Abstract

Our goal was to design and create a working prototype for a tablet based, interactive ordering system for use in restaurants. Initially, a review of the current systems on the market was conducted, as well as an investigation into the impact that tablet based ordering systems can have on a restaurant’s business. This lead to the development of three low-fidelity prototypes being designed and evaluated with respect to three example personas. These evaluations were then used to produce a second high-fidelity prototype, for which a more rigorous evaluation was conducted.
Introduction

For both customers and waiting staff, a busy restaurant can be a stressful environment. Customers will often have to spend several minutes attempting to gain the attention of a member of staff, whether it be to order food and drink, make a complaint or to settle the bill, whilst the waiting staff dash between the kitchen and dining area. One solution to this problem, which is currently being trialled in several restaurants across the world, is to provide customers with an interactive tablet in place of a paper based menu. This allows customers to order food, call for assistance and pay at their own pace, whilst also relieving the stress of the restaurant staff.

Currently, there are several business that provide tablet based ordering systems to restaurants, such as Ziosk [1], who provide tablets for the Chili’s and Red Robin restaurant chains in America. In addition to taking orders and paying bills, several of the current devices allow customers to play games, read the news and connect to social media sites. However, reviews from customers who have used these systems are mixed, with many customers, especially elderly diners, having difficulty accessing the full range of features that the tablets provide. Our goal was to design a system which collates the best features from the devices currently in the market, packaging them in an interface that would be accessible and intuitive to all users.

The effects of implementing a tablet based ordering in restaurants

There are many opinions whether the use of electronic tablet ordering devices is beneficial or not to restaurants and customers. At one restaurant chain – “Chili’s Bar and Grill” – tablets have been tested since 2013 and have proved so successful to the business that they are being implemented across the majority of the chain’s restaurants. The initial testing phase has provided many positive effects for customer, waiting staff and the restaurant. Contrary to what may be believed, the amount of tips left by customers has increased by 15% according to data from the tablet manufacturer [2]. This is due to the default suggestion of a tip being higher than what a customer might usually pay. And although the customer understands he is paying this amount of money, if the meal and dining experience was enjoyable then psychologically they do not want to decrease the amount of tip.

Impulse sales have also increased due to the tablets. Without the need to wait for a member of staff to greet you and afford you time to look at the menu, diners who arrive hungry order appetisers straight away, where they might not have done so when ordering the whole meal at once. These impulse sales are also effective for tempting a customer with dessert. As the image of the dessert can be displayed on the tablet as an advertisement while not in use, it is easier to order and harder to fight the temptation [2].

If the tablet system is used correctly by customers, the number of mistakes in a kitchen should decrease. Human error can arise when orders are being taken by waiting staff and also as the chef reads the order when it arrives in the kitchen, as the tablet system allows the orders to be displayed in the kitchen easily. Also, since a detailed description of the plate can
be given to the customer’s on the tablet, they are more likely to order what they want and will result in less food being sent back to the kitchen. As well as making the ordering process simpler, the tablets can be used for entertainment while waiting for the food to arrive at the table. These services typically come with a small charge, similar to purchasing an app on a phone or tablet, creating an additional source of revenue for the restaurant. This could also be a welcomed addition for parents attempting to finish their meal quickly while allowing the child to be distracted.

Due to the speed of the tablet system, as well as avoiding the need to wave down staff and waiting on bills and change, diners can either leave early, affording more space in the restaurant for new customers. Or they can sit and relax after their meal more than they would have, allowing them to order coffee and sweets.

Despite the positives, there is opposition to the use of tablets in restaurants. One such reason for opposition is the initial cost of the tablet system [3], as well as the upkeep and replacement of damaged tablets. In a busy restaurant environment it isn’t hard to imagine a drink being spilt on one of the tablets. Another source of opposition is due to the loss of a human element in the dining experience [4]. Some people use technology every day and one of the few places left where technology has not invaded our personal life is in restaurants. The character of a restaurant can be lost by adding such a system. For a period of time, the restaurant will be known to customers only for its use of a tablet system, distracting from the positives of the cuisine or welcoming atmosphere.

A review of the current systems

Before undertaking the task of designing an interface for a tablet ordering system, it is important to consider the successes and failures of the current devices that exist in the market place. Whilst there are several companies that are currently offering interactive menus for restaurant, we will focus on reviewing the most popular three; Ziosk [1], touchBistro [6] and eMenu [7].

In order to perform a worthwhile evaluation of the current systems, it is important to consider the general principles of effective user interface design. Joshua Porter, of Bokardo Publishers, outlines 19 principles that he recommends applying to user interface designs [22]. Porter suggests that focusing the clarity of the interface, whilst providing the user with a simple to use interface in which each screen focuses on providing one primary action, is the key to an effective user interface. These principles will be used as a guideline for the evaluations of the current system design.

The majority of companies that currently provide restaurants with tablet based ordering systems have attempted to implement the same basic functionality, in that they allow users to browse through available items, place orders, pay the bill, and access in-built applications such as games.
The following evaluations will focus on the usability of each system, how the above functions have been implemented, and how easy it would be for a first time user to access these features, along with a brief overview of the system. The usability of a system can be broken down in five components; how easy accomplishing tasks is for a first time user, how quickly tasks can be performed, how easy it is for previous users to begin using the system again, how the system handles user errors, and how pleasant the design is to use [5].

**Ziosk**

The American based Ziosk [1] system is one of the most visible examples of tablet ordering systems, due largely to their recent adoption by the Chili's restaurant chain. They focus on casual dining, running on a custom 7inch tablet with an android system.

They are not currently used for ordering all courses-Chili's use them for dessert and drinks, while other restaurants also use them for starters, with traditional menus and waiters used for main courses. The tablets can be used to stream images of starters and desserts, which Ziosk claims has significantly increased impulse buys.

They offer unlimited games (for a charge of $0.99) for adults and children as a distraction while waiting for food. Extensive social support is provided, with access to Facebook, as well as a built in camera which allows the uploading of photos. Restaurant loyalty schemes, e-clubs and charity support are also possible.

Ziosk allows payment at tables with a swipe card reader shows itemised receipts, and includes a tip calculator. The system uses a multicoloured LED to communicate with waiters-indicating readiness to order or pay. It also supports customer surveys.

![Figure 1: The home screen of a Ziosk device](image)
Upon entering the restaurant, customers are greeted by the screen displayed in Figure 1. Customers can begin ordering food or drink straight away by clicking on the respective buttons. Customers browse through the menu by swiping through available items, which is an action that will be familiar to modern smart phone users, but not for users unfamiliar with modern technology.

Different sections of the menu are accessed through the buttons on the bottom of the screen, which can be seen in Figure 2. Although these buttons are small, first time users should find these options easily visible, making navigating through the system easy. Items can be added to the users order through pushing a ‘shopping cart’ icon, which is always located to the left of each item. Placing the button in the same place on each screen would help first time users, and the ‘shopping cart’ icon will be recognised by the vast majority of users. The system doesn’t implement a search function, so customers who know what they wish to order will still need to browse through the menu in search of their wanted item. Before an order is sent to the kitchen, users are able to view the items they have selected, and they are asked to confirm that they have finished browsing. However, there is no option to view previously ordered items, which may lead to errors as customers accidentally add unwanted items to their order.

After dining, customers are prompted to pay for their meal. Customers are able to view the items that they ordered, and they are asked if they would like to leave a tip. As there is only one device per table, customers are unable to split the bill, meaning that one person will have to pay for the entire meal.

The interface is displayed on a 7-inch screen, and despite this small screen size, the text and options are well sized and cleanly displayed, meaning that first time users and users with poor eyesight should not struggle to access the area of the menu that they wish to.
touchBistro

touchBistro provides an ordering system which can be downloaded and run on iPads, either as a point of sale system for smaller businesses, or through multiple tablets in a larger restaurant.

Customers are able to use the system as a menu, where they are presented with large clear images and extensive descriptions. Figure 3 shows a typical view of the menu interface, where customers are able to cycle between items by swiping in their desired direction. As with the Ziosk system, this is an action that would be familiar to users of modern smartphones, whilst people unfamiliar with modern technology may struggle to access the system on their first few attempts.

![Menu interface for touchBistro](image)

**Figure 3:** Menu interface for touchBistro
Whilst customers are able to browse the menu items through the system, orders are entered by waiters, though they are still sent directly to the kitchen.

Figure 4 shows the interface through which the waiting staff accepts orders from the customers. Orders are associated with a particular seat at each table, allowing for the precise splitting of bills.

![Ordering interface for touchBistro](image)

Figure 4: Ordering interface for touchBistro

Many of the advantages that a tablet based ordering system brings to a restaurant, such as the reduction in staff stress and customer waiting times, will not be provided through implementing the touchBistro system. Additionally, having to pass the tablet between customers whilst they pick which item they wish to order and then back to the waiter so that orders can be entered, would increase the time taken to order, and seems less efficient than the current paper based system.

Whilst the interface allows for the staff to review orders before they are sent to the kitchen, which will reduce the amount of errors that occur, the design of the system is complicated, and servers that are new to the system may find it difficult to manage both the device and the customers at the same time. Allowing orders to be separated by table and seat also greatly increases the number of clicks that are required to add an item to the order, making the system cumbersome and inefficient to use.
eMenu

eMenu [7] provide menu and wine applications for both iPad and Android systems, as well as larger table side screens and touch screens for waiting areas.

The system serves as an electronic menu, offering detailed images and descriptions of the available food, including calories, allergen and nutritional information. eMenu focuses on the aesthetics of the tablet menu system, aiming to provide users with an attractive and easy to use interface. The menu screens, which are shown in Figure 5, displays each item with a clear picture and easy to read text.

![Figure 5: Menu Interface for eMenu](image)

Users can access further information about each item by clicking on a specific feature, which may not be immediately obvious to first time users. Clicking on the ‘Add’ button asks users to confirm that they which to add the item to their current order, which prevents accidental ordering.

