CooKING

Final report

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Introduction

This report intents to describe the conceptualization, implementation and final evaluation of a cooking application developed as a project for a Human-Computer Interaction subject. Human-Computer Interaction is a field which focuses on researching the uses of computer technology and their relation with humans. This subject has the purpose of teaching students about that field by challenging them to build a computer application which should reunite the best possible practices in such a way that both the user and the computer benefit from it.

In order to achieve the goals that were proposed, we have decided to develop an application which mixes usefulness and accessibility, and which could be used by a target group -in which we are included. We also wanted this idea to be following an approach based on the good practices of Human-Computer Interaction that were taught during the semester on the course. This idea, along with all the steps that were taken in order for it to be completed, will be described in the next section.

Conceptualization of the idea

Target group

With the globalization of modern times, more and more young adults chose to do (part of) their studies abroad. With that comes living independently, and thus most students cook if they have the opportunity to do so. However, time constrictions, poor experience and sometimes a lack of motivation are some of the issues most students face when trying to cook for themselves. On top of that, being abroad can cause its own food-related issues, for example in the supermarket.

We have chosen to target students studying and living abroad, whether they are Erasmus students, exchange students or full-time students. Experiencing a new culture and place as a young adult can be overwhelming, and thus we want to provide support of their day-to-day life, anywhere in the world. For simplicity, we chose to have the application to work with the English language, which is the standard for most international scientific institutes and therefore applicable to international students.

Expectations

The application that we had to develop should meet certain criteria regarding its features, which would not only keep the user satisfied with the project as a whole but also would follow the rules and good practices taught in the Human-Computer Interaction classes. As such, we wanted it to have:

- A user-friendly interface whose various menus could easily be found by everyone using them.

- A very fast application, which would allow its users to quickly find all theirs needs within the various menus that compound the application.
- Portability, which would allow the application to be used in a variety of different electronic devices, accessible to everyone, everywhere.
- An application which we would image to be used by a great amount of people around the world (our target group specifically as already described, but also other people from different contexts around the globe).

Initial idea

Our first ideas for this application consisted of making an application that would help students to get inspired to cook without having to leave the house. The application would evolve around ingredient-based searching. It should also be possible to search for recipes per some categories. The application could include the ability to suggest ingredients that would require a few extra ingredients. Also for users living abroad, there would be an ingredient translating function, which could possibly function based on their device location. These last two features could be combined into a small shopping list of items that are missing for a specific recipe and that could be translated to the language of the country the user is currently in.

Existing solutions

We couldn't find an application that joined together recipe searching and grocery shopping with automatic translation feature (which we received as good news, because then we could innovate the market with our solution). We found, however, several existing applications that were destined for meals. Between the ones we tested, we found Cookpad [1] (where users could add their own recipes), BigOven [2] (where there was also grocery shopping list feature, but without translation), Yummly [3] (which would also take allergies into account) and Dinner Spinner [4] (random recipe finding) to be the most interesting available in the Play Store.

Interviews

Setup

Several interviews were conducted among peers to investigate the needs of the target group. Initially, there was the need to learn the best way to mine information from a certain range of people in order to use that information to develop our future application. We've done as follows:
- Inside our target group, we've selected a number of people to interview. Since we are a group consisting of three people, we've decided that each of us would interview two different people at will (preferably doing the Erasmus programme as well), totaling to six people.

● We've decided to do the interview in a location that was easy and comfortable for the interviewed people. We didn't want them to come to meet us, instead going after them in their places. Coincidentally, all of the interviewees were either flatmates or were related to us in some way, simplifying the process of choosing the location of this interview.
● We've figured that regarding the purpose of our application, we could choose to interview only students that had experience cooking or were eager to acquire some experience in that field later in their Erasmus time.

Introductory questions

We have decided to do all our interviews following a script previously created in order to get a similar amount of answers from which we could take some information later on.
Initially, we began our interviews by doing a small presentation, whose purpose was to dig out some background information about the participants, how often did they cook in the recent past and how they usually decide what to eat. The script was as follow:

- *"Hello, my name is **[Interviewer's name]**, I'm a student from Budapest University of Technology and Economics, and I wonder if I could ask you some questions about your cooking experience here in Budapest?"*
- ***[Interviewee's answer]***
- *"Good! Could you please tell me your name, your age and what country who come from?"*
- ***[Interviewee's answer]***
- *"How often have you cooked in the past two weeks?"*
- ***[Interviewee's answer]***
- *"How do you decide what to eat?"*
- ***[Interviewee's answer]***
- *"And you do how go about preparing to cook?"*

By this time, we should have a clear idea if the selected student meet our previously described requirements.

Main questions

The purpose of this part of the interview was to determine the interviewees experiences regarding cooking, namely their habits when they come to preparing the meals they decided to put together, but also their shopping habits when they needed to buy ingredients in order to prepare the aforementioned meals. These questions were divided in two cycles which were very similar, changing only the first question as shown below in the rest of the script:

- *"Ok, so now can you tell me about the last time you cooked a meal here in Budapest?"*
- ***[Interviewee's answer]***

- *"And what was the hardest part about that?"*
- ***[Interviewee's answer]***
- *"Why was that hard?"*
- ***[Interviewee's answer]***
- *"How do you solve that issue right now?"*
- ***[Interviewee's answer]***
- *"How do you solve that issue right now?"*
- ***[Interviewee's answer]***
- *"And why do you think that is not the most appropriate solution?"*
- ***[Interviewee's answer]***

By this time, we should have a clear picture about the interviewees cooking habits and how we can fix their problems related to that by creating an application which specifically meet those issues. The second question, related to their grocery shopping experience in the foreign country they're currently living in, tried to determine how hard it was to search for ingredients in a place whose barriers such as unknown language and different products than those they're used to buy could prove to be very hard problems to overcome (specially at the the beginning). The question asked was:

- *"Can you tell me about the last time you went grocery shopping here in Budapest?"*

The rest of the questions asked were the same as the first main question, and the point was to let the participants reach their problems by themselves and think of a possible good solution without our influence while being completely unaware of the fact that we were thinking about developing an application that could fix those issues.

Wrap-up questions

At the end, we wanted them to know that we were a group of students with the intention of solving their particular problems by developing an application which could meet their expectations, as well as asking them if they wouldn't mind about participating in a later trial testing to see if said application was of their liking. The questions were:

- *"Do you have anything to add on the topic of cooking abroad as a student?*
- ***[Interviewee's answer]***
- *"We are developing a cooking application and would like to know if you mind to participate in its testing sometime soon?"*
- ***[Interviewee's answer]***
- *"Ok, thank you very much for your time!"*

Interview results

Our interviews were conducted by three members of our group. Each one of us interviewed a total of two people, all living in Budapest:

Name	Age	Nationality	Doing erasmus?	Conducted by
Qiao	22	Chinese	Yes	Eva de Wit
José	19	Portuguese	Yes	Eva de Wit
Tanya	22	Moldovan	No	Marc Zwart
Vadim	20	Russian	Yes	Marc Zwart
Pedro	20	Portuguese	Yes	Pedro Martins
Rui	21	Portuguese	Yes	Pedro Martins

The answers were all recorded and consequently annotated in the form of text to a table so we could dig out the most information we could. This answers were crucial because we could see:
- The problems arising from finding different recipes everyday (variety)
- The issues regarding grocery shopping in a foreign country (translating)
- The lack of time involved in the act of preparing a meal (quick, easy meals)

Variety, translation features and offering quick meals for a fast preparation were the main keywords regarding our application. The results conducted by the interviews were the following:

Name	How often have you cooked in the past two weeks?	How do you decide what to eat?
Qiao	1 time	*"I don't want to cook with a lot of oil so I avoid products which require much oil to prepare. I buy products which don't require much preparation time"*
José	Every day	*"It depends on what I've eaten before or what I like."*
Tanya	Every day	*"Leftovers, or get groceries, plan recipes"*
Vadim	Every day	*"Just something else than the day before"*
Pedro	8-10 times	*"Along with the other roommate decide what to eat at the start of the week"*
Rui	Every day (14 days)	*"We only eat meat since fish is not very available, so the decision is made at the store based on what we want to eat"*

From these questions, we could realize that most students cook on a daily basis or pretty much near that, and that the decision to be made regarding what to cook is usually made with some preparation time.

