User Interface Design and Usability Study of a Mobile Application for a Crowdsourced Fencer Database

by

Xiaoyi Ren

Submitted to the Department of Mechanical Engineering in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Mechanical Engineering at the Massachusetts Institute of Technology June 2015

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1
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Submitted to the Department of Mechanical Engineering on May 18, 2015 in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Mechanical Engineering

ABSTRACT

To be successful in fencing, fencers need to not only excel in techniques but also in tactics. The sport is both a physical and a mental game. The more a fencer knows about other fencers, the more likely he or she is going to be able to choose the most appropriate strategies. However, a lack of resources makes it difficult for fencers to learn about their opponents. The goal of this project is to study the needs of fencers and design the user interface for a mobile app that allows fencers to contribute and receive information on other fencers’ fencing ability and fencing style. This thesis describes a case study of the design and development of the mobile app, starting with the types of information a fencer might want to know about a potential opponent, the creation of provisional prototypes of an app that could gather and present that information, and testing of the prototype with users. The thesis concludes with thoughts on future development of the app.

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# Table of Contents

1. **Introduction**  
   1.1 Fencing Strategy Planning  
      1.1.1 Fencing Basics  
      1.1.2 Importance of Strategy Planning in Fencing  
      1.1.3 User Needs for Strategy Planning Tools  

2. **Interface Design of the Fencer Database Mobile App**  
   2.1 Paper-prototype of the Interface  
      2.1.1 User Testing with Paper Prototypes  
      2.1.2 Results and Conclusion of User Testing with Paper Prototypes  
   2.2 First Iteration of the Mockups  
      2.2.1 User Testing with Mockup Version 1  
      2.2.2 User Testing Results and Discussions  
   2.3 Final Mockups  

3. **Summary and Conclusion**  
   3.1 Challenges and Shortcomings of Design  
   3.2 Lessons Learned  
   3.3 Future Work  

5. **Bibliography**
List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1:</td>
<td>Three fencing weapons</td>
<td>11</td>
</tr>
<tr>
<td>Figure 1.2:</td>
<td>Target area for three different weapons in fencing</td>
<td>11</td>
</tr>
<tr>
<td>Figure 2.1:</td>
<td>User experience flow chart</td>
<td>16</td>
</tr>
<tr>
<td>Figure 2.2:</td>
<td>Paper Prototype of the “Search Fencers” screen</td>
<td>16</td>
</tr>
<tr>
<td>Figure 2.3:</td>
<td>Paper Prototype of the default fencer profile screen and the media section</td>
<td>17</td>
</tr>
<tr>
<td>Figure 2.4:</td>
<td>Home screen of the app that appears when user opens the app</td>
<td>19</td>
</tr>
<tr>
<td>Figure 2.5:</td>
<td>“Search Fencers” interface and the filtering side bar</td>
<td>20</td>
</tr>
<tr>
<td>Figure 2.6:</td>
<td>View fencer profile screens</td>
<td>22</td>
</tr>
<tr>
<td>Figure 2.7:</td>
<td>Edit fencer profile screens</td>
<td>23</td>
</tr>
<tr>
<td>Figure 2.8:</td>
<td>Updated “Search Fencers” screen</td>
<td>25</td>
</tr>
<tr>
<td>Figure 2.9:</td>
<td>Updated “Edit Fencer” screen to include options</td>
<td>26</td>
</tr>
<tr>
<td>Figure 2.10:</td>
<td>Final “Search Fencer” and related screen</td>
<td>27</td>
</tr>
<tr>
<td>Figure 2.11:</td>
<td>Final set of “View Fencer Profile” screens</td>
<td>28</td>
</tr>
<tr>
<td>Figure 2.12:</td>
<td>Final set of “Edit Fencer Profile” screens</td>
<td>29</td>
</tr>
</tbody>
</table>
Chapter 1

Introduction

Competitive fencing is a sport that requires serious strategy planning before the game and applying the appropriate tactics during the game. The mental component is as important if not more important than techniques. However, fencing is not a popular sport that receives high amount of attention or has analysis of player stats readily available in the way that other sports do. Fencers currently learn about their opponents through their coaches or teammates if their coaches or teammates are with them at the competition and know their opponents from previous competitions. This project aims to create a user interface for a tool that helps fencers get information on other fencers especially when other resources are not available and thus better prepare for competitions. The goal is to design the interface with a focus on usability of the tool.

