NextRound Tulip

intelligent boxing at home

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Master Design for Interaction at Delft University of Technology.

In collaboration with Sports-f(x) for their NextRound product.

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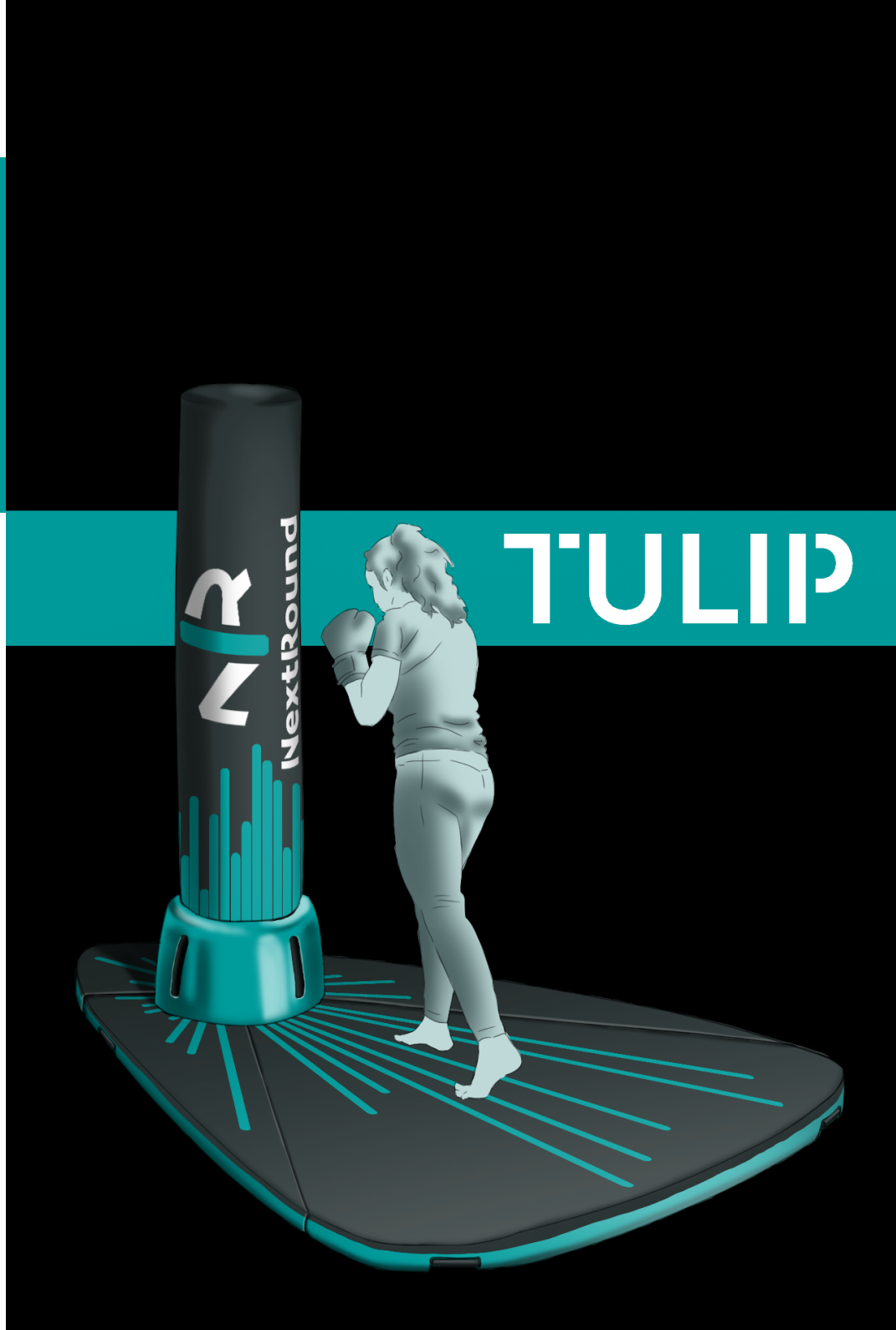
TU Delft

NextRound



Executive summary

This report contains a full description of my graduation project for my Master degree in Design for Interaction (Industrial Design Engineering at Delft University of Technology). I did this project in collaboration with the start-up company Sports-f(x), the creators of the NextRound boxing system.

The NextRound boxing system currently consists of an intelligent data-collecting punch bag, paired with a tablet. This system gives users direct feedback on their workout, and enables them to see their improvement in their workout data.

The system has potential to help many different kinds of people to exercise at home. However, there are many barriers withholding people from getting a bag like this into their homes. The main barrier is that positioning a large product like a punch bag (especially one which also needs access to Wi-Fi and electricity) and its accompanying tablet is quite the task.

My graduation project brief was to solve exactly this problem; helping people to position the NextRound system at home. For this purpose, I designed the NextRound Tulip.

To get to this concept product, I undertook a number of design research and exploration activities. To start off, I researched what kind of people might benefit from owning a boxing system as such. From this research I made five personas for potential users.

I used these personas to recruit people for a co-design session, as I wanted to get to know the values of the potential users. These values would afterwards lead to both a proper Design Goal and a list of Requirements & Wishes, which would guide the product development in later stages. The most important value found during the sessions was that people do not wish this big boxing system to be in the way in the house, so other activities done in the house would not be disturbed.

With the findings from this research I set up a brainstorm session with fellow DfI students to try and satisfy the Design Goal. From

these sessions I made a Morphological Chart, which led to six ideas. From these six I chose three to develop further into concepts.

I developed the three chosen ideas into three further iterated concepts. Potential users gave their opinions on these concepts through an online survey, which I used, along with the opinions of the company, to choose to develop the NextRound Tulip further.

I made some improvements on this concept and built a full-scale prototype to test and evaluate the concept with potential users. Lastly, I wrote a list of recommendations for future development for a product based on this concept.

The NextRound Tulip is a concept product which should satisfy the needs of users and Sports-f(x). It can be used with the NextRound punch bag, as well as other punch bags. In my opinion, it is a product solution to help people do boxing workouts at home.

Foreword

Well hello! Welcome to this report. In here, you will find a somewhat structured retelling of the findings I made and the process of development during the rollercoaster which was my graduation project. This was set up to complete my Masters studies for Design for Interaction, at Delft University of Technology.

Even though this project was conducted by myself, I could not have done it (well, maybe I could have, but it would have been a complete nightmare) with the help of a number of people. So a few words of thanks to:

Arjen Janssen for his no-nonsense feedback and guidance as the chair of this project.

Tomasz Jaśkiewicz for his research-oriented guidance and technical view as mentor of this project.

Tim van der Vaart for his guidance, many brainstorms, and insights as company mentor and co-founder of Sports-f(x).

Nilas van Woersem for his honest feedback and insights into the context as co-founder of Sports-f(x)

The men of the PMB staff for their insights and good laughs when I was busy making prototypes.

My parents for being loving, enthusiastic, and caring in a time where my life and project were a bit all over the place.

My boyfriend for his prototyping and brainstorming help, and the patience to live with a chaotic creature trying to graduate (that's me) over the past months.

My graduating friends for calling every morning of our projects to chat about what we were going to do for each of our individual projects, you made this project a lot less lonely than it could have been.

All my friends yet unmentioned for the good hangs, distractions, and their patience with me and my rants.

All the people who participated in my research and design activities for the help and insights they gave me to develop the concept product of this whole process.

Thank you all!

Stephanie Nieuwenhuizen

Delft, August 2022.

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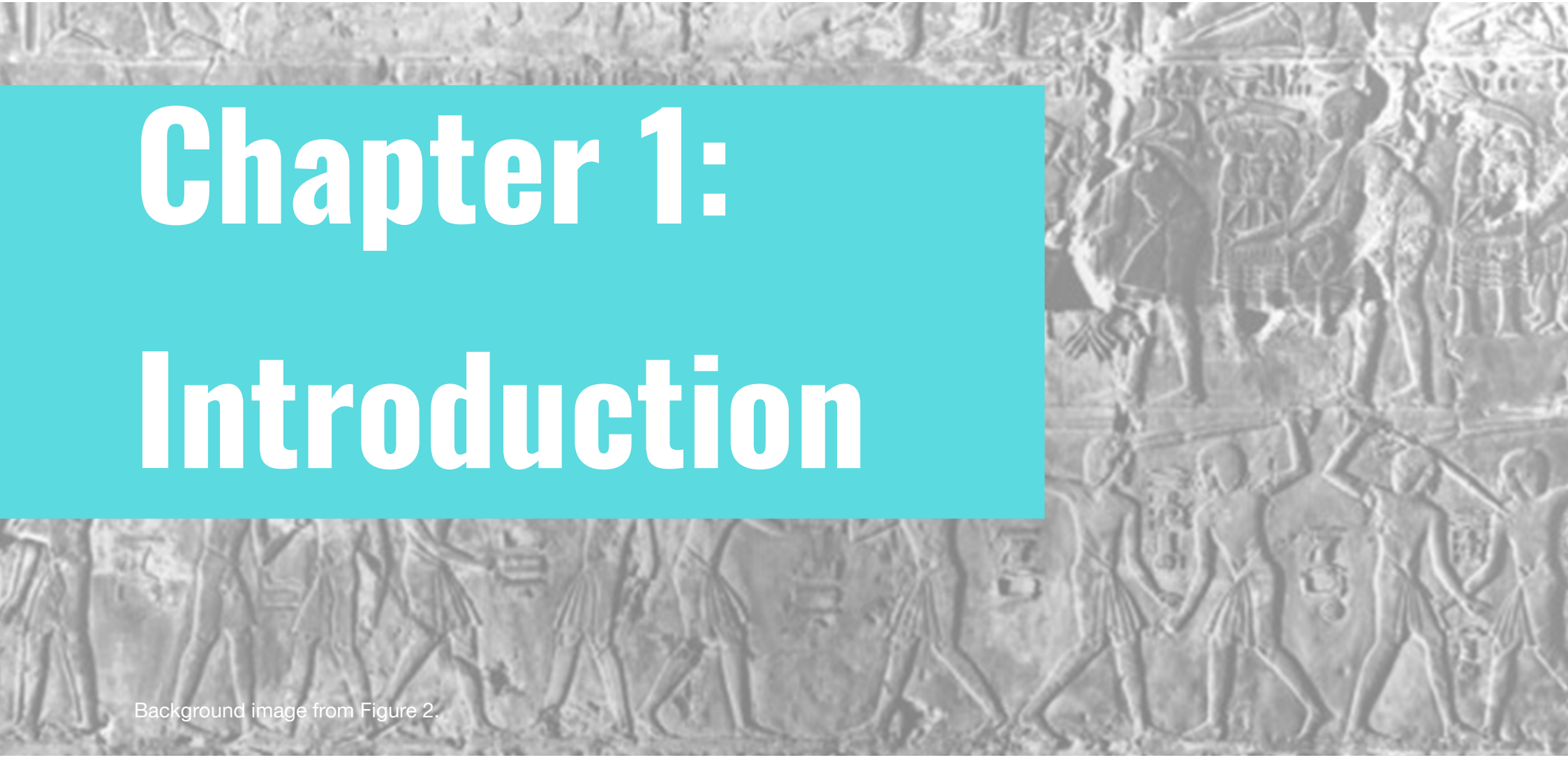
Chapter 1: Introduction



Background image from Figure 2.

Chapter 1: Introduction - introduction

During my graduation project, I've been busy delving into the world of boxing to design a product solution for the NextRound boxing system. Before going into the details of the whole project, allow me to introduce you into the past and present of boxing.

The history of boxing

Boxing, or fistfighting, is a form of combat practised for sport since the times of the ancient Mesopotamians (Figure 1), Egyptians (Figure 2) and Greeks (Figure 3) (Olver, 2021) (Murray, 2010).

Figure 1: Terracotta plaque of wrestlers and boxers. Khafaji, Nintu Temple, Early dynastic Period, 3000-2340 B.C.E.

Figure 2: Egyptian boxers and stick fighters, circa 1350 B.C.E., from the Tomb of Kheruef, Thebes, Egypt.

Figure 3: Boxer surrendering by raising one finger, Greek amphora painting, circa 500 B.C.E.

The first time it was recorded as a formal sport with its own rules and events was in the 23rd Olympiad held by the Ancient Greeks (Olver, 2021). They held boxing matches in single rounds, where the two fighters would fight until one of them surrendered by pointing a finger or until one of them was unable to continue. Most of the rules used back then are up to speculation, but historians are certain that clenching or grappling your opponent was strictly forbidden.

These matches were brutal and bloody, and back then boxing was considered the most injurious of Olympic sports (Olver, 2021). A single written record of an Ancient Greek boxing match exists, written in Homeros' Iliad back in circa 675 BCE (Appendix 1) (Lattimore, 1951). The poem explains how a boxing match was held by portraying a fighter, Epeios, asking to be challenged. A challenger, Euryalos, would respond and accept the match. An announcer declared the prize of the match winner beforehand. These were often a work animal like a donkey or ox for the winner, and a helmet or a piece of armour for the loser. After the announcement, the two combattants would generally take some time to trash talk another to establish dominance. After this, they prepared for the fight. The fighters would don sharp thongs, which were straps of ox leather to protect the hands of the fighters (Murray, 2010). The bout in Homeros' poem ends when Euryalos receives a blow after which he is unable to continue. After the match, Epeios portrays sportsmanship by helping Euryalos up when he is no longer able to stand.

Later in time, the Romans also practised boxing, but with a few adjustments. Instead of using leather straps around their knuckles, they would put a metal insert, named a "caestus" (Figure 4) in their knuckle dusters.

Figure 4: A Roman caestus insert, circa 150 C.E.

These caesti were considered brutal even by some Romans themselves. In a poem by Virgil in his book the Aeneid (Appendix 2) (Isard, 2021) (Olver, 2021), the young and agile fighter Dares even disagrees with the older and stronger Entelles, his opponent's brutal caesti. He argues that the metal inserts in the caesti make the gloves weapons instead of protection. In the fight, Dares has the upper hand for a long while, but Entelles beats him in the end. Even though Entelles wins, he kills the ox he won and argues that he couldn't perform his art and will therefore retire.

Boxing in these ancient civilisations was a bloody form of sports. By the time Christianisation came across Europe and the Roman Empire fell, boxing lost popularity and would not be practised on a large scale for a very long time (Olver, 2021).

In the late Middle Ages, boxing returned in Russia, yet mainly as a way of underground entertainment. This new style of boxing was named Kulachniy Boy (Figure 5) and was practised with bare hands (Bain, 1897). Governing bodies tried to make the exercise of Kulachniy Boy illegal twice, and failed, but in 1684 they made it so that these matches could not be held without police supervision. From this point onward, the use of weapons during fights like these were also officially banned. Boxing has remained popular in Russia since.

Figure 5: Lubok (print) of a Kulachniy Boy bare-knuckle fistfight, circa 1700.

The version of boxing which is most like modern boxing emerged in England (Figure 6) in 1867, under the name of the Marquess of Queensberry rules (Wikipedia, 2022) (Appendix 3). In the decades before these rules boxing had already regained some popularity in England, but after the instalment of the rules its popularity grew drastically. These rules were set up to make boxing more of a “gentleman's sport”, with less brutality and more sportsmanship.

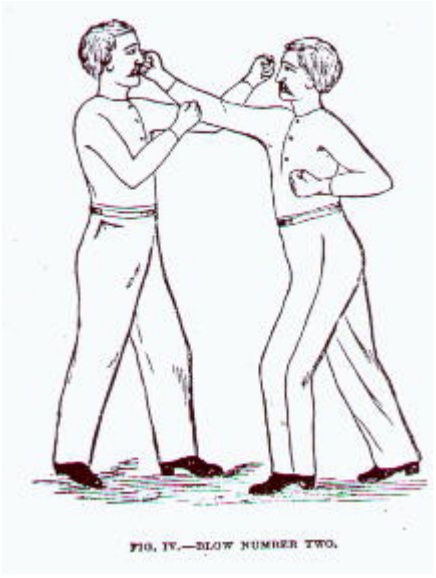


Figure 6: Demonstration of a straight right punch by Edmund Price, 1867 printed in a newspaper.

Since the first establishment of the Marquess of Queensberry Rules, the main changes in the sport are mainly the equipment worn by fighters. Fighters wear thick gloves to protect the bones in

their hands, a mouthguard to protect the teeth and gums, and shoes with soft soles to avoid injuring an opponent's foot when stepping on it (Wikipedia, 2022).

Over the time of history, boxing evolved from a brutal way of exercise and entertainment to a sport with sportsmanship. Its audience has grown from the strongest fighters, to a broader audience. Installing rules of safety, such as the policing rules for Kulachniy Boy or the later sportsmanship rules of the Marquess of Queensberry Rules, kickstarted boxing into the widely practised sport it is today.

Modern boxing stance & techniques

Boxing has evolved time and time again as a sport until it became the sport it is today. To familiarise myself and you, the reader, with the jargon and rules which I'll refer to during the project, in this portion of this chapter I'll explain the main aspects of the sport as it is today.

Modern boxing stance

The boxing stance was optimised over the ages to make them stand free, move fast, defend quickly, and put the force of their whole body behind every punch. There are two stances; the Orthodox stance and the Southpaw stance (RDX Sports Blog, n.d.) (Legends Boxing, 2020). The difference between the two is that the left and right side of the body are mirrored.

The Orthodox stance is the stance most commonly used by most boxers, especially by boxers who are right-handed, as this stance allows them to throw more powerful punches with their right hand (more about this under "Modern punch techniques", later in this chapter). When standing in the Orthodox boxing stance (Figure 7), a boxer has their left foot forward, with the toes pointing to their target. Their right foot stands in the back. The feet are about shoulder width apart. The toes of the back foot point slightly to the right, at an angle of about 45 degrees from the front foot. The boxer divides their weight evenly between their feet, and stands loosely. The heel of the right foot is lifted from the ground slightly, to improve this looseness. A boxer stands with their knees slightly bent. By having their feet and legs in place as such, they optimise their mobility and they can move around quickly.

With the lower body in position, the upper body follows. A boxer keeps their chin low, and their arms in front of their face. They will hold their right arm close to the chin, and their left hand at the same height in front of the other, with the thumb pointing towards their face. The hands are held at a height at which most of the face is covered, but so that the boxer can still easily look over them at their target. There should be some distance between the hands and the face, so the boxer won't punch themselves in the face when an enemy punches at their arms. The boxer holds their elbows down, as to cover their belly and chest from incoming blows.

Figure 7: Orthodox boxing stance

Boxers whose left hand is more powerful than their right hand, will generally use a Southpaw stance (Figure 8). The setup of the stance is nearly the same as the Orthodox stance, but Southpaw boxers have their right foot and hand in front and left foot and hand in the back.

Figure 8: Southpaw boxing stance

Professional fighters don't always follow the same guidelines as written here. Some fighters excell at continuously changing back and forth between Orthodox and Southpaw stance, to make it harder for their opponent to get a proper grasp at their movements. There are also some fighters who put their strong arm in the front instead of the back (expertboxing, 2011). So, in conclusion, there are no hard rules towards stance, but the Orthodox and Southpaw are the two main boxing stances.

Modern punch techniques

In modern boxing, three main types of punches are recognised; straights, hooks, and uppercuts (Legends Boxing, 2020) (FightCamp, 2021) (Balloo, 2020). Each punch serves its own function, and can be used for different purposes in a fight. These punches differentiate between the lead hand, which is the hand in front (left hand for a boxer in the Orthodox stance and right hand for a boxer in the Southpaw stance), and the rear hand, which is the hand in the back (right hand for a boxer in the Orthodox stance and left hand for a boxer in the Southpaw stance).

Straight punches (Figure 9) are punches which a boxer throws straight away from their body. These punches do not pack much power, but can be delivered quickly. Straight punches are delivered by straightening the punch arm from the boxing stance out onto the target. When delivering a straight punch, the elbow should be completely straight upon impact, and the other arm should be defending the face. A straight punch with the lead arm is also

known as a jab, and a straight punch with the rear hand is also known as a cross.

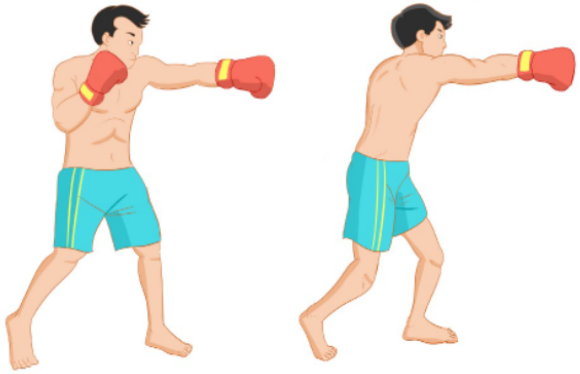


Figure 9: Jab (lead straight) and cross (rear straight) for a boxer in an Orthodox stance.

Hooks (Figure 10) are punches delivered by swinging the arm from the side onto the target. Hooks are more powerful than straights, but cannot be delivered as rapidly. When delivering a hook, a boxer twists their elbow at a 90 degree angle, and swings it horizontally onto a target. Boxers keep their elbow and fist at the same height when delivering a hook, to put as much power behind the punch as possible. By twisting the shoulders, legs and feet along with the arm, more force is added to the punch.

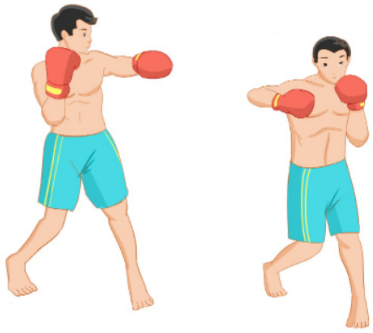


Figure 10: Lead hook and rear hook for a boxer in an Orthodox stance.

Uppercuts (Figure 11) are punches delivered upwards, generally aimed at an opponent's chin. These punches are delivered much like a hook, but instead of angling the punch in a horizontal plane, they aim upwards. A boxer swings their arm in an upwards motion, and twists their upper body to add force to the punch.

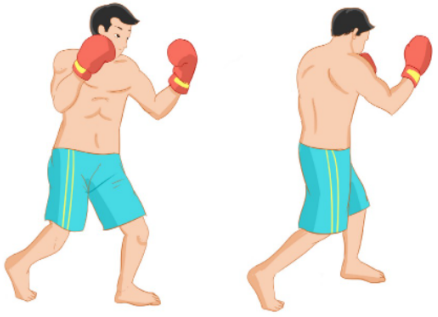


Figure 11: Lead uppercut and rear uppercut for a boxer in an Orthodox stance.

With these punches in mind, I can come back to the reason why, when using the right boxer stance, a boxer will have their strongest arm in the rear. This is because, when trying to hit a target with a lot of force, it is better to throw a swing with more momentum. What this means is that the longer the fist travels, the more force it will have behind it, especially when you put extra force behind the punch by putting your shoulders into it. Therefore, making your strongest arm your rear arm is profitable (expertboxing, 2011). For this same reason the rear hook is seen as the most powerful punch a boxer can throw (FightCamp, 2021).

Another reason for boxers to keep their dominant hand as the rear hand is accuracy (expertboxing, 2011). When your rear arm is your non-dominant arm, you will experience that you'll have a harder time properly hitting your target. Therefore, it is better to have your non-dominant hand in the front, where it will mainly be throwing jabs. For a jab, accuracy is less important because a boxer can easily throw relatively many jabs in a short timespan, compared to any of the other punches, so missing a few won't matter as much. For this reason, it is considered to be more profitable to use your non-dominant hand for jabs, and therefore as your lead hand.

Boxing and its benefits

Boxing in the modern day seems to have wildly different goals than it did in the past. These days, boxing classes are offered in gyms all over the world, and not only to elite fighters.

Boxing today is offered as a way of exercise or fitness to people of all ages. This suggests that the goals and benefits of boxing have shifted from beating your opponent to mush, to something else, gaining interest from people who aren't exactly looking to beat somebody else up.

Doing boxing exercise is beneficial to people and has gained popularity for the following reasons:

- **Boxing builds confidence:** Knowing how to fight and protect yourself gives people a boost. Combining this mentality with a stronger body and boxing increases people's confidence significantly (Groth, 2021). Aside from boxing increasing your confidence, confidence in itself makes you a better boxer (The Gruelling truth, n.d.). This means there must be a positive, self-fueling cycle.

- **Working out as stress relief:** Working out in any way, shape or form stimulates the production of endorphins and lipotrophin in your body (Harber & Sutton, 1984). These hormones increase happiness and reduce stress levels (Kraemer et al, 1990).

- **Increasing core strength:** When you look at a professional boxer, you'll see that aside from having huge arms, they'll have a very strong core as well. The force to deliver punches follows what is called a Kinetic Chain (Boxing Science

UK, n.d.). This chain is a metaphorical line which can be drawn through the body, from the feet on the floor, through the legs, through the torso and into the arm to deliver punching power. Power behind a punch starts at the floor, from which the leg of the punching arm pushes off. The force from the leg goes up through the torso, which twists to the side of the punching arm to deliver extra momentum. Lastly, the force goes through the arm into the fist to deliver it to the target. Since all force behind every punch goes through the core muscles, your core will get stronger when boxing. A sketch of this Kinetic Chain, portraying the force travelling from foot to the fist, can be seen in Figure 12.

Figure 12: The Kinetic Chain of force in the body of a boxer.

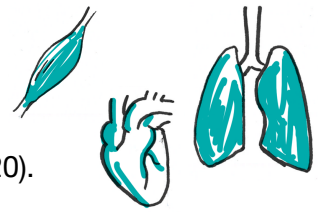
- **Managing your anger:** For many of the reasons boxing makes the body produce hormones to reduce stress levels, it can also help people manage their anger. The same hormones which fight stress also help reduce tension in the form of anger (Kraemer et al, 1990), in a way that doesn't harm anybody. Turning mental aggression into physical aggression into a punch bag, or some other product developed to deal with the punching force, makes the anger subside (Bevins, 2020).

- **Training your discipline:** Sticking to a boxing routine helps the mind become more disciplined (The Gruelling Truth, n.d.).

- **Getting sharper focus:** When doing boxing training, you will need to put your full focus into the training and drown out distractions (Bevins, 2020). Learning to tune out distracting factors can help in other activities in life.

- **Fast way to work out:** Boxing is a form of exercise which burns a lot of energy and does so fast. Within a number of minutes, you can feel like you have had a proper workout (Groth, 2021) (MacDonald, 2020).

- **Cardio, High Intensity, as well as Interval training:** Boxing combines the benefits of doing cardio with the benefits of doing high intensity training (Groth, 2021) (MacDonald, 2020).



Aside from these benefits, it should be noted that in order to practise boxing these days, there is 0 need to get beaten up. These days, boxing training can of course consist of sparring. However, there are many products being used nowadays to practise boxing skills without needing to throw punches at another person.

Over the time I've been working on this project, I myself have been following boxing classes in Delft, and had a number of conversations with gym owners at the NextRound office. From this, I have concluded that boxing training today consists of many different activities people can do. A list of these activities can be found in Appendix 4.

There are many facets to modern boxing training. The ways in which people can do so are wildly diverse. People's goals and motivations as to why they do boxing are very different as well. Boxing is a versatile sport, and its practitioners have the ability to customise their boxing training to their personal liking.

NextRound - what is this new product

As previously portrayed, there is a wide array of products people use in their boxing training on the market today. The NextRound boxing system is currently finding its spot in this wide market.

The NextRound boxing system is being created by Sports-f(x), an Amsterdam-based two-man scale-up company. The company was founded on the belief that a boxing system which used collected workout data to help users improve had potential, and could help a target group of people who have trouble get motivated to do cardio. Their first product is the NextRound punch bag (Figure 13).

Figure 13: NextRound punch bag being used at a gym.

The NextRound boxing system (NextRound, n.d.) consists of the NextRound punch bag, the accompanying NextRound Live app, and the personal MyNextRound app. Within the bags are sensors which measure the acceleration and time of each impact it receives. With the acceleration and time, it can deduce the frequency, speed, force, intensity, and location of each punch or kick.

The data the bag collects is sent to an accompanying tablet, which is the interface for the NextRound Live app (Figure 14). This app gives users feedback during and after workouts. While using the NextRound system, it shows each impact, be it punch or kick, in a graph which updates live. The app portrays impacts as vertical bars over the horizontal axis of time. The height of each bar depicts the force of each impact in kilograms. When the workout is completed, users can look into the graph and view further statistics of said workout.

Aside from providing feedback during and after a workout, the NextRound Live app is currently being developed to incorporate workout plans. These workouts can be chosen by users and will give them guidance as to what to do in this workout. These workout programmes include occasional instructional video material to get users started.

Figure 14: NextRound Live app on a tablet after a completed workout.

Lastly, the boxing system incorporates a personal app people can use to view and compare their personal statistics. This is the MyNextRound app (Figure 15). After somebody completes a workout, they can send the workout data to their personal profile. In their profile they can get deeper insights into their progression and statistics over time.

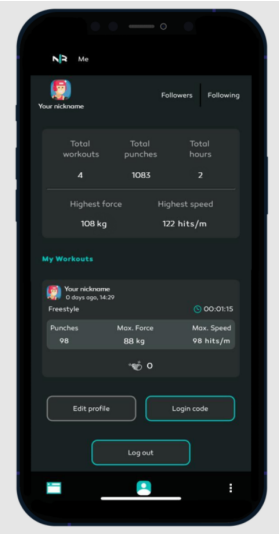


Figure 15: MyNextRound app.

The NextRound punch bag, NextRound Live app and MyNextRound app together form the NextRound boxing system. It is currently in use at a few dozen gyms in the Netherlands, and at several users' homes, and is seeking to grow to fit a wider market.

Chapter 1: Introduction - summary

Over the centuries in which people have been fighting with their fists, boxing has grown from being exclusively for trained ring fighters to a martial art which people all over the world practice. Boxing provides its practitioners with plenty of physical and mental benefits, and thus its popularity has grown among people of all ages and backgrounds.

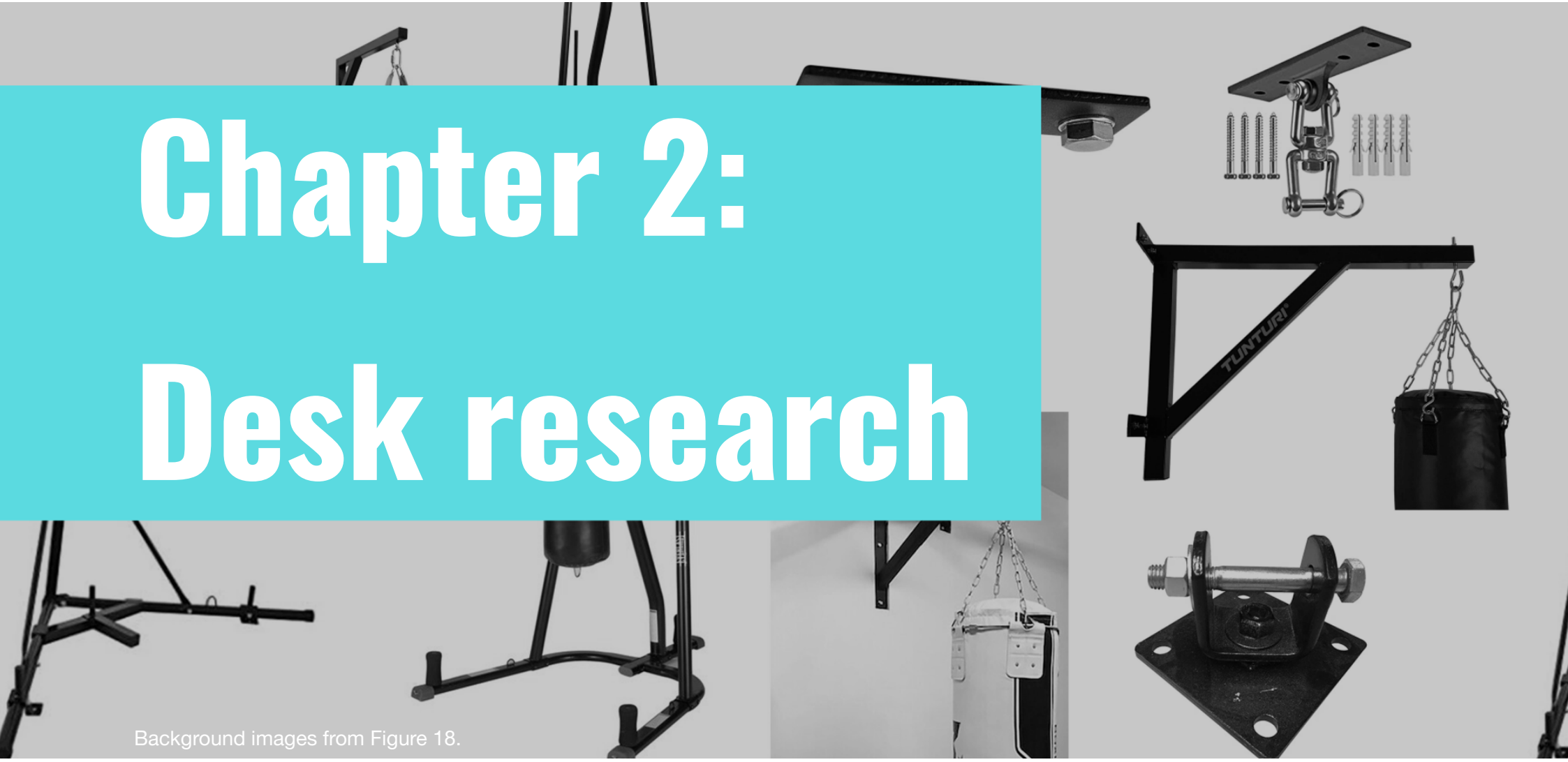
With this growth of the sport, innovative products for boxing purposes are being brought into the market. Plenty of companies, among which Sports-f(x), are creating products which bring new interactions and aspects to boxing training.

Sports-f(x) is the company which is creating the NextRound boxing system. This system consists of a punch bag with sensors, and two accompanying apps. This system allows users to get insights into their performance as they work out. It means to give users guidance and feedback as they work out, to keep them engaged and goal-oriented.

My project was done in collaboration with Sports-f(x), and with this NextRound boxing system. You can read more about the project itself in the upcoming chapters.

Chapter 2:

Desk research



Background images from Figure 18.

Chapter 2: Desk research - introduction

Before I could start developing a new product, I needed to get more familiar with the product context first. The current product is a kind of punch bag, for which many positioning solutions exist already. Through researching these products, I set out to define the product-level problems my design would need to solve.

The NextRound punch bag is not your average punch bag however, as it uses principles found in video games, through a process called gamification (more on that later in the chapter). This is a process which aims to make products and services more motivating to use. To understand gamification I researched motivation theory, and used it to try and define the society-level problems which the NextRound system could help solve.

Currently, there are already a handful of successful exercise product systems on the market, and I wanted to research some of the most successful gamified sports products to learn from their success.

Different kinds of punch bags

The earliest punch bags recorded were from back in 688 BCE, and were used by the Ancient Greeks in Korykos (Figure 16) (Els, n.d.). The patent of the modern punch bag was recorded in 1872 by Simon D. Kehoe (Els, n.d.).

Figure 16: Ancient Greek pot portraying two people punching and kicking at a punch bag made of a pig. Date of origin unknown.

Punch bags have evolved tremendously since the days people were punching at pigs. Today, many different kinds of punch bags exist for different purposes (Fight Quality, 2018). Some hanging, some standing, and in all sorts of different shapes.