Name	How do you go about preparing to cook?	Can you tell me about the last time you cooked a meal here in Budapest?
Qiao	*"I eat a little bit then start with the products I already have."*	*"In the morning, 2 dishes. a Chinese dish and broccoli"*
José	*"I open the fridge and see what ingredients I have"*	*"I cooked rice, my flatmates cooked the rest."*
Tanya	*"Get groceries, check recipes, prepare food for several days at once"*	*"The day before, banana pancakes, checked recipe to be sure, went to the grocery store to get missing ingredients"*
Vadim	*"Just get beans or salt, fry meat and/or potato, usually simple stuff. When going complicated however, generally preparing it beforehand"*	*"The day before, ate fried turkey with spaghetti. "*
Pedro	*"See the groceries, check the amounts, put everything in table, then I proceed to actual cooking"*	*"In the weekend before, rice, chicken and salad"*
Rui	*"Preparing is not that hard, since I have background in cooking"*	*"Last meal was pork chops with a bit of pasta and salad"*

From these questions, most people had a normal routine regarding their preparation to cook: they would either buy the ingredients and then proceed to cook, or buy ingredients previously and then just use them over the days to produce something. Also, most students had cooked very different recipes as theirs last meals, which gave us the information that our application should be able to return a large number of recipes focusing on variety.

Name	What was the hardest part about that?	Why was that hard?
Qiao	*"I have to motivate myself to start, and wash up afterwards."*	*"I come home late and I'll be tired. I don't want to eat out because it is expensive but I also don't want to stand up."*
José	*"Cutting the onions because I cried a lot."*	*"It wasn't very hard."*
Tanya	*"Getting the groceries, because she did not have everything she needed."*	*"Because it was early in the morning."*

Vadim	*"Not really hard, been doing it forever."*	-
Pedro	*"It's not always easy to see if the amounts are correct for the decided meal."*	*"Not used to actual cooking (home-country food cooked by mother), so it's hard to come up with meals sometimes."*
Rui	*"Cooking itself it not very hard since it's an easy dish, but variety comes with a problem specially regarding the ingredients (not much variety of meat.)"*	*"Hard to find as many meat as in home country, and fish is not very available in the country, also since I don't have many known dishes recipes would prove handy to improve variety of meals."*

Most interviewees found the issues to be what we were initially expecting: variety concerning what to cook next, the desired ingredients being available and a lack of motivation.

Name	How do you solve it now?	Why is that not the most awesome solution?
Qiao	*"I drink a glass of water and eat a piece of fruit, then I feel energetic enough to start."*	*"I think it is a perfect solution, it solves my problem."*
José	*"I just wait."*	*"I think it is a good solution."*
Tanya	*"Search for recipes on website."*	*"Rechecking the recipe is a pain, remembering website for the recipe, making sure it's the same one as used before."*
Pedro	*"Every week I go to the grocery shop and buy things based on what I think will be the meals during the week (with my flatmates)."*	*"Because sometimes spontaneous choices means sometimes we are wrong, and have to return to the supermarket for more food ingredients."*
Rui	*"I search for recipes in the Internet although sometimes I don't have the ingredients or the amounts required of those ingredients."*	*"Because searching is hard and then after searching I have to go to the grocery shop and that's too much work that could be simplified."*

Here we could understand how searching in websites for different recipes could prove itself to be a cumbersome task: not only remembering the various websites, but also considering the fact that most of these websites didn't look upon the available ingredients in one's house when fetching for new recipes.

By this point we had a pretty clear interpretation of some of the issues that Erasmus students could be experimenting. However, we felt initially that our application had to distinguish itself from the others available in the market, and we thought how helpful would be a translation feature which would allow the language barrier to be surpassed when grocery shopping. The next bunch of questions try to address that same issue:

Name	Can you tell me about the last time you went grocery shopping here in Budapest?	What was the hardest part about that?
Qiao	*"I bought a lot of fruit, because I was thirsty. I buy products which fit my needs at that moment."*	*"Not much. Choosing what to buy. In NL, there is not much choice compared to China and I didn't know a lot of recipes. I repeated what I already knew."*
José	*"I went today."*	*"It wasn't hard, it just takes time. Sometimes I cannot find the products because the names are in Hungarian."*
Tanya	*"I prepared a list of usual ingredients, sometimes forget items, which causes inconvenience when part for recipe is missing."*	*"Sometimes hard to figure out recipe, especially when missing a single ingredient."*
Vadim	*"Two days before, by usual scheme, just find some turkey, usually buying too much stuff that was not planned."*	*"Getting lost in the store, people are in the way walking in the wrong directions. After a month, the shop is familiar but at first just search or ask. It's sometimes not in the place you would expect it."*
Pedro	*"The same day, two hours before."*	*"Troubles with the translation of the existing items since they most of the times are not in the mother language or in English."*
Rui	*"Some food, some bread and some other house material."*	*"Language barrier (Hungarian is much different from Portuguese), so I have to either translate myself or ask someone to help me."*

With these two questions, we could understand that indeed most students which didn't have Hungarian backgrounds (or generalizing for the purpose of your application, most students which didn't know how to speak the country's language they were living in) had trouble finding the products they needed. They would usually have spent much more time shopping, and unknown brands and different ways of displaying the products made the task of grocery shopping a lot harder than what it should be.

Name	Why was that hard?	How do you solve it now?	Why is that not the most awesome solution?
Qiao	*"I want to try new products but I don't really know how they will taste."*	*"I buy 90% of products I know and 10% new."*	*"I am already satisfied. If there would be more options for vegetables in the supermarket that would help me. Often I don't know what else I can cook with the vegetables so getting new recipes would help me.."*

José	*"Because I don't know Hungarian."*	*"I ask people or use common sense."*	*"Sometimes I buy unexpected products."*
Vadim	*"Location of product unfamiliar, canned peas were for instance stored on shelf with random products."*	*"Searching, if lost ask someone."*	-
Pedro	*"Since Hungarian is not my mother language, and the brands are not the same as in Portugal, it's hard sometimes to understand what we are buying."*	*"Based on experience (one month later, we start to know the known brands and products)."*	*"Because it could be improved with some automatization."*
Rui	*"Losing time, need internet connection, or people nearby to help me."*	*"Online translation for products which I can't clearly see what they are."*	*"Because it's too time consuming and not very efficient."*

Most students had found some way of solving that language issue, either by translating themselves the names they found in the products to see if they were what they were looking for (wasting time in opening a different application) or asking someone in the store to do it. They sometimes also bought unexpected products and there was an agreement that efficiency could be improved if automatization could be applied. This would result in faster grocery shopping, which was one of our main initial ideas for this application as already mentioned.
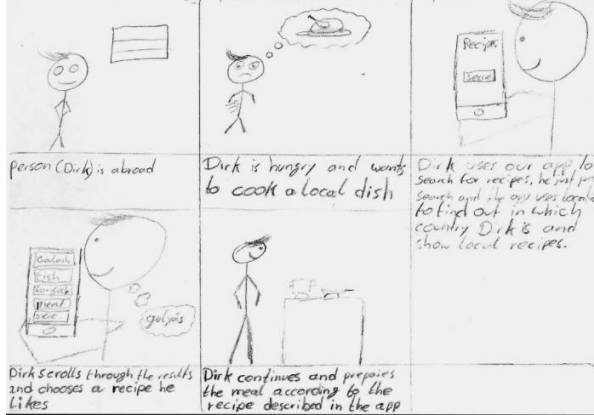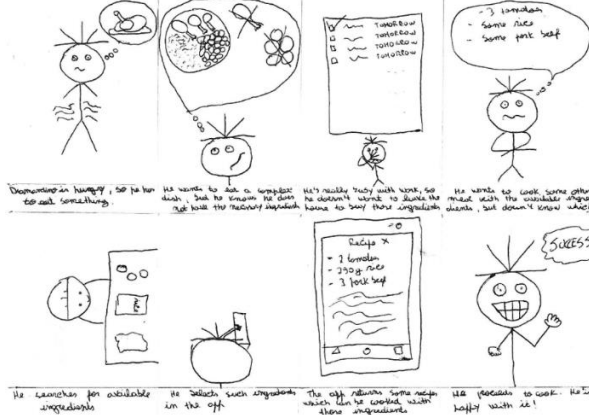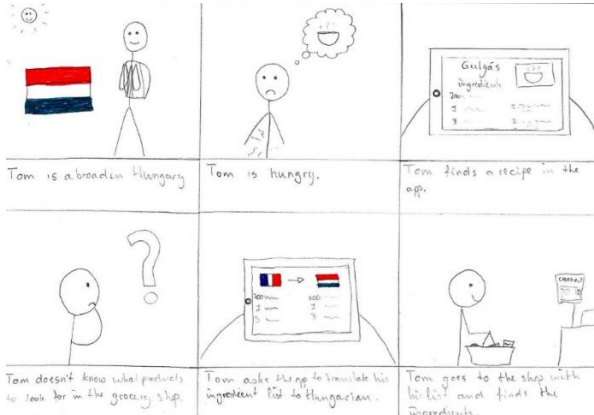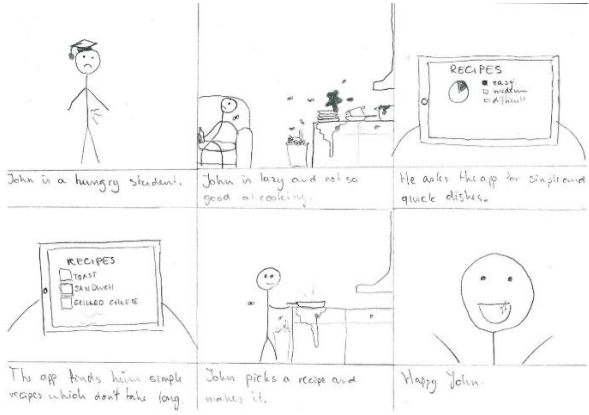
Name	What do you have to add?	Can we ask you to test our app?
Qiao	*"I want to learn a way to cook in a short time, and easy to find new recipes and new ways to cook food."*	*"Yes."*
José	*"I have to cook a lot more than at home."*	*"Yes."*
Tanya	*"Cooking is not something that's fun to do but it provides with a healthier lifestyle to counter the partying. You don't have everything you have back home, that might be a struggle."*	*"Yes."*
Vadim	*"Having your personal kitchen is very important, sharing one in dormitory is a big pain."*	*"Yes."*
Pedro	*"Nothing to add."*	*"Yes."*
Rui	*"Being an Erasmus student is part of knowing different cultures, and cooking should be used to that like tasting different flavors and local dishes."*	*"Yes."*