1.1 Fencing Strategy

Competitive fencing, also known as Olympic fencing, is one of the five sports that has been featured in every modern Olympic games. It became a sport instead of a form of military training in the 18th century. Fencing involves two fencers fighting with swords on top of a strip that is 14 meters long and between 1.5 and 2 meters wide. Fencers score points by touching target areas with different parts of the blades, depending on the particular weapon. Each match between the two fencers is called a bout.

1.1.1 Fencing Basics

There are three different types of weapons, foil, épée, and sabre. The three weapons have different shapes and sizes as shown in Figure 1.1.
Figure 1.1: Illustration shows the how foil, épée, and sabre are different in shapes and sizes.  

Foil and épée only allow fencers to score with the tip of the blades while sabre allows fencers to score with tips and sides of the blades. The three weapons have different target areas as shown in Figure 1.2. Foil targets only the torso; sabre targets the entire area above the waist; and épée targets the entire body.

Figure 1.2: Illustration shows the target areas for each weapon.  

Foil and sabre only allow a single touch to score. In the case that both fencers hit on target at the same time, both fencers score in épée while the referee determines who gets the point based on “right of way” in foil and sabre.
The fundamental differences in the three weapons make the three events very different and require very different approaches in strategy. Success in fencing relies not only on physical fitness, skills, or techniques but also on strategy. In addition, every fencer has very distinct style and it is important for fencers to plan their actions accordingly.

1.1.2 Importance of Strategy Planning in Fencing

Fencing is a strategy driven sport that requires the fencers to plan their actions based on the strengths and weaknesses of their opponents. It is often a “mind-game” as well as a physical game. Although physical fitness and techniques are important, strong tactics will allow the fencers to best use their techniques. Fencing technique refers to the actions fencers take to score points or to avoid being scored on. Tactics refer to the decision of what actions to use during each bout. Preparing a game plan before each bout helps fencers make more appropriate decisions on what actions to take. Having a plan will also help fencers prepare for how to react to their opponents’ actions.

In order to make appropriate game plans, fencers need to know what actions they are good at and what actions they should avoid. Often times, fencers try to prompt their opponents to carry out actions they want their opponents to do so that they can counter them with their desired actions. Using such strategy is referred to as “second intention actions”. The key to take control of the bout is to master second intention actions. If fencers can do this successfully, they can effectively make their opponents help them set up their actions.

To successfully use second intention actions, fencers need to draw the opponents to use their less competent actions. Therefore, knowing the opponents’ strengths and weaknesses is vital to a fencer’s success. The more knowledge they have about their opponents, the more likely they will be able to form the most effective strategies. Knowing more about the opponents also helps the fencers predict what the opponents are likely to do and form a plan of actions. Moreover, learning more about other fencers can also help fencers improve their own fencing based on what they see from other fencers.
1.1.3 User Needs for Strategy Planning Tools

As mentioned in the previous section, strategy planning relies heavily on knowing one's opponent. However, unlike most other sports, there is no quantitative measure of how good a fencer is. Fencing websites that have information on fencers only provide their recent results and overall record. None of the existing databases address the needs of knowing what other fencers' strengths and weaknesses are.

Qualitative user interviews were conducted to help better understand the needs of fencers who compete in various levels of competitions. Current fencers, alumni and the head coach from the MIT fencing team were solicited for their input on fencing strategy planning. A total of four fencers and a coach were interviewed individually over the phone or in person for 15 to 20 minutes. Among the four fencers, two are foilists, one is an épéeist, and one is a sabreist. The selected fencers have competed in collegiate, national, and international level competitions, which makes them part of the target user group of this app.

Each fencer was asked the same set of questions to establish consistency. The first question focused on what information fencers would like to know about their opponents. The following areas are crucial to fencers of all three weapons based on the interview results: offensive vs. defensive tendency, speed and quality of footwork and hand actions, preferred line of attack and parry, and strength of parries. There are also important factors that only apply one or two of the weapons. Foil and épée fencers would love to know if their opponents are good at point control and sabre fencers would like to know which exact areas their opponents tend to attack. Fencers also believed that photos and videos of others fencing would be very helpful for them. These results are important because they provide insight to what information is necessary to show in the app.

