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Designing a digital service platform for racquet sports equipment maintenance

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Abstract

This project aims to design a digital platform that will improve the racquet stringing service experience in Denmark for both service providers and customers. An argument is made that there is potential for the service process of racquet stringing to be improved. Racquet stringers spend too much time on generic tasks involving order creation and processing, and racquet players can be used as co-creators in the service, thus also providing them with increased accessibility and convenience. A literature review shows that no previous work has been done in the broader area of sports equipment maintenance and troubleshooting, and that this project will contribute new knowledge in that area. The literature review also investigates the reasons that users choose to adopt or reject new technology, just like it finds that customers of a service are willing to provide labor if they believe it will add value to the final result of the service. Furthermore, a review on academic research on parcel lockers verify the idea that the greater convenience and accessibility of parcel lockers will be able to create value for the users.

The researcher adapts an interpretivist approach, emphasizing that humans create meanings, and places the users in the center of the design process. Working with a service design approach, the author aims to design an improved service proposition through the means of a digital platform and parcel lockers placed in clubs. This is done by working with the double diamond as a framework, and applying methods from the fields of service design and interaction design with the purpose of co-creating with users. A clickable prototype was created in Adobe Xd and was used for several rounds of evaluation through think aloud testing, while other methods of insight gathering include interviews and brainstorming sessions. The deliverables, i.e. what will be presented as a final outcome, are a clickable prototype, a value proposition canvas, and a business model canvas. The values that the service proposition will add to the current service are 1) relieving stringers of some of the most generic tasks, and allowing them to focus on providing a good service, 2) allowing stringers to reach a broader audience, and players to reach more service providers, and 3) offering players convenience in order creation and service delivery, as well as accessibility in the shape of offering them the service during an extended window of time during the day.

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1 Introduction

This study will address the racquet stringing service, a service for racquet sports that have yet to be affected by digitalization, and attempt to design a digital platform with the purpose of creating more value for the users than is found today. Within the field of sports, digitalization plays various roles. Xiao et al. (2017) state that there is an increasing amount of digitalization used in sports - whether for performance optimization, equipment retail or merely an intensified experience. There is potential to track athletes' performance, harness and contextualize data, bring sports technology to the individual user, and enhance otherwise manual processes within the field of sports (Almudi et al., 2017; Canhoto & Arp, 2017; Gruettner, 2019; Pingali et al.,2000).

It will be argued that there is room for improvement in the current racquet stringing service layout in Denmark. Both stringers and customers experience pains and frustrations associated with the service delivery. This study will revolve around designing a digital platform with the purpose of creating value for both customer and service provider. The methodology builds on the fields of service design and interaction design. Service design is a field that is built on involving people in the process of designing and developing a service (Polaine, 2013). Interaction design deals with "designing interactive products to support the way people communicate and interact" (Preece et al., 2015). In the fields of service design and interaction design, there has been no academic work on racquet stringing and how the service is delivered. In Denmark, there is very little customer involvement in the service of racquet stringing, and there isn't a digitized or newly adopted service delivery method. This study involves the entire service of racquet stringing, and it will include features from other services, such as parcel delivery, using customers as co-creators of services, and trust in a hands-free service. These concepts and theories will be researched in a literature review, which will also entail a section on academic work in other areas of sports that have experienced technological and/or digital advancements.

The field of sports is a broad term, so it has been categorized into athletic performance enhancement, sports equipment manufacturing, sports equipment maintenance and troubleshooting, online training, e-sports, live-streaming services, ticketing systems, sports betting, and club related services (such as booking systems and membership management),

and most of these are going through, or have already gone through, major digitization processes (Gruettner, 2019; Xiao et al., 2017). This study will focus on sports equipment maintenance for the individual user within racquet sports using strung racquets. Racquet sports are highly popular in Denmark, and there are more than 200.000 registered tennis-, badminton- and squash-players in Denmark (Danmarks Idrætsforbund, 2020). There are other racquet sports, such as padel and table tennis, but given the fact that the racquets in these sports are not strung with strings, they remain outside the scope of this thesis.

1.1 The racquet stringing service process

This section aims to explain the current racquet stringing service process to the reader. Within the scope of this thesis lie the sports that use racquets with strings. These racquets are used by their owners with various frequencies, and need restringing every so often. This service is believed to stand to gain value . Higher level players break multiple strings every week, and therefore use stringing services with high frequency. There are various arguments as to how often a strung racquet needs new strings. A popular rule of thumb for amateurs in all string-using racquet sports is that unless the string breaks (in which case a restringing is necessary immediately), a racquet needs restringing as many times per year as hours played weekly. This means that if a player is on court for four hours on a weekly basis, they should have their racquets restrung four times per year. Either way, whether broken or merely in need of renewal, when a racquet needs new strings, players either 1) Take it to their preferred racquet specialist store for re-stringing, 2) Take it to a player at their club who strings racquets independently, or 3) string it themselves (requires a stringing machine, ranging from $300 to $6000, and expertise with stringing), which is a rare event.

The intention of this digital aid is to reduce the time that stringers spend on assisting customers with order creation and order processing, and expand the accessibility for customers to drop off and, in turn, retrieve their product upon service completion. Equally, another problem is addressed: Location of racquet stringer and location of playing court is not always within close geographical proximity, and store opening hours do not always make the service effortless for the customer. Rather than a “third party location point service experience” (home - club - **stringer/store**, a digital service and logistics solution will be proposed, where drop-off and pick-up will be available at the club during all the clubs opening hours (which are typically from

6am to 12am). Thereby, the service will happen where customers use their equipment, rather than somewhere they wouldn't otherwise need to go.

Stringing rackets with stringing machines has been going on since around the 1930s, and is done mainly in the specialized racquet sport retailers around the country. There is quite an extensive amount of work on the process of stringing racquets - meaning the actual stringing, where machines have gone from pulling strings with drop weight tensioning mechanisms to spring loaded tension cranks to electronically driven constant-pull mechanisms. Before machines, the strings were hand-pulled. This, however, does not take the service of racquet stringing into consideration.

To the extent of the knowledge of the author, there is little digital aid that goes into the racquet stringing service. When the racquets are brought to the stringer, there are processes that are time consuming for stringer and customer alike. If the player brings the racquet to a specialist retailer (who most often also strings racquets), there is a good chance that the customer will have to wait in line to get help. Alternatively, the stringer at the store, who typically has a set amount of time placed for stringing (this could be the entire work-day, or a given amount of hours until his/her time is needed on the floor to assist customers), will have to pause (or at least decrease the pace of) his/her work in order to assist the customer with a racquet for stringing. The guidance needed depends on level and ambition of the player (beginner, intermediate, tournament player), playing style (big hitter, counter-pusher, grinder, net-seeker etc.), tension - and subsequently there are formalities that need to be in place (name, phone number, price for the service, whether or not the service has been paid for, and when the racquet needs to be ready). The purpose of this service is that the customer will be part of the creation, as the order will be created based on their user profile (containing name, phone number, and an integrated payment system). The initial thought was that the customer will play a role in drop-off (creating the order digitally, and placing the racquet in a locker) and pick-up (using a "pick-up and pay" function in the application). The platform will log the customer's stringing history, and will allow the customer to pin selected stringings to the top of their dashboard, thus allowing them to create and place an order within a matter of minutes, at the same place where they play their sport. This solution, using clubs as a contact point, is deemed viable from a business perspective because there are so many clubs in Denmark, and racquet players "belong" to a club. The scope of this project is limited to Denmark, but scalability will be addressed in the discussion chapter.

1.2. The customer in focus

Bitner et al. (1997) talk about how some “experts believe that services can be delivered most efficiently if customers truly are viewed as partial employees and their participative roles are designed to maximize their contributions to the service creation process.” This, for example, could be when customers or receivers of a service help filling out information about their order - relevant for the racquet stringing service, as there are currently manual inputs of information necessary for each order to be carried out. Customers will play an important role in enabling the digital delivery of this service.

The introduction of a digital platform means that there is a degree of human interaction that fades. This comes with challenges, which will be addressed in the literature review, but it also presents opportunities due to the current circumstances in the world. With Covid-19 immobilizing the entire world, there is an increased focus on reducing unnecessary physical interaction. Giordani & Rullani (2020) claim that while it is not a universal truth, a temporary shock that enforces use of digital products and services, such as how the Covid-19 situation has changed our daily lives, is likely to leave a permanent stain and will affect the digitalization of a market. With the assumption that prolonging “opening hours” by creating parcel locker-themed solutions for stringing services would create greater value for customers, the Covid-19 situation has only further justified the idea of largely removing physical interaction between provider and consumer. The convenience and increased accessibility features of a digital solution (Walker & Francis., 2003) will mirror that of purchasing products online, which we have seen the retail industry move into over the last two decades. When creating an order with the platform designed in this study, customers will not have to wait until the next business day to refer to their local specialist retailer/stringer - they will be able to create the order instantly. At the same time, it becomes increasingly possible for service providers to offer their services to a broader audience, as their reach will go beyond those who physically find their way to the service provider’s location.

Services in general are facing a challenge when moving into the digital sphere. Some services rely heavily on physical presence for the delivery of the service, but the racquet industry doesn’t necessarily do that in the same way. This proposal raises the question of whether the service provider (i.e. stringer) will be able to fulfill the desires of the customer and provide them with sufficient information without interacting with them directly. Will a “string selector” tool, guiding

the customer to the optimal string choice for their style of play, be satisfying for the customer? And will the customer feel safe leaving their racquet(s) in a locker in their tennis club, rather than handing it directly to their trusted stringer? All the doubts beg questions to the trust of digital products. Denmark is known as a frontrunner in digitalization, and the people's level of confidence in government is high, which allows for extensive movement of personal information, which in turn promotes the use of information and communications technology (Igari, 2014). Digitalization is possible because there is a high level of trust - which is what is necessary for lack of personal interaction in a service, and for parcel lockers to function properly. Otherwise, the idea of the service would not be able to be brought to life, because customers would require physical interaction with the service provider.

1.3 Purpose & research question

With this project, digitalization's potential impact on a currently overall manual service on sports equipment will be investigated. The project will contribute to the area of digital services for sports equipment maintenance, which, upon research, has not presented any existing literature. The aim of this project is to design a digital platform that creates new value for both stringer and players, and to involve both parties in testing and ideating the design of the concept. It will provide an insight into how customers in sports equipment maintenance feel about purchasing services digitally, as they are increasingly doing with their products. Furthermore, it will propose an alternative use of parcel lockers, which have so far only been academically researched in the context of parcel delivery. Proven advantages of using parcel lockers, such as accessibility and convenience, will be explored in the context of sports equipment maintenance.

This article will contribute to the sports equipment digital services, which seems rather untouched if not for wearable performance enhancing applications. Likewise, there is a more dense concentration of literature revolving digitalization of sports (i.e. how sports are becoming performances are helped by digital tools like smart watches, trackers and radars), but said work pertains to whether or not people are interested in using technology to improve their athletic performance (i.e. previously unknown information). The field work done in this study has been conducted with the purpose of determining the requirements of a digital platform for the stringing service in Denmark, and to design, prototype and to evaluate the value added through the implementation of a digital platform developed to enhance the experience for customer and

service provider of the racquet stringing service alike. This leads to form the following research question: **How might a digital platform improve racquet stringing services in Denmark?**

A literature review was conducted with four purposes: 1) to research and define existing work on technologies and digitalization in sports, and thereby define the gap in the literature that this project will contribute towards. 2) to define the factors that affect whether or not users choose to adopt new technology. 3) to investigate the application of technology in a service, and the use of customers as co-creators, and 4) to investigate the possibility of using parcel lockers as contact points in the service process.

2 Literature review

The following section provides a review of relevant literature for the scope of this project. The topics that are reviewed include the following:

- Digital technologies in sports
- Acceptance of new technology
- E-services in sports
- Parcel lockers as contact points

2.1 Sports technology and digitalization

This section discovers the existing literature in sports technology and digitalization. The purpose is to define the areas that have been researched, and define a gap in the literature that this study will contribute towards.

Ferreira et al. (2020) conducted a bibliometric analysis to layout the existing research within sports innovation, and concluded that despite the need for innovation in sports, especially that involving digital technology, there are major gaps in existing literature on the application of sports innovation (innovation and entrepreneurial business ideas in the sports industry).

Aroganam et al. (2019) investigates trends and projections for wearable technology in sports, and why there is a need for such devices in everyday lives. They state that technology has allowed for greater user-centered design solutions for various industries, and that athletes are

drawn to quantify their own physical abilities. They also conclude that further user experience research will be beneficial to the field. There is also previous work on sports wearables (Canhoto & Arp, 2017; Chambers et al., 2015), which investigates the sensors inside the wearables, and how the wearables provide detail on athletic demands and performance. There is research on tracking technologies (Armstrong & Holeman, 1998; Pingali et al., 2000), where the purpose is to investigate the application of such technologies in baseball and tennis respectively. Racket stringing production processes (Cross & Bower, 2001; Joselow, n.d.) are also investigated with the purpose of optimizing tension accuracy in the racquet, but focus remains around product development and athletic performance enhancement. Therefore, digitalization of service facilitation and communication associated with maintenance and service delivery of sports products has not been sufficiently reported in literature.

Frandsen (2016) explores the transforming effects of digital media in sports organizations. She finds that media and communication have gained status as a powerful force in sports organizations. Ehnold et al. (2020) also investigate sports clubs, more specifically the scope and purpose of digital tools in clubs (i.e. employees communicating via intranet and video conferences, general administration, education, control of training processes, and managing member relationships).

It can be concluded that existing literature focuses on product development for sports and performance enhancement, but not on the design and development of service platforms in the sport sector. Therefore, this research contributes within the broader area of developing service platforms for the maintenance and troubleshooting of sports equipment, particularly for the racquet stringing service.

2.2 Acceptance of new technology

Walker and Craig-Lees (2000) investigate technology-enabled service delivery, and why customers might adopt or reject a given service. They find that there are proven advantages to adopting new technology. Customers can be offered additional or extended services, greater convenience and control, potentially more reliable information delivery, access to data and support services that may not have otherwise been available, and the ability to conduct transactions in such a way that does not necessitate the customer visiting the service organisation (Walker and Craig-Lees, 2000). Correspondingly, technology can be used by management to permit faster response to customer enquiries and problems, to improve internal

efficiency and productivity, to reduce labour costs, and to gain a number of distinctive and differentiating competitive advantages (Walker and Craig-Lees, 2000). The values that can be created with technology enabled service delivery will be used in the creation of a value proposition canvas.

Voss (2003) investigates service management and service quality in virtual service environments, where human interaction is not at the core. He states that creating trust is a major challenge when pursuing online services and e-commerce - it is difficult to gain, but easy to lose. Adoption or rejection of technologically facilitated services is moderated by the personal capacity and willingness of individuals (Walker et al., 2002). Intent and willingness to use new technology is no stranger to the academic profession, and there are models in place outlining constructs that affect a user/customer's intention to use (UTAUT (Venkatesh et al., 2003), Technology Acceptance Model (Davis et al., 1989)), such as perceived value, ease of use, etc. As the purpose of this study is to digitalize a manual service, these are concepts and considerations to keep in mind. The notion that trust in online services is fragile affected considerations on the business model during the creation of a business model canvas.

As mentioned above, the lack of human interaction, which is a prerequisite to accepting new technology, is an important consideration for this study. Technology can malfunction or break down, and its manner of use may create "technology induced hostility" in customers (Walker et al., 2002). Walker states that this might be due to technical faults and failings, but also due to situations in which human interaction is substituted or diminished by use of technology that is more in a service organisation's interest than in those of its customers. The aim of this project is to create more value for both customers and service providers than currently existing services. While existing models explicitly see service as being provided through interaction with people, new technologies are leading to increased automation of the service interaction (Voss, 2003). For service providers, the central issue is essentially that of deciding if a new and available technology, presumably one that would enhance the position of the provider, would be acceptable to customers and not detract from the overall service experience (Walker et al., 2002).

2.3 E-services in Sports

Product innovations in services can include significant improvements in how they are provided (for example, in terms of their efficiency or speed), the addition of new functions or characteristics to existing services, or the introduction of entirely new services. Providing on-site rather than remote management contact points is an example of an improvement in service quality (OECD, 2005). New Information Technology (NIT) has, ever since the internet was created, been used to create value and help conduct business. NITs help service practices enhance efficiency and reduce costs. When applying NITs to a service, it is typically referred to as an e-service, which is “the use of new information technologies via the internet to enable, improve, enhance, transform, or invent a business process or system to complete tasks, solve problems, conduct transactions, or create value for current or potential customers" (Benaroch & Appari, 2011). An e-service does not necessarily replace human interaction, however: “Several innovations can be termed digital or digitally enabled, which involve new combinations of digital and physical components to create novel market offerings" (Yoo et al. 2010).
Adoption of an e-service can also be compared to a technological process innovation (OECD, 2005). Technological process innovation happens when a production method (of a good or a service) is new or significantly changed. The concept of technological process innovation can be applied to sports equipment as well, as technological sports innovation involves the creation and improvement of sports equipment (Vrontis et al., 2019).

Applying service design to the process of innovating a service based on NIT goes along the lines with Lusch & Nambisan’s (2015) notion that innovations are no longer developed from within the confines of an organization, but rather emerge from co-creation between a network of actors (i.e. supplier and customer). Co-creation is defined by Payne et al. (2007) as the notion that “...suppliers engage with customers to co-create innovative goods, services and experiences”. Within the field of service design, building on a philosophy of building *with* people, not *for* them (Polaine, 2013, p. vii), the methods involve a user-centric approach and use consumer insights to ideate and develop solutions. Furthermore, the methods around prototyping and testing a product do not necessarily require advanced programming skills (Preece et al., 2015), emphasizing that the methods are meant for *designing* a product, not developing it. Prototypes are an effective way to explore design ideas and evaluate them with stakeholders, and service prototypes are sometimes captured in video scenarios in order to include role playing of service participants (i.e. customer and provider) (Preece et al., 2015).

Methods from Preece et al.'s *Interaction Design (2015)* and Polaine et al.'s *Service Design* (2013) are applied in this project.

According to Bitner et al. (1997), some "experts believe that services can be delivered most efficiently if customers truly are viewed as partial employees and their participative roles are designed to maximize their contributions to the service creation process." The most commonly lost opportunity is when enterprises neglect the resource that customers can be in terms of providing value back to the service. Customers are usually motivated to provide labor, knowledge, and data if these will help them get a better result (Polaine et al., 2013, p. 81). This notion can be found in Woratschek et al.'s (2014) research article *Value co-creation in Sport Management*, where the authors build their work on Vargo & Lusch's (2004) **service-dominant logic perspective**, suggesting that sports services (which are a means of sports goods) can be interpreted as resources that can be integrated into value co-creation processes. The intention of this project is to involve customers in the business process. Based on the findings in the literature in this section, I have been able to verify that customers can be used as co-creators in the business process.

