interest to understand the topic of motivation on a deeper level. Furthermore, we wanted to understand how we as designers can have an impact by creating an environment, which would make it easier for them to train in everyday life.

During our conversations we experienced that patients, who lost the ability to walk due to a traumatic disease or accident, are emotionally involved in their rehabilitation process. For some this process takes some months, years for others it's a process for the rest of their life. Hence, we investigated a possibility that would lead to a more intimate relationship with the suit, which could facilitate everyday training with the Myosuit.

3.3 METHODOLOGY CHOSEN FOR YOUR INVESTIGATION

3.3.1 Conversations

In order to investigate the area of our topic we started conversations with physiotherapists and patients to understand their situation better. The aim of our chats was to examine where we as designers can have a positive impact on their training with the Myosuit. The conversations were designed in an informal manner to create an environment where patients could feel comfortable. Through these talks we got a broader and deeper understanding for whom we are designing. We were excited to see that patients as well as physiotherapists were looking forward to working with us. The topic of motivation plays a significant role in their training and therefore, they were immediately involved.

Talking to physiotherapists

Usage of the Myosuit:

In the conversations with physiotherapists, it became clear that one of the advantages the Myosuit offers is that it gives patients the freedom to use it according to their individual needs. This means that a patient who likes to be outside can use the Myosuit to go hiking, however, the Myosuit could also be used for indoor exercising. How the different patients use the Myosuit is a topic which we discovered again when we got to know the patients and their preferences.

Another important aspect was that patients would profit a lot if they could take the Myosuit home to train. It not only enables patients to train more often and achieve better results but also is less expensive, because there are no additional expenses for therapy.

Training and exercises:

We talked with 6 different physiotherapists and discussed the different approaches they take. Some physiotherapists focus on gaining more muscles and on getting stronger in general. Others focused on specific exercises, which help patients to

master daily activities such as walking up and down the stairs or walking outside. The daily activities in combination with myosuit training became a more important role in later conversations with patients. Unfortunately, patients often do not train without the physiotherapists around, even though they would benefit from it.

Motivation:

One of the most motivating factors is when a patient recognizes the positive effect the Myosuit has on his or her health condition. However, physiotherapists experience that for some patients, it is hard to see their own progress. Patients sense their progress very individually, for some it can take months, whereas others feel a big influence after the first training.

Physiotherapists serve as coaches during the training session. They support them in the process to reach their goals, still, patients have to set their targets by themselves. Some patients manage to create a training which is self sustaining. They can motivate themselves at home, because they know that the training helps them. In these cases the therapist is there to set up the suit correctly and to perform extreme training in a safe and controlled environment. The scenario where the training with the Myosuit becomes self sustaining interested us and we wanted to investigate it further. At what point does training with the Myosuit become a self sustaining process and how can we help patients to achieve this point?

Motivation in the context of the patients' emotional state:

How the training makes the patient feel is a source which they use for motivation. Many also reported "after effects" of the Myosuit, as for example, they described that they had a smoother and more beautiful gait pattern after exercising. This experience leads to positive emotions and is very motivating. The after effect therefore plays a very important role in the motivation and continued use of the Myosuit. Only those who feel good while or after training with the Myosuit will use it regularly as an aid at home.

Some physiotherapists concluded that the psychological state of the patient is half of the training. The patient can train as much as he/she wants if they don't feel better, they won't recognize it. Further, the walking will not improve as the lack of confidence often causes the posture to suffer as well.

Talking to patients

Patient 01:

The first meeting with the patient started in a good mood. Even though we didn't know each other, it was an unforced conversation. The patient spoke about her disease, multiple sclerosis (ms), due to which she had a cell transplantation. Because of ms she lives with her parents and is also not able to work at the moment. She hopes that the Myosuit will give her more energy in her everyday life.

The first trial training was in November, so not long ago, yet she feels an improved

gait, her steps are larger and she walks more naturally and fluidly, more like a healthy person. Training with the suit gives her more stability thanks to the tight hip belt and she already notices that she can walk more upright and better. The biggest advantage of the Myosuit is that she uses her own muscles and the Myosuit only supports her. She is flexible in how much support she wants to get from the suit, on good days it is very little, but on bad days she can still train by increasing the support. This helps her to be more independent.

At the moment she trains every day for 20-30 minutes walking in the corridor of her apartment. She would like to use the Myosuit in everyday activities like going shopping. She hopes that when people see her walking with an exoskeleton it would shift the focus of her disease to the technology she wears. One of her aspirations is that the suit becomes a partner in her everyday life so that she can go shopping with it or walk along the Aare independently, without anyone else.

There are days when she harmonizes with the suit, these are the days when training feels especially good. The suit adapts to her and she learns to adapt to the suit. Sometimes she is impatient and frustrated during training because she would like to see faster results. Another big wish would be to be able to wear the Myosuit all day long and that it would support her in every activity and movement.

Currently she is training with the suit while moving around the apartment. She is also starting to take the stairs, do squats, and do the first stability exercises. The exercises on the MyoSwiss website are helpful and she also uses them at physiotherapy.

Patient 02:

He had an accident 35 years ago that left him paralyzed. It is possible for him to walk short distances with his cane, but it is very exhausting and tiring. Two years ago he learned about MyoSwiss and tested different prototypes and contributed with his feedback from the beginning. After that he also bought himself a Myosuit and trained with it. Unfortunately, he is not able to train due to an injured foot at the moment. With the Myosuit he can walk a good kilometre.

He has never trained with another exoskeleton and needs it mainly indoors, because putting it on and off outdoors is a bit more complicated (normally he needs 5-7min, outdoors 10-15min to put on the Myosuit). In addition, he uses the suit purely for training, because it is too inconvenient for everyday life and the suit would also hurt him in the long run.

He is actually very motivated to wear the suit and train with it. He has also set a goal, which is very helpful. He wants to run 10km in one go in about a day. For this he has also calculated mini intermediate goals, how much he has to reach on the cross trainer until which date.

But purely the feeling of walking with the Myosuit is rewarding enough. Sometimes there are moments when he melts into the suit and has the feeling of normal walking again. This provides a real endorphin kick and is a great motivator.

The only moments that take effort are the ones before putting on the suit, sometimes he needs a push to get it on.

Patient 03:

The patient is 60 years old and is paralyzed for 4 years due to a very rare spinal cord disease and feels nothing from the chest down. In the beginning, she was afraid of the training but after a few months of training she saw her progress. The main reason for her fear was her severe paralysis hence, she did not trust the suit to support her enough. However, when she realized that it worked, it was a great experience and she wanted to continue training with it. At the moment she can't train with the suit because of the coronavirus pandemic.

The motivation comes from herself, she is very interested in the Myosuit and likes to try new things. Now that she hasn't been able to train for a few months, she is back at the beginning of training, but the motivation has still remained. She is part of a research project so that her special and rare disease can be researched, so that she can help others with the same disease.

In addition to this, she is always looking forward to training with the Myosuit and is always very motivated to work with the suit. During the training with the suit she even managed to walk without a suit on the bars. Her new goal is to be able to move around her home with the rollator. For her it is clear that once you can walk and train with the suit, it is easier to use it at home. If it is possible for her to put on the suit on her own, she would like to use it outdoors and for long distances and need the rollator at home.

Patient 04:

She is a church musician and was diagnosed with MS in 2009. For a long time her condition remained stable, only in recent years it suddenly changed and became worse. Through her physiotherapist, she became aware of the Myosuit and immediately got trial training at MyoSwiss. The suit made a good impression on her even though she feels like a robot training with it. Since 2020 she is training with the Myosuit two times a week together with a physiotherapist. The effort was worth it because the suit has shown her new possibilities and she has learned more about her body and gained better coordination as well.

To achieve this, she had to be persistent, because at the beginning it is hard and depressing when you don't see results immediately. She doubted whether the suit would do her any good, but she continued with it and after about 3 months she felt noticeably better. Today she can walk independently for 30 minutes to 1 hour.

The motivation came all by itself. She was at a point where she realized that something had to change so that she would be able to play with her child. Her goal was to be able to walk to their tandem bike with her husband. So far, she felt exhausted arriving there, before they even took off. She wanted to change that and she did. As a next step, it's already enough motivation to stay fit and keep up with her son.

She wants to take an active part in life, because the disease isolates her, makes her lonely and it is depressing not to be able to do things that she enjoys and that she used to be able to do without effort.
In general she sees a particular barrier in recognizing the suit's potential. It takes time to see progress and the influence the Myosuit has on the body. As soon as you experience that the Myosuit helps, it is often enough motivation. It is only this threshold that must be crossed to realize the value.
She is very convinced and enthusiastic about the Myosuit, she did not buy the Myosuit. She would consider buying a suit if her physical condition would get worse. In addition to this, she hopes that the suit will continue to develop and that many things will become easier and more user-friendly.

Patient 05:
This patient brought her husband to the zoom meeting. This was the first time we talked with a couple. Throughout the conversation he supported her, especially when we talked about her disease, as it was difficult for her to talk about it. We didn't want to push her and therefore just listened and let her tell us how much she wanted to. This patient suffers from a genetic muscle disease. She has pushed her condition into the background for a long time, but because of her husband she is now coming to terms with her situation. At a handicap fair, the two came across the Myosuit. She also heard about exoskeletons at the University Hospital, and through her technology-enthusiastic husband they came across MyoSwiss. She has had the suit at home for about 1 year now.
For her it is difficult to define a specific goal. Furthermore, she doesn't exactly know why she should train with the suit. She certainly wants to strengthen and build up her muscles and maintain her current physical condition as well.
As there have been situations where the suit has worked against her, causing her to fall straight onto the floor, she lost some confidence while wearing it. These moments make it hard to build trust in the suit. Nevertheless, she wants to regain confidence in the suit.
Although the disease is always on her mind, she deals with her situation in a positive way. She tries to hike a lot and has recently finished her business school. She always tries to discover things that she enjoys. She also has a strong social environment that encourages her in her endeavours. Her friend, for example, thinks it's great what she's doing, even if it's difficult and exhausting.
During physiotherapy she feels motivated. It went great and she felt comfortable. At home, however, it is more difficult to motivate herself at home. She asks herself why she should do the exercises at all? Further, she also depends on her husband's help to put on the suit as well as partly for the training. This means that he also has to have time and be motivated. In addition to her training, she has a busy schedule, which is another factor that makes training difficult - it gets forgotten in everyday life. It would be ideal, of course, if she could put on the suit on her own,

which would make things a lot easier. She also hopes to be able to use the suit more in spring, because then she can also use it outdoors and take it with her on hikes. Indoors at home she finds it very difficult to find motivation to use the suit. She has created a weekly schedule of when she wants to exercise to get back into a routine, but often she is too tired in the evenings to train or prioritizes other things.

Progress is hard for the patient to see. Her disease progression is stagnant at best, making it difficult for her to feel her progress or to tell if the Myosuit is slowing her symptoms. Sometimes she feels that getting up from a chair is better or that she has become a little stronger, but at the same time she feels that climbing stairs takes more effort than before. However, in her opinion, she has not used the suit enough to really see any success.

Patient 06:

This patient has been using the Myosuit for 1.5 years. He has been suffering from Multiple Sclerosis since he was 23 years old. He has heard of the Myosuit from his self-help group. He was curious about it and thus tried it on. In the beginning he had trouble walking, he realized very fast that the Myosuit was helping him. With the suit he could walk much longer. When he took the Myosuit off he realized that his feet felt much lighter, less heavy and his legs felt normal. This whole experience fascinated him very much so that he trained with the Myosuit again, which helped him to e gain a lot of power.

To reach his cottage in Ticino he could barely walk 135 steps, but now with the Myosuit he reaches the top of the stairs and does not feel out of breath. He further participates in a Jogathlon, he can walk much further than before and has sore muscles in a very healthy way.

His goal was to independently walk around the area he lives. Unfortunately, he had to realise that in his condition this was not possible.

For him training works better with a physiotherapist around. Walking is intensive work, he told us that he has to think about every step while walking, which is very exhausting. He further said that if someone trains with him it is much easier to overcome himself because he's being pushed from the outside. One also has to be attentive for the movement and the right feedback is important for the right exercise.

3.3.2 User Journey

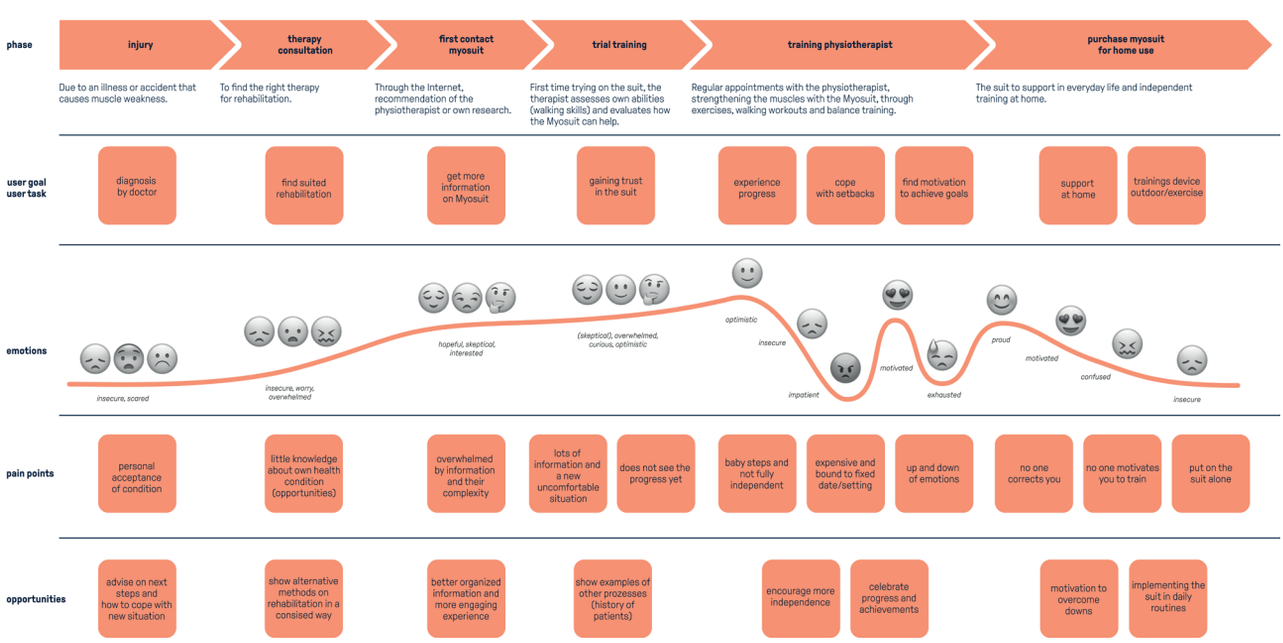
The user journey helps us in order to become clearer about the exact process a patient goes through in rehabilitation. The detailed steps visualized in the user journey have been verified in collaboration with a physiotherapist. The sequence of activities helped us to find our focus for the project. The journey starts with an accident, followed by a consultation with a therapist. During the process, either

through the therapist themselves or through their own research, the patient becomes aware of the Myosuit. There is a first test training, which in case of a positive experience becomes a regular training with the therapist. There are medical diagnoses that only require a few months training. For diseases such as MS, long-term use of the Myosuit is required. If after a while the patient is still convinced by the product, the Myosuit can be bought for home use. The idea is that the person can also train with the exoskeleton at home and only has to do specific exercises or adjustments with the physiotherapist once a week. This part is also our focus. We deal with motivation in the home environment, when no therapist is around and they need to find time for the Myosuit in their busy everyday life.

