Application for Dumpster Diving - A Design Proposal

Design Project Report in Human Computer Interaction DH1622

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Group C5

Mikaela Gärde, migarde@kth.se, 19991203-4726
Erik Meurk, emeurk@kth.se , 19970329-8670
Jessie Liu, jessieli@kth.se, 19990427-8489
Peter Borojevic, boroj@kth.se, 19990811-7337
John Brink, johnbri@kth.se, 19980417-5579

Tutor

Pavel Karpashevich

Abstract

This report examines dumpster divers as a user group, with the purpose of creating an interactive product that could help the user group in some way. It contains information gathered from interviews of the user group to help the examiners understand the needs of dumpster divers or issues related to the practise of dumpster diving. A primary prototype, resembling an app to help dumpster diver find dumpsters, was made in paper in order to do a user test. After collecting user feedback a second prototype was made, this time digital, and tested again to present the final form of the product. The result was a design proposal in the form of a digital prototype of an application that locates dumpsters and enables users to share real time status updates on what food is inside. It also provides the user with information useful in the dumpster diving process and enables them to get in contact with others. Lastly, discussion about the used methods and the final result was held, reviewing the work and suggesting possible improvements that can be made on the design proposal.

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Introduction

Background

Over the last couple of weeks we, a group of five members, have put in significant work to understand the needs of a specific user group and thereafter create a digital prototype that fulfills them as part of a design project in the DH1622 Human Computer Interaction course. At the beginning of the project, we were assigned the group of people who are politically driven to take advantage of food that was considered waste by others as our target group. We decided to focus on dumpster divers, people who attain food by going through dumpsters, mainly those that belong to grocery stores. This decision was made because of two reasons. The first reason was to reduce food waste. Data from the Swedish Environmental Protection Agency reported that in 2016, up to 1.3 million tons of food was thrown away in Sweden (Naturvårdsverket, 2016). With the ongoing climate crisis, this kind of statistic is dreadful, which is why we chose to try to confront this issue.

The second reason as to why we selected to work with dumpster divers was that they were more visible on social network platforms, for instance on Facebook where they had several communities. There we could witness how people worked together and helped each other by giving tips and wrote posts when they found food that they wanted to share. Furthermore, it would be easier to contact these members for data gathering through interviews.

Goal

The goal of the project is to create a digital prototype of an interactive product that makes the process of dumpster diving easier. The interface should have a design with high usability following the design principles mentioned in *Interaction Design: beyond human-computer interaction* by Helen Sharp, Yvonne Rogers and Jennifer Preece (2019).

Purpose

The purpose of this report is to give an overview of the group's work process and methods used for the different stages; from collecting our data to creating the final digital prototype, which will be motivated by referring to the literature. In addition, the report is meant to present a justification over which needs we decided to solve and the choice of product that was created.

Limitations

A number of limitations, as listed below, were not taken into account in the making of this prototype.

- People who cannot afford certain technology
- Monetary aspects and resources
- Implementations of certain functions

Method

The double diamonds of design methodology (Sharp, Rogers, and Preece, 2019) was followed from the very beginning of the project through the different stages of designing our prototype. The method is well known when it comes to interaction design and consists of four different phases: Discover, Define, Develop and Deliver(figure 1). 'Discover' is about finding the problems and collecting information about them . It can for example be done through interviews or questionnaires. The next phase, 'Define', is about going through the data that have been collected from the discoveries and draw suitable conclusions and requirements for the product. When moving to the next phase 'Developing', a design has to be created with the very basic elements of the upcoming product that will also fulfill the requirements. After that the development has finished and you 'Deliver' the product, meaning that you finalize and deliver it. It is important to mention that this is not a step-by-step process. It is instead an iterative work method, meaning that you return to previous steps several times. For example, letting your user group test a prototype of the product can lead to new requirements being discovered.