The shape and weight of punch bags tell a lot about the kind of punches or kicks which are meant to be thrown at the bag. Tall cylindrical bags tend to be good for receiving straight and hooked punches, and a bunch of different sideways and forward kicks. On the other hand, a more rounded bag which is hoisted up higher is made to receive uppercuts or upward kicks. Heavier bags can be

used to train strength, while lighter bags can be used to train speed.

All in all, the punch bag market is wide and full in variety, and bags of basically any shape or size have been made by some manufacturer or another. Below in Figure 17 you'll see a few examples of punch bag types commonly found on the market.

Figure 17: A number of different types of punch bags. From left to right, a free standing bag (a punch bag which stands by itself, exists in different sizes and weights), a standard heavy bag (a hanging punch bag, generally 80 to 150 centimetres long, weights between 15 and 40 kg), a heavy banana bag (longer and heavier than a standard heavy bag, generally 180 centimetres long and weigh about 45-50 kg), an angled bag (sizes vary, generally a similar size and weight to a standard heavy bag, but with an angled surface to do uppercuts on), a teardrop bag (generally 80-110 cm tall, weigh 30-40 kg), a speed bag (generally 12-20 centimetres tall, weigh no more than 0,4 kg), and a water bag (generally have a diameter of 38-55 centimetres and a weight of 25-70 kg).

The NextRound punch bag would qualify as a bag in the category of heavy banana bags.

Existing punch bag positioning solutions

I am definitely not the first person to design a product to position a punch bag.

For as long as punch bag-like products have been around, people have been finding ways to position them in whatever location they used them. This means there must be plenty products in the world from which I can learn.

Punch bag positioning solutions on the current consumer market can be roughly divided into two categories: punch bag hooks and punch bag stands (Figure 18).

Figure 18: Punch bag hooks and stands.

Products in both categories can be used to enable a punch bag to hang somewhere, so that it can be used.

Punch bag hooks are products which are attached to another surface, for instance a wall or ceiling. Upon installing the hook, a user can then hang their punch bag to the hook and use it.

Punch bag stands are free standing products into which a user can hand a punch bag. They are generally tall, steel products consisting of a vertical pole to which the bag is attached, and some profiles on the floor to keep the structure stable. Most punch bag stands have slots on them on which users can put weights. These weights help stabilise the product.

It should be noted that there are more different types of punch bag positioning solutions than these two categories discussed above. However, punch bag hooks and stands are most commonly used.

A new trend which has been upcoming in the recent past are free standing punch bags (Figure 19) (Fitnessbrain, 2022). These bags include a foot on their bottom, and they can stand by themselves.

Figure 19: Free standing punch bags.

These bags are specific to their bases, and cannot be used without the other. The bags can for instance not be hung onto a punch bag hook or stand, and other punch bags cannot be installed onto these bases.

The bases of these free standing bags need to be filled with either sand or water (depending on the model) to make sure the base is heavy enough to keep the punch bag in place.

There are also some punch bag positioning solutions which can make use of specific parts of the location it is installed in. For instance, when the installation location has beams running through it at ceiling-height, a punch bag could be installed to it through the use of a punch bag beam strap (Figure 20).

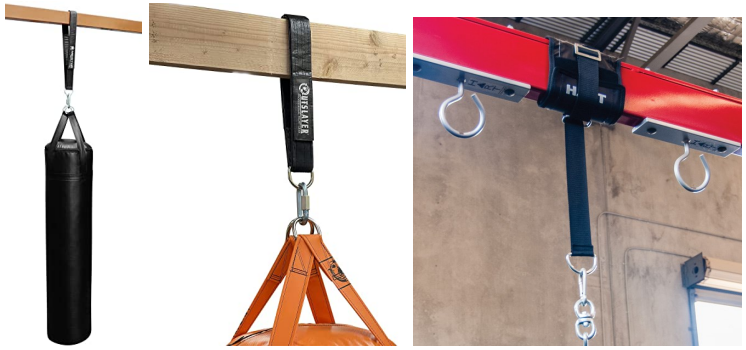


Figure 20: Punch bag beam straps.

Lastly, a positioning solution often seen in gyms specifically are rails (Figure 21) to which one or more punch bags can be hung. These rails are often custom made to fit the shape of the room it's placed in. Stock models exist as well.

Figure 21: Punch bag rails.

All in all, there are many different ways in which people can position their punch bags.

For instance, a punch bag hook or rails can only be placed in a location with a suitable ceiling or wall. A beam strap on the other hand can only be used in a location with a suitable beam. The advantage of a hook, rails, or beam strap is generally that the punch bag takes up no floor space. On the other hand, punch bag stands or free standing bags do take up floor space, but they don't require a suitable ceiling or wall. They do, however, require weights to keep them properly in place.

The choice as to what kind of product a person needs for their situation depends on the location where they wish to position their punch bag.

Product-level design problems

As discussed in the Introduction (under "Existing punch bag positioning solutions"), there is already a wide array of punch bag positioning products available on the market. I researched user experiences with these products by reading reviews users left on three of the most often purchased punch bag stands, and five of the most purchased punch bag hooks (Appendix 5) to find the problematic experiences users have had with these products.

Amongst these problems are the following:

- When installing a punch bag hook, users will always have to make permanent alterations to their home to make use of the hook possible. They will need to drill in walls or ceilings, which some home users will be hesitant towards. Not even all homes have walls or ceilings which are suitable for installing punch bag hooks, as these types of walls cannot bear the load.
- Since punch bag hooks are attached to a single location in a home, the punch bag cannot be moved around easily without installing a new hook in the new location.
- Smaller punch bag hooks have a tendency to break upon installation or after longer periods of use.
- Punch bag stands have a tendency to make loud, squeaking noises during use. This is likely caused by the metal parts scraping against one another.
- If a user's punches are a little powerful, they will need to put weights on their punch bag stands to keep them from falling over.
- Punch bag stands take up a lot of space.
- Punch bag stands are not always suitable for kickboxers or muay thai practitioners, because these fighting styles rely heavily on kicking. When parts of the punch bag stand obstruct the path of a kicking user, it is unsuitable. When a punch bag sways too much, it is unsuitable as well, because then users will need to wait for it to swing back before they can kick again.

Sports-f(x) wishes to have a newly designed positioning solution for their NextRound system, while trying to avoid the problems mentioned above. They want to put an innovative luxury cardio tool on the market, and the problems existing stands or mounts come with do not fit this image of NextRound. Therefore, a solution is needed which does not have problems like these, and which suits the innovative luxury image Sports-f(x) is looking for.

Later in this report (under "Design Assignment") I will explain more on how these problems feed into the design process.

Gamification and motivation

Gamification in design is the process of integrating gaming elements into non-gaming contexts (Deterding et al, 2011) (Aparicio et al, 2012). In an exercise context, these aspects are used to encourage people to work out. The NextRound boxing system was designed with some of these gaming principles in its software, through challenges and workout programmes.

In order to understand how encouragement through gamified services works, I studied the Self-Determination Theory (Deci and Ryan, 2012). This theory is based on the principle that motivations for people to do things can be divided into two types: intrinsic motivation and extrinsic motivation (Figure 22).

Intrinsic motivation exists from internal interests which a person takes action for for their own sake to satisfy their needs. For instance, a person might go boxing (action) because they wish to

lose weight (goal). They would be intrinsically motivated to take up the action, because their goal is a direct result of the activity itself, and this goal is a need of purely themselves.

Extrinsic motivation is motivation to take action to reach a goal which is separate to the activity itself. For instance, a person might train themselves to go long distance running (action) because they want to get good enough to be able to run a marathon faster than their sibling (goal). They would be extrinsically motivated to take up the action to reach a goal, as the goal is based on something beside themselves. The goal is not directly satisfied by the action itself, as the goal will not directly be satisfied by training. The action is performed to be able to fulfil the goal later in the future.

Figure 22: Intrinsic versus extrinsic motivation examples for a person to do (kick)boxing workouts.

If a gamified design is created to get people to exercise, it would only be effective if it did so repeatedly (Aparicio et al, 2012). The goal of the design should be to evoke an iterative sequence of exercise activities in people. Creating a repetitive behaviour through a design should be catering towards creating intrinsic motivation in its users. Extrinsic motivation can only be caused by external factors in a person's life aside from the goal, and therefore cannot be a part of the behaviour itself. This is because the goal in this case, is the activity itself, and not a thing separate from the activity.

This is where things get complicated, because intrinsic motivation is created by a person themselves. Their goals and intentions are personal. A gamified service to help people exercise needs to help motivate people intrinsically in order to get them to make use of the service.

According to the theory of Deci and Ryan (2012), intrinsic motivation exists based on needs. This is because people seek to satisfy their needs, and this search is fueled by motivation. In their Self-Determination theory they describe how these intrinsic needs can be divided in three different categories: need for autonomy, need for competence, and the need for relatedness.

The need for autonomy is the need people feel to not need the help of others to complete tasks. If this need is fulfilled, they will feel confident in their own abilities. The need for competence is the need to feel like you are improving at something you're doing, and getting more competent at a certain task. Lastly, the need for relatedness is the need to develop and maintain personal relationships.

With this knowledge of the processes of needs and how they play a role in motivation in people, I looked back at the NextRound boxing system, and how it motivates its users. The NextRound system as is helps people fulfil their needs for autonomy and competence when it comes to boxing.

The NextRound Live app aids its users in their learning process, at their own level, and at their own pace. They will not need to rely on instructors or opponents, because the system gives them enough workout and training options to choose from. This should help fulfil their need for autonomy.

Over time, as they improve, the system will show them their growth by ways of their improving statistics. By giving users insights into their workout statistics, and how they get better over time, the need for competence will be fulfilled.

I believe the need for relatedness also has potential to be fulfilled eventually, especially if users work out together with others. However, of the three needs described by Deci & Ryan, this one is the least fitting to the NextRound service for users at home. Aside from targeting at-home consumers, NextRound is selling their punch bags to gyms all over the Netherlands, and they have been experimenting with guided group workouts using their system, which has the potential of fulfilling the need for relatedness.

In my design, I will need to find ways to cater to the needs of autonomy, competence, and relatedness, in order to get users to intrinsically motivate themselves to work out with the gamified NextRound boxing system.

Society-level problems

It is common knowledge that exercise is good for people's health for many physical, as well as mental reasons. And yet, approximately 40% of the adult world population is overweight, and 13% of people has obesity (OECD/WHO, 2020).

There are many different reasons people do not work out, and these reasons tend to reflect a personal aspect of that person's life. These reasons can include, but are not limited to, the following:

- A lack of time.
- A lack of locations to exercise.
- Exercise can be expensive.
- Not knowing where to start.
- Local exercise locations don't fit their wishes.
- Exercise intimidates people.
- Fear of doing something wrong.
- Not having the right equipment.
- Not wanting to exercise alone, but not having somebody to exercise with.
- Not finding fun in exercise.
- Not feeling like they get better at exercising.
- A fear of getting injured.

I could go on listing reasons for longer, but I'll spare both your and my time. What a lot of these reasons come down to, are in general three problems:

- **People do not have the resources.** This resource can be time, or a location, or a person, or equipment. Some people refrain from exercising because they don't feel like they have what they need to do so.
- **People do not have guidance.** Some people refrain from exercise if they don't feel like they are going to be doing it right. Not knowing what to do makes people insecure and therefore less willing to start exercising. They cannot fulfil their need for competence if they don't feel confident in their competence to begin with.
- **People do not feel motivated to work out.** This can be caused by either a lack of extrinsic or intrinsic motivation to work out in people. People will not be extrinsically motivated enough to exercise if no external factors in their life drive them to do so. The lack of intrinsic motivation to exercise can be caused, as discussed before in Chapter 2, under Gamification and motivation, by a lack of fulfilment of the need for Competence, Autonomy, or Relatedness.

It is my personal belief that an exercise product, which guides its users and helps them feel motivated, has the ability to help a number of people overcome their barriers to get to working out. The NextRound boxing system is a system which fulfils these criteria.

I do feel the need to elaborate that the NextRound system, or even boxing for that matter, is not the solution for everybody. But still, a boxing system which guides its users, provides workouts to do, and which gives numerical feedback and insights into their performance, could help people feel motivated to work out. NextRound could be that for a group of people, if they were able to get a system of their own.

Intelligent sports goods

NextRound is a gamified exercise product in development. Sports-f(x) is at this time still finding its target group, and figuring out how to motivate these people to work out. To learn more about how other companies have made gamified exercise products successfully, I researched three of the most popular gamified exercise product-service systems: Peloton, Zwift, and FightCamp. By researching these product-service systems, I hoped to learn more about how these brands motivate their users to work out, and how they found their target groups.

Peloton

The Peloton bike (onepeloton, n.d.) (Figure 23) is an intelligent spinning bike and online community created by Peloton Interactive.

Figure 23: An indoor Peloton spinning bike.

Peloton encourages users to work out by the use of live online classes led by professional trainers (Figure 24). In these live classes, which people can follow from either one of the Peloton studios or on their screen from home, a trainer leads a class of people in a studio. Peloton presumably employs 51 trainers (Dean, 2022), who each have their own teaching style. Users can choose to follow classes from trainers of whom they know they enjoy their classes.

Figure 24: Photograph from a Peloton live class.

During a workout, the Peloton UI on the bike displays several statistics, as well as leaderboards. What I find especially interesting is that you can filter these leaderboards by your own gender and age category (Arthurs-Brennan, 2020). This means that for instance, an older person who is doing pretty good for their age, won't be at the bottom of the leaderboard because most other participants of the session are young and in their physical prime. By doing so, they help users see their personal growth and fulfil their need for competence.

Peloton started out as only a spinning workout tool, but the service started offering different workout disciplines over the years. Among these are running, boxing, yoga, meditation, and bootcamp to name a few. The non-cycling disciplines don't necessarily make use of the Peloton bike itself, but can be played from the bike screen nonetheless, when a user turns the screen to the side (Figure 25). A recent addition (december 2021) to the Peloton workouts is boxing (onepeloton blog, 2021). In their own words, it was their "most Member-requested discipline". These classes focus on shadowboxing.

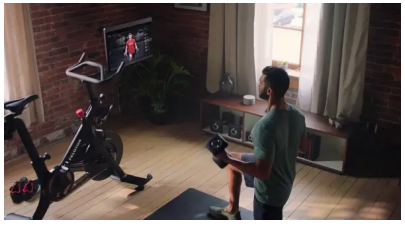


Figure 25: Peloton bike with the screen turned 90 degrees to the side so a user can do a different type of workout.

The target group of Peloton appears to be that of people with some money to spend and people who enjoy the togetherness of working out, really playing into people's need for relatedness. A Peloton bike costs 1195 USD, the installation another 250 USD, and the software subscription then costs another 39 USD a month. They also have bigger equipment packs, including other accessories such as cycling shoes, yoga mats, weights, etcetera. These accessory packs make the equipment costs go up to 1735 USD. All in all, it is a pricy product to own, but a user does get access to every class or workout which was ever made on the Peloton platform.

What I can learn from Peloton is how they motivate their users: through a live class with a trainer. Users can pick the workouts and trainers they find engaging, and hop in the saddle. They play into people's needs for relatedness and competence, but do not really make their users feel autonomous.

What's also insightful is that Peloton, even though their physical product is a spinning bike, offers way more disciplines than their bike offers. They listen to the wishes of their users, and add disciplines according to these wishes. Their platform has grown beyond spinning, because their product (the spinning bike) affords use for different disciplines (through the screen which can turn). If I were to design a product of which the shape could afford workouts in different disciplines, that could offer Sports-f(x) opportunities to expand their disciplines on the NextRound system in the future.

Zwift

Zwift (Zwift, n.d.) (Figure 26) is a software package for cyclists (Figure 27) and runners (Figure 28) created by Zwift Inc.

Figure 26: The Zwift software during a race.

Figure 27: A cycling Zwift user.

Figure 28: A running Zwift user.

Zwift is marketed as an exercise video game. Users can exercise by cycling on a spinner, or mounted bicycle, or run on a treadmill. As they work out, their movement input is transferred to the game, and their avatar moves as they move.

Movement input is measured differently for cycling users than for running users. Cycling users need to connect their bicycle to a bike trainer, which can either connect to the axis of their back wheel (Figure 29) or to the back wheel itself (Figure 30). This trainer reads the input a user puts into the system, and transfers it to the device which is running the Zwift app. The Zwift app then translates this input into the movement of the user's avatar in the virtual game world.

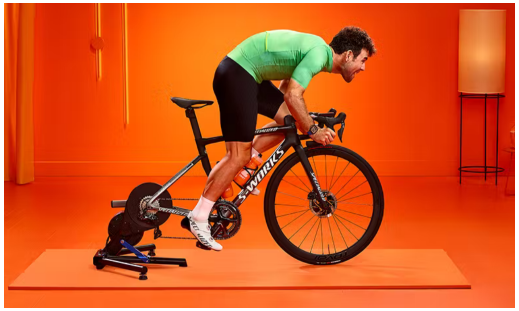


Figure 29: A Zwift user cycling on their bicycle, which is mounted on a bike trainer by the back wheel axis.

Figure 30: A Zwift user cycling on their bicycle, which is mounted on a bike trainer by the back wheel itself.

Running Zwift users need to connect a RunPod (Figure 31) to one of their shoes. This RunPod gathers movement input for runners to send to their Zwift app. The RunPods cannot be used outside or on a track, and require a treadmill to be used.

Figure 31: A Zwift RunPod attached to a user's shoe.

It should be noted that, aside from the Zwift RunPod, none of the hardware needed to work out with Zwift (a bicycle, bike trainer, or treadmill) are produced by Zwift. Users can use a bicycle or treadmill of their own preference with the Zwift app.

What sets Zwift apart from many other intelligent exercise products, is the fact that Zwift markets itself as a video game. Gamification has been applied deeply into the creation of the app. Users can customise their own avatar with skins and clothes which they can unlock through working out, or by partaking in events. Their avatars run or cycle through a fully rendered game world. Some of the maps (Schlange, 2016) in the Zwift app were based on real-life locations, such as Central Park in New York City, or l'Avenue des Champs-Élysées in Paris, or natural scapes in the Alps. Each map has several routes users can choose to take, each with their own length and difficulty. All these things users can explore and do help them get more competent, thus fulfilling their need for competence.

Aside from avatars and game worlds, Zwift also uses gamification principles in their Events. Aside from the workouts users can always choose to do, Zwift organises dozens of live events every day (Zwift, 2022) (Figure 32). When partaking in a live event, users can gain avatar customization items and experience points to level up.

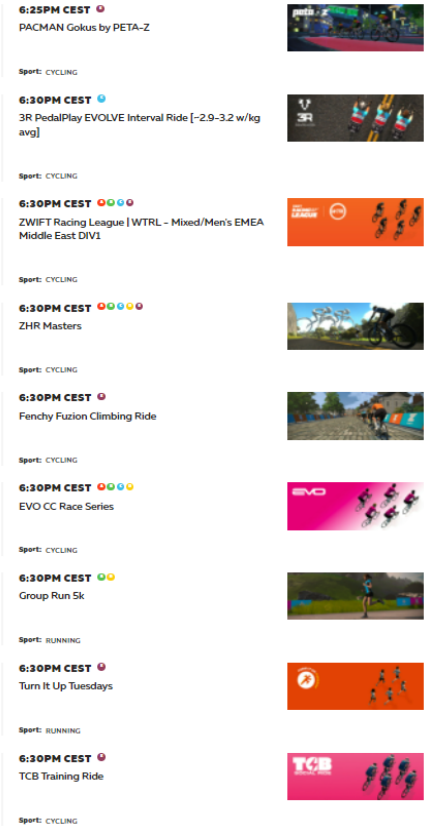


Figure 32: A small portion of the Zwift events on May 10, 2022.

In these live events people can compete live with other users partaking in the same event. All of their avatars will show up on the event map, and they can compete with them.

In their UI, there are many game elements, which hint at their target group being mainly people who play video games and are enthusiastic about sports.

Zwift supports an online community in which users can add other users as friends, or add them to friend groups. During a workout, users can communicate with their friends, or with strangers, through a number of simple messages and icons. This helps fulfil their need for relatedness.

What I can learn from Zwift is how far you can go with gamification. The gamification process in the Zwift service has been done very thoroughly, to the point where Zwift itself considers their service an exercise video game, and not a gamified exercise service.

Another thing I found through some reviews is that Zwift workouts are long. They start at workouts of half an hour, and can take up to several hours. I personally believe that when it comes to NextRound, it would be better to have some really short but high-intensity workouts, simply for when users only have little time.

What I can also learn from Zwift is how they guide their users what to do. They don't have instructors telling their users/trainees what to do, but instead the movements of the avatars guide users to what they need to do, which helps them fulfil their need for autonomy. Product wise, there is not much the Zwift service can

teach me for my own project, but learning about the software was insightful.

FightCamp

FightCamp (joinfightcamp, n.d.) is a product-service system (Figure 33) for at-home boxing created by FightCamp.

Figure 33: The main products of the FightCamp product line; free standing punch bag, workout mat, hand wraps, punch trackers, and boxing gloves.

FightCamp is the current market leader for intelligent at-home boxing systems. Their library currently contains over 600 workouts and they add 12 new workouts each week (FightCamp library, n.d.). The workouts are led by professional trainers (Figure 34) and users can follow these workouts through the FightCamp app. FightCamp workouts are divided in rounds, and typically last 4, 8, or 10 rounds. The workouts combine (kick)boxing moves with other strength, cardio, or stamina exercises.

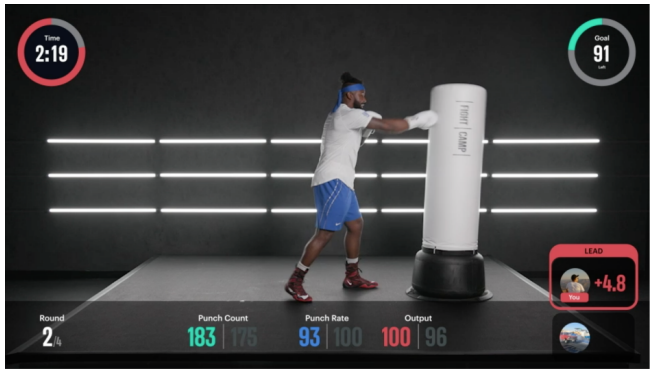


Figure 34: A screen capture of a FightCamp workout.

The FightCamp app has some gamified elements. A user “beats” a workout when they hit the punch goal count which is noted for every workout. Aside from that FightCamp has leaderboards per workout, so users can compare their performance to those of other users, which should help fulfil their need for competence.

The way FightCamp tracks punch data is very different from the NextRound system. The NextRound boxing system senses impacts through sensors inside the bag. When using FightCamp on the other hand, users need to put the punch trackers (which contain the sensors) into the back of their hand wraps (Figure 35). This means that the FightCamp trackers work not only when users punch at a FightCamp punch bag, but would also work when a user is shadowboxing, punching at pads, or at an opponent.

Figure 35: A FightCamp user putting their punch trackers in their hand wraps.

The FightCamp punch bag is a free-standing punch bag (Figure 36) (refers to punch bag types on page 23). This means that the bag is mounted directly on a base. This base needs to be filled with about 140 kilograms of water or sand to keep the system in place when working out (Galla, 2021).

Figure 36: The free-standing FightCamp punch bag.

The base of the FightCamp punch bag then fits into the FightCamp bag ring (Figure 37). In their own words (FightCamp shop, n.d.), the purpose of the bag ring is to keep the punch bag in one place when working out with the FightCamp punch bag, because it has a tendency to slide around.

Figure 37: The FightCamp bag ring being laid on a floor.

FightCamp also offers a system of eight 1-by-1 foot interlocking rubber tiles, which users can assemble into their own exercise mat (Figure 38). The punch bag and bag ring can then be placed on this mat. The mat provides users with a soft surface to do their workouts on.

Figure 38: FightCamp exercise mat with one tile disconnected.

In their shop, FightCamp sells several gear packages (joinfightcamp, n.d.). Looking at the packages and the software subscription, it seems like FightCamp's main target group are families, who have a bit of money to spend (their service costs 39 USD a month, and that is excluding all the workout gear). Their interface is simple, and their library contains a lot of workouts for beginners. Judging from these facts, I think FightCamp doesn't necessarily mean to target professional fighters, or people who have a lot of experience with (kick)boxing. They want to make it easy to get into the sport, and then work out a lot. It is a tool for people who wish to get some efficient, and guided workouts at home.

What I can learn from FightCamp is how they structured their punch bag stand to be as small and unobtrusive as possible. The foot is, in comparison to the bag, quite small. This has the benefit of not taking up any more space than needed. The downside however, is that the FightCamp punch bag needs extra products to be truly stable. The bag ring and exercise mat were products which were added to the FightCamp line because the bag would move around too much without them (FightCamp shop, n.d.).

The exercise mat itself intrigues me as well. Having a soft yet sturdy mat under their feet enables a user to work out barefoot, or do bodyweight exercises next to their punch bag. This gives FightCamp an opportunity to integrate more disciplines in their workout, aside from boxing, which makes their workouts more diverse. The downside of this system though, is that the mats take up a lot of space on the floor. They can be disassembled in between workouts, but then a user needs to take out the heavy tiles and store them somewhere.

If a user wishes to move the system to a different location, they would need to move the standing punch bag, the bag rind, and the tiles of the exercise mat all separately. This makes moving the bag a hassle, especially when the base has been filled with sand (Galla, 2021). So, while the product solution for positioning the FightCamp punch bag is quite innovative and seemingly sleek, it does have its problems.

All in all, I can see why FightCamp is currently the market leader of intelligent boxing systems. Their workouts are engaging, easy to get into, and can be done at many different levels of skill. Their physical products look nice, but the interaction with them does appear to have some problems still. When designing for NextRound, I will take these insights into consideration and try to learn from the competitor.

Chapter 2: Desk research - summary

Any good design process starts out with a proper dose of desk research. To get familliar with the context I would be designing for, I read about the product context of punch bags, and their existing positioning solutions. I concluded that punch bag positioning solutions can be divided in roughly five categories: stands, hooks, free standing bags, beam straps, and rails. Each solution type has their own advantages and disadvantages, and is applicable in different types of spaces. For my design, I tried to make it usable in as many different kinds of spaces as possible, by learning from how existing solutions do this.

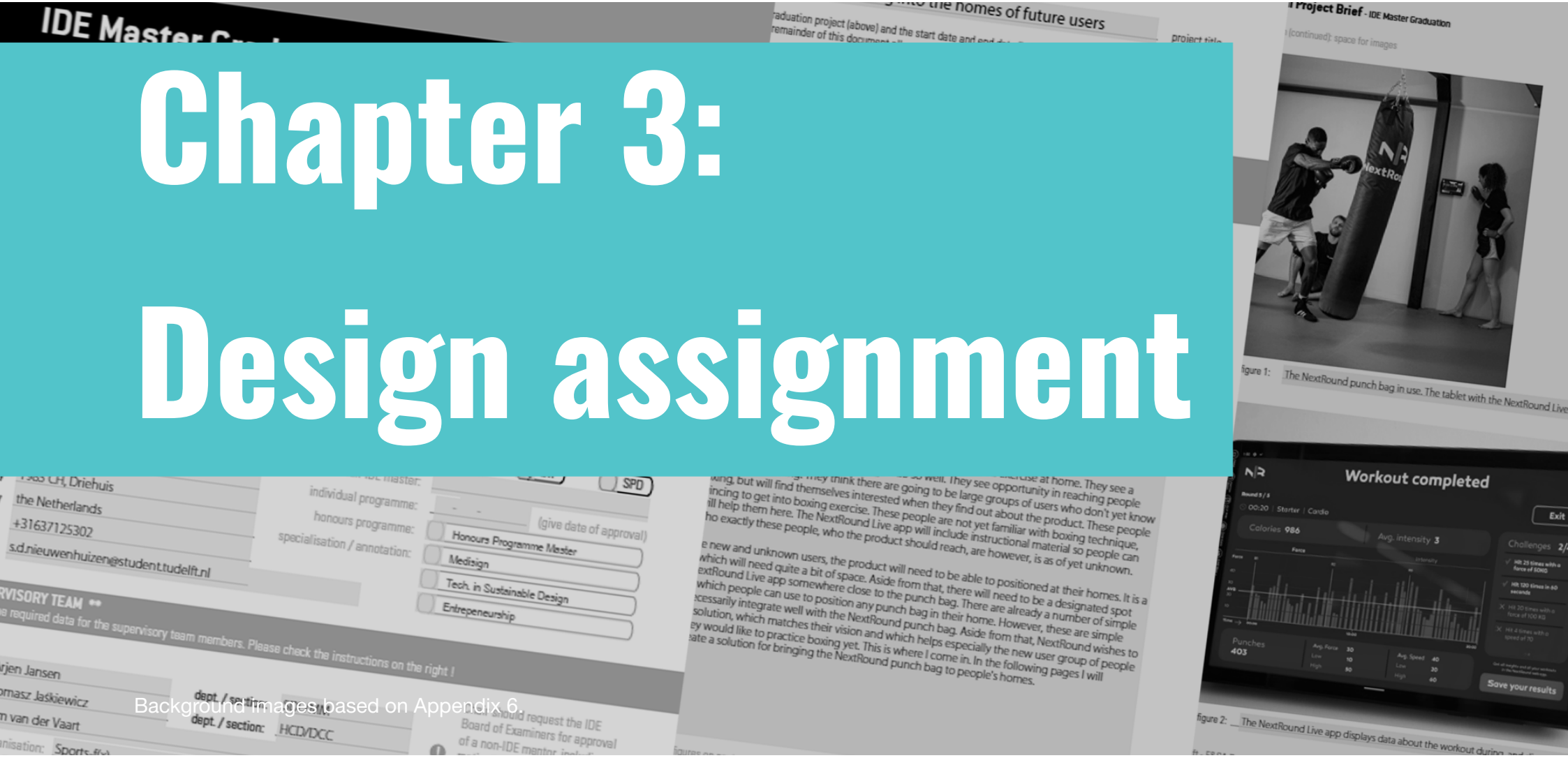
The reading about the Self-Determination Theory (Deci and Ryan, 2012) taught me how to motivate people to work out. My design would motivate users if it fulfils their needs for Autonomy, Competence, or Relatedness. If my design is able to do so, users will most likely feel motivated to work out with NextRound.

Lasly, I read about how three different companies have made intelligent sports goods which are successful. I analysed each on a product level, as well as how each product-service system motivates its users to work out.

With the knowledge gained from this research I tried to make a design which suits the current product context, and which has the potential to help people to feel motivated to work out and have fun while doing so.

Chapter 3:

Design assignment



Chapter 3: Design assignment - introduction

To set up a design assignment for the product, I looked back at the product-level and society-level problems found in the desk research phase. These problems would have to be solvable through the design assignment.

Combining these problems with my personal ambitions, I could conclude with the framing of the assignment. This assignment framing came together in a Project Brief, which can be found in Appendix 6.

Personal design ambitions

With this project I will try to design a product to bring boxing to the homes of people through the NextRound boxing system. Aside from; 1 making a good-working product, and 2 helping people, I had two personal ambitions to fulfil with this project.

Firstly, I wanted to learn how to integrate potential users and their opinions into a design project. During my Masters studies I had learned quite a bit about user testing and co-design. However, I wanted to gain more practical experience with these methods. I felt this way especially because during a sizeable portion of my Masters studies, the world had been in lockdown, which made user research especially difficult. Therefore, my ambitions were to do co-design sessions near the beginning of the project, and in the later stages involve users in concept evaluation.

Secondly, I wanted to make my project physical. What I mean by this is that I planned to build models during the project. I set out to build some low-fidelity models and prototypes during the project to find answers for design questions I got. At the end of the project, I wanted to make a working, full-scale model of the final design. This model was then meant to be tested with potential users to evaluate how well my design would be suited to the lives of real users.

Both of these ambitions are reflected in the Project Brief (Appendix 6).

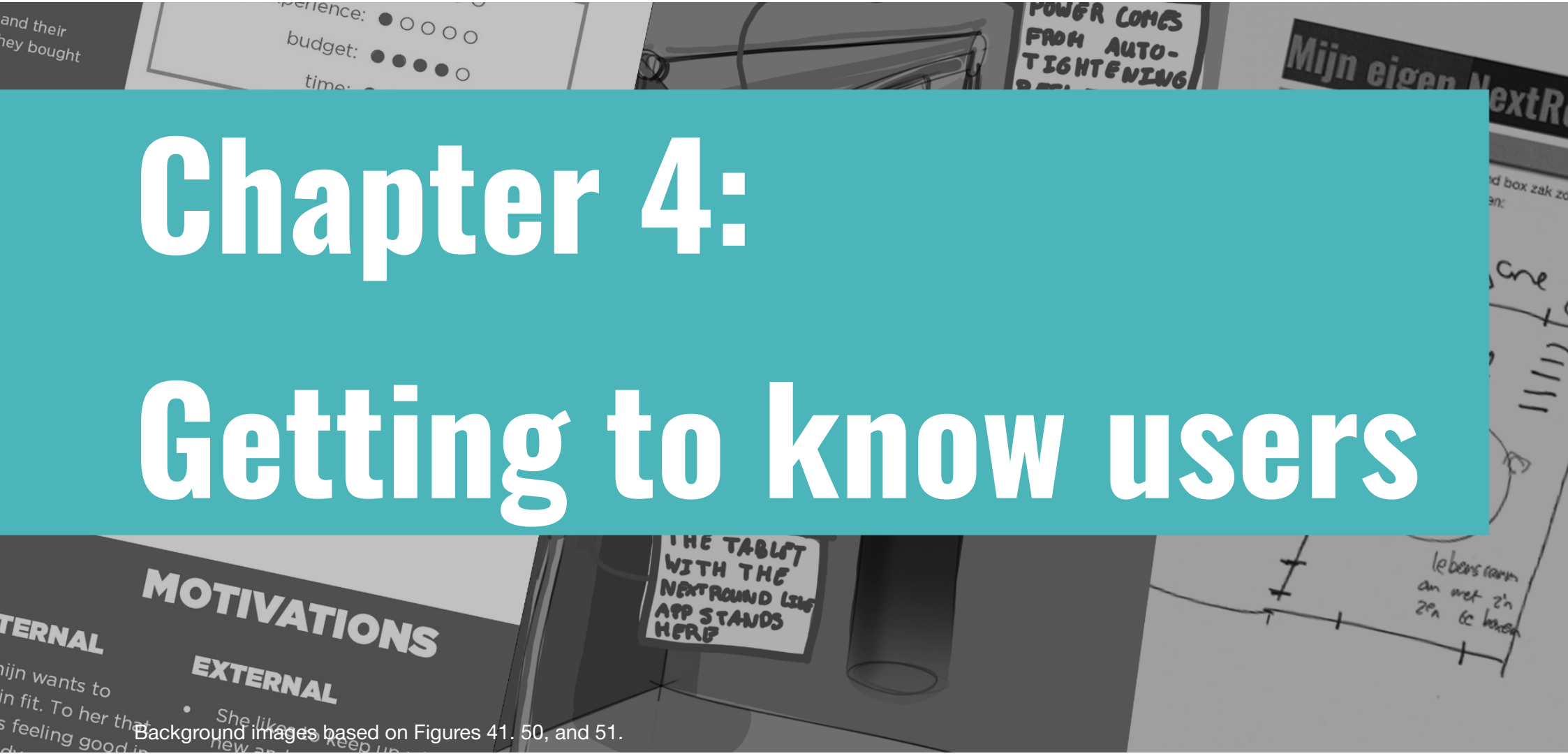
Chapter 3: Design assignment - summary

I researched the product and society context of the NextRound punch bag to define what the problems are which my design should help solve. Aside from looking at the problems in the world, I also defined my personal design ambitions to tailor the design assignment to my own tastes.