From the therapist we have confirmed that the emotional feelings of the patients are mostly very good at the beginning of the training. However, over a longer period of time, the therapists notice that many patients become impatient, they don't see much improvement, they feel insecure and they don't know if the training with the suit works at all. A similar tendency can be seen when patients decide to train with the suit at home. In the beginning, they are all very motivated, but this gradually decreases, they get tired, they feel they have no time or more important things to do. The human component of the therapists is of central importance, as they usually motivate the patients to overcome their downs and give them more security. As this human component is missing at home, patients turn to therapy sessions rather than training independently.

It is exactly in this tendency that we situate our project in the home environment, to keep the motivation level and try to make the training with the Myosuit a habit.

Thanks to this method of making a user journey, the verification of pain points and emotions development, have helped us in narrowing down and more clear definition of our project.



User Journey of the Patient with the Myosuit. (2021, March). Copyright 2021 by Mara Weber & Michelle Schmid.

3.3.3 Personas

Based on our talks with patients and therapists, we developed 4 personas.

01

First there is Karen. She is very goal-oriented and ambitious, which manifests itself especially in sports. Since her paralysis, her body quickly begins to hurt from conventional training. This however, puts a lot of pressure on her and can lead to frustrations if there is no progress. Due to her accident she moved back home and lives with her parents who support her in her daily life. Her goal is to become more independent in the future.

02

Secondly we have Felix. When he was diagnosed with MS, his health remained stable for the time being, but in recent years it has become increasingly worse, making even his favorite hobby, cooking, harder and harder for him. Even small daily tasks are difficult for him to perform alone. After shopping he is tired and feels unsteady on his feet. Exercising is not much fun for him either, as he tends to be rather lazy. He wants to be able to do simple home tasks on his own.

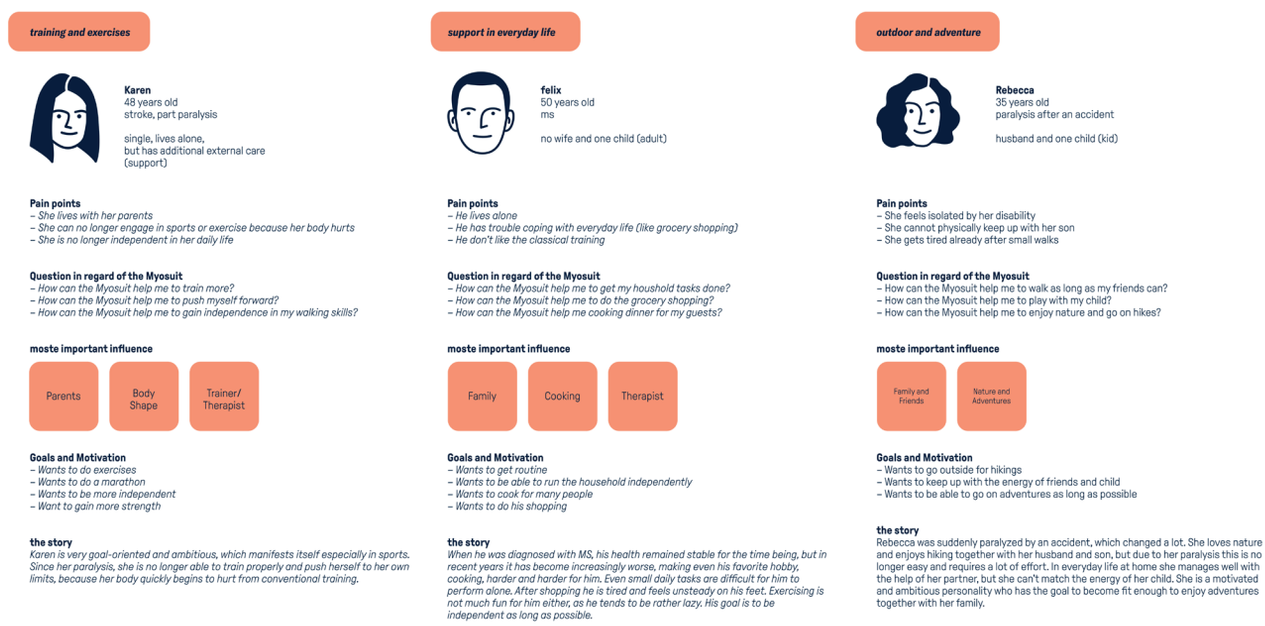
03

Rebecca was through an unexpected accident paralyzed, which changed a lot. She loves nature and enjoys hiking together with her husband and son, but due to her paralysis this is no longer duebel, this can lead to a feeling of isolation. In everyday life at home she manages well with the help of her husband, but she can't match the energy of her child. She is a motivated and ambitious personality who has the goal to become fit enough to enjoy adventures together with her family.

04

And at last there is Paul. Paul had a fulfilling life which resulted in his large family with children and grandchildren. In the last years his physical abilities decreased strongly, although he still feels mentally fit he tires quickly. He is no longer able to go for a walk with his younger and still fit wife. In addition, he feels insecure and does not trust himself with many things, which depresses him and isolates him from his family. To change this he is motivated to train and try new things. His goal is to be able to play a bigger role in social activities together with his family.

First we discussed our personas with MyoSwiss, as feedback we got that they were formed to close to the "real" patients. Some characteristics, such as living with parents at 48 years of age, affect only one patient specifically and are not a situation that affects the average patient. In addition, the person of Paul is a relevant user group, but they would exclude them from our project, because this is another large new group with its own needs and to which they do not yet have a large user group.
Both patients we discussed the personas could identify themselves with Karen and Rebecca. The therapist found all the personas relevant, but again noted that she never had a patient who still lived with her parents at that age. Most of them were in external care or had additional support for everyday life but not from their parents.
The feedback helped us to shape our personas and to better define our main user group. Based on that we excluded Paul from our personas and changed Karen from living at her parents place to using external support for her daily life.

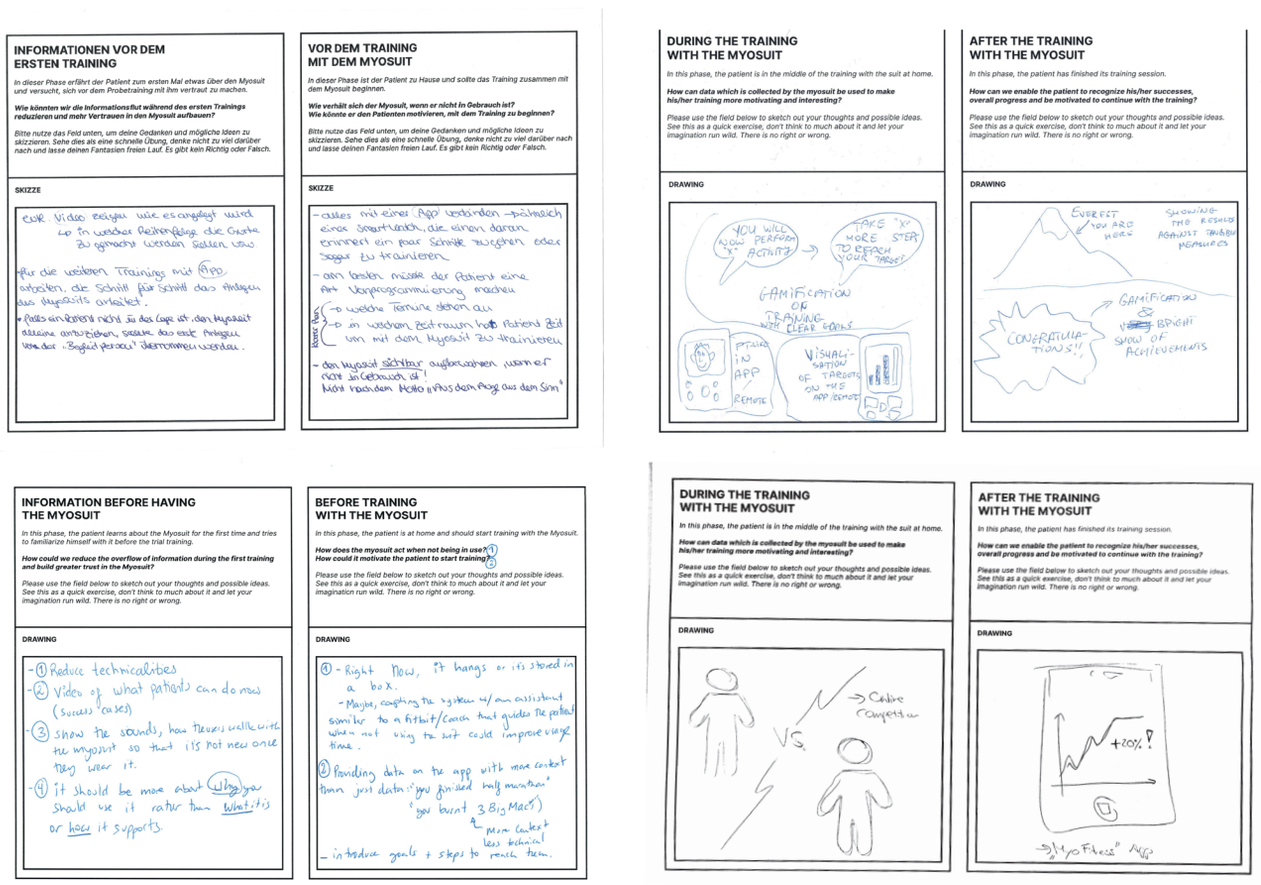


Personas we created from our User Research. (2021, March). Copyright 2021 by Mara Weber & Michelle Schmid.

3.3.4 Cultural Probes

The Cultural Probes were important at the time to find out what MyoSwiss, therapists and patients expect from a motivational tool. It was about understanding their interests and ideas and picking up their needs. We sent out a total of 14 emails (3 physiotherapists / 2 patients / 9 people from MyoSwiss) with a PDF, and asked the participants how they imagined the suit could motivate them before, after and during training. Back came 11 responses (3 physiotherapists / 1 patient / 7 people from MyoSwiss) with sketches and descriptions. We added these to our pool of ideas. It was a helpful exercise to give everyone involved the feeling that they are part of the project and to expand our own expectations. In addition, we got first impressions of how the person imagined the realized project. Most described an application, but some used elements directly on the suit such as speakers or lights that communicate with the patient.

We sketched out and summarized the ideas that emerged. These now serve us as a resource pool for the further development of the project and as inspiration.



A small selection of the answers from our Cultural Probes we received from MyoSwiss, patients and therapists. (2021, March). Copyright 2021 by Mara Weber & Michelle Schmid.

3.3.5 Workshop

In the next step we wanted to validate and add ideas with a first workshop together with patients and therapists. At that time we were already a bit further with our concept and tried to test elements that were inspired by a motivational theory called "ZRM", to understand the reaction of the patients. For this short workshop we interviewed a therapist, one male patient and one female patient together with her partner. With the therapist we had already spoken before, but we did not know the two patients yet. It is relevant to mention that both patients already have the Myosuit at home and therefore symbolize our direct user group. It was important for us to conduct this short workshop at this time to integrate all stakeholders step by step on our way. And to get opinions from different people repeatedly.

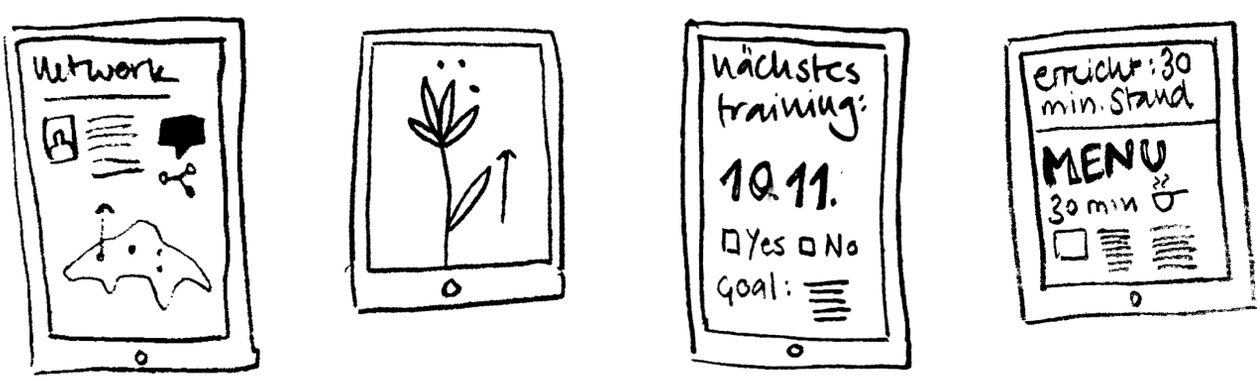
The workshop started with an interview because we did not know the patients yet. During these interviews, insights from the initial interviews were addressed again by patients. For example, patients repeatedly expressed a positive response to a possible network of Myosuit users. The illnesses and special situations patients live with often make it difficult for them to participate in social life. This makes them feel isolated and misunderstood. This awakens the urge to connect with other patients and learn from their experiences.