2.4 Parcel lockers as contact point

Parcel lockers will provide important accessibility in this project. The idea of extending opening hours far beyond those of a retail shop is built around the idea that parcel lockers will be placed in clubs for customers and service providers to drop off and pick up equipment. Thus, we remove the need for physical interaction, and extend the amount of time and give freedom to the customer by increasing the accessibility of their returned equipment. This will be an important feature, and therefore this section looks to investigate the use of parcel lockers.

The section above dealt with using customers to co-create. Using customers as part of the service is no foreigner in the matters of logistics. With the rapid growth of e-commerce, last-mile delivery has experienced increased pressure, and forced innovation (Vakulenko et al., 2017). To deal with the higher volumes of deliveries and returns and increasing customer expectations, retailers and logistics service providers have introduced innovative phenomena such as self-service technologies (Ibid.). As Vakulenko et al. (2017) report, parcel lockers are one of these self-service technologies, and it has received positive feedback from both the customers and the service providers. Parcel lockers have shown to improve the service experience for the customers, while enhancing the performance of the service provider (European Commission,

2012), (Van Duin et al., 2020). In addition, live information and status of the product in delivery are factors that can greatly benefit from a service being digitized. Voss (2003) uses parcel delivery as an example: Seeing the status of a parcel in real-time, knowing that an order has been placed and processed, creates value to the customer.

A study from a Polish city showed that customers were especially satisfied with the speed of service and the 24 hour availability, just like the most favored parcel locker locations are on the way home from work or nearby home (Iwan et al., 2016), pointing to the fact that convenience is a priority. Weltevreden (2008) notes that when collection-and-delivery points are located in areas that already generate consumer trips, little additional travel will be required. With parcel locker technology, the customer is effectively included in the service creation, ultimately using the customer to co-create value Lusch & Nabisam, (2015) For consumers, self-service technologies provide location convenience and service efficiency. While there are many benefits of parcel lockers, customers also have concerns about the use of them, including low ease of use and sensitivity to vandalism (Weltevreden, 2008).

From this literature, I was able to define the benefits parcel lockers can add, and concurrently the issues they might present. The benefits, such as keeping track of an order, and lockers being placed conveniently for the user, will be implemented and evaluated in a prototype. Likewise, the notion that users disliked the lockers because they found them difficult to use, helped me ideate on how the locker functions on the platform should be very simple, as I, in the section on acceptance of new technology, found ease of use to be a factor in whether or not users would choose to adopt a new technology.

2.5 Summary of literature review

In the first section, an overview of the existent literature within sports technology was covered. It showed that, while there is a good amount of literature within sports and digital concepts, there is no work on applying service design to individual users' sports equipment services. It was concluded that this study will contribute new knowledge in that field by designing a digital platform for racquet sport equipment services.

In the second section, the acceptance of new technology was investigated. The purpose was to outline certain factors that are relevant when deciding on requirements for the digital tools in an e-service. It was found that there are various benefits to adopting new technologies (convenience, additional services, accessibility, control, payment etc.), but that the adoption and willingness to use is affected by how the user perceives the value and the ease of use. These two factors are kept in mind throughout the course of the design process.

In the third section, the reason for digitizing services, and the notion of co-creating value between customer and provider was investigated. The purpose was to verify that customers could be used as co-creators in the proposed business process (creating orders, dropping off and picking up using lockers). It was found that customers should be willing to provide labor, so long as they can see it creating a better result for themselves.

In the fourth section, research on use of parcel lockers was reviewed. As stated, parcel lockers play an integral part in this project, as they serve as the contact point between customer and service provider. It was found that there are certain benefits and obstacles in the use of parcel lockers, but the majority of the research on parcel lockers shows that the convenience that access to lockers provides is key to consumers. Concerns with parcel lockers are vandalism and ease of use, which customers sometimes fear is lower than preferred. This led to conclude that in this project, it is a necessity that interaction with lockers is a simple and effortless experience.

3 Methodology

This chapter entails the methodology of this master's thesis project and establishes why the methods and frameworks applied to answer the research question were selected. The purpose is to provide readers with enough information for them to understand the choices of method(s), to assess reliability and validity of the procedure, and to evaluate whether or not they deem the findings trustworthy.

The project works based on Saunders et al.’s (2016) perspectives on business research, and the following sections will take into consideration the research philosophy, approach to theory development, methodological path, and ultimately the methods for data collection and analysis

will be described. The steps of defining the research philosophy and the approach to theory development, are based on the research onion by Saunders et al. (2016) (displayed below in figure 1), who note that the methods of data collection and analysis are built on underlying issues, which need to be explained in order for the research design to gain academic respect.

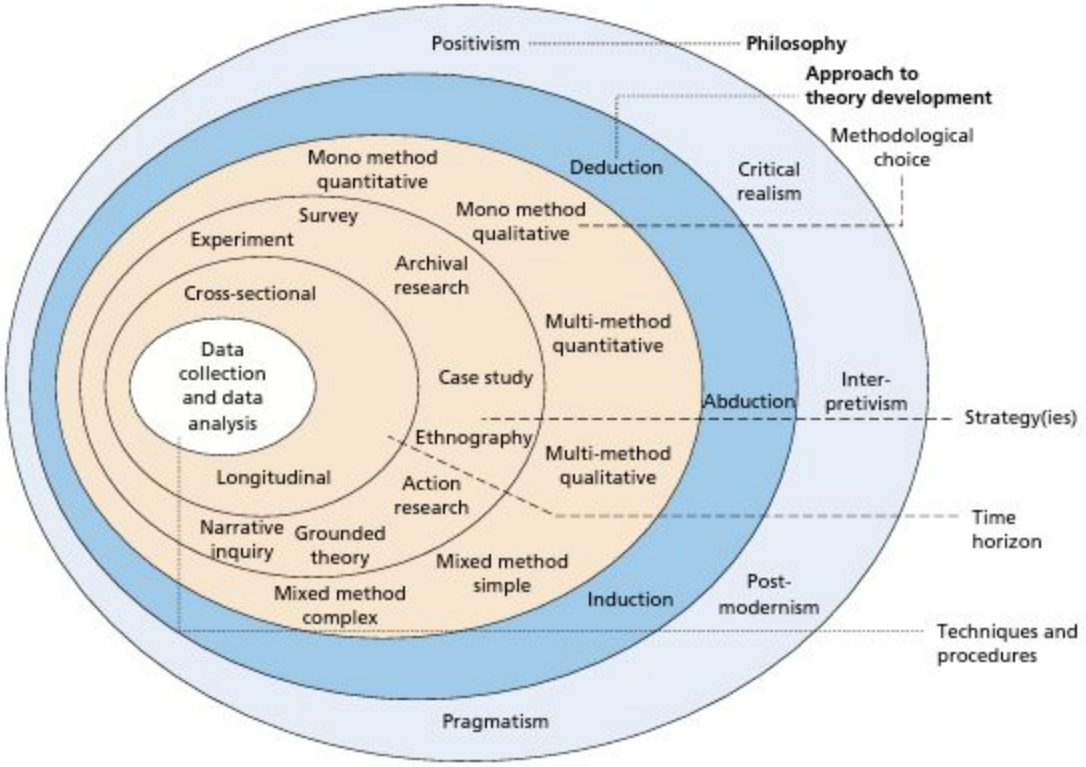


Figure 1 - the research onion (Saunders et al., 2016)

3.1 Research philosophy

Saunders et al. (2016, p. 124) describe research philosophy as a “system of beliefs and assumptions about the development of knowledge”. This study is based on interpretivism, which emphasizes that humans create meanings, and is appropriate for qualitative studies that seek to create richer understandings of a certain context (Saunders et al., 2016, p. 140). Interpretivism is a critique of positivism (Saunders et al., 2019, p. 140), which aims to define universal laws that apply to everybody. Interpretivism is based on the idea that humans experience different realities. Interpretivism argues against the idea that there are “universal ‘laws’ that apply to everybody.” (Saunders et al., 2019, p.140). Rather, people from different backgrounds and in different settings find their own truth, laws that apply to themselves, not everyone else. The job of an interpretivist researcher is to study these laws to gain a deeper understanding of certain

groups of people. Interpretivism helps the researcher look at a problem from the perspective of these different groups of people (in this instance players and stringers of racquet sports). Interpretivism is highly subjective, and therefore the researcher himself, due to extensive knowledge and experience in the field, falls into the category of subjectivist views, which should be taken into account.

3.2 Theory development approach

The approach to theory is often divided into induction and deduction, who are considered each other's opposites (Saunders et al., 2016). However, while beginning to write this section of my methodology chapter, I did some reflecting on how I *am* actually working on this project. I found myself looking at induction and deduction, and give them some thought. Per the book, "Deduction involves the development of a theory that is then subjected to a rigorous test through a series of propositions" (Ibid., p. 146), while induction works to create knowledge based on human interpretations of a context. Due to my extensive background knowledge on the matter, I have an immense amount of preconceived ideas for an application that I want to develop and test. You could say that I have a theory about if I develop features a, b, and c, output will increase with x and income could increase with y. However, with the iterative workflow processes of service design, and considering the fact that I am testing a prototype on players and service providers in order for them to provide me with feedback, I found myself somewhat in between theoretical development. With deduction, it is important that concepts can be operationalised in a way that enables quantitative measurement, however depth interviews and qualitative feedback doesn't exactly fit into this, and with developing an application, user feedback is absolutely key. It could be hard for the service provider to quantify the relative improvement in efficiency from using the digital tool instead of the way it is done today. That all comes down to how convenient and productive they find it, and that is hard to quantify. This notion, that sometimes qualitative research strategies actually start with a deductive approach to test an idea using qualitative methods, is mentioned in Saunders et al. (2016). They describe largely the same problem as mentioned above as an abductive approach, and note that "in practice, much qualitative research uses an abductive approach to theory development where inductive inferences are developed and deductive ones are tested iteratively throughout the research" (Saunders et al., 2016, p. 168)

3.3 Methodological choice, strategy and time-horizon

Moving into the next layers of the research onion (figure 1), we come by layers concerning methodological choice, research strategies, and time-horizon of the study. This thesis is a multi-method qualitative study, as it uses more than one method for data collection and analysis. The research strategy in this study is a design project. While the research onion does not display design projects in the “strategy” layer, the layer’s purpose is to address the plan of action, i.e. how the researcher will go about answering the research question. This happens with a **service design** approach. The time-horizon of the study is cross-sectional, as the design process happened over a short amount of time.

3.4 Design Process

When working in the field of service design, the focus is on “designing services that balance the needs of the customers with the needs of the business, aiming to create seamless and quality service experiences" (Stickdorn et al., 2017). The mindset of service design is pragmatic, co-creative, and hands-on, and it comes to show in the literature around it. The authors of the book *This is Service Design Doing: Applying Service Design Thinking in the Real World*, Stickdorn et al. (2017), attempted to define the term by crowdsourcing it with the help of 150 designers, who stated their own definition and voted for their favorite among the bids of their colleagues. Part of the most popular definition stated that service design works with methods that engage both customers and service providers, and that is the goal of this project; to design with the purpose of bettering a service for both customers **and** service providers (Stickdorn et al., 2017).

The following figure portrays the double diamond, the framework that will be used in the design process. A double diamond including the methods used in each phase will also be portrayed. After that, a table of methods will introduce an overview of the methods applied, the participators, and the activities/purposes/outcomes. The sections that follow will dive into methods applied and will describe them in further detail.

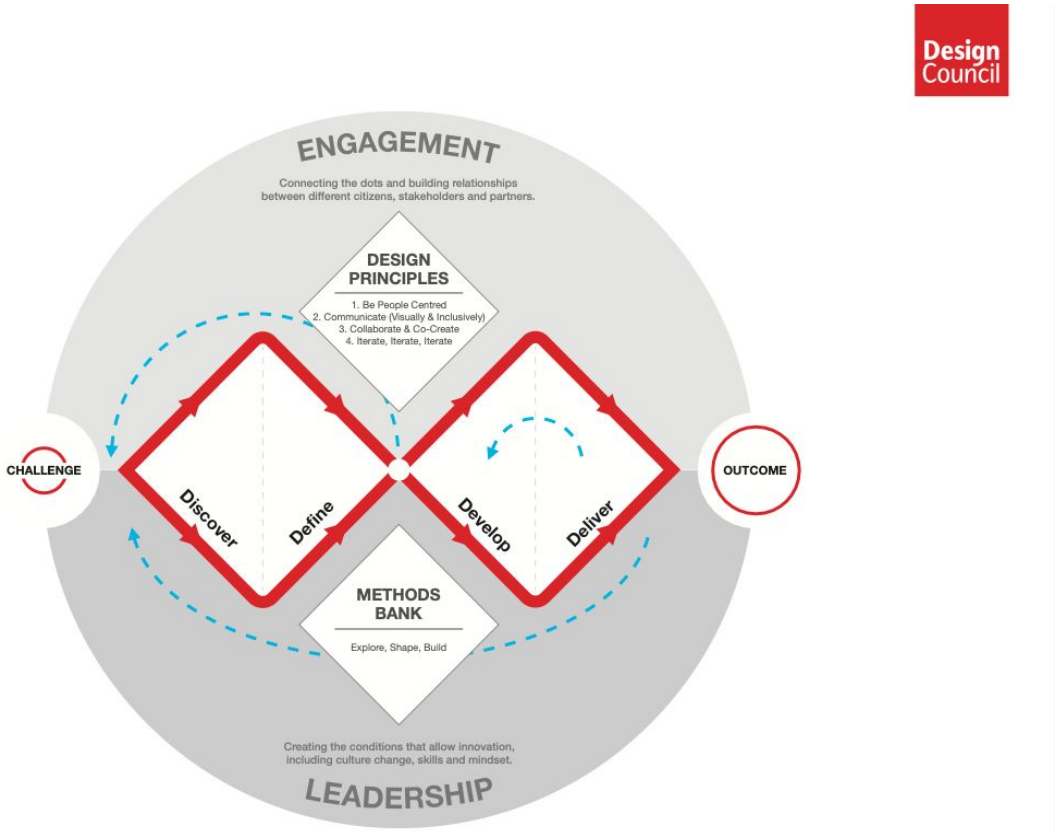


Figure 2 - the double diamond, as proposed by the UK Design Council.

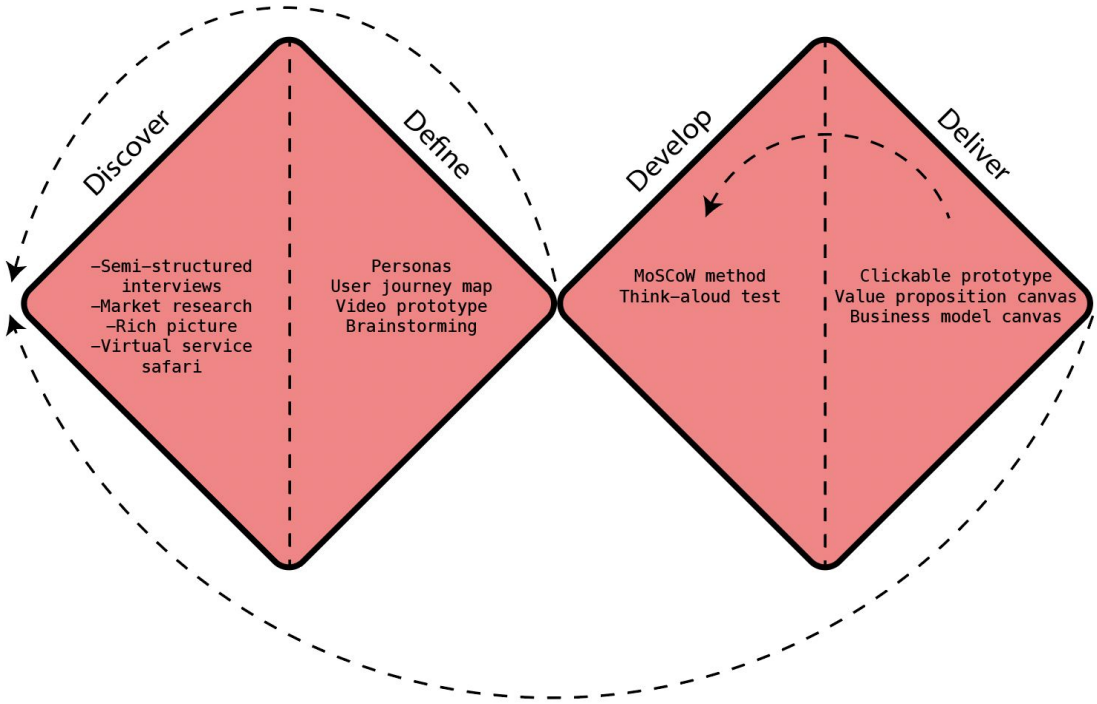


Figure 3 - this study's double diamond, including the methods and tools applied.

This project applies the double diamond framework. There are multiple frameworks, methods and processes that come from fields of software engineering, interaction design etc. that encompass iterative work. These have their own different wordings of the steps and phases, but they are all making sure to first find the right thing to build, before building that thing right (Stickdorn et al., 2017). The double diamond works in four stages (discover, define, develop, deliver) which take the shape of two diamonds to emphasize how divergent and convergent thinking guides the methods within - i.e. “It maps how the design process passes from points where thinking and possibilities are as broad as possible to situations where they are deliberately narrowed down and focused on distinct objectives” (Design Council, 2015). Likewise, another framework, The Process of Interaction Design, involves four activities; establishing requirements, designing alternatives, prototyping, and evaluating. A third interactive process called Design Thinking works similarly, with five stages (empathize, define, ideate, prototype, test). Common for these frameworks and processes is the notion that while the workflow suggests an order of progress, “the activities are intended to inform one another and to be repeated” (Preece et al., 2015, 1.5). The process of designing a service is iterative, meaning that the designer/developer is encouraged to move back and forth between stages upon new requirements presenting themselves.

I have chosen the double diamond framework because of previous experience working with the framework, and because of fondness for the idea of thinking convergent and divergent. The visualization of the double diamond also helps validate what is to be built, as the center of the model, the point between the two diamonds, is the point where one makes sure one is solving the right problem (Stickdorn et al., 2017). The Double Diamond isn’t a competitor to the other above-mentioned frameworks, but rather a model that incorporates many models and frameworks of design processes (Design Council, 2018). With the author’s extensive knowledge on the topic at hand, the process of the double diamond will help guide the author to design the right thing.

3.4.1 Table of methods & tools

The following presents an overview of the methods that were applied in the different phases of the double diamond framework.