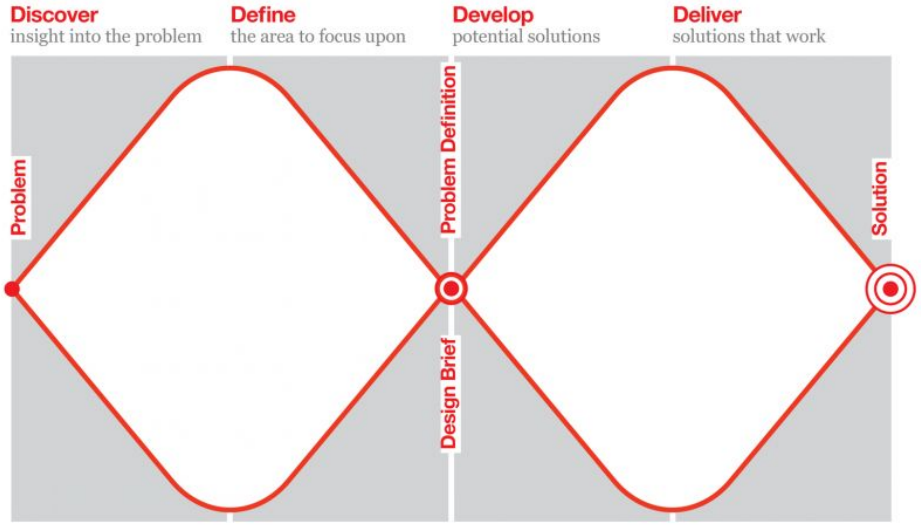

Figure 1: The double diamond

For the discover-phase, interviews were held. These interviews were semi-structured, meaning that there was a set of questions prepared, however, the interviewer was not constrained to them and could divert to other questions if it was suitable (Sharp, Rogers and Preece, 2019). Although it was not specified in the instructions that the project should contain this kind of interview, it is noted that semi-structured interviews have its advantages as it helps customize the interview according to the different interviewees. Moreover, the interviewees might present different perspectives and further knowledge than expected if the interviewer is allowed to diverge from the prepared questions.

When moving into the next phase of the double diamond methodology, the acquired data was used to define the requirements for the prototype. By doing so, one may learn what the product should do and how it should perform (Sharp, Rogers and Preece, 2019). To find the requirements, the method of creating user stories by listing different personas in the user group was utilized. This strategy is applicable when interaction designers need to catch the user characteristics of their user target group and the user's goals. The creation of personas was made with the earlier collection of data, which resulted in different characteristics

and goals for each persona. Afterward, user stories were made up according to the individual personas to establish their needs, which would then form the requirements for the design.

After the requirements were defined, ideas were created and discussed. When one idea was chosen, per feedback from the tutor, it was implemented into a paper prototype. A paper prototype allows testing of how the basic functions of the product works and interacts with the users, without having to sacrifice too much time and effort. Thereafter, user tests were conducted by giving users different tasks that they should accomplish with the prototype using the Wizard of Oz method, a way of testing prototypes by having a person imitate the interaction that occurs as the user interacts with the prototype (Sharp, Rogers, and Preece, 2019). These tests are crucial for a design's development as it enlightens the changes and improvements that are needed. With the results from the user tests, a digital prototype was developed where feedback from the user tests was implemented. Lastly, another user test was performed with the digital prototype so that final changes could be made before the presentation.

Implementations

Data gathering

In order to understand what needs and problems our user group may have, research was done on the subject. The research consisted of googling and reading in Facebook groups for dumpster divers and by conducting interviews. By doing so, we found patterns in how people dumpster dive. The focus was especially on one Facebook group called "Dumpstra i Stockholm" (Facebook, 2019). From that group, three distinct patterns were recognized from the different posts. One was that people would share their findings if there was an abundance of food, another one was that people looked for someone to go dumpster diving with. Lastly, multiple people asked where one could dumpster dive. The number of people who posted regarding these issues during the September month is listed in figure 2.

Different types of posts during September		**Number of people**
People who shared their food findings		3
People who looked for a dumpster companion		5
People who asked where one should dumpster dive		6
Miscellaneous posts		9

Figure 2: Table of the number of people who posted in the Facebook group 'Dumpstra i Stockholm' during the September month 2019.

To further investigate the patterns, semi-structured interviews were held with five participants from the user group with different backgrounds and ages. It was quickly noticed that the participants most of the time had similar interests and problems, following the patterns we found earlier. First and foremost, they all wanted to be able to share the food they found in dumpsters with other divers to reduce food waste. The issue was that some did not use social media, some wanted the dumpster for themselves and some thought the Facebook-groups often cover too large areas, which would make the information about certain

dumpsters unusable for many group-members. Secondly, several participants tried to find information online about how and where to dumpster dive when they started out but did not find enough. Some mentioned that it is time-consuming to look up store opening times each time they went out dumpster diving, especially when they needed information about several dumpsters at once. Participants also mentioned that information about when a dumpster is emptied would be of great value. Lastly, the vast majority never dumpster dives alone.