As well as offering one touch payment through card, the eMenu interface offers a navigation only mode, which means the system acts purely as a menu rather than as an ordering system. This feature must be chosen by the restaurant, however, allowing this feature to be turned on and off by customers would be beneficial for customers with children, allowing them to browse through the menu without the worry of unwanted orders.

Navigation through the menu is uncomplicated, with customers selecting the area of the menu they want through the options at the top of Figure 5. An arrow points at the section of the menu that is currently being viewed, which may be too small for users with poorer eyesight.
Several useful features have been created for the system, such as the ability to customise menu items by switching, adding or removing certain ingredients, which would be useful for customers on specialised diets. The system also provides in built applications, such as games, with the idea of occupying customers as they wait for the food to arrive, and recommendations that are updated based on the items that the customer has currently ordered.

**General Design Principles for Tablet Based Devices**

Despite tablet based technology being a relatively new area, there has been a lot work published on how to design effective user interfaces for the new crop of tablet devices. Both Apple and Android, who are two of the main providers of tablets, have released guidelines for software developers who are creating applications for the respective devices.

Android suggest that allowing users to interact with real objects, rather than buttons, provide users with a more enjoyable and interactive experience [23]. Applying this to an ordering system, it would be preferable to provide users with an interactive menu, similar to the current paper based menus, that users are able to browse through.

In order for the tablet ordering systems to be effective, they need to be easier, less stressful, and as intuitive to use as the current paper based menus. Several design guidelines, including Androids, stress that users should only be presented with the minimum set of options that they need to complete a specific task [23]. This reduces the cognitive burden placed on users of the system [25], whilst increasing the clarity of the interface [24], making the system easy to use for first time users, and quick to use for experienced users.

In order for the tablet to be easy to use, and quicker than ordering through a server and a paper menu, the number of touches that are required to perform an action should be kept to a minimum [25]. Having users interact with the tablet unnecessarily, in terms of the number of clicks needed to perform an action, will increase both the time taken to use the device, and the stress that using the device places on the user.

Another way of reducing the stress placed on users of the system is to make the entire system easy, and quick, to navigate through. There are several methods of doing this, such as the navigation bar provided on the eMenu system, the breadcrumb approach taken by many current websites, and through providing obvious transitions when switching between screens [23].

Preventing unintentional user error, and allowing users to recover gracefully from errors that they do make, is another area of tablet application design that is given a high importance in several of the published guidelines. The Android guideline encourages designers to be gentle when they prompt users to correct errors that they have made, providing clear instructions to users on how they can rectify errors that they have made [23]. Due to the touch screen devices, users will often find that they have accidentally press buttons and areas of the screen.
that they didn’t intend to, and there should be a system in place that allows users to easily recover from these mistakes [26].

**Implementing a Recommender System**

As part of our ordering system interface, we plan on implementing a recommendation system which will provide diners with options from the menu based on their current selected items. For example, when a user selects a certain main meal, they will be recommended a choice of drinks, starters and desserts that would complement that meal.

Currently, recommendation systems are used on many online retail, media, and ecommerce websites, such as Amazon and Netflix. Many studies have reported a positive correlation between the implementation of an effective recommendation system and revenue, with one study, conducted by Belluf et al, reporting a revenue increase of between 8% and 20% [8]. The value that companies place on recommendation systems can be further highlighted by Netflix, who, in 2009, created a competition in which they offered a $1 million dollar prize to anybody who could improve the accuracy of their recommendation system by 10% [9].

An effective recommender system relies on two things; the set of algorithms that it uses to provide the user with recommendations, and the interface through which the user is able to view, and select, from the list of recommended items. When an effective recommender system is implemented, both the customer and the company benefit, as the customer is helped in selecting the products that they want, and the company is able to collect data on popular product combinations [10]. In the following study, the focus will be placed on the recommender interface design, with the aim of producing a list of features that are required to provide the user with a satisfying experience.

Swearingen and Sinha [10] comment that a well designed user interface for a recommender system must consider the user’s needs, and then implement specific features that match those needs. The study, which reviewed several of the internet’s largest media stores, concluded that an effective recommender system must inspire trust in the user, which can be done by recommending a mixture of familiar and new items. Swearingen and Sinha also presented findings suggesting that users prefer systems which provide details about the recommended items, and that allow the user to refine suggested items.

In order to build our recommender system interface, we will briefly review two popular, online systems, provided by Amazon and Wine-Searcher, based on the guidelines provided by Swearingen and Sinha.

**Amazon**

Amazon is an online ecommerce site that allows users to make purchases from a huge range of stock. The site provides users with recommendations based on their previous search and
purchase history, as well as data they have collected from worldwide purchase trends. When a customer views an item on the website, they are presented with recommendations based on other user’s purchases, as seen in Figure 6.

The user is provided with a range of items that are similar to the one they are currently viewing. Information regarding the price and average user rating is given to the user, allowing them to make informed choices about any future purchases. Amazon provides a huge range of recommendations to the user. As mentioned, this may inspire trust in the user, as they will see both familiar and new items in the selection, however, some users may be overwhelmed with the volume of items they are able to view, which may have a negative effect of the chance of them purchasing a further item.

One common complaint about Amazon’s service is that users are unable to refine their recommendations. For example, one off gift purchases will generate recommendations to the user that may not be relevant to their own interests [11]. Allowing users an easy way to refine the recommendations would improve the quality of service that is provided.

Wine-Searcher

Figure 6: Amazon Recommender System

Figure 7: Wine-Searcher Recommender System
Wine-Searcher [12] is an online service that allows users to refine the types of wine that they are looking for, and then provides users with a range of wines that meet their selection criteria. Users are provided with the average price of the wine, the average user score and a link that provides a list of places from which the wine can be purchased.

Allowing users to refine their search means that users are able to quickly view a selection of wines that are relevant to their interests. The website can be praised for the range of ways in which the user can refine the recommendations; however, it may be the case that these options may be intimidating to new wine drinkers, and an option to hide some of the options may be beneficial. Despite this, the overall simplicity of the interface means that the vast majority of new users will be able to successfully navigate through the system.

**Personas and Usage Scenarios**

The success of any system depends heavily on the user interaction; in order for an application to succeed, the user interface should help the user understand and interact with the content without interfering with it, and display clear, easy to read text with precise icons that have clear functions [13].

In order for our tablet based ordering system to be a success, there must, therefore, be a heavy emphasis on how users will interactive with it. With this in mind, three example users have been created which will be used to both design and evaluate the prototypes that are created.
**Persona 1**

<table>
<thead>
<tr>
<th><strong>Name</strong></th>
<th>Clay Evans</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>23</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>Student at University of Birmingham</td>
</tr>
</tbody>
</table>

**Goals of using system**
- Easily keep track of what he spends during dining
- Dine out whilst maintaining a healthy diet
- Be able to track macronutrients during a meal out

**Previous experience with similar technology**
- Uses tablet/smart phone daily
- Used a similar ordering system whilst on holiday in the previous year
- Regularly uses an online fast food ordering system

**Overview of life / day to day activities**
Clay is a 23 year old student, currently undertaking a PGDipEd course in maths at the University of Birmingham. He is currently on the university phase of the course, and as a result has more free time that he normally would. Outside of teaching, Clay's main hobby is competitive swimming, and because of this, he tries to maintain a healthy diet, carefully tracking his macronutrient intake. However, on rare occasions he enjoys a cheat day, where he allows himself to eat and drink whatever he wants. As well as this, Clay is also a vegetarian.

As Clay is a student, he has to be careful with his budget. Due to his university course, at the end of each month he receives a bursary, and he normally ends up spending more money during the following week.

**3 scenarios for using the tablet**

1. Clay goes out for a meal with his friends from the swimming team after a competition. He had been paid the previous Friday, and is looking forward to a cheat meal, where he aims to eat as many calories as he can for under £15. He also wants to keep his bill separate from his friends.
2. Clay takes a girl to the restaurant on Saturday for a first date, and he wants to eat a healthy meal. As he is paying for the girl's meal, he wants to keep track of the total spend, but he wants to do this discreetly. He also wants to try to impress the girl by ordering a nice bottle of wine, but he doesn't know which kind to buy to go with the meals.
3. Clay's parents are visiting for the weekend, and they want to take Clay for dinner the evening before a swimming competition. He ways to make sure that he gets the correct macronutrients he needs to compete well the following day, and he wants to make sure the meal is less than 800 calories.

