York Civic Trust Plaque App

Team 5
Chris Cowl
Team Member 2
Team Member 3
Team Member 4
Team Member 5

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Part 1.1: User Requirements Gathering

Our users' requirements gathering involved an online questionnaire which involved 33 questions covering demographics, app usage in general as well as for sightseeing apps, user behaviour in a tourist setting and proposed app features. The questionnaire involved 11 open ended questions, 17 multiple choice questions and five 5-point Likert Scale questions involving a total of 20 sub statements. Informed consent was acquired from participants before at the start of the survey (**Fig. 44**) in which there was also an information sheet (**Fig. 45**) describing the context of the survey.

We identified potential international tourists, tourists from other UK cities and local residents that we knew from a broad range of ages to target for our data collection. We received 82 responses from participants, the last 15 or so confirming what the early data was already showing us. We selected these people because we wanted to get a diverse range of insights and data that would give us a good spread of options when it comes to the design phase.

We found that most participants in the survey were in the 20–40 (83% **Fig. 1**) age range with the mean = 32 and SD = 15, mode = 24, median = 24 across the data sample. The sample showed an almost even gender split (49.4% male and 50.6% female (**Fig. 2**), that most participants were international tourists (59% **Fig. 3**) and local residents (33% **Fig. 3**), were students (61% **Fig. 4**) or in employment (27% **Fig. 4**), and 12 participants had an impairment or disability (15% **Fig. 5**). We were a little surprised by the fact the participants that suffered visual impairments were mostly 24 years of age (60% **Fig. 6**). It was also reassuring to know 67% of participants currently use an app to inform them whilst sightseeing (**Fig. 7**). Also 51% of the participants used apps for sightseeing either often or always (**Fig. 8**).

Goals and behaviours

1. **Distance and direction to next plaque** Participants ideal walking distance to the next sight is – 11-20 minutes (30% **Fig. 9**) and over 30 minutes (29% **Fig. 9**). Participants would like a feature that informed them about direction and distance to the next plaque (61% thought this was very or extremely important (**Fig. 10**))
2. **Amount of sights** Participants like to see – most of the sights (41% **Fig. 11**) and some of the sights (30% **Fig. 11**)
3. **Places to eat** Participants like to eat out most of time in some form or another when sightseeing (91% **Fig. 12**) and would like a feature that informed them about places to eat close by (57% thought this was very or extremely important (**Fig. 10**))

4. **General places of interest** Participants would like a feature that informed them of places of interest close by (59% thought this was very or extremely important (**Fig. 10**))
5. **Planning** Participants are almost all planners, so any features that helped them ahead would be beneficial (88% **Fig. 13**). There was also a desire for the following features – a 'favourite a plaque' feature (39% **Fig. 10**), plan a route by length (56% **Fig. 10**) and plan by category (42% **Fig. 10**)
6. **Plaques visited** There was a desire for a feature that enabled them to log the plaques visited (37% thought this was very or extremely important (**Fig. 10**))
7. **Search by list** There was a desire for a feature that enabled users to search plaques by a list (38% thought this was very or extremely important (**Fig. 10**))
8. **Vision deficiency settings** 13% of the 39 participants that responded directly to Q.7, or 6% of 82 participants if you assume that the participants who didn't respond didn't have a disability or impairment, stated they had some sort of visual issue. Of those, most were 24 years of age (60% (**Fig. 6**)). Participants thought a feature to make text bigger and more readable was beneficial (43% thought this was very or extremely important (**Fig. 10**)) and a feature that helped people with colour vision deficiencies was useful (46% thought this was very or extremely important (**Fig. 10**)).

Needs

1. **Distance and directions to next plaque** To know directions and walking distance to next plaque on the app.
2. **Amount of sights** To work out how many plaques the users would like to see on the app.
3. **Places to eat** To be able to see places to eat close by on the app.
4. **General places of interest** To see what other general places of interest are around the user whilst travelling to the next plaque.
5. **Planning** To plan before they arrive in York, for example to find out what plaques interested them beforehand and favourite them, plan a route or plan by category or other filter.
6. **Plaques visited** To have a feature that logs plaque progress. Maybe a reward style feature.
7. **Search by list** To view the plaques by list.
8. **Vision deficiency settings** To have a setting that aided people with visual deficiencies whether that was colour vision deficiencies or long-sightedness.

There are three needs from the above list that can be understood from existing knowledge of the capabilities of users.

Plaques visited
This user need relates to cognition memory. As discovered by Miller in 1956, the human brain is capable of storing around seven chunks of information in the working memory, from five to nine chunks depending on the human in question [1]. This helps us make a case for the plaques visited feature that records which plaques have been visited by the user. A user wouldn't be able to remember up to 100 plaques they have visited.

Distance and direction to the next plaque
This particular user need will rely on attention, and in particular divided attention. Literature by Kantowitz and Sorkin tells us when the user concentrates on more than one task at time their attention is divided [2]. Research by Burgess suggests that it depends on the nature of the task that dictates how hard it is to multitask [3]. Burgess argues that if the tasks are light, such as walking and talking then multitasking is perfectly acceptable. If we increase the load on the user however, multitasking becomes difficult. Therefore we have to make sure the information on screen is clear and visible to avoid forcing the user to stop and check their phone and keep divided attention to a minimum as they will be distracted by sightseeing. The directions could be audible to help the user even further.