During the interviews it was discovered that apart from the dumpster diving issues brought up so far, many people also seem to be bothered by security guards, fences and locked up dumpsters. In fact, these were among the most mentioned problems. However, these problems were chosen to not be included in this project since helping dumpster divers get around these problems could be against the law.

Requirements and ideas

When developing the requirements for the design, two different personas were made representing the different desires within the user group discovered through the data gathering. These personas were people who dumpster-dived for economical reasons and people who did it for the climate aspect to reduce food waste. For each persona, user stories were created to discover what problems they may encounter when dumpster diving. From them, it was possible to define what needs to be achieved with the product and what general requirements it should have.

- **Functional requirements:** The product should implement some type of information to assist dumpster divers to take advantage of food waste. Moreover, the design should also help user connect with each other.
- **Environmental requirements:** The design needs to be adapted to the different environments that dumpster divers might be in.
- **User characteristics:** The product should be made for people who are dumpster divers. This means that it will be used by people of different ages, backgrounds and personal preferences as the user group is diverse.
- **Usability goals:** Because of the wide range of users, the design should be usable through simplicity while maintaining efficiency. As the functions might be unfamiliar for first time users, the product should have an introductory stage for first-time users in order to explain the functions.
- **User experience goal**: What the user should feel while using the product is that it helps them in the dumpster diving process. The user should get the impression of reliability and helpfulness regarding dumpster diving after using the design. They should also feel more engaged afterwards, in the sense that they want to keep dumpster diving with the product accompanying them.

After defining the requirements and goals for the product the brainstorming stage began where five different product ideas that would suit the requirements were created. Some examples of the ideas were a forum for dumpster divers, a recipe application for when the user finds ingredients from dumpster diving and an application that would map out the different dumpsters. The latter one was inspired from a website called Dumpstermap (www.dumpstermap.org), which was encountered during the discover-phase. The website maps out different dumpster where people can go to find food. In addition, the website also has a comment section for each location where people can comment about the dumpsters. In the end, it was decided to further develop the idea for a dumpster-mapping application as it fulfilled most, if not all, requirements.

Continuing with the idea, the user group who focused on the environmental and climate aspect of dumpster diving was chosen as the core user group, while still allowing others to use it for economical reasons. The general idea for the dumpster map application was that it would map out different places where people could go dumpster dive. Furthermore, it would provide the users with useful information about the dumpsters, such as what time and days they would be emptied. The users would also be able to contribute by rating the dumpsters through reviews and uploading pictures of what was in a dumpster, inspired by the 'story'-function in the photo sharing application Instagram.

Prototypes and user testing

Paper prototype

The paper prototype consisted of a number of cards, each representing a different screen page, as seen in figure 3, to imitate a real interactive product. It was made with a back and forth process, testing many different alternatives of screens, functions and buttons.

As mentioned before, user testing was conducted and problems with the initial prototype were discovered. The main issue was the provided 'status' function in the prototype. Several participants pressed the food icons on the Dumpster card to get more information about what food was in the dumpster, when in fact they were supposed to press the 'status' button. Furthermore, it was also difficult for the users to know that the 'status' button was clickable as well as what it meant for a dumpster to have a status. To make the status button more intuitive and clickable, an animated and colored ring was added around the status, much like the Instagram story icon. This was implemented in the digital prototype together with a text with "status" to further the understanding of what the button was for.