**Frustrations / Pain Points / Disabilities / User Requirements etc.**
- Suffers from red/green colour blindness
- Likes to know calories and macronutrients for the meals he needs
- Dislikes having to hunt through menus for the vegetarian option
- Dislikes having to divide the bill up when dining with friends
- Dislikes not being able to easily make substitutions for meal items
### Persona 2

<table>
<thead>
<tr>
<th><strong>Name</strong></th>
<th>Jeanette Williams</th>
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<tbody>
<tr>
<td><strong>Photo</strong></td>
<td><img src="image" alt="Photo" /></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>36</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>Corporate Lawyer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Goals of using system</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Rapid ordering and payments</td>
</tr>
<tr>
<td>- Easy access to dietary information</td>
</tr>
<tr>
<td>- Easy language selection</td>
</tr>
<tr>
<td>- Detailed explanations of meals</td>
</tr>
<tr>
<td>- Clear children’s menu</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Previous experience with similar technology</strong></th>
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<tbody>
<tr>
<td>- Extensive use of tablets and smart phones as an end user</td>
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<tr>
<th><strong>Overview of life / day to day activities</strong></th>
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</thead>
<tbody>
<tr>
<td>Jeanette is a well paid lawyer working in the City. She has two children, Ryan (9), and Charlotte (10), who is gluten intolerant. Her husband, George, also has a demanding, highly paid job. Their weekdays are meticulously planned out, with everyone leaving the house for work or school by 7am. At work Jeanette is well regarded, and is expected to be promoted to management of her department within a few years. She frequently meets with overseas clients, and takes them to working lunches. After work one parent will ensure they pick up the children from after school clubs at 6pm, sometimes taking them for a meal. Jeanette will occasionally work over the weekend to meet deadlines, however on most weekends she spends time with her family, either in London or on weekend trips around the country.</td>
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<table>
<thead>
<tr>
<th><strong>3 scenarios for using the tablet</strong></th>
</tr>
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<tbody>
<tr>
<td>1. Taking some Chinese clients out to lunch. Here Jeanette is looking to impress her clients, so the desired experience would be stylish and fashionable. Her clients only speak a little English and have little experience with Western cuisine, so would need detailed explanations or images of the food. As the meal is paid for by her company cost is of minimal concern.</td>
</tr>
<tr>
<td>2. A family weekend meal. As her children are excitable and somewhat fussy, Jeanette would prefer to be able to pay and leave with minimal fuss. She needs to know which dishes are suitable for her gluten intolerant daughter Charlotte, as well as being able to see the calorie count for her own diet. She also expects the restaurant to provide something to entertain her children while waiting for the food to arrive.</td>
</tr>
<tr>
<td>3. A romantic meal with her husband George to celebrate their anniversary. Jeanette would like the dining experience to be uninterrupted and seamless, with the process of ordering and payment to distract as little as possible from her evening. Any complications arising from mistakes would have to be dealt with as little fuss as possible. As it is a special occasion she is prepared to spend a large amount on the meal, and is less concerned about keeping to her diet.</td>
</tr>
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<table>
<thead>
<tr>
<th><strong>Frustrations / Pain Points / Disabilities / User Requirements etc.</strong></th>
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</thead>
<tbody>
<tr>
<td>- Jeanette is dieting, and likes to see the calorie count of her meals and drinks, as well as order low calorie versions when available. Her daughter Charlotte is gluten intolerant so menu items must either indicate whether they are gluten free, or provide the option to order gluten free versions.</td>
</tr>
<tr>
<td>- During meals with her children an entertainment system to occupy the children would greatly reduce the stress of the meal, allowing Jeanette and her husband to relax. The ability to order and pay quickly, allowing them to leave promptly, is also appreciated. Large pictures of the meals on the children’s menu would make their ordering easier.</td>
</tr>
<tr>
<td>- For entertaining clients Jeanette would like to be able to hide the prices on her client’s menus, as well as have multiple languages available and the option of a more in depth explanation of the dishes.</td>
</tr>
</tbody>
</table>
### Persona 3

<table>
<thead>
<tr>
<th><strong>Name</strong></th>
<th>Agathe Perrot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Photo</strong></td>
<td><img src="image" alt="Agathe Perrot" /></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>66</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>Retired Baker</td>
</tr>
<tr>
<td><strong>Goals of using system</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Text size increase</td>
</tr>
<tr>
<td></td>
<td>Explanation of dishes</td>
</tr>
<tr>
<td></td>
<td>Educational apps/games</td>
</tr>
<tr>
<td></td>
<td>Speed of response to requests</td>
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<td></td>
<td>Ability to customize</td>
</tr>
<tr>
<td><strong>Previous experience with similar technology</strong></td>
<td>None</td>
</tr>
</tbody>
</table>

#### Overview of life / day to day activities

Agathe is a retired Baker from Marseille who has moved to Bristol to be closer to her son and her grandchildren after her husband passed away recently. She has very little English speaking skills at present, having only moved over from France recently. As well as this she struggles with small text, due to poor eyesight, and has no previous experience using a tablet, smartphone or any other touch enabled device.

Agathe spends most of her days inside her apartment reading, but is often visited by her son Oliver accompanied by his children, Jeremy (age 8) and Charlotte (age 12). She hasn’t been able to spend much time with her grandchildren before moving to the UK as they were raised in Bristol. She struggles to communicate with them as they have only a small knowledge of French and feels as though she needs to spend more time with them. She is worried about becoming a burden on her family.

#### 3 scenarios for using the tablet

1. Oliver has left the children with Agathe for the day as she requested time to spend with them during which time the children request they go out for a meal. Agathe is unfamiliar with the setup of the restaurant, as well as preferring to keep track of her bill due to her low income.
2. After walking around Bristol, Agathe wants a cup of coffee before going home. She wants to specialize her order of a double espresso with a small jug of steamed milk so as she can add it herself. She doesn’t know how to make this order in English and would rather not struggle to communicate with a staff member.
3. Agathe is meeting her family for a meal followed by a French play in a nearby theatre. Her family are running late meaning she is alone at the table. Oliver calls Agathe asking her to place their order ensuring they aren’t late for the theatre. Agathe has forgotten her glasses and is having trouble signalling a staff member to help her. She wants to order the food quickly before her family arrives as she wants to show she can be self-sufficient.

#### Frustrations / Pain Points / Disabilities / User Requirements etc.

- Agathe wants a menu in French and prefers to not communicate with staff when they don’t understand her language.
- Agathe wants to know the prices of her meal as she is ordering.
- The small descriptions on traditional menus are hard for Agathe to read with her poor eyesight.
- Agathe likes to have an activity to do with the children to bond with them such as a game that helps learn French.
- She dislikes spending time in a restaurant seeking a staff members’ attention.
- Unfamiliar with some British cuisine and dining experience.
First Generation Prototypes

Rationale for the first generation prototypes

The following first generation prototypes were shaped by considering the specific needs and wants of the three personas and their example usage scenarios. In addition to the personas, the evaluations that were carried out on similar devices, and the design principles offered by industry experts, have been used to influence the following three designs.

In order to explore a wide range of ideas, specifically with regards to the features and overall interface of the application, each member of the group independently produced their own prototype. Through doing this, we aimed to produce three prototypes that tackled both the problems found in the current devices, and the needs of the three personas, in unique ways. The successful features of these three prototypes could then be collated into the second generation prototype.

Each of the following prototypes were hand drawn, and as such they don’t offer any interactivity. The aim, at this stage of the design process, was to quickly produce prototypes that gave an insight into what a final working version of the software would look like.

Plan for evaluating the first generation prototypes

In order to examine these interfaces, the prototypes were evaluated using Nielsen’s Heuristics [14], which offers a ‘rule of thumb’ approach to interface design [15], allowing us to make quick judgements on the effectiveness of each interface with regards to the user requirements. Nielsen sets out ten general principles for interaction design [15], and each of the prototypes was evaluated against these principles using the severity ratings [16] shown in Table 1.

<table>
<thead>
<tr>
<th>Severity Rating</th>
<th>Usability Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I don’t agree that there is a usability problem at all</td>
</tr>
<tr>
<td>1</td>
<td>Cosmetic problem only: fix if there is extra time available</td>
</tr>
<tr>
<td>2</td>
<td>Minor usability problem: fixing this should be given low priority</td>
</tr>
<tr>
<td>3</td>
<td>Major usability problem: fixing this should be given high priority</td>
</tr>
<tr>
<td>4</td>
<td>Usability catastrophe: must be fixed before the product is released</td>
</tr>
</tbody>
</table>

Table 1: Describes the ratings used with Nielsen’s Heuristics [16]

The ratings were assigned to each of the interfaces based on how the three personas would have been able to interact with the design, and how easily they would have found it to successfully complete the scenarios that were described in their profiles.

As each member of the group produced a prototype independently, the heuristic evolutions were carried out by the other two members. The mistakes that the members of the group
found were then collated to form the evaluations that follow the prototype walkthroughs. The prototypes were then evaluated based on the usage scenarios of the three personas.

**Prototype 1 walkthrough**

The implementation of this prototype would be similar to that of the Ziosk [1] ordering system, in that the tablet would be attached to the side of the table on a rotatable arm. The prototype features an example home screen, an idea for the menu interface, and a possible solution to implementing an effective recommender system.

When customers are seated at their table, they are presented with the home screen, which is shown in Figure 8. Customers are presented with four options; ‘Order’ to browse the menu, ‘Assistance’ to call a member of staff, ‘Pay Bill’, and ‘Games’, which provides access to the tablets in-built applications.

![Figure 8: Home Screen]

Buttons for settings and selecting language
Selecting the ‘Order’ button takes customers into the menu, an example of which is shown in Figure 8. The menu is split into three sections, ‘Food’, ‘Drink’, and ‘Recommendations’, and customers are able to navigate through these by pressing on the appropriate button. Figure 8 shows the ‘Food’ section of the menu, and customers are able to navigate through the subsections of this menu through the options on the left hand side. Each item of food provides the customers with a picture, a brief description, the ability to change ingredients used in the item, and the option of adding the item to the order. In order to decrease the number of clicks that the user has to enter into the device, a one touch ordering system has been implemented, so clicking on the order button automatically adds the item to the user’s current order. Clicking on the item brings up further information, such as the nutritional content.

![Figure 9: Menu Screen](image-url)

Tabs are used to access different areas of the menu

Scroll bar

Allows users to filter the menu, so that they only see certain items

Brings up a pop-up containing more information about the item

Allows users to change an item’s ingredients.

Adds an item to the current order
The recommendation system is shown in Figure 9. Recommendations are based on the items currently in the customer’s order, and they are given the option of removing an order in order to refine their recommendations. These features were implemented based on the reviews that were carried out on current recommendation screens; allowing users to refine their recommendations whilst providing them with an easy to navigate interface for viewing their recommended items. The recommendation screen has a similar layout to the menu screen, in order to promote familiarity and ease of use for first time users.

![Recommendation Screen](image)

**Figure 10: Recommendation Screen**

### Heuristic Evaluation of Prototype 1

1. **Visibility of System Status**
The interface doesn't allow users to easily track the cost of the bill as they order items. This means that people on budgets, such as Clay Evans, will find it difficult to track how much they are spending. Users have to navigate to the home screen before they are given the option to see their bill, which would be cumbersome and difficult for people who are new to the system.