After that we tried a first experiment with the picture selection of the ZRM. The patients had to choose a relevant picture from a card index and describe why that particular picture would help them train with the suit. Together with the found keywords we tried to formulate an attitude towards the intention, an attitude that should help them to motivate themselves during training. One patient chose the beach as her image and her resulting motto goal was: "I want to feel like when I'm in the water, weightless, that I can move as I want." A nice motto as we think. However, we did not go further into the motto, as we wanted to get a first reaction from the patients. To our surprise the experiment was so far a success. The patients were quite intrigued by the image and the motto spoke to their situation. Due to this experience we investigated and tested further possibilities how the image could be used as a motivational ressource. Out of these situations the idea of the avatar started to evolve.

Next, we looked at the personas and tried to confirm with the patients and therapists their authenticity, or which persona the patients would associate themselves with. Both patients noted that they were not sure how the suit could support them in everyday life. The Myosuit has different profiles, for example to support the patient in standing or walking. For household chores, they would need a combination of the two profiles, as the constant switching of profiles would be a hindrance. In general patients were interested in the idea to use the Myosuit for daily duties. However, they mentioned that they need more clearer guidance to be able to implement the Myosuit training in their daily activities. As for example, they both recognized cooking as an everyday task for which they could use the suit for.

Finally, we looked at the pool of ideas that had emerged. One patient with her partner and the therapist found most of the ideas to be enriching and interesting and recognized added value in all of the sketches. The therapist found the ideas very creative and well thought out. She is a big fan of new ideas and different approaches. The patient with her partner was enthusiastic about the idea of an application. She particularly liked the linking of daily activities with the Myosuit training. She would welcome a strategy which supports her in combining Myosuit exercises with everyday duties. Especially when cooking she could imagine using the suit. They were also interested in conventional ideas, such as displaying meters walked, comparing oneself to others, and rewards. This was also true for the second patient, who also particularly relied on the tools he was familiar with, such as showing comparison and progress. He found new ideas such as integration into everyday life or feedback on emotions difficult to assess and was rather skeptical about them. We also noticed that he made contradictory statements, for example during the interview he told us that he would like to use the suit for cooking, but with the pool of ideas he was not convinced about cooking as a training unit. A finding we will certainly have to keep in mind.

Our project will go in an experimental direction and we will try to develop tools for motivation which speaks to the patients needs. It will be interesting to further develop and test our ideas with them in order to see what really motivates them and what doesn't. Thanks to this workshop, we have also been able to further narrow down and define our topic area, as many wishes were repeated during the workshop.



Some of the sketches we discussed with the patients and therapists during our workshop. (2021, March).

3.4 SECOND RESEARCH ON MOTIVATION

3.4.1 Rubikon-Model

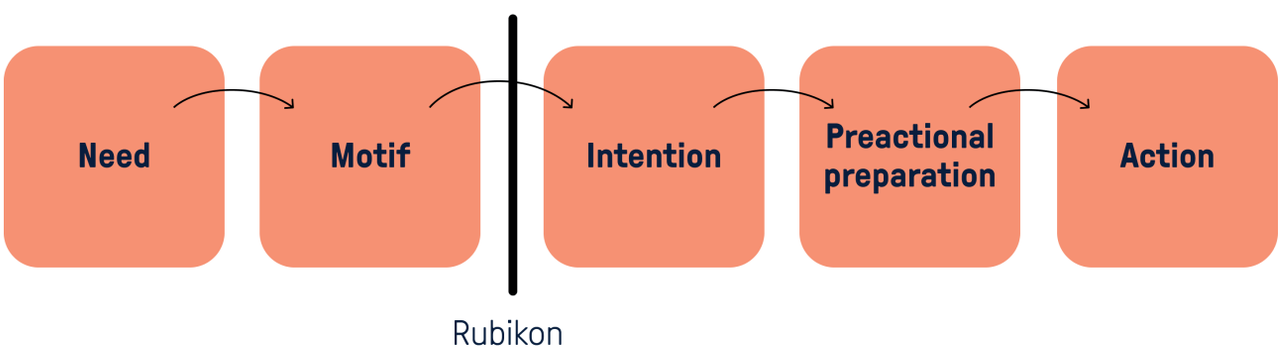
In the book by Maja Storch and Frank Krause "Selbstmanagement – Ressourcen-orientiert" they write about Heckhausen and Gollwitzer who developed the Rubikon-model. The Rubikon-model describes the development of action goals. It thrives to analyze fundamental problems of motivational psychology „the choice of action goals on the one hand and the realisation of these goals on the other hand" (Gollwitzer,1991: 39, as cited in Storch, Krause, 2002: 58) Or in other words, why are we motivated and how does it influence our behaviour? The Rubikon-model is divided into six phases. The needs are still unconscious, through the process they evolve into motives, which are consciously perceived wishes.

Roth writes that we need something, which gives an incentive from our unconscious mind to be able to formulate wishes or needs in our conscious mind. These then can evolve to an emotional acceptable action plan. A conscious motive which is in harmony with the unconscious needs, can then move forward to a target oriented action. If the conscious and unconscious are in conflict towards each other, one has to first sort out what has priority (Storch, Krause, 2002: 61).

Heckhausen's model shows a process which leads from motives to intentions, what he calls crossing the Rubikon into action. A core aspect which is important to surpass the Rubikon is a positive feeling. If the positive feeling has settled the person has decided what she/he wants (Storch, Krause, 2002: 64).

Once a person has crossed the Rubikon, it means that a clear intention has been created. The strong positive feeling reinforces a person to set its objectives into actions. In motivational psychology the term volitional strength describes how strong the intentions are wanted, this affects how consequent the intentions are changed into actions. The more attractive an objective seems, the higher is the willpower to start acting towards it. Two important factors in this process are „desirability" and „feasibility" (Storch, Krause, 2002: 66). However, even if a person has a desirable and feasible objective, there are still possibilities that one can not

act them out, because it gets forgotten in daily routine. One reason that intentions are not set into action, is that for the new patterns of action there is no neural automatism present (Storch, Krause, 2002: 67). If one creates new intentions, one has to involve them in the implicit modus. Implicit knowledge can be created by creating automatisms through repetition. This is essential if one wants to create long lasting solutions and for example is also used to learn how to drive a car.
Further through implicit knowledge a form of unconscious learning can foster to activate emotions, personal attitude, objectives and intentions.
„Once people have formed implementation intentions, goal-directed behavior will be triggered automatically when the specified situation is encountered."(Gollwitzer, 1999: 501, as cited in Storch et al., 2002: 71)
If people come into the phase where the action starts, it means that probably they have been through preparation and precise execution intention. Still there is a possibility where they are not able to fulfil their actions, because of unpredictable events. The question here is how a person can be educated to perform well in difficult tasks. How can one stay motivated even though it comes to failures and setbacks? If a person does not have the ability to react towards such setbacks, it is possible that one gives up on a goal too early.



A scheme from the Rubikon-Model. (2021, March). Copyright 2021 by Mara Weber & Michelle Schmid.

3.4.2 ZRM

In our thesis we dealt with the ZRM „Zürcher Ressourcen Model: Grundlagen und Trainingsmanual für die Arbeit mit dem Zürcher Ressourcen Modell". The ZRM is a self-management training course, which Maya Storch and Dr. Frank Krause developed for the University of Zurich. The ZRM is based on novel neuroscientific insights on learning and acting. It is oriented on the Rubikon-model, which is a theoretical system that explains how one can create goal oriented action. The ZRM was additionally developed for a practical implementation of the Rubikon-model (ZRM, 2020). It uses practical methods in order to cause a person into goal oriented acting. These methods have further been used in rehabilitation clinics as for example in the Pension Insurance institution in Germany in order to support the rehabilitation process (Institut der FernUniversität Hagen).

ZRM by Storch and Krause, they refer to the neuroscientist Roth, who explains that people's needs, wishes and drives are created in our limbic system. In the limbic system is our emotional experiential memory. Our emotional experiential memory has the ability to tell our biological well being, what feels good and bad. This is further known under the name somatic markers.

However, even though we have this knowledge about what feels right to us, stored in our emotional experiential memory, it is still not always consciously available to us. Topics which are not consciously available can therefore not be used for a conscious action plan (Storch, Krause, 2002: 60).

In order to access the knowledge hidden in our emotional experiential memory, the ZRM uses a projection process. This helps to determine which topics are currently relevant for a person. For this purpose the ZRM uses images. The method works as follows: a big variety of different pictures is presented to a person. Intuitively the person has to choose which image appeals to him or her the most. The goal of that method is to also identify the unconscious topics in our psychology. After the patient has determined which topic is currently important to him/her, it becomes important to transform and develop the thoughts into a motto-goal (Storch, Krause, 2002: 153). The important aspects for a motto-goal are defined in the chapter „Creating a motto-goal". Once a motto-goal is developed, the next challenge is to bring the explicit knowledge of the motto-goal to implicit knowledge. The ZRM-training is basing its knowledge on how to get implicit knowledge on a neuroscientific basis. „The motto-goal" in the ZRM is viewed as a neural network, which defines together with other neural networks, the behavior of a person. The new motto-goal is a new neural network which is rather weak. Therefore, it needs to be strengthened to become actionable and easy to access consciously. If one does the right precautions, one eventually does not need to consciously decide to do an action or activate a neural network, rather it happens automatically (Grawe,1998: 268, as cited in Storch, Krause, 2002: 101).

The ZRM therefore creates different resources which help people to activate the

neural network. In the following chapters we will present these resources in more detail. In particular, the resources are an image which is connected to the mot-to-goal, the motto-goal formulated in a sentence, the embodiment of the mot-to-goal and cues in everyday life, which help to remember the motto-goal, consciously as well as unconsciously.

Creating a motto-goal

In practical use for coaching one can divide three layers which are important for a motivational goal. The three layers are: attitude, result and behaviour (Storch, 2011: 13). Attitude describes the general mindset of a person towards the topic or goal. In order to create the right attitude the ZRM has created a new goal-type called motto-goals (Storch, 2011: 13). Motto-goals synchronize the (IG) intentional memory which is important for thinking, maintaining intentions and planning together with the (EG) extension memory which is important for emotions and self-knowledge (Wikipedia-Autoren: Psi-Theorie (Kuhl), 2021). In the layer results, it is the exact specified goal, which describes what one wants to achieve in detail. The last layer describes what behaviour is needed to put the right attitude into action (Storch, 2011: 13). Further, it is important to mention that goals which trigger a positive affect have a higher potential to be set into action. Ferguson (2008) argues that people can act towards their goal more easily , if they are able to generate a positive effect (Ferguson, 2008, as cited in Storch 2011: 14).

Three main criteria are important in order to develop an effective motto-goal according to Storch and Krause (Storch, Krause, 2002: 86). They argue that it needs to be formulated as an approximation target, it needs to be under one's own control and it needs to show a motivational effect. An approximation target describes a motto-goal which implements the desired condition which one wants to achieve. The opposite are formulated as avoidance goals. These are goals which describe the condition which should be avoided. Storch states that it is scientifically proven that people who formulate their goals as avoidance goals tend to have higher anxiety, worse moods, reduced life satisfaction and a worse health condition. In addition to this, they feel less competent to place their goals into action (Elliot, Sheldon, 1997, as cited in Storch, Krause, 2002: 87). Wegner argues that a reason for avoidance goals creating negative effects one creates a mental representation of what should not happen. Neuroscientifically this means that it has created a neural network of what should not happen, which ironically increases the potential for it to become action relevant (Wegner, 1994, as cited in Storch, Krause, 2002: 88).

The second important aspect for creating a goal, is that one can achieve the goal independently. This is important because the higher the feeling is that one can achieve the desirable goal on its own, the greater the motivation to actually achieve it is.

The third criteria verifies the positive effects which are essential to bring a motif into action. Whether a goal has a positive effect and is therefore positively saved in

our emotional experiential memory, can be observed from external persons or from the person who creates the goal. One can observe a change in body posture, breath or a smile on the face (Storch, Krause, 2002: 93).

Embodiment

If one has successfully created a motto-goal it is important to activate it regularly so that the newly created neural network, which represents the motto-goal, is easier to activate. One way to multicode the motto-goal is our body. Here Storch refers to an example called the „Do-Effect" by a memory-psychologist Engelkamp. During the „Do-Effekt" different participants were shown different sentences of actions for example to comb one's hair. The other group had to act them out. The results of the study showed that the participants who needed to act out the action, could remember the different sentences much better. Engelberg explains this phenomenon with the fact that the second group of participants had the information coded on a further level namely their body (Engelkamp,1998, as cited in Storch, Krause, 2002: 109). Leuzinger-Bohleber, a Swiss psychoanalyst maintains that information which is kept sustainably in our brain, has always a physical component as well. The embodiment, he writes, allows us to remember reliably (Leuzinger-Bohleber, 2001, S.83 as cited in Storch, Krause, 2002: 110). Therefore, one of the main advantages to encode the motto-goal into our body is that one can sustainably remember it over a longer term. Another important aspect is that neuroscience and memory psychology assume that a neural network or the motto-goal can be activated by every layer. Therefore, if one can embody its motto-goal, the embodiment could activate the emotions and the perceptual awareness, which results in a readiness for action. As one can control its body posture through will power it is interesting to use it to get to a certain mood which facilitates the according action. Psychological experiments have proven that body posture can influence the emotional process of experiences. And as already mentioned emotions are an essential part for motivation (Storch, Krause, 2002: 111).

Cues in everyday life

The resource model, as it is described in the ZRM, works with resources (Storch, Krause, 2002: 167). The motivational goal, which was formulated in a sentence is for some people already enough input to activate their implicit modus and the neural networks. However, there is another method that enables us to bring the motivational goal into the implicit knowledge namely reminders. Hüther writes in his book "Bedienungsanleitung für ein menschliches Gehirn" that the networks in our brain, which we use and activate often get stronger, whereas the networks, which we use rarely, are getting weaker or stay the same. Consequently, this means that we have the possibility to program our brain, depending on how we use it. The brain can reorganize neural networks and in this way adapt to new environmental states. The two important aspects to strengthen neural connections, Hüther argues, is how

often the connection has been used and how successfully these connections have been used (Hüther, 2001: 99, as cited in Storch, Krause, 2002: 106).