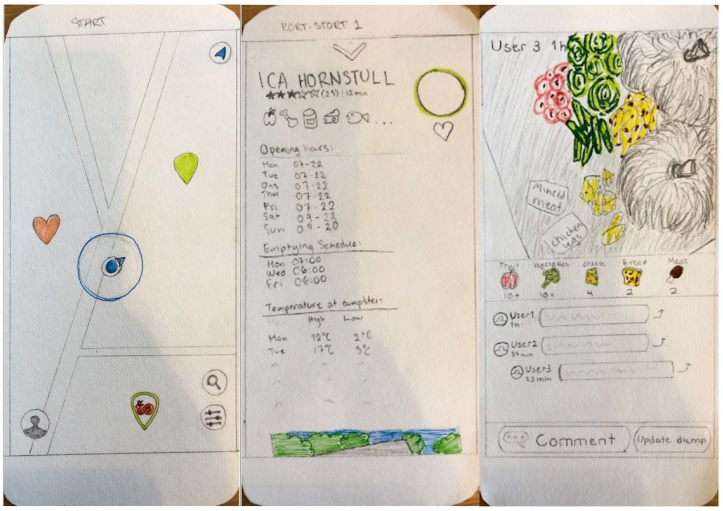

Figure 3: Pictures of some of the paper prototype's different pages.

Furthermore, a majority of the participants thought that a tap on the review stars would take them to the reviews. This insight was helpful and later on implemented in the digital prototype. Because of the lack of functions in the paper prototype, another function was added giving the users the ability to connect with other nearby users by sending them messages and seeing them on the map.

Digital prototype

The prototype making tool Proto.io (www.proto.io) was chosen to be used as it could deliver a high fidelity prototype while also providing a service that was easy to use, even for beginners. After the digital prototype was finished, another round of user testing was made. This time, the users were mostly dumpster divers, unlike during the user test of the paper prototype. This decision was made as the digital prototype is the final stage of the design project, which meant that the feedback received from it would be more useful if it came from the targeted user group.

The design choices made followed the principles mentioned in the literature. Additionally, the prototype was designed to appeal to the specific user group. The colors used in the prototype were mainly green and white to give a clean and fresh feeling to the thought of dumpster diving which is something that otherwise can be thought of as disgusting. Green is also a color associated with the environment and climate friendly products (UX Planet, 2017) which is another reason it was used. The minimalist design also contributes to the fresh feeling. Since most of the functions revolve around the map, that was chosen to be the start screen. A good mapping was implemented between the operations and the buttons for them by using well-known pictograms like the magnifying glass as a search button, and an avatar as the button that would lead to the profile page(see figure 4). Although these are not isomorphic to each other, the conventions between the icon and the operation makes the mapping good (Sharp, Rogers, and Preece, 2019). The pictogram for the 'people nearby' button was designed with a pin with an avatar inside and a chat bubble. This is to show that it is a function where the user can chat with people and see where on the map nearby people are.

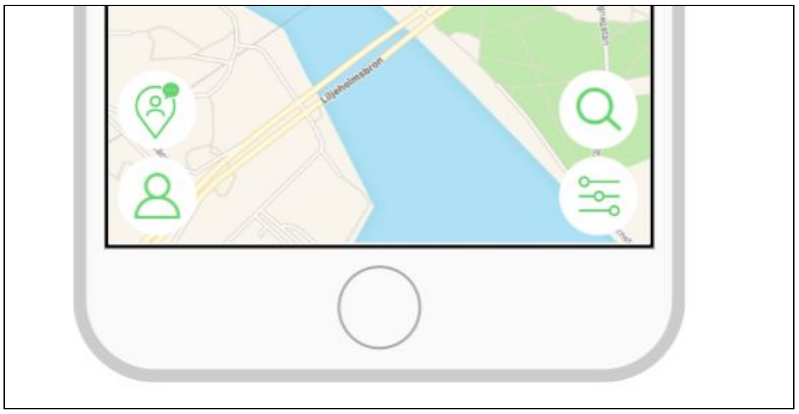

Figure 4: Navigation buttons at start screen

The navigation buttons were positioned at the bottom of the screen to make the prototype more ergonomic for users who use their phone with one hand, as it is easier to reach them there than at the top of the screen. The choice of having the navigation buttons as small round circles placed near the sides was to put the focus on the map. A consistency in the design was kept by using similar fonts and colors on all pages and also through things like always having the exit-cross at the same position, using the same style on the icons and having the same type of transitions between the different pages.

The affordance of the prototype was also put into consideration when deciding on the design. The scroll function on the information cards about each dumpster affords through an animated arrow at the top

showing the user that the card can be dragged upwards (see figure 5). To increase the affordance of the status button an animated border was added to show that it is something one can interact with(see figure 6). The animation gives the feeling that there is more information if one clicks on it. Apart from animations, affordance was added to buttons by creating a border and a different colors-background.