All the fencers interviewed agreed that knowing more about their opponents helps them better prepare for each bout but all of them are concerned with other fencers knowing too much about them. However, three out of the four fencers interviewed stated that they would be willing to let people know more about them in exchange for more information on their opponents. When asked about how they prepare for each bout, everyone stated that they most often get advice from their coaches and sometimes other teammates. It is easy to get advice from teammates at collegiate competitions because each school competes as a team and everyone from the team
competes at the same location. However, fencers are often separated from their teammates and sometimes their coaches at national competitions; therefore it is hard to get advice when they need it. Moreover, coaches sometimes have to help multiple fencers at each competition and may not always be available to give advice. Also, they might not know about every fencer well enough to give advice at the competition. Fencers mentioned that they also try to draw information about other fencers from their memory if they have fenced the opponent before but sometimes they would forget about their previous experience fencing the specific opponent.

Currently, there are no tools for fencers to organize their own notes on what they know about other fencers or share the information they know with their teammates. The existing database of fencers also does not provide the kind of information that will help fencers prepare for the competitions. All the online databases, such as the one from the International Fencing Federation (FIE), only provides information on rankings and recent results of each fencer but not specific traits or characteristics of their fencing. Since fencing doesn’t have quantitative results like field goal percentage in basketball, it is also hard for these online databases to provide information that is useful for strategy planning.

Based on the interview results, there is a clear need for a tool that gives fencers specific information about other fencers that is helpful for competition preparation. There are no existing tools that target this need because fencing is not a popular sport with a large amount of participants or spectators. Therefore, the goal of this project is to create a tool to help fencers get more information on their opponents’ strengths and weaknesses so that they can better prepare for their competitions.
Chapter 2

Interface Design of the Fencer Database Mobile App

The goal of this project is to create a user interface for a mobile app that allows fencers to learn about potential opponents. Based on the needs uncovered in interviews with competitive fencers, it was decided that the app should include a mechanism for users to add in their comments and ratings of their opponents and allows fencers to look up information on fencers that people in their network have entered information on. The app facilitates the crowdsourcing effort to provide more information on different fencers so that users can use the information to better prepare their strategies. This project studies the usability of the interface and aims to design a user interface that is easy to learn and use while providing necessary contents.

2.1 Paper prototype of the User Interface

Low fidelity paper prototypes were made to realize the concept and conduct preliminary user testing. Using paper prototypes makes it easier to represent many different alternative designs and obtain feedback faster. Paper prototypes also do not appear as a finished, complete design so testers are more likely to provide suggestions and critiques. During this stage of the design, several designs of the critical screens were created using markers and notecards. Only critical screens are created and tested because the focus of this study is the usability of the strategy planning function.

A user experience flow chart (Figure 2.1) was created to guide the design of the app. There are sample screens designed to address the opponent info branch. The “Search Fencers” screen (Figure 2.2) allows users to look up fencers they want to get more information about. The screen includes the name and handedness of the fencers as well as a crowd sourced overall score given to the fencer. The tab on top of the screen allows users to choose if they would like to see fencers for a specific weapon.
Figure 2.1: User experience flow is used to guide the design of the app.

Figure 2.2: Paper Prototype of the “Search Fencers” screen.

On the main screen (Figure 2.3) that shows the information on each fencer, users can scroll through different screens look at summary, comments, pictures & videos, and recent results. The small dots on the bottom indicate that there are multiple screens that the users can scroll through. By default, the summary screen will open when the user opens up the profile of a fencer they want to look at. The user can see a radar chart that shows the average rating the fencer received in different categories. The radar chart is chosen because it is similar to the
fencing tactical wheel and is used in different places to show skill sets. The intention was to maintain external consistency so that it is easier for people to learn.

![Image of fencing tactical wheel]

Figure 2.3: Paper Prototype of the default fencer profile screen and the media section.

2.1.1 User Testing with Paper-prototype

The goal of the user testing of the paper prototypes is to study if the features on the app would address fencers’ needs for a strategy-planning tool. The tests also seek to address the question of whether or not the user experience flow is reasonable and intuitive for the fencers. To accomplish these goals, two potential users who are competitive fencers were given scenarios and asked to complete tasks using the paper prototypes.