With these problems and ambitions, I created the following design assignment for this project:

“Design a product to bring the NextRound punch bag to users at home. This positioning-solution product will be integrated with the punch bag, and the NextRound Live app. The product should fit to the punch bag visually, and in use. The bag and the newly designed product should become a whole, and the new product should add a new functionality to the already existing functionalities of the punch bag.”

By designing a product which satisfies assignment I hope to make a product which suits the NextRound punch bag in its product shape, and its mission to help people exercise in a way in which they feel like they have the needed resources, they feel motivated, and feel like they have the guidance and knowledge to work out properly.



Chapter 4:

Getting to know users

Background images based on Figures 41. 50, and 51.

Chapter 4: Getting to know users - introduction

A design meant for people to use cannot be made in a void. Whatever comes out of this project should be usable by actual people and suit their lives. If I want to help people exercise at home with NextRound technology, I will need to know how I can make a design to suit their home situation. So, before I went on to design, I first conducted several weeks of user research to get to know the kind of users I would be designing for.

Personas

To start finding out who the potential users of the NextRound punch bag could be, I looked back at the earlier desk research I did. The following factors which influence the kind of potential users were found:

- For private users, the NextRound punch bag costs €800,- upon purchase, and then it costs another €19,- a month to have access to the software. These costs are high enough to think not every person is willing to pay as much for an exercise-at-home product.
- Boxing is becoming more and more popular as a workout tool in the Netherlands. Many gyms already incorporate boxing routines in their workouts (Klaassen, 2018) (Elling et al, 2017).
- The NextRound punch bag collects data during use, and can give immediate feedback to its users. This is an opportunity in and of itself, since this data can help people see their improvement, which could help them satisfy their Need of Competence (Deci & Ryan, 2012).
- A data-driven workout system could be especially interesting to people who are interested in technology. If the NextRound apps can also cater to these people, they could be interested on two fronts.
- NextRound already has quite a bit of traction on social media, and they have connections throughout gyms in all of the Netherlands. Their network spreads by the day, so there should already be a large number of people who are at least somewhat familiar with the system. The combination of word of mouth marketing with social media marketing could reach many different people.
- 82% of Dutch people don't live alone (CBS, 2022), and therefore there are also potential users to be found in the house members of people who purchase this NextRound system. 27% of Dutch adults have at least one child who lives with them (CBS, 2022), which means that there is potential to be found for NextRound with users who might have children.

These factors of the NextRound system say a lot about what kind of people would use a product system like this. Therefore, I used

these factors to find five user groups to whom these factors would facilitate:

Ilona: a middle-aged mother who wishes to feel more confident

From research, I found that more and more gyms are offering boxing classes to everybody. Boxing has become less of a sport for big fighters, and more of a workout for everybody who might be interested.

A group that is often overlooked in the exercise world, is women during menopause. In this period they might experience many symptoms, among which are dizziness, heat flashes, migraines, and mood swings. During this period especially, it is very healthy to keep a proper workout schedule. Boxing is a good tool for these women (Latte Lounge, 2018) (Health and her, 2021).

Boxing helps women during this time feel confident, and stronger inside their body, which feels less stable than it used to. As boxing combines cardio with strength training (MacDonald, 2020), all the muscles they need are catered to.

A NextRound system would be interesting to her to enable her to work out from home, and see her improvement. The system can offer her workouts to engage her, and keep to her workout schedule. Aside from that, the system would engage her and help her keep proper form and technique, so she'll feel guided even when there's no trainer nearby.

This user profile is summarised as a persona named Ilona (Figure 39).

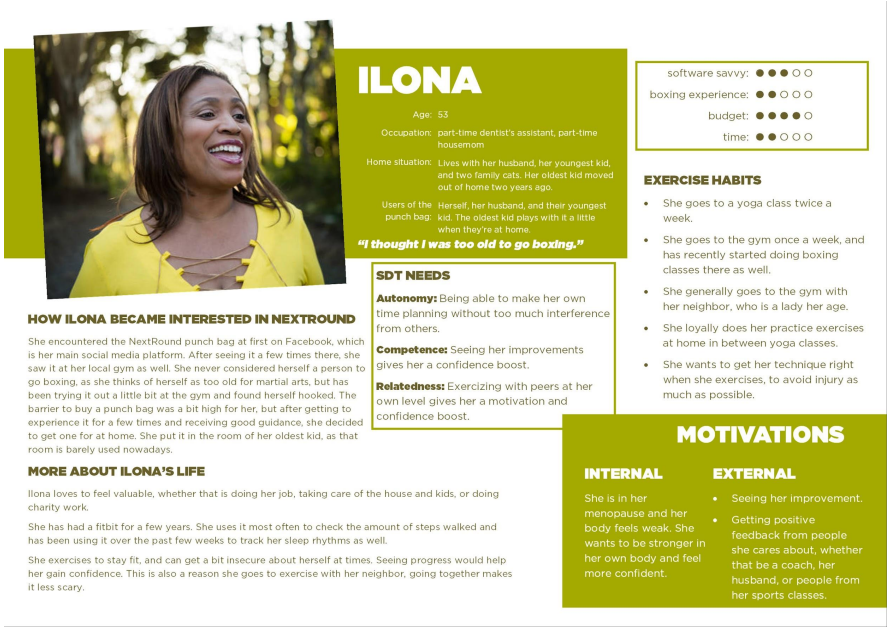


Figure 39: Ilona persona.

Cor: a busy middle-aged man who wants to feel strong and energised

The NextRound boxing system is meant to be a bit of a luxury product, and its price tag reflects that. While it's expensive, it provides a premium workout interaction which takes relatively little time and still trains many of the body's muscles, as well as being a great cardio tool.

These factors alone make it a suitable exercise product for somebody who's got quite a bit of money, little time, and an interest in boxing or intelligent sports' goods. The person I envision meeting these qualities would be a man in his fifties, with a busy professional life and a sense of valuing his quality time greatly.

In this period of his life, he would experience that getting and staying fit takes a lot more effort than it did when he was younger. He has little free time, and therefore would like to spend the bit he has to the fullest, instead of needing to do hours of cardio every week.

He views the NextRound boxing system as a piece to be proud of. Showing his new stuff is something he and his friends would be doing all the time, and the NextRound would be one of those things. He is a man who also wants to be better than others and his mates, much like he and the boys used to do back in the day.

This user profile is summarised as a persona named Cor (Figure 40).

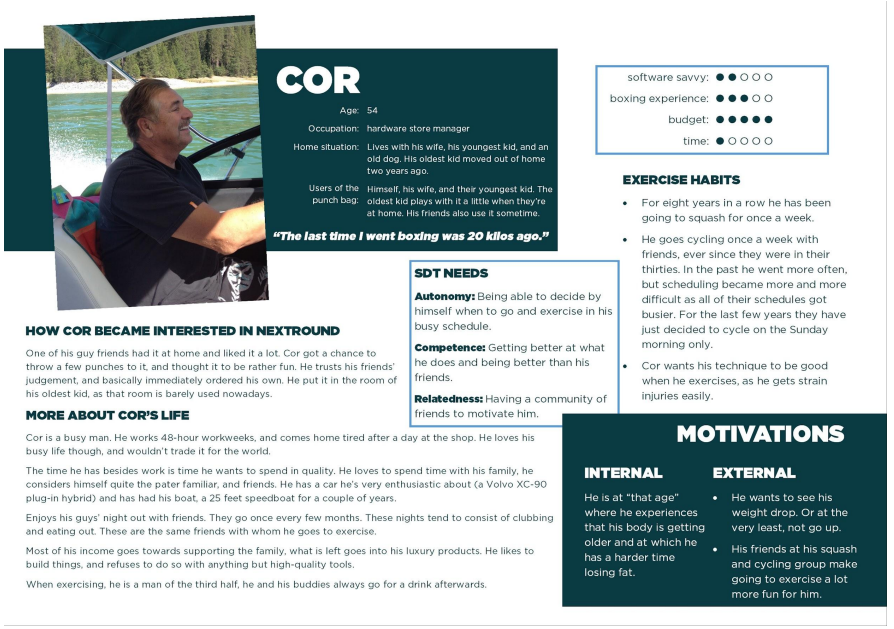


Figure 40: Cor persona.

Jasmijn: a young adult who's interested in sports & innovation

The NextRound system is an innovative boxing system, making it interesting for people who enjoy exercise as well as innovation, and who have a bit of budget.

This user profile is summarised as a persona named Jasmijn (Figure 41).

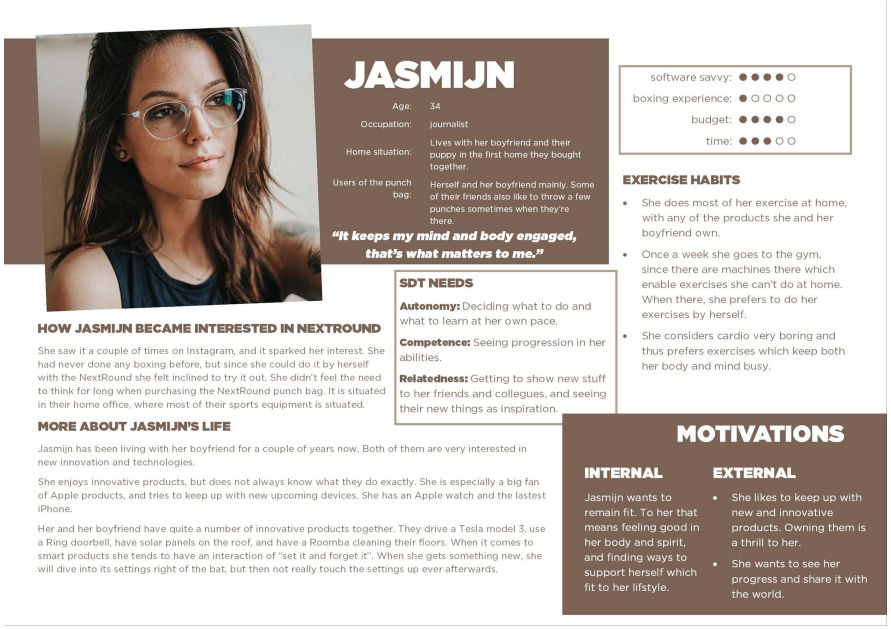


Figure 41: Jasmijn persona.

Daniel: enthusiastic kid with short attention span during puberty

Boxing is also an interesting form of exercise and a good energy outlet for children. Children also tend to be quite handy with software and apps. These two factors combined tell me that boxing with a NextRound system could be interesting for kids.

Many kids tend to have high energy levels, and having an outlet for pent-up energy is really nice for them. I imagine kids in their mid-tens could be especially interested in a NextRound system.

Tailoring the NextRound system to suit the lives of children, and perhaps enabling them and their parents to work out together, could be very fun.

It should be noted that very few children would be able to afford a NextRound boxing system. Financially, they would depend on their parents to purchase the system.

This user profile is summarised as a persona named Daniel (Figure 42).

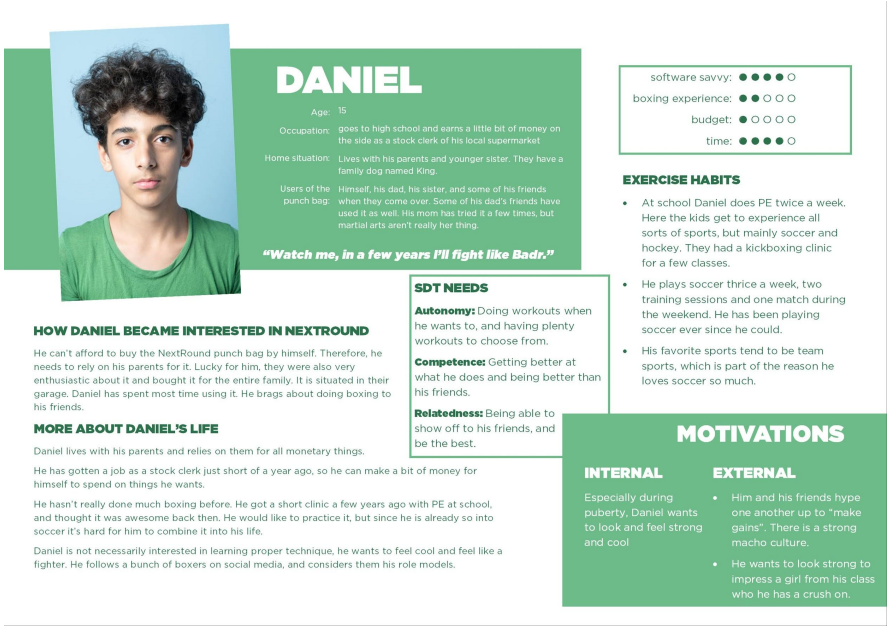


Figure 42: Daniel persona.

Edgar: young inactive adult who's interested in gamification

The NextRound system can from one angle be viewed as a sports' product with intelligent functions, but from another angle it can be viewed as an innovative gaming object for which you need to work out.

People who perceive the system with the second view are likely people who've been interested in innovative technology for a longer amount of time. They would also be people who are interested in video games, and in nonstandard ways of playing them. By nonstandard I mean things like motion control, VR or AR gaming, or technologies alike. They would be interested in other kinds of video gaming than the more common keyboard & mouse combination, or standard gaming controllers.

To make this user profile a bit clearer, I also figure that they might not be the most sporty people. Therefore they probably need guidance to move their body correctly since they're not the fittest, and encouragement to get to working out. Once they are hooked however, there is a large chance that people like this get competitive, and want to get in-game achievements and awards. Once they are hooked on a system, they'll want to explore every little aspect of it.

This user profile is summarised as a persona named Edgar (Figure 43).

Figure 43: Edgar persona.

Co-design

During persona creation, I tried to find opportunities for the kind of people who might be interested in owning a NextRound boxing system. Now, in order to get to know these potential users, their values, their struggles, their wishes, I set up co-design sessions.

The goal of these sessions was to do qualitative research with potential users and learn what wishes and demands they would have when coming to own a NextRound boxing system.

Research questions

The personas and user research up until this point was only theoretical. The personas are not real people of course, but they are user groups I imagine to be interested in the NextRound boxing system. In order to test the theoretical user group, and find out what the demands and wishes of these people are, I defined the following co-design research question:

"What would the ideal use case be for potential users if they were given a NextRound punch bag?"

In order to answer this question, I needed to have a number of smaller, more specific questions answered:

- Do the participants work out?
- What motivates the participants to work out?
- How much experience do the participants have with boxing?
- How do the participants feel about boxing?
- What would people want out of their NextRound boxing system?
- Where would potential users want to have their NextRound boxing system?
- Why do people want to have their NextRound system in a certain location?
- What functionalities and features do potential users want to get from the positioning solution they choose?
- Why do participants want their solution to have certain functionalities and features?

Method & materials

For the setup of the methods and materials for the co-design sessions I made extensive use of the Convivial Toolbox (Sanders and Stappers, 2012). The order and contents of the questions and activities were largely based on the methods presented in this book.

I had some design questions which participants could potentially answer in the form of an interview. Some questions however, I thought would be more suitable for answering in a more creative and visual way. Therefore, I decided to split the session in two research parts: starting off with an interview and continuing with a co-creation session. Before these two research parts, I informed participants about my goals and intentions for the session, and would make them fill in an informed consent form. All the materials I created for the co-design session can be found in Appendix 7.

The order of activities and questions is based on the theory of the four types of experience of information in a person (Sanders, 2002). This theory states that the experience of a person's needs, knowledge and wishes are divided in four levels and are accessed by different types of activities (Figure 44). The first is explicit experience. This knowledge consists of facts which people can readily produce. Among explicit experience is the knowledge of a person's age, how often they exercise, or if they have ever done boxing before. Explicit information can be expressed through words. Observable information experience is generally harder for a person themselves to be aware of, but is readily observable by

others. Some examples of observable experience information are the face a person makes when they make a phone call, the sounds they make when working out, or how they hold a water bottle. Tacit experience information is the knowledge of how to do a certain activity. Tacit information is often attributed to muscle memory, where a person tacitly knows how to do a certain activity, but will have a hard time explaining it. Instances of tacit knowledge include knowing where the turn signal is in a car, how to close the clips of one's sports bra, or how to wrap boxing wraps around your hands. Latent experience information is the deepest level of experience, and is the hardest for people to access. Tacit knowledge is based on knowledge of things which don't exist yet, and have not been experienced by a person yet. Latent experience is based on the wishes and dreams a person might have of an ideal future scenario. In order to access latent experience information, a person needs to create something new to satisfy their needs. Latent experience can lead to solutions to problems. Some of these could include a system where a meeting gets postponed automatically when a person gets delayed because of a late train, or which guides a person to the nearest drinking water source before they won't come by any fresh water, even when they aren't thirsty, or which based a person's bench press weights to their physical state that day.

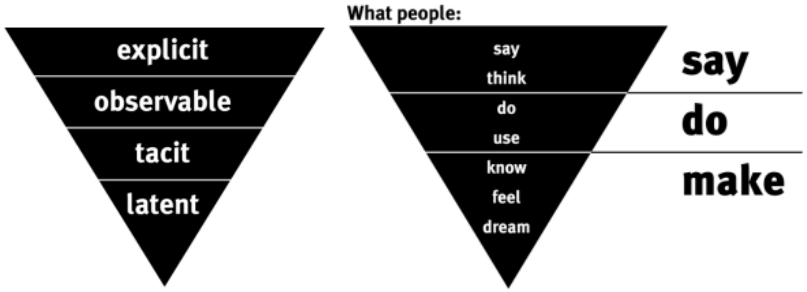


Figure 44: The levels of experience information and the activities of people to access this knowledge.

Because I'm designing a product which doesn't exist yet, and for which I need to get a deeper understanding of the latent experience information in people, I needed to set up the co-design sessions in a way which I could properly prime the participants to share latent experience information. However, to access latent information, it's easiest for people to first experience the information of their explicit, observable, and tacit experience, in that order.

First, I chose the questions which I could answer through the interview. These can be found in the Interview Questions in the Appendix. I structured these questions to start with more factual questions, the kind of questions which people can answer immediately as there is only really one answer to the questions. These questions would target their explicit experience information. During these conversations, I observed closely to get a deeper understanding of how they felt while they answered the questions about different topics, to get an understanding of their observable

experience. Later on, when the participants were acquainted with answering the questions, the questions could go deeper into their opinion space, and less into the factual space, to prepare them for diving deeper into their subconscious experience information, for the tacit and latent knowledge.

After the interview questions, I made the participants explain how they would work out in their current situation, and ask them to show me where they did these exercises and act things out. When at the locations where they would work out, they could access their own tacit knowledge.

After having addressed the explicit, observable, and tacit experience information, the participants would be in a headspace to access their latent experience information. This I did by giving them an assignment; to imagine what they would do if I were to give them a NextRound punch bag. Along with this assignment I used a collage to help explain what the NextRound system was and could be used for, so they would know what they were getting.

First, I asked them to imagine where they would want to position it, and use a sheet with some post-it notes to reflect on having a NextRound punch bag in this location. They would reflect by writing three pros and three cons of having a NextRound punch bag at this location.

After reflecting on the chosen location, I asked the participants to show me this location, and what they would imagine having the punch bag here would be like in their perfect situation. Together, we drew this perfect solution out on a map.

Lastly, I planned to take a picture of the participants in their imagined solution space, and pretend to work out with their punch bag. Later, I sketched on these pictures to get an image of what their solution could look like in practice.

By ordering the co-design sessions in this way with these materials, I aimed to get an insight in the latent experiences and wishes potential users could have regarding the NextRound boxing system.

Results per session

Each session resulted in a map and some drawings of their final design in the context of use. Aside from this visual material, the interviews provided information about why the participants had certain feelings towards exercise or wishes for the products.

Fuller descriptions and quotes from the sessions can be found in Appendix 8.

Session 1 - participants 1 & 2.

Both participants were in their fifties, and relatively active. They exercise to keep healthy and be strong in their bodies, to avoid future injury. This fear of injury exists in both of them because they had both had different types of injuries in the past, and thought of those periods as quite depressing.

They are both active at their own respective gyms, and do boxing regularly. Participant 1 enjoys the confidence boost it gives her, aside from the bodily strength. Participant 2 loves how boxing gives him an adrenaline rush and makes his mind feel focussed.

When I asked them to design their positioning solution if they were given a NextRound punch bag, they opted to put it in their garden. For this situation, they designed two solutions, one which requires little change to their home (Figure 45) and one which requires more change to their home (Figures 46-47).

For the solution requiring little change to their home, they would use the swingset in their garden to hang the punch bag to. When not using the bag, they would store it in their garage, which is close to the swingset. This solution would require them to move the bag up and down to the swing set every time it was used. They deemed this inconvenient, and therefore designed a second solution.

Instead of making use of the swingset, they would build a porch onto their garage. This porch would serve two functions: a roofed terrace and a place to do boxing. They hung their imaginary punch bag on rails in the ceiling of the porch roof. This way they could pull the punch bag out if they wanted to work out, and push it to the side when they were done. This way they could keep a path free for walking, or for when they would hang out on their terrace. This solution would be convenient space-wise, as the space could easily be converted from a place to work out to a place to relax, by shoving around some chairs and a punch bag.

Figure 45: Sketch of participant 1 showing the solution, which requires little change to their home, she and participant 2 came up with during co-design session 1.

Figure 46: Sketch of participant 1 showing the solution, which requires much change to their home, she and participant 2 came up with during co-design session 1.

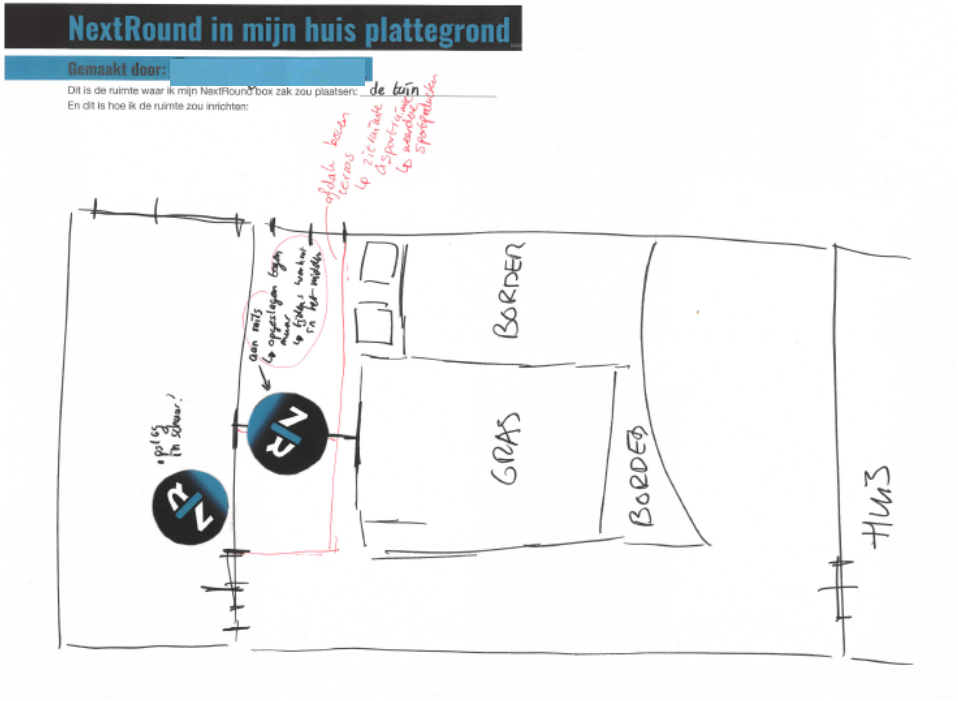


Figure 47: Map drawn in co-design session 1.

Session 2 - participant 3.

This participant was in his twenties and at the time didn't exercise much. He did karate for a long time when he was a kid, but when he moved to another city to study he was unable to continue the class. In this city he used to go to the gym regularly with a friend, but once this friend moved away, and at the same time the first COVID-lockdown hit, he no longer went to the gym.

He doesn’t feel very confident about exercising at a public place by himself. It makes him feel like he’s being watched. So, going together with a friend was great for him, as they could hype eachother up.

So on one hand, being with a buddy motivates him to work out. On the other hand, his favourite thing about karate was mastering the techniques. For him, having to hit somebody else and potentially hurt them was not fun. But, the feeling of perfecting a technique was great.

When I asked him to design his positioning solution if he were given a NextRound punch bag, he chose to put it in his student room. He lived in a studio with a small balcony, so there wasn’t much room to choose. Therefore, he opted to have the bag hang at the centre of the studio, in his living space (Figures 48-49). He wanted to be able to easily attach and detach the bag from its location, so he could use the space for working out and for other living area purposes. When hanging up the bag, he would need to move his little table to the side, but that was fine with him. If he were not using the punch bag, he wanted to be able to put it somewhere where it would not be in the way of other activities, so he wanted to be able to put it behind his couch.

For him, space in his home was very limited, so it would need to be used efficiently, especially when a new product as big as the NextRound punch bag comes into the home.

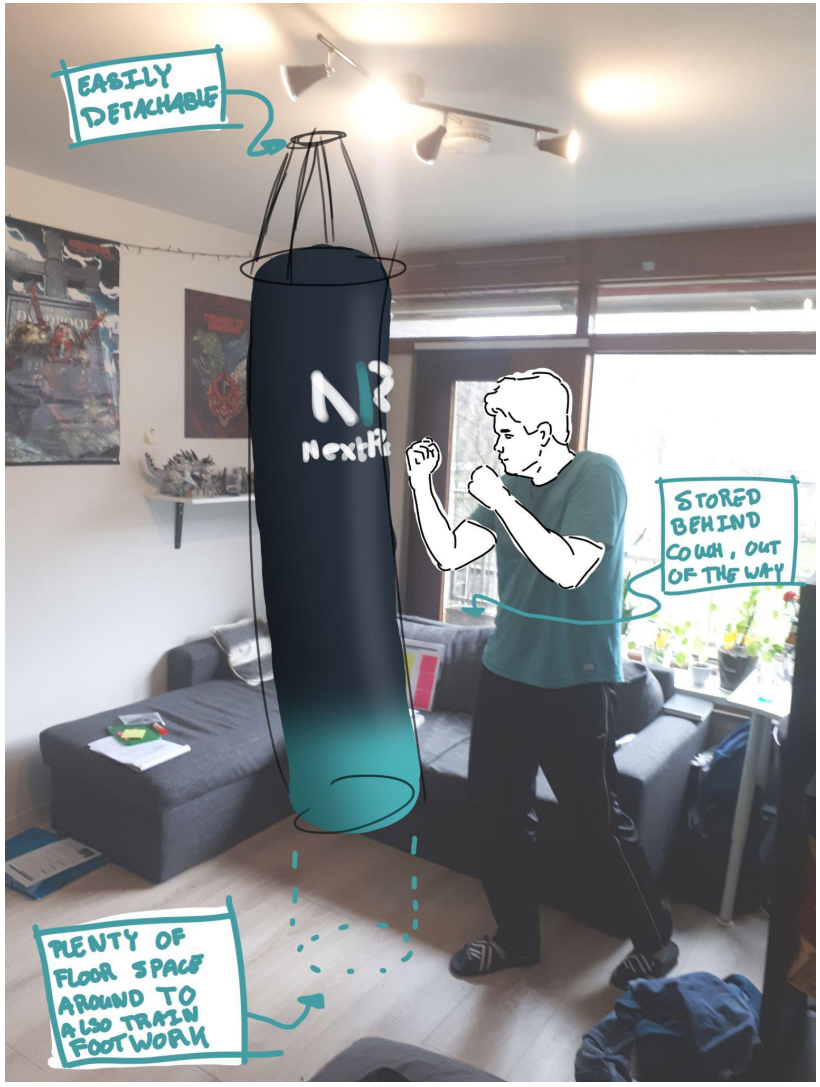


Figure 48: Sketch of participant 3 showing the solution he came up with during co-design session 2.

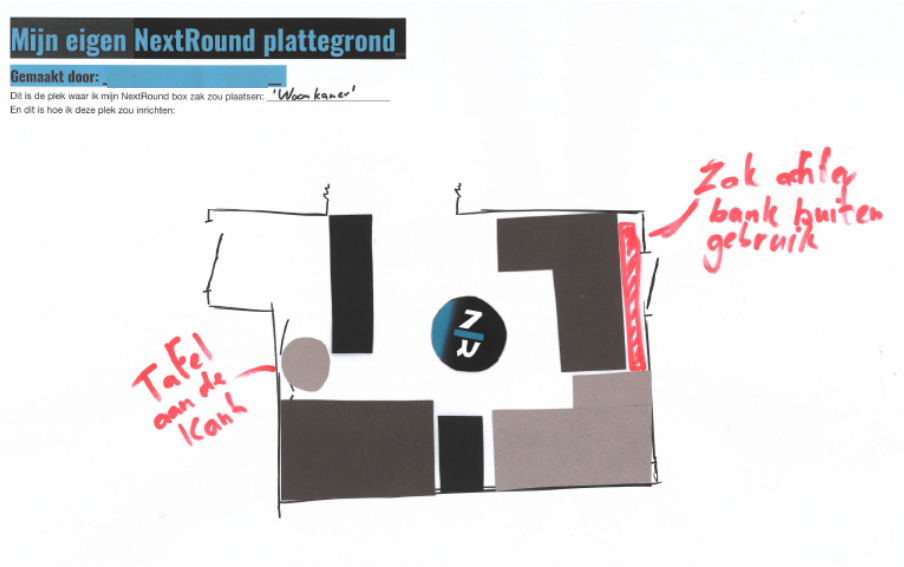


Figure 49: Map drawn in co-design session 2.

Session 3 - participant 4.

This participant was in his thirties and exercised a lot. He practices many different sports. Since his work schedule became a lot more flexible a few years ago, so did his workout schedule. For him, it's important that his exercise plan is suitable for altering times. Generally, he exercises every morning to start the day and every evening to let all the stress and worries of the day fall off of him.

When I asked him to design a positioning solution for if he were to get a NextRound punch bag, he told me he would have it at his uncle's home gym. Every Sunday he works out with his uncle, at his home gym. Here his uncle has a lot of equipment, and they alternate equipment to both be busy. They had been doing some boxing exercise at the time, and he thought their workouts would improve if they could use the NextRound system.

After some sketching, he realised that his uncle's home gym was already quite full. However, in the room below his home gym, his garage, there would be space for the punch bag (Figures 50-51). At the moment of the session, his uncle had a non-digital punch bag hanging at this location.

If they were to hang the NextRound punch bag here, they would need to attach and detach it every time they work out here. To make this easy, the punch bag would be attached to a pulley system, so it could be lowered from and hoisted to the ceiling easily.

In the beginning, he would probably put the tablet with the NextRound Live app on a chair, but eventually he would want to have a better and more permanent solution for the punch bag.

He wanted to have the punch bag in this location for three main reasons. First of all, in the garage the punch bag would be close to the rest of the home gym. Secondly, hoisting and lowering the bag would be easy. And thirdly, There is enough free space in the garage to work out with two people at the same time.

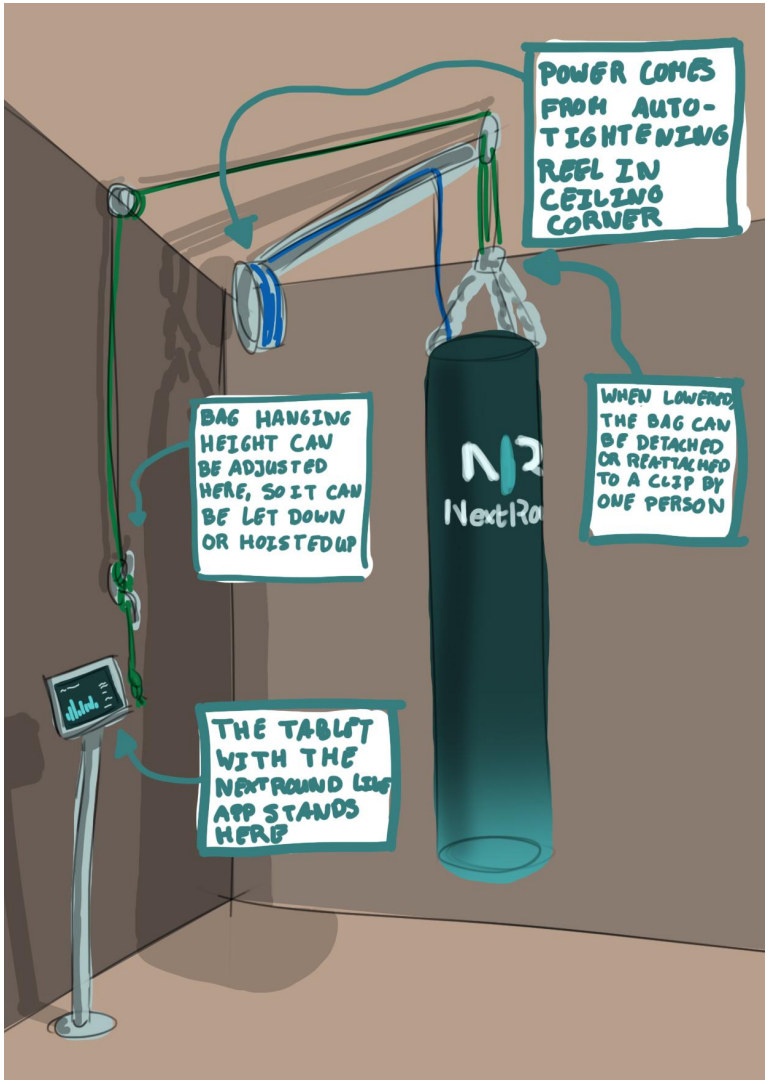


Figure 50: Sketch of participant 4's solution he came up with during co-design session 3.

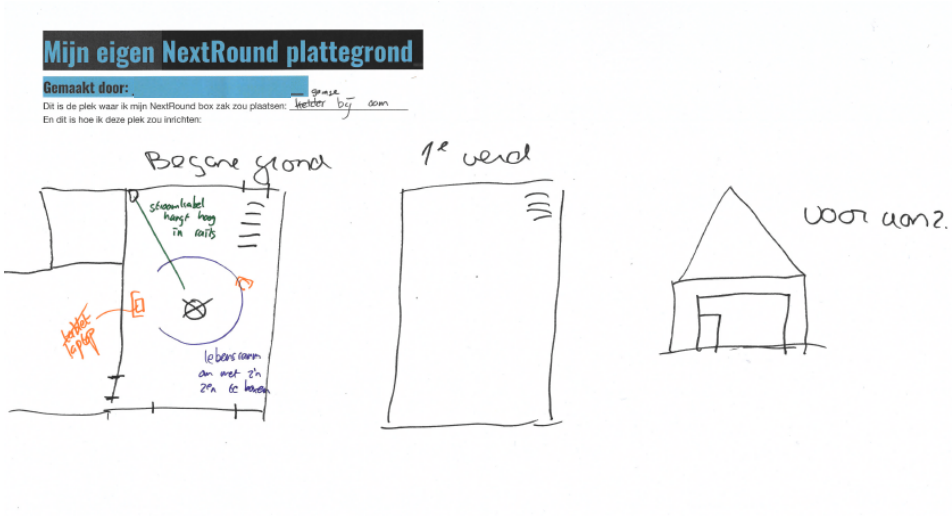


Figure 51: Map drawn in co-design session 3.