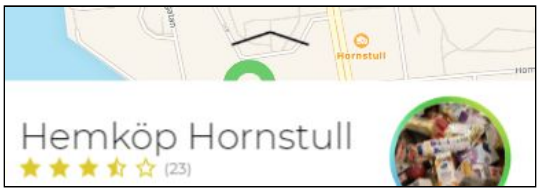

Figure 5: Arrow at the top of the information card

Figure 6: Example of button in prototype

The prototype also gives the user feedback when performing different actions. When the user enters how much food there is inside a dumpster the user uses a slider that gives feedback on what number the slider is on when sliding it around(see figure 7). Another type of feedback in the prototype is the favorite icon that turns red once the user adds it to favourites. The pin on the map also turns into a heart showing the user that this is a dumpster they have favorited(see figure 8 and 9).

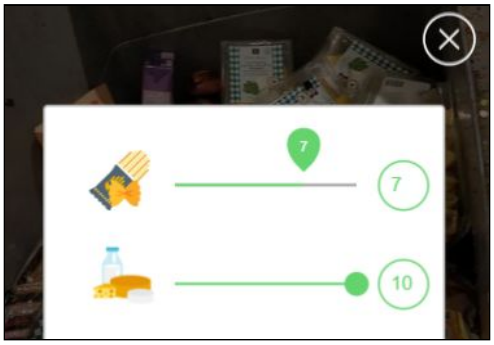

Figure 7: Feedback when using slider

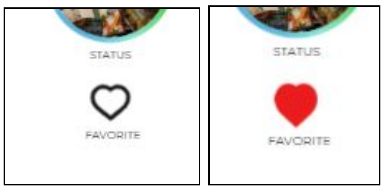

Figure 8, 9: Feedback when adding a dumpster to favorites

The general response from the user tests was that they were positive towards the main function of the prototype; the mapping of dumpsters and other functions such as status, however a bit hesitant towards the 'find people nearby' function. The issues test users had with this function was that they did not feel comfortable sharing their locations, or knew other dumpster divers who felt that way and said they would find the prototype more appealing if it was anonymous. Furthermore, they considered the message function to be excessive as there are already many established and well done chatting applications. Another thing was that the 'status'-function needed some clarification, for example the texts being too small and difficult to spot and how the update function did not present to the user that a photo has to be taken in order to proceed. In the dumpster information card section, test users felt that it would be more intuitive to be able to swipe the card down to close the section screen instead of clicking on the map, and also mentioned that the text and buttons in parts of the information was too small. Finally on the filter page, test users found it unclear whether they had filtered a food object out or not when clicking on it because of how it was represented. All of these issues, except the 'People nearby' page, were corrected for the final version of the prototype.

Result

The final solution was a digital prototype that works as a design proposal for an application that solves the dumpster divers problems - sharing food found, quickly acquiring information about different dumpsters and finding people to dumpster dive with. The application was given a bright and minimalist design with a clean feeling.