As wrap-up questions, every interviewee showed itself to be excited with our idea, and wanted to test our application as soon as it would be ready.

Prototyping

Storyboards

In terms of prototyping our application, we created four different scenarios where we could envision our target users doing a common task where the application could prove useful.

Scenario 1: In this situation, the character wants to eat something, yet doesn't have much experience with cooking. The application works by returning good dishes with simple steps and many images.
Scenario 2: The user wants to eat something, but doesn't have time to go grocery shopping. He uses the application to search recipes with the ingredients he has, and the application returns results based on that.
Scenario 3: The user finds a recipe in our application which meets his tastes, yet has not the necessary ingredients and needs to buy them. The application translates them for him.
Scenario 4: The character doesn't have much time, so he wants to cook something fast. The application then returns really simple, quick dishes to prepare.

Implementation

Development decisions

In order to come up with a multiplatform solution we decided to go for a web based approach, building the interface in HTML and CSS, controlled by JavaScript and rendered by a web browser. Using the Cordova framework, we could transform these source files into an android and iOS application. Sadly, we were unable to acquire a mac machine so we could not build an iOS app, however we did have the android solution which worked pretty good. Due to some issues with this framework however we conducted all our tests through regular web browsers instead of an actual installed app, this was due to the fact that some of the plugins used during development did not work on old tablet's native browsers, only in newer versions of for example google chrome. Since the focus was on the interface and not the backend functionalities we decided that to prove the effectiveness of our interface this was a satisfactory solution so we hosted the files on a remote server and accessed them from an android tablet's chrome browser and from the tablet view simulation that the desktop version of chrome has built in.

Design decisions

For the design, a mostly monochromatic design has been created to support color blind-friendly usage. A chic Bordeaux red was chosen as main color, with a lighter shade as its counterpart. The color was chosen to represent the warmth, conviviality, and coziness of cooking combined with the graciousness of Bordeaux wine, while preserving visual attention for the colorful images of the food. Next to that, this shade of dark red tends to color well with the different colors of the food.

Consistency is key in the design, hence the dichotomy of the screen for recipes/methods and original/translation. Furthermore, searching and clearing buttons are always in the menu bar.

Both visual and verbal cues have been implemented in the design to provide maximum guidance and feedback to the user. This can be seen in the highlighting of selected buttons, arrows for maneuvering, text in buttons and a visual-directed menu bar.

Since the name of the application is CooKING, the logo had to be associated with that. A combination of cook and king was made, and the double 'o' in the name lend itself very well for a set of eyes or glasses. Thus, a face was born, with both a cook's hat and a crown, and a typical mustache was added to complete the whole. For ease of recognition and implementation, the logo has been made into a combination of text and image.
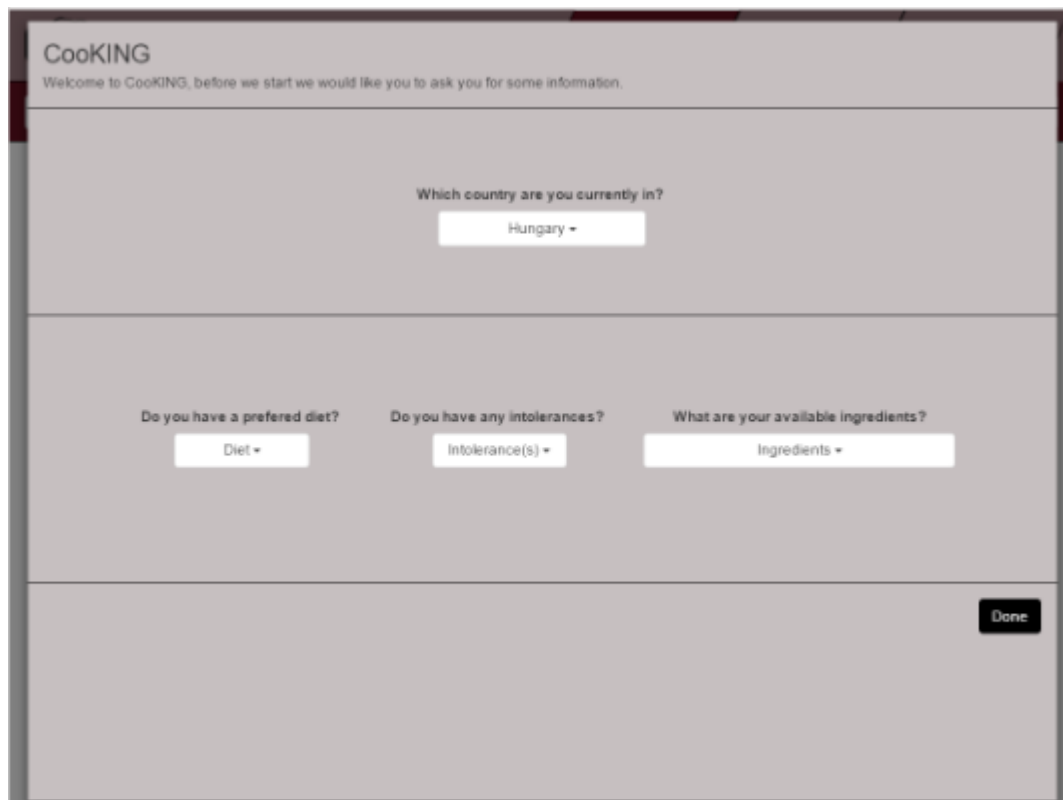
The CooKING logo as seen in the app

When the application is started, the user is presented with a loading screen showing a loading bar to keep the user informed of the progress the application is making in starting.

The CooKING splash screen including the logo and the loading bar

On the initial start of the application an onboarding screen is shown. In this process, we ask the user for some simple information, such as in which country the user is (this will return in the shopping list feature description). This country is automatically selected based on the user's current IP address (however for testing purposes this is now hardcoded on Hungary since we currently do not have anyone in another country. This way of determining the user's current country is highly precise and can easily be done through a HTTP request to for instance "http://ip-api.com/json").
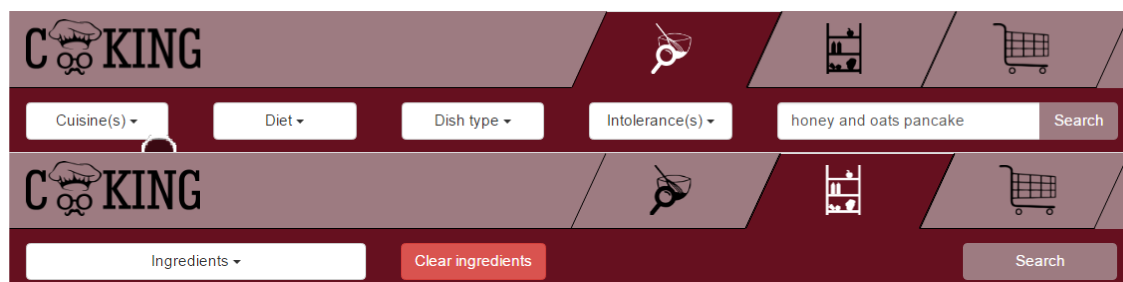
Other information that is asked for is the user's diet, food intolerances and available ingredients. The selected values will be used as defaults in the two search features that will be described below. The button to press that the user is done is in high contrast with the background to ensure that the user can easily recognize this button (besides it being the only button on the screen at this point as so to avoid having any confusion on what step to take next).
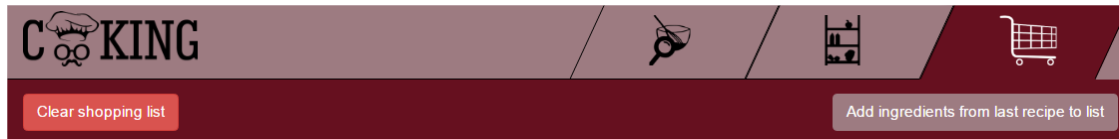
The CooKING onboarding screen

In order to provide a quick overview in the menu bar (the two different ways to search and the grocery list), pictograms are used instead of words. We highlight the menu that is currently selected so the user is always aware of where in the application he currently is. The currently selected menu has its icon displayed in white to ensure visibility of this icon. Below this menu is displayed.