Vision deficiencies
To help users who may have some form of visual impairment or deficiency such as deuteranomaly, deuteranopia, protanopia, achromatopsia or long-sightedness. As Cooper et al advise when designing for visual deficiencies:

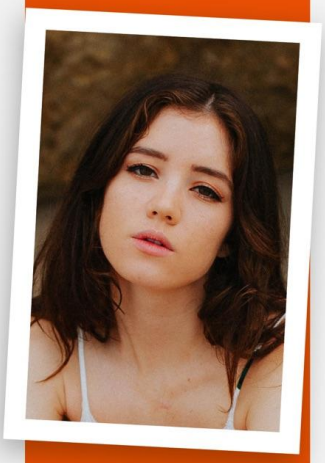
- "A high-contrast (minimum 80 percent) display option, using predominantly black text on white backgrounds
- Options for enlarging the typeface and increasing its weight (ideally, these are independent settings)
- An option for colour-blind-friendly information display, if applicable
- An option for minimising motion and animation in UI elements, if these are used in the default interface
- Furthermore, your application should not rely on colour alone as the sole method of conveying the meaning of data or functionality. It should use other attributes, such as size, position, brightness, shape, and/or textual labelling, to make meaning clear" [4].

For the user who is not affected by a visual deficiency, we need to embrace some of the above suggestions by Cooper et al [4] and incorporate them into the design of systems as standard. We can make sure that colours in general contrast well (lack of contrast with shades of grey seem to currently be a trend/problem) and use text that is concise, clear and large enough to read comfortably.

Personas

The personas that we developed were that of Ming and Lily (Fig. 20-21). For the data that informed the behaviours of the two personas can be seen in Fig. 1-19. This was not all the data collected but a selection informing the main behaviours, goals and needs.

Fig. 20 Ming persona



Lily

BIO

Lily is a 24 year old English speaking local resident who works full-time and enjoys sightseeing in different cities in the UK. She likes to stay in one place for 1-3 nights mostly and likes sightseeing with one of her friends. She loves walking around the city centre and is happy to spend over 30 minutes walking to the next sight. She likes to wander and see most of the sights whilst spending all day doing so. Lily gets excited about planning her trips before she arrives to make sure she doesn't miss much. She loves sitting down and relaxing in a cafe or bar for lunch when she is taking a break. She has a slight visual impairment in that she is long-sighted, so viewing things close up is sometimes difficult. She generally uses Google Maps for sightseeing and is quite confident doing so.

> "Discovering lots of sights with my best friend is so exciting!"

GOALS

- **To wander around and see most of the plaques, ticking them off her list as she goes.**
- **To find general places of interest around her on her way.**
- **To be able to plan her itinerary before she arrives because she wants to make sure she sees most of the plaques.**
- **To easily identify the types of plaques she is interested in.**
- **To easily read the app due to her long-sightedness.**

FRUSTRATIONS

- **Not being able to remember or record the places she's been to, as a sense of achievement.**
- **When she doesn't know what other general places of interest are around her.**
- **When it's too much effort to plan what to see if she is forced to use many sources of information.**
- **When it takes long to search through what sights may interest her.**
- **When information on her phone is too small or low contrast forcing her to pinch and zoom all the time, leading to high battery usage.**
- **When there isn't enough information about sights including when it closes and links to further information.**

Fig. 21 Lily persona

Two goals that will be satisfied by the design of our prototype relating to these personas are as follows:

Ming
Goal one: To find good restaurants around him.
We can satisfy this goal by showing nearby restaurants not only to the user at that exact time, but also along the route to the next plaque and surrounding the selected plaque of interest. This makes it easy for Ming to find a restaurant at any point.

Goal two: To be able to plan his itinerary and work out a route to minimise his time travelling between plaques, avoiding walking for more than necessary.
We can satisfy this goal by allowing the user to search by list, category or by map. The user can use the 'Your Route Planner' to add or remove desired plaques and the app will work out the shortest route accommodating all selected plaques. This will save time and effort on Ming's part and minimise the time taken travelling between sights. The feature will give Ming time and distance information for the whole route and the individual legs of the route.

Lily
Goal one: To wander around and see most of the sights ticking them off.
We can satisfy this goal by allowing thoroughness when searching via the search list feature and allowing logged in users to confirm they have visited the app when the device senses they are at the plaque. This will be logged in the app and Lily will be awarded an achievement badge and the app will mark the plaque as visited. Different levels of achievement could be unlocked as she goes.

Goal two: To easily read the app due to her long-sightedness.
The general design of the app will incorporate a high contrast approach. This will make it easy for all users in general but specifically for Lily, a setting to enlarge text will help her use the app more easily. It will also help with the completion of her other goals.

Part 1.2: Scenario Based Design

Problem scenario

The setting
Lily is sitting at home in the UK and is getting excited about her trip to York. She wants to plan with her friend what she is going to see and looks through Google Maps on her phone to see what plaques there are in York. She is disappointed that the York Civic Trust plaques don't appear on Google Maps. She tries to plan by using the York Civic Trust website but the site doesn't have a filter to filter by type or route or a feature to plan a route herself. She has to keep cross referencing the map with the list which is only by alphabetical order. This makes planning the trip time consuming, even with the help of her friend who is travelling with her. She is also finding it hard to view general places of interest around the plaques and again cross referencing with Google Maps. The planning stage of her trip leaves her spending way too much time and she ends up left frustrated. She could have found more plaques to visit but she doesn't want to search all 100+ plaque pages individually to check she's found all the ones she is interested in. Lily will be accompanied by her friend Alice on the trip.

Goals
She wants to be able to find and plan which plaques she is interested in easily so she can be sure she hasn't missed much. Anything that helps planning her trip will be beneficial. She wants to see most plaques so to know she has a good understanding of what's on offer will reassure her. She wants to see most plaques, so it would be useful to record the ones she has seen so she is not confused. Once out sightseeing she would also like to see other general places of interest. Because Lily has long-sightedness, she would find it beneficial if there was an option to enlarge the text to make it clearer.