Scenario 1 tells the user that he or she has just finished a round of competition at a North American Cup (NAC) and wants to enter their comments and ratings of various fencers they fenced. The task is to rate a fencer the user has comments and opinions on in terms of 3 different categories. This scenario is realistic since NAC is main national level competition in the United States and fencers normally have some down times to relax and prepare for the next round in between rounds.

Scenario 2 describes that during a competition, the user sees the pool assignment and wants to know about the fencers in his or her pool to better prepare for these bouts. The task is to
find one of the fencers in the user’s pool, check out the summary of the fencer’s ability in
different categories, and read the comments other people say about said fencer.

Both users found it easy to navigate the “Search Fencers” screen but wished there was a
way to limit the search to a specific gender, weapon, and handedness. Once they select a fencer,
neither of the two users could find the way to switch from editing the scores (default screen) to
adding comments. Users also found that the specific comments for each skill category are not
necessary. Users both stated that the extra comments under each category are redundant since the
comment section is providing very similar information.

2.1.2 Results and Conclusion of User Testing with Paper Prototypes

Overall, testing with the paper prototypes shows that users find the flow of the user experience
logical but some of the buttons on the screens do not have the correct affordance so users did not
understand the intended use of some of the buttons and scrolling capabilities. The next iteration
aims to solve the issues identified in this round of user testing.

In addition, user testing scenarios and tasks present some limitations. First of all, neither
scenario addresses the issue of updating existing comments and ratings. Since fencers’ fencing
style and ability can change drastically overtime, it is very important that the users have the
ability to update the existing comments and ratings they entered based on previous experience.
Therefore, scenarios and tasks were modified to improve the testing process for the next section.

2.2 First Iteration of High-Fidelity Mockups

After testing with paper prototypes, high-fidelity mockups of different screens were designed in
Adobe Photoshop. Unlike the paper prototypes, these mockups have a more realistic look and
feel. Changes were made to the features and look of the user interface based on the feedback
from user testing with paper prototypes. More functionality was added to improve the user
experience and address the needs of the users. Since the app is designed to be used mostly at
competitions, efficiency and learnability is extremely important. It is designed so that users can
find and understand useful information as quickly as possible. The design of the interface takes
the minimalistic approach to enhance both efficiency and learnability. A less vibrant color
scheme is used to create the trustworthy look and feel of the app.
The home screen in Figure 2.4 is designed so that users can access the key functions quickly. Icons on this screen are chosen so that they follow the external consistency with icons commonly used for similar functions. “Add Fencer” function opens the screen shown in Figure 2.7, which allows users to easily add a fencer they fenced to the database. “Search Fencers” brings up the search screen where users can look up specific fencers. “Add Results” allows the users to quickly add the results of their recent bouts which “View Results” allows users to access recent results in the database easily.

“My Network” and “Training Plans” are not the focus of this project but are there to demonstrate the important features users would like to see based on the feedback from user research. “My Network” function dictates what information is available to the users. Upon implementation, users will only be able to see the comments and ratings about other fencers entered by people in their network which could include teammates, coaches, and other friends. This design decision is made because privacy is a big concern for all users but they would also like to know more about other fencers. This design allows them to decide if they would like to let more people know about them in exchange for information on other fencers.

Figure 2.4: Home screen of the app that appears when user opens the app on their mobile device.
Figure 2.5 is the “Search Fencers” screen that allows users to search a specific fencer to view or edit. On the search screen, profile picture, name, weapon, and handedness of each fencer is shown so that users can easily select whom they are searching for. To improve the efficiency of the search function, filters can be applied to narrow down the search. Users can choose to filter by weapon, gender, and handedness.

![Search Fencers screen](image)

**Figure 2.5 (a) & (b):** Figure (a) is the “Search Fencers” interface that allows users to search for a fencer to either view the fencer’s profile or add comments and ratings about the fencer. Figure (b) shows the filtering function of the search function.