The main menu in all its forms

The menu bar contains the most core control features of the app, this way the user will only have one main place to search for the controls. The filter options always displayed on the left (in case it is present), the clear buttons to the right of these options and the main control feature on the right. This results in a certain consistency in the application and allows the user to make predictions on where a certain feature might be.

The natural search has several search options, which all work in highly similar manner to ensure consistency. All of the parameters that can be set are done by dropdown menus which either have single of multiple selection options. The cuisine option can be used to select of which cuisine the user wants to see recipes. The list is rather big, therefore we included an internal search function to filter more specific results (this function is seen in action in the screenshots below). The filter option has an instant search feature, which when typing will automatically narrow down the results in the list (it refreshes with every character typed to provide a smooth search and does not require the user to hit any "search" button, therefore providing them a way to just type what they want).

The second filter is to select a Diet in case the user has any. This can for instance be Vegetarian, Vegan, Pescetarian, Lacto-vegetarian and several other options. If the user filled out a dietary preference in the onboarding process this filter will be set to this value by default. The third filter is the Dish type filter, where the user can select which type of dish they want to find (for instance, a main dish, a dessert, an appetizer, a soup, a breakfast but also drinks and other fluids like sauces, drinks or beverages).

The final filter in this menu is the intolerance selector, where the user can specify any food intolerances it has, such as lactose, peanuts, gluten, seafood or wheat, among several others. Just like the diet filter, this is preset to the value specified by the user in the onboarding process if the user has done this before. To make this search a bit more natural it also includes a text field where the user can specify a query to search for. If the user for instance wants to search for pancakes, he or she can type 'pancake' to narrow down results to pancakes.
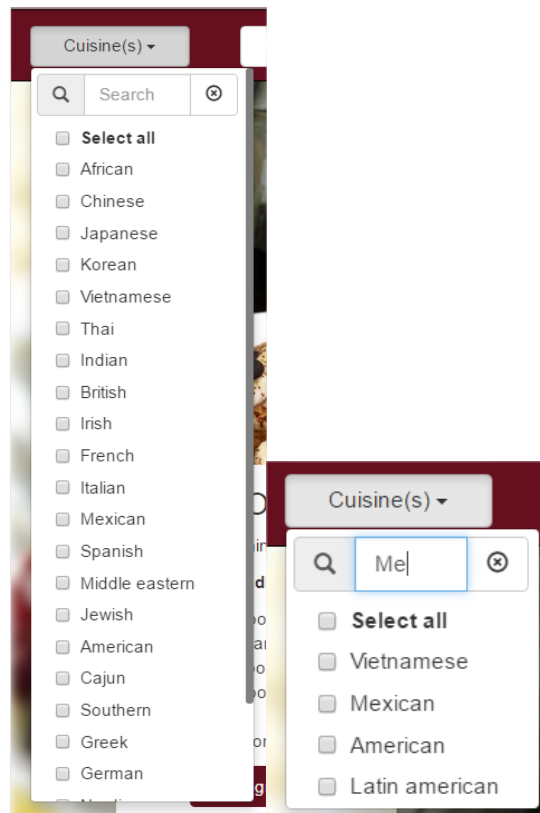
The cuisine selector in the natural search, with the filter search function in action

The ingredient search there is only one selector, the one for selecting which ingredients are available. In case the user specified this in the onboarding process, the values will be preset as filled out by the user. Next to this selector there is a clear button to empty this selector. The dropdown menu is separated in several categories to separate ingredients into clear sections, making the big list that we got from the Spoonacular API (which also provides our search functionality) more structured. Because of the size of this list we also included the same search functionality as seen in the cuisine selector in this list. We also included a new category "Popular Ingredients" in which we included ingredients which students often have in their kitchens. We will discuss why we added this category in the section on the results of our user test. The 'Clear ingredients' button is displayed in red to show the user that this is a high impact button, that when pressed will deselect all selected ingredients in the list and the user will have to re-select new ones before being able again to search for the results (which include the ingredients he or she wants).
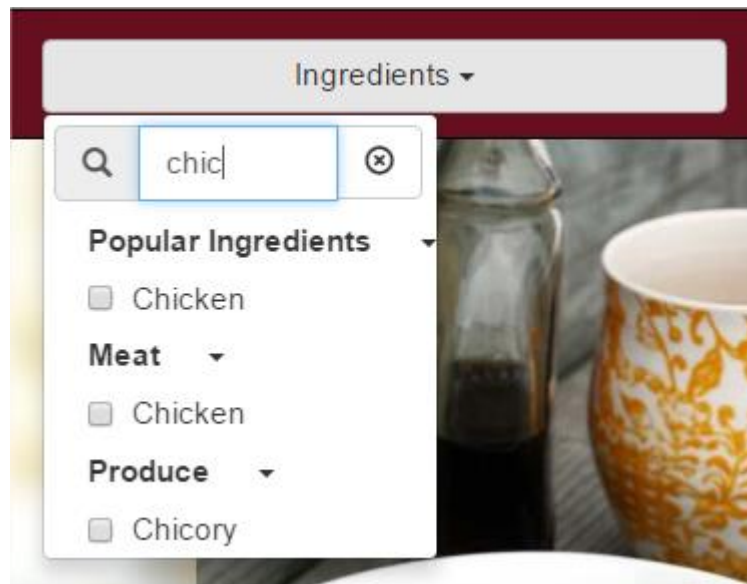
The ingredient selector in the ingredient search, with the filter search function in action

Since we have plenty of space on the screen, we developed a clearly comprehensible interface for the display of found recipes (be it through the 'natural' search or the ingredient search). The display is divided into two halves, and the left half shows the name and picture of the dish (combined with controls for navigating to the next or previous recipe). It also shows the required ingredients (including quantities) and below this a button to add these ingredients to the shopping list (this button is close to the description of the ingredients, which is a rather natural position since they relate in an obvious way). The list of ingredients can be scrolled through, which is indicated by the scrollbar that is seen on the right side of this list.

The arrows clearly indicate that there are more results to display, showing a small preview of the respective recipe's photo blurred in the background.
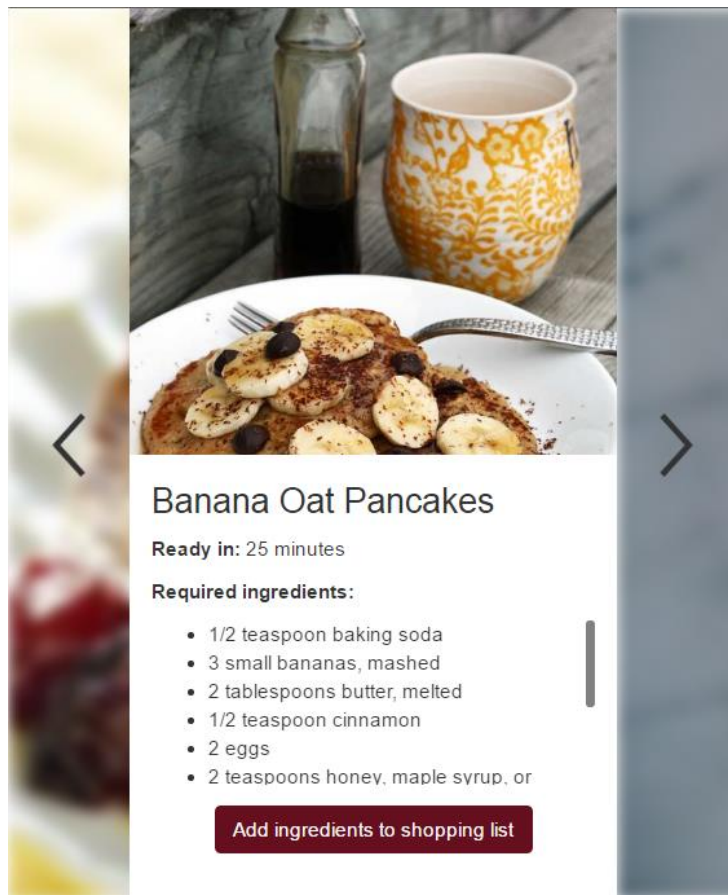
The left side of the recipe view

The right side of this interface shows the steps necessary to take in order to prepare the found dish. It is neatly paginated in order to keep each step clear and to not cram an overload of information on a single page. The step number is shown, which correlates to the number in the pagination, below which a description of the actions to take in this step and finally it shows the ingredients that have to be used in this ingredient including their pictures to clarify what is required. This list of ingredients with images can also be scrolled through just like the list seen in the left side. The indicator that there can be scrolled is the same as on the left side so the user can recognize this feature as working in the same manner.