This is why the ZRM-training works with reminders as activators of a neural network. Whether the activation of a neural network is done consciously or unconsciously is not relevant. This, as Storch writes, can be beneficial in situations where a therapist gives his or her clients homework. Homework often gets forgotten because of everyday life situations and not because the clients don't want to do the homework. If the activation of the neural network can happen unconsciously and it still changes the neural structures, then one can use reminders to activate the neural network and then go back to everyday activities since the processes in the brain start to work independently . The reminders that are used in ZRM vary a lot because it is important that every person can choose from reminders towards which they have a personal connection. Reminders can be in the form of music, odor, clothing, elements of the apartment, plants or jewelry. For the reminder cues it is important to ensure that they have a connection to the goal which needs to be realized, as they should stimulate the neural network. It is beneficial to implement the reminders in your everyday environment, as it leads to using the neural network even if we are consciously working on other activities. Further, the ZRM describes stationary reminders and ambulant reminders. Stationary reminders are objects which are placed in the place where the actual action happens. But since there is not always the possibility to place such stationary reminders, there is the concept of ambulant reminders. Ambulant reminders can be for example, a clothing piece that you wear every time you need to present in front of a big audience (Storch, Krause, 2002: 110).

Somatic Marker

Maya Storch describes in her paper „Pizza-Probe: Gute Entscheidungen treffen" that making a decision was for a long time in human history emphasized to be connected with your conscious mind. Emotions as well as body sensations were rather seen as disturbing factors during the decision making process. In German there are common sentences which underline an attitude which says that only people who are able to control their emotions are capable of committing the right decisions. As an example Storch presents these two sencentes: „Sei doch vernünftig!" or „Jetzt denk doch endlich mal nach!". In contrast to that stands Antonio Damasio's theory „Descartes Irrtum". Antonio Damasio is a neuroscientist, who argues that emotions and bodily sensations are essential parts of human consciousness (Damasio, 1994). Today, brain researchers estimate that every human being is in possession of an emotional experiential memory. Already from the moment of birth, the emotional experimental memory starts working and growing. It saves experiences in the form of emotions and body sensations, non verbal and on an unconscious layer in our brain. In detail, it works as follows: once a person experiences a situation which fosters a feeling of well being, it will be marked by a good feeling. Consequently, the contrary happens when a person encounters a

situation which makes her/him feel bad. These experiences, good or bad, are then saved in our emotional experimental memory.
In future situations, when a person encounters a stimulus, the body reacts in split seconds with signals, which can be good or bad. The signals depend on how similar situations have been experienced before and accordingly saved in our emotional experiential memory. Damasio defines these signals as good somatic markers or bad somatic marks (Damasio, 1994). The word somatic comes from the word „soma" which means body in greek. How a person perceives the somatic signals varies depending on the person. Some somatic markers are experienced as a comfortable warm feeling in the stomach and others cause people to shake their legs or tense their jaws. One way to trigger somatic markers is to go through the situation in your mind. In this way one can create a trial of a difficult decision (Storch, 2004).

3.4.3 HAPA

In the following section, we describe the HAPA model (the Health Action Process Approach; Schwarzer, 1992). This model refers not only to the creation of an intention but also to its implementation. In other theories such as Theory of Planned Behaviour (TPB; Ajzen, 1991) and Protection Motivation Theory (PMT; Maddux, et al., 1983), generating intention is considered the most important to change behaviour. HAPA, in comparison, explores other measures that are needed after intention is formed to sustain behaviour change (e.g., Sniehotta, et al., 2005)(Scholz, et al., 2009). Like other theories, HAPA begins by forming an intention. Three points are crucial in this process: "risk awareness," "self efficacy" and "outcome expectations".
Under "risk awareness" the communication of possible consequences is meant. It is about making the person aware of their own losses and thus creating a stronger intention. A prominent example of how policy makers try to change behavior are the stickers on cigarette packages that display potential consequences. Studies have shown that this method is not completely ineffective but also not really effective (Tannenbaum, et al., 2015; Ruiter, et al., 2014).
By "self efficacy" is meant one's own conviction that one can implement the goal. You have to believe that you can do it. This measure requires one's own willpower to want to realize the intention. Finally, the person must recognize the benefits of a new behaviour under "outcome expectations" (e.g., Schwarzer, et al., 2008).
In contrast to other models that are based on intention in particular, HAPA deals not only with the motivational part but also with the translation of intentions into new behaviour (Schwarzer, 1992, 2008). Because almost everyone can say from their own experience, an intention is one thing, but translating it into a new behaviour is significantly more difficult. This phenomenon is known as the "intention-behaviour gap" (Sheeran, 2002). The HAPA introduces 3 tools: "action planning", "coping planning" and "action control" to facilitate the translation into long-term behaviour.

"Action planning" involves making a detailed plan and defining exactly when, where, how, and with whom one will perform that action (Gollwitzer, 1999; Leventhal, et al., 1965). This should make it easier for the person to actually act according to his or her intention. Evidence for this strategy already exists for its effectiveness in a broad area, but especially in the health sector (Gollwitzer, et al., 2006).
For "coping planning" it is important to be prepared beforehand for unforeseen problems. So that one can carry out one's intention without interruption, even if a discrepancy occurs (Sniehotta, et al., 2005; Sniehotta, et al., 2006). There are three things to keep in mind: Defining potential barriers and difficulties, developing a coping strategy, and having a vision of success scenario. An example would be: I go for a walk outside when the weather is good. If the weather is bad, I go to the swimming pool. A combination of "action planning" and "coping planning" is shown to be very effective (Kwasnicka, et al., 2013).
Lastly, there is "action control", in which the person must be aware of what exactly their intention is, what exactly one wants to change (awareness of their own standards). After that, one can compare the desired behaviour with the current situation and try to find out if they stick to it (self-monitoring). If there is a deviation from the intended behaviour, some effort is needed to overcome the discrepancy. This may mean rescheduling or modifying the schedule (regulatory effort)(Carver, et al., 1998; Sniehotta, et al., 2005; Sniehotta, et al., 2006). For this measure, there is also a study showing that people with action control were more physically active than the test groupe (Sniehotta, et al., 2006).

So these 3 measures help across the intention-behaviour gap and promote behaviour change. But how can this behavioural change be maintained in the long term? How can the new behaviour be integrated into everyday life in a sustainable way? In terms of maintenance, very little evidence is available (e.g., Kwasnicka, et al., 2016). But there is a new systematic review that tries to combine different theories on maintenance of health behaviours. From this five main themes are extracted (Kwasnicka, et al., 2016): Habit, Resources (self efficacy), maintenance motives (why do you want to maintain the behaviour change), self-regulation (action/coping planning & action control) and social influence.
There is already an impressive study that shows the importance of behaviour change in a social context. This is about the behavioural change in smoking, more physical activity and a diet over 2 and 4 years (Jackson, et al., 2015). The data show that if the partner continues to smoke or exercise little, it is difficult for the subject to make the behavioural change over a long period of time. If the partner had a healthy lifestyle before (not smoked, exercised a lot, etc.) then it is a little easier for the participants. But very interesting is that if the partner together with the test person at the same time participates in a behavioural change, it is very beneficial and easier to maintain these new behavioural patterns. (Institute for Complem. and Integrative Medicine USZ, 2018)

3.4.4 Intrinsic and extrinsic motivation

Intrinsic motivation is the motivation from within. The joy of doing something for its own sake. Intrinsic motivation is characterized by the feeling of self-determination up to "optimal experience" or "flow" (Csikszentmihalyi, 1997). It is about the satisfaction of having solved the task (Hennessey, et al., 2015). It allows the individual to strive for activities that interest them without internal constraints (Deci, et al., 1993).

Extrinsic motivation in return refers to an external goal or to satisfy expectations coming from outside (Hennessey, et al., 2015). It can be caused by many factors in the social environment such as reward, competition, surveillance, time limits, and external control over task engagement (Amabile, 1996; Deci, et al., 1985).

Experiments showed that when intrinsic motivation is combined with extrinsic motivation (e.g., by money or award), intrinsic activity decreases (e.g., Deci, 1971, 1972; Lepper, et al., 1973; Ross, 1975). Individuals who received an additional extrinsic reward were subsequently less motivated to perform their activity in their free time than individuals for whom this was not the case. Deci (1975) then made the link that adding extrinsic motivation to intrinsic motivation minimizes the subjects' self-determination, so that they no longer perform the activity based on their own satisfaction (Deci, et al., 1993).

This study caused many to assume that intrinsic and extrinsic motivation are two opposites. However, it was later found that under certain conditions a combination is quite possible and may even be beneficial to maintain the intrinsic motivation (e.g., Harackiewicz, 1979; Ryan, 1982; Ryan, et al., 1983).

Still, two conditions are required for a successful combination: first, intrinsic motivation must exist and is strong/salient; second, the reward provided by extrinsic motivation must appeal to the individual's capabilities or the value of the work. The interaction between the performed task and the feedback from relevant people, can either strengthen or weaken self-confidence. These dynamics determine whether extrinsic and intrinsic motivation cooperate or compete (Bénabou, et al., 2003).

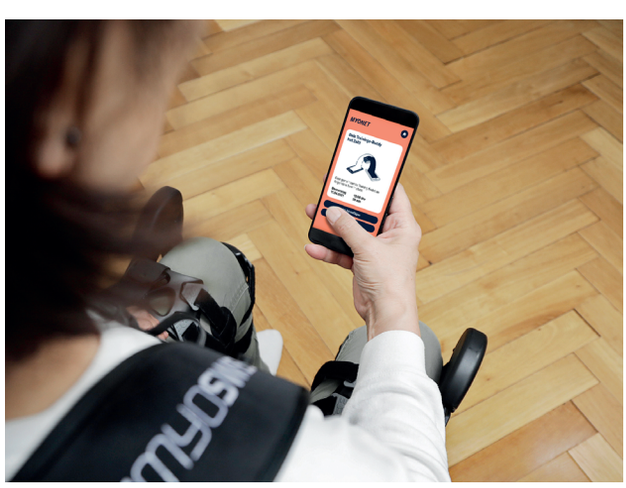
Children have also been found to be more likely to perform an action voluntarily and to be more creative in performing it, thanks to intrinsic motivation (Deci, et al., 1985). The same is observed for adults who, when intrinsically motivated, are more likely to be creative in their occupation (e.g., doing artwork and inventing new products). This phenomenon consists of the main principle that people are most creative when they feel motivated by their own interests, pleasures, and the challenge of the work itself, and without the external pressure or incentive (Amabile, 1996).

3.5 MOTIVATION AND INTENDED CONTRIBUTION

We see our part as designers as mediators, between the exoskeleton and the patients. Further in creating a collaborative process, where everyone gets a chance to influence the results. The patients seem overall happy with the Myosuit, but for some reason they often forget to put it on and actually train. Over a longer period of time the motivation to use the Myosuit decreases and patients do only train when a physiotherapist is around otherwise they prioritize other tasks to work with the Myosuit. Further we investigated not only what could help the patient while training but also what role does the patient have in society when walking with the Myosuit. We realized very quickly that the Myosuit because of its technological advancements is a technology which draws a lot of attention to, not only because of its looks but also because it makes a lot of noise when using it. Some patients can deal with that situation farely well while others have their problems with it.
Based on that we will try to figure out how we can create motivational structures which help patients to incorporate the training in their daily life, so that it becomes an integral part of their life and not an additional effort to do. How can training become a habit which they like to do and not have to do? We will try through observations, workshops and conversation to understand the patients daily life, the meaning of the Myosuit in their life, their visions for their future and what the problems are which they face. How can we as designers create and experience which could make their whole rehabilitation or training times easier to do.
Our part we see in hearing patients out, test some ideas and develop together with them concepts, evaluate what they think about it, how we can change it, what helps and what does not.

From the beginning we were intrigued by the advanced technology of the Myosuit. A technology which we mostly only know from science fiction movies. Therefore, we were curious how patients interacted with the exoskeleton and further how we can have our impact in improving this interaction. What we especially were looking forward to was to get to know the patients and collaborate with them.

4. CONCEPT



A showcase image of our project. Displayed is a screen in which you can create your own avatar. (2021, May).

4.1 CONCEPT AND ANGLE

4.1.1 Problem

Through all our user research, interviews and observations with patients and therapists, we were able to define the main obstacles which we would like to address with our concept.

Many of our patients who use the Myosuit at home have experienced that the motivation decreases over time. This finding was also confirmed by the therapists, they observe how the motivation is very high at the beginning when the patient bought the suit and has it at home. However, over the weeks and months this motivation weakens. The stressful everyday life intervenes, other things become more important. The Myosuit moves more and more into the background and the training gets neglected. A problem patients face is to keep up their motivation in everyday life, when they are confronted with a busy work schedule and further, sometimes face setbacks regarding their disease. The fact that putting on the suit takes time and is also tedious to put on, is one of the excuses why patients do not exercise. Understandable for us, but we learned from the therapists that setting up the Myosuit is a manageable problem. With a little practice, the partner together with the patient should be able to put on the suit in five minutes, some patients even manage to put it on or at least take it off alone.
In conclusion, these are some of the obstacles patients face in their everyday life, which we would like to consider our concept.

Out of the conversations with the patients we noticed that the physiotherapist is an enormous motivator. This has to do with the fact that the patients have a fixed meeting on which they train and also keep this appointment free. In addition, the physiotherapists also give them security and self-confidence during the training.
The question for us is how can we transfer this type of motivation into the patient's social environment or into a new network of Myosuit users, so that it creates a

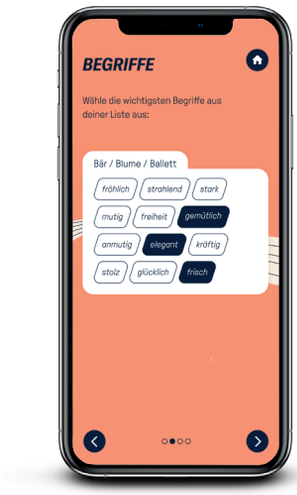
similar binding structure like in training with a physiotherapist. This has also a further benefit for patients. We repeatedly heard that the disease of muscular weakness in the legs can lead to isolation. The reason for that lies in the fact that they get more exhausted, this affects social gatherings or group excursions.

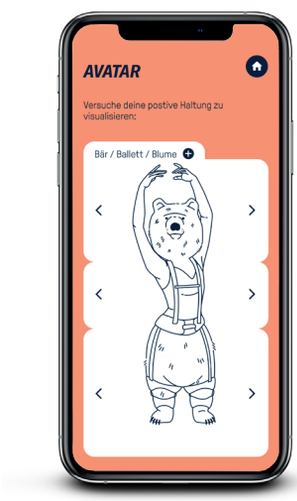
The next point was difficult for us to tackle because it was perceived differently by the patients, yet it seems to be an important issue for them and each patient has a story to tell about it. It's about the attention that the new technology brings. Many of the patients we spoke with use the suit outside, to go for long walks or hikes. Everyone is aware that they are being stared at. Exoskeletons are becoming more and more accessible to the masses, but for most people they are still part of science fiction movies. Although the suit is kept in a simple black and with its reduced design reminds more of leg guards than a robot, it stands out, and the mechanical noise of the suit doesn't help.
How they deal with it varies, but we heard from most that it is very uncomfortable and even obnoxious on some days. One patient told us about an outing in London where the family couldn't walk a step without a passerby pointing out the exoskeleton. A negative experience that others shared similarly. How far we can solve this problem with our concept is still unclear, but we hope that a more positive attitude and also the embodiment of it can help to deal more confidently with such situations.