Actions and events
Lily checks the York Civic Trust website to find plaques she may be interested in, the website shows the 100+ plaques, in alphabetical order, she has to read every plaque listing to find out if they are interesting. Once she decides the ones she likes, she makes a list of them on paper. She has to zoom into the map and work out which ones she can visit realistically with the time she has on any particular day. She has to always check Google Maps to cross reference the map on the York Civic Trust website to find her way around and work out how far the plaques are from each other. She has to switch to Google Maps or Tripadvisor to see if there are places of interest near her at any particular time. Because of her long sightedness she has to zoom in on the York Civic Trust website to read any small text,

the current website shows no support for this, so she gets eyestrain. Lily's phone battery usage is high because she takes a long time to achieve her goals, so she has to plug her phone in whilst planning.

The objects identified in this scenario are mobile phones, on which Lily accesses the website, also one of the objects, Google Maps and Trip advisor.

Claims analysis (problem)

From the above mentioned scenario, there are some analyses and conclusions we could draw from it. Despite the obvious downfalls of the website, there are numerous positives of the website:

1. **Basic map** This identifies plaques quickly
2. **Pictures and information** It shows pictures of the plaques and its related information.
3. **List** Well organised list of plaques in alphabetical order.
4. **Places of interest** The map also shows nearby places of interest, like a restaurant or any other historical sight.
5. **Depth of information** As an informative feature, the website displays enough information about each plaque, about its history, its significance and other relevant information.
6. **New plaque suggestion** You can suggest a new plaque to add to the current list.
7. **Share the map** You can share the map to your friends that you could be travelling with.
8. **High contrast** The design is high contrast which helps everyone as well as people with visual impairments.

On the downside of the website, we have identified the following points of frustration:

1. **Basic map** This doesn't show enough information e.g. time or distance to the next plaque. No key for the colouring of the pins on the map. There is no obvious way to identify what the blue or the red pins mean. The pins for plaques and places around the plaque are the same design which leads to confusion. The map cannot be filtered or irrelevant information removed. They can't create a bespoke route that is relevant to them. This adds cognitive load on the user and hinders planning.
2. **List (planning)** Although alphabetised, there is no way to view the list by category or to filter unwanted plaques out or to mark which places interest the user. The user cannot also mark the plaques they have seen which we know is one of Lilys' goals. This hinders efficiency, pleasurability and adds cognitive load on the user.
3. **Places of interest** These are confusing the map as they are in a similar style to the plaque pins. The places of interest cannot be

filtered or turned off. This increases cognitive load on the user and slows them down.

4. **Depth of information** Whereas information about the plaque is a positive thing, too much information can result in losing interest of the user and hence is a tricky balance. It may put some users off entirely.
5. **Share the map** This only shares the full map with all plaques on. This is not bespoke to the user. This doesn't really help the user plan or make the process efficient.
6. **Recording plaques visited** There is no way to record what you have seen, this just adds to the lack of ease of using the website.
7. **Navigation** The navigation has a blue bar on the current page selection which is confusing.

The current system has some good points but they are mainly negative and add frustration, inefficiency and cognitive load on the user.

To be scenario

The setting
Lily is sitting at home in the UK and is getting excited about her trip to York with her friend. She knows about the York Civic Trust app. She is happy that she can view all plaques on an interactive map that also shows eating places and general places of interest around the plaques and along the way without having to check Google Maps and Trip Advisor. There is also a setting in the new app that displays all information larger for Lily's short-sightedness. She can now filter plaques by category, list and route length which makes the planning so much easier. She can also create a bespoke route for the plaques she wants to see in the day which also gives her a breakdown of walking time and distance in between each plaque. This feature is really useful to Lily as she can also share the route with her friend Alice! She is now confident that she has found all the plaques she is interested in. The actors in this setting are Lily and her friend, Alice.

Goals
There is slightly more ease of navigation, and hence Lily can now plan, filter and favourite plaques easily and now wants to design the route and share it with her friend. She plans to see most of the sights because she now has a great understanding of the plaques on offer. Another goal is to have a record of all the plaques she has visited. Once she is out sightseeing she can see other general places of interest in York, therefore her experience is enriched. She wants to comfortably be able to read the text because she has long-sightedness.

Actions and events
There are still 100+ plaques shown on the app but this time they are categorised by location, popularity and alphabetically. When Lily checks the York Civic Trust app to find plaques she may be interested in, she can filter by category, list or route length to decide which ones she is interested in. The app saves her favourites and allows her to share with friends but also create a bespoke list to add to the 'Your Route Planner' feature. The map includes information on places to eat and general places of interest around the places and on the way. The route planner tells her the distance and walking times (and other transport times) between all plaques she is interested in as well as the whole route. One of the features that Lily wanted was for the app to save the plaques she has already visited, giving her an achievement badge everytime! The app does not strain her eyes or drain her battery due to the setting for those with visual deficiencies and the fact it is much easier to find and filter plaques and not have to switch between apps.

The objects in this scenario are mobile phones. Evidently, this has reduced from the previous setting.

Claims analysis (to be)

Lily is happy that she spent minimal time planning and finding the plaques she wants to see. She is confident she has found all plaques she would be interested in because of the search by list filters. She loves the fact that she can save her favourite plaques for later and add them to the 'Plan Your Route' feature and share it with her friend! She now doesn't have to worry about where other interesting places are around her when she is walking between plaques as the app informs her of these before and during her route. She feels relaxed about the app informing her exactly how long she'll take to walk around her planned route. She is very happy at the setting to increase the size of text as this helps her in the planning and walking the route stages.