Step 1

In a medium mixing bowl, combine mashed bananas, melted butter, lemon juice, and sweetener (honey, maple syrup, or sugar). Beat eggs and add to banana mixture. In a separate bowl, combine the remaining dry ingredients. Make a well in the dry ingredient mixture and pour in banana mixture. Stir to combine but don't overmix or the pancakes may get tough. Allow to sit for 10 minutes.

Ingredients for step 1:

lemon juice   banana   butter   honey

| 1 | 2 | 3 |

Step 2

Add in brown sugar, Greek yogurt, and vanilla extract until smooth.Gradually add the wet ingredients into the flour mixture, mixing until just combined.Give your griddle or skillet a chance to heat up over medium heat, and make sure it is well greased.Scoop 1/3 cup of the batter and pour it onto the hot skillet, allowing the pancake to cook on one side until there are bubbles in the center, about 1-2 minutes per side.I had to add more cooking spray between each pancake to keep them from sticking.
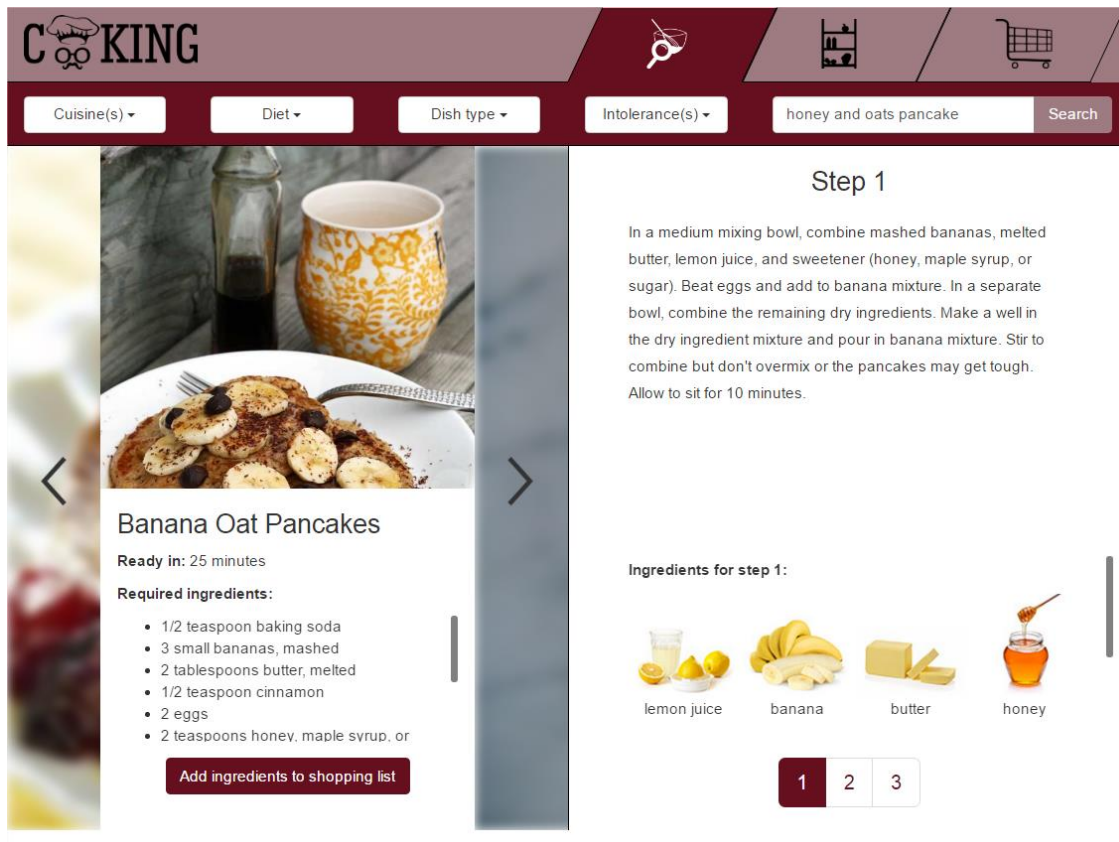
Ingredients for step 2:

all purpose

| 1 | 2 |

The right side of the recipe view

This results in the following view for a whole search function, clearly separating the menu bar from the result view and segmenting the result view in two parts which each display different type of information.

The whole interface including the recipe view and the main menu

The last interface we have included is a rather simple one, the grocery list view, that includes the third menu bar displayed above. The main action button on the right side is to add the ingredients from the last recipe to the shopping list. The high impact button on the left is to empty the whole list. The main section of the screen is, just like the recipe view, divided in two halves, one half with the ingredients in English, the other half with the ingredients translated to the language of where the user currently is (or at least what he or she has specified in the onboarding process). The user can take their tablet with the application to the store and use the grocery list in a fashion where he or she can tick off ingredients that were bought. The two lists are synchronized so if you select an ingredient in either of the lists, their respective translations also get highlighted. A small hint that this is possible is shown on the bottom of the screen. This feature is seen in action below.
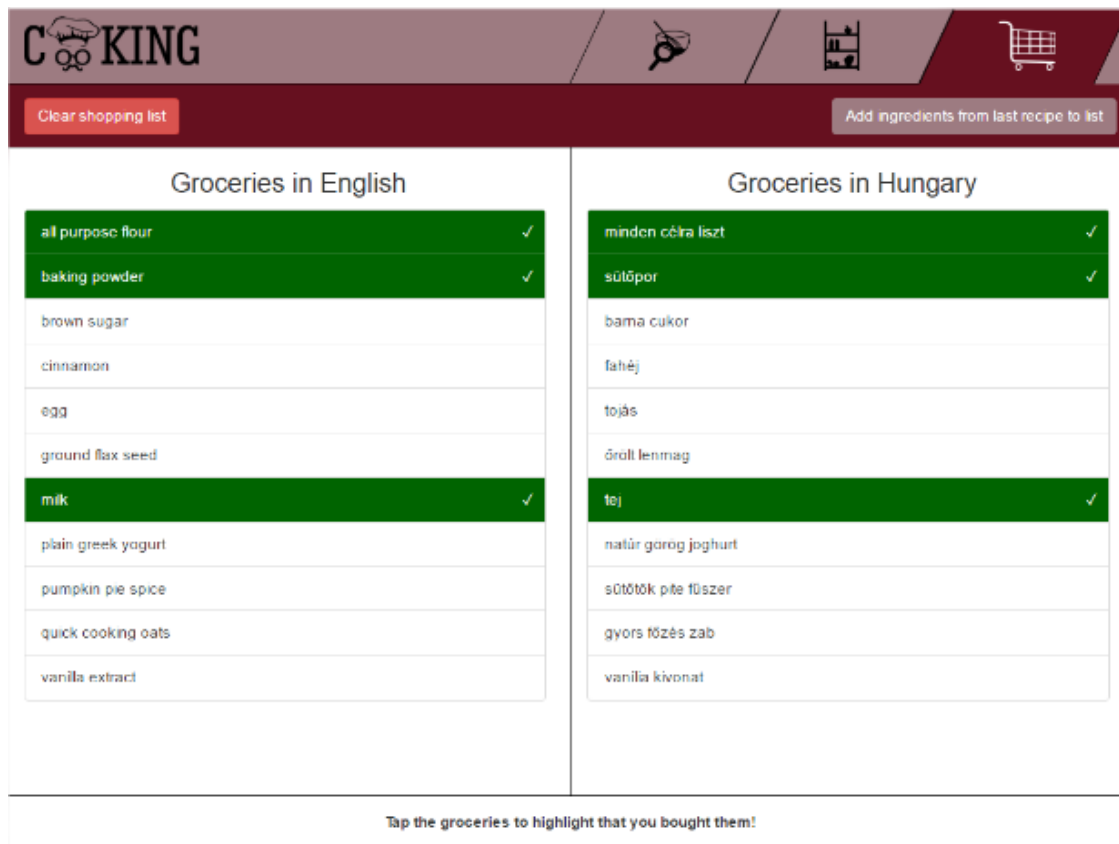
The whole shopping list interface with the highlight feature in action

The ingredients can not only be added from the button on the top right, but also from the recipe view as discussed earlier. When the "Add ingredients to shopping list" button in the recipe view is clicked the ingredients will also be added to the shopping list. To indicate this action to be successful a badge with an exclamation mark appears next to the grocery cart icon to indicate a change in this menu.