Once a user finds the fencer they would like to look at, they can tap on the name and that leads them to the profile page of the selected fencer. The user can toggle between Metrics, Media, Results, and Comments sections. During user testing with paper prototypes, users had difficulty finding their way to switch between different sections; therefore, descriptive tabs instead of small dots on the bottom are used for visibility. In the article “Obvious Always Wins” by Luke Wroblewski, a Product Director at Google, it is shown that engagement increases drastically when the menu is highly visible.
The default section shown is Metrics (Figure 2.6 (a)), which is a graphical representation of average score the fencer received under each category. The categories are different actions or descriptive terms used to describe fencing abilities. Similar to the paper prototypes, a radar chart is used to illustrate the scores received by the fencer. The radar chart shows a minimum score of 0 and a maximum score of 10. In this iteration, footwork quality and speed, bladework quality and speed, strengths, and strategy are the defaults categories used to evaluate the fencer.

The media section as shown in Figure 2.6 (b) includes pictures and videos of the selected fencer. Since fencing lacks of quantitative measures of one’s fencing ability and there are many subtleties that are hard to explain or express in comments or scoring, pictures and videos are very helpful for users to learn more about other fencers. This section will ideally contain pictures and videos scrapped from web content and user uploads.

The comments section as seen in Figure 2.6 (c) allows users to see what other fencers say about the selected fencer. The comments section is similar to the comments section on other popular websites like Yelp.com. This similarity is used to ensure external consistency so that people can learn the user interface faster. Users can see who made the comment, which gives them a better idea of how relevant the comment is to them.

The results section is not focused in this project because it heavily relies on what information will be available through backend data scrapping.
If the users want to add in their own input on a certain fencer, they can choose “Add Fencer” from home screen, enter the name in Figure 2.7 (a), and either allow the database to autocomplete the name and choose that if the fencer is in the database or add new fencer information in the database. There are default categories already provided when the user opens the page. User can slide the sliders to give the fencer their ratings. The plus button in the bottom right corner lets the user add new personalized categories. Comments and media section allows users to add their own content simply by pressing the plus button on the bottom right. The overall design of the edit pages follows the new Google material design style. This is intended to create external consistency for better learnability.
2.2.1 User Testing with High-Fidelity Mockups

Five fencers from the MIT fencing team participated in this round of user testing. Similar to the process for user testing with paper prototypes, each test subject is given scenarios and list of tasks to finish with the mockups. POP – Prototyping on Paper app from the app store is used to conduct user testing. POP allows users to link pictures of existing prototypes together. This tool makes the prototype looks and feels realistic without having to implement any real functionality.

Small modifications were made to the first two scenarios described in the earlier section and a third scenario is added to make the test more comprehensive.

Scenario 1: The user has just finished a round of direct elimination (DE) bouts at a North American Cup (NAC) and wants to enter comments and ratings of various fencers he or she fenced. The task is to rate a fencer in terms of 3 different categories and add comments on what the opponent's favorite parries are.

Scenario 2: During a competition, the user sees the pool assignment and wants to know about the fencers in his or her pool to better prepare for these bouts. The task is to find one of the

**Figure 2.7 (a) – (c):** The edit screens for Metrics, Media, and Comments section respectively.
fencers in the user’s pool by narrowing down the search to user’s event, check out the summary of the fencer’s ability in different categories, and check if there are any video clips available.

Scenario 3: The user has fenced the same opponent before and noticed some changes in his or her fencing ability. The task is to add new comments about the opponent’s fencing style and update the previous scores the user gave the opponent in terms of footwork quality and strength.

2.2.2 User Testing Results and Discussions

This section will discuss the critical incidents that happened with each screen presented during user testing. The critical incidents discovered exposed critical usability issues of the design that lead to significant changes for the final Mockups. The user testing results were measured by the number of misuses in each scenario. There was no misuse when users were trying to complete scenario 1. For scenario 2, three out of five test subjects misused the tabs and had to check out different tab to find the videos and pictures. All three users tested first could not find the filter option yielding a 100% misuse rate for one of the tasks for scenario 2. The 100% misuse rate led to a quick design update before the next round of testing and reduced the same misuse rate to 0%. Three of the five users misused the big plus button on the “Edit Scores” section and could not figure out how to add more metrics.

Although the home screen (Figure 2.4) is very straightforward, the functions on it are not clear enough for the users. Two out of five users tapped the “Search Fencers” button directly when they were trying to complete the task in scenario 1 though the intended use for “Search Fencers” is for users to look up fencers they are going to fence or have fenced before. These two users used the “Search Fencers” screen to find the fencer and used edit button on the profile page to add information. They found this flow natural and not too cumbersome. Two out of the three users who chose “Add Fencer” were initially confused when the next screen (Figure 2.7 (a)) appeared. After figuring out that they needed to put in the name and trigger autocomplete, they were concerned that they were going to choose the wrong fencer who just happens to have the same name as the intended fencer.