Session 4 - participant 5.

This participant was in her late fifties and very active. Her workout schedule changes every week, and she really enjoys the flexibility. She exercises every day. She is a member of a gym chain with many locations all over Europe, and her membership allows her access to all of them. She mainly does classes, and picks whatever class she feels like whenever she wants to work out.

What she enjoys about the classes is that she has a trainer in front of her, and other people with her. She also really likes it that her gym membership allows her to try out different disciplines. The barrier is very low. She goes to the gym by herself most of the time, but often goes on walks or cycling trips with other people.

A number of years ago, she had a hernia. This meant that she couldn't exercise for a while, which was a hard time for her. Exercise is fun to her, and this fun is the main reason she does it so often. What she did find during this period however, was that she did not miss running at all. Since her hernia she hasn't been running or jogging again, and she didn't mind. She explained how she thought running was absolutely boring.

During our conversation she explained to me that for a while, she had a punch bag at home. It was her son's, and it stayed behind after he moved out. She had been trying to work out with it numerous times, and she took a few boxing classes at her gym chain, and came to the conclusion that she just did not enjoy the sport. Therefore, instead of designing her perfect NextRound positioning solution, she designed how she would put a virtual spinner in her home. She explained that she goes to spinning classes every now and then, and had done a couple of virtual spinning classes at her gym. She liked these classes, so designing for a virtual spinner was a good substitute for the NextRound punch bag.

She would put her virtual spinner in her basement (Figures 52-53). Here is the old room of her son, which is currently a guest bedroom. She would want the screen of the virtual spinner on the wall, and the bike in front of it. When she's not using it, she would ride it to her storage room, which is close to the guest bedroom.

She made it clear that she wanted the spinner to be out of the way and out of sight when she wasn't using it. This was because, if she were to see it while she was doing something else, she would want to be exercising instead of doing whatever she was doing. She also showed me her exercise equipment, which was stored in a closet in her bedroom. Here she showed me that all her exercise goods were stored out of sight.

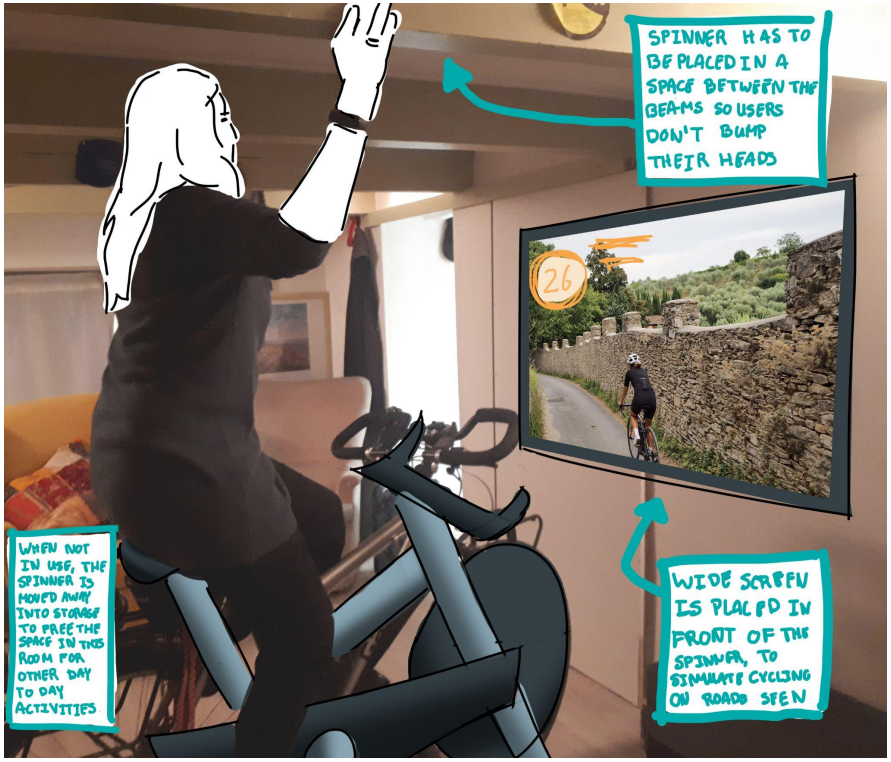


Figure 52: Sketch of participant 5 showing the solution she came up with during co-design session 4.

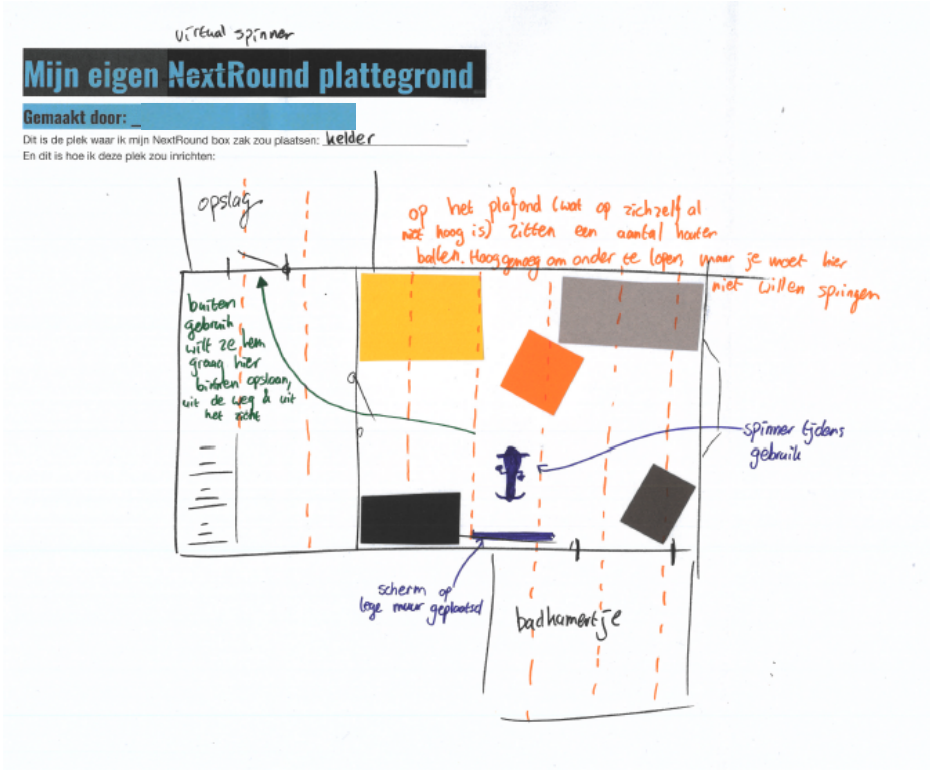


Figure 53: Map drawn in co-design session 4.

Co-design session conclusions

In these sessions, I found a number of trends. These relate to motivation, exercise, and the designed solutions.

First of all, the reasons why people exercise are different and personal. Through the interviews, I found that the motivation behind exercising differed from person to person, but they did relate to the needs from the Self-Determination Theory (Deci and Ryan, 2012). For instance, participant 1 worked out to fulfil her need for Autonomy. She wants to feel strong in her body, and prevent injury. Participant 2 was fueled by the need for Relatedness, as well as Autonomy. On one hand he loved to exercise with others, to have people to relate to. On the other hand he too mentioned that working out prevented him from getting injured easily. Participant 3 then got motivated to work out to fulfil his need for Competence. Mastering a skill, such as a boxing technique, makes exercise fun and motivating for him. Participant 4 also got motivated to fulfil his need for Competence much like participant 3, and also mentioned wanting to prevent injury to keep his need for Autonomy satisfied. Lastly, participant 5 got motivated to work out so much by her trainers. Having fun and getting good at a discipline like the trainers fulfilled her need for Relatedness.

So, for different people, different needs are more prevalent than others. The way they seek to satisfy these needs are different as well. There are some common themes though. Working out to keep the body strong and a person functioning fully is a theme to keep people feeling autonomous. When a person recognises they are getting better at a certain skill, it makes them feel competent. And when they have a role model or trainer to look up to and follow makes them feel related.

Another trend I found was on a product level. Each participant designed their solution to be moveable. A punch bag, like the NextRound bag, is a big product. Most people don't design their homes to incorporate a space to put a punch bag and work out

with it. Therefore, most potential users who purchase a NextRound punch bag will have to make some adjustments to their home to make it suitable for having this bag. Before purchase, potential users will likely want to prevent the punch bag from inconveniencing other activities already done in the house. To phrase it dramatically; they do not want the punch bag to be an intruder to the current activities and rituals this person does in the house. When making their design solution moveable, or easy to put away, they make sure their activities will not be disturbed by a punch bag hanging or standing in the way.

From these trends, and other user-level and product-level needs and wishes I found, I needed to create guidelines and tools to aid the further design process. In the remainder of this chapter, I will explain how I set up an iterated design goal for the project. I also made a List of Requirements and Wishes, to give guidance on what the final design needed to be able to do, partially based on the user needs from the co-design sessions.

Discussion of results from the sessions

The co-design sessions provided me with a deeper understanding of potential users' perspective for the NextRound boxing system. It should be noted however, that in regards to the sessions themselves, there are still a few points up to discussion:

- I learned the hard way that setting up co-design sessions, and recruiting participants, is a very time-consuming process. This was especially true during times of the lockdown of the winter of 2021-2022. Because of this, I was only able to have sessions with five participants, before I went on with the further stages of the design process. The results and takeaways would have been more thorough if I had done sessions with more people.
- The people I did sessions with were a rather diverse group. If I were to relate the participants back to the personas made earlier in the process, I would categorise them as follows: participant 1 was like Ilona, participant 2 was like Cor, participant 3 was like Edgar, participant 4 was like Jasmijn, and participant 5 was like a mix between Ilona and Jasmijn. I did not have a session with a person who is like the Daniel persona, so the "Daniels" of the world are not represented by my research findings.
- In session 3 with participant 4, we could not go to the location where he was designing his solution, because the session did not take place at his uncle's home. Therefore, the map and drawing of the punch bag in place could not be referenced to the actual space.
- Participant 5 from session 4 had no interest in boxing. She had tried it several times and gave it many chances, and concluded the sport was not for her. This is very valid, not every sport suits every person. What this meant for the session was that we needed to do the design exercise with a different product than the NextRound punch bag, because she would never want a punch bag in her home. This made the results different from the other sessions, but still I got findings from the design exercise which were

valuable for the design goal and List of Requirements and wishes.

- Lastly, the designs made by the participants were heavily influenced by what they know about existing punch bag positioning products. This is logical, because they will base their designs on what they know to exist. Still, even though their designs did not include wildly new or innovative products, they did reflect their values and wishes. And in the end, their product values were what I wanted to learn from these sessions.

Iterated design goal

The co-designed sessions gave me a better idea of what the design problem is in reality. The main design goal of the new product I'm to design is still the following:

"Design a product which can be used to position the NextRound boxing system at the homes of users."

In order to fulfil the design goal properly, the new design needs to also satisfy the following design subgoals to solve the product-level problem definition (van Boeijen et al, 2016, pg 101) of the problems which users would have when purchasing the NextRound boxing system:

1. The product needs to be able to hold the NextRound punch bag.
2. The tablet with the NextRound Live app needs a place in the product system of the punch bag together with my designed product.
3. The product needs to allow the NextRound punch bag space to swing or wobble when it is being punched or kicked, so users won't injure themselves upon impacting a static object.
4. The product system should either allow for easy transport by one user, or be static in place under the condition the product is still desirable to users in its static form.
5. The product system needs to facilitate its users to take all the space they need to do their punches and kicks properly, while taking up less space when out of use. During use, the needed space would be about 2 metres width, and 1,5 metres depth.
6. The product needs to add a new aspect to the interaction of working out with the NextRound boxing system, providing users with a workout package which consists of more than just punching a bag.
7. The product system needs to incorporate encouragement during the workout, to encourage people to finish the workout they started and to keep being motivated to continue doing workouts in the future.
8. The product system needs to offer its users guidance, so they'll know what to do and how to do so properly, in or.
9. The product needs to facilitate use by two people.

This design goal and these functions should come back in the newly designed product I'm going to create.

List of requirements & wishes

The abovementioned design goal and functions reflect the product I'm designing in isolation. However, the product will not be in isolation when it's actually in use by people at their homes. In order to embody all needs, desires, and wishes the users, I myself, and the company have for the new design, I created a List of Requirements (van Boeijen et al, 2016, pg 102-103). I divided this list in two parts: Requirements & Wishes. Requirements are demands which the final design has to satisfy, while Wishes are guidelines towards how the design could suit the users well.

Every requirement or wish was based on desk research, on the company's wishes, on wishes of users from the co-design sessions, and on my personal wishes. After every requirement or wish the source of said requirement or wish is noted.

Requirements

- **Safety:** Using the system must be safe. The system should prevent injury by encouraging its users to move correctly during workouts. Users should do their techniques properly, and take the space to do so. (co-design sessions 1 & 3)
- **Integration:** The system is integrated with the punch bag and the tablet. (company demand)
- **Functionalities:** The system should offer more functionalities in training than a non-intelligent boxing system, like a non-digital punch bag. (personal demand to make the product stand out from non-intelligent boxing products, to offer an interaction products like that don't offer)
- **Ease of installation:** The installation of the product system should be doable with only basic tools like screwdrivers or a hammer. (personal demand, I want every person to be able to install the system without needing to own specific tools)
- **Preparation:** A user must be able to set up the system by themselves. If the system requires preparation before it can be used, this should be doable by one person. If the system requires its users to put it away afterwards, this should be doable by one person, keeping in mind that users might feel tired & sore after working out with it. (co-design sessions 2 & 3)
- **Exercises:** The system should enable users to combine their boxing workout with other exercises, to keep the workouts engaging. (co-design session 1 & personal demand to improve workout sessions with the product system)
- **Floor space:** When not in use, the system should take up no more than one square metre of floor space. (co-design

session 1 & 2 & personal demand to improve on existing solutions, which are listed in the Appendix 9)

- **Height:** If the designed product stands by itself, the system should be no taller than 2,10 metres. (personal demand to take up less height than many existing solutions, which are listed in the Appendix 9: Existing standing solutions for punch bags, and to fit in just about every Dutch home, which tend to be between 2,40 and 2,70 metres) (Plameco Plafonds, n.d.)

- **Ceiling solution:** If the designed product is attached to the ceiling, the system should be adjustable in height to fit rooms with different ceiling heights. (company demand to have the system fit in all sorts of differently shaped homes)

The product I'm designing needs to satisfy each of these Requirements which are applicable to it. After the ideation phase, I used the Requirements to evaluate the quality of the ideas.

Wishes

- **Set-up time:** The system requires no longer than a minute of set-up time, so people can get to boxing quickly and easily. (co-design session 1)

- **Functionalities:** The system should offer more functionalities in training than the NextRound punch bag currently offers when it's used with another pre-existing positioning solution. (personal demand to make the product stand out from non-intelligent positioning solutions, to offer an interaction products like that don't offer)

- **Form & colour language:** There is a uniform form & colour language between the positioning product, the punch bag, and the tablet interface. (personal wish, the new product should look like it fits the interface and the punch bag)

- **Techniques:** The system should enable users to train and improve their technique. (co-design session 2)

- **Footwork & Defence:** The system can be used to practice and improve the users' footwork and defensive techniques. (co-design session 2)

- **Different punches:** The system allows users to use jabs, crosses, hooks, and uppercuts. (co-design sessions 1 & 3)

- **Impermanent installation:** To install the system, users don't need to make permanent alterations to the space the system will be installed in. (personal wish, to make installation easier and lower the barrier of getting this system)

- **Silent:** The system is not noisy during use. (company wish, to make sure the audio cues from the tablet can still be heard clearly)

- **Exposure:** When working out with the system, users shouldn't feel like they're exposed to strangers. (co-design session 1 & 2 & 4)

- **Out of sight:** When not being used, the punch bag isn't visible. (co-design session 4)
- **Two users:** Two people can use the system at a time. (co-design session 3)
- **Cleaning:** The system is easy to clean. (co-design session 4)
- **Inside & outside use:** The system can be used inside & outside. (co-design session 1)

The more Wishes the final design can satisfy in a meaningful way, the better the final design should be. During and after the conceptualisation phase, I used these Wishes to improve and evaluate the quality of the concepts.

Chapter 4: Getting to know users - summary

In order to get to know the values of the potential users of the NextRound boxing system, I made five personas. These personas were used to recruit people for a co-design session.

In these sessions I spoke with 5 different people over 4 different sessions. In these sessions I interviewed them, and asked them to design their personal solution for how to position a NextRound punch bag if I were to give one to them.

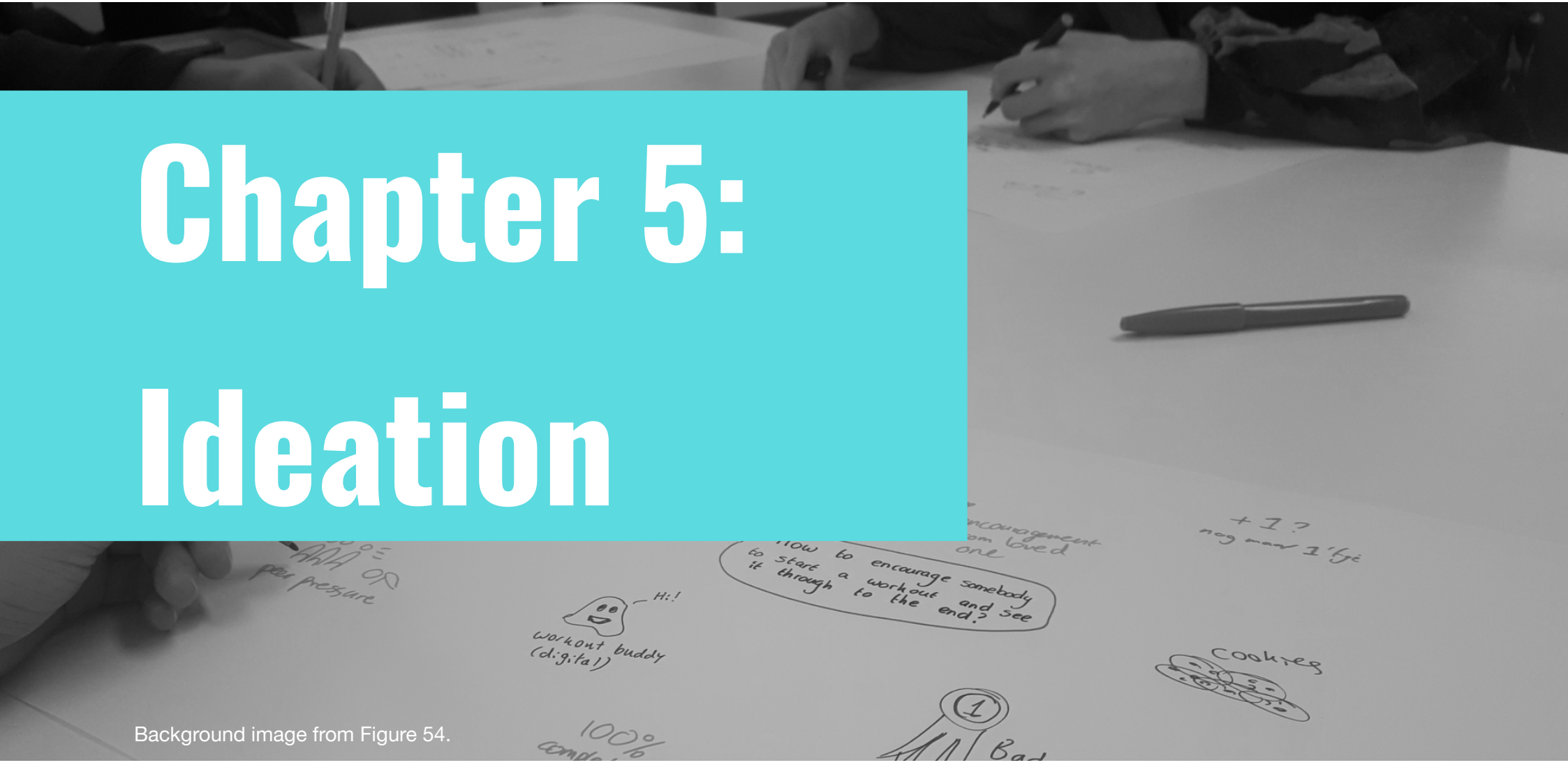
From these sessions, I learned about the values and wishes potential users have for the product. Above all, users don't want the system to take up space needed for other activities they do in and around their home. This leads me to believe that a good product solution for my brief is a solution where, when users are not working out, does not intrude on users' lives.

Aside from that, I believe the system needs to integrate different kinds of workout activities to offer a user-product interaction which is richer than a person would get with any other boxing product.

From these sessions, I made a newly defined Iterated Design Goal, which helped me ideate on product solutions in the following phases. Aside from making a design goal for myself, I defined a List of Requirements and Wishes which reflected the demands and wishes potential users, and the company, would have for my final design.

All in all, performing the co-design sessions and researching the potential users helped chart possible valuable interactions I could design for, and shaped the idea development phase, about which you can read in the following chapter.

Chapter 5: Ideation



Background image from Figure 54.

Chapter 5: Ideation - introduction

After all this research, it was about time to get to doing some actual designing. Where the research steps from before provided the knowledge about the users and context surrounding the product and boxing itself, the design steps are meant to provide a product fitting to the context and valuable to users.

This chapter is an account of the design exploration steps I took to come up with six ideas for products which could satisfy the Design Goal and subgoals set in the previous chapter.

Brainstorming

Since I had been researching the product context for quite a while when I came to the ideation phase, I knew I would be suffering from tunnel vision when I came to the ideation phase. So, in order to help me keep my options more open, I set up a brainstorming session with two DfI student peers.

The goal of these sessions was to tackle the design challenges posed by the Design Goal and its subgoals, and get inspiration for aspects of future designs from the sessions.

Questions for the brainstorm

First, I had to define the questions I wanted to have answered for myself in the brainstorm session. I based these questions on the Iterated Design Goal of the previous chapter. The questions should each tackle a problem challenge which arose from the research phase. It should be noted that these questions are a bit broad in order to not limit the creative process of the brainstorm participants. Once I return to making a design myself, I'll focus on the Design Goal and its full specifics, and not necessarily these simpler questions.

The questions I used to probe the brainstorm participants into brainstorming about product solutions were the following:

- **How to place a punch bag at home?** (based on main Design Goal, as well as subgoal 1)

This question kind of sums up my entire project, this is what it's all about. So it feels only fitting to try and see if we can come up with answers to this question in a high-paced brainstorm session.

- **How to get a tablet at a height somewhere about 1 to 2 metres off the floor?** (based on subgoal 2)

The NextRound Live app plays a very important role in the user-product interaction people will have with the NextRound boxing system. It's the starting point for every workout, and a point where users will reflect on their workouts. Since this app is displayed on a tablet, this tablet should have a place somewhere in the product system. How to place it in said system is a question which needs answering.

- **How to keep a product from falling over when it's being punched or kicked?** (based on subgoals 1 and 3)

A very practical problem and fear people have with punch bags, especially those mounted in stands, is them falling over. They are big and hefty products, which users kick and punch about, so when they somehow do fall they could potentially cause quite some damage. Somehow, I want my product to reassure users there is no danger of falling over. And to do so, I need to have some solutions to the problem.

- **How to make a big & heavy product (like a punch bag) easier to move by 1 person?** (based on subgoals 4 and 5)

Participants of the co-design session mentioned again and again that having a large product like a punch bag at home can be a bother when it's located in a space which they also use for other activities. A solution to said problem is making it transportable. Making a product system, which is bound to be big and heavy, transportable by one person is no easy task however, so I need to try and find ways to make it happen.

- **How to help people work out with proper technique?** (based on subgoal 5 and 8)

A problem of trying to get people to work out at home is that it's harder to guide them to work out properly. If they don't feel like they have the skills or guidance to do what they need to do, their need for competence cannot be fulfilled. My product should not invite improper use of technique, as that is like asking users to injure themselves. Somehow, the product system of the NextRound punch bag, the NextRound Live app, and my positioning solution, should help people train with proper technique.

- **How to work out at home?** (based on subgoal 6)

Somehow, I want my product to offer a new aspect to working out with the NextRound punch bag. For this, I want to explore options of how people can and do work out at home.

- **How to make exercising at home, by oneself, more fun?** (based on subgoals 6 and 7)

I believe people can only build long-term habits if there is enjoyment to be found in said habit, and fun is an important factor in gamification theory and why it works (Sarbadhikari & Sood, 2018). Therefore, the interactions users have working out with the NextRound boxing system should provide them with a bit of joy. How to do so is a question I want to try and answer through these brainstorm sessions.

- **How to encourage somebody to start a workout and see it through to the end?** (based on subgoal 7 and 8)

A big difference between working out alone and at home and working out somewhere else (at a club or gym for example) is the lack of external motivators in the form of peers, coaches, or trainers. These external motivators can provide encouragement to people who seek to get to work out. Since these external

motivators will likely not be around for a large part of the interactions users have with their NextRound system at home, the system itself should encourage people to get to working out, and help users feel intrinsically motivated, and to see the workouts through to the end.

- **How to work out indoors, together with a buddy?** (based on subgoal 9)

Punch bags are not really products two people can use at the same time. You can't really punch and kick a punch bag with two people at the same time, as there is a big chance of hitting the other person, and as the punch bag will move about from the impacts of the other. However, a lot of people do work out in pairs or larger groups (co design session 1 and 3 showed this). Somehow, I want to enable users to still work out with their buddies, even if they can't go ham at the bag at the same time.

Method

With these questions formulated, I could try to give shape to how the brainstorm would go.

Since all the questions I wanted to have answered for the session are questions of "How to…", they were suitable for a brainstorm session based on the How-tos method (van Boeijen et al, 2016, pg 127). I set this session up as follows:

I took the NextRound collage I used during the co-design session (Appendix 7), and made two sheets with existing punch bag positioning solutions (Appendix 10). I used these at the beginning of the session to explain what NextRound is all about, and to explain about what kind of solutions already exist. I did so to get the two peer participants up to speed with the knowledge I had gathered thus far, so they would know what context they were brainstorming for.

For each research question, I took a blank A3 sheet and wrote the question in the middle, creating nine sheets with one "How to…" question each. We would fill these sheets with possible answers to the questions during rounds of 1 minute each, so the session was very fast-paced. Before starting a round, I took a little bit of time to check if the participants understood the question.

After nine rounds of 1 minute, all three of us had filled in each sheet once, and we discussed the answers. (Figure 54)

Figure 54: The Brainstorm session in progress from my perspective.

Afterwards, I looked back at all the results (Appendix 10) and evaluated them. I sketched in more sketch solutions where I saw there was more potential. After that, I circled the solutions which I thought were most interesting and could be used in the next step; a Morphological Chart.

Ideation through the Morphological Chart

The solutions I deemed interesting from the Brainstorm sessions were only aspects of a potential design. To take these aspects and create a proper design from them, I needed to relate the findings from the Brainstorm back to the Design Goal, and turn the aspects into product ideas.

The Morphological Chart

To turn aspects into products, I set up a Morphological Chart (van Boeijen et al, 2016, pg 120-121) based on the Iterated Design Goal (page 60-61) to ideate.

In this chart, I took the nine subgoals from the Iterated Design Goal and put them on the left column. For each subgoal, I sketched a number of options for product design aspects which could satisfy the goal. The majority of these options were options I considered interesting from the brainstorming session (the options circled in Appendix 10), and some were added which I deemed interesting and thought of while filling in the other options. Each subgoal had between seven and nine options to its name.

With the options filled in, I went through all the options and made six sets of options. Each set of options can be recognised by its colour. So for example, every option with a blue background belongs in an option set with all the other blue options. The same goes for the yellow, pink, purple, brown and green option sets.

These option sets contain one option from every subgoal category, so each set of options should be able to satisfy every subgoal. I picked the option sets to have the options, the solutions to the subgoal, suit one another, because I knew I would be using them later to define six different product ideas.

The Morphological Chart which resulted can be seen in Figure 55.

FUNCTIONS	OPTIONS								
1 The product needs to be able to hold the NextRound punch bag.	drilled hook	over beam	punch bag stand	bolt to floor	store to ceiling	weighted base	clamp	chains	rails
2 The product needs to be able to hold the tablet on which the NextRound Live app can be used.	wall mount	bendable arm	hang from ropes	telescoping pole	stacking pole	lowering belts	hold in hand	console	
3 The product needs to allow the NextRound punch bag space to swing or wobble when it is being punched or kicked, so users won't injure themselves upon impacting a static object.	wobbling base	not touching floor	bending bag	free space around	springs	swing freely	ball joint	soft material	
4 The product system should either allow for easy transport by one user, or be static in place under the condition the product is still desirable to users in its static form.	wheels	handles	folding	easy disassembly	pulley	lever	rolling logs	rollable	
5 The product system needs to facilitate its users to take all the space they need to do their punches and kicks properly, while taking up less space when out of use. During use, the needed space would be about 2 metres width, and 1,5 metres depth.	closet	rolling up	folding	indications where to put feet	bundle up with rope	move around to force space	hoisting		
6 The product needs to add a new aspect to the interaction of working out with the NextRound boxing system, providing users with a workout package which consists of more than just punching a bag.	reflex training	body weight exercises	weightlifting	use furniture	inside & outside	yoga	footwork	defensive movements	
7 The product system needs to incorporate encouragement during the workout, to encourage people to finish the workout they started and to keep doing workouts in the future.	1 → 2 → 3 levelling up	GO ON! encouraging audio messages	set & reach goals	get achievements	digital workout buddy	avatar	minigames		
8 The product system needs to offer its users guidance, so they'll know what to do and how to do so properly.	instruct about importance of good technique	digital personal trainer	monday: ... (tuesday: x) wednesday: ... workout plan	free trial with coach	workout videos	see & reflect on progress	indications		
9 The product needs to facilitate use by two people.	alternating equipment	compete	one goes for real, one practices dry	reaching goals together	peer pressure (one can't stop until other is done)	offense vs defense	use two bags		

Figure 55: The Morphological Chart.

The ideas

The six sets of options from the Morphological Chart gave me six different design directions to explore. I set out to create one product idea per option set. These ideas should be able to satisfy the Design Goal in its entireity, since they are built from aspects which are meant to satisfy each subgoal separately.

For each idea, I started my thought experiment at subgoal 6; the added workout interaction. I built the ideas starting from how I would implement the added interaction, as the interaction users will have with the product system dictates largely the shape of my product.

After denoting how I was going to implement this interaction, I added the other aspects to the design, to make it a full product. For each idea I made a one page sheet (Figure 56-61) fully explaining what the idea is about, with each option from its corresponding option set integrated into it.

The colours in the borders of the ideas correspond to the colours of the option sets in the Morphological Chart.

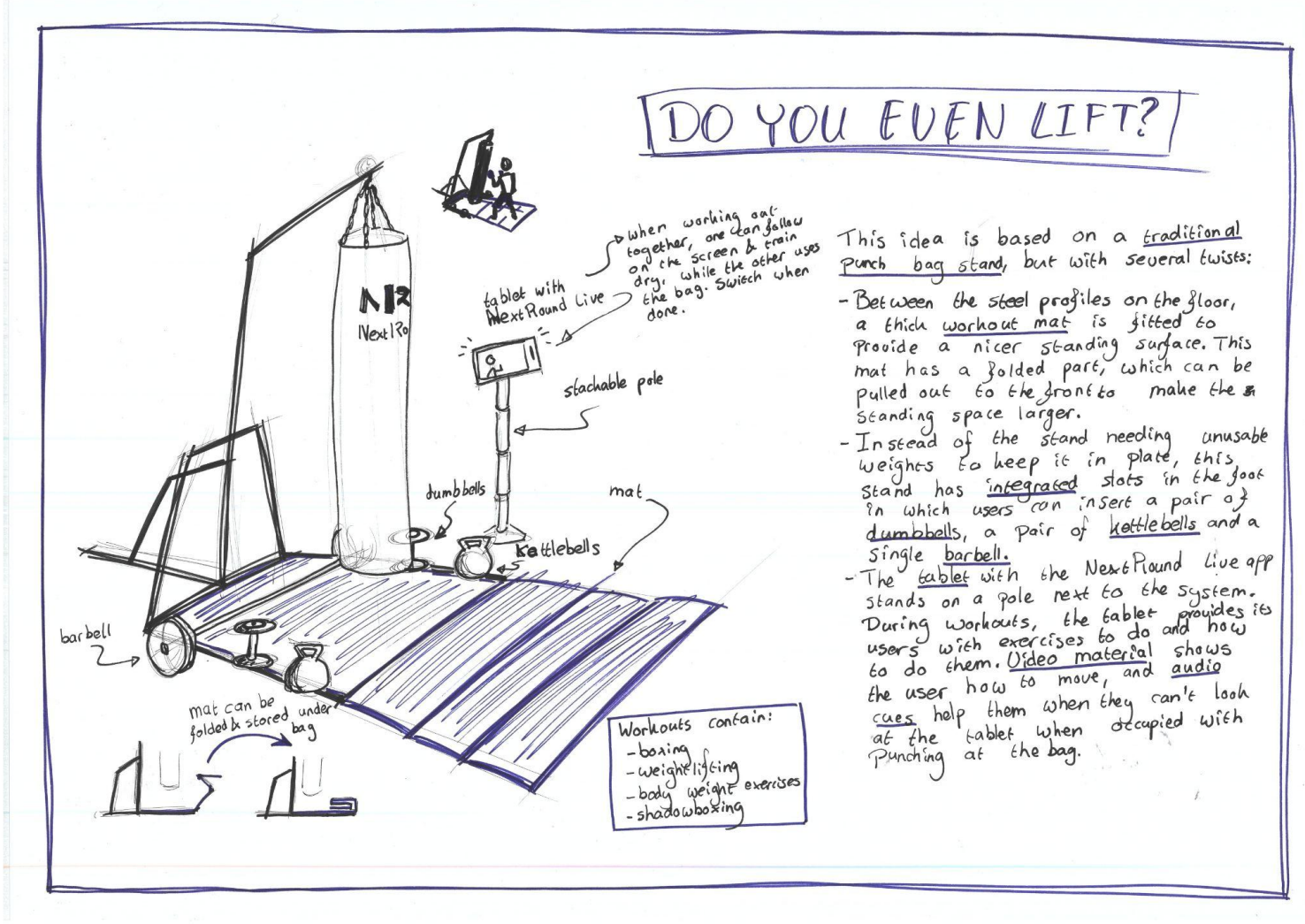


Figure 56: Idea 1, based on the purple option set - DO YOU EVEN LIFT?