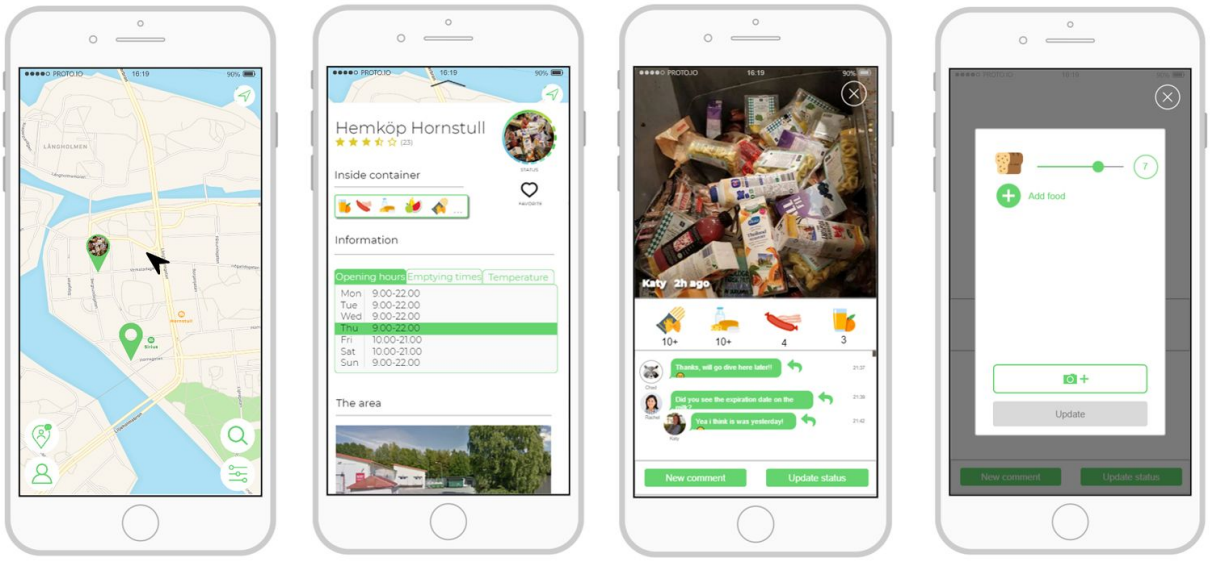

Figure 10: Pictures showing functions (left to right); map, information card, status and update of status

The application revolves around a map that presents nearby dumpsters to the user (see figure 10). When a pin-icon on the map is tapped, an information card about the dumpster is shown revealing the most important things the user wants to see; reviews, an insight on what food is inside at the moment and also opening times of the store and emptying times of the dumpster. To see the containers current status, the user taps the status symbol or the food icons in the 'Inside container' section. There, users have updated fellow dumpster divers what food is in the container by uploading a photo and adding food icons to indicate how much of each product is visible in the dumpster. In addition, a comment section is present, enabling users to communicate.

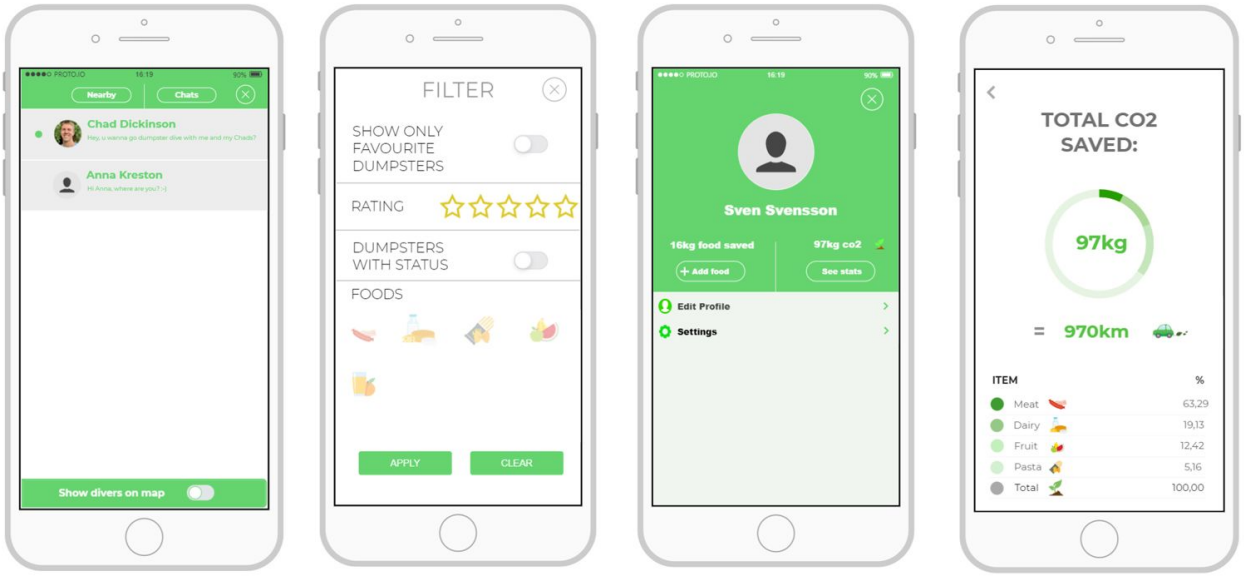

Figure 11: Pictures showing functions (left to right; find people nearby, filter, profile and statistics)

The proposal includes a 'Find people nearby'-function where the user is able to find nearby dumpster divers and chat with them (see figure 11). A filter function is available, allowing for filtration of dumpsters by favourites, rating, if the dumpster have a status or not, and which types of food the user is looking for. There is also a profile section where the user can choose a profile picture, change the settings and see statistics (see figure 11) about how much carbon dioxide they have saved by reducing food waste.