Design framework	Double Diamond (Design Council, 2015)	Participants	Activities, purpose & outcomes
Discover	Market research/competitive landscape	Researcher	Researched the landscape of digital and non-digital stringing services, with the purpose of empathising with users and translating experiences into ideas for service propositions. Concluded that there was an opportunity to include players in service creation, since no such digital services appear to exist. Led to conduct interviews with stringers.
	Semi-structured/Depth interviews (Preece et al., 2015; Polaine et al., 2013)	Researcher, Stringers (White Sport & Independent	Conducted a 60 minute preliminary interview with two of the most experienced stringers in Denmark, in order to understand the current pain points of retail shop stringing services, and their take on player pain points. Led to create personas and a user journey map.
	Rich picture (Monk and Howard, 1998)	Researcher, Stringer (White Sport)	Rich picture mapping to define the complexity of the service. Visual representation led to brainstorm on interactions between players and stringers.
	Virtual service safari (Polaine et al., 2013)	Researcher	Investigated other service-delivery platforms with the purpose of looking at a service from the outside in, and to generate ideas about how this service might look.
Define	Personas (Cooper et al., 2007)	Researcher, 2 stringers (retail and independent	Created personas to accommodate players with different needs. 4 personas were co-created with stringers, leading to defining a group that would require a string guide.
	User journey map (Polaine et al., 2013)	Researcher	Developed a user journey map to understand the complexity through the eyes of players and stringers going through the service and experiencing it differently. Led to define pains and to brainstorm pain relievers, that are ultimately visualized in the value proposition canvas..
	Video prototype (Arnowitz et al., 2007)	Researcher	Created a video prototype in order to conduct testing on the entirety of the service proposition because parcel lockers are not part of the readily available infrastructure. Led to further insights on the service proposition, and to iterate on the clickable prototype.
	Brainstorming (Design Council, 2015)	Researcher, 3 tennis players, 2 stringers	Multiple rounds of brainstorming sessions with selected tennis players and stringers, with the purpose of ideating possible features and solutions that might benefit users (players as well as stringers) of the application.
Develop	MoSCoW Prioritization (Ahmad et al., 2017)	Researcher, Developer from DTU	Conducted MoSCoW prioritization with developer to consider what the most important features of the app could be.
	Concurrent think-aloud test (Usability.gov 2014)	3 stringers, 8 players)	Observed interactions of participants using the clickable prototype in order to understand their thoughts on interface.
Deliver	Clickable prototype (Arnowitz et al., 2007)	Researcher	Created a clickable prototype with Adobe Xd, using insights from interviews, video prototype feedback, and brainstorming sessions. Continuously edited and improved based on insights from brainstorming and think-aloud tests.
	Business model canvas (Osterwalder et al., 2014)	Researcher	Mapped the building blocks of the business proposition in a business model canvas to explore how the new business creates, delivers, and captures value.
	Value proposition canvas (Osterwalder et al., 2014)	Researcher	Created a value proposition canvas to ensure that the value this project intends to create fits the expectations of the users.

3.4.2 The iterative flow of the Double Diamond

As mentioned, the double diamond model maps four stages of activities in designing a service. Each of the four stages will be headlined, briefly describing the purpose of the phases before going into detail about the methods applied in the given phase. It is also worth mentioning that the process is not linear. The arrows on the double diamond figure above will show that the author was led back to previous stages of the double diamond for further iteration. For example, while prototyping is described as a method in the develop phase of the double diamond, early prototyping and testing can also be considered part of the discover phase (Design Council, 2019).

3.5 Discover

The first quarter of the Double Diamond covers the start of a design project. It is a period of discovery, information gathering, identifying user needs, and developing initial ideas. It is meant to help people understand, rather than assume, what the problem is, and is applied by speaking to and spending time with people who are related to and/or affected by the issue (Design Council, 2019). The diverging shape of the first quarter represents the concurrent divergent thinking - meaning that the researcher is open to a broad spectrum of information. Methods applied in the ‘discover’ phase were market research, semi-structured interviews, rich picture and a virtual service safari.

3.5.1 Market research

Research was conducted on the existing landscape of digital business tools for racquet stringing. Upon researching the web for digital tools, and reaching out to a network of actors in the field (local stringers, racquet sport retailers, the European Racquet Stringers Association), digital tools and services within the racquet stringing industry were identified and investigated with the purpose of defining features that could be relevant for this project.

3.5.2 Semi-structured interviews

Polaine et al. (2013) and Preece et al. (2015) use the terms depth interview and semi-structured interview respectively. They hold many of the features, such as using both closed and open

questions, but both staying within a certain context. The interviewer will start with some preplanned questions, but will attempt to exhaust the information that the interviewee has to offer on the topic. (Preece et al., 2015). Depth interviews are long interviews with relatively little structure, but in the context of a topic. They provide an opportunity to explore relevant issues while also allowing the interviewer to verify what the interviewee says (Polaine et al., 2013). For these reasons, both methods were applied to the interviews of this project.

The interview guide was very loosely defined, as the purpose was to explore and gain information with an open mindset. The interview guide held questions on the topic that the interviewer deemed appropriate and wanted to cover during the interviews. As depth interviews/semi-structured interviews allow for the interviewer to pose follow-up questions and probe, i.e. ask the interviewee to elaborate their responses, they follow the notion that the interpretivist approach takes; to understand the meaning and situational interpretation of the interviewee (Saunders et al., 2016).

When conducted properly, interviews are the most efficient way to engage with people in the right context and allow them to explain (Polaine, 2013, p. 50). The purpose for the interviewer is to set an informal scene and ensure an engaging interview (Polaine, 2013, p. 51). Therefore, service provider interviewees were met at their place of business, whether at a retailer or stringers at a club, while customers were met in their club. With the level of knowledge of the author, fairly little research was conducted before the interview, and main focus was on designing tools for interviewees to interact with. Furthermore, it is important to note that the interviewees should never be corrected about something they explain, even if they are completely wrong (Ibid. p. 51). Rather, they will be asked how or why they know what they know. This pertains to customers, and not service providers, as the interviewed stringers are assumed to be more knowledgeable than the author.
An informal talk with stringers took place before the actual interviews, which were conducted individually. The reason for individual interviews, rather than making it a focus group, is that while focus groups hold many of the same benefits that depth interviews do, focus groups have the limitation of only giving each participant relatively little speaking time, and there is a risk of social pressure from other participants. Therefore, Polaine et al. (2013) argue, in-depth interviews offer better insights and provide more value for money.

To remain within the right scope, but still stick to the interpretive approach, I decided to create an interview guide that would not have specific questions, but rather to have a bullet-point overview of areas of the service that I wanted to get covered. Being able to pose the questions freely/without strict manual would also allow me to create a more comfortable environment for the interviewees, making them feel as if it were an informal chat between two acquaintances, rather than a formal interview, thus creating a relaxed setting for the interviewees to speak their minds openly.

The interview guide was focused on finding out how other service providers (i.e. racquet stringers) feel about the way they deliver their services, and how they would feel about the flow of the proposed service innovation. In order to guide the interviews in the right direction and promote and further discussion (Saunders et al., 2016, p. 391), I made a clickable prototype in Adobe Xd, which was very basic, but had the essential features of the initial idea, which I would then walk the interviewees through.

The interview guide looked as follows
-What does the stringer's service currently look like?
-What are some of their pain points in the service delivery?
-What is most important to the stringers in terms of service delivery?

The first interviews I conducted were with two stringers from one of Denmark's oldest racquet shops, White Sport. The one had worked there for nearly six years, where he has been stringing racquets from day one. The other has had his own racquet stringing and customization business for approximately 7 years. He now also works at White Sport, and is poised to take over the business after the current owners. I started with the service provider because I wanted to get a grasp of whether or not other service providers shared the same views and pain points that I did. Also, with them working at a retail shop, meaning a 3rd party venue, it was interesting to hear if they would welcome a service like the one I propose. After all, it would mean taking a cut in bottom line profits due to the app's commission fee.

3.5.3 Rich picture

A rich picture is a presentation of the work context of a problem. It is a tool for understanding the complexity of a service. "The rich picture depicts the primary stakeholders, their interrelationships, and their concerns. It is intended to be a broad, high-grained view of the

problem situation" (Monk & Howard, 1998, p. 22). The rich picture can be separated into three important features; structure, process and concerns. Structure includes all the people of a service, along with the physical and geographical aspects, while process refers to the direct interconnectivity between the structural elements, and concerns refer to the motivations of the actors in the rich picture. I decided that a rich picture would be beneficial after my first round of interviews, and it was created with help from the two stringers from White Sport, because White Sport is the biggest racquet retailer in Copenhagen, and therefore arguably represents a large group of users, and an individual stringer from Gentofte Tennisklub. They were selected because they all have the benefit of a long and proven track record within racquet stringing, just like both are racquet sport players themselves.

3.5.4 Virtual service safari

Service safaris serve the purpose to provide inspiration and generate ideas from other businesses and other industries, seemingly unrelated to the service of question (Polaine, 2013).

With the proposition being a business model where revenue streams stem from commission percentages of service charges from both customers and 3rd party service providers, it was beneficial to conduct research on how other third party applications were outlined, and gather intel on how marketplace providers create value for both customers and service providers. This type of business model is particularly popular within the food and restaurant business, where companies like Wolt, Uber Eats, Just Eat and Deliveroo create a space for restaurants and customers to link up.

I conducted research into how companies like Wolt, and Just Eat function, attempting to answer the questions below:

What do the services claim to be their advantage?
What are key advantages for service providers?
What are key features in the app?
What percentage do the businesses charge their users?

3.6 Define

The second part of the double diamond is the Define phase, which is the phase where designers try to make sense of the information gathered in the first phase. The insights are supposed to help the researcher define the problems, and the goal is to apply methods that frame the specific design challenges of how user needs and issues align (Ball, 2019), by structuring findings into a reduced set of problem statements (Design Council, 2015). The converging shape of the second part of the first diamond represents the convergence of information into specified issues for solving in the next phases. The methods applied in this stage of the work were personas, user journey mapping, video prototyping and brainstorming

3.6.1 Personas

After a few interviews, most significantly an elaborate interview with a stringer from White Sport, I decided that, because different kinds of customers of stringing services require different attention, and because this idea did not suit each type of player equally, personas could help me specify the necessary features in the service for the target user segment. There seemed to be a group of people that he felt might not be thrilled about the fact that the physical interaction and dialogue was reduced/removed, and so I split the players up into personas

Personas are “a way of thinking and communicating about how users behave, how they think, what they wish to accomplish, and why” (Cooper et al., 2007, p. 75). They are based on the behaviors of relevant users in a project. According to Cooper et al. (2007), the logic of creating products to satisfy the largest possible amount of people often make designs navigationally challenging for users. Instead, they recommend designing for specific types of individuals with specific needs. In that way, it is possible to accommodate a variety of users. Furthermore, it is important to choose the right individuals to design for - the ones who represent the needs of a larger set of key constituents (Cooper et al., 2007, p. 77. Separating different groups of users into persona segments is helpful because it can help a designer determine what actually characterizes the users of a service, and not just how a researcher views it. This kind of user is referred to as an elastic user (Cooper et al., 2007). Everyone has their own view of how a user experiences something, so specifying personas is helpful to keep focus on the actual user needs.

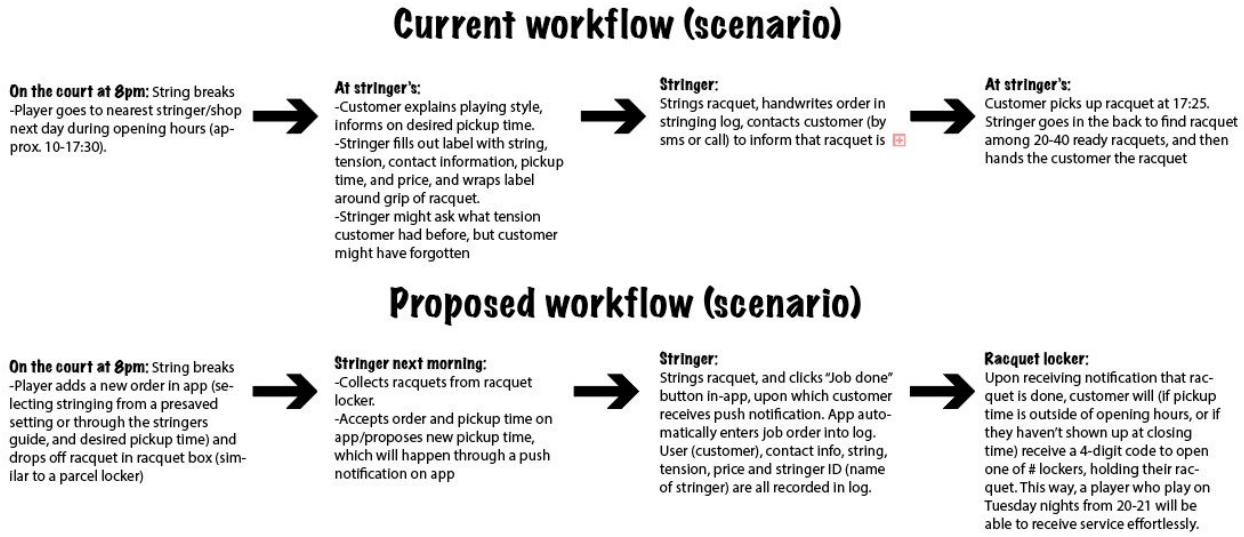
At first, I decided to create three different customer personas: The first was the customer who either breaks their string OR decides it's time for a new one (based on time elapsed since last stringing), and goes to their preferred stringer and asks for guidance on what to choose next. The second kind of player is the one that plays often and re-strings often, who is interested in knowing more and will try different options, and the third is the player who is well-aware of what he/she plays with, has their own string, and merely needs stringing. I wrote down the specifications of these personas and showed them to my group of selected stringers, who suggested that there could be a fourth - the one who doesn't come in often, and also doesn't need guidance. This is the type of player that doesn't care much about what is in their racquet, so long as it is playable.
I also found it relevant to ask the group of stringers (4 others and myself), who had agreed on the four archetypes, what the demographics were on these personas in terms of relative customer base size, and relative revenue size. They suggested slightly different numbers, but largely agreed (i.e. retail stores said customers who needed guidance represented a slightly larger percentage of the customer base, but noted that this could also be due to the relatively higher age of customers who "still" go into brick & mortar stores and request guidance).

3.6.2 User journey map

The user journey map is a visual representation of a user's journey through a service, showing the different interactions they go through (Design Council, 2015). I deemed it appropriate because it takes the user's point of view, and I have primarily the perspective of the service provider. It would help me establish credibility, and could ensure that I manage to see issues from all relevant angles. The aim of a User Journey Map is to identify problems in a service where new things can be added (Ibid.), and by trying to generate new concepts by reorganizing how actors in the service work together (Polaine et al., 2013).

With the elaborate experience of the author, it was possible to create a journey map without elaborate interviews/observation, which are otherwise recommended methods to establish workflow. Upon agreeing to collaborate with Tala Azlak of the Danish Technical University for development purposes, I created two basic workflow scenarios. One of how the service looks today, and one of how I believed that the service would work even better - for her to understand the touchpoints between customer and service provider. These workflows are shown below. I

used the workflow to create the User Journey Map as well.



3.6.3 Video prototype

A video prototype is a narrative method that can be used in a participatory design process to iteratively develop a nonexistent software (Arnowitz et al., 2007). They can be beneficial when a service includes functionalities “beyond the capabilities of mainstream prototyping tools” (Ibid., p. 388). A video prototype can be used for usability testing and evaluation in a service where the non-existing functionalities are mimicked on camera, thus making for a holistic service experience (Ibid.).

It was upon my first iteration after a cognitive walkthrough of wireframes that I decided to make a video prototype. The specific features and workflows of the service included the use of lockers, and I found that there were some unanswered questions from the users that could best be addressed if they were to grasp the entirety of the service experience more tangibly. The goal with creating a video prototype was to introduce it to prospective users and obtain ideas and feedback on the idea.
I assembled the video snippets in iMovie, added screen recordings of clicking through the clickable prototype, so those presented with the video could follow the flow of the service, and inserted subtitles, so viewers would be able to understand what was going on.

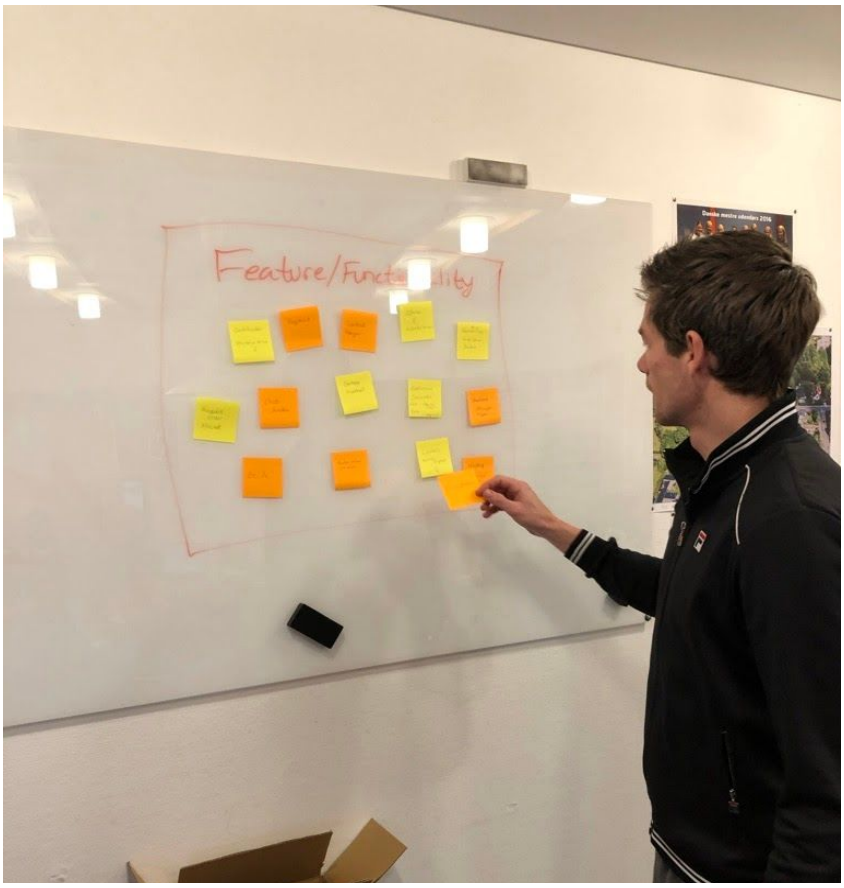
3.6.4 Brainstorming

Brainstorming is used to generate alternative solutions and opportunities (Design Council, 2015). It was useful for me because I used it to discuss and develop on the suggestions and concerns from the interviews I conducted.