The few features we have decided to keep, we have enhanced them to increase functionality and efficiency:

1. **Interactive map** Pictures of the plaques and brief information is shown if tapped on.
2. **Pictures and information** It shows pictures of the plaques and its related information.
3. **List (planning)** Filter list by category, alphabetically, distance to plaque, newest, most popular and by map. Plaques can also be favourited and added to the new 'Your Route Planner' feature. This increases control, efficiency and makes it easy and pleasurable for the user.
4. **Places of interest** The map also shows nearby places of interest or places to eat. The icons for these are differentiated from the plaques

to make it easier for the user. These can be turned off if the user doesn't require them.

5. **Depth of information** We will include a summary paragraph and key facts at the top of the listing so if people aren't interested in depth of information they can grasp the highlights.
6. **New plaque suggestion** This is a useful feature but is not a main feature.
7. **Share the map** Users can still do this, but they can also share their favourites list and bespoke route they have created themselves.
8. **High contrast** The design is high contrast which helps everyone as well as people with visual deficiencies.
9. **Visual deficiencies** We have added two options for larger text and allowing for users with colour vision deficiencies.
10. **Navigation** Clear, high contrast navigation with most important functionality in the bottom navbar.

Part 1.3.1: Interactive System Prototype

Design process

In the early stages of prototyping, we decided to sketch ideas of the prototype first. According to personas, we have summarised the functions required by this application, and drew corresponding sketches and added to a Jamboard for each function (Fig. 23-24), as well as for other ideas we had. These functions are search by list, directions to next plaque, plaques visited functionality and our own functionality which was a route planner (which was an add on to favourites initially).

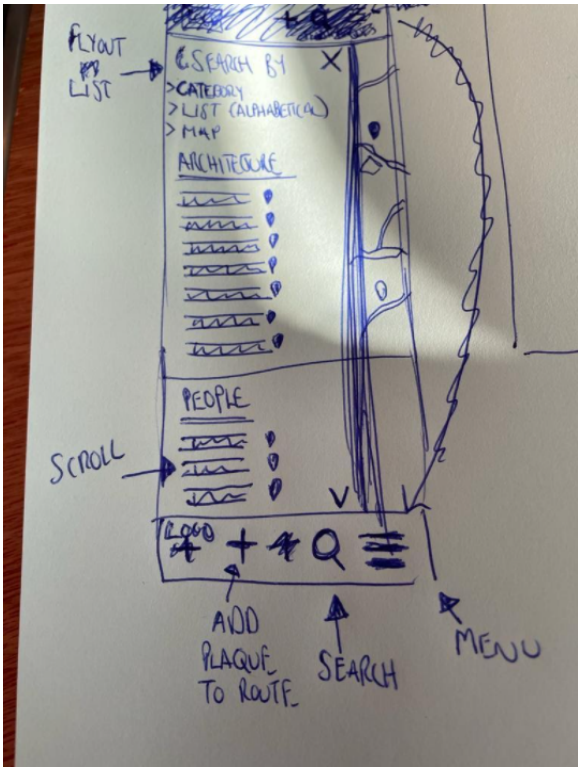


Fig. 22 Navigation sketch

This is a navigation sketch (Fig. 22) drawn by one of the team members. We believe that the navigation bar should be placed at the bottom of the application interface. At the same time, we believe that the UI design in this sketch is very good. These elements are ultimately retained and applied to the subsequent prototype design.