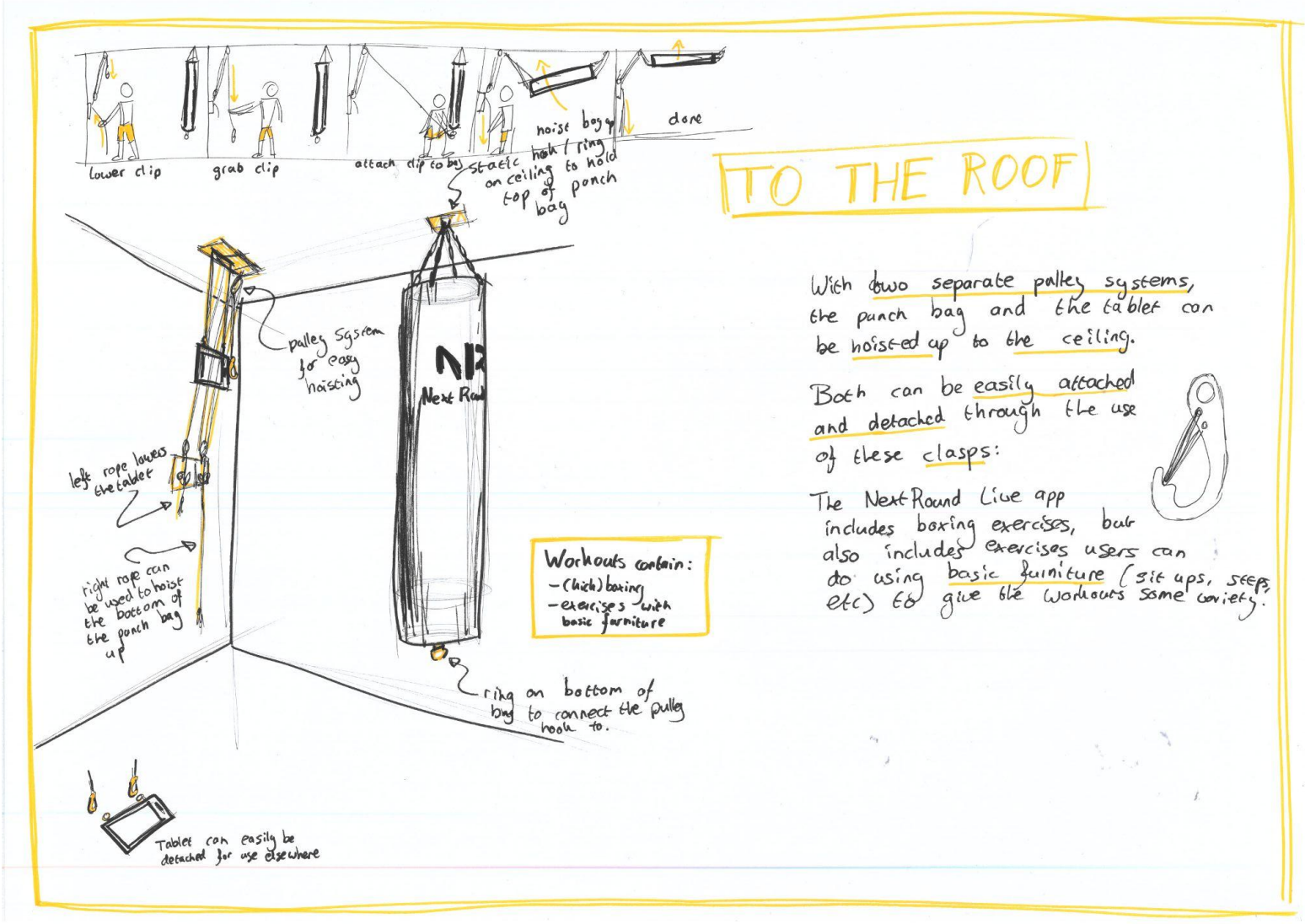


Figure 57: Idea 2, based on the yellow option set - TO THE ROOF

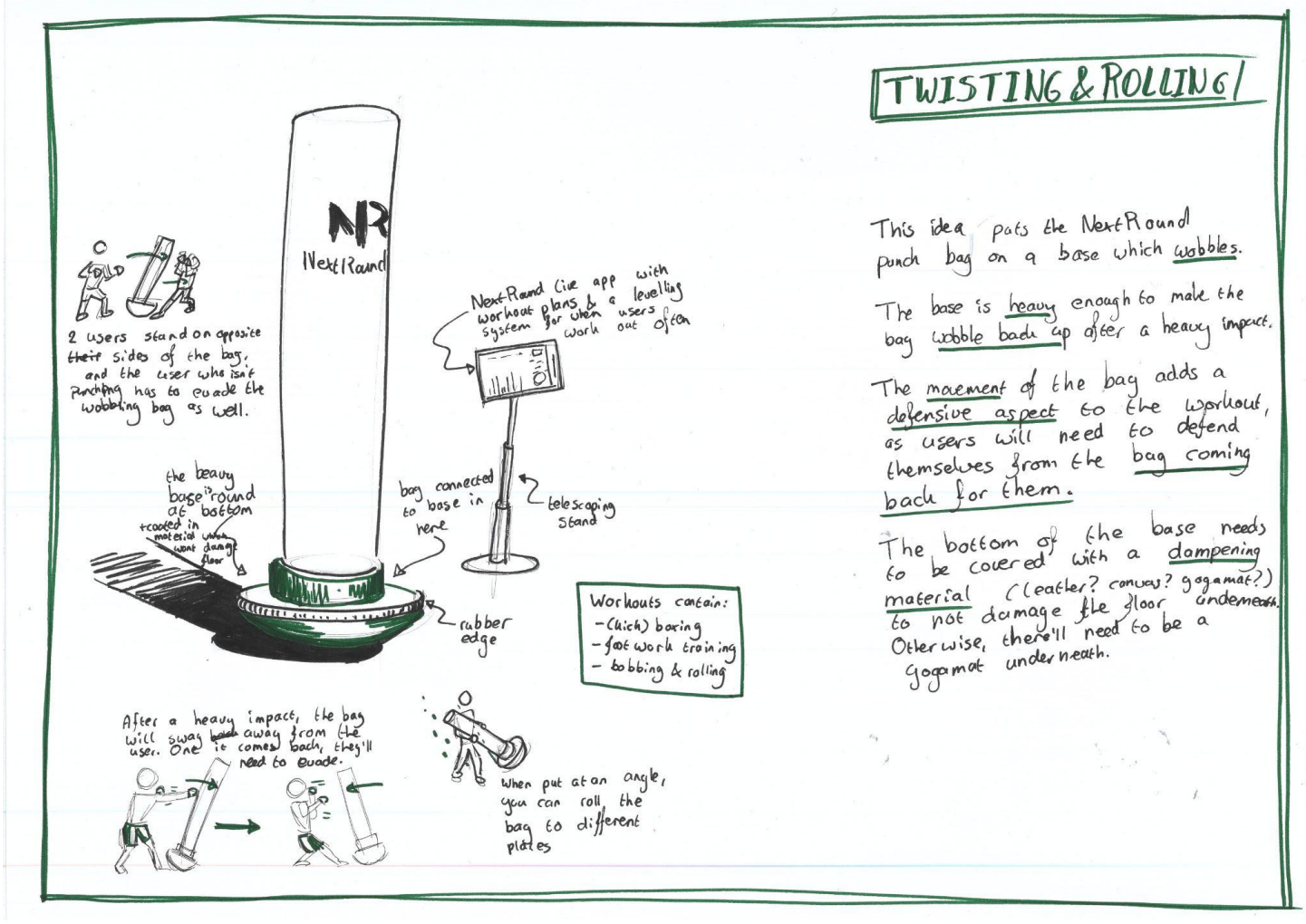


Figure 58: Idea 3, based on the green option set - TWISTING & ROLLING

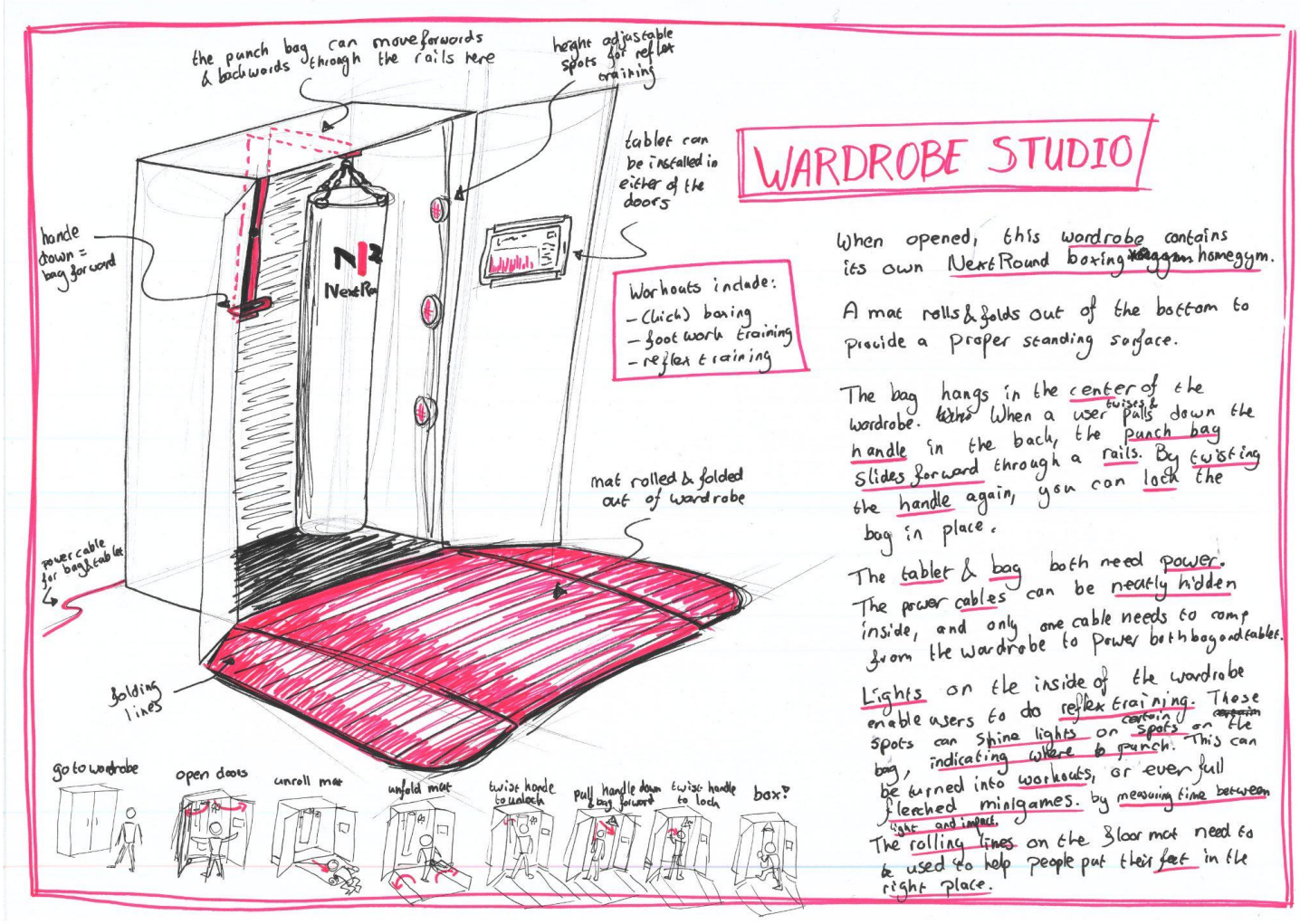


Figure 59: Idea 4, based on the pink option set - WARDROBE STUDIO

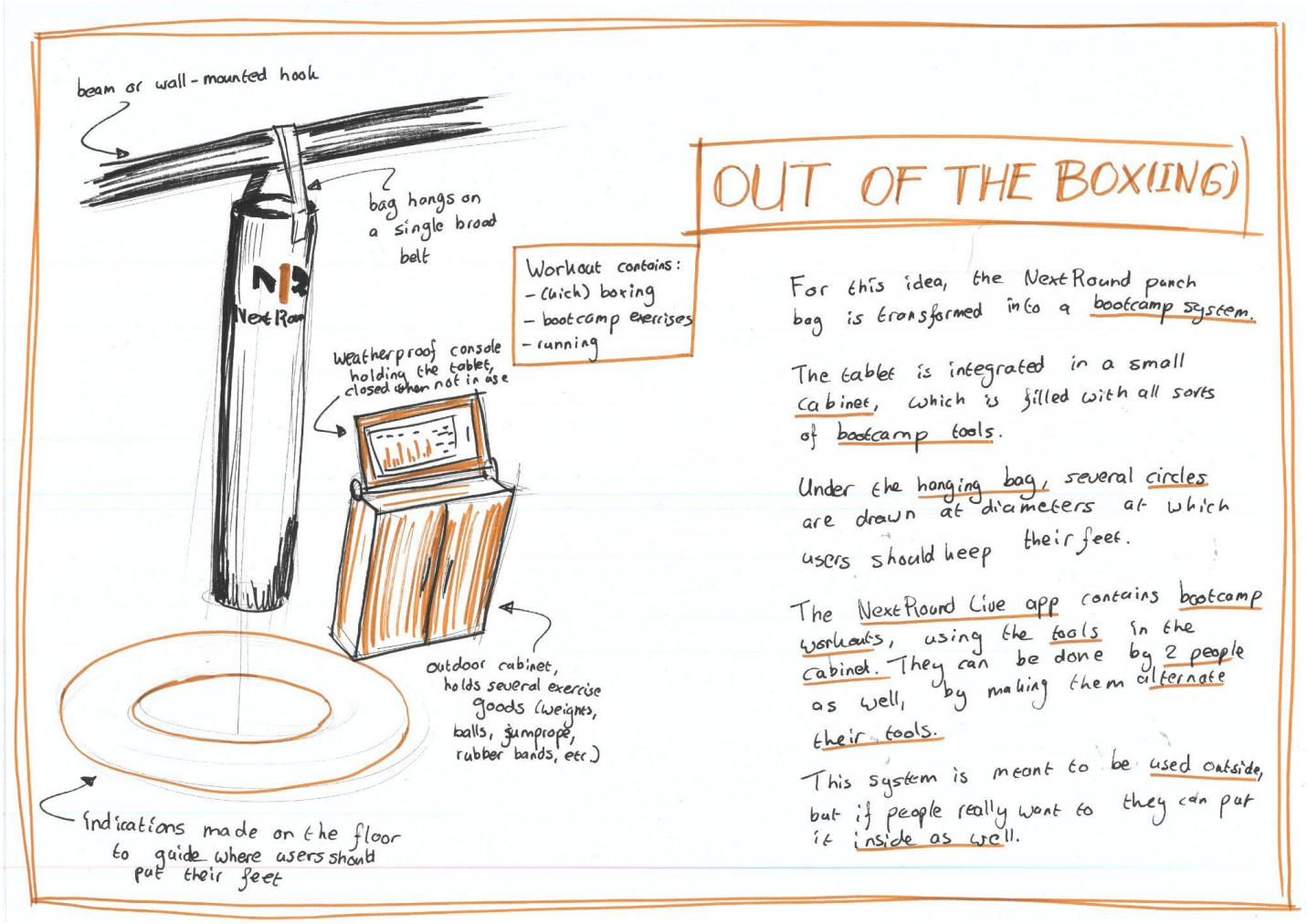


Figure 60: Idea 5, based on the brown option set - OUT OF THE BOX(ING)

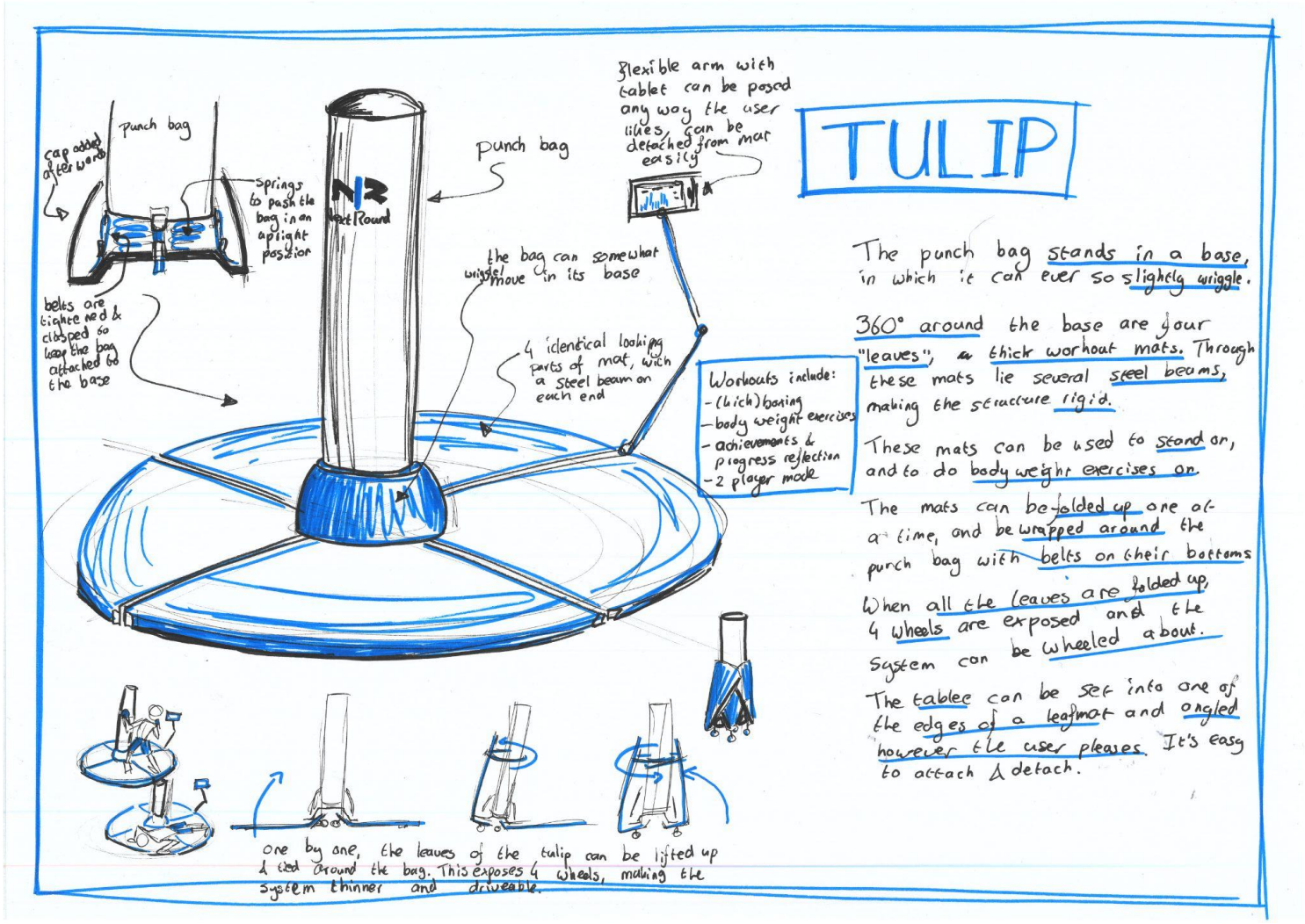


Figure 61: Idea 6, based on the blue option set - TULIP

Idea picking

The six ideas described before would all have their strong points and weaker points, if they were developed into a full product. For the next steps, I wanted to develop a number of these ideas further, but not all of them.

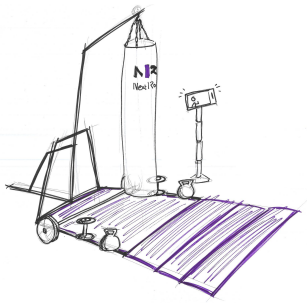
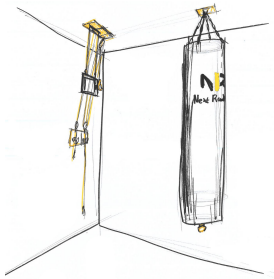
To pick the ideas which were most suitable for the potential users and therefore most suitable for further development, I evaluated them together with the client and methodically picked the best of the batch for further development. I tried to find methods which would help me find the ideas which were most desirable to the potential users, and decided to make use of two methods: the vALUe method to evaluate the strengths and weaknesses of each idea, and the Weighted Objectives method to try and evaluate the potential of each idea numerically.

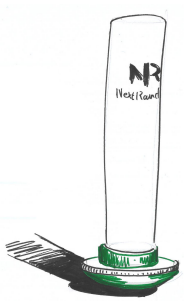
vALUe method

I used the vALUe evaluation method (van Boeijen et al, 2016, pg 149) to evaluate the ideas I made in the previous step. vALUe stands for Advantage, Limitation, and Unique elements. This means that for each idea, even though they're still rough and somewhat vague ideas, you define a number of Advantages the idea has, then look into its Limitations, and lastly define what the Unique aspects of the idea are.

This method is advantageous, because the ideas, even though they satisfy the same goals, do so in very different ways. The vALUe method helped me look at each idea independently, and see the strong, weak, and unique points of each of them without comparing them to the others too much.

After I filled the vALUes in for each idea, I discussed the ideas and the vALUes I found with the client, and we continued filling the vALUes in together. The results of the vALUe evaluations can be found in the table of Figure 62.

	Do you even lift? 	**To the roof** 
Advantages	• Integrated workout system using weights and a mat. • Its shape is close to that of traditional punch bag stands, which have already been widely researched in the past, so the product shouldn't be hard to engineer. • System stands free, and doesn't require users to mess around with sand or unusable weights.	• System is easy to set up and clear out.
Limitations	• It takes up quite a lot of floorspace, even more than a regular stand. • Its looks are quite traditional and not very innovative. • If the weights are on the floor, picking them up is not very ergonomic. • NextRound currently sends all their products over the post, and shipping weights is very expensive.	• Instead of needing to drill one hook into your ceiling (for a traditional punch bag hook), users will need to drill at least three products into their walls to use this system. • There will be lines & ropes everywhere, which can tangle. • This system is stuck in one place in the home, and cannot easily be moved somewhere else. • Does not have the looks of a high-end product.
Unique elements	• Weightlifting and boxing integrated into one workout product. • Integrated mat provides the possibility to include body weight exercises in the NextRound workouts.	• Storing your punch bag to the ceiling keeps a lot of space free in the home.

	Twisting & Rolling 	**Wardrobe studio** 
Advantages	• System can be easily rolled about. • Product is very compact and takes up little space during workouts and when it's stored. • Has an interesting aesthetic to it. • No need to make permanent alterations to the home it's placed in.	• Very easy to set up. • When putting the bag away, it is not only out of the way but also out of sight. The workout is truly closed off. • The inside of the wardrobe can be decorated in various ways to give it a studio-feel. • Reflex training and footwork training can be offered. • Other workout equipment could be storable inside. • Has the opportunity to explore how to shape the doors.
Limitations	• Floor underneath will need to be protected, or it will get scratched and damaged over time. • It's questionable whether a wobbling punch bag is what people are looking for. • The base needs to be really heavy to keep the bag from falling over or being smashed all around the room.	• Needs to be against a wall. • Needs to be anchored to the wall. • Very big and heavy product, will be hard and expensive to ship to users' homes. • This product is big and has many relatively intricate parts, this product will without doubt be very expensive. • Has many moving parts susceptible to damage. • Walls on the side prevent users from kicking the bag.
Unique elements	• The wobbling punch bag will make users have to also train defences while working out.	• Complete workout system in one wardrobe. • Integrated mat provides the opportunity to include body weight exercises in the NextRound workouts.

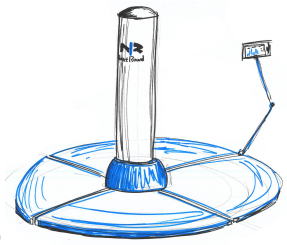
	Out of the box(ing) 	**Tulip** 
Advantages	• The system takes up very little space. • The system can be used outside.	• Easy to transport. • The mats suggest users have space to do their exercises properly. • No need to make permanent alterations to the home. • The folding of the mats can be done smoothly, so setup is easy. • Has potential to explore whether mats in all directions are needed, or if users can figure out themselves how many 90 degree mats they need.
Limitations	• The system requires users to install a suitable beam or hook. • Less suitable for indoor use. • Cannot easily be moved once installed. • The NextRound punch bag is currently not made to be weatherproof, which this system does require.	• Takes up a lot of floorspace during use. • The circular shape makes it hard to put somewhere, as it won't line up with its environment.
Unique elements	• This system integrates boxing with bootcamp aspects, and has potential to incorporate crossfit aspects as well.	• System provides an integrated workout mat for body weight exercises. • This system has potential to become a beautiful product once folded up, so it becomes a kind of art piece when not being used. • The tulip shape offers branding opportunities.

Figure 62: vALUe evaluation for every idea.

Weighted Objectives using the List of Requirements

After evaluating the ideas, I needed to pick a few of them to develop further into concepts. Ideally, I would end up with about 3 or 4 concepts. To try and help myself pick the ideas which are most suitable to the potential user group, I used the Weighted Objectives method (van Boeijen et al, 2016, pg 150-151).

By using this method, I could define how well each idea satisfies the Requirements from the List of Requirements (page 61-62), while also attributing which of the Requirements are more important than others. Therefore, I gave each Requirement a weight. Requirements with higher weights are more important than those with lower weights. The total of the weights for the Requirements is 100.

I based these weights on the importance I personally attribute to each requirement. For instance, I believe that the Safety Requirement is the most important, because using the product should be safe. Then, I considered the Integration and Functionalities Requirements to be the following Requirements to be important, because they are integral to the functioning of the product, and its value over existing products. These were then followed by the Ease of Installation, Preparation, and Exercises Requirements. I considered these Requirements of medium importance, compared to the others, because they discuss ease of use of the product. Then, the Floor Space, Height, and Ceiling Solution were the least important compared to the others. This is because at the level the ideas are at at this moment, I cannot yet attribute hard numbers to each idea. These were still relatively hard to judge, and therefore I deemed them less important.

After giving a weight to each of the Requirements, I scored each idea on each Requirement on a scale of one to ten. Then I multiplied each idea's Requirement score with the Requirement weight, coming to the total idea score. By adding all of those together I had a total score for each idea. The ideas with the highest scores being more suitable than those with low scores.

It should be noted that all ideas qualify for either the Height Requirement, or the Ceiling Solution Requirement, but never both. Standing solutions will have a score for the Height Requirement, and hanging solutions will have a score for the Ceiling Solution Requirement. This is because, as is in line with the Requirements with the same names, each product either stands on the floor or hangs from the ceiling. So, a product which stands cannot score on the Ceiling Solution requirement because it does not hang from a ceiling. The opposite goes for a hanging solution, which does not qualify for the Height Requirement because it doesn't stand.

Requirement	Weight	Do you even lift?		To the Roof		Twisting & Rolling		Wardrobe studio		Out of the box(ing)		Tulip	
		Score	Total	Score	Total	Score	Total	Score	Total	Score	Total	Score	Total
Safety	20	8	160	5	100	6	120	9	180	7	140	9	180
Integration	16	6	96	8	128	9	144	9	144	8	128	9	144
Functionalities	16	5	80	2	32	10	160	9	144	6	96	7	112
Ease of Installation	10	4	40	1	10	6	60	2	20	6	60	5	50
Preparation	10	7	70	8	80	9	90	9	90	9	90	9	90
Exercises	10	8	80	3	30	2	20	9	90	9	90	10	100
Floor Space	8	2	16	10	80	10	80	6	48	9	72	10	80
Height	5	4	20	x	x	10	50	5	25	x	x	10	50
Ceiling Solution	5	x	x	10	50	x	x	x	x	2	10	x	x
Total	100		562		510		724		741		686		806

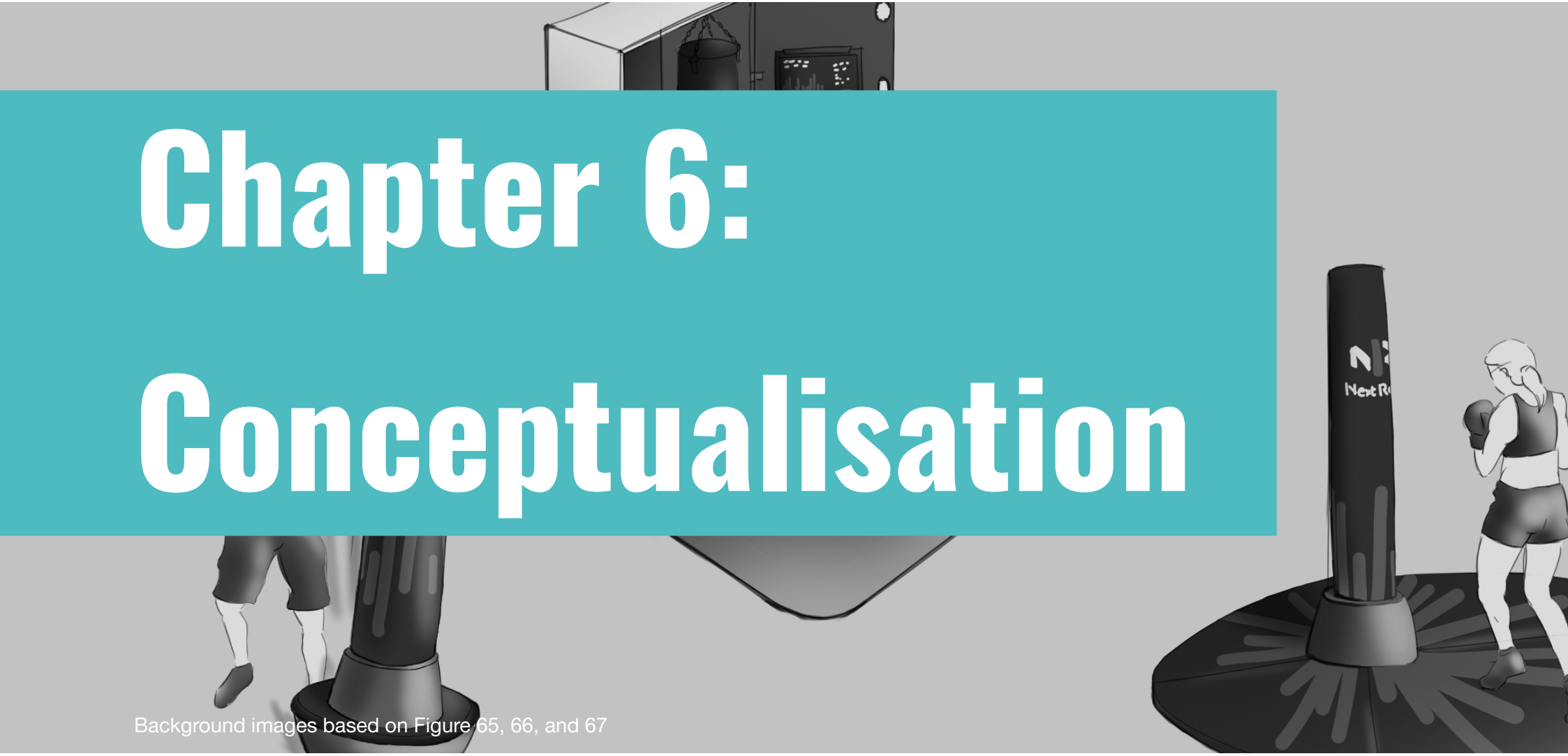
Figure 63: Weighted Objectives table

Looking at the Weighted Objectives table, the Twisting & Rolling, Wardrobe Studio, and Tulip ideas score really well. Since I personally also believe these three have potential to grow, I will continue with these three ideas.

Chapter 5: Ideation - summary

From the ideas created with the Morphological Chart, I will continue developing the three ideas which scored well in the Weighted Objectives table. These ideas are the Twisting & Rolling idea, the Wardrobe Studio idea and the Tulip idea. These ideas will require work before they can be called concepts. In the next steps, I will work on improving these ideas, by trying to work out the Limitations I found for the ideas in the vALUe evaluation, and will improve them so they fit the List of Requirements & Wishes better.

Chapter 6: Conceptualisation



Background images based on Figure 65, 66, and 67

Chapter 6: Conceptualisation - introduction

Last chapter described how I created six ideas of how I could create a positioning solution for the NextRound punch bag, and how I chose three of these ideas to develop further. In this chapter I will explain how I improved these three ideas and developed them into concepts, and then at the end decide how I'll pick one concept to create a final concept from.

Development chosen ideas into concepts

The Weighted Objective table of the last chapter helped me pick the three of my ideas which were most suitable for further development; Twisting & Rolling, the Wardrobe Studio and the Tulip. To iterate these ideas into concepts, there were a few things I set out to do.

Firstly, these ideas had flaws. I already defined these flaws when using the vALUe evaluation (van Boeijen et al, 2016, pg 149) during the Ideation phase. In some way or another, I wanted to tackle the limitations from the vALUe evaluation during this conceptualisation phase.

Secondly, I wanted to give at least an indication of the dimensions of these concepts. Having an idea of their size and weight is going to help me make them feel more real to myself, but this would also help communicate the ideas to users.

With the dimensions covered, I also wanted to define some materials for these concepts, as well as the mechanisms inside them. I needed to define how the concepts would work.
Lastly, I wanted to get a clear idea of the human-product interaction when installing the product for the first time, when setting the product up for use, when working out, and when putting it away after a workout. To do so, I made sketches and a storyboard where it seemed fit. With these steps, I worked the three ideas into the concepts of the following paragraphs.

NextRound Defence

I first tackled the Twisting & Rolling idea. First things first, the name I gave the idea didn't sit well with me, as it has no "roll of the tongue" value whatsoever. So, I renamed the concept the NextRound Defence (Figure 65), as the main idea of it is that users can train defensive manoeuvres while working out with it.

So, first I looked back at the limitations found during the vALUe evaluation, and defined how I planned to tackle these.

- Floor underneath will need to be protected, or it will get scratched and damaged over time.

In order to protect the floors of users, I decided to cover the base with a vinyl foam. This foam is known mainly for its use in yoga mats. It's a very compressible material, even when it's focussed on a small area. Aside from that, the finish can be made very smooth, meaning no small scratches can occur from moving it around much. Vinyl foam makes the base less slippery, so it also won't slide around as much, and translate more of its sideways impacts into wobbling, instead of sliding around.

- It's questionable whether a wobbling punch bag is what people are looking for.

I decided to wait to research this until after the three concepts were done. After the concepts were done, I made a survey for potential users to give their opinions on each concept, and explain why some of them are more suitable for them than others. Therefore, I did not tackle this limitation specifically as of yet.

- The base needs to be really heavy to keep the bag from falling over or being smashed all around the room.

Despite the vinyl foam already helping avoid some moving around, the base still needed to be heavy. To do so in a manner that is as easy as possible for users, I decided to shape the base in such a way that it's a hollow steel shape (bent and machined) which users need to fill with 50 litres of water to add extra weight, making the NextRound Defence weight about 70 kilograms (bag excluded). The way this is done can be seen on the right of Figure 65.

Another adjustment I made to keep it from falling over is the shape of the bottom of the base. The earlier version had a uniformly round surface at the bottom. The improved version has a different shape (Figure 64), meaning it'll be harder to actually topple.

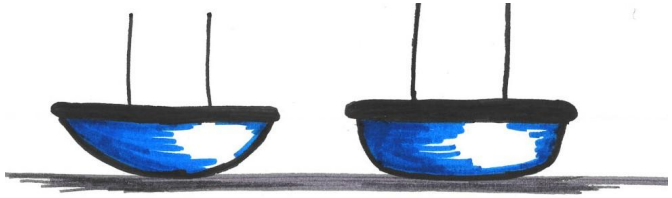


Figure 64: Sketches of the evolving shape of the bottom of the NextRound Defence. The earlier version is shown on the left, the improved version is shown on the right.

As for dimensions, when a 1,80 metre bag is installed, the NextRound Defence stands 2,10 metres tall, and has a diameter of 1 metre.

The way users can work out with the NextRound Defence is quite straightforward. It's a boxing tool which moves away from the user when they punch it, and it moves back to them as long as the user doesn't topple it by punching it so hard the angle with the floor becomes less than 27 degrees or punching it harder than 1502 N (Appendix 11). Non-professional users should not topple the system. A professional user might topple it if they try really hard, but for them it should be very difficult to do so.