The successful adding of ingredients to the shopping list is indicated to the user in the following manner

Evaluation

During the evaluation of the build product we conducted two test rounds. The results of the first test round will be discussed, then the changes made in response to this evaluation round. After that, we discuss the second test round and the changes made after that round.

First user round

In the first round of user testing we asked six fellow Erasmus exchange students to test our application. We did this by giving them three tasks and watching them as they attempted to perform them. The six test subjects were:
- Julia von Matternhorn (no neptun code, studies in Budapest business school)
- Qiao Ren (V2L5Q4)
- Pedro Silva (V6MT4Z)
- Rui Costa (HCEQB1)
- Tanya Gurduza (Y01O6I)
- Erik van der Kuil (J2WLQX)

And the tests were conducted by all our group members, i.e. Marc Zwart (P91QRH), Pedro Martins (UKK82W) and Eva de Wit (CB36PE). The following tasks were given to the subjects:

1. "Find a dessert you would like to make."
2. "Make a grocery list with the ingredients for the dessert you don't already have and prepare to go shopping."
3. "You would like to cook dinner, but you realize it's late and the shops have closed. Find a recipe with ingredients you have at home already."

This way we could more easily compare the results of the tests as all subjects are confronted with the same challenges which incorporate all the features of the application. The following issues that our users had were found during the test:

- During the onboarding process:
  - Too many ingredients in the ingredient selector, users found it confusing to use
  - It was unclear what to select if the user has no specific diet
  - Not everyone filled out all the information during onboarding
- During the first task: "Find a dessert you would like to make."
  - Unclear what to select if the user has no diet
- During the second task: "Make a grocery list with the ingredients for the dessert you don't already have and prepare to go shopping."
  - Several users did not see the "Add ingredients to shopping list" button and went straight to the grocery list menu.
  - Users tended to not see the badge with the exclamation mark on the shopping list menu button.

- During the third task: "You would like to cook dinner, but you realize it's late and the shops have closed. Find a recipe with ingredients you have at home already."
  - Users generally went straight to the correct menu, or they figured it out in a considerable amount of time
  - The results often included results that had many missing ingredients

During the test, we also ran into some minor bugs, like images of dishes not being displayed correctly (due to bad scaling) and long step descriptions overlapping with the images of the ingredients required for that step.

There were also several positive points of feedback during the test:

- Notes on Task 1:
  - Users seemed to encounter very little problems
  - Several pointed out that they found the search to work nicely/intuitive.
- Notes on Task 2:
  - Once the "add ingredients to shopping list" button was found it was deemed very useful.
- Notes on Task 3:
  - The users that had selected their available ingredients during the onboarding found this search functionality to work very quickly and smoothly.

Changes based on the first round of feedback

We made quite some changes based on the first round of feedback in order to improve the app and we will discuss these in this section. We removed a part of the ingredients as a lot of users struggled with the number of available ingredients. We also added a new category called "Popular ingredients", and we filled this category with ingredients that students often have in their kitchens so that they will generally need little more than that one category. We fixed the scaling of images and made long step descriptions scrollable (the scroll possibility is indicated by the scrollbar next to every scrollable element in the interface). We changed the colors of the bottom buttons (the "add ingredients to shopping list" and the step pagination) to the darker Bordeaux red color to make them stand out even more. This way the users will be able to find them more easily.

Also, when the "add ingredients to shopping list" button is clicked it becomes unclickable and the text changes to "Ingredients added to shopping list" , appearing a badge with the exclamation mark on the shopping list menu which was enlarged to make it stand out more.

Besides these changes, we also increased the line height of the step descriptions to make them more easily readable. In the dietary filter, we changed the name of the "Dairy" option to "Dairy (Lactose)" because to one of our lactose intolerant testers this was not very clear and we introduced the "none" option in this filter so users always know what to choose. We introduced the white icons in the main menu bar to make the icon more visible because the

contrast between the Bordeaux red and the black icon was too low to be properly visible, potentially causing the user to be unsure of which menu he currently is in.

While searching and navigating through results we also added more user feedback by providing a message that states what the application is currently doing (for instance, while searching for recipes a message is shown that the application is retrieving recipes. When navigating through the results, messages like "Loading next recipe" or "Loading previous recipe" are shown. This looks as follows:
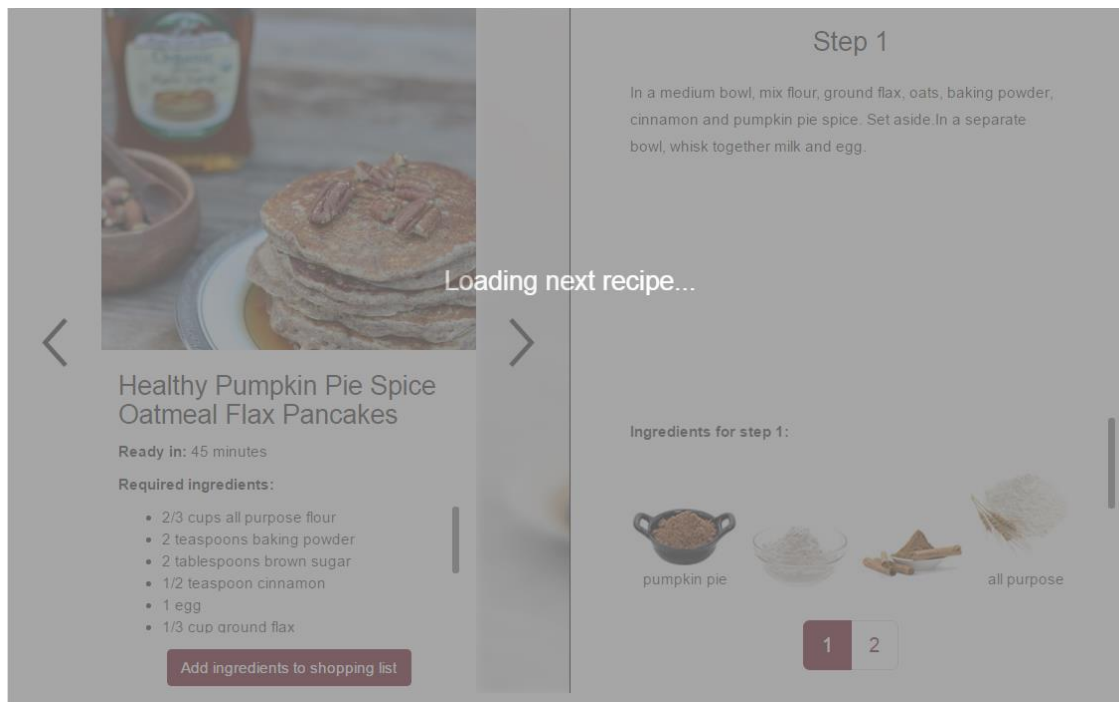
The whole interface with the "Loading next recipe..." message displayed
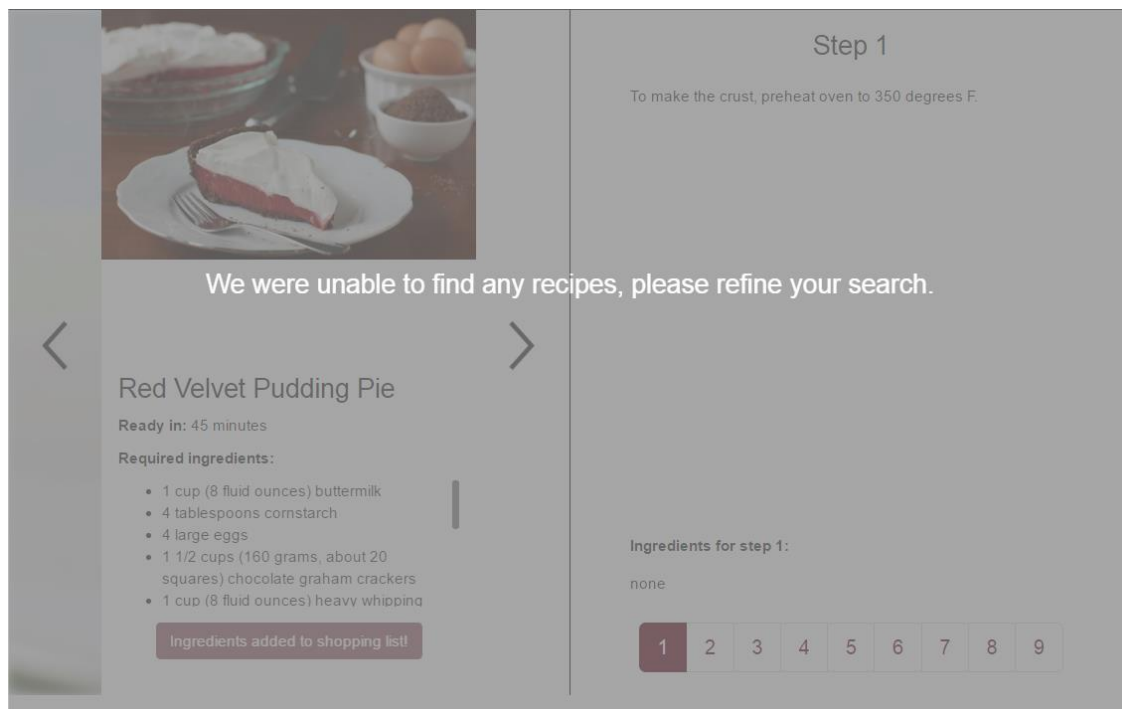
In case there are no recipes found we present this message to the users