Progress is very important for patients, because one wants to recover as fast as possible. However, the constant need for progress can be pressuring for patients and lead to frustrations. Especially because sometimes progress happens very slowly. Therefore, it is also important to consider the training itself as a valuable part in the process of recovering. From therapists we heard about the importance of highlighting the positive feeling patients get from the training.

In general, here as well as with the above mentioned obstacles, the therapist is the first and most important contact person. With our concept we only try to shift the motivator a bit away from the therapist and towards the patient themselves, so that the patients also want to train as much as possible at home and without a Therapist.

4.1.2 Project





Creating a visualisation of the attitude in the application

When the patient opens the applications he/she has the possibility to create a visualisation of the attitude they want to embody when they wear the suit. As the reason for creating an avatar is not very intuitive, we want the reader to have the possibility to inform themselves about the topic of long term motivation and what factors steer it. We want to show them how their attitude influences their thinking but also their willingness to act.

To create a visualisation which fits their attitude the patient is asked to put his mind into vacation. The following questions need to be answered without thinking as they address the experiential memory of a patient, which is mostly perceived by our unconscious knowledge. As our unconsciousness speaks with images we ask them the question "Does it give an animal with properties that could help you with the Myosuit training?" If an image pops into their head the user can write it down, the procedure repeats itself but the question changes. The patient is asked whether a "plant", a "real or fictional person", or other elements could help him with the training. Until the patient has gained a maximum of three elements which could be of help to move forward. As a next step we ask them which properties of the elements in particular help them to train. For example if a patient chose a tiger, the question would be which characteristics of a tiger help you to train? One of these characteristics could be for example: "strong". The user is invited to write down all the important characteristics which come to his mind and then choose the three most important. As a last step they create a sentence for example: When I wear the Myosuit I want to feel as strong and elegant as a tiger. Further the patient can create an Avatar. For example with the head of a sunflower, a body of a tiger and the shoes of a car. The body of the avatar is always displayed with a Myosuit. At the end of this process the patient has two resources, a motivational sentence and a visualisation which shows how he/she wants to feel when wearing the suit. Now there is a theoretical input about the connection of neural networks and their new attitude they have created. It basically explains that the more the new created neural networks are used the stronger the connections become and the easier one can act upon them. Therefore one should place the resources in places where one can see them often.

The avatar in itself helps with the positive attitude towards the training, that the Myosuit is displayed more present in the everyday life of the patient and that the training is not forgotten, even on busy days. Further, the avatar gives them a positive feeling towards the training and they have a personal connection to the avatar. However, our testing confirmed our assumption that the patients do remember the training thanks to the avatar, but that does not mean that they actually train

more. This has already been observed in other studies in the field of physiotherapy, which worked with similar methods of positive attitude (Bieri, 2020). This is also the reason how the two parts are connected and why both parts are needed. In our second conceptual part we try to go deeper into the way of doing the training.

Linking habits and social environment

In our application, we offer the patient a tool to find more easily every day activities which are suitable to combine with the myosuit training. In doing so, the patient can add more habits as desired. Once these moments are defined, we require the patient to clearly and define what, when and with whom the training will be done. This is to create a binding training and to make it more difficult to postpone the training or skip it completely. In addition, we offer the patient the possibility to create a plan for each activity in case of obstacles. As a simple example, the patient trains his balance every Wednesday after dinner while doing the dishes. If dinner is ordered that day, or if no dishes are needed, he plans to exercise in front of the TV for 15 minutes after dinner. This is another step in limiting avoidance and making exercise an integral part of the day.

The patient keeps an overview of all his defined activities and can remove some and add new ones over time. The goal is that these activities do not have to be planned so precisely over time, since training with the Myosuit becomes part of everyday life.

By talking to the therapists about this part of the concept, we immediately find open ears. Together with patients and physiotherapists we decided that it makes sense to link the training with already existing tasks in the household, which have to be done one way or another. This should relieve patients of additional work, since they can simply put on the suit to cook and do standing exercises at the same time. Therapists see the importance of linking the training to the patient's daily routine not only to reduce the amount of effort required to train, but also that patients actively practice such household tasks and strengthen their multitasking. A lot of the exercises are related to repetitions that can be easily combined with other habits. Moreover, the therapists tell us that doing a little bit every day is just as effective as exercising for a long time on two days.

Through this concept, the patient and the Myosuit become part of everyday life and also of the social environment. For example, the patient can cook together with his partner. For more intensive exercises, the duration of the training can also be adapted to the daily structure of the partner: While the partner folds the laundry, the patient exercises. Planning exercises with other people, is more engaging and should also facilitate compliance with the training. As we have already recognised in the defined problem, the physiotherapist is an important motivator. Through this inclusion of other people as well as linking training to habits that need to be done, we try to maintain the motivational structures even in the absence of the physiotherapist.

Above we mentioned how the patient can use their own social environment to train. In our application we introduce another tool for the patient to access a network of Myosuit users. This part of the concept has been developed from theory on one hand and from the conversations with patients on the other hand. Thus, we have observed and been told by some patients that they are interested in how others are doing and on the training with others. The theory shows studies that used a partner as a motivator, the outcome was a longer motivation period (Jackson, et al., 2015). In our application we implemented for now a simple version of a Training-Buddy tool. The idea is that patients can get in contact with others and conduct fixed training together over an online call. At the start of their training session they introduce themselves to each other and talk about the workouts they want to do. After that, they shut down the camera and train individually on their exercises. At the end of the 30 to 45 min training, they tell their achievements to each other and finish the call. This kind of setting has the advantage that patients with different physical limitations can train together without comparing their own ability to the others.

The focus of this tool is to train. It is about providing inspiration for patients to create their ideal motivating environment in which the Myosuit cannot be forgotten.

In the end, the goal of our concept is to create a new routine where the Myosuit is an integrated part of everyday life.

4.1.3 Experience Journey

To make our concept a bit more understandable and tangible we created an experience journey. It shows all touchpoints a user has with our application and in which way it influences their daily life. It displays a normal working day of a patient who uses the Myosuit to train. The pain points explain the problems a patient faces, which we would like to address with our concept. In the following paragraph we present the obstacles a patient faces during a day.

After a long working day patients are often too tired to train. In addition other daily duties are given a higher priority than training with the Myosuit. Another factor which influences their willingness to train is their emotional condition, sometimes they are just not in the right mood. The Myosuit comes in a box, which is often supplied in the closed. Consequently the Myosuit has no physical presence in patients' homes and therefore tends to get forgotten faster.

In order to create space in patients' tight schedules we provide different possibilities how training with the Myosuit can be linked to daily activities. In particular cooking in the evening, getting the mail, doing laundry. It should help them to create a clear structure to implement their training in their daily life. Thus when the patient gets up in the morning he starts brushing its teeth, while doing his first squats in the Myosuit. The patient has the possibility to create an avatar. The avatar

has an overarching goal to bring awareness to how a patient wants to feel when training. This should shift the focus from what they want to achieve to how they want to feel in the moment. As we have learned, goals can be pressuring and lead to frustrations. Further it should serve as a positive physical reminder on the training with the Myosuit. Therefore patients can print it out and place it in their apartment. Therefore initiate a positive feeling towards the training. When a patient comes home after work he or she could see the avatar before entering the kitchen. This reminds the patient on the training on the following evening, where the patient does balance training while cooking.

A further possibility is training with other Myosuit users. In the application patients can search for other Myosuit users who would be interested to be training buddies. They can create an appointment where they meet together and train independently. This should foster a training environment similar to the one with a physiotherapist. This kind of event we do not necessarily see during the week, but rather on a weekend. However the focus of training buddies lies in being active together with another person rather on the social exchange.

4.1.4 Benefits of the concept

The overall benefits of our concept we see in the flexibility the patient still has to establish its own ideal training environment. Our application serves as a constant supporter and source of inspiration.

Positive attitude towards training

For long term motivation a positive attitude is essential. This is why one part of our concept considers the emotional state of patients and gives a positive input to bring awareness on how they want to feel when training. We are aware that this does not help if somebody has depression, nevertheless the visualisation speaks to the patient's mind and shows their personal double, the way they want to feel when training, their aspiration, which should give them a momentarily good feeling but also hope for the future. In addition, we have heard that some of the patients feel pressured to train in order to do progress. The avatar should shift the focus on the training rather on the progress. This is also important because progress sometimes is hard to see and often happens slowly over time.

Reminder in daily life

We realized that the Myosuit tends to get forgotten, as it is placed in a box. The visualisation of the avatar should not only serve to give a positive feeling but also as a reminder so that the Myosuit does not get forgotten in everyday life. We imagine a scenario where the patient comes home after a working day sees the Myosuit and is reminded of its future training in a positive manner.

Binding event

Over the last few weeks we had many conversations with patients. They all had very good intentions and wanted to train more. However, training often got forgotten during everyday life. When we asked them how their training plan looked, we often heard the answer that patients train when they feel like it. Which is not a bad thing to do, still it gives a lot of room for procrastination if there is no defined date to train. Therefore we searched together for possibilities to create a binding event, which is not only bound to time and date.

Link to routine

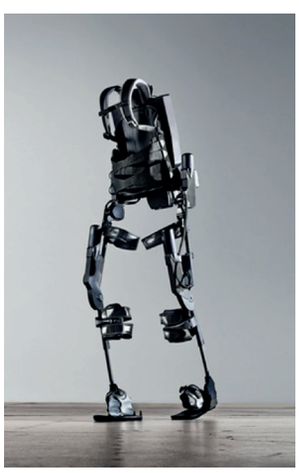
A regularly spoken topic was that it is hard to do their daily duties, besides thinking of their training. Further it became clear how patients measure their progress and what success means is to them. Their rewarding moments were always connected to activities which they were once able to do, but due to their disease it was not possible anymore. For example, one patient told us about the experience of being able to put on his shoes independently. As the daily activities of patients are directly connected to measure achievements, the patient has the ability, through our application, to see which daily activities are suitable to do in combination with the myosuit. This should enable the myosuit to not become an additional training device but rather becomes a partner which helps to fulfill daily duties. Integrated in everyday life and connected to existing habits it should prevent that the myosuit gets forgotten.

Social element

Our concept allows patients to connect with other patients to train together. This should create a training environment where they feel understood. It is a possibility to break out of the routine from time to time, see how other patients are doing and get new inspiration or motivation through other patients. Muscular weakness in the legs is a disease which can isolate you. As one often does not have the energy to walk as long as their friends. From patients as well as physiotherapists we heard that patients ask for each other's well being even though they don't know each other. Further we heard that there is a wish from some patients to get to know others in a similar situation. We enable patients to participate in a joint training with other Myosuit users. This should create a similar binding event as if they would go to a training session with a physiotherapist, as the physiotherapist is one of the main motivators.

4.2 RELATED PROJECTS

4.2.1 Exoskeletons



A showcase image of exoskeletons from "EksoNR". Retrieved 28.05.2021 from https://www.rt-flash.fr/exosquelette-pour-aider-personnes-handicapees-remarcher/article.
Copyright 2014 by RT Flash.

To get an overview of the current situation, we researched various other exoskeletons and their implementations and interaction with the patient. This helped us to get a rough understanding of the material and the status quo. Among all the different suits, we have chosen 3 that we will present in more detail. All 3 are, just like our project, in the rehabilitation sector and have already gone through several prototype phases. In addition, we chose the following because of the different interactions between the patient and the wearable.

ReWalk™ Personal 6.0
Amit Goffer
Yokneam, Israel
2001

ReWalk is an exoskeleton suit that allows even completely paralyzed individuals to stand and walk again through motorized leg attachments. The system is powered by a backpack battery for all-day use and controlled by a simple wrist-mounted remote that detects and amplifies the user's movements. A forward tilt is recognized by the system and triggers the first step (Whitwam, 2014)(ReWalk Robotics, 2021).
In this project, we found the watch that serves as the suit's control interesting. It has only a few buttons with clear icon language and easy navigation. In addition, the placement on the wrist is comfortable for the patients to use, since many of the users need crutches in addition to the suit to walk.

The Indego®

Vanderbilt University

Tennessee, United States

2010

The Indego is an electric leg support that enables people with walking disabilities to be more independent and mobile. This system impresses with its easy handling in transport and storage, the very light design of 13 kg and the modular quick-release fastener that allows the patient to put on and take off the suit without assistance. It is powered by sophisticated motors in the knee and hip joints. Through the wireless Indego app settings can be changed, the suit can be controlled and data be collected. For example, stride length and speed can be effortlessly regulated during gait training (Anatomical Concepts, n.d.)(Parker Hannifin Corporation, 2021).

We were particularly interested in the advanced application for this product. The Indego suit is already being used by private individuals, so this requires a clear and simple structure for the app. In addition, all data must be prepared in a user-friendly manner and all parameters must be explained in a comprehensible way. Furthermore the patient is free in the use of the wireless device when, where and by whom the settings are carried out.

CUHK-EXO

Bing Chen, Chun-Hao Zhong, Xuan Zhao, Hao Ma, Xiao Guan, Xi Li, Feng-Yan Liang, Chun-Yiu Jack Cheng, Ling Qin, Sheung-Wai Law, Wei-Hsin Liao

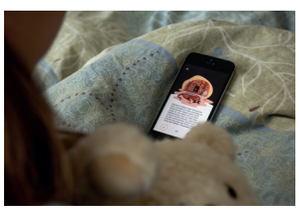
Hong Kong, China

2016

CUHK-EXO is an exoskeleton designed for the lower extremities of paraplegic persons. The aim is to regain the execution of basic movements for daily life. It analyzes and helps to improve the mobility of standing up, sitting down and walking, and to improve the physical and mental health of the patients. The robotic device takes into account ergonomics, user-friendly interface, safety and comfort. In order to gain the patient's confidence in the suit in the initial phase, an application helps to operate the skeleton which is explained by a physiotherapist. In this app, settings can be made on the suit and movements can be monitored. The developed smartphone app improves safety and comfort when using the CUHK-EXO. As with the other projects, additional crutches are provided with this exoskeleton to better maintain balance. In the CUHK-EXO, these crutches are equipped with sensors, measuring units, batteries, Bluetooth modules and microcontroller units. Thanks to this technology, the patient's effort can be estimated and position information can be acquired. These data are sent to the main controller in the backpack thanks to the Bluetooth modules. One crutch also contains some buttons to control the switching on and off of the CUHK-EXO and to select the types of movements. The patient can operate the CUHK-EXO comfortably, conveniently and safely with the help of these smart crutches (Chen, et al., 2017).