The motion of the bag simulates the movement of an opponent, by wobbling from the bottom. This is different from a hanging punch bag, as these move from the top. While exercising with the NextRound Defence, users can practice defensive manoeuvres by evading and blocking against the punch bag.

Figure 65: Drawings of the NextRound Defence concept.

NextRound Wardrobe Studio

Next up, the NextRound Wardrobe Studio concept (Figure 66). The Wardrobe Studio has a height of 2,10 metres. When closed, it's 90 centimetres wide and 60 centimetres deep. When it's open and has its mat rolled out, the complete product is 1,60 metres deep and 1,90 metres wide. Much like the Defence, this concept had a few points to improve on, found in the limitations of the vALUe evaluation.

- Needs to be against a wall.

This limitation is a limitation I decided to not tackle directly, but make adjustments to try and solve the underlying problem. The problem of needing to place the Wardrobe Studio against a wall, is that users have less freedom to decide where their Wardrobe Studio is going to be placed in the house. I believe a wardrobe's place in a home will always be against a wall or another, so the fact that this concept needs to be placed against a wall isn't really the problem here. What I did change however, is the way the doors open, as can be seen in Figure 66. In the earlier version of this concept, I had a door open to the left and to the right. This meant that the wardrobe could not be placed in a corner, as that would mean users could not open one of the doors fully. In this iterated version of the concept, one door and side wall open to the side. This means that the product system can be placed in a corner. The wardrobe can be installed to open to either the left or the right, providing users more freedom as to where they place their Wardrobe Studio.

- Walls on the side prevent users from kicking the bag.

Changing the way the Wardrobe Studio opens solves this problem as well. By opening the product fully on one side, and moving the punch bag to the front corner of the Wardrobe Studio, there is a lot more space to the sides of the punch bag. With this open space, users can make sideways kicks all they want without needing to fear they'll kick the wood of the Wardrobe Studio.

- The more moving parts a product has, the more parts are susceptible to damage over time.

This limitation is solved in part by the new door system. The new doors have rubber feet at the bottom which keep it in place when folded out, the interaction of which you can see on the right in Figure 66. By means of these feet, I hope to keep the door nicely in place during workouts, as well as when the wardrobe is closed. The floor mat has less moving parts as well, making it less susceptible to damage over time.

- This product is big and has many relatively intricate parts, this product will without doubt be very expensive.

The Wardrobe Studio will always be an expensive product to some degree. However, there are a few things I'll keep in mind in the design to at least make it cost-efficient. The concept will be made of as many pre-fabricated parts as possible. I believe it will be possible to make all the connections, such as the hinges, the feet, the bag rails, of pre-fabricated parts. That should keep the costs down. Aside from that, I believe it should be possible to make one

set of wooden parts, and make these installable in both a left-opening and a right-opening configuration. What I mean by this is that the wooden parts can be installed in two ways; with the door opening to the left and with the door opening to the right. This should make production and processing cheaper, as there is no need for making two different part sets for the two configurations. Lastly, I think it could be considered in the potential future development of this concept to implement an IKEA-like delivery concept for this product, by leaving the assembly to the users themselves. Users who feel like paying a little extra for a bit less of hassle could potentially pay a little extra to have the product installed as a service. With these changes, I think I can cut the costs of the product down efficiently, without compromising quality.

To conclude, the NextRound Wardrobe Studio is a product concept for a closet which holds everything a user might need when they work out with their NextRound punch bag. When closed, the product looks like a sleekly designed wardrobe, but when opened, it becomes an at-home boxing studio.

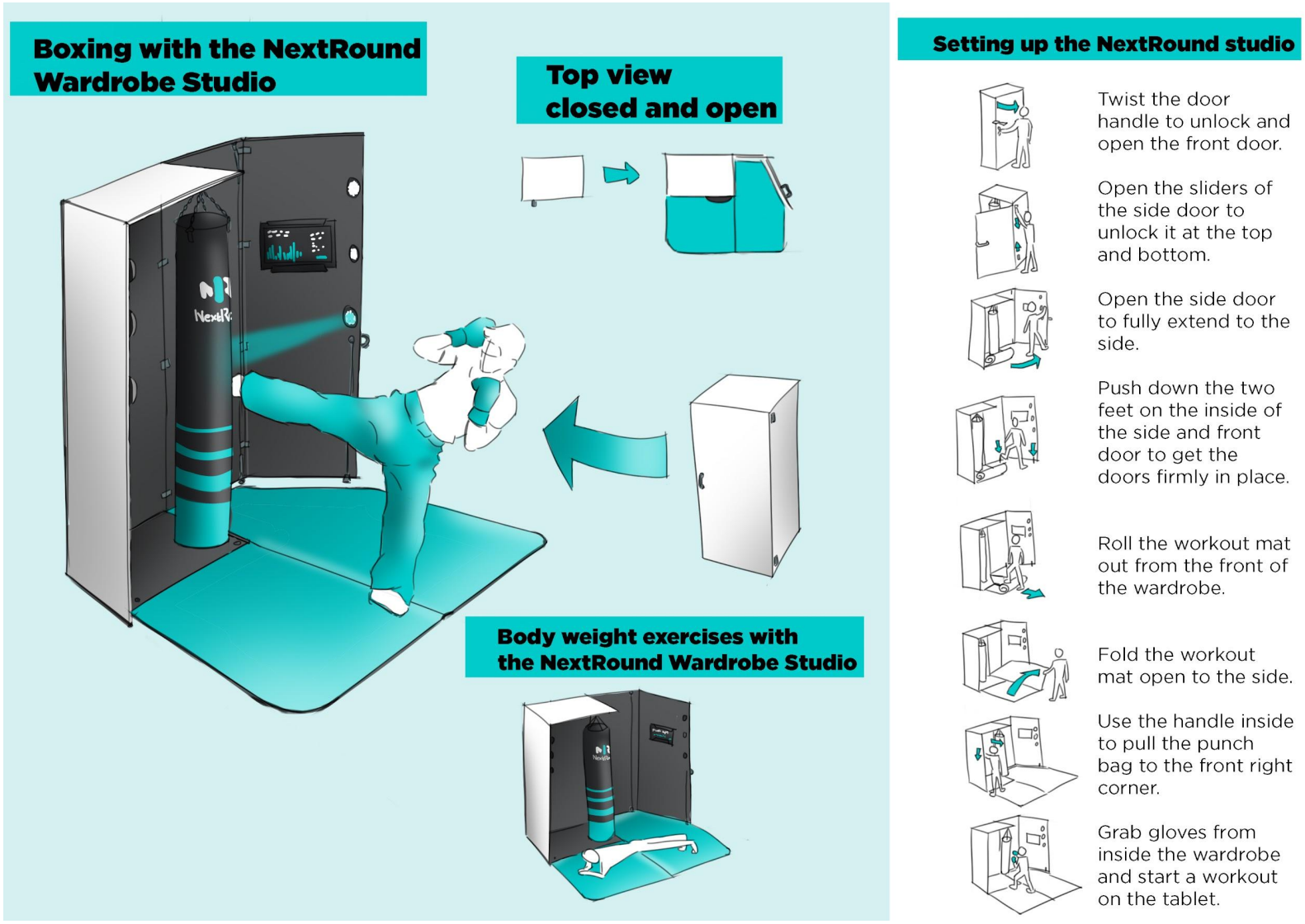


Figure 66: Drawings of the NextRound Wardrobe Studio concept.

NextRound Tulip

Lastly, I iterated on the NextRound Tulip (Figure 67) to make the concept an improved version of the previous idea. The Tulip stands 2 metres tall. When the mats are folded out, the whole becomes 2,20 metres wide and 2 metres deep. The mats provide users a workout surface which can be used for body weight exercises, as well as barefoot boxing. The mats can be folded up to take up less space and to expose the wheels on the bottom of the base, so users can ride it somewhere else. The vALUe evaluation of the earlier version of this concept gave two limitations, which I iterated on.

- Takes up a lot of floorspace during use.

The previous iteration of the NextRound Tulip had a circular mat on the floor with a radius of about 2 metres, which would take up a total of 12,6 m^2 when in use. It is not realistic to expect the potential users to have a circular space with a 4 metre diameter on their floor to work out. So, the area the mats take up had to be lowered drastically. The mat shape and size were changed, so the depth and width of the product were both about halved, without compromising usability.

- The circular shape makes it hard to put somewhere, as it won't line up with its environment.

From my previous research I found that it's most likely for users to want to have their punch bag against a wall or in a corner, and not in the middle of a space. A product with a circle as a footprint does not fit against walls or in a corner nicely. Therefore, I changed the shape of the floor mats. The contour of the mats is now more like a triangle, with very rounded edges. By making the edge behind the bag a more straight line, the shape of the system suggests that it can be put near a wall. The area in front of the punch bag is large enough for users to do body weight exercises, while not taking up overly much space.

In conclusion, the newly iterated NextRound Tulip concept allows users to do (kick)boxing workouts at home in a safe environment, combined with other types of workout activities. When users are done working out, and want the product to be out of the way, it can be folded up and driven around to be stored efficiently.

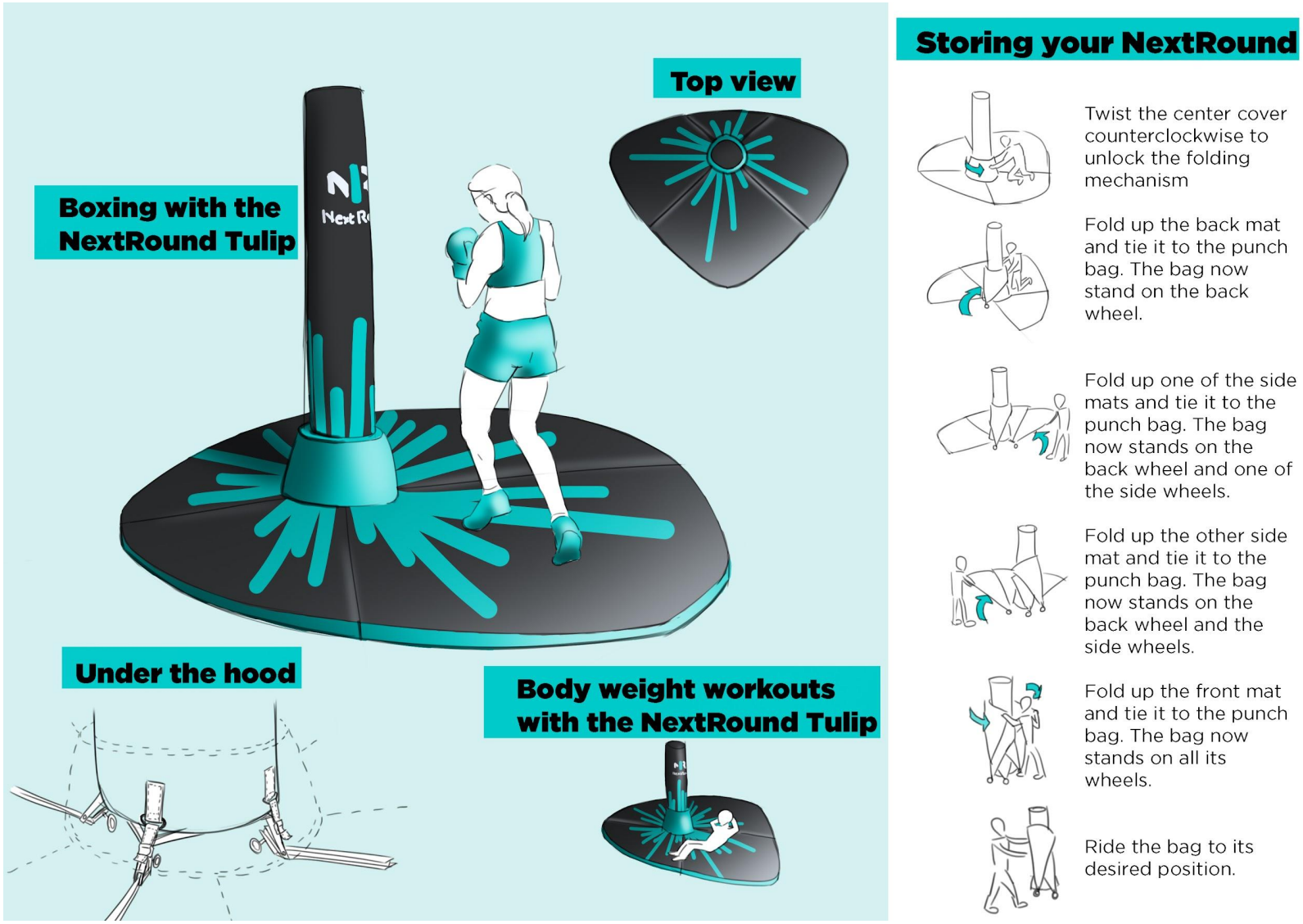


Figure 67: Drawings of the NextRound Tulip concept.

Concept picking

For further development of this project, I need to continue with a single concept. This final concept could very well be a combination of the three concepts mentioned before, but then I needed to know what features to incorporate. In order to make an educated decision about which concept to continue with, I set up an online survey to ask potential users to evaluate each of the three concepts.

Evaluation survey setup

The goal of this survey was to learn what aspects of the three concepts potential users would find exciting and enjoyable, and what aspects they dislike or have doubts about.

The survey was set up as follows:

1. An introduction about the NextRound boxing system. In order to be able to judge the product concepts I made, they would first need to understand what the NextRound system is.
2. An explanation as to what the survey data would be used for, to be transparent to participants what would be done with their data.
3. Drawings and explanatory text for each concept. These drawings and text should help participants to get an idea of what kind of products the concepts were.
4. For each concept, I asked four questions.
    a. First, I asked them how enthusiastic each concept made them on a scale of 1 to 10. This could help me determine which of the three concepts each individual participant deemed most suitable for their home situation.
    b. Then I asked them to name an aspect of the concept which they liked, followed by a question to name an aspect they disliked about it. I based those two questions on the theory of the aforementioned vALUe method (van Boeijen et al, 2016, pg 149). By asking what they liked about each concept, I wanted to find the Advantages. By asking what they disliked about each concept, I wanted to find the Limitations. The Unique aspects I hoped to find through both questions. I set out to find the Unique aspects by analysing the answers to the previous two questions.
    c. Lastly, I asked them what they would change about each concept. I asked this question to get a deeper understanding as to why the respondents liked or disliked certain aspects of the concept.
5. Demographic questions about age and gender of the participants. I wanted to collect this data to research if the respondent group was diverse enough.
6. Room for questions or remarks, if they still had them. If respondents still had questions or other remarks regarding the survey I wanted to know this, to see if I had made the survey clear enough.

7. If they would be interested to participate in potential user testing sessions, they could leave their email address. I asked this because at this point in the project, I was already planning to do user testing sessions later on. This way, I could already recruit some interested individuals to perhaps take part in these testing sessions.

The survey was made in Dutch, as NextRound operated only in the Netherlands at the moment of testing. Therefore, the potential users should primarily be Dutch. I made an estimation that the vast majority of this group would have Dutch as their native language.

The full survey questions can be found in Appendix 12.

I spread the survey through the following channels:

- In posts and stories on the NextRound instagram page (Figure 68).
- In a post on my personal LinkedIn page, which was shared around by NextRound colleagues (Figure 69).
- In a post in a Facebook community called “Boksfans van Nederland”, which is a community of Dutch boxing enthusiasts (Figure 70).
- In a post on my personal Facebook page (Figure 71).
- By asking people around me if they knew people who practise boxing, and then asking them to fill in the survey.
- By asking the people in the group I boxed with if they, and other people they knew who practised boxing, could fill in the survey.

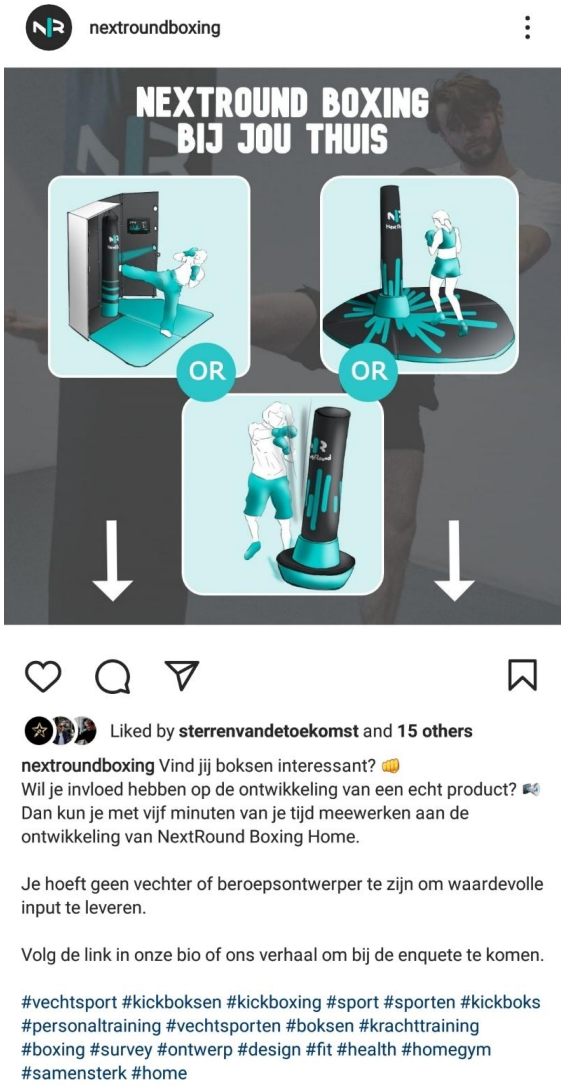


Figure 68: Survey post on the NextRound instagram.

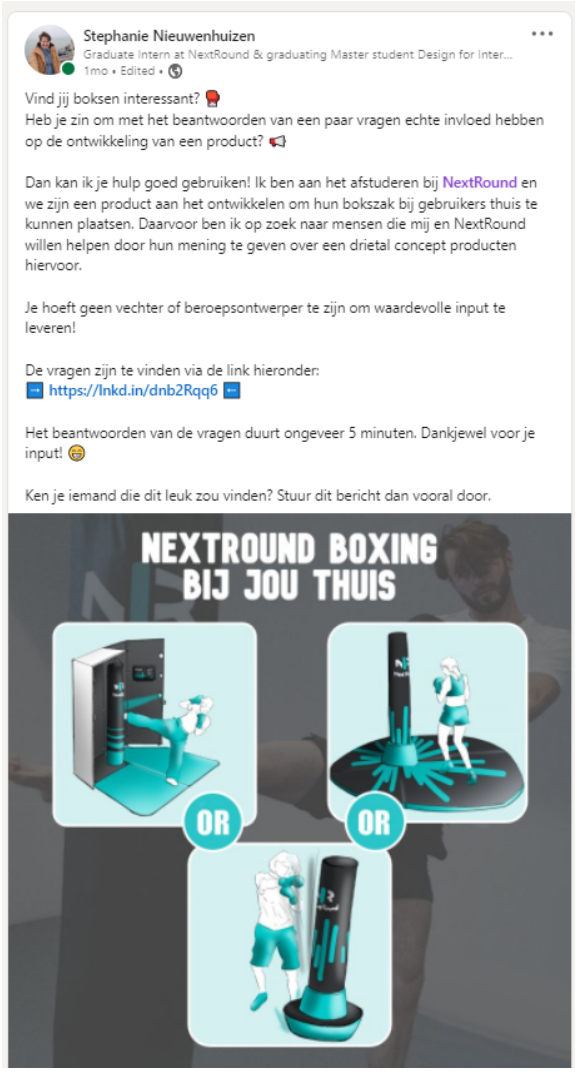


Figure 69: Survey post on my LinkedIn page.

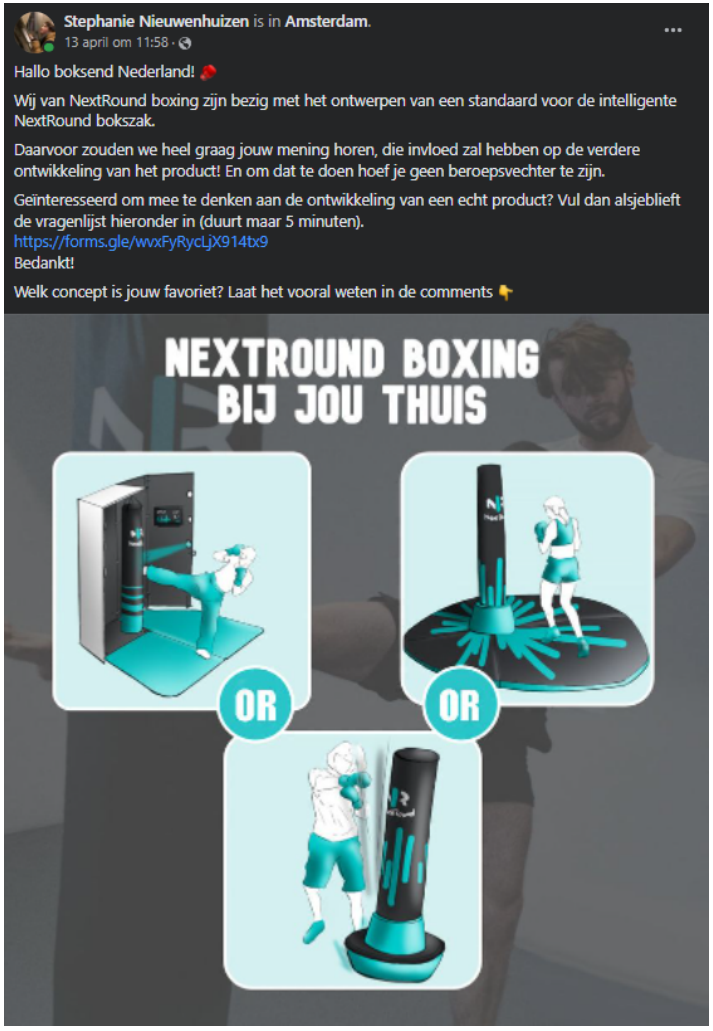


Figure 70: Facebook post in the Boksfans van Nederland community.

Figure 71: Facebook post on my personal timeline.

I shared the survey around through these channels with the goal of reaching potential users. I figured it would be especially insightful if the majority of the respondents would be people I don't know personally, to get unbiased answers. To do so, I made it clear through every channel that if people who saw the post knew other people who practised boxing, I would appreciate it if they could share it with those people.

Evaluation survey results and conclusions

The survey was online for a total of two weeks, and got responses from 13 people. The full raw results can be found in Appendix 12.

The group of respondents was relatively diverse. Both men and women were represented (Figure 72). There were more male respondents, but boxing is a sport which has more male practitioners (Heiskanen, 2012), so this should still be somewhat representative of the group of potential users. The ages of the respondents were varied as well (Figure 73).

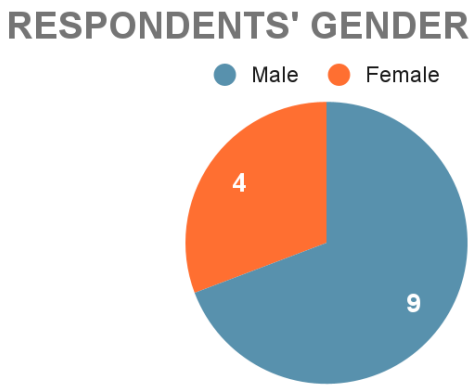


Figure 72: Gender of the survey's respondents.

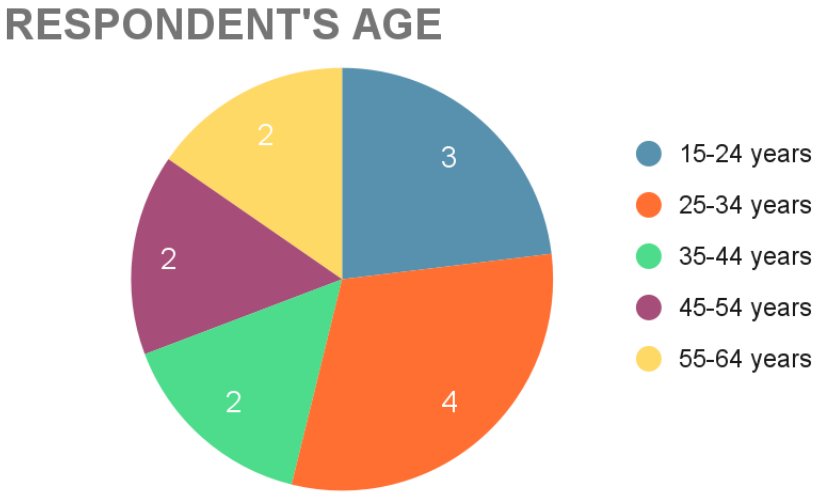


Figure 73: Age of the survey's respondents.

By comparing the grades the respondents gave for each to the question "How enthusiastic does the [concept name] make you?", I could conclude which concept would be their favourite (Figure 74). Each concept had its fans, and people were enthusiastic for different concepts for different reasons. The NextRound Tulip had a few more fans than the NextRound Defence and the NextRound Wardrobe Studio.

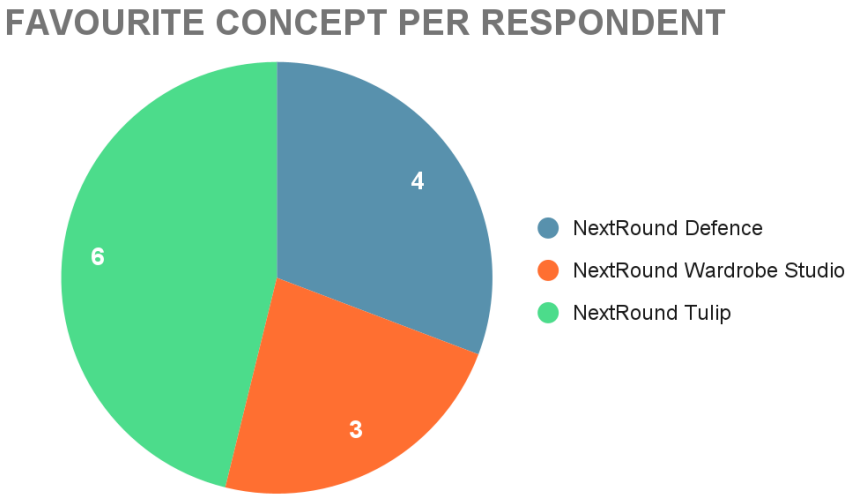


Figure 74: Favourite concept per respondent, based on the concept they scaled highest on the question "How enthusiastic does the [concept name] make you?" for each concept.

For each concept, I created a list of pros and cons according to the opinions of the respondents. These lists consist of clusters of answers given to the questions about what they liked, disliked,

and/or would change about the concept. The numbers behind every pro or con show how many of the 13 participants mentioned this in their answers.

NextRound Defence

Pros:

- Easy to place and move (7)
- Moves from the bottom, simulating opponent (5)
- Takes up little floor space (2)
- You can move 360 degrees around it (1)
- Looks like it's made of high-quality material (1)

Cons:

- Room needs to be adjusted to accommodate movement (4)
- Water is a hassle (3)
- The moving around of the top can be annoying (3)
- Heavy hitters might throw it over (2)

NextRound Wardrobe Studio

Pros:

- Reflex training (8)
- When closed, everything is put away neatly (7)
- Workout mat (1)

Cons:

- Takes up much space (6)
- Can't move around it (3)
- Does not fit current interior (2)
- Wall anchors (1)

NextRound Tulip

Pros:

- Transportability (5)
- Workout mat to (kick)box without shoes (4)
- Integration of other workouts (2)
- Sturdy (1)
- Move around 360 degrees (1)

Cons:

- Takes up much space (4)
- Folding is a hassle (3)
- Not aesthetically pleasing (2)
- Folding and riding mechanisms will deteriorate over time (1)

These perceived pros and cons per concept helped me get a deeper understanding of how the respondents viewed each concept's value to their personal lives. Based upon their preferences, as well as conversations with Sports-f(x), I believed these insights would help me decide on a plan for future development of one concept.

Concept chosen for further development

In the last stages of the project, I developed one concept to fulfil the design assignment. This concept was based on the previous concepts, and the findings from the evaluation survey with users.

As a base, I decided to take the NextRound Tulip, with some adjustments to make it a better product. The main reason I chose to take this concept, is because the respondents, as well as myself, believe this concept is the most suitable for heavy hitters. Respondents had their doubts about the Defence concept, because they feared they would make it fall over. The NextRound Wardrobe Studio would likely also not be suitable for these people, as some of the respondents thought the swinging punch bag might hit the walls after a really powerful punch or kick. Aside from heavy hitters having their doubts about the dimensions of the NextRound Wardrobe Studio, very tall users would likely also have problems with the Wardrobe Studio, as they might hit their heads, or wish to punch higher than the bag allows them to.

Of the three concepts, the NextRound Tulip is the most resistant to withstand heavy impacts. Aside from that, it allows people to do kickboxing exercises on bare feet, as the floor becomes suitable for barefoot training. Lastly, the fact that the Tulip is easy to move about, and takes up little space when not in use (the Defence also has this as a pro), makes it very desirable.

So, I decided to continue developing the NextRound Tulip concept, albeit with some changes. First of all, the main con of the concept is that it takes up a lot of floor space in use, so I would continue to optimise this. I also needed to figure out how the folding mechanism in the base would work, and be sturdy. I also needed to find a way to get some suspension between the bag and the base, so the system could flex and take impacts better.

Lastly, the majority of the respondents of the survey were enthusiastic about the reflex training aspect of the NextRound Wardrobe Studio concept. It would be a shame to just forgo this just because I chose another concept, so I will keep this in mind for future development.

With these changes, explorations, and adjustments, I planned to continue to develop the NextRound Tulip concept.

Chapter 6: Conceptualisation - summary

After developing the three chosen ideas from the last chapter into concepts, I evaluated these with potential users and the company. Based on these evaluations I chose to develop the NextRound Tulip concept in the last steps of my project. With some adjustments and iterations, I trusted I could make it into a product to satisfy the needs and wishes of the potential users as well as the company.

Chapter 7:

Final concept

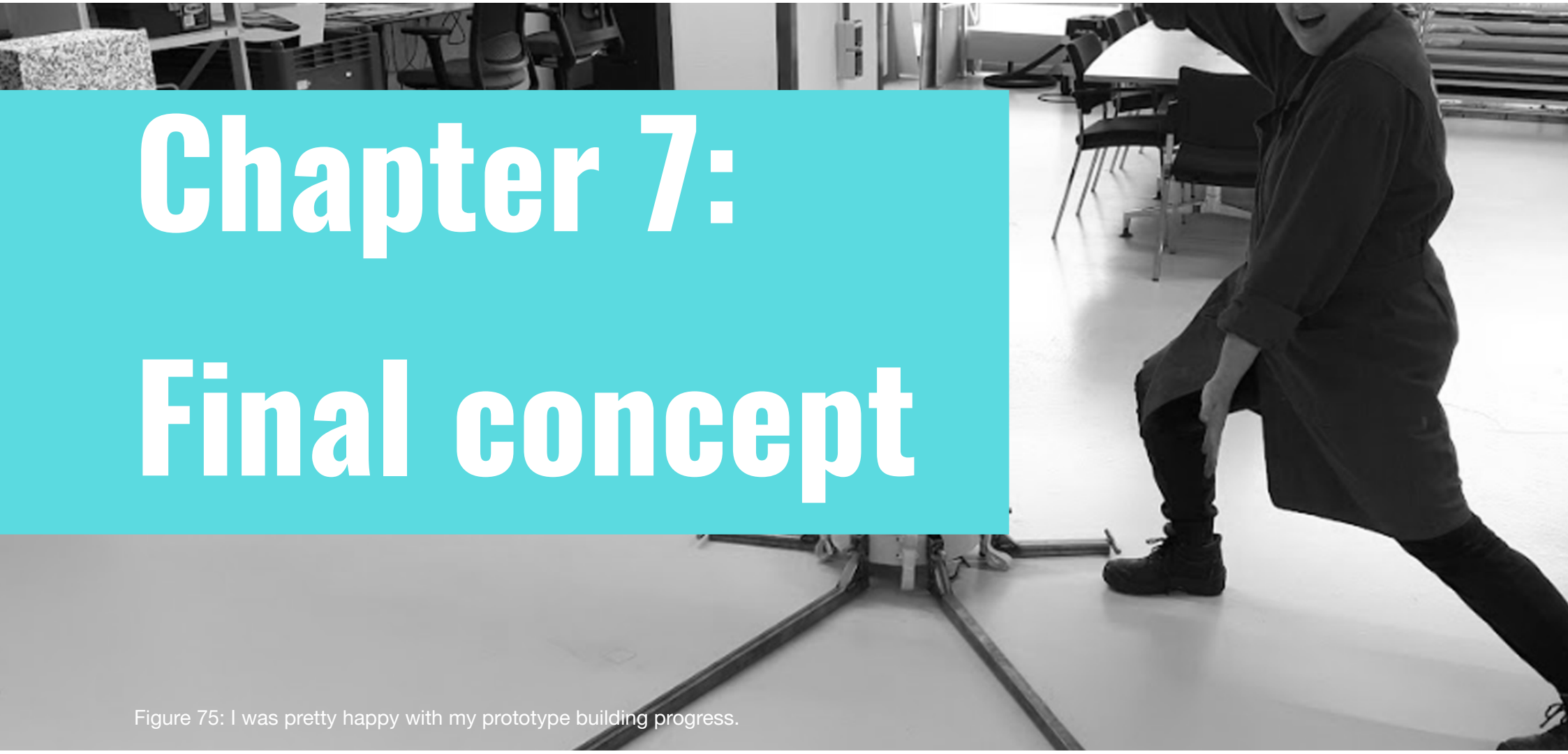


Figure 75: I was pretty happy with my prototype building progress.

Chapter 7: Final concept - introduction

The concept of the NextRound Tulip has already seen some iterations up until this point. There are still some problems to solve, and I wanted to have some actual user feedback on the product, so there was still some work cut out for me to do. In this chapter, you can read about the development steps I took to finish up this design project.

Development final concept

After the evaluations made on the chosen concept in the last chapter, there were three main topics of improvement I would have to figure out to find the final concept of my project. These topics would be the shape and size of the mats, how the folding mechanism works, and the materials everything would be made out of. You can read about my explorations in each aspect of the concept here:

2Mat shape

The shape of the mats needed to change after the conceptualisation phase. The main concern the respondents of the survey had was the amount of space the mats would take up in a room. I deduced the shape of the mats also needed some upgrade, as the previous version would spread really far out to the sides.

The dimensions of the mats should satisfy the following demands:

- The mats are big enough for all users to have a proper workout on them.
- The product can be placed in different parts of a room (in a corner, against a wall, in the middle of a space), so users can put it wherever they please.
- The mats have a shape which is aesthetically pleasing.
- The mats are not too big or heavy to be foldable by one person.

I believed that in order to find an optimal shape for the mats, its shape would need to suggest that it could be placed in three different kinds of situations: in the corner of a room, against a wall of a room, or in the middle of a room space. Thus, I sketched a number of shapes, how walls could form around these shapes (Figure 76).