This way we keep our users more informed about what is going on in the application and will result in a more intuitively working application. Furthermore, we changed the list of required ingredients which is displayed on the left side to a list which includes the amounts that are required. Because this list tended to become rather large we made it a scrollable element which shows the scrollbar on the side. In the initial version, there were some inconsistencies regarding the action button in the menu bar being on the right, filters on the right and the high impact buttons left of the filters (if existent). We fixed this in the updated version. A final small polishing included changing the placeholder text in the natural search from "Search..." to "Find a recipe" to more clearly distinguish it from the search button since they had the same text before.

We also found that our users did not notice the badge on the top right when adding ingredients to the shopping list. Therefore, we clarified this by changing the button after it is pressed and changing the button text with it, to indicate the successful action that was taken.

The button indicating that ingredients have been added to shopping list

Second user round

In the second user test, we asked half of our original test group to perform the same tasks and asked 3 new users to test the app. This way we could get feedback on our improvement while also simultaneously getting feedback from a fresh point of view (from users that were not biased by our previous version).

Results from the old users

The users we had in the first test round which were also present in the second one were the following three:
- Pedro Silva (V6MT4Z)
- Rui Costa (HCEQB1)
- Qiao Ren (V2L5Q4)

We found the following results:
- During the onboarding process:
  - No problems encountered.
  - Some used the popular ingredients.
- During the first task: "Find a dessert you would like to make."
  - Little problems encountered.
  - Positive response to modifications made, such as quantities added to ingredients.
- During the second task: "Make a grocery list with the ingredients for the dessert you don't already have and prepare to go shopping."

- ○ Users used both the restyled button "Add ingredients to shopping list" in the recipe view and the newly introduced button "Add ingredients from last recipe" in the shopping list menu.
        - ○ Positive response to clearer notification that ingredients were successfully added
    - During the third task: "You would like to cook dinner, but you realize it's late and the shops have closed. Find a recipe with ingredients you have at home already."
        - ○ Generally worked okay.
        - ○ Users still seemed to get a little lost in the big list of ingredients.

Generally speaking, these results are satisfactory. The main issue found was with the ingredient select, which at this point is pretty much caused by the size of this list. The obvious solution to this problem is to decrease the size of this list, resulting in some ingredients ending up missing but general improving usability due to a more responsive interface and less confusion while searching for ingredients.

Results from the new users

The new users we had in the second test round were the following three:

- Luis Alejandro GM (CIVJH0)
- Mathieu Post (ADHRZD)
- Anne de Graaf (Dutch art student)

We found the following results:
- During the onboarding process:
    - ○ On iPad (safari) ingredients menu very slow, presumably due to the size of this list.
    - ○ Popular ingredients were extensively used, and made process a lot easier.
    - ○ It was not entirely clear it was onboarding for one user.
- During the first task: "Find a dessert you would like to make."
    - ○ Two users tried to instantly search using the ingredients they entered.
    - ○ One accidentally cleared the selected ingredients (which were 38).
    - ○ Generally speaking, people ran into little problems.
- During the second task: "Make a grocery list with the ingredients for the dessert you don't already have and prepare to go shopping."
    - ○ Users used both the newly introduced button "Add ingredients from last recipe" in the shopping list view and the restyled "Add ingredients to shopping list" button in the recipe view.
    - ○ It generally went smoothly. The highlight function was not very clear for some users, but once pointed out it was received very positively.
- During the third task: "You would like to cook dinner, but you realize it's late and the shops have closed. Find a recipe with ingredients you have at home already."

- ○ For one user, it was not clear to what menu to go to.
- ○ Generally went smoothly.
- ○ Sometimes recipes returned with ingredients that were missing.

We think the second test iteration showed some nice improvements. Users did not get lost in adding the ingredients to the shopping list due to the restyled button and the newly introduced button in the shopping list. During the natural search, little to no problems were encountered and even the third task, in which the ingredient search was to be used went generally smooth for most users.

Generally speaking we found one thing that critically required change, which is the list of ingredients that can be selected being too big. It was not only confusing to users but also caused slowness on tablet devices due to its size and the plugin that renders this list not being very efficient. The proposed solution for this was to severely cut down the list of ingredients further, to a list that would not cause this confusion and could be scrolled through quickly. We would have to make this list custom for students, so we do not have to include ingredients such as caviar or agnolotti because such ingredients are relatively unlikely to be present in a student's kitchen, where "agnolotti" could also be replaced by a more general ingredient term such as 'pasta'.

## Changes based on the second round of feedback

The changes we propose based on the second round of feedback will be discussed next. First of all, as mentioned above, the ingredient list has to be narrowed down to a more useable subset of the current list of ingredients. Furthermore, we want to add checkboxes to the ingredients in the shopping list to clarify that they are clickable. Some users did not completely understand the icons in the menu bar so we also add text to more clearly describe what the menu is. This results in the following modification:

New menu bar including the textual description of each menu item

One last change we want to point out is that sometimes recipes that have missing ingredients are returned by the ingredient search. Sadly, we cannot change this because this functionality is provided by the Spoonacular API that we use for the search functionality. We will return to this problem in the "further consideration" section.

We also included a special screen to describe the newly implemented voice control, where all available voice commands are defined and there's guidelines on how to use them and what are they for.
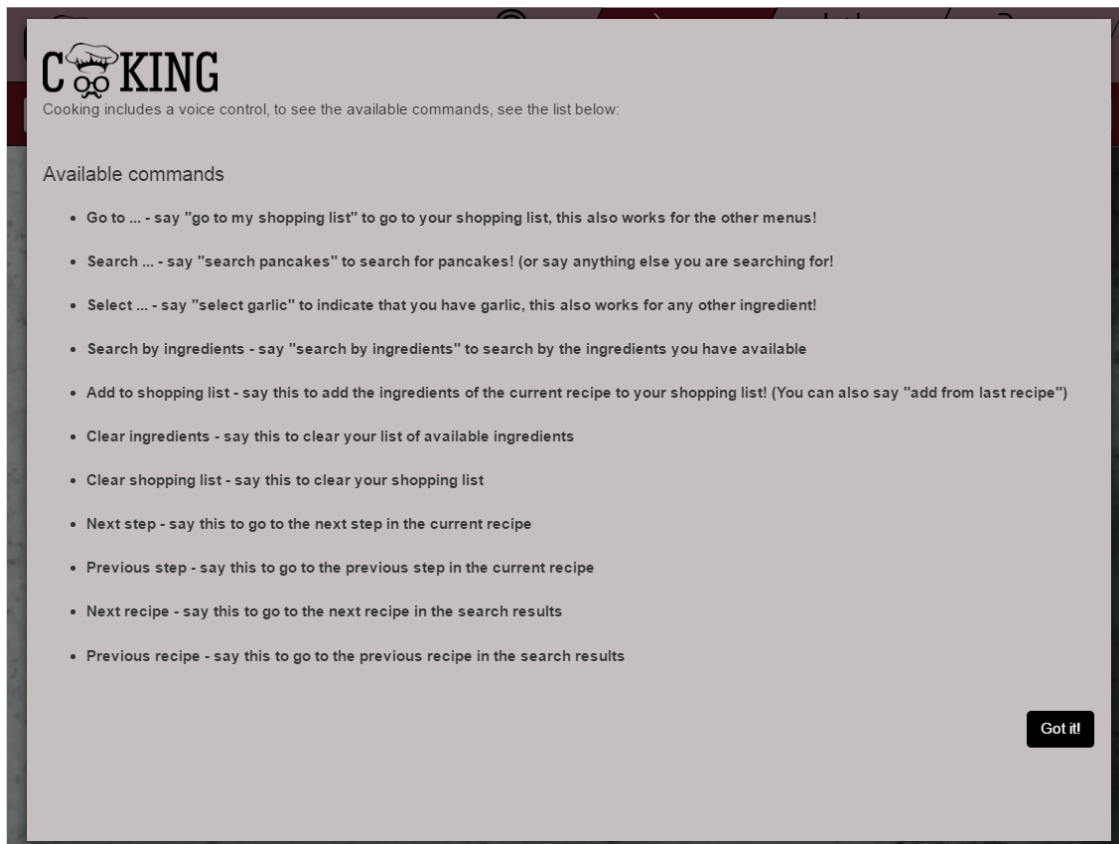
New screen to show the available voice commands

This menu shows up when the user presses the new microphone symbol. As seen below, its theme may be very clear, as it has the microphone pictogram shown. Its clickability is indicated by the 'Click me!' text.