Score: 3

2. **Match between System and Real World**
The interface uses a flag symbol to represent the language that is currently being displayed, which is universally recognised. Much of the language used in the menu is the same as current paper based menus, which means that users will be familiar with it.

Score: 0
The interface has a 'Filter' button, which users should use if they wish to refine the menu, and the function that this button provides may not be immediately obvious, depending on the user.

Score: 1

3. User Control and Freedom
Items are added to users' bills by clicking on the 'Order' button displayed on the menu. This means that users may often accidentally add unwanted items to their menu. This will be a major problem for users unfamiliar with the technology, such as Agathe, and for users with children who are likely to play with the tablets, such as Jeanette.

Score: 4

4. Consistency and Standards
The same interface is used for both the menu and recommendation screens, which means that users who are familiar with the system will be to easily navigate through it.

Score: 0

People who are unfamiliar with technology may find the multiple tabs confusing, and they may struggle to know which section of the menu they are in.

Score: 2

5. Error Prevention
As mentioned, the menu uses a one click system for adding items to the menu. This would be a problem for all users, and future versions should ask the user if they are sure an item is to be added to their bill before the order is placed.

Score: 4

The 'Home' button will take users back to the initially screen if they accidentally enter a section of the menu that they didn't wish to, however this could be improved by taking users back to the previous screen.

Score: 3

6. Recognition rather than recall
Users view which section of the menu they are in by the tabs located on the top and left side of the screen. These tabs are small, and users with poor eyesight may struggle to view which section of the menu they are in until they have learnt the layout of the menu.

Score: 2

7. Flexibility and Efficiency of Use
Users who know what they wish to order prior to entering the restaurant can use the 'Search' feature to select the desired item.

Score: 0
8. Aesthetic and Minimalistic Design
The menu and recommendation screens are both cluttered. Users are presented a wide variety of options, which could be confusing for first-time users. Users navigate the menu through tabs, which are bulky and take up a considerable amount of screen space.

Score: 2

9. Helping Users to Recognise, Diagnose and Recover from Errors
Users are unable to track the cost of their bill as they select items to order, meaning that they will be unable to recognise accidentally ordered items. Users are able to view the final bill before an order is placed, however, they may not notice unwanted items if they are unaware of what the rough cost of the meal should have been.

Score: 4

10. Help and Documentation
The system was designed to be intuitive, with the idea that users should be able to navigate through the system easily with their first use. However, users who are unfamiliar with technology may struggle, and there is no option to ask for help once the menu has been entered, and only the home screen offers this option.

Score: 3

Persona and Scenario Review of Prototype 1

Clay Evans
Since the system doesn't allow the user to track the cost of the bill as they navigate through the menu, Clay would find it difficult to keep track of how much he is spending. Dietary and nutritional information is available on the menu, which would allow Clay to keep a track of his calorie intake during a meal, however he would prefer it if a record of this information could be kept as he adds items to his bill.
When ordering items, the system doesn't make it clear which bill the item is being added to, which would make keeping personalised bills difficult.
Using the filter option on the menu, Clay would be able to narrow down the selection to items that match his dietary requirements, and the clear 'Change' button would allow him to easily make substitutions to his chosen meal items.

Jeanette
The ability to change the language of the system at any point during its use would be useful for Jeanette and the foreign clients she frequently dines with, and the option to filter the menu would allow these clients the ability to narrow down the menu to their preferred types of cuisine.
When she takes her children with her, the 'Games' section located on the home menu could be used to keep them occupied. However, the system doesn't offer the option to lock the tablet in
any particular location, and she may find that the children are able to navigate through the system and unsupervised.

Agathe
Agathe would struggle to navigate through the system. Although the interface offers the ability to change language, she may find the flag symbol difficult to locate on her first use of the system, which would make the rest of the menu inaccessible to her. As with Clay, not being able to track the cost of the meal as items are ordered would be a problem and the clustered interface would make navigating through the menu difficult. The games section of the menu would be ideal for her grandchildren, however it is unclear whether she would be able to join in with these activities is she wished to.

Prototype 2 Walkthrough

The aim of this prototype is to cater more for those who need a system that allows better ease of use. It is also required that users are not easily confused by the interface of the system. The interface has been made simple and clean with a fair amount of space between each interactable object present on the touch screen. This aims to decrease chance of an error caused by selecting the wrong option. This prototype is aimed more at those less used to a touch screen tablet such as Agathe.

This prototype uses a configuration where the tablet device is integrated into the table. This is to prevent the device being knocked over or damaged as easily and it shall be large enough for every customer at the table to view the screen. The device will need a stronger glass front to prevent scratches, breaks and water damage. This set up also creates the need for the screen to 'lock' after an amount of time to prevent accidental input.
The first screen the customer is presented with is a language option screen. A large flag is displayed that represents the language of a country such as a French flag for French language. A line of text underneath reads “Please use the touch device to select your language and place an order”. This text cycles throw different languages slowly in order to inform people who are unfamiliar with the set up. A large ask for assistance button is present in the top right corner of this screen and remains in this section of the screen in all further menus.

Figure 11: Language Selection Screen
The second screen is called the Home screen. This contains options to go to the different sections of the restaurant’s menu such as starters, mains, etc. The buttons are very large and spaced out to be easily readable and prevent an error entry occurring. At the top of this screen and future screens is a breadcrumb. This allows the user to see what steps they have taken to get to the current location in the interface. The text in the breadcrumb is also a button that can take the user back to any point in the system such as going back to change the language.

Figure 12: Home Screen

A space on this home screen is afforded to advertising space or recommendations based on already ordered food such as selecting a wine to compliment a main dish.
If the user selects for example “Mains” in this home screen, they are taken to another screen. This is the menu portion of the interface. The majority of the screen is taken up by a scrollable box containing all the items classed as main dishes.

Figure 13: Mains Screen

Scrollable shopping cart, displays the ordered items and the total cost

Clicking the ‘Order’ button opens a pop-up asking users to confirm their item selection
Selecting one of these items creates a pop up to appear which shows more detailed information on the item such as a picture, nutritional information and alterations that can be made to the dish. A “add to cart” button is also present that places this item in the users cart and closes the pop up.

On a menu screen there is also a section displaying the current shopping cart of items. These are items that have been picked but not yet been ordered and sent to the kitchen. Below this is an order button. This brings up a pop up which shows the user what all is about to be ordered as well as total price and a confirm order button.

If the tablet is not used for 30 seconds it locks itself so as accidental input is not performed. Tapping the screen and swiping the screen to the side unlocks it to be used further. While the user waits for their order, they might wish to play a game or read news from an app on the tablet. A games and apps button appears in the home screen after an order has been placed. This is to prevent people from using games and apps before placing an order and taking up time in the restaurant.

When paying for their meal, the user selects the payment option found in the home screen. They are then presented with a screen that details their bill, presents them with an advert/ picture of further drinks and desserts they could order and allows them to pay the bill. If paying by cash or voucher the system will call a waiter to handle the payment, but payment by card can be handled by the system. A card can be inserted into a card reader installed in
the table beside the tablet, and the tablet interface can then display a keypad to be used to enter a pin. This allows no interaction with the staff and a fast transaction.

Heuristic Evaluation of Prototype 2

1. Visibility of System Status

Users are presented with the shopping cart and running total of items as they are ordering. This along with the 'Confirmation of Order' pop up allows them to constantly understand how much the bill will be at the end of the dining experience. As well as this the breadcrumb present on every page allows the user to see at what section of the interface they are at and the steps they took to reach this point.

Score: 0

2. Match between System and Real World

The system mostly uses language that is used currently in restaurants which should be instantly familiar to the user. For foreigners, the first interaction with the system is to choose a language which should help mitigate problems they would have if not fluent in the primary language of the country the restaurant is located in.

Score: 0
3. User Control and Freedom

The breadcrumb allows users to move swiftly between different sections of the interface. There is however no obvious back or cancel button for someone wanting to immediately cancel an input.

Score: 2

The shopping cart of items is constantly displayed to the user as they are looking at the menu. There is also a confirm order pop up before an order is sent to the kitchen to prevent placing a wrong order.

Score: 0

There is a major oversight that there is no way to remove an item from the shopping cart once it has been selected. This could be fixed with a simple cancel button beside the items listed in the shopping cart present on any menu screen.

Score: 4

One other option that is missing is the ability to flip the display on the screen. This would benefit users sitting opposite each other preventing the need for one of them to attempt to read the menu upside down.

Score: 2

4. Consistency and Standards

Each screen has a similar interface with large buttons spaced out, the breadcrumb present at the top of the screen and the 'Call for Assistance' button in the top right corner.

Score: 1

5. Error Prevention

Since an item needs to be selected, creating a pop up, and then another selection made on a pop up to place an item in the shopping cart it is difficult to order an item by accident. Same with sending an order to the kitchen, a pop up is created which asks to confirm the order. The interface also utilises large spaced out buttons to prevent a wrong button being selected.

Score: 0

As mentioned before a 'Cancel Item' button is necessary in the shopping cart if an incorrect item is placed there.

Score: 4
6. Recognition rather than recall

The consistencies in the UI should become easily recognisable to a user, and due to the different screens causing only a few buttons to be present per screen, the less cluttered look of the interface should therefore be simpler to use. Less thought is required as each button is clearly labelled.

Score: 0

7. Flexibility and Efficiency of Use

The language can be altered from the very first screen to help accommodate those with less language skills. There are no expert users for this system and therefore efficiency of use is less important. However, for a regular user in a rush, all the pop up confirmations could be tedious and time consuming if he/she already knows what they want.

Score: 1

The dimensions of the tablet could become a problem. This ultimately depends on the size of the table the tablet is integrated into, but it may be difficult for every user to view the screen easily. For large parties as well, 2 tables may be pushed together by the restaurant. This would mean that half of the group of users would order separately, causing food to be delivered at different times. This could upset the dining atmosphere for the customers.