The intelligent crutch is of particular interest for us because it is easy to use and hides technology and sensors behind a commodity. In addition, the crutches are intuitive and easy to use. The type of physical computing is more familiar and easier to understand for elderly patients. This project combines an application with a haptic operation and brings the advantages of well-visualized data and a more usable interface.

4.2.2 Rehabilitation



A showcase image of "Journey to Recovery". Retrieved 28.05.2021 from https://interactiondesign.zhdk.ch/en/projects/journey-to-recovery/. Copyright 2020 by Claudia Buck & Randy Chen.

Journey to Recovery

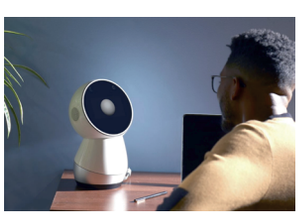
Claudia Buck, Randy Chen

2020

Journey to Recovery is an application for children that aims to make sleep therapy more motivating, entertaining and informative.

Medical treatment for better sleep quality is repetitive and monotonous, thanks to engaging stories this application tries to change that. With a playful approach, it transmits knowledge about sleep and at the same time entertainment for children. In the process, thanks to this solution, a child-friendly experience is created for a successful therapy (Buck, et al., 2020).

The integration of storytelling in the rehabilitation phase has been successfully combined in this project. Thanks to different design methods, the needs of the users have been understood and implemented. This solution, like ours, is in the rehabilitation sector and shows different ways to generate motivation and sustainably engage users.



A showcase image of "JIBO". Retrieved 28.05.2021 from https://xconomy.com/boston/2018/06/12/jibo-lays-off-staff-several-months-after-launch-of-social-robot/ Copyright 2018 by Xconomy.

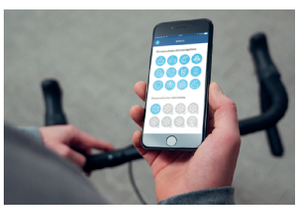
JIBO

2020

The paper „A Robotic Positive Psychology Coach to Improve College Students' Well-being" by Jeong et al. investigated how a robot can change students mood and psychological well-being. It highlights the importance of designing a social agent which is perceived as a helpful and supportive companion in order to successfully deliver mental health related intervention. In this paper they claim that the basis for a general therapeutic success between a therapist and a client is their relationship and alliance. Important factors are genuine and empathy. A good established relationship improves the collaboration, which facilitates agreement upon expectations and goals. Afterwards long term behavioural changes can be created. To enable technological agents to build relationships with people they are endowed with social skills inspired by human psychology. Like for example prosody when talking or an empathic feedback coming from the robot. Further a shared experience can improve trust, familiarity and a mutual understanding between a robot and a client. One method to create familiarity is by referring to the client by

its personal name. Through chit chatting about the weather for example, the robot can become a companion beyond delivering mental health interventions. In this paper they worked with positive psychology Intervention, enabling people to thrive (Jeong, et al., 2020).

4.2.3 Motivation



A showcase image of "SmokeFree Buddy". Retrieved 28.05.2021 from http://zuniversal.com/work#avnet. Copyright 2021 by Zuniversal.

SmokeFree Buddy

Bundesamt für Gesundheit BAG

2018

This app refers to the fact that quitting smoking is easier when you have a partner. Together, a person who wants to quit smoking can link up with a self-selected partner via the app. When the desire to smoke a cigarette becomes too great for one person, they send their current state of mind to their partner. The partner immediately receives a message and can react to it. Different actions are available to him, such as a direct message in the chat, a predefined message from experts or to send an encouraging bonus. The content and support suggestions in the app are based on scientific principles.

This personal interaction and the combination with expert opinions and information are intended to make it easier for people to quit smoking in the long term. In addition, the app offers success statistics to further motivate ex-smokers (Bundesamt für Gesundheit BAG, 2015).

Of particular interest to our project is behavior change in a social context. As studies show, changing behavior is easier when you have a supportive partner (Jackson, et al., 2015). We find this aspect especially appealing solved in this app as well as the combination with an expert opinion. This makes it easier for the buddy to support the person correctly and quickly while still adding a personal touch.

A showcase image of "Fabulous". Retrieved 28.05.2021 from https://phase.com/magazine/story-behind-the-fabulous-app/. Copyright 2021 by phase.

Fabulous - Daily Self Care

Amine Laadhari, Sami Hassine

2013

Fabulous is an app developed in collaboration with Duke University: Behavioural Economics Lab. The application is a habit tracker whose goal is to show the user new and healthy routines. Each routine consists of small steps that build on each other until the routine is complete. For example, the first step for the morning routine is to drink a glass of water.

For this you can add predefined suggestions as small habits or create your own in a routine. These can also be triggered with an alarm to remind you to perform them. In addition, the app has a library for meditation exercises and training exercises (Suzie, 2017).

Promising here is the attempt to integrate new habits and routines into everyday

life. The small mini-steps are engagingly implemented and make it easier for users to adopt and implement new behaviors, and the alarm reminds the person to carry out these habits. Adding your own habits makes the application even more personal and at the same time is supported with guidelines from experts.

A showcase image of "Pokémon Go". Retrieved 28.05.2021 from https://www.pocket-lint.com/de-de/spiele/news/138270-beste-pokemon-go-tipps. Copyright 2020 by Pocket-lint.

Pokémon Go

Niantic; The Pokémon Company, Nintendo

2016

Pokémon go is a game on mobile phones. Players can catch virtual creatures „Pokémons". Additionally the caught Pokémons can be trained and battle against other Pokémons. The game was created by a software company Niantic and uses Augmented Reality (Ninantic, 2021). It can track GPS Data of the players and position the player on a virtual map to create an augmented reality (Webwise, 2021). The study „Gotta catch em all Pokémon Go and physical activity among young adults: difference in different studies" by Howe et. al. researches about how Pokémon Go influences the amount of daily steps taken by a young person. The participants used online survey data and were between the ages of 18 to 35. It counts the data of the daily steps taken, four weeks before downloading Pokémon Go and six weeks after it has been downloaded. This data is being recorded by a Health Application. The participants who reported to be playing Pokémon Go walked on average 4'256 steps before downloading the app. During the first week after downloading the app studies show an increase of steps over the next five following weeks. However after the sixth week the daily steps taken of the participants returns to the average amount before downloading the game (National Library of Medicine, 2016).

A showcase image of "Focusmate". Retrieved 28.05.2021 from https://www.focusmate.com. Copyright 2021 by Focusmate Inc.

Focusmate

Taylor Jacobson

2016

Focusmate is a platform that brings two people together via computer to work productively and focused on their respective projects. You choose a time in which you want to work on something, this is confirmed via the platform and you are getting assigned to a partner. The session lasts about 50 minutes, at the beginning you introduce yourself and define your goals, then everyone works on their individual tasks. This method is intended to prevent distractions, moreover, by planning an appointment, the commitment should be greater to carry out this session (Focusmate Inc., 2021).

This concept, based on scientific principles, is also used in our environment by friends. We find this kind of motivation very interesting and confirms our elaborated concept and research. We hope to achieve a more regular training, which is kept free from other activities.

4.3 SITUATION

Our project is in the rehabilitation process of walking disabled patients. This walking disability can be caused by various diseases and accidents. The age group is therefore not clearly defined, but tends to be more adults (30-50) to people of older age (50+). This plays a role in the design of our solution so we try to make an engaging and enjoyable interaction without being too playful and childish. The project must be able to convey complex information in a way that is easy to understand, while still providing transparency to build trust. It is important for us to be able to motivate and support the patient in the long term. For this it is central to create an individual experience for each user and to become part of their daily routine. In addition to the physical aspects, we also try to make the psychological improvement tangible for the patient and to generate positive moments with the suit. We want to create a relationship between the Myosuit and the patient that is inspiring and encouraging.

4.4 FIELD RESEARCH AND FINDINGS

4.4.1 Experts

ZRM

On Tuesday 16.03.2021 we had a conversation with Dr. Julia Weber, an expert for the ZRM. She explained in detail the benefits of the motto goal and how it can be activated in everyday life. The motto goal creates an attitude towards the intention, this attitude should motivate and facilitate the achievement of the goal. It is important to internalize this new neural network (the motto goal) and to activate it often, so that one is more confident and more assured, for example, to do exercise.
The conversation with Dr. Julia Weber was very insightful and has strengthened our understanding that we have already gained during our desk research. It was good to get an external opinion on our concept. This conversation also helped us to decide that we would like to go forward with our own idea of "the visualisation of the attitude" which we developed together with patients. The ZRM and the wishelements served us as an inspiration.

The most used method to connect the desire from the unconscious to the conscious mind is through the help of a selection of images, the person looks for the one thing that the unconscious says will help them train with the suit. After that, we ask the unconscious for the reason for the selection. While looking at the picture, we search for suitable words.
Through our conversation we became aware of the second technique besides the method of image picking. This technique is called wishelements and is basically a simpler and more reduced version of the image variant. It is about asking the person for desirable characteristics or elements without any reference pictures, for example: Is there an animal (vehicle, sport, landscape, plant, person, ect.) that has characteristics that can help you train with the Myosuit? Who or what could handle what challenges you? Who or what could master it? The idea is to ask for different categories until the participant receives images from the unconscious that can be

helpful to a certain problem. There can be one or more images that stand out. Then the same game as in the first method begins, words are searched for and the consciousness is asked why these images appeared in the subconscious. This technique is a bit more difficult to perform and needs clear guidance and instruction, as there are no pictures to help. On the other hand, the result is much more personalized to the person and fits exactly to the needs, which may not always be the case with the first image version. The wishelements technique is also often used with young people, since the image card index often cannot keep up with the fast trends of young people and this method is particularly good at highlighting the desired characteristics that they themselves do not yet embody. Nevertheless, there is also the danger that the persons do not find a picture that can trigger a clear somatic marker (Bünger, n.d.).

These initial steps to unite the conscious and unconscious are very important so that the person does not feel pressured in the next steps such as the planning and control of the concrete intention. This motto goal should ensure that the participants have the right attitude and think positively. If this is not the case, for example, self-control can trigger negative feelings, one looks for excuses to not have to train, or lies, this suppression of feelings can be very depressing and lead to the collapse of motivation.

HAPA

On 19.03.2021 we spoke with Dr. phil. Walter Bierbauer, who gave us detailed information about HAPA and his opinion about a combination with ZRM.

To begin with, it is important to distinguish between the two groups of patients from those who can recover from their disease or accident and those who cannot. The motivation is individual for everyone and the motivation for example for a person with MS lies more in the connection to the social life or the everyday situation that can still be managed. With a worsening disease it is about showing what one can still do and to maintain the quality of life as long as possible. Especially when training with the Myosuit, the progress, if any, is very slow and difficult to detect. Maybe therefore a motivation would not necessarily to run again but to be able to participate more in social life. So the goal may not be a single global intention, but simply standing in the kitchen for 10 min and helping.

These intentions are important that they are generated by each person themselves. But it is also important to make sure that they are not too abstract or far from reality. The motto goal, which in ZRM creates an attitude to manage the intention, must not be confused with the actual intention. Thus an intention: "I would like to walk like a ballerina" is set too abstractly and must be clearly distinguished from the attitude how one carries out the intention to the actual intention. So the intention can be: "I want to go shopping independently" and the posture I have is that of a ballerina: straight and powerful.

But Walter finds the attempt to query the emotional side of the patient with this posture a very nice idea and a playful way to strengthen their trust in the intention.

Another thing to keep in mind about a motivational strategy is that it is not always a left-to-right model, sometimes you have to revise your intention, rethink your planning and create a new attitude. Our project must allow for this flexibility.
In addition, the emotional component is very important and therefore it is also very good if we can also check it in the process. These affective components are important for long-term success and also more important than the progress itself. Because if you always feel good while doing the intention, the progress is secondary. Including this component would be very interesting and helpful. This is also closely related to the notion of intrinsic motivation, where, for example, runners only do extreme sport because they like it. They like doing the action in itself and they have not been externally influenced. This internal attitude towards an intention is more long-term than behavioural control from the outside.
Finally, Walter would be interested to know if the generation of the visualisation can increase self-efficacy and action outcome.

4.5 NEXT STEPS: TESTINGS

The individual parts of our concept have emerged from discussions with patients and therapists. They have either directly desired individual elements, such as contact with other patients or described a problem to which we created a solution in collaboration. In addition, our solution approaches in the concept are inspired by various motivational theories and studies. However, these two factors that have led us to develop this concept, we would like to do testings, specifically with our patients. This will strengthen and influence our project.

4.5.1 Positive attitude and avatar

We will conduct testing with three patients over a period of at least four weeks. In this time we will focus on the first part, the creation of a positive attitude towards the training with the Myosuit and the visualisation of their mindset. For this purpose we have planned a workshop with each patient individually. In this session we will provide them with theory of long-term motivation as well as deep insights into the importance of attitude and the involvement of the subconscious mind. At the end of this one-hour meeting, the patients, with our support, will have created a sentence about their desired feeling in the suit as well as an avatar for its representation. Over the following three weeks we will hold weekly check-ins with the patients to evaluate how they used the avatars and the phrase and where they have placed them in their home. How they feel when they look at the resources and if they remind them of the training. These 10-20 minutes conversations will take place via Zoom and will be evaluated by us.

4.5.2 Linking Habits

The links between the training and everyday life will be looked at and worked out in detail with a therapist and patients from MyoSwiss. The exercises provided by

the physiotherapist will serve us as a template and working material to create a prototype.

In addition, we will conduct a concept testing with one patient. The goal is to determine if tying the training to an activity makes it easier to execute it.

To find a suitable combination, we will look with the patient at which days they are busy, and what their daily structure looks like. Then we will try to find a date together in which they can link the training to a fixed activity. After one or two weeks we will do one check-in. Did they remember the training? Was it easier to do? And how did it feel?