On the search screen as shown in Figure 2.5 (a), none of the first three testers were able to find the filter button. They stated the filter icon is not intuitive and they did not recognize the icon. Since improving the filter icon is a minor change that will make the test go more smoothly
and reduce unnecessary confusions, a small text was added under the icon as illustrated in Figure 2.8. The following two users found the icon easily and did not have the same issue again. The hand icons used to describe handedness on this screen confused two users. They were unsure if the palm or the back of the hand is shown. All users pointed out that there is not enough information about the fencers on the search screen to differentiate two fencers with the same names if the user does not already know how the fencer looks.

Figure 2.8: Updated “Search Fencers” screen with the text filter written under the icon to avoid confusion for users.

Once users were able to open the filter function presented in Figure 2.5 (b), all users were able to filter the results as required by the task. However, one of the users wished there were more filter options. The user mentioned that he would use this app for training as well. He explained that if he wants to train for a specific action or set of actions, he would look up fencers who are good at that area and try to use the photos and videos to guide his training. The same user also said sorting would be helpful if he would only like to see fencers with an overall score above a certain point.

Only two of the five users said the radar chart in Figure 2.6 (a) was easy to read. The other three users found it confusing and were not sure how to read it. Moreover, even one of the
users who understood the radar chart well said it was hard to compare across different categories unless there is an obvious outlier. Users also mentioned that it would be very useful to show a comparison between the user and the selected fencer. All users were able to find the tab to switch between different sections on this screen. However, three out of five users were not sure what media meant. They all assumed media was referring to news coverage. In addition, the order of the options in the tabs does not follow normal use flow. Users stated that they would want to see the summary, read the comments, and then look at pictures, videos or recent results.

The big plus button was not obvious to three of the five users. They did not know what it was and completely ignored the button when they were asked to create a new category under Metrics. Also, two users mentioned that if a numerical rating system is used, there should be a separate overall score since average of each category might not reflect the true fencing ability of the fencer. The updated version shown in Figure 2.9 was created after the first two tests to include the overall rating so that fencers who are mediocre at different areas but use everything well together would not be overlooked.

![Updated “Edit Fencer” screen with a slider for “overall” fencing ability.](image)

**Figure 2.9:** Updated “Edit Fencer” screen with a slider for “overall” fencing ability.
Overall, users were able to finish most of the tasks without any problems. However, some parts of the interface, such as the “add new fencer” screen, still present significant learnability issues. The wording of the tabs was ambiguous and the add button was not clear to some users.

2.3 Final Mockups

The final mockups were created after analyzing the user testing results. One of the key changes was removing the original home screen. The reasoning behind removing the home screen was because most of the functions on the home screen did not actually contribute to the user experience. For example, “Add Results” and “View results” still required users to find specific fencers. Therefore, to simplify the user experience, the original home screen in Figure 2.4 was replaced with the new search screen shown in Figure 2.10 (a). The list of fencers on the search screen was also updated to include more details so that users can differentiate fencers with the same first and last name who fence the same weapon. If the user tries to look up a fencer that is not in the database, the app will prompt the user to add the new fencer to the database as shown in Figure 2.10 (c). The bottom tab in Figure 2.10 (a) & (c) gives the users the option to switch between Add/Search fencer, My Network, and Training Plan sections.
**Figure 2.10 (a) – (c):** The “Search Fencers” screen and “Filters” for narrowing down search results are shown in (a) and (b). If the fencer is not in the database, the app would prompt user to add the fencer to the database like seen in (c).

Once the desired fencer is selected, the profile screen of the fencer will open up. The default screen is still the summary of the ratings as shown in Figure 2.11 (a). Since the radar chart received poor reviews during the previous user testing session, it is replaced with a simple horizontal bar graph. The bar graph was selected because it shows relative levels clearly as the levels are shown along the same axis. Since the bar graph is commonly used in different places, users are more likely to be familiar with it as well. Comments and media sections remain the same as the previous iteration as there were no complaints about the two.