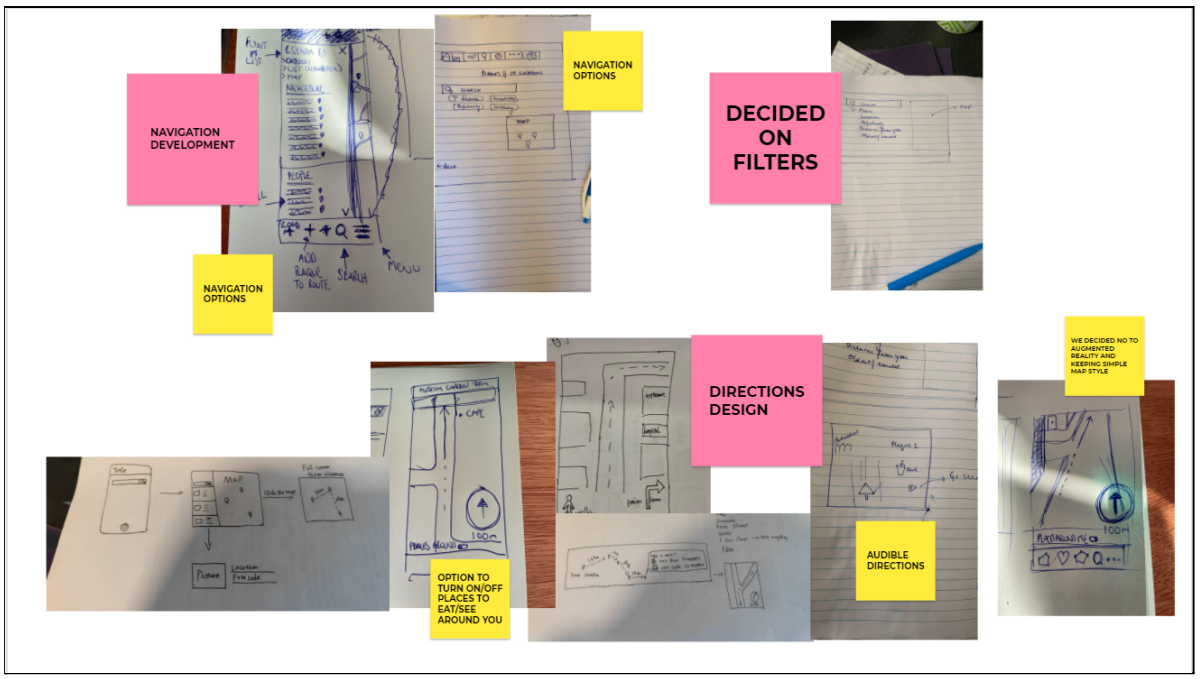


Fig. 23 Sketch prototype jamboard

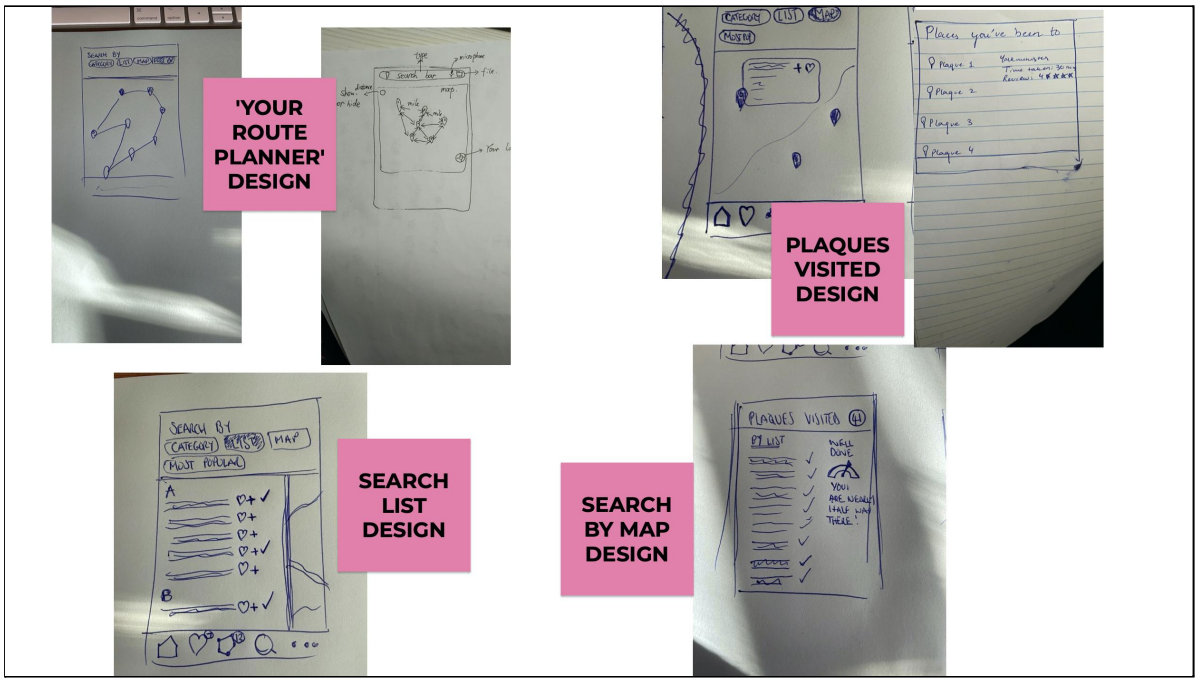


Fig. 24 Sketch prototype jamboard

We finished the sketches in the group meeting and made a Jamboard (Fig. 23-24) based on these sketches, and determined the functions that need to be designed and retained. The next step is to use Balsamiq Wireframes to make the prototype. In consideration of the participation and activity of each member of the team, we decided to let each team member design their own prototypes and compare and amalgamate them a week later.

Evolution of the prototype

There were two versions of the project's prototype inorder to get to the expert evaluation stage.