There were multiple rounds of brainstorming. The first rounds happened individually, with a male (intermediate) player in his 50s, a female (intermediate) player in her 50s, and a beginner-level player in his 50s. These players were selected because they were some of the most active customers in the service that the researcher had provided for a couple of years, and fit the profile of the archetype player to be happy with a service like the one proposed in this study. These brainstorming sessions were informal, did not include any tools other than the researcher taking notes, and could be considered to be somewhere in between an interview and an actual formal brainstorming session. The reason for this was that the idea was mainly in the researchers head, with little to no tangibles for evaluation, and the purpose was simply to let the players build on the researcher's ideas in an informal setting.

The ideas were developed on, other methods were applied to create tangibles for evaluation, and another round of brainstorming was conducted, this time with the two stringers from White Sport (one in his 20s, the other in his 30s). After implementing the new ideas into the clickable prototype, another brainstorming session was conducted, this time with a larger group. This group consisted of three players (a teen, one in his 20s, and one in his 40s, all highly skilled) and a stringer who provides stringing for the players at their club, to find out more about their dynamics, and what they are looking for. They were presented with the prototype, which sparked the discussion with constructive criticism.

The participants were asked to write the ideas/features on post-it notes on the table, and in the end we would select the ideas we felt were proper for the service, and place them on the board.



Stringers and players at Gentofte Tennisklub brainstorming on features.

3.7 Develop

The third part of the double diamond is the Develop phase. In this phase, the problem statements addressed in the Define phase are taken through an iterative process of creation, prototyping and testing. The phase is the diverging part of the second diamond, which means that several possible individual solutions, all based on insights from the first two phases, can be developed and tested, before developing the features of the final outcome. The methods applied in this phase were MoSCoW prioritization and think aloud tests.

3.7.1 MoSCoW Prioritisation

After initial brainstorming talks with Tala Azrak of DTU, who would be doing a study on the same topic for her bachelor thesis, and after specifying project scope, we conducted a MoSCoW prioritization to prioritize features of an application. The work was conducted on a Zoom meeting.

The MoSCoW method (or the MoSCoW prioritization) is a method for prioritizing requirements used quite widely by followers of the the Dynamic Software Development Method (DSDM), and was first developed by Dai Clegg, who was one of the early participants in the DSDM consortium (Bittner et al., 2008, pp. 74-75). With the MoSCoW prioritization, we decided what was important at **that** point in time. With the MoSCoW method, features are categorized into four columns: **M**ust have, **S**hould have, **C**ould have, and **W**on't have (Ahmad et al., 2017). "Must have" defines the requirements that must be included in the final product, "Should have" defines high priority requirements to be included if possible within the time frame, "Could have" represent desirable or "nice to have" features that could be included if they don't incur too much effort, and "Won't have" are features that are desirable but are (in consensus) not within the scope of the current time frame (Ahmad et al., 2017).

3.7.2 Think aloud tests

Think-aloud tests are a simple method to gather thoughts from users as they go through a system - very simply just verbalizing their thoughts as they move around in the interface.
I created a clickable prototype of the platform through multiple rounds of reflection, iteration, and adjustment, as the users provided feedback and thereby co-created the service along the way. I presented the clickable prototype and the video prototype to eight players and three stringers,

and took notes of their comments about the interface as they went through the clickable prototype, as well as hearing their thoughts on the entirety of the service proposition in the video prototype.

Stringers at White Sport testing the clickable prototype

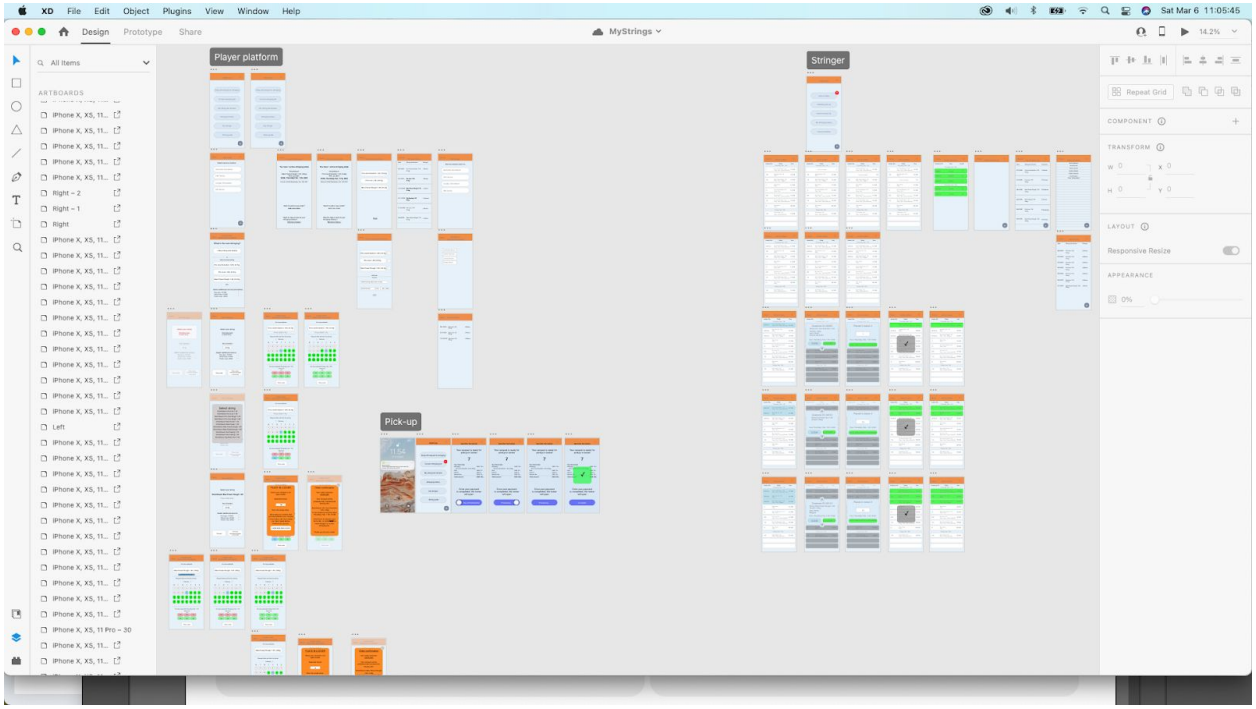
3.8 Deliver

The final phase of the Double Diamond is the Deliver phase, where the final outcome product/service is presented. In a business situation, it is due diligence to take the concept through final testing in a small-scale setting, reject the solutions that will not work, and improve on the ones that will, thus working convergently towards applying the developed solutions, and going back to another step in the process if deemed necessary (Design Council, 2019). The deliverables in this phase are the most recent version of the clickable prototype, a value proposition canvas, and a business model canvas.

3.8.1 Clickable prototype

Prototyping is an essential part of this project. It has also taken up a very large amount of the time spent on the design process in this project, because the level of prototype also affects the potential level of feedback. The reason for prototyping is to test an experience before using large amounts of resources on developing the necessary technology to make it run (Polaine et al., 2013, p. 139). Rather than asking people to imagine the service, which often causes problem-oriented mindsets, it is an advantage to present them with something tangible - a somewhat working prototype holding the key features of the service, which will help them react to the service with a performance-oriented mindset (Ibid,. 2013, p. 140).

A high-fidelity clickable prototype was created in Adobe Xd. High-fidelity prototypes look like the final version of a product, and are useful for testing purposes. Adobe Xd allowed me to create wireframes of a mobile application with click-through features, so as to imitate the actual features of the application, without the actual functionality behind. Thanks to usability testing, brainstorming and think-aloud tests, the current prototype has been moderated every time a new idea arose from testing, or a feature/function was deemed unnecessary/inadequate.



Prototyping in Adobe Xd

3.8.2 Value proposition canvas

A value proposition canvas illustrates how a project addresses the needs and wishes of users. It helps designers make sure that their products/services conform to the users' expectations, and that it creates value for the users. By creating a "fit" between the two sides, the designer ensures that he/she is building the right thing (Osterwalder et al., 2014).
The canvas has two sides:

- A customer profile side, which describes the target segment in the business model, only more structured, breaking the customer down into **jobs** (what they are trying to get done), **pains** (bad outcomes, risks and obstacles to jobs), and **gains** (what they desire to achieve/concrete benefits they seek). (Osterwalder et al., 2014, p. 9)
- A value map, describing the features of the value proposition in the business model, only more structured, breaking the value proposition down into **products** (the actual products/services the value proposition is built around), **pain relievers** (the attributes that alleviate customers of their pains), and **gain creators** (attributes that create customer gains). (Osterwalder et al., 2014, p. 8)

A value proposition canvas was created as a deliverable in this project in order to fit the proposed solutions with the pains and gains that were discovered and defined, thus helping to answer the research question of how the racquet stringing service might be improved through the means of a digital platform.

3.8.3 Business model canvas

A business model describes how a business creates, delivers and captures value (Osterwalder & Pigneur, 2010). The canvas that Osterwalder & Pigneur set forth is built on nine building blocks:

1. **Customer Segments**, defining the different groups of people the business wants to reach and service
2. **Value Propositions**, describing which and how the products and services create value for a customer segment

3. **Channels**, defining the means of communication and delivery in order to deliver value to customer segments
4. **Customer Relationships**, describing the type of relationship a business expects to have with its customers
5. **Revenue Streams**, representing the type of income a business expects from each customer segment
6. **Key Resources**, defining the most important assets required to make the business work (physical, intellectual, human, financial)
7. **Key Activities**, describing the most important activities a business performs in order to make the business model work
8. **Key Partnerships**, defining the suppliers and partners the business will have in order to work
9. **Cost Structure**, describing the costs incurred to operate the business model

A business model canvas was created as a deliverable in this project in order to display how the digital platform and service proposal in general will create, deliver and capture value in a real-life setting.

3.9 Methodology discussion

The following section offers considerations on the methods used for gathering and analyzing data in this study, and addresses the terms concerned with data quality in design projects.

3.9.1 The market research

The market research that was conducted in the discover phase of the design process was less of a method, and more of a business-review, much like the literature review, just concerned with the value propositions that were already existent in the industry. It really helped me think about how the service might look. I had been building on the idea for this digital platform for several years, and it was very beneficial to me to be able to take a look at how other digital tools provided value. Had this project not been for academic purposes, but because I was starting this business, I would have taken the next step and purchased access to these services in order to test them in the actual business setting, evaluating how it potentially created value for me. I

have only accessed the information that was provided to the public, and therefore actual market research might provide more accurate insights.

3.9.2 The business model canvas

The business model set forth in this project was one that was not clearly defined in the beginning of the project, as the author saw multiple options that could give the company a competitive advantage through the digital platform. The specifics of the platform required the business model to be set in stone, but before then, different options were considered:

One way that this platform would have been a competitive advantage was if one took ownership of the entire concept and service offering - being the only stringing service that offered this kind of service. In this way, it would be possible to increase revenues by receiving full payment for every service order, rather than just a service fee. One would also be the only reason for players to download and experience the platform. Likewise, naturally, the costs would increase with having to purchase stringing machines, products, hire and train stringers to conform to equal standards, and it would increase liability. This idea was sacked because of the fact that the platform (and with that the costs associated with lockers) only lives so long as one provides an excellent and fulfilling service. One bad stringing, or one missed deadline, and players will head back to their previous stringer. As was noted in the literature review, trust is hard to obtain, and very easy to lose. Rather than incurring all these costs and going to war with a potentially well-established competitive landscape, it is proposed that a platform like this shall be available to all who want to use it. This increases the possible number of users of the service, just like the platform would enter the market providing an until now unexplored value to customers, making it interesting for multiple stringers in the same area, thus creating several potential users on the provider side of the platform.

No matter how the business model would look, one of the key costs, but also key value drivers, are the racquet lockers. While it is recognized that the service can also alleviate some pains for customers who will continue to drive to their specialized retail store for stringing, the idea of this platform was built on the notion that customers should be relieved of that extra trip, just like they have been relieved of trips to their clothing stores, equipment stores, and even grocery stores. There was a clear consensus among players that this would add value for them, so long as they could be guaranteed the same reliability and quality they are used to. This was addressed with

string guides and certification stamps for stringers, that could be provided by the platform provider. As the lockers represent an important touchpoint in the overall service proposition, it was early on decided that the placement and responsibility would fall on the platform provider, in order to alleviate any risks associated with wrongful placement, mishandling, and troubleshooting.

3.9.3 The think aloud tests

The think aloud tests were used constantly, and in the early stages, when the prototype had very limited click-through functionality, the users were taken through something reminiscent of a cognitive walkthrough/wizard of oz, where think aloud tests simply functioned as the means of collecting information. These walkthroughs often took place very casually, and some did not involve immediate documentation of the user's thoughts. In retrospect, I would have liked to formalize the numerous informal talks with people that I discussed the service proposition with, because it would have helped emphasize that the right thing was being built.

3.9.4 Validation and verification

Design projects deal with the terms validation and verification as quality control parameters. These terms can be explained as verification being about building something the right way, and validation being building the right something (Rajkumar, 2020), or as Buxton (2007) subtitles his book; Sketching User Experience: *Getting the Design Right and the Right Design*. This title, Buxton says, draws on Schön's distinction between problem setting and problem solving, where problem setting asks "*what is the right thing to build?",* and problem solving asks "*how do we build it?".* According to Buxton, it is important not to try to take a straight path through a design process, as it will only work if the idea is just right from the very beginning, in which case the products largely turn out to be late and/or overpriced (Buxton, 2007, p. 77).

Much too often, Buxton argues, design projects are too focused on getting the design right, and nearly omit focusing on building the right things. Those who come up with an idea are too quick to decide that this is what they want to develop, and start focusing on verification, or as he calls it; getting the design right. Needless to say, in order to create a valuable project, validation is key.

I have, to the best of my abilities, attempted to keep an open mind throughout this design process, and have not made decisions that were final until they were tested and approved. Due to my background in the field, the double diamond framework served as a valuable creator of validation, as the first diamond is focused on defining the problem right. While I did start by making simple prototypes, the iterative nature of the process sent me back to reconsider certain features, as evaluations and interviews presented new considerations. Assuming that I have achieved this open mindset, and have not made decisions based on bias, I consider my background in this field a clear advantage, as a designer who did not know much about the context would have had to spend more time exploring. At the same time, I believe I have achieved some good perspectives from talking to people outside of the industry, some of them being friends, relatives, the developer from DTU, and my supervisor.

A considerable amount of focus was aimed on the prototype. I had started making wireframes before I even started this thesis. It helped me grasp how I might create value. I had worked with sketching and prototyping a few times before, and was familiar with Buxton's work. Buxton (2007) argues that methods such as sketching and prototyping make design projects gain an advantage in terms of validation, because iterative prototyping (i.e. developing tangibles for testing and refining) while continuously maintaining a dialogue with users, is an example of validation in and of itself. It allows users to test products and provide feedback not on the design of the project, but on the idea of the project. Where validation might otherwise occur at the end of a software development project, iterative prototyping has the ability to validate during the design stage of the project, thus reducing the risk of presenting the users with something they don't want/need/like/appreciate (Buxton, 2007).

Verification, or getting the design right, refers to whether or not the methods applied address the project in a relevant way. Therefore, it was crucial that methods were used with a purpose that led to a valuable outcome, either leading to verify assumptions, or to reiterate other steps of the design process. The selection of methods, and the order of which they were applied, largely follows the suggested design process laid out by the Design Council's guide; *Design methods for developing services* (2015). I have found the double diamond to provide excellent opportunity and flexibility in allowing the designer to make choices on whether to go back and re-iterate, or to move "forward".

The silver lining that was attempted kept throughout the choice of methods to be applied was to discover the nature and attitudes toward the current stringing service offerings, define the problems that needed solving, exploring options that could relieve pains and create value, and deliver a result that could be used for realizing the service proposition. The value proposition canvas is a visual representation of how the focus has been on building the *right* thing.

The players that were asked for feedback were all selected because they fit a persona and/or were deemed to have experience that would entail valuable opinions and ideas to discuss the service proposition with. The majority of the players involved in feedback were players at the club where the author has played for several years. Due to Covid-19 restrictions, racquet clubs were closed for business, and it was therefore not possible to walk into another club and apply methods to obtain their thoughts on the service proposition. The author did make sure to reach out digitally to players in his network to gain feedback on the prototypes he had created - most of them merely responded positively, stating that it was a good idea, and that they loved the simplicity, or had comments on minor details in the app interface. It was clear that there was more information to gain when speaking directly with players, and therefore this project does hold the limitation that only players from one club were actively and directly interacted with. The members of this club have been used to being able to receive stringing services from a stringer that strings in the club, and therefore I will make the argument that clubs that do not have direct access to stringing services from someone in their club would express even more interest in such a service proposition, than those who are experiencing the luxury of having a stringer they can approach at the club.

3.9.5 Limitations

The author of this project is a life-long tennis player, who has provided independent stringing services for tennis players for ten years, and only for badminton and squash players for two years. Furthermore, the author has no background in the club-milieu of badminton or squash clubs, so knowledge and assumptions are largely based on circumstances of tennis clubs.

Due to the nature of Covid-19 forcing recreational activities to be closed during this project, the researcher had very little access to badminton and squash players. However, with White Sport being a service provider for all racquet sports since 1964, and considering that stringers in White Sport noted that tennis is the racquet sport with the most elaborate stringing

customization, I can only assume, and at this time not verify, that this service proposition will be just as relevant for badminton players and squash players. White Sport stringers did state that they believe there to be a smaller fraction of squash players who primarily at their home club repeatedly (they were more likely to play in different locations, as opposed to tennis and badminton players).

4 Results

This chapter presents the findings and conclusions that the methods applied in the double diamond framework have resulted in. Like in the section on the design process, the results are grouped into the phases of which the methods were applied in the double diamond framework. In the end of the section you will find a summary of the results, and a brief description of the final service proposal.

4.1 Discover

4.1.1 Market research

I was able to identify two applications that were designed for stringing service purposes. One, “stringr”, was a Los Angeles started application that facilitated the order, pickup and delivery of stringing services from the customer’s home. The service cost was broken down into stringing ($15), string ($15), delivery fee ($10) and service fee ($5), coming out at a $45 total. The other, StringJob, was a service with many of the features I had imagined for this project as well. However, it was, like the other services I discovered later on, only for the service provider, rather than being a two-sided platform. I would later discover that White Sport, the retail shop I used for interviewing stringers testing the prototype, had started using this application. They said that while the idea of it was good, allowing them to keep digital records of stringing service orders, the app was very heavy in details about the racquets, something that was mainly relevant for professional players, whose racquets are customized to their very needs, and don’t conform to industrial specifications.