Ranking, rating, and affiliation information are included in the profile section as seen in Figure 2.11 (a)-(c). The additional information will give users a general idea of what level the fencer is at which will help users get to know the fencer better. The additional information is also added to prevent opening and editing the wrong fencer.
Figure 2.11 (a) – (c): The profile screens for Metrics, Comments, and Media section respectively.

No major changes were made to the edit screens. The Metrics screen (Figure 2.12 (a)) was updated so that there is an input field for users to enter new categories. The input field was added so that it is more visible thus improving the learnability of the function. The big plus button is removed from the comments screen (Figure 2.12 (b)) and was replaced with a simple text input field and a button. This is intended to make the comment posting function more intuitive and easier to access. The add media screen in Figure 2.12 (c) remained the same.

Figure 2.12 (a) – (c): The edit screens for Metrics, Comments, and Media section respectively.
Chapter 3

Summary and Conclusions

3.1 Challenges and Shortcomings of Design

Throughout the whole process of this project, it was clear that there is a serious need for a strategy-planning tool for fencers. However, the nature of fencing makes it difficult to measure fencers’ fencing ability in a quantitative manner and there is not an existing forum for sharing such information. There are many contributing factors to whether or not a fencer is successful and it is therefore hard to put a measure on how good the fencer is. It is difficult to design a system that is easy to use and easy to understand while providing enough information about other fencers for the users.

Since the concept behind the design of the app Tactician is to use crowdsourcing as a way to provide information for users, it is hard to control what input there is. There is a natural bias in the system. A fencer who is not very good might perceive an opponent with average ability better than he or she actually is and provides feedback that would be inaccurate to other users. One of the few ways to reduce the effects of this is to show users who added the specific comments and ratings. Furthermore, the more data there is, the more accurate the ratings will be. Therefore, user acquisition will be very important when the app is the market.

While crowdsourcing is an easy way to acquire data, it also presents challenges with privacy. Some users mentioned that they would be uncomfortable with people uploading pictures or videos of them fencing without their permission. The current concept is to only allow users to share information with people in their network. Future development effort should definitely try to balance protecting users’ privacy and providing as much information as possible.

3.2 Lessons Learned

This project aims to solve a seemingly straightforward problem that has many tricky details. One of the lessons learned through the user testing process is that even if some icons or wording seem universal to the designer, there is still a high chance that the users do not know what they are. During the user interface design process, it is important to test often with a diverse audience to
get unbiased results. The design process of this project also shows the importance of testing early. User testing has shown its value as critical incidents were discovered and appropriate changes were made to the design to improve usability including learnability and efficiency.

The ineffectiveness of the radar chart shows that it is more important to choose a graph that can communicate the message effectively than to choose a graph for its style. When designing data visualization, it is crucial to utilize established external consistency to make it easier for people to learn and understand.

This project reveals the interests in strategy-planning tools in the fencing community. This project shows one way to address the long-existing issue in the world of fencing. Through this project, it is clear that the most important thing to the users is to receive well-organized and easily understood data. This study also shows the potential of a strategy-planning tool. It can be used for both competitions and for practices. The simple design of the app also allows users to utilize the app based on their preferences.

3.3 Future Work
Small-scale need finding research shows that fencers have a serious need for a strategy-planning tool. Currently, there are no resources that provide easily accessible data on fencers’ ability and fencing style. More detailed user research should be conducted with fencers from a more diverse background. A large-scale survey or user interviews should be conducted to determine what features and information is important to the fencers in general. Although all the fencers interviewed and tested in this study have different fencing experience, they are all MIT students who are more likely to be familiar with using data and technology. In the future, it would be useful to find out if other fencers are interested in using the same type of tools.

The critique received during user testing guided the changes implemented for the final mockups in this design. More user testing should be done to address any usability issues that might arise. Once the design for critical screens is finalized, a complete wireframe should be created to guide the development of the app. Future steps after that would be to develop the app and conduct user testing with the functional app. The app should allow user to search most of the fencers in the FIE database as well as local database. Deployment within a small community, such at the MIT fencing team, would be useful to gauge user feedback and guide future development. Ideally, there will be a mobile app available for download or purchase for any
fencers in the world after the app is developed. Since the app utilizes the crowdsourcing effort to provide information for fencers, it would be important to study the market and use that knowledge to achieve successful user acquisition.
Bibliography