At the same time we are still working on our self-testing, in which we link the learning of a new language to habits in everyday life. In this testing we have the opportunity to observe over a longer period of time how our motivation develops and how the initial plan changes during the process.

4.5.3 Social Network

The idea of network and training buddies came from explicit requests and observations of our patients. Furthermore, in our desk research we came across first effectiveness studies, which show a positive influence of a buddy on long-term motivation, when trying to change behaviour. It is assumed that the social environment plays a very important role in creating long-term motivation.

Nevertheless, we want to test with our patients how we can implement their wishes. We will put the patients in contact with each other and create tandem training sessions. But the planning and execution will be done by the patients themselves without our intervention. This aspect was important to us. Since our application only provides contacts, the initiative has to come from the patients themselves. In the following check-in conversation with each patient individually we try to evaluate if it is easier to stick to their training plan if it is arranged with another person. How did the workout feel over Zoom? Was it a distraction to the workout? Would they do it again? And how they conducted and planned the training together?

As a showcase, we looked at a learning app that connects people through the computers with other unknown individuals so that both can actively learn and work on their areas. So you create so-called focus-mates via this platform which should enable you to work productively on your own projects.The framework is simple: You set a time when you want to learn, this will be confirmed by the platform. At the beginning of the 50 minutes session, you introduce yourself and describe your goal, then everyone works on their own (Focusmate Inc., 2021). Both this application and ours have the goal of facilitating one's own learning or training through the presence of another person. The goal is to train more regularly and actively and to keep the training free from other activities.

5. PROJECT DEVELOPMENT

5.1 1ST TESTING: CREATING AVATAR

5.1.1 Process

Setting

3 Patients, per person ca. 45 min

We want to clarify how patients who have an exoskeleton at home and train with it could use and benefit from different motivational methods we use in our concept. During our user interviews we realized that patients focus a lot on their progress. This can lead to frustrations as progress happens rather slowly. The avatar therefore could shift the focus onto how they want to feel when training. We would like to develop the right tools in order to create an attitude which can help them if they find themselves in a similar situation.

Do they feel more comfortable wearing the suit? Did it help to remind them of the training? Do they train more? Are they more positive towards the training? This should give a first indication on how patients feel about the new tool.

We try to talk to the patients once a week over a timeframe of 3 weeks via zoom. How did they use the resources? Where did they place the resources? How often did they think about their motto goal? How did it influence their training with the Myosuit?

Attitude

First, we ask some intro-question in order to start the conversation on the topic of motivation. What is the patient's goal? How do they want to achieve it (intention)? How many times per week do they want to train? As a next step, we will create a visualisation of the feeling they want to embody when wearing the suit. First we will advise them to send their brain into break. Then we will ask them, is there an animal, a plant, a vehicle, a fictitious person, ect. that has attributes which could help them with the training with the Myosuit? These questions should be responded intuitively and from their unconsciousness. Out of these images the patient can create their personal avatar. This method we find essential to get patients more self confident while wearing the suit and at the same time shift the focus from the progress to the training itself.

Priming

The new created motto goal can be seen as a representation of a new neural network – neural networks can be strengthened the more one uses them. The same happens when you start learning a new language. The more you use the foreign words the easier you can access them over time.

To train your neural network, you can activate it from three layers: Body, emotions and mind. For example, the chosen image and the motto are already two resources which they can use to activate their attitude. And now we will present them two more options they can use to activate their neural network.

Patients can further connect objects, symbols, colors or other things to their goal. These can also serve to activate the neural network consciously or unconsciously during everyday life activities to strengthen their neural network. We give the patients some first ideas how this could look like, but we let them decide freely what feels right to them.

End

We now have created different ressources with the patient. These can be placed in everyday life, in the apartment on the Myosuit or somewhere else where it could help. In addition we will fix dates, when we can talk again about their experience.

5.1.2 Patient 1

Workshop

For our first user testing, we had a patient who we already knew from the previous interviews. Therefore she has been part of our process already and belonged to the patients who shaped our concept.

As our first interview was already very intense and personal, it felt like the testing was with a person who was comfortable talking to us. The atmosphere was very calm and pleasant.

We started with an introduction into the topic, because of the coronavirus all our interactions with the patients have so far been over zoom. In the introduction we explained to her that we looked deeper into different motivational studies and to underline it again we told her our focus of long term motivation. In the next step we talked about the positive feeling which is essential for long term motivation. This positive feeling is what we wanted to create with her..

She felt very engaged with the topic and was immediately interested. Finding motivation over a longer period of time is difficult for her. Sometimes she feels pressured to train which also influences her motivation in a negative way. She experienced that even though she likes to train, everyday life comes in between, she forgets about it and slowly the training with Myosuit fades out of sight. Therefore, when we told her we wanted to help her with that issue, she was on board. She told

us that we are coming at the right time because she is preparing for a marathon walking with the Myosuit, so she could use any additional motivation.
Our next step was to figure out what is in her unconscious mind that could help her to train with the Myosuit. Therefore we asked her what animal can help you adopt a comfortable posture in the Myosuit? This question we repeated every round we exchanged the word "animal" with another element, like a plant, a fruit, a real or a fictitious persona and so on. At first one could see that she seemed a bit irritated about the question. It took a bit but then almost at once many images started to pop up. A star, a bicycle, her husband and flowers.

For us that was already quite an achievement. It was a fun process for her and for us. We explained to her that the next step was to figure out why her unconscious mind has shown her these images. For that we asked her which terms and properties she connected with these elements.
She told us "Luck", "Freedom" and "lighthearted". At the end she created a motivational sentence for herself. "When I wear the Myosuit I want to feel free, lighthearted and happy as a star." She was satisfied with her motivational sentence. Thus, we made her familiar with the theory that these newly created sentences are like a representation of a new neural network. The more one activates it, the more the network grows as well as the readiness to act. She understood it very well, thus we moved forward to create her avatar.
She told us that the sun is a factor which helps her to motivate, thus she would like to have a sun right to her head which warms her face. Her husband has always been there for her and motivates her to train therefore, she wants to have her wedding rings inside of her body. The color violette as well as the stars have been very important elements in her life which help her to get energy. For this reason, she wanted trousers with stars, sparkling shoes and a pullover which is violet. Stars are not only present in her visualised avatar but also in her life it is represented on scarfs or other clothes.
She was very satisfied with her avatar. From her own side she started to tell us where she could imagine to place it. In her bedroom, in the entrance or also in the mirror in the bathroom.

1st Check-in:
We realized that she is a person who is at the moment in a state of mood where she appreciates a lot of the work we do for her. She sees the visualisation as a chance to improve her motivation to train. At the moment she is preparing for a marathon to walk with the Myosuit. She says she can use any motivation she gets. This is as well the reason for her to place the avatar four times in her apartment. She wants to be reminded of the training, therefore she has placed it in the bathroom mirror, on her wardrobe for when she gets up in the morning, close to the door where she comes in and as well in the kitchen. She told us that she has seen

the avatar many times in her apartment and overall, it gave her a positive feeling. It also reminds her to train, but because she did not train this week, the picture increased a guilty feeling on her.
She feels the stars being her motivators, which is why she wanted to call the Myosuit her star and put some star stickers upon. We will see in the next sessions whether she completes her intentions or not, nevertheless she already mentioned that this is a task which she might not be able to complete in the following weeks.

2nd Check-in:
When we spoke to her again after two weeks, she was still happy with her avatar. It still hangs at several places in the apartment, so that she can see it often. Friends who were visiting her also noticed the avatar and asked about it.
She is very satisfied with the visualization of the avatar and she is sure that she will keep using it.
She has her fixed training with the physiotherapist, in addition she wanted to go running twice a week, but that doesn't always work out. And she had to admit to herself that she can always find an excuse not to train. In general, she likes to go to the physio, but the one in Zurich is not around the corner. She would like to have some tips on how to integrate such exercises at home.
Even if the avatar does not directly help her to exercise more, it is still motivating. As an example she told about an experience: She went with her husband to the vita parcour to train with the Myosuit. But the training was difficult, she became impatient and angry. A passerby noticed her frustration and spoke to her, telling her that with perseverance she can do anything. Then the avatar came back to her mind, this package was very motivating for her.

3nd Check-in:
For the last check-in she told us that at the moment she feels pretty well. This has to do with the avatar, but also with her momentary life situation and weather. The avatar still helps her, she further concluded that in comparison to the sentence, she prefers the avatar. It helps her more when she can see something visualised. At the moment she trains outside or walking in her apartment. The only thing that troubles her sometimes, is that it is hard for her to see her progress. Further she needs to gain a bit more trust into the suit, because the last time training she fell down. However, she is motivated to work on that.
It was good to hear that the feeling and pressure of "having to train" reduced. She tries to be less strict with herself, when she does not accomplish training.

5.1.3 Patient 2

Workshop

The second patient we had was a bit special for us. As he has not been part of our process before and we did not know what kind of person we were about to meet. As he entered the zoom room we quickly started talking together, he seemed very open minded and interested in what we did. From the beginning, he concluded that the Myosuit, as good as the machine is, without the motivation to use it, it has no influence. As we did not know him beforehand we prepared some questions to get to know him and to figure out where his bigger troubles lay.

He is someone who really likes to train with the physiotherapist, this is something which we realized is not uncommon. Many patients prefer to train with a physiotherapist rather than alone. Further he made clear that he finds it very unpleasant walking outside with the Myosuit, because it draws a lot of attention. He has a technical professional background and therefore is fascinated by the Myosuit, but still he says he often forgets to use it.

The theoretical part seemed very clear to him whenever he knew something about it he would start talking openly about everything. When we came to the point where we started to ask him which animal or plant had properties which could help him with the training with the Myosuit he did not hesitate long. The pictures came straight out, a tree was important to him, his tesla of course, the sun and a horse. Again, we asked him to reflect upon which words and properties he connects with the chosen elements. His favorite four words were independent, freedom, relaxing and vacation.

Out of it we concluded with a motivational statement which was: When I wear the Myosuit, I want to feel relaxed and free as in nature.

1st Check-in:

As we entered the conversation for our first check-in with him, he started the conversation right away by telling us that he so far feels good and that he has searched for further motivational pictures. One which he has placed as a zoom background, it is a train track and a sun. We asked him whether he has changed the avatar further with these new images, this he denied though. He further told us that he does not think that the place above his working space is ideal for the avatar, because he sees it rather rarely. He suggested to us his idea that he would place it on his mobile phone as a background saver. We will check upon him next week and see how it has evolved whether he has changed the place of his avatar or not. Further he mentioned that he gets a good feeling when he looks at it. He does not get a guilty feeling when he looks at it, this probably is connected to the fact that he is satisfied with the amount of training that he does weekly.

2nd and 3rd Check-in:

Unfortunately he was not able to participate on his second and third check-in because he had to work. We definitely understand that, however we would have liked to get another insight into how he has been doing so far. It is not clear to us if he cannot participate in the testing due to time pressure or if he is not interested in it anymore.

5.1.4 Patient 3

Workshop

We knew our 3rd patient from one of our very first interviews. That was already a few months ago and we were very happy to talk to her again. At the time of our interview, the patient was no longer exercising much, the reason being problems with her hip as well as the first Corona vaccination, which affected her severely. Nevertheless, she tried to train with the suit from time to time, but realized that it was still too much for her. This was the main reason for her to go to rehab at the end of April to make sure she is fit to train with the Myosuit at home. Her goal after rehab is to be ready to use the Myosuit 2-3 times a week.

Our process and the short theory introduction about the method tested today were clear and understandable for her. To our surprise, she told us that she has been working on personal development and visualization of goals she wants to achieve. During our talk she thought of doing this with the training with the Myosuit as well. She is convinced that would help a lot to make the attitude towards the Myosuit positive. It was therefore understandable that she reacted very positively to the revelation that this is exactly the goal of the workshop: to jointly try to develop a representation for her positive attitude.

The desired elements worked very well for her and in the end we were able to collect more than just 3 pictures: Tiger, poplar, apple, wonder woman, wild flower meadow and dancing.

The transition from the unconscious images to the conscious words was very understandable for her. Through the multitude of images that appeared in her head, it was easy for her to collect a lot of related words. Among them were terms like strong, brave, fast, freedom, robust, elegant and many more. As particularly important for herself she felt the 4 words: Courageous, thinking big, trusting in life and growing beyond limits. From this she easily created the sentence: "When I wear the Myosuit, I want to feel brave like a tiger, want to grow beyond my limits like Wonder Woman and trust in life like a poplar", with which she was very satisfied.

She especially enjoyed visualising her sentence and with a little help at the beginning, she came up with various ideas on how she wanted to incorporate which image. So it was clear to her that she wants the heart of a tiger and the flexible feet of a dancer. We selected suitable pictures together with her and created a collage according to her imagination. She was fascinated about how the avatar changes accordingly to her instructions. She was very happy with the final result and could identify with the image.
She also had some ideas where she would like to place the avatar to see it often and has a direct link to her green keychain as another resource. We also agreed with her that we would send her the avatar with the phrase as a postcard.

In the end she left the workshop with a good mood and a smile on her face. We see this workshop and her first reactions as a great success. She understood the theory and our motivations well and in the end created a sentence and a representation that appeals to her.

1st Check-in
At the moment the avatar is very prominently placed in her room. Sadly, she told us that she at the moment is unable to train because of her 2nd corona vaccination. For this reason she feels frustrated, because she would like to workout. However, the avatar helps so that training can't slip into the background. The sight of the avatar reinforces her belief that everything will be fine and shows a vision of how she wants to feel. She always finds the avatar motivating and is very happy with the visualization.
Next week she will go to rehabilitation and take the Myosuit as well as the Avatar with her. There she would like to see how she can connect the feeling which the avatar gives her with the training and if she is able to learn how to take on and off the Myosuit.

2nd Check-in
The patient has just arrived at rehab and has brought the avatar with her. The avatar visualizes her goal and is very motivated to continue training. She is determined to incorporate the Myosuit into the rehab program and learn how to put on and take off the suit on her own. Since she is in rehab for the next few weeks and needs to settle in first before she can actively start training, we have postponed our last check-in conversation for 2 weeks. We are excited to find out how motivated she is after this time and what kind of progress she has made.

3rd Check-in
As mentioned above we waited 2 weeks before we conducted the last check-in with this patient. In order to get feedback which also includes her thoughts while training with the Myosuit. She is now in rehabilitation and already feeling an improve-

ment. In the beginning she almost couldn't walk, now with the help of walking sticks she can walk little routes. She is using the Myosuit to train together with a physiotherapist, in addition she learned to put on the Myosuit by herself.