I contacted the European Racquet Stringers Association (ERSA) to find out if they use or are familiar with any digital tools for stringing. I established a correspondence with the director, Mark Maslowski, who informed me that they use several different kinds of software. For professional

tournaments, when ERSA are the official stringers, they have software that can scan a player's badge and bring up all his/her info on the screen, such as string, dates, tensions, grips, repair and charge.

I got in contact with the Danish ERSA manager, who told me that there were two softwares that had been recommended to him, and that I should investigate further. The one, iString.Online, was a Brazilian based company for stringers (and only for stringers, i.e. the service provider). iString.Online market themselves as being "An easy to use software to manage all your orders… Online!" (iString.Online, n.d.), providing features such as order creation, customer payment registration, product and stock management, multi-racquet in single-order service, online reports, and compatibility with desktop and mobile formats. The monthly user fee comes in at $5. The other software, jvcstringer.com, a UK-born software previously used by Grand Slam tournaments (the four biggest tournaments of the year) is also "designed to help manage stringing records", and therefore also only created for stringers. jvcstringer.com offers player database options, so stringers can keep user profiles and maintain data on users. Furthermore, especially relevant for this project, jvstringer.com offers a text and e-mail notification system, automatically sending out a text (only UK-phones) or an e-mail upon service completion. They also offer an option to maintain a list of different stringers and stringing machines, which is relevant to this project because stringers and machines inevitably string differently.

Finally, I discovered an American company called RacketAid, whose purpose resembled mine with a few exceptions. RacketAid are (based on their "estimated shipping time heat map") located in Alabama or Mississippi, and provide their services to the entirety of the US. They brand themselves as being "the first truly digital platform for sports racket stringing and customization **by mail**" (RacketAid, n.d.), and their reason for starting the business was that they believe that people are far too busy to be bothered by the inconvenience of today's stringing services. They wanted to make a "one-stop-shop for the active tennis player who wants convenient, fast and professional racquet stringing without ever leaving their house" (RacketAid, n.d.). In the United States, however, there are two factors that contribute to why it is convenient for the customers to get their racquets done at home, rather than at a club. Firstly, players aren't associated with clubs the way players in Denmark are. In the US, some people play in country clubs, but there are also lots of young people who go to high school and college, where the teams are often responsible for racket stringing. Secondly, the geographical distances in the US might make it difficult for some to find a professional service nearby, which

is why an online solution and a reputation as highly professional service providers could go a long way in the US. I did, however, agree with the fact that there are inconveniences about the stringing service today that could be improved from both the customer's **and** service provider's point of view.

The research led me to create the first version of the clickable prototype. Upon researching the existing digital solutions to aid in the stringing service, I also decided to set up talks with local service providers to discover how they feel about the way they are providing stringing services today.

4.1.2 Interviews

Interview 1: Stringer from White Sport. 24 years old, semi-pro player, national champion of Denmark. Estimates that he has strung between eight to ten thousand racquets. At White Sport "It used to be so that the customers would come in with a racquet, and we had a note with two separable parts. One was attached to the racquet, and one was given to the customer, for them to bring when they returned to pick up their racquet. We wrote the name, phone number, string, tension, pickup date and time, price, and whether the service was paid for or not, so we knew whether to charge or not when the customer comes back to pick up the racquet." He emphasized that it was a lot of work, and even though they had adopted a software to manage stringing jobs, there were still manual input pains associated with order creation because the software didn't address their specific needs. Furthermore, upon finalizing the racquet, they send a text or call the customer to let them know the order is done. The stringer expressed that he was pleased with the simplicity of the platform, but raised concerns over the lack of human interaction, as he noted that a large chunk of their customer base needed guidance on string choice and tension.

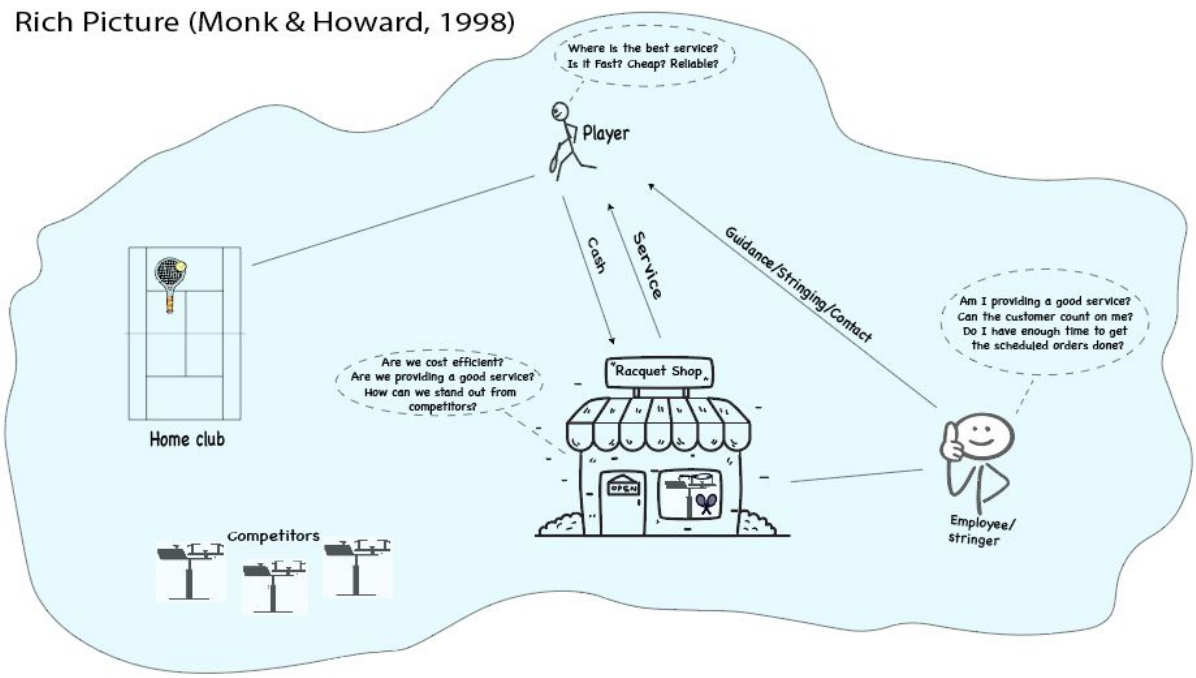
Interview 2: Stringer at White Sport. Owns his own sporting event company, mainly working at professional sport events and international junior tournaments in Denmark. Danish manager of European Racquet Stringers Association, where he was trained and certified as a professional stringer. Expressed displeasure with the software they use (StringJob), noting that details were too heavy and unnecessary in the context of the absolute majority of stringing jobs in Denmark. Intended on using software because of the access to customer history and ability to handle and organize orders.

Interview 3: Independent stringer, plays tennis in Gentofte Tennisklub. 34 years old, former professional tennis player, now associate head coach at Gentofte Tennisklub. Emphasizes that "because I use my own phone to text or call clients, some of them see no problem in calling me in the evening or whenever they need to know how soon I can string their racquet, and that becomes stressing and annoying to receive phone calls from numbers I don't know". Furthermore, he uses the same type of notes to create order. He strings in the office at the club, so clients will be able to drop racquets off during working hours at the club. Emphasizes that he has "considered if there is a way for clients to leave their racquets at the club outside of opening hours instead of them just calling me to know when I'll be there next". Another issue with using that type of drop off is that when some customers get used to the service, they feel as if it is enough to leave their name on the note. While there is an agreement with the coaches' joint office (which is open from 10 to 5) that customers are free to drop off racquets without the stringer being present, he does not rely on the other coaches to ensure proper order creation.

The insights from the interviews led me to determine that it would be beneficial to create 1) a rich picture, because I had finally validated what my own thoughts were, and because the rich picture could help me think about the interaction between actors in the service, 2) personas, because there was a group of customers that would require certain attention, and 3) a user journey map, mapping the pains of players and stringers.

4.1.3 Rich Picture

The rich picture depicts the actors in the racquet stringing service. The player uses their home club to play their sport, and the stringer when they need to have their racquet strung. The player is concerned with how they receive the best service, and will choose stringer based on how fast and reliably they can deliver the service, and whether it is at an acceptable cost. The racquet shop is concerned with delivering a good service and making money, and the stringer (who can also be independent from the racquet shop) is concerned with whether or not they are reliable and efficient in providing the stringing service. There are competitors in the shape of other racquet shops and independent stringers.



Having the rich picture helped me define and specify the issues/proposed improvements when co-creating further along in the design process. It also led me to conduct research on other marketplaces (a virtual service safari) that provided a similar type of accessibility, and connected service providers with customers.

4.1.4 Virtual service safari

In the virtual service safari, I posed four questions that I wanted to have answered during this research:
What do the services claim to be their advantage?
What are key advantages for service providers?
What are key features in the app?
What percentage do the businesses charge their users?

The restaurants' side of the platform is only available to registered Wolt restaurants. In order to answer how the layout looks for service providers, i.e. restaurants, I went to a burger joint in Copenhagen called Jagger, early in a workday afternoon, with the hopes that they wouldn't yet be busy, and would show me how the app looked in terms of creating their menu and handling orders. While platforms like Uber Eats and Deliveroo also fall into this category, their services are unavailable in Denmark, and therefore the insight I was able to gain was limited. I did,

however, manage to find that they charge 30% commission to restaurants, and offer their solutions to restaurants with their own delivery staff as well. Likewise, Deliveroo is not functioning in Denmark, but they charge 35% commission on restaurants.

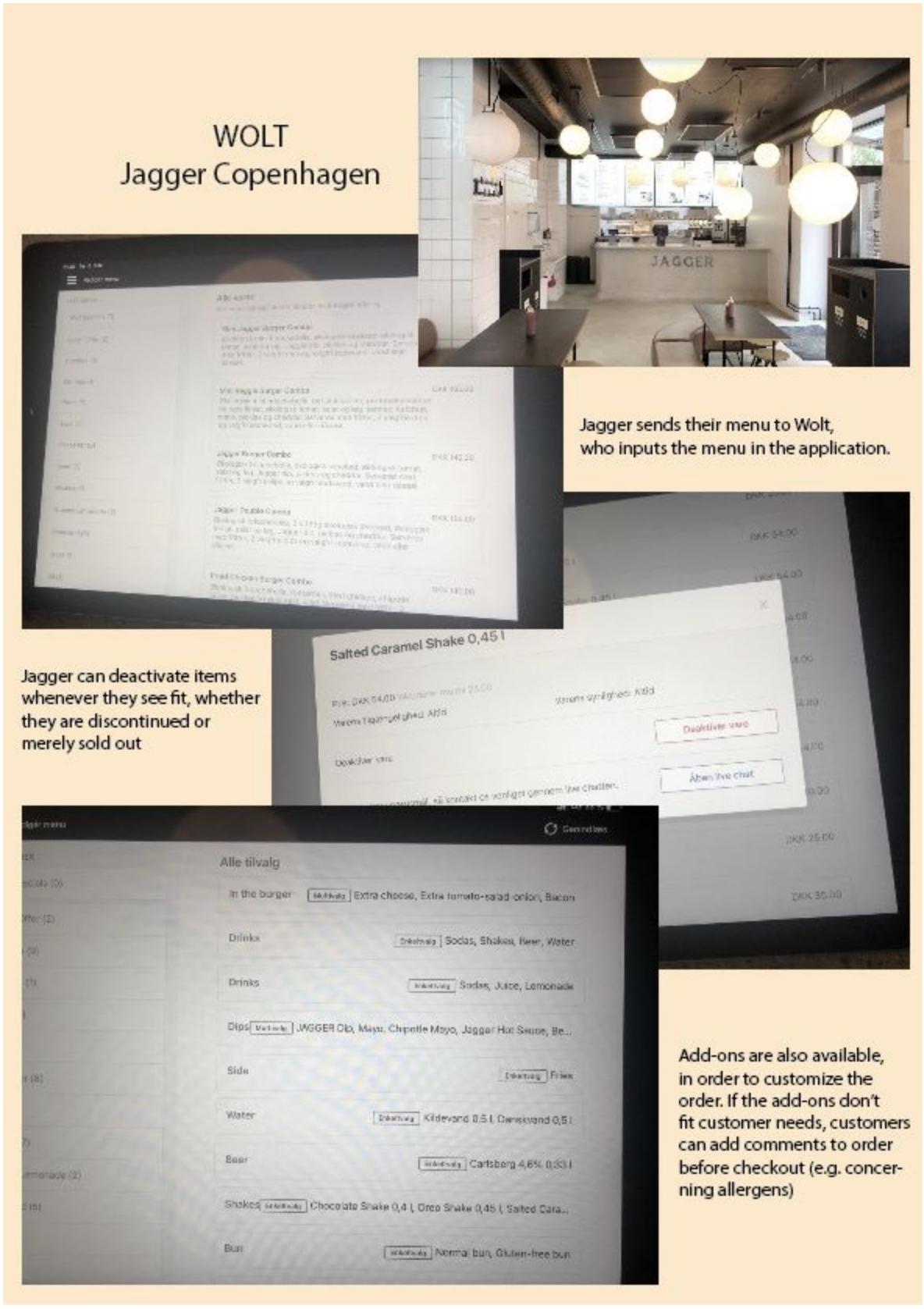
Wolt:

1. It will make ordering very easy, it creates convenience, and it's reliable.
2. It will help customers discover the restaurant, it's risk free (can withdraw from Wolt anytime, Wolt only charges commission fees), services have always been pre-paid, it will increase revenue, it's targeted marketing.
3. The merchant app contains the menu that the restaurant has provided Wolt with. This includes all the restaurant's items, even though some might be seasonal, in which case the restaurant can freely deactivate and reactivate menu items. The platform will keep orders in order. When an order come in, the app will ask front-staff whether they can fulfill the order in a given timeframe, and the restaurant will either answer "yes", upon which the order will go into the "active" orders, and the customer will be notified that the order has been accepted with the given time frame, or "no", upon which the restaurant is then asked to provide a new time OR state another reason (closing soon, item unavailable, other reason).

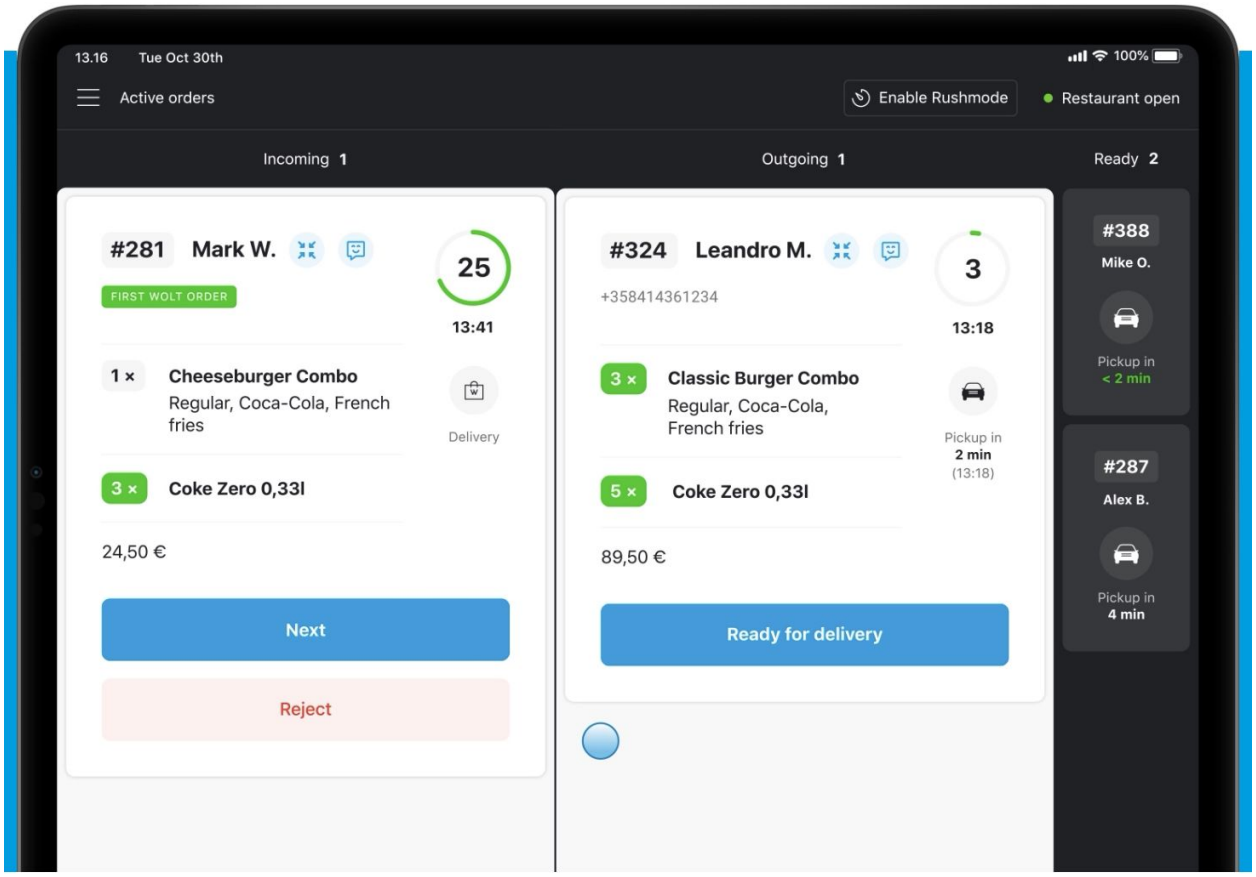
   The customer side of the app starts by presenting the user with a map over the nearest restaurants, and its recommendations. There is a tab for exploring cuisines, a tab for those who offer delivery, and a search function.
4. Restaurants pay a 25-30% commission to Wolt for every sales order. Charge nothing for using app

Just Eat:

1. Improves order process for customers. Fast, easy and safe payments.
2. Adds value by taking care of time-consuming tasks, allowing them to focus on getting the best out of their orders. Improves order process,
3. The customer side of the app looks a lot like Wolt's - you can either check out nearby restaurants by inserting zip code (Wolt uses location services), or explore different cuisines. The restaurant side of the platform was not accessed.
4. Takes 14% commission from restaurants plus a fixed administration charge (£ .50)



Menu management for Jagger in Wolt



Incoming and outgoing order management for restaurants in Wolt

The service safari led me to brainstorm how some of the features (e.g. inventory input, ordering, payment and delivery) of Wolt and Just Eat might apply to the context of this project, and. This was addressed in the brainstorm.

4.2 Define

4.2.1 Personas

Originally, I had three types of players in mind. First, the player that doesn't use the stringing service very often, and needs a lot of guidance. Second, the player that uses the service often, and is interested in selecting strings and tension based on personal trial-and-error - therefore requiring a good amount of guidance as well due to changing string and tension often. Third, the player that comes in often, and is familiar with strings, their specifications, and what type of tension they prefer. These are typically higher level players, and while they don't represent a

large group in and of themselves, they do represent a large chunk of the revenue that service providers experience.