Discussion

Method

The design proposal presented was supposed to achieve two goals: to make dumpster diving easier and to design an interface with high usability. In order for us to succeed and to work systematically we used the double diamonds of design methodology as it gave us a clear structure during the project. In the first phase, 'Discover', we needed to get an insight into the problem and conducted interviews with our user group. We had difficulties finding participants, especially since we wanted to meet them in person. After a lot of searching we managed to find five dumpster divers from different backgrounds. It was fortunate that their lifestyles were different, but it is not very likely that they represented the whole user group. The problems

they described could potentially not be seen as problems for others, especially since the majority of the people we interviewed were found using Facebook, which means that we perhaps were missing a part of the user group which are not using the platform. In fact, one interviewee told us that most of her dumpster diver friends could not afford a cellphone, which could indicate that these people do not use social media platforms at all. If we could have interviewed more people with even more diversity in living conditions and lifestyles we would have gotten a deeper understanding of the problems dumpster divers face, giving us a better opportunity to deliver a more usable product for the user group.

During the phase of defining our gathered data we encountered a problem. We were a bit confused whether we should have defined the potential requirements first and then later start working on possible designs for a product, or if we should have worked the other way around. Eventually we formulated problems from our user stories to work from, followed up by general requirements and finally some ideas that agreed to these terms. In the process of brainstorming ideas, we found ourselves struggling to follow our general requirements, and rather followed our formulated problems.

In addition, we had issues in entering the positive mindset that is required for brainstorming. Brainstorming sessions needs to be more about quantity than quality and presenting a lot of ideas that are creative and high-achieving (Sharp, Rogers and Preece, 2019). During the brainstorming session we came up with one idea that everyone in the group liked because it solved our defined problems, and after that it was difficult to keep brainstorming and having a positive attitude towards other ideas. We should have been more open-minded during this part of the development phase and kept the brainstorming instead of sticking to the favourite idea. From the idea we liked the most we then redefined the requirements, making them more specific and thus, in a way chaining us even more to this concept. If we would have brainstormed ideas better in line with our general requirements, we would have followed the double diamond methodology in a better manner. This would have affected the iterative-aspect of going back and forth between the stages of defining and developing, perhaps changing the outcome of the design process.

During the developing phase we had what we thought was a successful paper prototyping session. We had a prototype that was interactive with several screens and that solved our users group main problem: sharing food with others. Quite a lot of time was also spent on coloring and making it aesthetically pleasing. In hindsight we spent too much time on the details, making it more like a high fidelity prototype, and too little on the general usability and interactivity. We should have focused more on the core purpose of paper prototyping: testing and adding different functions to solve our users problems while also making an interactive design with high usability (Sharp, Rogers and Preece, 2019). Furthermore, none of the participants in the user tests for this prototype were dumpster divers. This meant that we only tested the interface and its interactive design, but did not get any feedback on the functions and if they solved any of the problems. However, after a tutoring session and internal discussions we recognized that our paper prototype in fact lacked functionality and so a “people nearby” function was then added to the digital prototype.

Functionality and design

The user tests on the digital prototype was made with actual dumpster divers. This meant that we got feedback on both the usability and the functions, which gave us a lot of new insight compared to the paper prototype tests. We learnt that the importance of testing on the user group cannot be stressed enough. Only the users know if the product solves their problems and if it is usable to them. We now understood that our

new ‘find people nearby’ function, that was added without user testing on the paper prototype, needed modifications. Not interaction design wise, but function wise. The interface worked well and had a high usability with its good affordance and mapping, but the function did not fully solve the problem in a way that the users liked. However, due to the lack of time, we were not able to implement a better solution based on the feedback. What we wanted to do was to make it more group oriented. Instead of being able to connect with individuals, the user should instead find groups nearby and join their group chats. As mentioned by one tester, dumpster diving is quite a social event and dumpster divers often went on dumpster trips in larger groups. Therefore, by making it group oriented, the function would help users organise themselves into groups depending on their location.

Another thing that we wanted to implement but could not due to deadlines, was to create a guide for first time users in the digital prototype. As the application does have a few unconventional features, such as the ‘status’-function, we deem this kind of guide to be important for the understanding and learnability of them, to improve the affordance of certain functions. However, the icons used for the functions seem to have rather favourable mapping and therefore, once the users are introduced to the new functions, they do seem to understand what they control due to the memorability of the icons.