Score: 2

8. Aesthetic and Minimalistic Design

The buttons are big and spaced out to create a less cluttered feel. However, since there is nothing other than the text to distinguish the options, the user is not especially drawn to any particular option. The layout may be classed as boring by younger users of the system.

Score: 1

9. Helping Users to Recognise, Diagnose and Recover from Errors

As mentioned before a cancel option is required for the shopping cart to cancel an item added to the cart by mistake.

Score: 4

The order confirmation pop up should however allow users to recognise and recover from errors when the cancel button is implemented.
As well as this there is no option to inform a user that an item is no longer available – a waiter would need to inform the user after the order has been sent to the kitchen which slows and disrupts the dining experience.

Score: 3

10. Help and Documentation

An 'Ask for Assistance' button is present on every screen to call a waiter if the user ever needs help with the system or if they simply do not want to use it. The first screen also provides a line of text describing that the device is touch activated and used to place an order.

Score 0

Persona and Scenario Evaluation of Prototype 2

Clay Evans

Being comfortable with technology Clay would find this system easy to use. The ability to keep an eye on the total of the bill as he is looking at the menu and the function to split the bills as the end of the dining process would suit him well.

While the nutritional information is displayed when ordering an item there is no way for the system to keep track of this information and display total calories for the whole meal for example. This would have been a helpful feature for Clay if it had existed. There is also no filter options feature to allow Clay to exclude options unsuitable for him as he is vegetarian.

Jeanette Williams

Jeannette will also be able to use the system easily and her children would enjoy the games and apps function while waiting for their meal. The need to change language half way through the ordering process may be tedious as it involves going back to the first screen. Jeanette may have preferred better functionality for this if she has business meetings with foreign clients and they wish to see the menu in their first language. The payment options from the tablet suits Jeanette as well when she is trying to quickly get home with her children as there is no need to interact with a member of staff if she is paying by card.

However the overall layout of the system, being integrated into the table, may be inappropriate for Jeanette during business meetings as it doesn't associate itself with a serious atmosphere such as a meeting. The fact that everyone orders off the same device may be too casual. Jeanette would also prefer if the system had a filter option to remove items with gluten as her daughter is intolerant to gluten.

Agathe Perrot
This system is aimed more towards Agathe and therefore it is hopeful that she could use the system well. Her language barrier need not be a problem as the first interaction with the system is selecting a language. Her eyesight will also not be strained as each screen has big buttons with big text describing what each does. She can also easily find the call assistance button if she needs to do so.

If the change button does not provide her with enough options she may struggle with ordering a specific drink of her choice such as the coffee with steamed milk as there is no other way to specify this unique request.

Prototype 3

This prototype is designed to mirror traditional menus in design, both to help users transition from paper-based menus and to produce a sense of style. It is an App that runs off a tablet encased in a covering which serves both as protection against spillages and impacts, and helps give users a sense they are using a normal menu. Users can request locked tablets, which can only browse the menu but not order food or call staff, designed for use by children who are not entirely trusted by their guardians to not abuse the system.

The management of the restaurant can update the menu in real time as dishes become unavailable or specials are added. They can also customise the appearance by choosing colour schemes and fonts, allowing them to differentiate themselves from other restaurants using the system, and match the system to their décor.

The basic layout is standardised across all screens, with language selection (via the ubiquitous flag symbol), the restaurant name, a call staff button, and a staff login. The system name and icons which send the user to the home page, and an icon displaying the current bill, are also displayed. The staff login gives access to options to limit the available functions, such as disabling ordering and the call staff button for children's menus, as well as limiting which devices can be used to order to help with bill management.
The homepage consists of the basic layout, with four large and obvious buttons sending users to various areas of the system—menu, drinks, games and payment. Menu and drinks send the user to directories established by the restaurant—typically starter, main, desert etc. Payment shows the user an itemised bill with the option to choose a payment type, summoning a staff member to carry out the transaction. Games gives the user access to various entertainment systems, not designed in this prototype.

Figure 16: Home Screen
Page 2-Menu directory

The menu directory shows a list of various sub directories of the items available, with a sample image by each.

Figure 17: Menu Screen
Page 3-Menu subdirectory

Each sub directory follows the same layout. A list of items in that section, with the price, and a small image of the item is displayed. The order button brings up a yes/no pop up for the user to confirm their order. The name of the item can be selected to bring up a pop up with more detailed information on the item, including dietary information (both for allergies and calorie content), a detailed text description, a larger image and, where applicable, options to customise the item.

Figure 18: Menu Subdirectory
Page 4-Drinks directory

The drinks directory is similar to the menu directory, with a sub directory page by drink type (wine, beer, soft drinks etc.) leading to lists of drinks in the same layout as the menu lists. The drinks menus also includes a recommendation system, where items that match already ordered food are flagged with a tick symbol and inserted at the top of the lists. Recommendations are established by the restaurant staff and can be used for any item in the drinks section, though most establishments would focus on the wines section.

Figure 19: Drinks Directory
Page 5-Payment screen

The payment screen consists of a scrollable list of the items ordered, displaying the name, quantity and price, with a total at the bottom. The 'Pay' button brings up a pop up asking the user how they would like to pay the bill-the staff then respond with the appropriate method (bringing a card reader or taking cash and returning the appropriate change).

Figure 20: Payment Screen
Heuristic Evaluation of Prototype 3

1. Visibility of System Status

Each page has an obvious title (Starter, Drinks etc.) indicating the user's location in the system, though a full breadcrumb directory system is not implemented. The current bill can be quickly and easily accessed from any page through an easily recognisable symbol. The device lacks an indication of battery status or wi-fi strength; while the former can be managed with an effective charging regime by the restaurant the latter is a potentially significant problem in larger restaurants or older buildings with thicker walls.

Score: 2

2. Match between system and real world

Language selection is via the highly recognisable flag image. Translations are managed by the restaurant so may vary in quality. The restaurant staff can update the menu in real time to allow instant removal of dishes that have become unavailable.

Score: 0

3. User Control and Freedom

The system lacks a method to return simply to previous pages-either a back button or a breadcrumb navigation system. Users instead must return all the way to the homepage, a potential irritation if they wish to compare different sections of the menu.

Score: 2

4. Consistency and Standards

Each page uses a highly consistent design, with crucial buttons (home, bill, call staff etc.) all located in the same place. Menu screens are also similar, so the user will only need to study the page layout once to understand all of the system.

Score: 0

5. Error Prevention

Customers can request child locked menus which cannot be used to order or call staff, increasing the control the primary user has. The yes/no pop-up reduces the chance of accidentally placing an order, but once the order is placed there is no way to later cancel it without contacting the staff directly.

Score: 2
6. Recognition rather than recall

The overall layout is based on the traditional menu layout to help users unfamiliar with the system. Commonly recognised symbols are used for the home, bill and language selection, though technologically inexperienced users may not recognise them without labels. Some of the symbols are also rather small, limiting recognition in users with poor eyesight.

Score: 1

7. Flexibility and Efficiency of Use

There are no short cuts available for more experienced users, but this is a rather small issue as the basic interface has fairly few steps anyway. Some users may find the yes/no confirmation pop-ups when ordering an irritation, especially if they are simply ordering drinks.

Score: 1

8. Aesthetic and Minimalistic Design

The system focuses on a fairly simple, consistent design across all pages, with minimal information being displayed by default (users can access additional information as required). The colour scheme is chosen by the restaurant, allowing them to establish an aesthetic theme that fits with their interior.

Score: 0

9. Helping Users to Recognise, Diagnose and Recover from Errors

The two main errors that may occur with the system are incorrect ordering of food and navigating to the wrong page. The first should largely be prevented by the yes/no confirmation pop-up, but if it does occur can only be remedied by interacting with the restaurant staff. The second can be remedied by returning to the homepage and navigating from there, but there is no option to simply return to the previous page.

Score: 4

10. Help and Documentation

The only help option is via the call staff button. The system is designed instead with intuition in mind, though less technologically inclined users may still experience problems. The restaurant can ensure staff are familiar with the interface so they can help struggling customers effectively, though this reduces the efficiency advantages of the system.

Score: 2
Persona Evaluations of Prototype 3

Clay Evans

Clay would find the system familiar and easy to use, with easily recognisable symbols and simple navigation. He would welcome access to dietary information, though it may not provide sufficient detail for him (no information about macro nutrients), and the lack of a filter means he would have to check every item he was interested in. The ability to check the bill from any screen will help him track his spending and stay within budget, though then having to re-navigate to the page he was on from the homepage may become tiresome. He would appreciate the recommended drinks feature, allowing him to select an appropriate bottle of wine.

His red/green colour-blindness may be a problem if the colour scheme chosen by the restaurant relies on using those colours. Similarly whether or not there is a vegetarian directory depends on the structure decided upon by the restaurant. As dividing the bill is only an option when separate bills are created to start with, this may be a problem if the decision is made to split it part way through the meal.

Jeanette Williams

Jeanette would find the system easy to use due to her familiarity with touch screen interfaces. She would easily recognise the symbols used for navigation. The language options would help her when entertaining foreign guests, as would the large images of food and detailed descriptions in pop ups. The ability to have child friendly devices with staff interaction disabled would also be greatly appreciated, as well as the entertainment options available for when she is out with her children. She would also appreciate the dietary information available, both from the perspective of her diet and her daughter's gluten intolerance. The traditional menu layout and elegant covering would improve the aesthetic of her meals with clients and her husband.

The system lacks an accelerated ordering option, or means to pay quickly without involving staff, both of which would be improvements when Jeanette wishes to have a particularly quick and hassle free meal, especially if her children are misbehaving.

Agathe Perrot

Agathe would find a few advantages to the system-easily accessible language selection, the large images alongside descriptions of food, ease of calling staff and access to entertainment systems for her grandchildren.