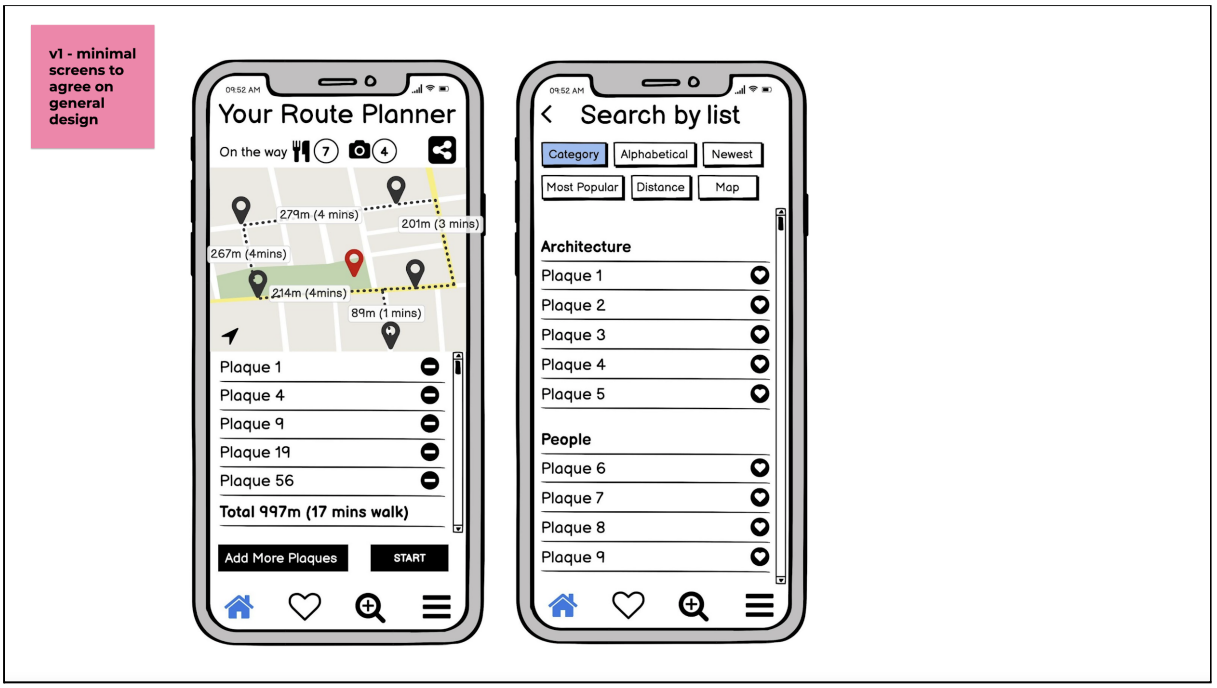


Fig. 25 Evolution of prototype jamboard (v1)

Version one

This is the original Balsamiq prototype (Fig. 25), which only includes two functions designed according to user needs, search by list and "Your Route Planner'. This is because as a team we wanted to make sure all members were happy with the overall feel of the prototype. At this stage the route planner was an add on to the favourites list and so doesn't appear in the bottom navigation.

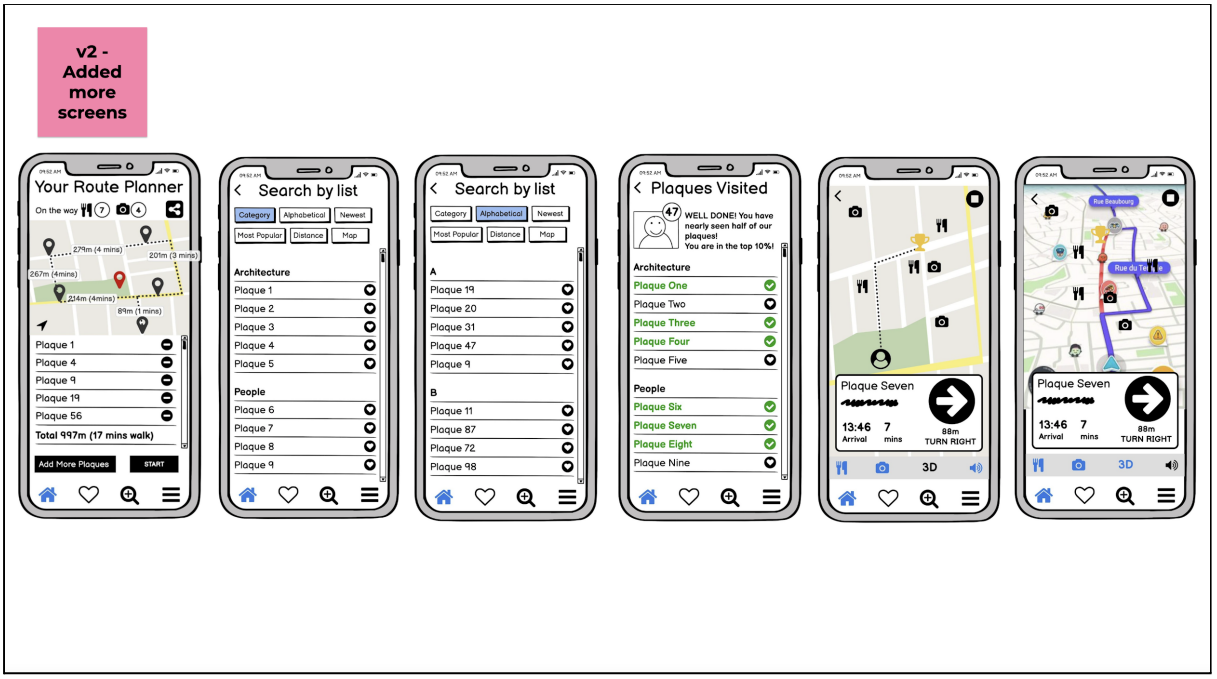


Fig. 26 Evolution of prototype jamboard (v2)