Thanks to the co-creational nature of the service design process, interviews led me to determine that I needed to establish personas, and establishing personas led me to discover that the three archetypes of users that I had in my head, actually appeared to be one short. Stringers, both from a retail store and independent, agreed that there was a fourth archetype, one that resembled the first player, but did not need guidance. These are players that do not care much about equipment other than playability. They might represent a group of players that aren't very skilled, are relatively old (perhaps >50), and play a few times a month or less.

With this information, I established the following four personas.

Player personas (Cooper et al., 2007)

Player 1

Portion of revenue: 30%

Comes in with a racquet for stringing rather rarely, and needs/is interested in a fairly extensive amount of guidance on string selection and tension. Doesn't play all that often, not very skilled. Often above 60 years old.

Player 2

Portion of revenue: 20%

Comes in rather often, and is very curious and interested in different options. Also needs a relatively high degree of guidance. Relatively skilled hobby player. Typically below the age of 60.

Player 3

Portion of revenue: 40%

Comes in often, well experienced with strings and tension. Usually 1) high-skilled (male or female), or 2) intermediate male who is interested in equipment. Needs little to no guidance. Does not represent the majority, but makes out majority revenue contributor.

Player 4

New!

Portion of revenue: 10%

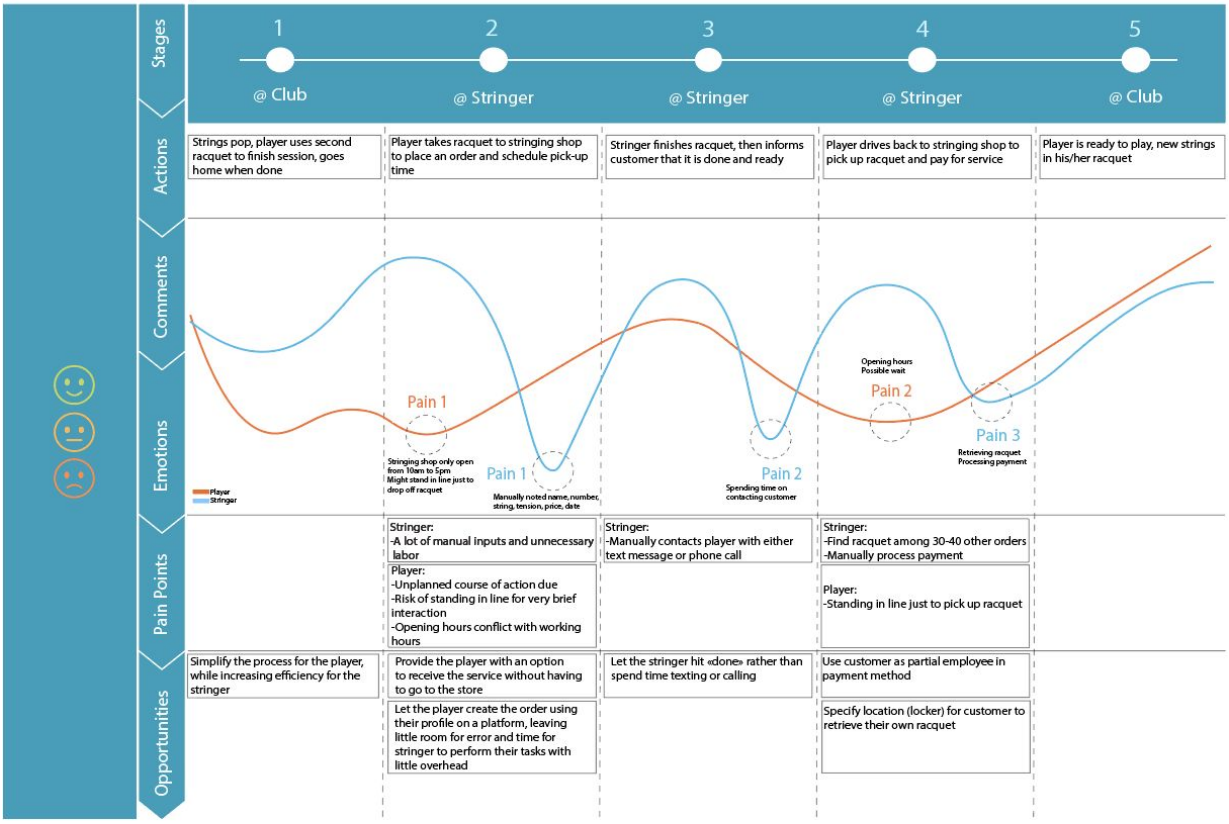
Comes in with a racquet for stringing rarely, does not care much about specifics of string, just that it has high playability. Usually will say "I just want whatever is in it now". Might be subject to guidance, but typically ends up saying "just give me the same as before".

With these personas, I concluded that Player 1 would need extra attention in order to satisfy their needs, and that these needs might exceed the capabilities of a digital platform, as Player 1 relies heavily on communication with stringer. I decided that the digital platform should include a string guide in order to address the guidance guidance needs that the other players might have.

4.2.2 User journey map

Creating the user journey map helped me define three pain points for stringers: 1) time consuming manually entered information, 2) contacting customers through phone, 3) racquet retrieval and payment processing, and two possible pains for customers: 1) stringing shop's opening hours collide with working hours, 2) customers might have to wait in line to hand off and or pick up their racquet. A third hassle, which players don't consider a pain because that is just how it's done, is that they either have to physically go to a racquet store, or manually contact their preferred stringer to ask if they are free to string their racquet, and agree when to meet.

Service blueprint (Polaine et al., 2013)



The journey map helped me specify the pains that customers and stringers experienced, which, in turn, could help me brainstorm possible solutions. It also allowed me to define opportunities/value creators that could be used in a value proposition canvas.

4.2.3 Video prototype

Due to Covid-19 restrictions largely shutting down all recreational activities during the time frame of this thesis, the video prototype also allowed me to reach out digitally to players I was familiar with and ask for feedback. Had I been able to gather a lot of empirical data from shops and clubs, the setting would have been different. It is only within a couple of weeks of handing in this thesis that recreational activities were re-opened, and only for outdoor activities, which means that squash and badminton remained closed, while tennis could open any courts that are playable in cold weather (hard court surfaces and hybrid-clay courts).

I decided to go to my local tennis club and enact what the service could look like from the point of finishing a session and sitting with a racquet needing re-stringing. From thereon, the scenes would look something like this:

1. Player is sitting courtside after session, takes out phone
2. Starts creating order, deciding on string, tension, additional services and pick-up time
3. Drops off racquet in locker, thus finishing order creation
4. Stringer takes out racquets, bring them to stringing facility, opens app and retrieves information on racquet
5. Stringer finishes stringing, places racquets in empty lockers respectively, hits button in app to notify player of order completion
6. Player receives notification. Next time player heads to play tennis, player picks up racquet by swiping to pay with a MobilePay integrated payment, upon which locker unlocks, and player pulls out freshly strung racquet.

The creation of the video prototype in and of itself also allowed me to actually try to work through the entire process and test necessary features in the clickable prototype. For example, it led me to change the outlook of the stringer picking up the racquets, a feature I had not yet paid much attention to, just like the flow of payment received a brush-up upon creating the video.

Some of the feedback from the players that were shown the prototype included that they appreciated the simplicity from the player's perspective. This player included the comment that selecting a time for the racquet to be done, rather than waiting for a store to give an estimate, was very positive. It gave him greater control over the service. A concern for this player was the risk of technological failure, i.e. that the locker wouldn't open due to technical error. He came up

with the idea that within opening hours, one could merely call the shop/stringer, and outside opening hours there could be an emergency contact feature.

The independent stringer that was interviewed in the discover phase, who stated that he did not recognize the need for scheduling, was shown the video prototype, and recognized the benefit of the scheduling, because it would help limit the risk of lockers being occupied.

The video prototype allowed me to conduct think-aloud tests with users upon their “service experience”. It helped me evaluate in another way than the clickable prototype, considering that the clickable prototype was to be used for testing of user interface and in-app flows, whereas the video prototype provided me the opportunity to test the service as a whole.

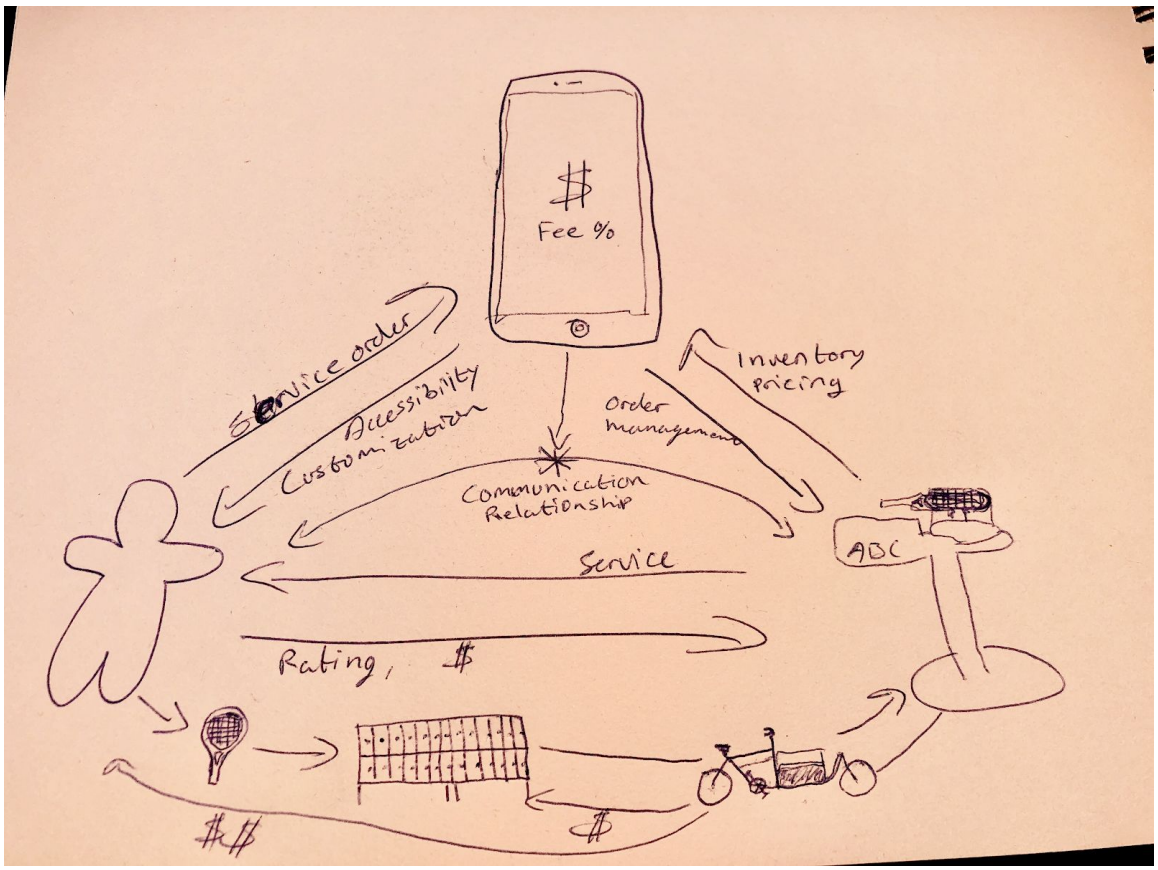
Link to video prototype: https://www.youtube.com/watch?v=uwnrCoaP5Ao

4.3.4 Brainstorming

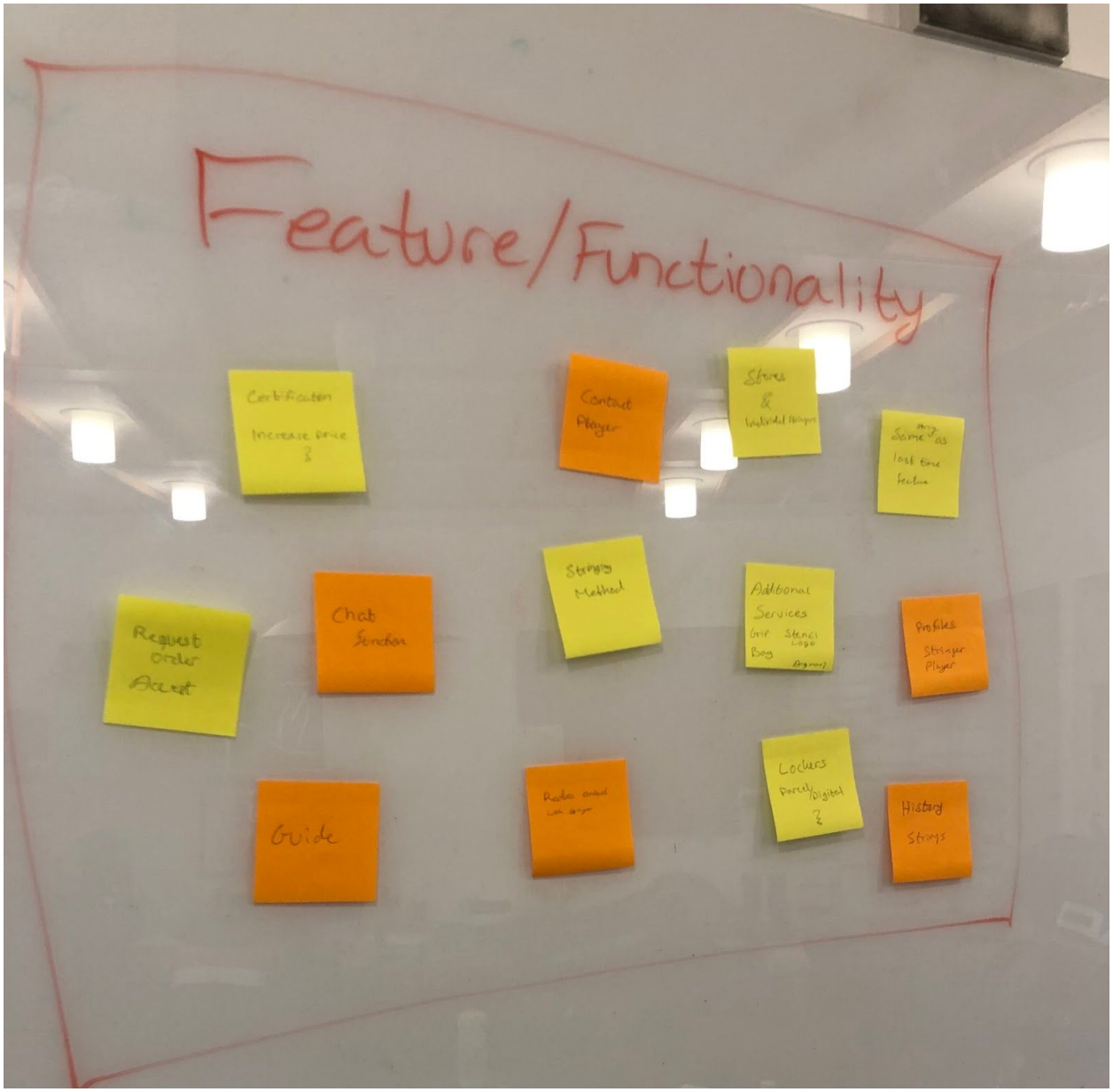
The brainstorming sessions with players has the purpose of ideating and discussing the service proposition with users. One of the ideas came from a male player in his 40s, who noted that he didn’t believe that there could be a competitive advantage in prices, but suggested that I add a feature that would allow players to purchase additional services, such as grip replacements, stencil logos, having the racquet bagged.
Another key outcome was the fact that order requests and accepts, where there is potential for a lot of back and forth communication between player and stringer, should be discarded in favor of a stringer schedule where players could "book" a slot for their stringing, much like booking a time for another service appointment.
In terms of the string guide, one player noted how it would be great with a question-based filtering function, allowing players to answer a few questions about their game, to then be recommended a string that their stringer of choice has in inventory. Likewise, should the player choose to switch stringers, he/she could risk that the new stringer does not have the exact make and model of string, and the string guide could then recommend the string that is most like their previous preference.
In one of the interviews, the stringer at Gentofte Tennisklub noted that he was tired of unnecessary back and forth communication. This comment led me to question the relevance of requesting and accepting orders in the app, as the stringer would experience a higher degree of interaction with customers than he seemed to prefer. I removed the “request order” from the

prototype and changed it to a schedule of availability, so that the stringers could input their working hours, and the customers could select a pick-up time based on the availability. Thus, the orders would fill out the schedule, and the application would manage when a new order could be finished - i.e. the same function as a booking system. I came to think of the occasional rapid request, and decided to try and put that in as well, so a customer, who really needed a racquet strung quickly (for example from the even they are playing till the next afternoon), could put in a rapid request, providing the stringer with a notification, and letting them accept/deny the order, based on whether they could make it or not. An accepted rapid request would add an additional service fee.

When bringing this proposition back to the stringer, he expressed a further desire to be able to receive racquets and merely be able to notify customers of when it was done. He said that the volume of his business had him at a service order turnover ratio of around 2-3 days, and that he did not recognize a need for scheduling. I recognized the considerations, and thought that maybe it would actually be best if it was entirely up to the stringer to choose the type of time settings available in their profiles on the platform. This iteration had not been implemented or tested in the clickable prototype at the time of submission.



Visualizing the service proposition, enabling brainstorming on interaction between actors.



The brainstorming sessions resulted in some ideas that were implemented into the clickable prototype for testing and further evaluation, just like it resulted in defining gain creators that would appear in the value proposition canvas.