New menu item to call for the voice commands screen

Some final changes we did to make sure our app is consistent and more aesthetically pleasing are to display the highlighting in a different color, to ensure that the whole app is in line with the monochrome design we chose (this way it is still user friendly to colorblind people). We also included the empty checkboxes to clarify the clickability of these items.
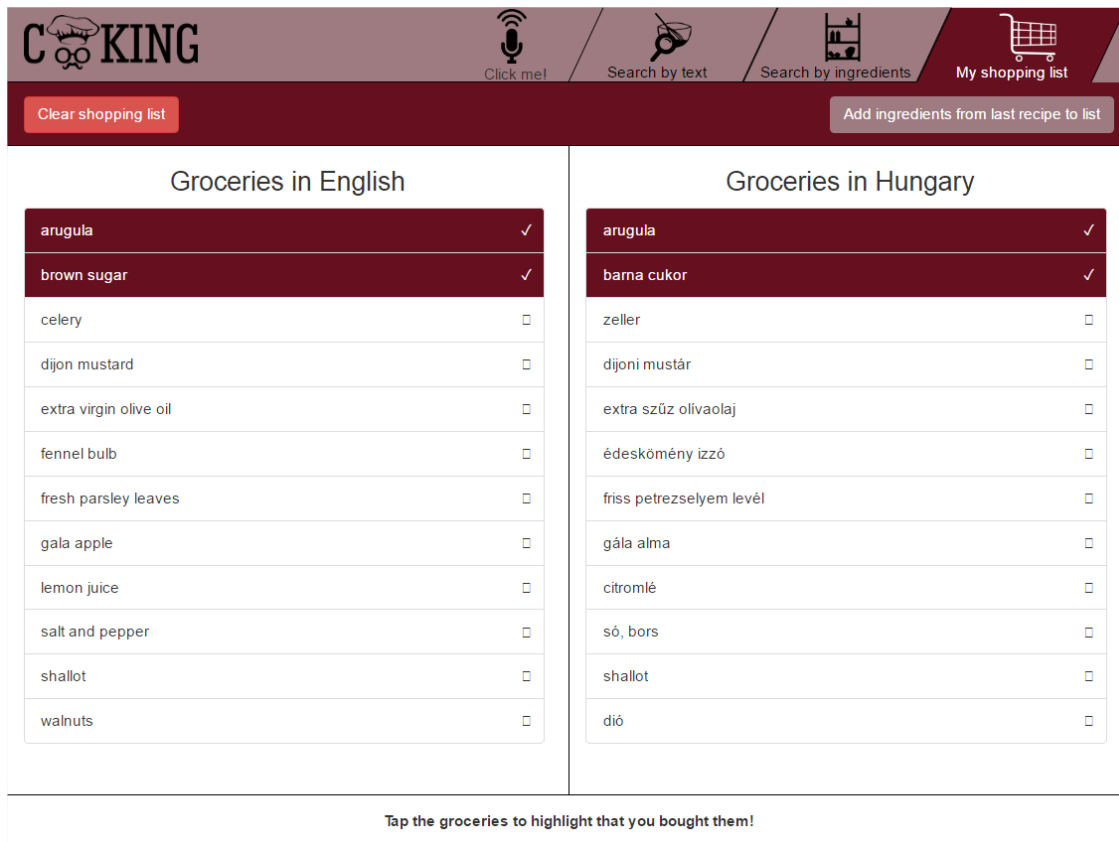
The new highlight color in the shopping list and the new checkboxes

We also did a color change (and a small style change) on the badge that indicates a change in the shopping list. This is now displayed more neatly and is also colorblind friendly.

The new highlight color in the shopping list badge

We also modified the onboarding screen to look slicker and put a nice image as the initial start screen instead of the boring, uninteresting white background.

The initially displayed screen with a more pleasing background than the original white one

The updated onboarding screen

End results

The media device for which we made the application is a 1024x768 Android tablet in landscape orientation. Because the application focuses on usage on a tablet, the design has not been made responsive. This could be done in a following version if the application would be published. Since zooming is impractical on a tablet, the whole interface should be visible at one glance. For ease of access, our web application has been developed to be approachable for students since no installation is required: they can simply go online to start using the application.

The elegant rule of simplicity was applied to prevent over stimulating the user with possibilities. It explains the following design decisions:

A participation design was considered for its continuation, adaptation to culture shifts and community creation. It was however not implemented to ensure a higher quality of recipes and other information. A more primitive version of a user profile was created for the user to personalize the application to the country they reside in, their meal preferences and the

products they have at home. In a future version, a full profile could be implemented where users can save their favorite recipes, for example.

The interest of the users is food-related and can vary from occasional use to multiple times a day. The content our users are looking for is somewhat urgent when they are looking for products in the supermarket: it is the daily task and the students are simply trying to find the right groceries. Therefore, the application can provide the translations of ingredients from the moment a recipe is picked: the information is now readily available, waiting for the user to need it. In the case of finding recipes, the application is somewhat slower but this is due to the large amount of data it needs to seek through before presenting the results. Since the waiting time is inevitable, a screen is shown during the waiting to indicate the application is loading to prevent exasperation of the users.

For the information division, the image and title of the recipes are placed in the part of the screen which get viewed the most by the users. For quick access, the menu bar is placed at the top.

The screen division was chosen to be in equal parts, approximately. Fibonacci was considered but a golden ratio design did not live up to the demand of the usage of the application. For example, when searching for recipes, a large image, title and ingredients are necessary, but after that the steps become the most important feature. Therefore, a 50/50 approach was taken. Next to that, the recipe image has the same amount of space as the recipe overview because of their equal importance: from the image, it is not always clear what the recipe is, and from the title it may be difficult for the user to make out what their creation will look like in the end and if they find it appetizing. For the primary and secondary menu bar, the primary menu bar was chosen to be larger for clarity towards the user. This way is it easier to make out the levels.

Simple navigation has been adopted with all menu items showing at all times, indicating which option is currently selected. Text has been added to the buttons to clarify where they point to. In the case of the ingredient translator, a hint is given to the user about the checklist.

On the topic of perceivability, operability, understandability and robustness, many remarks have been made in this report already, but it can be added that the application provides users with enough time to read and use the content since it's not time-based and the application was not designed in a way that can cause seizures. To improve the usability for users with reduced control over their hands, voice control has been implemented using simple commands.

Further consideration and possible improvements

Various improvements could still be considered before the application would be publishable, but were left out due to complicated implementation, financial constraints or extremely time consuming realization. For instance, an algorithm could be applied to identify the food in the pictures accompanying the recipes and frame them clearly and attractively.

The steps of the recipes are currently separated by the API, however they could be regulated by setting a maximum number of sentences per step and creating a new step when the maximum number of sentences is reached. This prevents overcrowding of text and

ingredients in one single step in recipes which are not set up very well. We could also improve our application by refining our use of the API, either by selecting recipes which are interesting (by removing those recipes that don't have ingredients or steps on how to make them) or even implement our own custom API with our own database of recipes.

We could also improve our voice feature by adding a way of checking if the feature is listening to our voice or not or even how is the overall volume of the device that is using it. We would use this to create a form of user feedback that shows the user that the application is actually listening. This could for instance be implemented into the microphone pictogram, where the amount of 'sound waves' above the icon corresponds to the volume of the voice input. An extra option would be to change the icon to a crossed through microphone logo in case the microphone is muted/disabled on the device. A final important aspect that would further improve usability is narrowing the list of ingredients down to a more useable subset, but since this is more content related rather than interface related, we did not focus on this change during the last iteration. For usability, it would make a big difference though, therefore making it definitely something to consider in case of further development.

Conclusions

By developing this application we've managed to learn a lot regarding web application development but also, and more importantly, human-computer interaction notions that we will be able to use in our future professions. It wasn't always easy, between deciding what to do and on how to make it special and different from other existing cooking applications, but overall, we can say that it was a really good journey where we achieved something at the end. We also need to thank the extensive list of people whose time spent testing and valuable given feedback were essential to improve and refine our application with more features. We wanted to show that original implementation of cooking-based applications is still possible and interesting to explore, and our final product is the main proof of it.

By writing this report which comprises more than 50.000 characters (being ourselves a group of three people), we're aiming for an offered grade. Every member in the group positively contributed to the final solution, and the workload was equally divided by all of them.

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