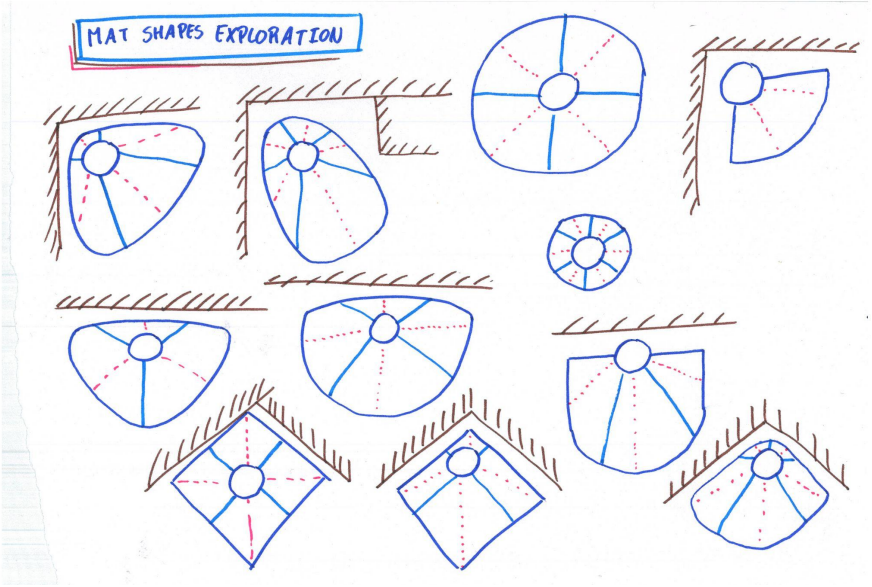


Figure 76: Mat shapes explorations sketches.

From these sketches I found that a somewhat elongated triangular shape, with the punch bag standing near the far point, should fit in a corner, against a wall, and in the middle of a space. Aside from fitting in several different places, the mat shape should also enable users to use it as a workout mat. I believed it would be possible to take this shape as a starting point, and make sure it has enough stability to withstand impacts from different sides. With this vague shape, I explored further (Figure 77), to find the balance between having enough space to work out, and as little as needed to fit into spaces more easily.

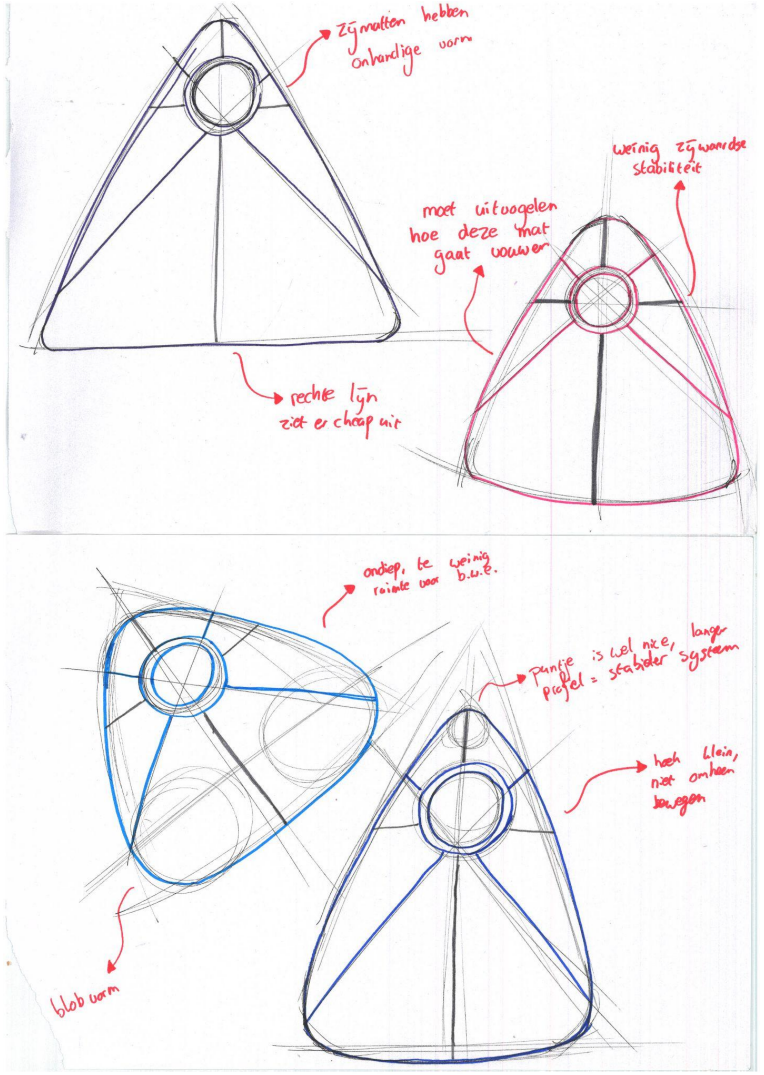


Figure 77: Exploring the vaguely elongated triangle mat shape for the mats of the product.

The elongated triangle shape seems workable. As long as the mat has enough space to do body weight exercises, it should function. To try out what the mats would look like in full scale, I planned to make a low-fidelity paper model of the mats, and took the following dimensions (Figure 78) as guidance.

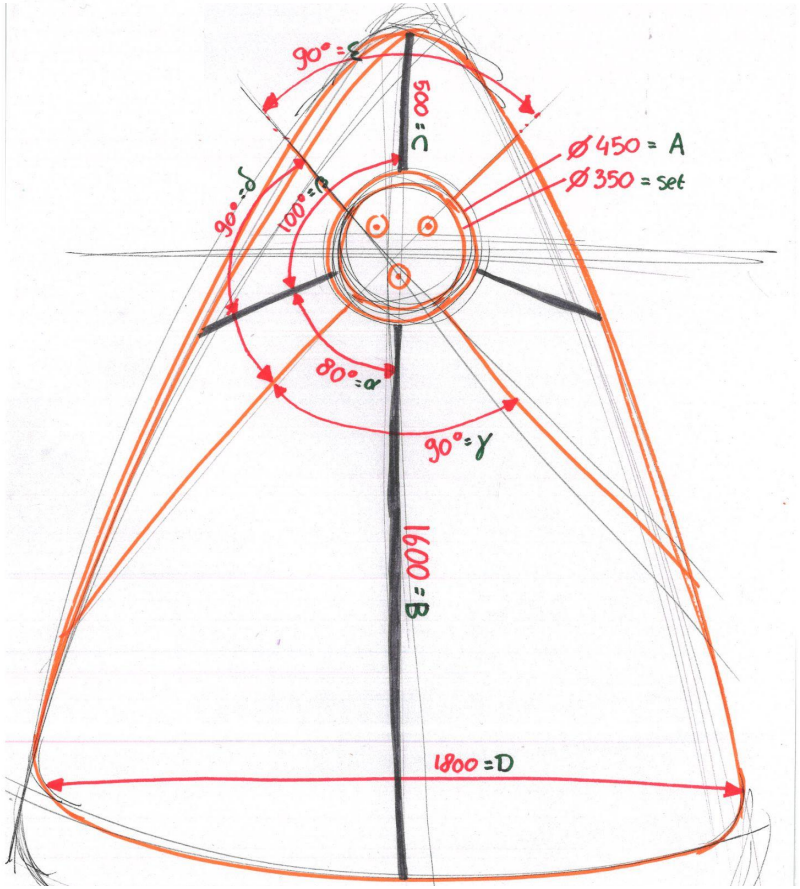


Figure 78: Dimensions full-scale model plan.

Next, I built the model itself. For the mat, I taped together large sheets of paper big enough for the entire mat to fit on. Then, I sketched the shape on it, and with help of the shape and dimensions of the earlier plan (Figure 79) I was able to figure out the actual mat shape, which I cut out of the shape.

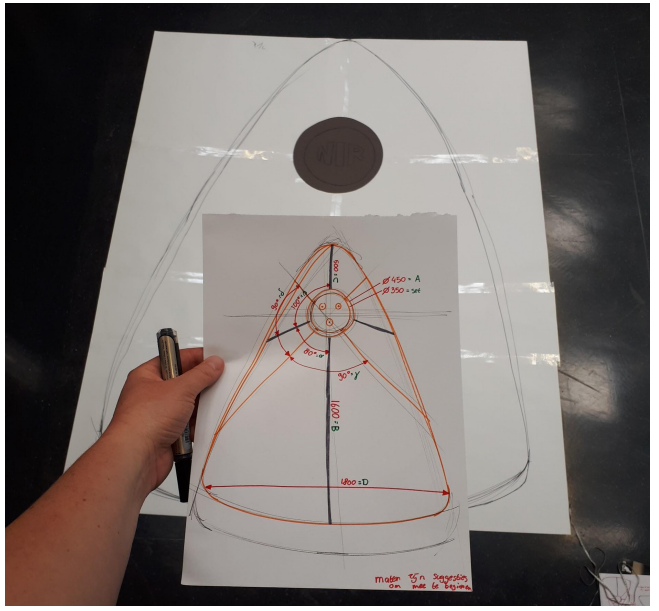


Figure 79: The full-scale mat model in progress; I took some distance to view the model and compare what I saw with the sketch to get the shapes right.

After finding the outer contour, I cut the mat out of the sheet, and cut the four mats loose from one another. I then attached wooden beam profiles on the mats, on the locations I had annotated on the

model plan. These would simulate where the steel profile in the final product would lay (Figure 80).

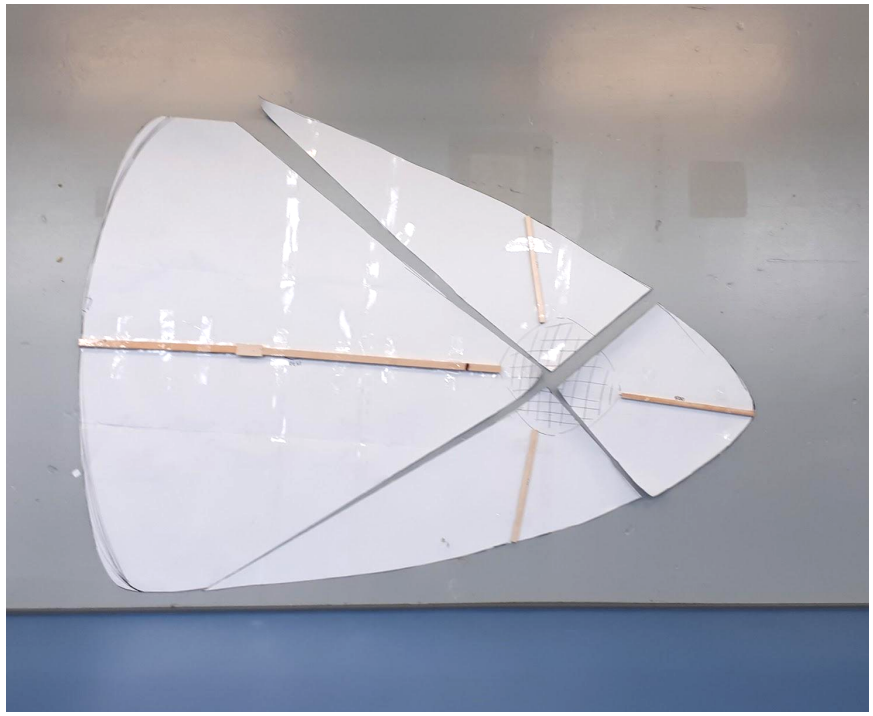


Figure 80: The full-scale mat model finished, and laying on the floor with its mats down.

In order to test further interactions with the product model, I placed an object (in this case, a trash bin) with a diameter roughly the same as the punch bag (the bin was 20% wider) in the place where the punch bag would be if this were a real product (Figure 81). This object simulated the punch bag itself.

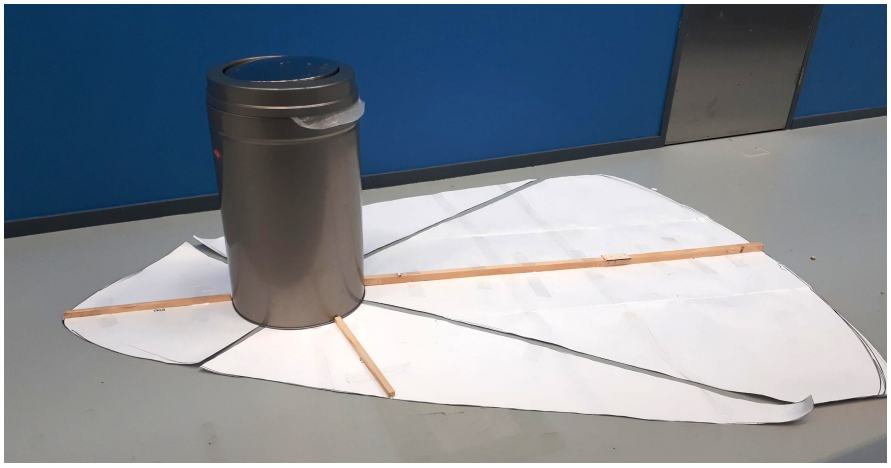


Figure 81: The mat model with an object in the place of the punch bag.

With the model in place as such, I did some shadowboxing (Figure 82) against the imaginary punch bag to get a feeling for if the dimensions would enable a user to do their boxing workouts.

Figure 82: Shadowboxing with the mat model.

From these tests I concluded that for myself (a person with a P50 height for Dutch adults of mixed gender) the mats were definitely big enough to do my workouts properly. I had plenty of space left, so bigger users than myself should have no issues with not having the workout space they need. Afterwards, I asked some people taller and shorter than myself to try the mats out, and they could move around fine as well (no images in this report, as I forgot to ask for their consent to use their images, so I won't do so).

After concluding the mats are of satisfactory size to work out with, I tried to experience what folding the mats would be like. I folded each of the paper mats up (Figure 83).

Figure 83: Folding the mats of the lo-fi mat model.

From folding them, I found that the side mats are very suitable to tie together the back and side mats, as the front flap of the side mats wraps around the entire punch bag. The front mat needs to tie itself together, as this one is way bigger than the others, and connects at the top. So, the final concept needs to have some kind of clasping mechanism to let the mats connect to themselves and keep the whole system nicely tied up.

In the end, the final dimensions which I found to be suitable for the model were as displayed in Figure 84.

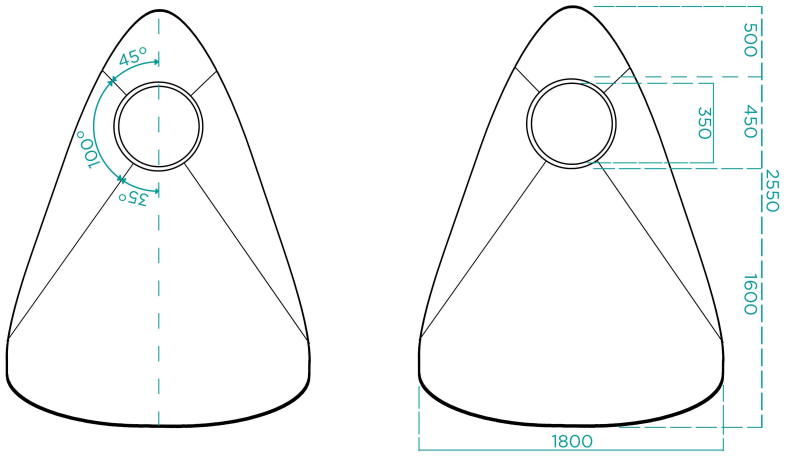


Figure 84: The mat with its dimensions annotated.

Folding mechanism

Somehow, the mats of the NextRound Tulip had to be able to fold up and down, depending on whether users wanted to have it in use or out of the way. To allow this folding, I had to design a mechanism “under the hood” of the NextRound Tulip.

The folding mechanism should satisfy the following demands:

- The mechanism is stable in both folded and unfolded configurations.
- The mats can be folded by one person by themselves.
- The mechanism is safe to fold.
- There is a suspension between the base and the punch bag, so the punch bag can take impacts without putting stresses on the base.
- When the mats are folded up, the product should be able to be pushed around by one person.

For the folding mechanism I decided to try out a system where the base cover would lock over the base and the profiles using a bayonet fitting. The mat profiles would have an L shape, with a pin for the bayonet connection at the inside of the vertical beam of the L (in the position where the mats are on the floor). With a connection like this, I intended to make the base cover lock the system in place in two directions: on the inside it would clamp the profiles inward, and on the bottom it would clamp them down. Thus, the system would hypothetically be stable.

When a user would want to fold the mats up, they would need to unlock the bayonet-fitting base cover and tilt it upwards slightly. When folding each of the mats up, the cover would be able to sit on the profiles.

To test if a locking system like this would work in reality, I modelled a simplified version of this system in SolidWorks (Figure 85).

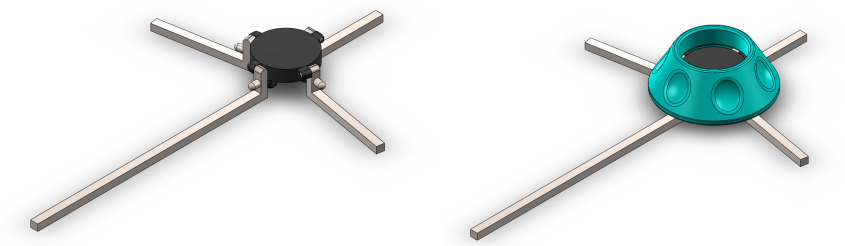


Figure 85: 3D sketches of the mat profiles through the base, with (right) and without (left) the base cover.

I 3D printed these 3D sketches on a 1:10 scale, and assembled them (Figure 86).

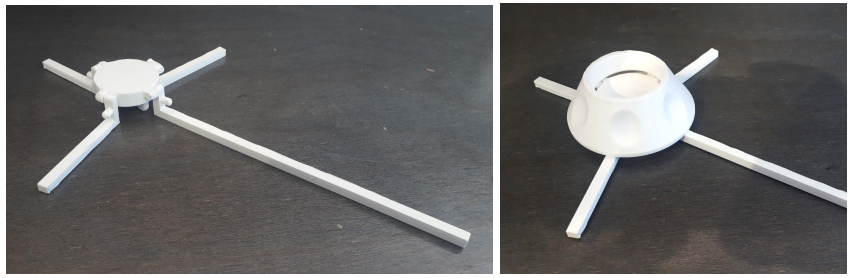


Figure 86: 3D prints at a 1:10 scale of the folding mechanism.

What I found from this print were a couple of takeaways:

- The outer diameter of the base cover was too big. When folding the profiles upward (Figure 87), the profiles could not go up all the way because the cover was in the way.
- The bayonet fitting itself clamped the profiles inward and downward in a satisfactory amount.
- The actual base cover needs some kind of handhold or grip so users can turn it easily.
- It is unclear if the profiles, as I sketched them here, give the product enough stability if a user were to be boxing with the NextRound Tulip. This needs further research.
- I doubt hinges like the ones I modelled here are suitable for the final product. This needs more research.

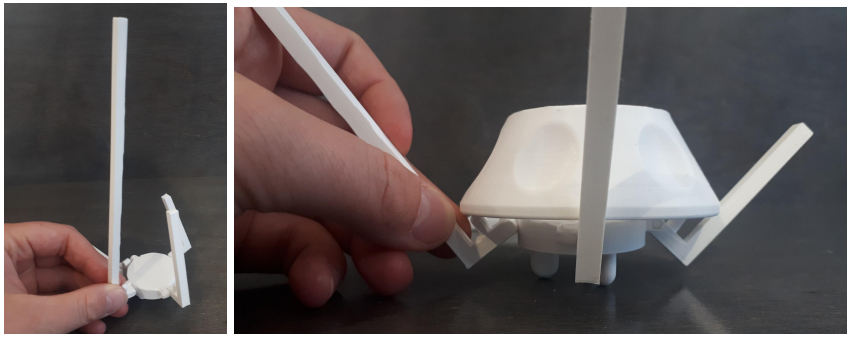


Figure 87: Without the base cover (left), the profiles can fold up just fine. With the base cover (right) however, their path up is limited because of the width of said base cover.

All in all, I concluded that a folding mechanism like this one could work well for this product, if I made a couple of changes and iterations based on my conclusions with this prototype.

Stability

As noted in the section about the folding mechanism, I had some doubts about the stability of the product concept. I decided that, in

order to optimise the system's stability, I was going to further design the profiles in the mats.

The profiles should satisfy the following demands:

- The system is stable enough to not fall over upon a forceful rear hook given by a tall user, when their feet are placed aside of the centre of the front mat.
- The system is stable when the mats are folded up.
- The system can be folded up easily by one person.

I sketched eight different options for profile orientations to test (sketched in Figure 88). These were based on two variables. The first variable was the orientation of the profiles in the side mats, which can be seen from left to right in the sketches. The first option would have the side profiles pointed towards the user, at the same angle as the 3D printed model of the folding mechanism. The second option would have the side profiles perpendicular to the profiles in the front and the back. The third option would have its profiles angled more to the back. The fourth option for the side profiles would be a double profile, one pointing more towards the front and one pointing more to the back. The second variable was the front mat's profile. I wanted to compare having one profile running through the centre (upper row in the sketches) with two profiles at an angle to one another (bottom row in the sketches).

Combined, these two variables gave me eight different options to test, as portrayed in Figure 88.

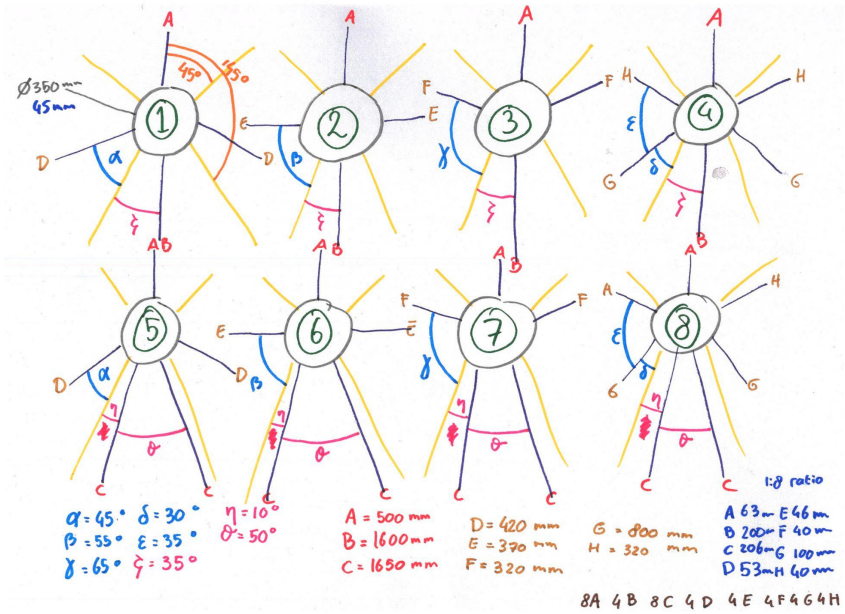


Figure 88: Sketches of the eight different profile orientation options to test the stability of.

I wanted to compare the stability of these options by making low fidelity models of the options and see how they moved upon impact. For this, I glued wooden sticks at the appropriate lengths (at 1:10 scale) and angles to cardboard cores, on which I glued another wooden stick vertically (Figure 89). Over this vertical stick, I slid a low fidelity cardboard tube, which simulated the punch bag. Then, I "punched" against the cardboard tube by tapping and flicking it, to see how the system would respond to impact.

I decided to forgo making a model of option 3 and 5 from the sketches. I forewent option 3 because it had many profiles pointing backwards, which I assumed would not provide much sideways stability. I forewent option 5 on the other hand because it almost only had profiles pointing forward, which would give it little stability towards the back. Both option 3 and 5 therefore seemed redundant to test.

The resulting models looked as seen in Figure 90.

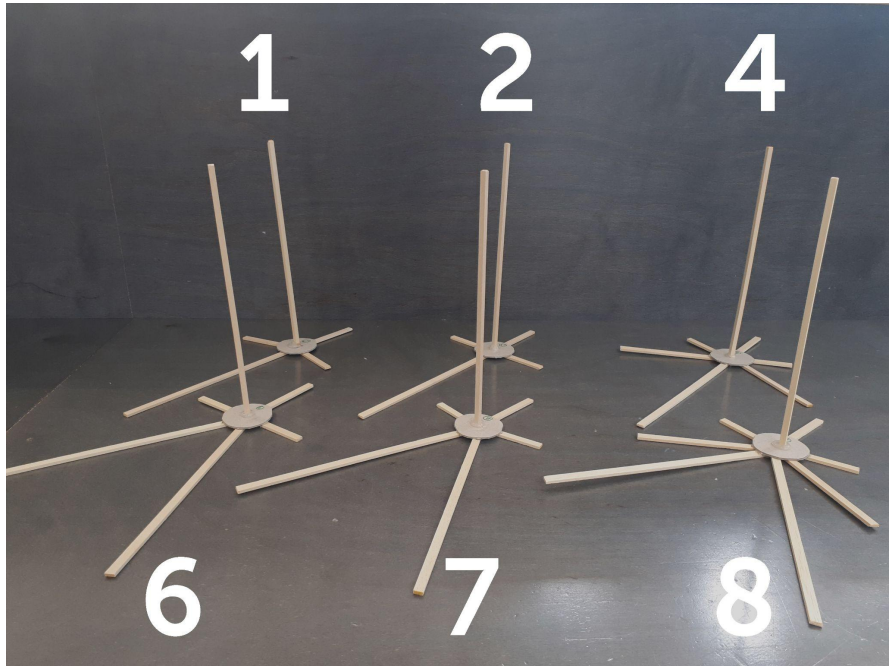


Figure 89: The wooden 1:10 scale models of the profile orientation options as shown in Figure 88.

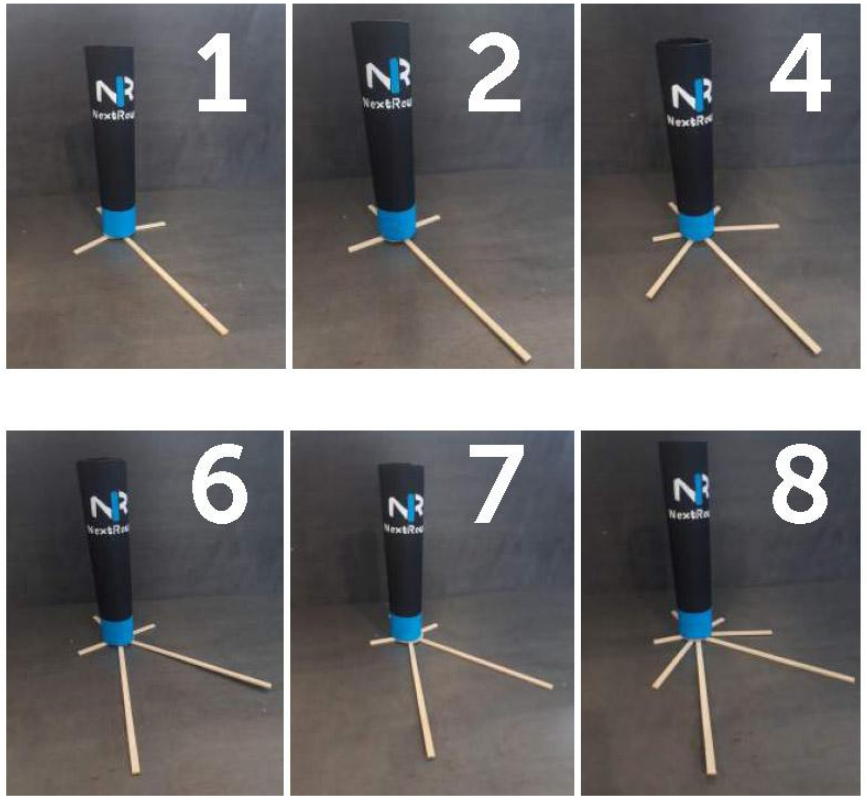


Figure 90: The low fidelity models with the different profile orientations.

After flicking each model, I made the following conclusions for each of the models:

1: Resists impact from the front quite well, but falls over quickly when the model is flicked from the sides.

2: Little difference to be experienced between this model and model 1.

4: Resists sideways impact better than option 1 and 2, but falls over quickly upon taking impact from the front.

6: Resists impact from the front well. Sideways stability is fine.

7: Resists impact from the front very well. More sideways stability than 6.

8: Resists impact from the sides and front well.

Purely based on performance, option 8 is the most stable. However, option 8 has a lot of profiles in many directions, making the product heavy. A problem option 8 would have is that the profiles of the side mats and the front mat are likely to cross when folding the mats up, which makes folding them up a hassle. As noted in the demands made for the profiles of the system, folding the mats up should be easy to do for one person. Therefore, I decided that taking the orientations of option 7 (which is only slightly less stable in the sideways direction) would likely be better for the final product. The orientations of the chosen option can be seen in Figure 91.

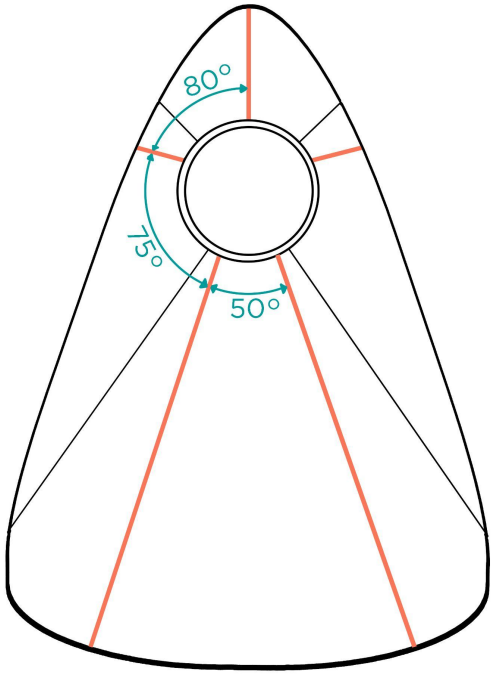


Figure 91: Chosen profile orientations for the final product.

Final design

The shapes and dimensions of the product discussed above come together in one design concept; that of the NextRound Tulip.

With its newly defined features the concept looks as shown in Figure 92.

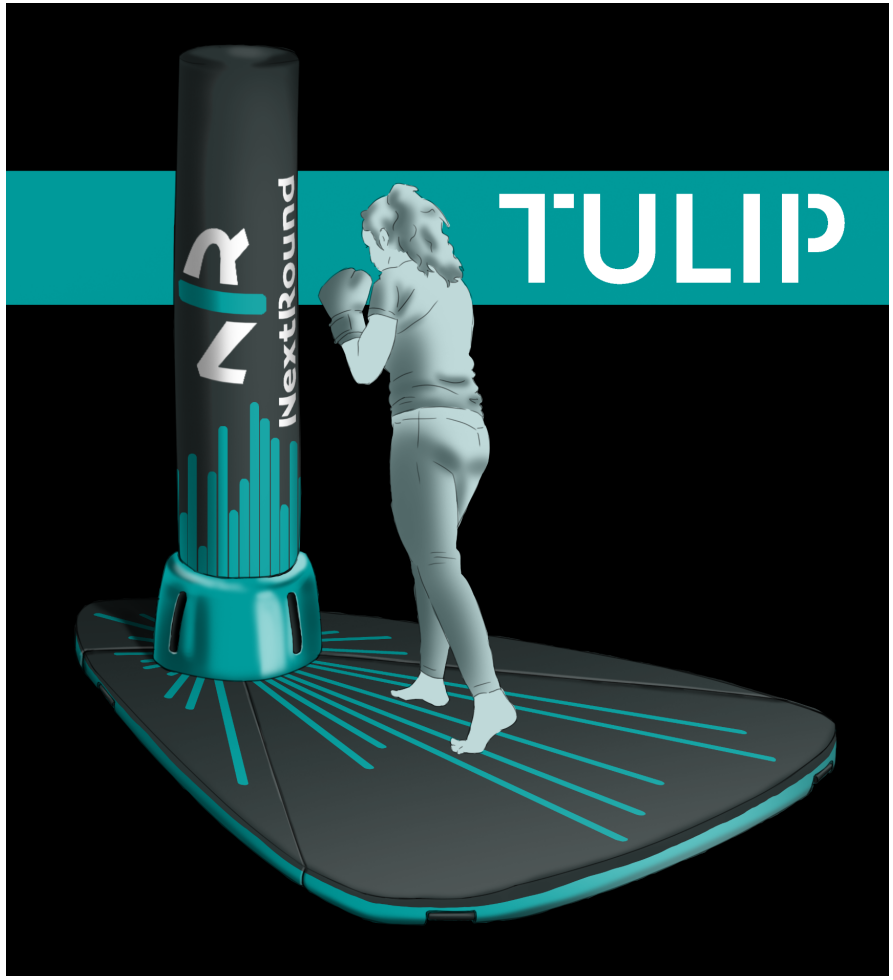


Figure 92: Drawing of the final concept of the NextRound Tulip.

The product can have its mats folded up by following a couple of steps, which are shown in Figure 93.

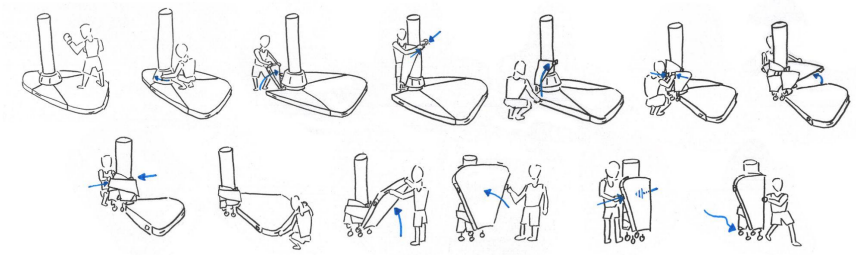


Figure 93: Sketches of the steps needed to fold the mats of the product upwards, to make it transportable.

This design is the conclusion of all the research and design steps taken up until this point. Thus, theoretically, it should solve all the problems defined earlier. However, I wanted to give the final concept one last evaluation in practice, with actual potential users, to truly test if it works as intended.

User testing

So, I set up a user test to evaluate the concept in practice. To do so, I built a 1:1 scale testable prototype and tested it with potential users.

Prototype building

The prototype was built using several different materials and techniques. The final product and the way it was built can be seen in Figure 94.