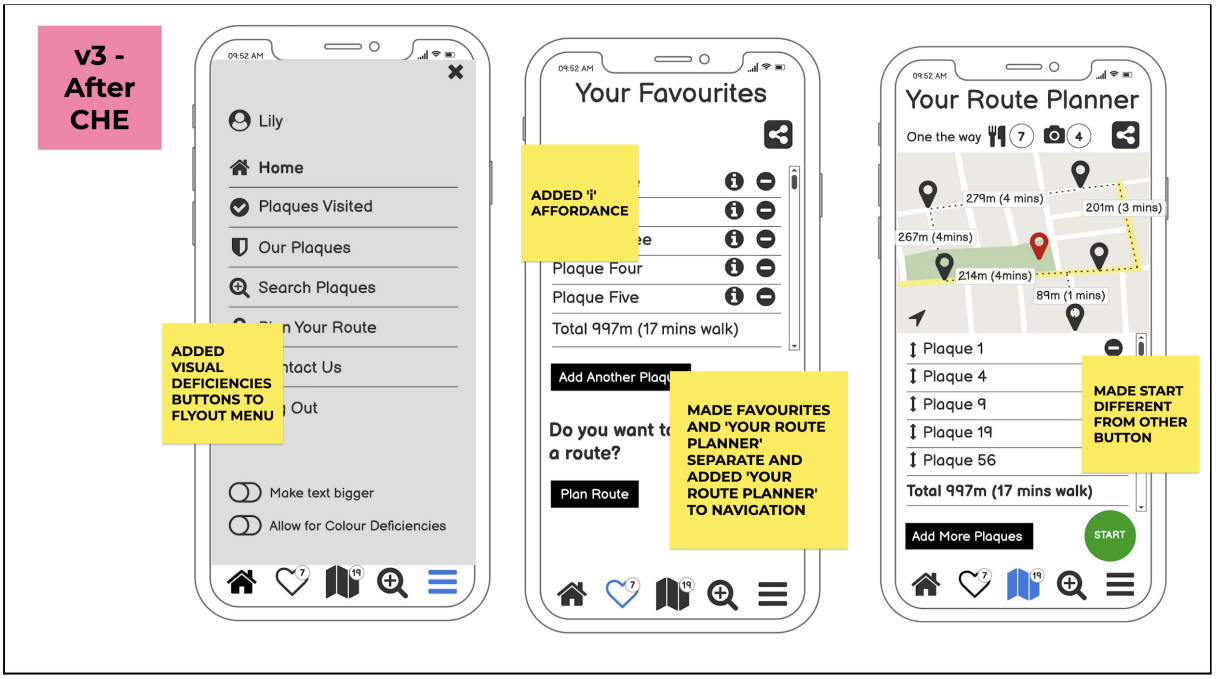


Fig. 27 Evolution of prototype jamboard (v3)

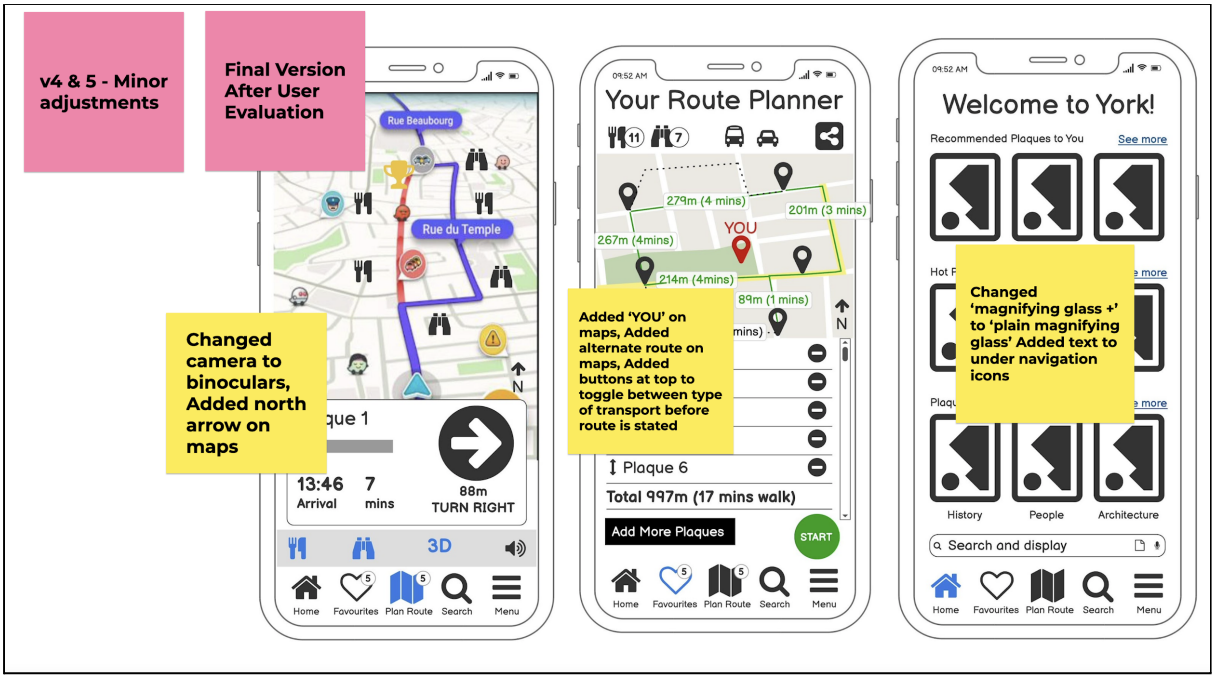


Fig. 28 Evolution of prototype jamboard (v4-final)

Version two

In version one there were just a few basic pages to agree on navigation and general layout. In version two of our prototype (Fig. 26), the route planner functionality allows users to plan their own routes. Users can choose their favourite plaques and decide the order of plaques they want to visit by themselves.

Versions three, four and five (post expert evaluation)

We added a few elements and made a few design decisions based on the expert evaluation (Fig. 27 and 28) which we go into more depth in sections 1.3.2.

Final version (post user evaluation)

We added a few elements and made a few design decisions based on the user evaluation (Fig. 28) which we go into more depth in sections 1.3.3.

Feature that didn't make the final prototype

During the ideas phase of sketching, we had a group idea that a haptic vibration alert would alert the user of their closeness to the selected plaque. This would help guide them to the plaque. We thought this was a great idea and sure to be useful for the users.

So we asked the participants of the user requirements gathering survey the following question:

“How important are the following features to you in terms of the York Civic Trust Plaque app? - A vibration alert that gets stronger or more frequent the closer you get to your selected plaque (e.g. within 100m).”

32% of participants (**Fig. 19**) thought is was important or very important so it had potential, but we felt as a group, that the ‘Your Route Planner’ feature was more important to add to the app simply because almost all participants were planners (88% see **Fig. 13**) and wanted to plan a route by length (56% see **Fig. 10**).

Final prototype

For the design of our prototype, we have taken a human-centred approach to design. The design of interactive systems emerged in the 1980s and was designed to reflect the responses given by systems under certain conditions.