However she would also have numerous issues with the system. The touch screen interface would be unfamiliar to her, though its intuitive nature would help with this. The size of the icons and text would be problematic, she would likely have problems reading the text,
especially without her glasses. She might also have trouble recognising the flag symbol, and hence be unable to change the language setting to French, causing her great difficulties. Her lack of familiarity with modern design would give her problems with recognising the icons used on the home and bill buttons. While some customisable options are provided for it is likely she would desire a greater flexibility than these provide. Any problems she encountered would have to be solved by interacting with staff, a situation she would not enjoy. While the system allows for some customisation, it would likely be insufficient for Agathe, as well as not being obvious enough for her to notice.

Summary of First Generation Prototypes

Through the process of creating and evaluating the three first generation prototypes, it is clear that future editions should focus on providing a system that can be easily accessed by all first time users, and allowing users to easily prevent, and recover from, errors.

As a result of these findings, future editions will focus on providing users with an easy, intuitive layout, and it is likely that the breadcrumb approach to navigation from Prototype 2 will be implemented, as it allowed users to easily see which area of the menu they were in. It is also essential that future versions allows users to easily view which items they are currently set to order, and that they have the option to easily remove unwanted items before the order is sent to the kitchen.

Through evaluating the prototypes using the personas and their usage scenarios, we have also discovered that we are unlikely to fully meet the user requirements of each persona, as the vast quantity of features that are needed to do this would leave the system feeling bloated and overly complicated. Future editions will focus on meeting on fully meeting the base functions, such as having the ability to customise items, filter the menu, and easily separate bills, whilst providing an easy to use system for users new to technology.

Second Generation Prototype

Evaluation of Prototyping Tools

Using the evaluations from the first generation prototypes as a starting point, a second generation prototype was produced. Initially, this was done through low-fidelity, hand drawn sketches, which contained the key features and ideas that we wished to implement in the final version. Using this low-fidelity prototype as a starting point, a high-fidelity, interactive mock-up of the software was produced.

In order to conduct effective user evaluations, it was important the second generation prototype provided interactivity. This would allow us to test the system against the persona scenarios, and to determine how effectively the system met the three persona's requirements.
To create a high-fidelity prototype, three mock-up tools were considered; Balsamiq [17], Microsoft PowerPoint, and Pencil Prototype [18]. Each of these was considered as they would allow us to create good looking visual models, whilst allowing us to easily add basic interactivity to the designs.

Balsamiq offers the ability to produce prototypes quickly, as users are able to build designs using in built widgets. The software allows users to develop mock-ups for a range of system, including websites, web based apps, and mobile/tablet apps. The mock-ups that are created using the software are given a hand drawn look, which is both visually appealing, and simplistic enough that it still has the feel of a prototype, rather than being a finished product [19].

Similarly, Pencil Prototype offers users the ability to quickly create mock-ups from a range of built in widgets. The interface through which users create the mock-ups is intuitive, making it extremely simple and quick to use [20]. Both Balsamiq and Pencil Prototype allow users to easily add interactivity to the mock-ups that are created, which would allow us to create moving links between the sections of the menu.

PowerPoint was initially considered as it was software that every member of the group was familiar with. Using PowerPoint, interactivity could easily be achieved by created links between different screens. However, all drawings would have to have been created from scratch, as PowerPoint wouldn’t have offered the pre built in widgets that the other software provided.

Balsamiq was chosen over Pencil Prototype as it offered the ability to produce the mock-ups through a desktop application, and it allowed mock-ups to be created specifically for tablet devices, whereas Pencil Prototype was more generic, and catered more for website design.

Second Generation Prototype Walkthrough

Upon entering the Restaurant, each adult user is given a tablet through which they can place orders for food and drinks, access a range of inbuilt games and apps, and pay for their meal.

The following walkthrough of the second generation prototype demonstrates how a user would order and pay for a meal.
This page displays the 'Home' screen for the prototype, which is the screen that greets users as they begin to use the tablet. Unlike previous versions of the menu, users are able to directly access either the 'Food' or 'Drinks' section of the menu directly from this screen, as users may wish to begin their meal by ordering drinks.

The 'Call for Assistance' button is located in the top right of the screen, and it will be placed there on each of the subsequent screens.

Users are also given the option to change the language of the menu to their preferred choice, which they can do by either swiping at the flag, or by pressing on one of the arrows until they reach their desired flag.
The next screenshot displays what a user would see had they clicked on the 'Food' button on the Home screen.

1. The breadcrumb feature allows users to locate which section of the menu they are currently in, and to navigate to back to previous screens.

2. Clicking on the 'Filter' button opens up a pop-up menu. This allows entering their dietary requirements in order to refine the items that they see on their menu. This feature is shown in Figure 8.

3. This displays the current item menus, which in this case would be mains, as highlighted by the bottom menu. Users can navigate through the menu either by swiping, as they would do on a smart phone or tablet, or by pressing a one of the arrows located either side of the scroll bar. In order to add an item to their order, users are required to click on the menu item, which opens up a pop-up containing further information about the item (see Figure 9).

4. This section of the menu interface displays the item menus that the user has currently ordered. Users are given the option to remove items by un-checking the check-box located at the side of the item, and then clicking the 'Update Order' button.

5. Clicking the 'Order' button brings up a pop-up, allowing users to confirm their choices before the order is added to the bill and sent to the kitchen (see Figure 10).

6. The bottom section of the menu screen features a scrollable navigation bar. Users can click on the section of the menu that they wish to view. This then brings up further options, which the user can select in order to further refine the menu.
Page 3

Figure 8 shows a screenshot that would greet users if they clicked on the 'Filter' button on the menu page. Users are given the option to remove various items from the menu that they see, to only view options that fit within a specific diet, and to only see items that fall under user defined calorie and fat percentage limits.

![Figure 23: Filter Options](image)

Page 4

To add an item to a current order, users must click on the desired menu item. This brings up a pop-up containing further options, which is shown below in Figure 9.

![Figure 24: Adding an item to order](image)
From this screen, users are able to read the full description and nutritional information about an item, see a picture of the item, make changes to the content of the item (such as changing an ingredient or swapping a side), and add the item to their current order. Clicking anywhere outside of the pop-up returns the user to the rest of the menu.

Page 5

Once a user has finished adding items to their order, they can click on the ‘Order’ button to add the items to their bill and send the order to the kitchen. Clicking the ‘Order’ button brings up the pop-up shown in Figure 10.

![Figure 25: Completing an order](image)

From this screen, users are once again given the option to remove items from their order before it is completed. Items the user wants to order will have a ‘tick’ present in the checkbox next to the price of the item, un-checking this box will prevent the item from being ordered when the ‘Confirm Order’ button is pressed. Users can exit this screen either by clicking the ‘Confirm Order’ button, which would take them back to the home screen, or by clicking anywhere outside of the pop-up, which takes them back to the menu screen.
Once users have finished their meal, they can pay by clicking on the ‘Payment’ option on the home screen. Doing this brings up the screen shown in Figure 11.

Users can complete the payment of their meal by clicking on the ‘Pay the Bill’ button, which gives the user the option of paying by calling for a waiter/waitress, in order to pay by cash or through a debit card reader, or by swiping their debit card on the bottom of the tablet.

Clicking on the ‘Add other tablets to Bill’ button allows users to the bills of other tablets to the current bill before paying, in case one of the diners wishes pay for everybody else’s meal.

Once the user’s payment has been confirmed, a pop-up message thanking the user for their custom will be displayed, and the user can leave the restaurant.

**Plan for Evaluating the Second Generation Prototype**

The second generation prototype will be evaluated in a similar manner to the three first generation prototypes. To begin with, a heuristic evaluation will be conducted, which will allow us to quickly form conclusions on the general usability of the system. As with the initial prototypes, Nielsen’s ten heuristics will be used [15].

Following this, a more specific, user driven evaluation will be performed. Through making use of the interactivity that the second generation prototype provides, the three personas that were created will attempt to act out their user scenarios, commenting on the ease at which their actions can be completed. Following this, each persona will answer a questionnaire, which will be based on the System Usability Scale [21].
The System Usability Scale questionnaire we will use for the evaluation presents the user with ten statements, which will be as follows:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use the system.
5. I found they various functions in this were well integrated.
6. I thought there was too much inconsistency in the system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get on with this system.

Each persona will respond to each of the statements with a score between 1 and 5; 1 if they strongly disagree with the statement, and 5 if they strongly agree with it. The scores that each of the personas provide for the ten statements will they be manipulated to provide an overall usability score out of 100. In addition to providing a usability score, each persona will provide comments expressing their feelings towards the system based on the ten statements.