She took the avatar with her to rehabilitation and looked at it many times during the day. At the moment she has a very busy schedule with lots of training. The avatar therefore helps her to keep the training up even when it gets harder, it brings her into the right mood to train.

5.2 2ND TESTING: LINKING HABITS

5.2.1 Self-testing

For several weeks we have also been conducting a self-testing of this concept on ourselves. This is a slightly modified situation, since we do not train with the Myosuit. So we tied the learning of a new language to a certain activity that should make it easier for us to implement it.

In order to consistently learn the vocabulary of a new language even in stressful times, we set ourselves a clear plan. Every evening before going to bed we repeat all the previous vocabulary, then we learn 10 new words and repeat them again together with the old stack. This routine required some attention at the beginning so that it would not be forgotten. The pile with the terms was therefore placed beside the bed so that we could see it well before we go to sleep. In the meantime, it has become a habit that we remember automatically. Over the weeks we have also learned that it is difficult to stick to these rules on weekends and have therefore decided that we do not necessarily have to practice on weekends. Instead, on these days we sort out the words that we have already learned and that we have internalized.

This exercise is insightful for us to see where the strengths and weaknesses are in this concept. So it is very important to have a detailed idea of what you want to achieve during this activity, while also remaining realistic. The routine that we have now established was a process of adjustments in which we had to find out where it is still fun to learn and at what point it becomes too time-consuming. For that we referenced a physical therapist who told us that 15 minutes of training every day is just as helpful (if not more) than 1 hour on only two days. What we've been amazed to discover is that we approach learning with much less pressure. Since we stick to our plans almost all the way through, an occasional break is much less of a big deal. And it's easier to get back to the routine the next day. These principles we want to consider in our concept.

5.2.2 Testing Patient

Together with one of our patients, we conducted this test to understand how much effort it takes to combine habits with training, whether our selected activities make sense and whether we have put together suitable exercises.
Through a collaborative process the concept of linking habits and training together has evolved, now we wanted to know how it is, once acted out. We chose her as our test person because she had already participated in our workshop to create the Avatar. During this time we noticed that she finds the avatar very appealing and motivating, but she does not train more because of it. In addition, she mentioned several times during our conversations that she does not follow a specific training structure and therefore does very little of her exercise during the week.
When we did the testing with her, she started by explaining her great interest in this part of the concept and what she expects from it. She would like to train more regularly, but that the TV in the evening is simply more tempting than the workout with the suit. As for this statement we decided together with the patient to combine the training with watching TV, because she does this activity regularly with her husband and it is easy to combine it with the workout. Since she already has appointments on many days, we decided on Monday evening. On this evening she has no additional appointments and can keep the time free. Lastly, we settled on a 30 min session during which she would do her calf or balance workout.
We were able to quickly find the link between an activity and an exercise and plan it in more detail, which encouraged us that it would not take too much time for other patients either. In addition, we noticed that this linking should be used in a progressive way. It should start with one activity and expand over time as desired. She was happy to have a first reference point to do the training again on weekdays and was also satisfied with the choice of activity. In a week we will get feedback on how she did and if it was easier to do the training when it is linked to her own distraction.

Check-in with patient

Combining the Myosuit training with everyday tasks worked very well for the patient. She was excited about this new way of training and will conduct that now every monday. It was very nice to see that she included the Myosuit not only in the routine we discussed with her but also in other habits like taking out the trash.
This testing was a success, as the patient found routines in which she could integrate the suit more easily and at the same time felt good while training. This check-in serves as a first indication on the effectiveness of this concept for long term motivation. But it is already very promising and it would be worth continuing this.
We will get more Feedback from her over the course of time to better understand what the main advantages and where the difficulties are.

5.3 3RD TESTING: TRAINING-BUDDIES

5.3.1 Testing Patient

Unfortunately, we could not perform this planned testing at the moment, because many of our patients who would be suitable are ill or in rehab. For this specific training, only test persons who have the Myosuit at home are eligible, which makes it even more difficult to find suitable candidates. We have one patient at the moment which would be willing to do this testing. We hope to find a second one in the next few days, so that we can at least conduct one test.

6. CONCLUSION

In our conclusion we will give an overview of the process we have experienced over the last five months. This will enable us to better understand the journey we have undertaken to create our Bachelor thesis. We will highlight our design area of engagement, the ups and downs of the process, our developments and our final findings.

We started with the decision to make a Bachelor thesis in collaboration with MyoSwiss, a company that creates a soft wearable exoskeleton to support patients with muscular weakness in their legs. Our main investigations focused on patients who live with an exoskeleton and use it as a training device. In particular, we considered how to foster a more intimate and motivating relationship between the Myosuit and the patient. Our overarching aim was to create an environment for patients, which transforms a training exercise into a habit. Since neither of us knew the health sector well nor the patients for whom we were designing, it was of central importance to create a project that came to life through our exchange with patients and physiotherapists in a participatory design process. Through MyoSwiss we had the opportunity to get in touch with multiple patients and physiotherapists who use the Myosuit. These patients were dealing with different medical histories, in particular, with multiple sclerosis, partial paralysis and spinal cord disease. We talked to them, listened to their stories, conducted online workshops, observed their online and offline training, sent out cultural probes and tested prototypes in order to have an outcome of value for patients.

For us as designers it was important to create a relationship with patients where they felt understood and comfortable. We felt honoured to see their willingness to open up and work with us. This experience had a great impact on us, thus we wanted to find a respectful way to learn from the patients' experiences with the Myosuit and properly represent them. We regarded it as crucial to allow these patient experiences and thoughts to shape the outcome of our BA thesis.

Our initial thoughts were to use the data collected by MyoSwiss to motivate patients. This, however, changed early on in the process. Our focus shifted as we realized that one of the challenges patients confront is maintaining their long-

term motivation. Essential to long-term motivation is not allowing external factors to drive the process. This led us to consider alternative methods to motivate patients, for example, non-data driven methods. To narrow our project scope, we decided to establish motivational structures supporting the long-term goals of patients, in particular, when they are training at home without a physiotherapist. Patients could train more independently and frequently, regardless of appointments with their physiotherapists. However, currently patients tend to neglect the Myosuit in the context of daily life. We were surprised to realize that even such an advanced training device was often not used due to lack of motivation.

Returning to our initially posed research questions: "How can we create a motivational environment based on patient habits in daily routines?" "How can we guide the patient through the rehabilitation process in a more intimate way?" Our ideas evolved through dialogue with patients, physiotherapists, experts and background research. Looking back we think our project incorporates ideas, which lead in the right directions to address the initial research questions. The following three paragraphs demonstrate how we intend to create a motivating environment and a more intimate rehabilitation process. Specifically, we recommend linking training to existing habits, taking social aspects into consideration and responding to patients' emotions.

Together with patients and physiotherapists we agreed to investigate possibilities where training with the Myosuit could be linked to activities executed by patients. The aim was to integrate the Myosuit better into daily life with a busy schedule. Further, this should begin by changing the role of the Myosuit in the patient's life so that the training tool becomes a partner in daily activities, like doing groceries, cooking or hiking in the woods. It should enable patients to be more independent when conducting daily activities and duties.

Interestingly, moments of decision seldom arose in our process. Moreover, topics of importance to patients simply emerged and grew into ideas that we discussed together and later tested. One of these regularly talked about topics were exchanges among patients who use the Myosuit. The community of patients who use an exoskeleton to train is rather small, therefore it makes sense for them to connect and train together. This should create an environment of training where they feel understood, similar to their training with a physiotherapist.

From patients we learned that some of them feel a lot of pressure regarding the training. The idea that they have to train in order to recover or stagnate their disease, is a big burden. Through testing with patients we together created an avatar visualizing how they want to feel when they are training. This should shift the focus from their progress to how the training makes them feel at the moment. This

should also bring more awareness that the Myosuit training itself makes them feel good. This is important because it is often the case that progress only happens slowly and over a long period of time, which can be frustrating.

The application itself acts as a supporter helping patients to create an environment where they feel comfortable to train and where the Myosuit assumes the role of a partner in everyday life. The patient can assemble an avatar, print it out and place it in their apartment. Furthermore, they can create a training plan based on everyday activities suitable to combine with the Myosuit training. They can also set training appointments where they meet other patients for an online training. These structures should facilitate patient training in everyday life. It was interesting to observe that each patient to whom we talked and with whom we developed our concept had a personal preference for methods to include in the training routine. Therefore, our application should function in the background as a source for inspiration to create training around the Myosuit. It was nice to see that some patients used the avatar visualization to further think how to change the Myosuits appearance. Our aspiration is that the patient's training with the Myosuit assumes a natural expression of their self-initiated journey. It was exciting to see that through our testing and workshops patients gained motivation to take the Myosuits out of their dusty closets, to give them another try and to find a better way to live with their Myosuits.

Along the journey we think we were successful in probing the above-mentioned research questions and developing solutions sensitive towards how patients already are handling their daily routines and diseases. We created a participatory design process where every member could share thoughts. We view our role as designers in understanding the different needs patients have toward establishing a motivating environment.

6.1 LEARNINGS

This journey was full of new experiences and first times. Getting an insight into future health treatment was very enriching. To get in contact with the Myosuit and the people behind it. The physiotherapists who use the new technology and incorporate it in their treatments and specially the patients who see a chance in the Myosuit to improve their health situation. To see how all these different expertise interact together and being an active part of this community, was extremely rewarding.

Due to these circumstances, it made sense to work in a co creative process together with patients, physiotherapists and MyoSwiss. This collaboration had a great impact on us. The methods we learned over the course of our Bachelor were helpful to approach topics which are not easy to talk about. But also to create an environment where everyone felt safe to tell their opinion. We had the opportunity to prepare and conduct workshops with patients and therapists, send out cultural probes and be part of their training. These methods helped us to better understand what their wishes and needs are. We have never before had a project that was developed over such a long period of time. It gave us time to really use the methods, and raised interest to invest more time exploring this topic.

We learned a lot from the patients. It is particularly important to them to have social support, therefore we were delighted when we also got to meet their partners. Further we saw the difficulty of how the pressure to progress can be a burden. It made us reflect about our own experience and how we pressure ourselves to reach certain goals. Of course it is not on the same scale, but we could empathise with the patients. Each of them had at one time of their life a blow of fate, which changed their life completely. It is astonishing to see that no matter what, patients continued to actively participate in our project.

We valued the external opinion from physiotherapists, who provided another view on certain situations, since they guide the patients throughout the whole rehabilitation process. We experienced that it helped to overcome downs and moments of slow progress, because we had a strong personal interest in the topic.
Looking back, this experience shaped us in many ways. Seeing that we have left a lasting impact on the patients leaves us proud, even if it may only be a small one.

6.2 CONTRIBUTION

The technology of the Myosuit is constantly evolving. However, currently it is mainly used in training guided by physiotherapists. This makes training with a Myosuit expensive. These trainings are bound to a certain place and appointment, which does not leave much room for flexibility. Having a Myosuit at home could therefore lead to a more natural handling of training. Nevertheless, we learned that most patients who have a Myosuit at home, return to training with a physiotherapist. Hence, it was time to analyse and shape the experience patients have when training with the Myosuit at home, to unlock the full potential of a suit, which offers possibilities to gain independence.

Several devices in the health sector present difficulties with the usability. There is a lot of potential for improvements. During our journey revolving the Myosuit, we also came across different problems that patients are having. For example, the control system to set up the suit, which is difficult to manage, or the basic fact that it is still difficult to put on the suit completely independent. In the end we decided to focus on patient motivation, since we realized that even the best technologies lose their potential if they are not used, due to a lack of motivation.

During our journey to explore motivation in the context of rehabilitation, we saw several possibilities for a potential contribution. Overall, we wanted to take an alternative approach to goal oriented motivation. The rationale is that goals can become very pressuring and daunting in the long run. We searched for other factors which are important to create a motivating environment. For example, the social environment of patients or the community of patients who use the Myosuit to train. Further we created visualisations of the desired feeling while training, We further looked which structures already exist in patients everyday life where the Myosuit could be included.

Therefore our main contribution aims to create a motivating environment for the patients while they train with the Myosuit at home.

6.3 FUTURE STEPS

Our project is a first concept on how to maintain long term motivation for patients who use the Myosuit in their training. This is based on research, discussions with patients and first testings. However, in order to test the effectiveness of the concept on long term motivation, further testing on a larger scale would need to be conducted. A study over at least a year would provide reliable insights. One could observe how the concept manifests in patients routine, how the concept evolves once it is used by different patients? What are the aspects of the concept which they are emphasising the most? Are parts neglected over the course of time ? Do patients become self-runners?

Through an extended testing period the first results concerning the avatar could be further developed and expanded. How is the relationship with the avatar? Is it becoming disruptive or more supportive? Does it still remind them of training? Do they want to change it? Can they translate the feeling visualized by the avatar into their daily life and training?
We only touched the surface of the answer to these over a timeframe of 3-4 weeks. We also could imagine further development and research alternative methods or ideas to generate the avatar.

During this collaboration we linked first basic exercises to everyday activities that can be done at home. These serve as a first reference point. We see potential to adapt and include more daily activities which could be linked with the Myosuit training. This partially depends on further technological development on the Myosuit itself. Currently the Myosuit is not very dynamic, thus some activities like hovering could hardly be imagined with the Myosuit.
Further testing would be beneficial to evaluate which activities provide the highest benefit.

One aspect which was pointed out by patients was that the Myosuit offers the possibility to evolve the training by including social aspects. For now, we developed a

simpler version of the Training Buddy. Individuals meet a buddy from a pool of other patients online, explain what they want to train, conduct the training by themselves, and follow up. For some patients, this is already enough to support them in keeping their appointments and strengthen the community. Since the actual training part is done individually, it has the advantage that patients who have different training levels can make an appointment for their workouts. We realized that we need to be sensitive to not match patients who have bigger walking restrictions with patients who only have minor impairments, since this could result in additional stress and frustration.

In the future with a broader community of Myosuit users one could imagine bringing together patients who are on a similar level on their training journey for a joint training session, where they could motivate and inspire each other during the exercises. However, this would need to be further observed and tested for future iteration.

To conclude we think that because of the insights, learnings and reflection we gained over the course of our Bachelor thesis we are moving into the right direction with our application. Nevertheless, we think there is a lot of potential for next iterations of this concept of living with an exoskeleton.

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