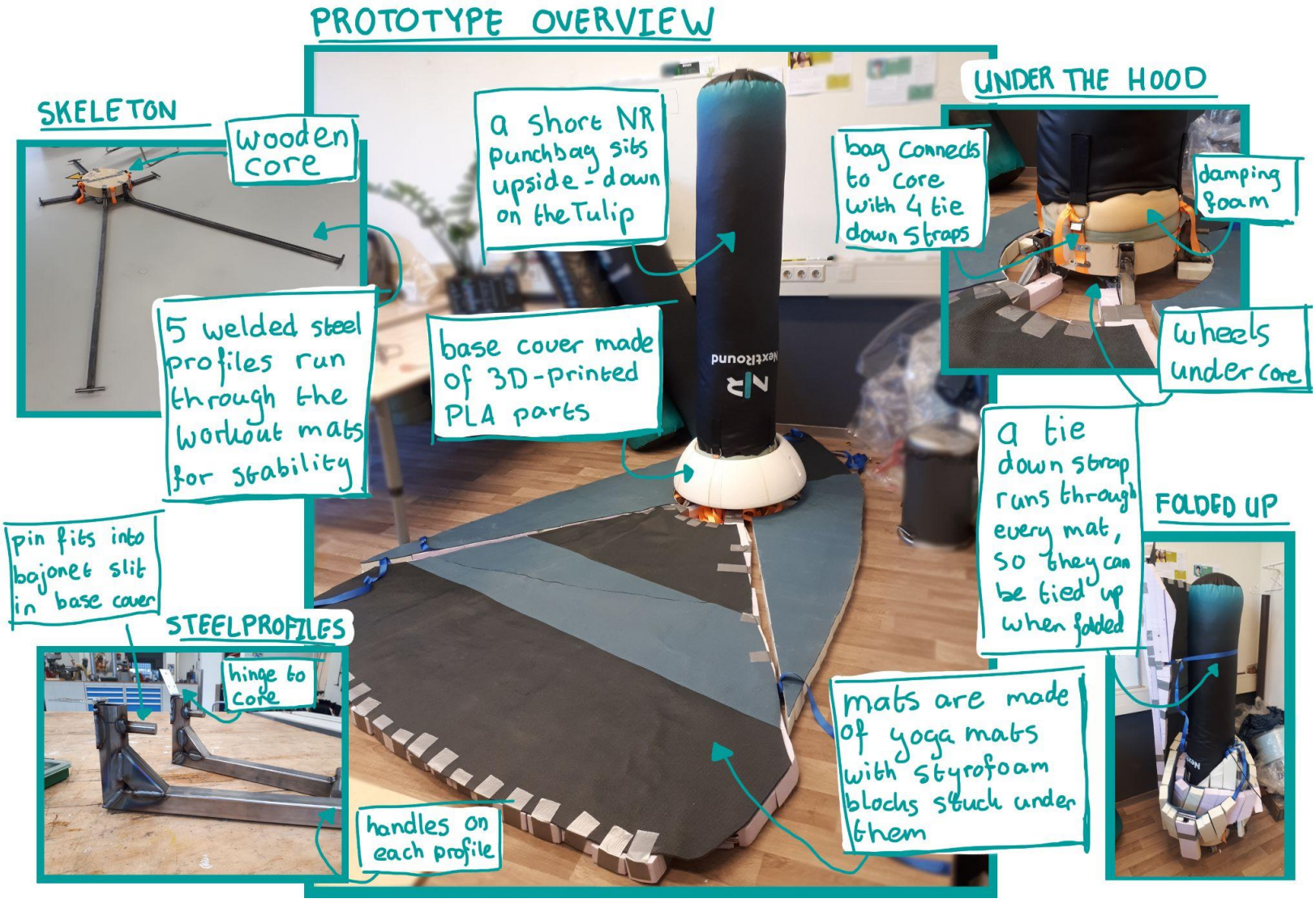


Figure 94: Buildup of the final prototype.

Testing plan

To evaluate the NextRound concept with potential users, I wanted to have them compare my prototype (Figure 95) with a NextRound punch bag in a “regular” punch bag stand (Figure 96) (in this case an Outshock stand). My prototype had a short NextRound punch bag mounted in it (one which is 1,50 metres tall), and the Outshock stand had a tall NextRound punch bag (one which is 1,80 metres tall) hanging on it. These evaluations were held at the NextRound office in Amsterdam in a semi-structured way:

To start off, I’d ask them how much experience they had with the NextRound system. Some participants had already worked out with the NextRound system, and some had no experience with it. I’d give those with little experience some more guidance with the app, while I let the more experienced participants pick their workouts themselves.

After learning about their experience levels, I would first let them do a short workout with the Outshock stand, and allow them to browse through the workouts in the NextRound Live app.

After trying out the NextRound system with the punch bag stand, I’d ask them to try out the prototype. When testing the prototype, I made sure to let each participant work out with the prototype, and also make sure each participant had to either fold out the prototype, or fold it back in, so they would experience this interaction as well.

Figure 95: User test participant working out with the NextRound Tulip prototype at the NextRound office.

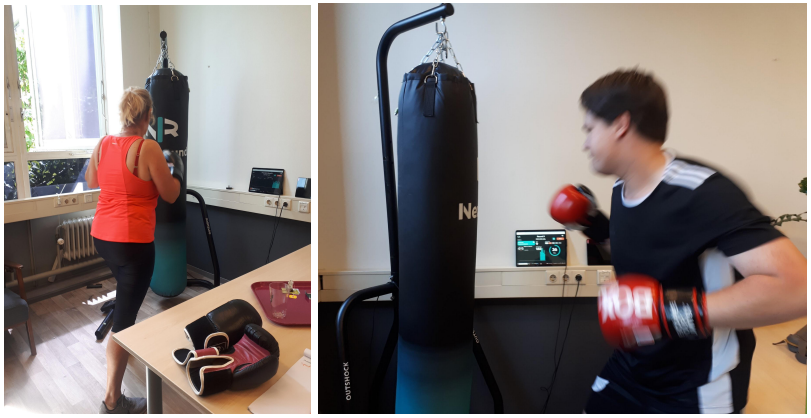


Figure 96: User test participants working out with a NextRound punch bag in a “regular” punch bag stand at the NextRound office.

After allowing each participant to work out with both the punch bag stand and the NextRount Tulip, I would ask them to reflect on both workouts. I asked them to compare the interactions, and give positive and negative feedback on the interactions.

Afterwards, I reflected on their feedback to evaluate the desirability of the NextRound Tulip concept, and to see if this concept helps solve the product-level and society-level problems stated earlier in this project (page 25-26 and 29-30). I also meant to find out whether this concept had problems not found earlier, which should be addressed in further development.

Test results

I conducted user tests with five participants. Each had prior experience with boxing. One was female, four were male. One was in his twenties, two were in their thirties and the other two were in their fifties.

When evaluating the prototype, the participants made the following notes (both positive and negative) on the concept:

Positive notes:

1. The NextRound Tulip system is very silent compared to the regular stand. The only noise you hear when working out with it is the impact of your punches.
2. The mats allow for a “playing field” to work out in. This playing field is described as a space in which users can work out safely (soft mats underneath, no objects in the way).
3. The mats enable users to do exercises on the floor (Figure 97) to make the workouts richer than when a user only does boxing exercises.
4. The NextRound Tulip is very suitable for training low kicks when compared to a hanging punch bag. A hanging punch bag will sway far, meaning users will need to wait for it to sway back before they can kick again. Since the Tulip doesn’t sway, users can do repeated low kicks without needing to wait for the bag to swing back.
5. Folding the mats out and back in was intuitive; every participant figured it out immediately.
6. While the prototype doesn’t look pretty, the drawing of the final concept (Figure 92) was considered aesthetically pleasing.
7. Being able to ride the concept around to different locations excited the participants, it enables them to work out in different spots (like outside for instance).
8. The feel of the mat enabled the participants to work out barefoot if they wanted to.
9. The Tulip does not require weights to keep the system in place, it keeps itself in place.

Figure 97: User test participant shows a leg exercise he could do with this product, and not with a regular punch bag stand.

Positive notes 1, 2, 3, 4, 7, 8, and 9 show advantages of the NextRound Tulip over existing solutions. They solve many problems stated before in the Product-Level Problems (page 25-26). These positive notes should help the NextRound Tulip in being a more desirable product than many existing products already on the market.

Positive note 5 was delightful to hear, it meant that the interaction with folding the mats is simple enough for potential users to understand without the need of extensive instructions.

Over all, I felt like the positive notes helped prove the desirability of a product like this one.

Negative notes:

1. The front mat doesn't fold neatly, and hangs outward when folded up (Figure 98).
2. The prototype could only measure impact from punches and kicks in its bottom half properly. Most of the punches given to the top half of the punch bag didn't register properly.
3. The base cover couldn't fit in the product when the mats were folded up, meaning it would need to lay on the side when the mats were folded up.
4. Over time, the punch bag would sag backwards slightly.
5. For tall participants, the punch bag would not be quite tall enough to do high punches and kicks.
6. The front mat is wide and heavy, which makes it hard to fold up for one person. With two people (Figure 99) it was very doable however.
7. When working out with the system, the mats would move apart from one another slightly, which created gaps between the mats.
8. The edges of the mats were a bit tall, which meant that if a user were to step on the edge or fall off, there would be quite a risk of spraining your ankle with this prototype.

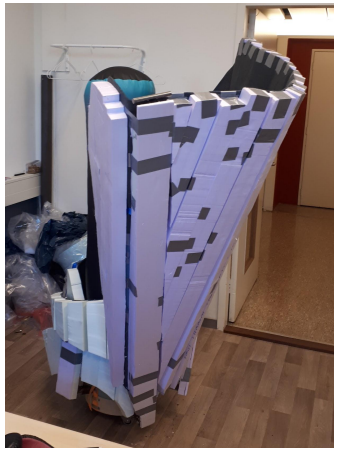


Figure 98: Even when the mats are folded up, the front mat hangs outward, meaning the product takes up more space than when it would fold up more neatly.

Figure 99: Folding the mats out was considerably easier to do by two people than by one.

When analysing the negative notes, I made a distinction between negative aspects of the prototype specifically, and negative aspects of the concept.

The negative aspects of the prototype are aspects which would be nonexistent in the concept if it were a proper product, instead of a made-by-hand prototype. I thought negative notes 2, 3, 4, and 5 (there were no tall punch bags available at the time of testing) would belong in this category.

As for the other problems, they would need more research and development before this product could hit the market.

As for problems 1 and 6, the shape of the front mat would need to be reimagined. It could for instance be cut in two front mats, or maybe one steel profile through the centre would be enough.

Negative note 7 could be solved by adding velcro, or another type of connection between the mats. This could prevent the drifting apart of the mats.

As for negative note 8, there are a few ways to tackle this. The mats themselves could be thinner, or maybe the edges should slope gradually down instead of abruptly.

I will evaluate the product concept in more detail in the next chapters. Specifically the problems the concept still has will be discussed further in Chapter 9.

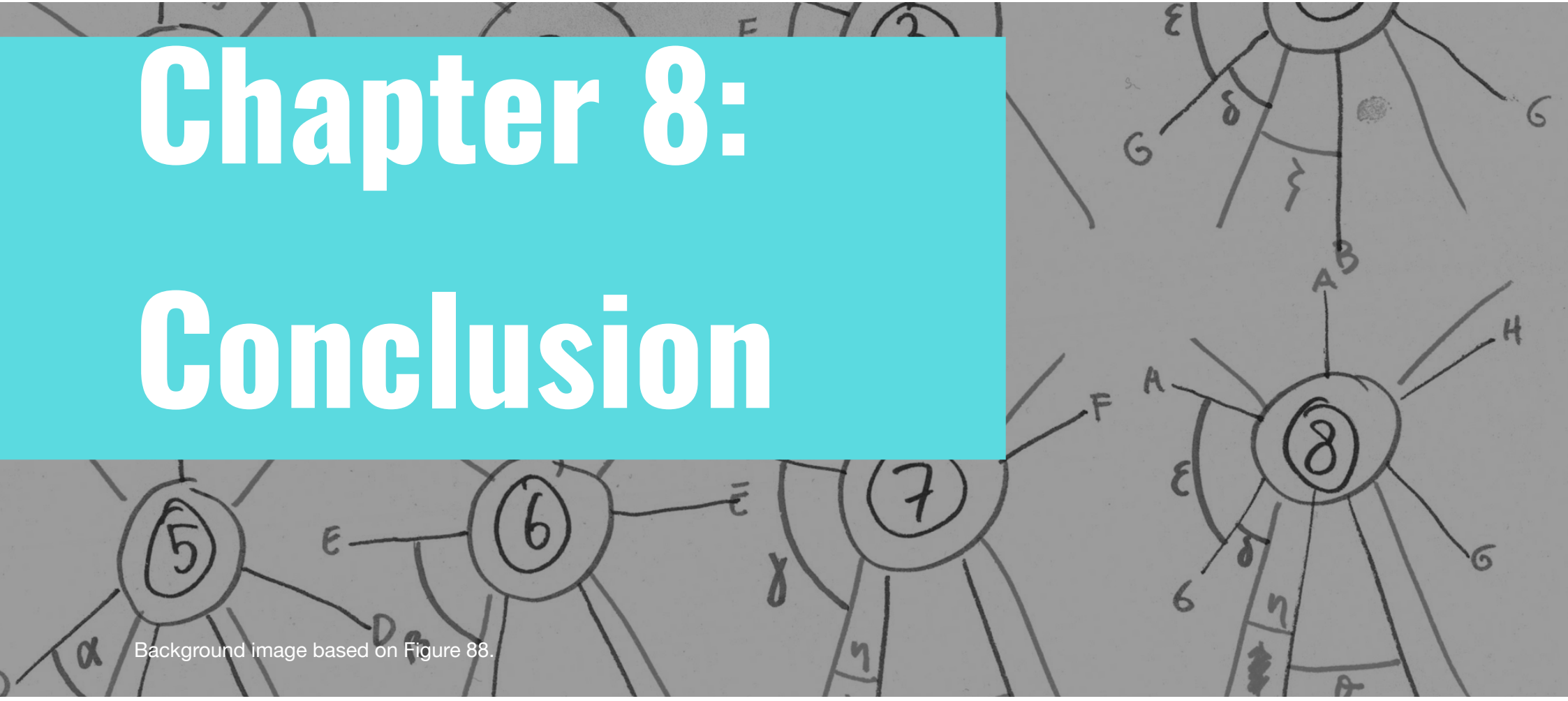
Chapter 7: Final concept - summary

The big picture of my final design of this project has been created and dubbed the NextRound Tulip. This concept product can be used with the NextRound punch bag to create a boxing workout system optimised for use at home.

I tested this concept product with potential users using a prototype of the concept, to find some final aspects which still need adjustments before this concept is developed as an actual product.

The final concept product of my project is done as of now. However, in the two following chapters I'll dive a bit deeper into the final evaluations I made on it and the recommendations I give to Sports-f(x) for the future development of this product.

Chapter 8: Conclusion



Background image based on Figure 88.

Concept evaluation

My solution to my project brief was designing the NextRound Tulip. In this chapter I'll reflect on the design itself, to evaluate if it solves the problems defined earlier, and meets the set requirements.

List of Requirements

The List of Requirements (page 61-62) was defined after the co-design sessions. Here you'll find a short reflection for each Requirement of whether and how the NextRound Tulip satisfies the Wishes.

- **Safety:** When working out with the NextRound Tulip system, users are guided in their workout by the NextRound Live app. Aside from workout guidance, the product also creates a safe workout space through its soft mats. The floor itself is soft and enables users to work out barefeet. Another safety advantage of the NextRound Tulip is that by laying down the mats, there can be no objects close to the punch bag. This way, users cannot accidentally hurt themselves to an object in their workout space. The only safety concern the concept still has is the potential of spraining one's ankle on the mat edge, I'll tackle this in the Recommendations chapter.
- **Integration:** The punch bag sits firmly in the product system, and integrates well with its shape. The tablet however, does not have its own place in the product itself. This was done deliberately, because together with the company I decided that any existing tablet holder/stand/clamp can work with the NextRound Tulip as is, so making a solution within this project would be unnecessary.
- **Functionalities:** Moving the bag around easily on wheels without needing to disassemble the system, and having it take up little space, are functionalities which I have not yet found in competing products.
- **Ease of installation:** Installing the NextRound Tulip does not require any tools and can be done by one person.
- **Preparation:** Folding the mats up and down can be done by one person. The front mat is as of now big and heavy, so it's not optimal, but it works.
- **Exercises:** The shape of the NextRound Tulip offers an opportunity to Sports-f(x) to create workouts which combine body weight exercises with boxing exercises.
- **Floor space:** With the mats folded up, the system takes up about 0,7 square metres of floor space, which is less than the demanded maximum of 1 square metre.

- **Height:** Assuming a tall NextRound bag (1,80 metres) is installed in the NextRound Tulip, the system is 2 metres tall, which is beneath the demanded maximum 2,10 metres.
- **Ceiling solution:** Irrelevant, as the product stands on the floor.

Every demand of the List of Requirements has been met. There are still some slight concerns within the Safety, Integration, and Preparation Requirements, and I will address these in Chapter 9.

List of Wishes

The List of Wishes (page 62-63) was defined after the co-design sessions. Here you'll find a short reflection for each Wish of whether and how the NextRound Tulip satisfies the Wishes.

- **Set-up time:** Setting up the prototype of the NextRound Tulip took about 80 seconds per user. This was for the prototype however, which isn't as neat as an actual product would be. Therefore I believe the set-up time of a produced NextRound Tulip would be less than a minute, which satisfies the wish.
- **Functionalities:** The mats make the NextRound workouts richer and offer opportunities for new workout exercises, thus offering more functionalities.
- **Form & colour language:** There is a uniform form language between the positioning product, the punch bag, and the tablet interface through the rounded-off shapes and bold lettering. The colour scheme of the NextRound Tulip is the same as the house style of the whole NextRound system.
- **Techniques:** Users can train techniques with this system, although that is more because of the NextRound Live app than because of the Tulip.
- **Footwork & Defence:** I did not really design a product which can help users train defensive techniques or footwork. There is potential to offer workouts on these subjects in the NextRound Live app, however.
- **Different punches:** The system allows users to use jabs, crosses, and hooks. You can't really do uppercuts on a banana bag, and I did not design a feature on the system to allow for uppercuts either. So this wish is not really satisfied, because I did not make changes to the shape of the punch bag.
- **Impermanent installation:** To use the NextRound Tulip, users do not need to make any permanent changes to the space the punch bag is in, which is convenient.
- **Silent:** The user tests with the prototype showed that the only noise heard when punching at the bag is the impact noise of kicks and punches onto the bag, which participants noted on and enjoyed.

- **Exposure:** The NextRound Tulip can be moved around relatively easily, which means users can put it in a place where they won't feel exposed if they wish.
- **Out of sight:** The NextRound Tulip doesn't really get out of sight when not in use. However, users could hide it if they wished, since it's relatively easy to move around.
- **Two users:** Users can easily move around the punch bag and alternate punches and kicks. So, the system is usable by two users at a time.
- **Cleaning:** I don't think the product is very hard to clean. The mats and base cover probably require to be wiped clean every now and then, and they are quite accessible for cleaning.
- **Inside & outside use:** Since the NextRound Tulip can be moved around relatively easily, users can work out inside and outside as they please. The product is not very weatherproof however, so it probably should not be stored outside for long periods of time.

The majority of Wishes can be satisfied with the NextRound Tulip as is, or with small adjustments on the user's part. The only Wish it truly cannot satisfy is allowing users to do uppercuts on the bag. Users cannot do uppercuts on a regular hanging NextRound punch bag either. Within this product, I have not found a solution to this Wish. The other Wishes however, are satisfied if you ask me.

Product-level problems

The NextRound Tulip solves many problems (page 25-26) which other punch-bag-positioning products have. It doesn't require people to drill into their walls or ceilings, it doesn't require extra weights to stop it from moving, it doesn't have to stay in one place, it's not noisy in use, it can take punches as well as kicks, and it takes up little space when out of use. Looking back at the earlier defined product-level design problems, it seems to solve all of them.

Society-level problems

Earlier I defined a number of society-level problems (page 29-30) which cause people to not work out. These came down to three categories of reasons: a lack of resources, a lack of guidance, and a lack of motivation.

- **People do not have the resources.** The NextRound Tulip is a complete product package for people to do boxing so it helps people who lack the resource of equipment or a location. Since boxing is a high-intensity sport, it takes people little time to get a good sweat in, meaning that it also works for people who lack the resource of time. The NextRound Tulip product system should give users all the resources they need to work out, and thus have their need for Autonomy fulfilled.
- **People do not have guidance.** The NextRound Live app contains materials which can help people with the motions

they need to do when boxing, and provides them with workout exercises. Aside from the app, the NextRound Tulip itself offers guiding through its mats. The mats can be viewed as a contour of the workout space a user has. Users will likely stay on the mats while working out, so they'll stay in punching and kicking range. The NextRound Tulip combined with the NextRound Live app should together help users fulfil their need for Competence, and give them the amount of guidance they need.

- **People do not feel motivated to work out.** As noted just now, I believe the NextRound Tulip as a product helps people fulfil their needs for Autonomy and Competence. Users who choose to work out together with somebody else could also help themselves fulfil their need for Relatedness. All in all, I think the NextRound Tulip will help users feel intrinsically motivated to work out.

The NextRound Tulip is not a workout product for everybody. But no product ever is. For those potential users who could get into boxing with NextRound through this product (I imagine people like the personas on page 45-48 could be those potential users), the NextRound Tulip would solve a number of society-level problems defined earlier.

Feasibility

Building the prototype of the NextRound Tulip taught me a lot about how it should be produced in the future.

The core of the product could be either milled from wood or steel. I used wood in my prototype, but I am unsure if wood is strong enough over longer durations of time.

The product will make use of a number of prefabricated parts. Among these are the wheels on the bottom, as well as the hinges which connect the steel profiles to the core. The hinges should be sturdy, and of the same material as the steel profiles, so they can be welded together. The steel profiles themselves should be welded as well.

To connect the punch bag to the base, the product will need several clasps measured to length, to keep the bag tightly attached to the core. The foam in between the bag and the core, which is the same type of foam used inside the punch bag itself to keep the steel tube with the sensors in place, is likely sufficiently dampening enough to prevent the stresses and strains from the impact on the punch bag to damage the core and the connections to it.

The mats themselves can be made like rollable gym mats (example in Figure 100). To produce these, Sports-f(x) will likely need to partner themselves with a company which already produces mats like these. I have as of yet not found any of these mats with metal inserts, so how feasible it is to produce these mats I cannot say with complete certainty, but I feel like it should be possible.

Figure 100: Example of a rollable gym mat, Nijha.

Lastly, the base cover needs to be produced. There are several ways Sports-f(x) could produce this part. They could make it out of plastic using for instance rotation moulding or injection moulding. Or they could let the outside shell of it be made by vacuum forming, and then add plastic with milled bajonet slits in them afterward. The part should be producible with all of these manufacturing techniques.

To conclude, producing the NextRound Tulip should be feasible, but requires a bit of research when it comes to the mats and the base cover.

Viability

NextRound as a product system is currently busy finding its place on the market, and who its users are. Therefore, what I say here should be read with the knowledge that I'm speculating here.

I think the NextRound Tulip (excluding the punch bag) would probably have a manufacturing cost of some €1200. This is based on the following estimations:

- Mats: €900 (based on the prices of rollable gym mats on the market)
- Prefabricated parts (wheels, belts with clasps, hinges): €90
- Core: €40
- Steel profiles: €80
- Base cover: €50

These numbers are very rough estimations. The NextRound Tulip then would likely cost around €1500 for retail.

Compared to existing products (punch bag stands and hooks), this product is going to be expensive. However, it is also considerably more high end. Therefore, there should be a market for this product.

The product will be expensive, but I believe there is a large enough group of potential users who'll want this product, which should make it viable to produce.

Desirability

The NextRound Tulip fulfils the requirements and wishes which I based on my user research. It also solves both product-level design problems as well as society-level problems to get people to work out.

The workout interaction with the product has shown to make people enthusiastic (as I found during the user tests with the prototype), and offers a fitting workout interaction.

I believe the NextRound Tulip will make people enthusiastic to work out, and feel autonomous while doing so. The fact that it can be folded out into a workout space and folded in to take up less space is a unique selling point compared to other existing products to position punch bags at home.

All in all, the product does what it should, offers a better workout interaction than existing products, and gets people excited. Therefore, the NextRound Tulip is a desirable product.

My thoughts on the final concept

This project was not without its challenges. In essence, my brief was to design an add-on product (the NextRound Tulip) onto a product which itself is still developing (the NextRound punch bag).

I think the NextRound Tulip is a strong product with potential. It was, from the start, a product built on actual potential users and their opinions. All of this with the intention to make it suit these potential users. In theory, it should, as the needs and requirements I set have been fulfilled. In many ways, it should be superior in interaction for at-home boxing to competing products.

Before it can become a true product on the market, it still has quite a long ways to go (the next chapter will give you more on that). There is still plenty to be developed about it.

All in all, I think this final concept is an exciting product with potential! I'm proud to have designed it.

Chapter 9:

Recommendations for future development

Background image based on Figure 94.

As for now, the concept of the NextRound Tulip as it stands is the end of my design project. From now on, it is in the hands of Sports-f(x).

There is still plenty to be researched and iterated about the concept though. In this final chapter you'll find my recommendations for the future development of this concept product.

Mats

The workout mats of the NextRound Tulip are the parts of it which will require most research and development from where they are right now.

Materials and production

In the concept as is, I suggested the workout mats to be made of the same material as rollable gym mats. To make them as such, Sports-f(x) would need to partner with a manufacturer who already makes mats like these, and work these parts out. They would also need to figure out how to integrate the steel profiles into the mats, as I have as of yet not found any gym mat manufacturer who uses steel inserts in their mats.

Sports-f(x) and the manufacturer should together also figure out the production costs of mats like these. I made a guesstimate earlier that producing the mats would cost about 900 euros (this was based on the retail price of regular gym mats, and then 20% more than that). Obviously, this is an educated guess, and nowhere near final.

If it turns out that this method would result in parts which are too expensive, there alternatives for mat materials which I imagine could work.

Maybe it might work to make the top surface of the mats out of leather, and then attach rubber gym tiles or foam blocks to it underneath. There are plenty of material options, and once again Sports-f(x) would need to partner themselves with a company with experience with workout floor surfaces.

Shape of the mats

The current shape of the mats was designed to be optimal for single-user use at home. It offers enough space for a single person to box on the punch bag, and to do body weight exercises on the floor. It was designed to then not take up too much space, so it would fit more easily on the floor. Two users can use it at the same time as well, although they would likely need to switch spaces a few times to both be able to beat at the punch bag.

I can imagine however, that some users would like a larger mat. For instance, because they would like to move around the bag more. So, it could be an option to produce multiple sizes of NextRound

Tulips for different users. An example of what this could look like is shown in Figure 101.

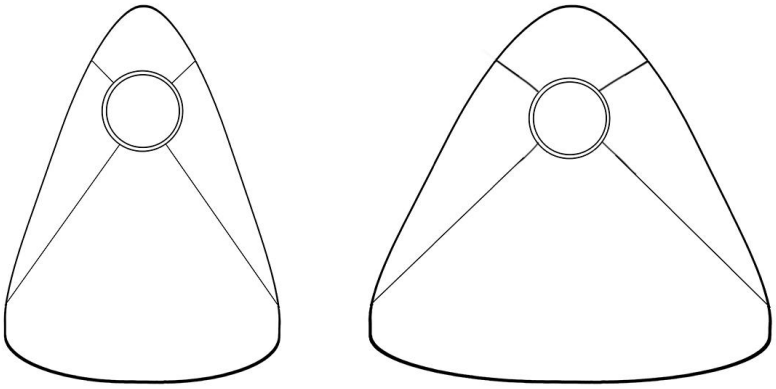


Figure 101: A sketch of the mats as is (left) and a sketch of what a larger mat could look like (right).

Another thing about the mat shapes which needs to be developed further is the front mat itself. As found in the user tests with the prototype, the front mat is wide and heavy, so folding it up by yourself is a bit of a hassle. What I also found in the user tests however, is that the system was very stable. So, perhaps the choice for the profile orientation (page 111-113) was over engineered, and having two profiles run through the front mat is excessive. Or maybe another option to make it less of a hassle is to split the front mat into two separate pieces. There are plenty of ways to make the front mat less bulky, and these should be explored.

Folding mechanism

The folding mechanism of the mats also needs to be explored. First of all, Sports-f(x) will need to find proper hinges to connect the profiles to the core. The hinges I used in the prototype would for the actual product not be sturdy enough, so the product needs thicker hinges.

Aside from needing thicker hinges, Sports-f(x) could also explore adding a spring damper system onto the connection between the profiles and the core, to make lifting the mats up and letting them down to the floor less heavy for users.

Lastly, the connection of the mats around the punch bag (when the mats are folded up) needs to be explored and tested. I think a system with clasps should work, but this needs testing.

Mat edges

As mentioned in the user test results, the outer edges of the mats are a bit tall, and there is a danger for users who step on the edge of the mats to sprain their ankles. A solution for this could be to give the mats a more gradual slope towards the end to prevent this spraining from happening (Figure 102). Other ways to prevent spraining could be explored as well.

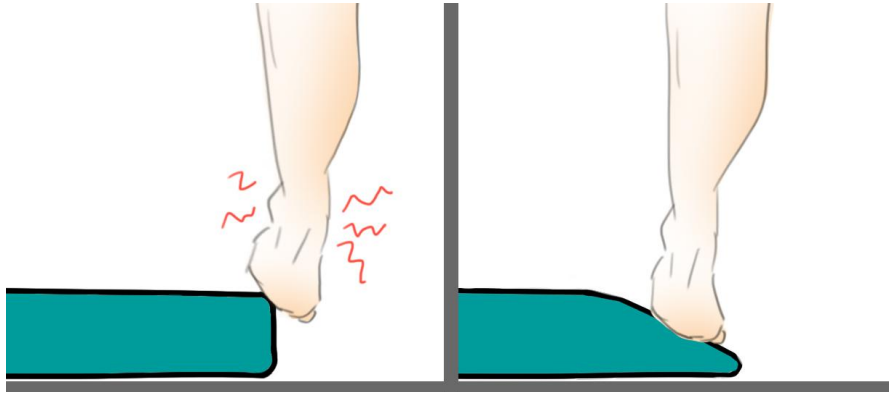


Figure 102: Sketches of how the outer edges of the mats could be changed to prevent users from spraining their ankles. On the left is a sketch of the current situation, on the right is a sketch of how the mat edges could be changed.

Aside from the outer edges of the mats, Sports-f(x) should also explore the mat edges in between the mats. As found in the prototype tests, the mats have a tendency to drift apart over a longer workout time. This problem needs to be solved. A solution for this could be to add velcro in between the mats.

Aesthetics top and bottom

Both the top and the bottom of the mats are going to be visible to the users. The top of the mats will be visible while the mats are folded out, and the bottom of the mats will be visible while the mats are folded up. Therefore, the aesthetics of both sides matter.

For the top of the mats, I made a sketch suggestion of what they could look like in Figure 103.

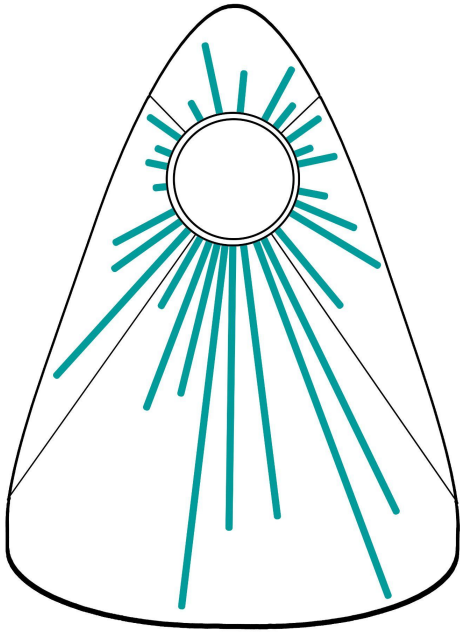


Figure 103: Sketch of what the print on the top of the mats could look like.

The lines here are based on the vertical bars in the graph which appear in the NextRound Live app when a user punches at the bag.

Testing

There are a number of things about the NextRound Tulip which will need to be tested and iterated in the future.

Tall bag

The user tests with the prototype were done with a short punch bag (1,50 metres), simply because at the time there was no tall punch bag (1,80) available. Since the short punch bag will make the system too short for taller users (they will look down on the punch bag and therefore cannot do any high punches), the future tests and prototypes need to be done with a tall punch bag.

Sturdiness

The system will need to be tested over a longer period of time on sturdiness. This could perhaps also be done in a simulation. All in all, it is going to be important to know how the system's sturdiness and integrity will fare after longer periods of use.

Workouts

Aside from recommendations revolving purely around the product I designed, I also have the following recommendations for workouts in the NextRound Live app, which can be enhanced by making use of the NextRound Tulip.

Reaction time training

Reflex training, or reaction time training, is an interest of users (as found in their reactions to the NextRound Wardrobe Studio concept), and something which is currently not really offered by any competitor on the market.

With the NextRound technology, it should be possible to offer some kind of Reflex training in the NextRound Live app. In a training like this, the app could give cues (probably audio cues) to prompt a user to do a certain type of punch or kick (for instance, a body cross, or a low left kick). The system could then measure the time between giving the audio cue and the registered impact of the user afterwards. This is a number it could then give to its users. This way, it's going to be possible for users to hone their reflexes and get a shorter reaction time.

Exercises with Tulip

Since the NextRound Tulip combines a workout surface with a punch bag, there is an opportunity to create workout exercises tailored to the NextRound Tulip in the NextRound Live app.

Aside from the well known body weight exercises such as push ups, planking, or sit-ups, Sports-f(x) could design exercises which make use of both the mats and the punch bag. For instance, they could create an exercise where users lay down on the mats, with their feet on either side of the punch bag. Then, they could do sit ups, and whenever they are up, they could give the punch bag a

jab-cross. Or, they could lay down with their feet both on one side of the punch bag, and then lift their legs up straight and move them to the other side of the punch bag (as was demonstrated by a user test participant in Figure 97).

All in all, there are plenty of opportunities for workout exercises in the NextRound Live app which make use of the NextRound Tulip's unique shape.

NextRound system

To let the NextRound Tulip function fully within the NextRound product family, there are some aspects which might need further development.

Connection punch bag

As for the sake of this project, I designed the NextRound Tulip to connect to a standard NextRound punch bag, with no changes made to the punch bag itself. This has the advantages of not needing to develop a special type of punch bag, and it allows for users who may already have a (NextRound) punch bag to own a NextRound Tulip without needing a whole new special punch bag. It has the disadvantage though, that the connection between the core and the punch bag has to happen through four belts.

As for the prototype, I used tie down straps to connect the punch bag to its core. For the actual product, a different connection is likely needed. I would suggest researching a different kind of clasp to keep the system in place.

Another solution would be to design a special type of punch bag to connect to the core, perhaps one with more connection points than four.

As for the scope of my project, I made the design so it functions with a standard NextRound punch bag. However, the opportunities for different, and better, connections should be explored.

Tablet

The tablet with the NextRound Live app currently does not have a connection with the NextRound Tulip. The reasons why have been explained on page 122.

In the future it might be interesting to explore connecting the tablet to the product.

Print on punch bag

In the drawing I made of the final version of the NextRound Tulip (figure 92), I drew a different print on the punch bag than the product currently has. This was because Sports-f(x) gave me some freedom visualising the bag prints, as they are still experimenting with different prints.

I would suggest that, if the punch bag for the NextRound Tulip can indeed be a standard NextRound punch bag, that Sports-f(x)

changes the NextRound logo to be sideways on the punch bag. This would mean that, whether users have their punch bag hanging down or standing in the NextRound Tulip, the print of the logo will never be upside down.

Aside from that, I think it would look neat if the pattern on the punch bag and on the mats of the NextRound Tulip were integrated with one another. This is why I sketched vertical blue bars on both the mats and the punch bag in Figure 92.

Viability

Earlier on page 126 I made some rough estimations to the viability of this product. Since the product is still a concept at this point, and since I am no expert on the financial aspect of product development, the viability of this product definitely needs a more thorough analysis.

Cost price

On page 126, I gave a rough estimate of how much it would cost to produce one NextRound Tulip, and what the retail price would likely be. This is only a rough estimate however. Once the production partners and materials are more defined, a thorough new cost price analysis should be done to get the actual cost and retail price of this product.

Production numbers

Even after my studies, I feel like I lack the experience to make an estimate of how big the series size is of the first batch of NextRound Tulip. Somebody with more production knowledge than myself should have a look at this and make a proper estimate.

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