**Heuristic Evaluation of the Second Generation Prototype**

1. **Visibility of the System Status**

   As with the second 1st generation prototype, this version implements a 'breadcrumb' approach to menu navigation, which informs users which section of the menu they are currently in. Users who are familiar with current technology would find this system easy to use; however less technology savvy users may find it difficult to distinguish which section of the menu they are in on their first use. This could have been prevented by adding a 'Title' section to each page, displaying which section of the menu the user was currently in, although this may add to the clutter of each page. (Score: 1)

   The interface doesn't display the status of the system anywhere, so users will be unaware when the device has lost connectivity to the restaurants internet. This means that users will spend time collecting items to order, only to be unable to complete the order and send it to the kitchen. The interface would need to be changed to incorporate this, either though a signal bar or a pop up which informs users that they need to make contact with a staff member. (Score: 3)

2. **Match between the System and the Real World**

   The language that was used in the first generation prototypes was adopted for this mock-up. This means that much of the language that is used in paper based menus was present in this system. (Score: 0)

   Users can select their preferred language by using the flag system on the home screen, which
is a universally recognised symbol. (Score: 0)

The system allows users to navigate through menu items by either swiping in their preferred direction, or by holding down the arrow symbols located either side of scrollable sections. This means that users who are familiar with current smart phone/tablet technology will be able to navigate through the menu in a manner that is similar to the way they use their phones, without older users being confused. (Score: 0)

3. User Control and Freedom

The 'breadcrumb' navigation will allow familiar users to undo mistakes they make when navigating the system. Users unfamiliar with the 'breadcrumb' feature may find this difficult on their first few uses, and a 'Back' button to take users to the previous screen may have been preferred. (Score: 1)

Once users click on either the ‘Order’ or ‘Payment’ options, a pop-up appears containing further functions. Users can remove this pop-up by clicking on the screen anywhere outside of the pop-up. First time users of the system may not realise this, leaving them stuck with the pop-up on the screen. This could have been prevented by placing either an ‘x’ or ‘exit’ button in the upper right hand section of the pop-up. (Score: 3)

4. Consistency and Standards

Once users are in the menu, each section will use the same layout. (Score: 0)

The features that the system provides, such as the 'Call for Assistance' button, are always located in the same position on every screen. (Score: 0)

5. Error Prevention

The one click to order feature that was present in the first 1st generation prototype has been removed in favour of a pop up that asks users for confirmation before an item is added to their order. (Score: 0)

The current order is displayed on each of the menu pages. From this, users are able to unselect items that they wish to remove from the order. This is completed by unselecting a checkbox, and then clicking the 'Update Order' button. This allows users to remove unwanted items, whilst preventing them from accidentally removing an item they wanted to keep. (Score: 0)

6. Recognition rather than Recall

As with previous versions of this software, each screen of the menu is stylistically the same. The layout aims to be uncluttered, with each button being decently sized and clearly visible. In practice, first time users may be confused by the method in which they access different sections of the menu. Currently, this is done through the scrollable buttons on the south of the menu. Due to the location of this feature, first time users may have a hard time locating it. (Score: 1)

7. Flexibility and Efficiency of Use
For error prevention reasons, users are required to confirm that they were to perform certain actions, such as adding items to their order and completing the order. Experienced users, and users who are in a rush to order, may find this to be cumbersome. (Score: 1)

The search function is now hidden as part of the scrollable section at the bottom of each menu page. Once a user is aware of this feature, they will be able to use it to quickly search for the items that they wish to order. As this option is somewhat difficult to find, users in a rush to order may find it quicker to manually search for their wanted item rather using the search feature (Score: 2)

8. Aesthetic and Minimalist Design

In order for a user to add an item to their menu, they first locate the item in the menu, and then click on the item to locate the 'Add to Order' button. Doing this presents the user with the nutritional and dietary information about the menu item, which may be unwanted, for example with users who are trying to ignore their calorie intake. (Score: 1)

9. Help Users Recognise, Diagnose, and Recover from Errors

Unlike previous versions of the software, users are now given the option of removing unwanted items from their current order, preventing unwanted items from being purchased. (Score: 0)

Users are asked for confirmation before serious decisions are made, which will prevent mistakes from being made during the ordering process. (Score: 0)

10. Help and Documentation

As with previous versions, the system was designed to be intuitive to use, which would negate the need for documentation and help. In practice, the system could benefit from providing users with a 'Getting Started' option on the home page, which would walk new users through the ordering process. (Score: 3)

Persona and Scenario Driven Reviews of the Second Generation Prototype

The following evaluations are based on how the three personas would interact with the system, and how easily they would be able to act out their three example scenarios.
Clay Evans

Scenarios

1. As the restaurant offers each diner their own tablet for ordering, Clay wouldn’t have a problem keeping his bill separate from his friends.

Clay would enter the Menu section of the tablet, where he would want to quickly filter the menu so that he is only presented with the vegetarian options. As he is aware of current technology, Clay would click on the ‘Filter Menu’ option, and he would presume that this would give him the options to only see the vegetarian meals. Clay would then check the vegetarian option, and click back on the menu to update it.

The menu doesn’t offer Clay the option to track his calorie intake for the items that he adds to his order. This means that he would have to do it manually, which he would find unnecessarily difficult.

At the end of the meal, Clay would be able to pay for his own meal without having to worry about splitting the total cost of the bill.

2. Clay would be able to use the ‘Filter Menu’ option to view only meals that lie within a certain calorie range, allowing him to eat a healthy meal.

After ordering his food, Clay would click on the Drinks section of the menu so that he could order a bottle of wine. The Drinks menu would then display the available drinks, with the first two options being recommendations based on his current order. Clay would have the option to unselect items from menu which may be affected his wine recommendations. However, he would be unable to add his date’s items onto his menu, meaning that the recommended wine would only be from his items. This would leave Clay feeling embarrassed, as he wouldn’t know what the correct kind of wine to order would be.

At the end of the meal, Clay would be able to add his date’s bill to his own. However, throughout the meal he would have been unable to track the total spend, and the meal may have gone over his budget.

3. Clay would be able to use the ‘Filter Menu’ option so that he could only see menu items low 800 calories. Clicking on each menu item would allow Clay to see the protein, fat and carbohydrate content of each meal. However, he would be unable to keep track of this information as he built his order, and he would need to keep track of this information manually. Clay would prefer it if he could keep a record of this information, or he could easily compare the nutritional information of one meal with another.
System Usability Scale

1. Clay would like to use this system regularly. Although it doesn’t contain all of the features he would like, he enjoys having the ability to filter the menu, and the ease at which he can keep his bill separate from his friends.  
   Score: 4

2. As Clay is familiar with current technology, he found the system easy to use. However, during the meal with his parents, he had to spend a short amount of time helping them to navigate through the system.  
   Score: 2

3. Clay had no difficulties using the system on his first go.  
   Score: 5

4. Clay was easily able to use the system during each of his scenarios, and he feels that he would not need the support of a technical person.  
   Score: 1

5. Although Clay thought the system could have been improved, he found the features that were present in the system well integrated. He liked having pop-ups for the filter and ordering buttons, as this made it easier to keep track of where he was in the system. He also appreciated the menu auto-updating itself once the filter was used.  
   Score: 4

6. As each menu screen was designed to be similar, Clay didn’t find any inconsistency in the system.  
   Score: 1

7. During the meal with his parents, Clay had to help both his mother and father out at different points during the ordering of their meals. His mother was confused about how to remove the filter pop-up from the screen, and his father didn’t recognise that the ‘Order’ button needed to be clicked for the order to be sent to the kitchen (“Surely it should ‘Complete Order’ if that’s what it’s for” he commented). Therefore, Clay can conclude users with less experience with technology may struggle to use the system on their first attempt.  
   Score: 3

8. Towards the end of the ordering process, Clay began to get annoyed at how many times he was asked to confirm a decision, for example being asked to confirm that he wanted to add the item he was viewing to his order. However, he changed his mind about this when he accidentally clicked on the ‘Add to Order’ button for an item he didn’t wish to order.  
   Score: 2
9. During the first and third scenarios, Clay felt confident using the system. However, during the second scenario Clay felt unsure about how to correctly use the recommendation system, and felt uncomfortable not being to view the items that his date was ordering without asking her. 

Score: 3

10. Clay was able to use the system correctly during his first experience with it, and he believes that he got the most out of the system during his first use.

Score: 1

Clay gave the system a usability score of 80.

Agathe Perrot

1. Agathe will be very unfamiliar with the system used in the restaurant. The children may be presented with tablets of their own and may possibly order something without knowing it. This will frustrate Agathe and possibly leave her with a bad dining experience. She will however, appreciate the menu being fully viewable in a French.

If the children co-operate with Agathe and help her use the system then Agathe will enjoy the fact that the total cost is viewable as she is ordering to keep track of cost.

There is the option to increase the size of the text but this will be difficult for Agathe to find having never had experience of using a touch device.

She will be able to pass the time waiting on the food to arrive using the games and apps feature of the tablet with the children. This will allow her to get along with them better as she desires.

2. Agathe will again appreciate the menu to be in French but she may struggle to be able to customize her coffee to exactly how she wants it. As only a certain number of varieties of choices are available for customisation, it is unlikely to cover everyone’s preferences. This would mean she would need to interact with a staff member in order to order correctly which she wants to avoid.

The pop-up showing more description of an item is useful to Agathe as she is not familiar with British cuisine.

3. Agathe will feel under pressure to use the tablet system alone and without glasses. She may need a staff member to increase the text size for her at the start. She then would be able to go through the menu to order the items she has been told or alternatively use the search function to find the items exactly.

If an item isn’t present on the menu she will be worried about what to order and be under stress to order the food quickly before her family arrive. Agathe would prefer if the
recommendation system could be used for missing items as well. She will however, easily be able to find the call assistance button to signal a staff member she is in need of help.

System Usability Scale

1. Agathe may not like some aspects of the system but the ability to see the menu in French and not have to interact with staff members may become more appealing once she becomes more used to the system.
   Score: 3

2. Agathe would find the system complex, including the navigation bar at the bottom of the screen that expands and hides items. The large button layout however and the assistance button being visible would help to mitigate this.
   Score: 4

3. Due to never having used a tablet before Agathe would not find the tablet straight forward. However, if the text size was already pre-set to a readable level for Agathe and her order was simple, the system can be mastered quickly.
   Score: 3

4. Agathe would require someone more used to tablets, at least for the first several times using the system. She may not want to put effort in to learning a new system for ordering at a restaurant in the first place however.
   Score: 5

5. The language options and the search feature would be useful for Agathe. As well as the ability to customise an order to her tastes. Being able to call for assistance at any time is also a very much appreciated feature.
   Score: 4

6. With the assistance button in the same place every screen, and the overall feel of the system to be similar on every screen allows a controlled consistent feel for Agathe.
   Score: 1

7. Agathe would understand how quickly her grandchildren and son picked up and used the system and understands how with a bit more practice how the system could be mastered and used to make the dining experience easier and faster.
   Score: 4

8. Agathe would found the touch screen to be cumbersome as a technology overall. She would have much preferred to be in a French restaurant with French speaking staff to aid her in her ordering process.
   Score: 5
9. Agathe would feel a lack of control, especially while taking care of the grand children using this system. As she wouldn’t want the children to have their own tablets and they may be trying to show her how to use her system but just confusing her more. The pop up confirmations however would let her regain a sense of trust that she will not make a mistake when placing her order.