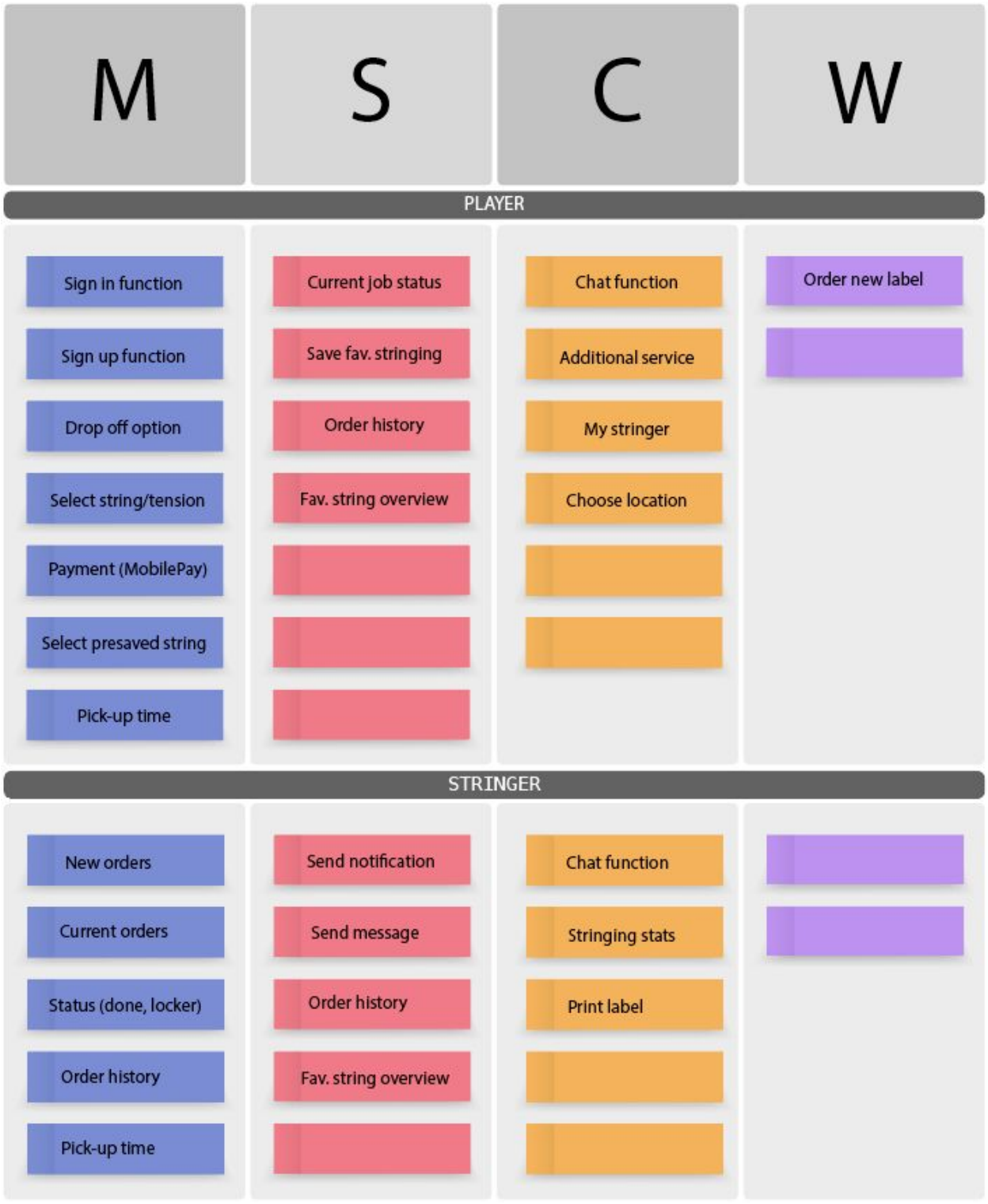
4.3 Develop

4.3.1 MoSCoW prioritization

The MoSCoW prioritization served to help prioritize the features of the platform as we saw it at the time. At the core of the service proposition was the convenience of using lockers for

dropping off racquets and picking them up again, so this functionality was placed right below user profiles. In order for the service order to be created, the customer also needed to be able to select their string and tension of choice. Then, in order to pick up the racquet from a locker, a payment function was needed in order to complete the service delivery. We also deemed the customization feature of having pre-saved string/tension combinations to be a must, as this would create added value and ease of use. Last on the must haves for the player was selecting a time for picking up the racquet, as there would not be an infinite amount of lockers.
The should-haves and could-haves of the platform were features that would create added value, and would come second in line when developing the platform. These were features providing further accessibility, such as seeing one's stringing history, purchasing additional services, chatting with stringer, and choosing locations (when there are lockers in multiple facilities). A feature that wouldn't be decisive for the testing of the platform was ordering a new label to place on the racquet.

On the stringer side of the platform, must haves were new and current orders, so as to provide the stringer with an overview, as well as a feature to show the status of active order (whether it was done and ready to take to club, or already placed in locker, and waiting for customer pick-up). Furthermore, it was a necessity to have a feature telling the stringer when individual orders were scheduled for pick-up, and a feature that allowed them to notify when the order was done and ready for pickup. The should-haves and could-haves of the platform were to be able to access order history, sending messages to customers (if there were special comments on the service, i.e. that the racquet had damage), and acquiring statistics on most popular strings and seasonal changes. Lastly, the stringer could be able to print and replace a damaged label.



As mentioned, the MoSCoW prioritization was conducted with the purpose of specifying and prioritizing features for the platform, and it led to building a clickable prototype.

4.3.2 Think-aloud test

The think-aloud tests produced some very concrete feedback, such as the fact that users did not mind creating the order themselves. They found that it would give them greater control over what they ended up with in their hand after the service was finished, just like they appreciated the feature of being able to go back and see their stringing records. They also responded positively to the added feature of being able to select additional services (such as new grip, stencil logo, bagged racquet).

One user (intermediate player) complemented the fact that it saves the user time, and provides accessibility. He noted that it would also clearly benefit the stringers, allowing them to keep track of the customers and what they have previously used. He said that he found it to be a common issue around his playing partners, that when they needed a re-stringing, they had trouble remembering what their tension was. Sometimes the stringer would be able to dig out some records, or an old message, stating the string and tension, but this application would allow them to have that accessibility at all times, whether during day-time, during evenings, at other clubs or internationally.

The same user saw potential for the specialized retailers as well. He is familiar with the owner of one of the retailer shops in the Greater Copenhagen area, and said that these retailers typically employ young people to string racquets and help on the sales-floor, and that a system like this, where specific deadlines were sorted and prioritized automatically, could help the retailers plan their employees' hours at work. An example was if one day, twenty different clients came in and all needed their racquets strung by the next day, the stringer would be completely occupied the entire day, and that would cause stress on not only himself, but also his co-workers, seeing as they would have one less colleague to help servicing customers. "Then I might also show up with a racquet and have to stand in line for 15 minutes. With this app, I could just create an order, walk in, drop off my racquet, and get on with my day." With retailers taking on the task with the parcel lockers, he noted that an option, as an alternative to have an employee drive out to clubs by car to drop of the racquets, could be to hire a young employee and equip him/her with a Longjohn bicycle that could fit all the racquets. This would be both sustainable and a green initiative, considering how it would aid in reducing the time players spent driving their car to the retail store.
Another user applauded the idea of parcel lockers due to their technological infrastructure, and suggested that retailers and club stringers could make an attempt at collaborating with

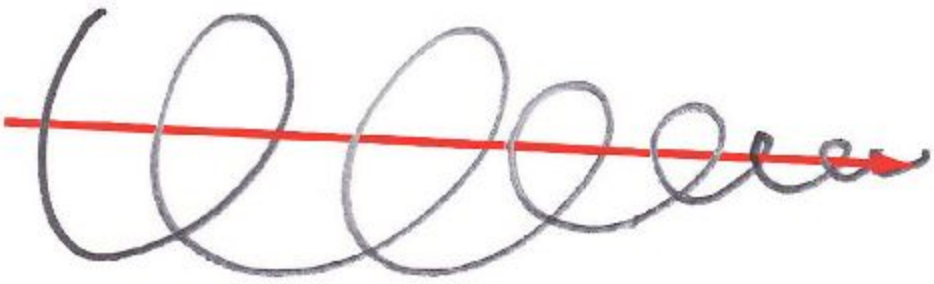
PostNord, who makes use of parcel lockers around Denmark, and merely rent a section in their locker modules. This chimed along the lines of what was discovered in the literature review, where other researchers had found that people responded positively to lockers being “on the way or nearby”
This user also pointed out that a notification symbol was also needed on the stringer’s side of the platform, just like the player could see a notification on their “current orders” if their racquet was ready for pickup, to show how many active orders there were for the current day.

The think aloud tests ultimately led me to iterate the clickable prototype, resulting in the current version, which will be presented in the deliver phase.

4.4 Deliver

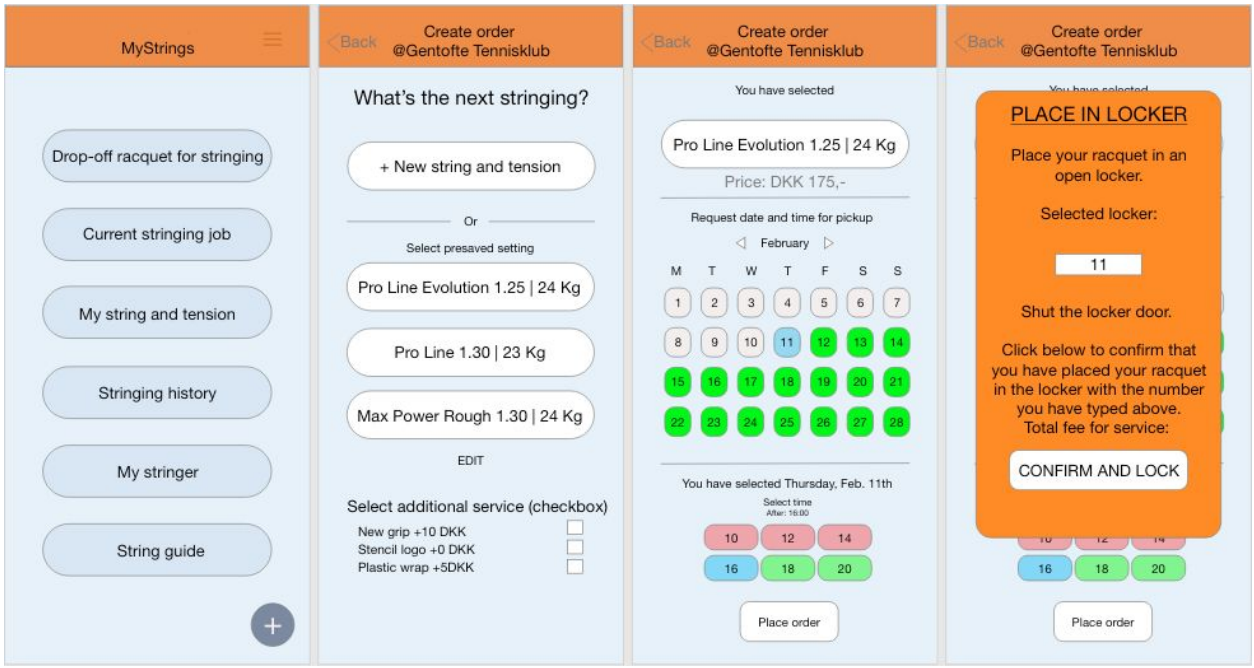
4.4.1 Clickable prototype

The constant testing and refining of the clickable prototype kept leading me closer to what the service proposition would end up looking like. The process of this can be portrayed by the below figure, showing how I kept moving closer and closer to the desired outcome. This figure is taken from Buxton (2007, p. 388), where he calls prototyping a validation technique. I also consider it a representation of the second diamond in the double diamond - working around the defined problem in the beginning, considering solutions, to then narrow down to what will be presented as the final outcome of a project.

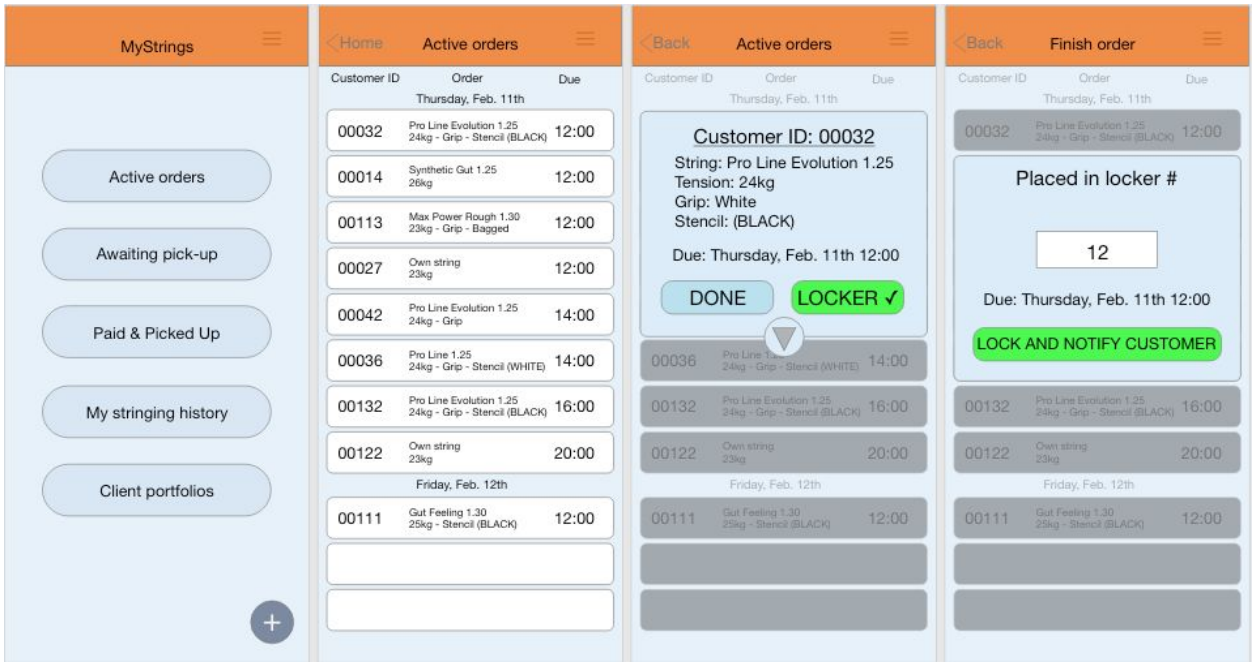


From Buxton (2007): Prototyping as iterative incremental refinement.

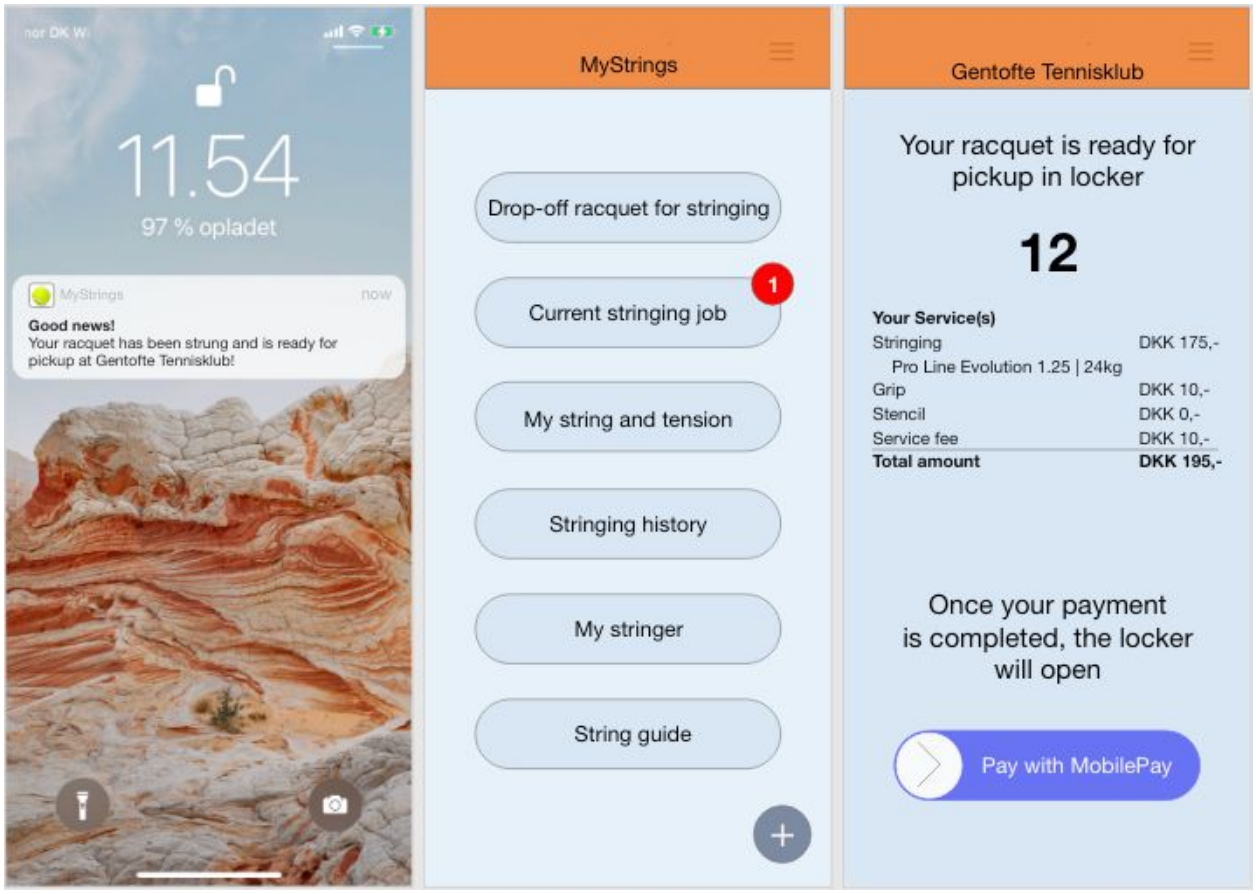
Below are some snapshots of the app’s layout.



Snapshot of player order creation flow, beginning at the home page, selecting to drop off a racquet for stringing, selecting the desired string and tension, and any additional services, selecting the time of pick-up, and confirming that the racquet is placed in a locker.



Snapshot of stringer platform flow, overlooking active orders, opening up an order to find information, being able to mark the racquet as done, and ultimately placing the racquet in a locker and notifying the customer that the racquet is ready for pick-up.



Snapshot of player pick-up flow, receiving notification that racquet is ready, entering the app to find the notification symbol under active orders, and swiping to pay with integrated payment function, thus opening locker.

4.4.2 Value proposition canvas

As was discovered in the literature review, there are a number of value creators associated with technology enabled service delivery, which can provide customers with additional or extended services, greater convenience and control, potentially more reliable information delivery, access to data and support services that may not have otherwise been available, and the ability to conduct transactions in such a way that does not necessitate the customer visiting the service organisation. Likewise, technology enabled service delivery can be used by management to permit faster response to customer enquiries and problems, to improve internal efficiency and productivity, and to reduce labour costs. These values are addressed in the value proposition canvas below.

On the right side of the value proposition canvas is the customer profile. This profile represents the customers of the platform, i.e. both stringers and players. This profile consists of “jobs”, pains, and gains. Marked with yellow are the service provider’s “jobs”. These are the tasks the stringer is trying to get done. The stringer wants to provide a reliable service, provide the customer with proficient information, give the customer what they decide they want, and be able to care for each order.

In the bottom of the customer profile, marked with red, are the customer pains. These pains were defined in the user journey map, and consist of the inconveniences associated with players having to go to a store, the opening hours, waiting in line, creating orders, and the stringers’ pains of spending too much time on order handling and processing.