We also discussed about implementing a navigation bar to improve the interaction design. In the beginning of the design process, the prototype only had two navigation buttons at the start screen and it was therefore decided to not have a bar since it would take up more space than two small icons. However, we ended up adding more functionality to the start screen and therefore had to add two navigation buttons, which make the start screen seem a bit cluttered. A solution to this could be to to have a navigation bar at the bottom of the start screen to separate the navigation buttons from the map. By leaving out less important functions from the navigation bar from the mapping of the buttons could also change in a way that you would understand that those are the core functions. This is because a navigation bar is a common way to display the important functions in an application.

There was also a lot of discussion around the icons representing the food inside the dumpster. The plan was first to have these unclickable and just be informative, giving the users a fast overview of what is inside the dumpster without having to go inside the ‘status’ function. The user would then have to go to the status to get the exact information about what is inside. But when the user tests were held, almost all participants tried to tap the food icons to get more information, instead of tapping the ‘status’ function. This raised a few concerns. If the icons are tapped instead of the ‘status’ function when a user wants real-time information about what food is inside, is the ‘status’ button unusable? Or was it unclear instructions in the user test? Or were the icons tapped because the ‘status’ function is new and unknown to most users? Eventually our solution was to listen to the users and make the icons interactive, making them lead to the ‘status’ function to see what food is inside. However, more user testing and discussion is needed and there are still questions raised: is there an issue with two different interactive elements leading to the same function? Why is the ‘status’ function not as clickable as the icons? If the users would know what the ‘status’ function does - does it have a high memorability and would it in the future be interacted with instead of the food icons? More research is needed as our current solution is not optimal because of the uncertainties and possibilities.

Finally, we need to investigate the icons and if their connotation is understood by the users. Was it clear that the cheese and milk connotes dairy products? As the icons are a central part of our solution it is absolutely necessary that they are understood.

Result and further explorations

Despite all the improvements that can be made, the application we designed still solved the main issues that were brought up during the interviews. It was also very well received by the dumpster divers during the final user test and they said that they would benefit greatly from the application and would use it themselves. The interviewees mentioned that they would scout for dumpsters by driving around or check Google Maps with satellite view. By gathering information about different dumpsters such as their locations and emptying times, our user group would not need to go through the trouble of having to find dumpsters by themselves. As mentioned earlier, we got inspired by the website "Dumpstermap" that we saw had the potential to solve many problems, but lacked many functions and could heavily be improved in terms of usability. The user tests confirmed that we had created a product with high usability. There were some small issues with the interaction design that needs to be improved, but the overall reception was very good. From this we can draw the conclusion that our product was successful for its designed purpose.

In the long term, there could be some potential issues with our product. By mapping all dumpsters and including information about them, dumpster diving becomes easier and more available. This is of course positive, however, we are also aware of the negative aspects that our product will bring. For example, a shortage of food in dumpsters could occur because of an increase of dumpster divers, making it more difficult for dumpster divers to find food in places they normally would have found something. This concern was also raised by one interviewee who mentioned that they were a little hesitant to reveal their favourite dumpster in order to keep food to themselves. However, this interviewee dumpster dived mainly for economical reasons. In contrast, the interviewees who did it for environmental purposes celebrated the fact that many more might start dumpster diving as it would reduce food waste. Looking at our application from this perspective, the fact that the dumpsters might be emptied by people is only beneficial.

Furthermore, making dumpster diving more available would also introduce the activity to many more, thus increasing the amount of visitors to the dumpsters. This could lead to grocery stores locking the containers and increasing security in order to avoid disarray from people looking through their waste and making a mess. Hence, this product could sabotage dumpster diving in the long term, which would not be favourable for any dumpster diver, no matter what their reason for dumpster diving might be. As for how one should solve this problem is up for future explorations.

Conclusion

By systematically using the methods and guidelines described in the course literature we have created a prototype for an interactive product that evidently made it easier to dumpster dive. Thus, the goal of this design project was reached. However, there are still future explorations and improvements to be made with this idea. Furthermore, we have learnt that creating an interactive design is an iterative, challenging and endless process that needs both time and commitment to achieve a satisfactory result.

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