   Score: 2

10. A getting started screen may have helped Agathe, or simply a brief walkthrough by a member of staff. On her own, in a foreign country, and never having used a touch screen device before Agathe would be unprepared and perhaps unwilling to use such a device.

   Score: 5

   Agathe would give this a usability score of 40.

   Jeanette Williams

   Scenarios

1. Taking her Chinese clients out to lunch, Jeanette does not need to worry about them having any problems understanding the menu, with the obvious language selection on the first page and detailed descriptions and images of meals available. The simple to navigate interface also helps in this regard.

   After the meal Jeanette can pay for the entirety of the meal by simply adding her clients bills to her own.

2. At her family meal Jeanette allow her children to use the entertainment options available, however she has to keep an eye on them to ensure they do not order anything they were not supposed to or mistreat the call for assistance button. She appreciates the ability to filter by calorie and allergy, helping her maintain her diet and showing the options that are safe for her daughter Charlotte. The easily navigable interface also helps her children search for their own meals easily.

   When her children become a little rowdy after the meal they can leave quickly after paying the bill through the integrated system, without having to worry about becoming embarrassed by her children's antics.

3. At her romantic meal with her husband, Jeanette enjoys the comprehensive menu and wine list available, as well as using the item images to understand items she is not familiar with. The ease of being able to order and pay directly from the tablet makes the experience seamless and relaxing, increasing her enjoyment of the occasion. However she finds the interface slightly clunky, detracting from the otherwise high-class experience.

   System Usability Scale

1. Jeanette enjoys how easy the system is for her foreign clients and children to use, as well as the seamless ordering and payment from the tablet. While she sometimes felt the interface was a little crude she still enjoyed using it.

   Score: 4
2. Jeanette has no problems using the system, as she uses touch screen interfaces (tablets and smart phones) extensively in her job.  
   Score: 1

3. Jeanette was able to understand and use the system with ease on her first attempt.  
   Score: 5

4. Jeanette never felt the need of technical assistance in using the system, recognising with ease the various symbols and navigation tools available.  
   Score: 1

5. Jeanette found the integration of various functions effective, particularly the filtering of items based on dietary requirements.  
   Score: 5

6. Due to the highly consistent design of the various pages Jeanette did not find any inconsistencies.  
   Score: 1

7. Jeanette expects that most technologically aware users would have very little problems using the system. Due to her experience with her foreign clients she knows that provided an adequate translation service is provided nationality would be no barrier to its use, as long as the user has some experience with modern touch screen systems. However she would also expect that some elderly or less technically minded users would experience issues.  
   Score: 3

8. Jeanette experienced some slight irritation with the repeated yes/no pop ups, but when taking her children out quickly realised how easy it would be for some users to make mistakes.  
   Score: 2

9. Jeanette found she could use the system quickly and effectively in all of her scenarios. However when her children were ordering and using the entertainment systems in the second scenario she felt some slight anxiety that they would (on purpose or by accident) order items without her approval or misuse the assistance button.  
   Score: 4

10. Jeanette did not feel that she had to learn much in order to use the system effectively. The filtering system took a little while to appreciate, but she felt it was very much worth it.  
    Score: 2

Jeanette gave the system a usability score of 85

**Overall Conclusion of the Second Generation Prototype**

From the user reviews of the 2nd prototype, it is clear that the system is progressing but still has flaws. While Clay and Jeanette had very little problem with the system, Agathe ultimately
struggled to understand and correctly use it. There are a number of reasons for this, such as her lack of experience with tablet devices and poor language skills. These fundamental problems are seen with most tablet devices when tested with similar users and is difficult to resolve. However, this system has no revolutionary features to resolve this issue and at the current stage is only practical to be used by users with a better understanding of technology.

The features that worked in the 1st generation prototypes have been collated into the 2nd generation prototype, as well as new features being added such as the navigation bar. The system now has an easy layout and assistance options, coupled with filtering options and more expert uses such as the search feature allowing it to benefit the majority of users. The features that were enjoyed by all of the users were the use of pop ups to provide an extra layer of confidence in selecting items and placing the order as it meant less errors and more user control. As well as this the consistency of the screens, the breadcrumb, and the ability to view the current total of the order on every screen was appreciated by all of the users.

The user reviews could have been improved by providing them with working models of the system design. A fully functional tablet with added colours and improved icons would be easier for the user to interact with. But besides this there are flaws to be corrected for the next prototype before the system could be produced. These include the already mentioned need to make using the system easier for the inexperienced technology users. This may include providing a ‘Get Started’ button option on the opening screen which would slowly walkthrough the required steps of placing an order with the user. Any further form of documentation would irritate the customer and they would simply prefer to order from the staff instead of attempting to learn how to use a system they would infrequently use.

Another improvement that should be considered moving forward is the addition of an X button to close a pop up screen. It was found that some users were unaware that tapping outside of the pop up would close it and thus, a more obvious way of closing the screen should be included. As well as this, minor improvements such as a Back/Undo and a gesture control to enhance the size of text or images should be implemented. The Back/Undo button together with the breadcrumb would be a better tool to recover from an error as some users found the breadcrumb alone a slower method of doing so. The ability to increase text size would be useful for those with poor eyesight and also for a large family dining experience where someone is perhaps attempting to show another family member an item on the menu. This feature would also aid Agathe, providing the gesture was explained and she was made aware of its benefits.

The overall usage design may have to be reconsidered as providing every customer in a group showed problems such as the possibility of children placing orders that the parent or guardian is unaware of or the recommendation system not being able to take into account the items already ordered by others. Add to this the cost to the restaurant of purchasing many more tablets than if only one tablet was provided to a dining party. The solution to this problem would be discussed at length before another prototype could be produced.
Summary and Recommendations

This report aimed to produce an interactive application that would run on touch screen devices, which would allow customers to order, and pay for, food and drinks in a restaurant without needing the assistance of a member of staff. This was achieved by first creating three low-fidelity prototypes, which were evaluated based on a set of heuristics and the example usage scenarios of the three personas. Using these evaluations, an interactive, high-fidelity prototype was then produced, on which a more rigorous evaluation was conducted.

Our first step was to carry out research on the current tablet based ordering systems that are in use today. These systems were evaluated based on a set of general design principles, with the idea that these evaluations would be used to shape our own designs. The evaluations that were carried out on these devices were perhaps not as detailed as they needed to be. This is partly due to the fact that we were unable to use these devices in person, instead relying on videos of the systems in action, as well as user’s opinions on the devices. It would have been advantageous to gain hands on experience with these devices, as this would have allowed us to more accurately describe the issues they have that needed addressing.

From these evaluations, and through considering the general design principles for tablet applications, three example personas were produced, along with a set of example usage scenarios. These personas were later used to shape the designs of our prototypes, as well as acting as tools for evaluations.

Through both the needs of the personas, and the research into current devices, we agreed on a set of features that the ordering system should implement. Using these as a guideline, each member of the group independently produced a hand drawn, low-fidelity prototype. It was presumed that producing the first generation prototypes independently would lead to three distinct designs. However, since each member of the group had the same access to the research that was carried out on the current devices, each of the three first generation prototypes ended up looking somewhat similar. If the project were to be carried out again, it would have perhaps been beneficial to come up with three distinct prototypes as a group, and to have fully explored the ways in which the needs of the personas could have been met.

Despite each of the first generation prototypes being somewhat similar aesthetically, there were benefits to producing them independently. As each member of the group carried out work on different sections of the report, including each member independently producing one of the personas, each system including a feature that was unique in meeting the needs of a particular persona. This meant that these features could be carried forward into the second generation prototype.

To evaluate the first generation prototypes, a mixture of heuristics and the personas were used to highlight the problems that each of the prototypes had. The evaluations of each prototype were carried out by the members of the group that didn’t produce it. Through being thorough with these evaluations, a range of problems in each of the prototypes were found.
These evaluations were effective in highlighting the main issues that needed to be addressed by the second prototype.

The second generation prototype was then produced, and evaluated against both a set of heuristics, and the needs and example scenarios of our three personas. As was expected, the elderly user, Agathe, had difficulty accessing the full range of features that the tablet provided, including the ones that were included based on her needs. Whilst it was important to consider the needs of users who are unfamiliar with technology, in practice it would be difficult to design a device that fully meets their needs without losing some of the functionality that was needed to meet the needs of other users. Including a ‘walkthrough’, which assists users new to the system in placing orders, would negate some of the issues that inexperienced users would have with the system.

It is difficult to fully comment on the successes and weaknesses of the second generation prototype based on the evaluations that were carried out. If time and resources were not issues, it would have been beneficial to carry out evaluations based on the experiences of real life users with the system. As each of the real life users would have different needs and expectations for the system, a wider range of problems would have been highlighted.

By reviewing the project as a whole and comparing the outcome with our expectations of what would be achieved going into the project, it can be concluded that there has only been a partial success. Whilst several of the problems that were identified whilst reviewing current devices were rectified in our second generation prototype, a new set of problems were identified during our evaluation which would need to be fixed in future versions of the interface.

In terms of the team’s approach to tackling the project, again it can be concluded that there was only partial success, in that the overall organisation of the team, and the delegation of the work within the group, could have been handled better. Perhaps due to the group containing only three people, a team leader was never appointed, which resulted in the team lacking in direction at certain points in the project. If the task were to be completed again, the team would have benefited from having a member whose job it was to manage the overall direction of the project, which may have lead to a more cohesive document being produced.

References