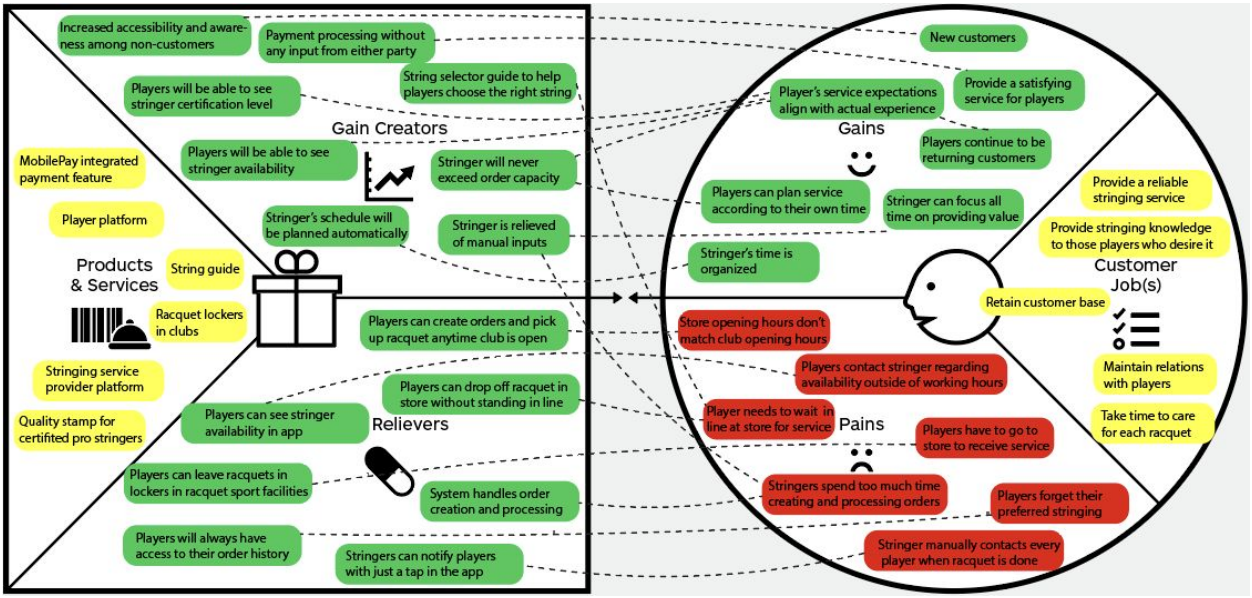
The last third of the customer profile is the gains, which consists of the benefits that are trying to be achieved. These are things like players experiencing a convenient, reliable and satisfying service, and stringers being able to focus on providing value to their customers through their stringing jobs, rather than spending time on simple, time-consuming tasks.

On the left side of the value proposition canvas is the value map. The value map consists of products and services, pain relievers, and gain creators. Marked with yellow are the products and services proposed in this project. These are digital platforms for players and stringers, including services like string guide, order management, integrated payments, and certification stamps, alongside digital racquet lockers.

The purpose of these products and services is to relieve the pains that users are experiencing, which is addressed in the bottom third of the value map, marked with green. The lockers situated in the clubs relieve the pain of limited opening hours at a shop, with the convenience of access to lockers during the longer opening hours of the club. The lockers also relieve players from having to potentially wait in line at the store, as there is no need to get in touch with an employee that might be busy with other customers. Should the player want guidance in choosing their string and tension, a string guide will assist with this. The digital platform enables players and stringers to interact and create value for each other, as the stringer will be relieved of the time-consuming tasks associated with handling and processing the order, just like they will be able to notify the player that their order is done with a simple touch in the platform, rather

than spending time on contacting players manually. Furthermore, the access to stringing history will allow the customer to never forget the details of a previous string job.

Gain creators are located at the top of the value map. These describe how the products and services create gains for the users. The players' increased accessibility to stringing services will allow stringers to target new customers, and the certification stamps will allow them to differentiate themselves from their competitors. The players will have increased control over when their service can be delivered, and their expectations of the service will more often align with reality. Working time for stringers will be planned automatically, reducing the risk of a stringer being forced to work overtime, and the integrated payment processing in the digital platform will provide an easy-to use service for the players.



The value proposition canvas for improving the racquet stringing service with a digital platform.

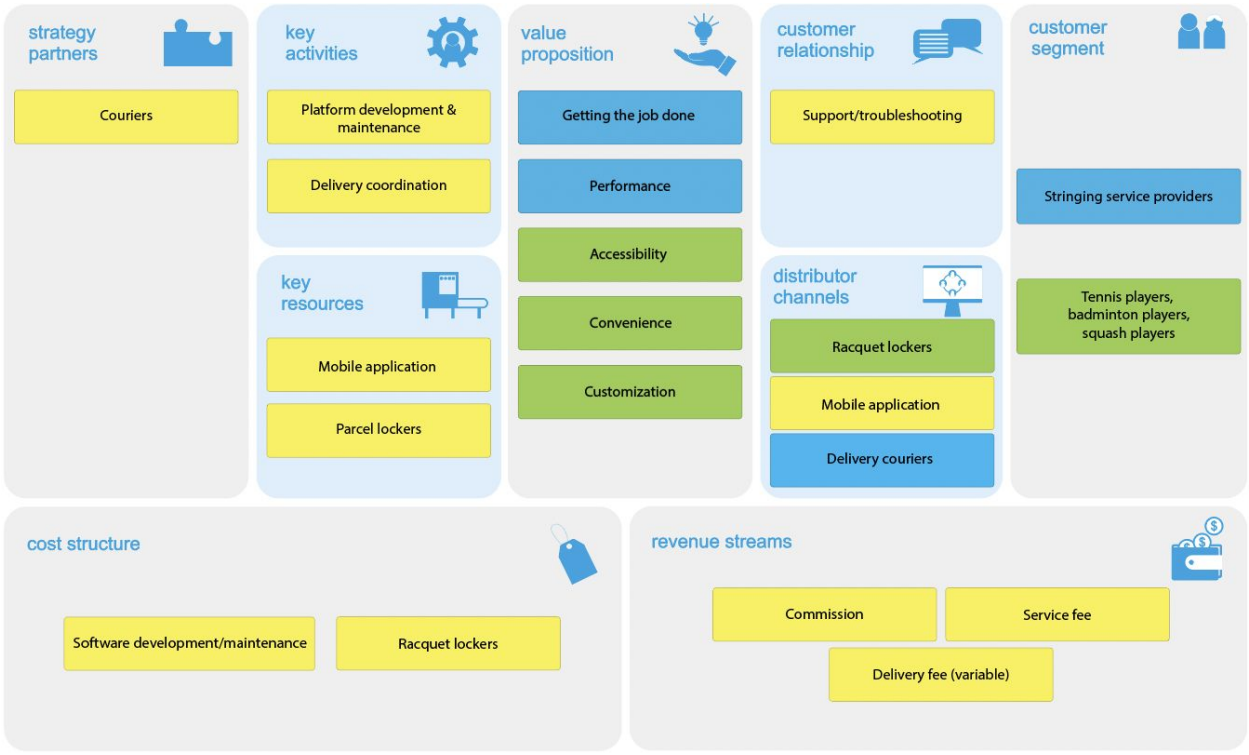
4.4.3 Business model canvas

A business model describes how a business creates, delivers and captures value (Osterwalder & Pigneur, 2010). The canvas that Osterwalder & Pigneur set forth is built on the following nine building blocks, each followed by a description of how this project fits in the building blocks:

1. **Customer Segments**, defining the different groups of people the business wants to reach and service

    a. For this project, the customer segments are stringers (both independent stringers, and racquet stores that offer stringing) and players who need their racquet strung.
2. **Value Propositions**, describing which and how the products and services create value for a customer segment
    a. For this project, the value propositions differ slightly between service provider and customer: service providers find value in that the mobile application allows customers to be co-creators, and increases service providers' focus on performance by automatically managing and processing orders, thereby increasing efficiency, while the increased accessibility for players increases awareness for stringers, leading to an opportunity to expand customer base.
    b. For players, this service adds value through convenience (not having to go to the store, not having to stand in line, automatic payments), accessibility (being able to create orders and pick up orders at facilities (longer opening hours), always being able to keep track of order history), and customization (being able to save favorites, making ordering faster).
3. **Channels**, defining the means of communication and delivery in order to deliver value to customer segments
    a. For this project, the channels that the business will connect with their customers through is the mobile application, racquet lockers and the delivery couriers
4. **Customer Relationships**, describing the type of relationship a business expects to have with its customers
    a. For this project, the customer relationship will be limited, as the business proposition builds on a self-service platform, where the only contact there should be is customer support for troubleshooting purposes
5. **Revenue Streams**, representing the type of income a business expects from each customer segment
    a. For this project, revenue streams will consist of commission from the service providers, service fees from the service customers, and delivery fees from customers.
6. **Key Resources**, defining the most important assets required to make the business work (physical, intellectual, human, financial)
    a. For this project, the key resources are the platforms and the parcel lockers

7. **Key Activities**, describing the most important activities a business performs in order to make the business model work
    a. For this project, the key activities include platform development and maintenance, as well as delivery coordination.
8. **Key Partnerships**, defining the suppliers and partners the business will have in order to work
    a. For this project, key partnerships are with delivery couriers.
9. **Cost Structure**, describing the costs incurred to operate the business model
    a. For this project, the costs that will be incurred are the racquet lockers and the development and maintenance of the software.



The business model canvas for improving the racquet stringing service with a digital platform.

4.5 Results summary

Upon applying the Double Diamond frameworks and coherent design methods and tools to design and develop a digitally based service proposition for the racquet stringing service in Denmark, in the shape of a platform, it can be concluded that players and stringers do

experience pains in their current service experiences, and that the proposed application and infrastructure can alleviate some of those pains, as well as it can create value in the shape of accessibility, convenience and performance. Both the retail store and independent stringers responded positively to the service proposition, and both parties have greatly affected the features of the platform by being actively used as testers and co-creators, providing feedback throughout iterations of ideation and development.

4.5.1 The service proposition

In brief description, the service proposition upon applying the digital platform is as follows: When a player breaks their string (or decides it is time for a new stringing), they take out their phone and open the platform to place a new order. Upon selecting their location and stringer, they will need to select which type of string from the stringer's inventory they desire, and the tension (the weight that is pulled on the string, i.e. the "hardness" of the stringing. If they are in doubt, they can choose to look in the string guide that is available in the app, which can provide them with information on different strings, and how much tension is recommended. Upon selecting the string and tension, the player will select a time at which they would like to pick their racquet up again. The time selection function can be specified as **after** a specified time of day (e.g. after 2pm). Players are then asked to place their racquet in an available locker in the locker section located in their club. Just before the club's closing time (usually 11pm or midnight), a courier (or the stringer/an employee) will pick up new orders and take them to their stringing facility. The stringer will be able to access the service provider platform, and see which racquets need to be strung in which order. The racquets will be identified through a QR-code on the inside of the racquet, which will be created and placed in the racquet by the stringer during the customer's first service order. Upon service completion, the stringer will ready the racquet for shipment back to the club. A courier (or the stringer) will take the racquets for next day pick-up to the club, and place them in lockers. When they have been placed, the player will receive notification that the racquet is ready for pickup in their club. The stringer will unlock the locker by using an integrated payment function to pay for the service. The digital platform provider will charge stringers a commission fee of approximately 15%, and charge players a service fee that will go to covering the cost of the digital lockers.

5 Scope of future work

As was stated in the previous summary of the results, this study can conclude that a digital platform combined with racquet lockers can improve the perceived value of the service, and benefit both stringers and players. Therefore, I deem it appropriate to move forward with the service proposition and development, and will here consider some of the implications of further work on the service design.

One of the important steps when realizing this service proposition will be to investigate in which locations the value contribution and possible revenue outweigh the costs of providing the service. For one, it will be necessary to determine the costs of placing racquet lockers in facilities, and providing delivery, measured against the number of players in and around that facility.

Throughout the course of this project, focus has mainly been on whether or not this could add enough value for it to be realizable. It is safe to say that validation, i.e. building the right thing, has taken up a lot of the focus. I will claim that, in moving forward with this project after the submission of this thesis, the prototype needs to be looked at from a more UI-focused perspective. The purpose of this service is to add value through convenience and accessibility, and I propose that the platform should have a more simple and sleek layout.

I believe it could be valuable to go deeper into working on the setup in the sports clubs in which the lockers will be situated. As clubs are typically always interested in obtaining more members, or as a minimum retaining their members, clubs will find themselves motivated to have racquet lockers in their facilities, thus adding value to their members without incurring any actual costs. An effort to market the service could be a joint offer with the club, providing members with a discount to use the service, thus making it more attractive to be part of a given club.

5.1 Considerations on retail stores

While the stringers at White Sport expressed a high degree of excitement, stores might generally be reluctant to adopt parts of this service proposal. I propose that future work on this project addresses the business model and value propositions of the traditional specialized racquet retailer, when implementing this service. As one of the players in the brainstorming

sessions noted, bringing people into the shop for stringing purposes also helps generate other sales. Brick and mortar store owners, such as the ones in Copenhagen that have a rich history of customer loyalty, partially due to their own longevity in the industry, will have to dig deep within themselves to be willing to reinvent their business models to accompany a service proposition like this. They will have checks and balances that need to be weighed out, such as whether they might be better off with less esteemed physical store addresses, that are heavy on rent, and focus on online sales. This would raise a number of different challenges, such as the customer not knowing anything about who actually strung his/her racquet. It would just be a name on a screen. To address that concern, I would like to highlight the point about having certifications in the app and promote these accordingly, with videos and information on the stringing process, such that the customers know that their racquets are receiving the best possible service. Co-creators in the brainstorming sessions believed that there would be a large number of customers who would gladly pay more for premium services, knowing that their strings received the attention and care similar to that of the pro players' racquets. This provides ground for further exploration, as this assumption would need to be addressed directly.

Specialized retail stores are already suffering - their sales are down due to e-commerce gaining ground over the last two decades, and this will only challenge them even more. Taking a bite out of what is arguably their best relative net income will only frustrate them, so why should they use it? Restaurants have been presented with the same dilemma, and it is not hard to see what they chose. You can find them on one of the dining apps. In researching Wolt and Just Eat, I discovered an interview with an owner of a diner, who said that their presence on this platform created an awareness that was unique - she found that if customers were happy with the food they had delivered to them through the delivery app, they would also be more inclined to stop by the restaurant in the future. The awareness rose remarkably. The value that stores can find in this service is the opportunity to create an online name for themselves. Specialized racquet retail stores in Denmark all have webshops, but their online sales are primitive compared to the born-and-bred e-commercers. This service proposition will allow stores in Denmark to show that they are able to provide a reliable and fast service, and they will have the opportunity to provide extensive customer service, due to the fact that they are located in Denmark. If a customer has an issue with an online purchase from Germany (where the largest e-commerce tennis retailers, tenniswarehouse-europe.com, tennis-point.de and tennis-man.de are located), they will, in spite of advanced order return systems, inarguably find that a Danish located retailer will be able to provide greater customer service.

Retail stores will also have the opportunity to distinguish themselves from others by providing a wider selection of inventory, as they purchase reels of string for reselling as well as stringing. It is commonly known that it makes economic sense to purchase an entire reel of string, rather than purchase string from the stringer at every stringing job, so long as the player is set on their preferred string. A string reel generally holds 200m of string, which supplies string for somewhere between 16 and 18 stringing jobs. Retail stores will purchase these reels at cost, and will have advances on reselling, which will make their prices competitive with those of independent stringers, who typically don't have the same degree of overhead.

The accessibility that this service proposition offers the stringing service customers will challenge stringers to diversify themselves in order to stand out from their competitors, but it will also require them to live up to the standards their customers expect, because switching costs suddenly become very light for customers to bear. These are consequences that benefit the players, but they also increase service reliability, which can certainly make customers come back for more in the future.

5.2 Sustainability

With society's focus on sustainability today, I believe that future work on this project should include focus on how this service could be considered a sustainable service for the future, as there is a clear connection between innovation and sustainability. This project already offers the following sustainable solutions:

1. Driving to a third party location (often in bigger cities) in the relatively high standard of racquet sport players' cars is something that could well be removed. Instead, the service proposition suggests sustainable means of transportation, such as courier bikes or "carpooling" (racquets) multiple orders to one facility.
2. The digital nature of all orders means that very little paper will be used for the service. As was discovered in the dialogue with White Sport, printed labels are a key part of their order management system, being the only way for a customer to verify that a certain racquet is actually theirs, and being the only way for the stringer to know the details of the service order. The only physical requirement is that racquets have a small adhesive label with a QR-code somewhere on them. The QR-code can be scanned by any new smartphone today, retrieving all relevant information, and the big difference will be that in contrast to the current method, where a label is produced and printed for *every* order,

this service proposition will only require new labels to be printed if the customer should change their racquet, or if their label is damaged/destroyed (even though labels will be placed on the safest spot of the racquet, racquets go through normal wear and tear, and “safe spots” are occasionally subject to sudden impact with hands, balls and other surfaces).

What I believe should also earn focus is the fact that most strung racquets would be delivered wrapped in a plastic bag, as can be seen in the picture below.

There are various reasons for wrapping, such as keeping moisture away from gut strings (very few players still use gut strings today), and keeping the racquets free from any scratches or harm to the grip. When transporting racquets to and from racquet lockers, there is added benefit in wrapping racquets. In 2019, tennis’ oldest tournament, Wimbledon, ditched plastic bags from the tournament entirely, in a joint sustainability effort from the tournament and the professional players’ council (Reuters, 2019). To the best of my knowledge, no stringers have made such efforts in Denmark. It would be a great initiative to take, and would likely increase popularity as well.

5.3 Scalability

As research for this project has been conducted with a focus on the outlook of clubs and stringing services in Denmark, it is worth exploring if stringing services in other cultures could sustain the service proposition of placing lockers in clubs. I will argue that cultures that resemble

Denmark should find value in this service, but it cannot yet be concluded that this service proposition will present the same value, or hold different challenges in other markets.

6 Concluding remarks

The stated objective of this product was to answer the question **How might a digital platform improve racquet stringing services in Denmark?** This was addressed by applying methods from service design and interaction design in the double diamond framework to design a digital platform that would improve racquet sport equipment service experiences for customers and stringers alike in Denmark. The design outcome is based in part on the author's experience within the field, and on the application of several methods and tools that facilitate co-creation, thus validating the project by repeatingly testing concepts and implementing changes. The platform improves the stringing service experience by 1) relieving stringers of some of the most generic tasks, and allowing them to focus on providing a good service, 2) allowing stringers to reach a broader audience, and players to reach more service providers, and 3) offering players convenience in order creation and service delivery, as well as accessibility in the shape of offering them the service during an extended window of time during the day.

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