The contemporary devices that people use to interact are mobile phones and more mobile devices. Lily and Ming, whom we have targeted as users, are a microcosm of our wider audience.

Our users' needs, which were identified by our data collection, are as follows:

1. **Distance and directions to next plaque** Both personas needed to know the distance and direction to the next plaque for different reasons. Our app addresses these needs by giving the user control to plan their own route and inform them of the distance to the next plaque, directions to the next plaque, how much time it will take and overall times and distances.
2. **Amount of sights** Lily wanted to see most of the sights and Ming wanted to see just some of the sights. Our app allows users to find the apps they are interested in and add them to their favourites list or add them directly to the ‘Your Route Planner’ feature giving the users control as to how many sights they want to visit in an efficient manner.
3. **Places to eat** Ming wanted to know about good places to eat along the route because his focus was not just on seeing plaques, it was to see plaques in a more casual manner and experience the local food. Our app enables users to turn on places to eat that are on route to the next plaque. This enables the user to see how many places to eat there are on the way before they set off.
4. **General places of interest** Lily also wanted to see general places of interest along the route that she could choose from, we discussed and added the 'Scenic spot' icon to the function bar below the directions map. When Lily taps on the 'Scenic spot' icon as she travels her personally selected route, all the general sights on route

will be displayed. This enables the user to see how many places of interest there are on the way before they set off.

5. **Planning** Both personas were planners. Anything that assists them in planning is beneficial. To be able to collect plaques of interest that she sees. In response to this need, we developed and designed the 'Favourites' function that allows users to add their favourite plaques to the 'Favourites' section. The user's favourites can be kept as a list or added to the ‘Your Route Planner’ functionality. Users can also now search by alphabetical list, category, most popular, newest plaques, nearest plaques and by map.
6. **Plaques visited** We have designed an achievement based feature to our app to fulfil Lily’s need for seeing most plaques. The app detects your location and confirms you have seen the plaque with an alert prompt. The plaque is then added to her plaques visited screen and various statistics and positive messages are displayed.
7. **Search by list** Users can also now search by alphabetical list, category, most popular, newest plaques, nearest plaques and by map giving them control.
8. **Vision deficiency settings** We have added two settings on the flyout menu to aid people with visual deficiencies whether that was colour vision deficiencies or long-sightedness. The settings make the text bigger and change the colours respectively.

From the perspective of our users, an interactive system is a technical means to make life more convenient. Through the design of our app, the connection between users, their needs and goals has been well established and we have met their needs in order to create a pleasurable and useful experience for them.

Functionality of the app

Search by list

The search by list functionality can search by category (Fig. 29), alphabetical list (Fig. 30), newest plaques, most popular plaques, distance to plaque and by map. This satisfies Lily and Ming’s need to search and plan efficiently and make sure they know they have found all plaques they are interested in. Nielsen’s Heuristics No.4 Consistency and Standards’ and ‘No.8 Minimalist Design’ was used so the user is not overwhelmed [5]. We also made sure ‘Norman’s Principle No.6 Affordances’ was used when designing the favourites heart buttons. When designing the app in general, the Gestalt principle of ‘Proximity’ is always used to indicate to the user that elements belong together and mean similar things or have similar functions. This is displayed by keeping buttons clustered at the top and the list in order with nice spacing below the buttons. We decided to unify the design language of all icons, all UI and buttons in this app to make them look consistent. This is to correspond to the consistency

principle in ‘Tog’s First Principles of Interaction Design: Consistency – the overall look & feel of a single app’ [6]. The structure of the search functionality and the app in general reduces the load on the semantic memory, the information is logically structured and the information linked appropriately.

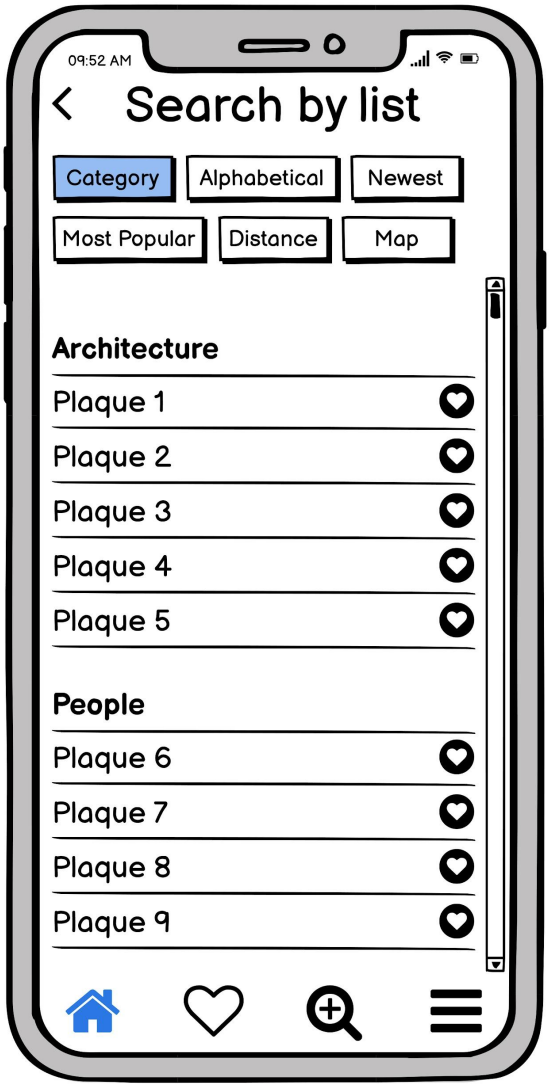


Fig. 29

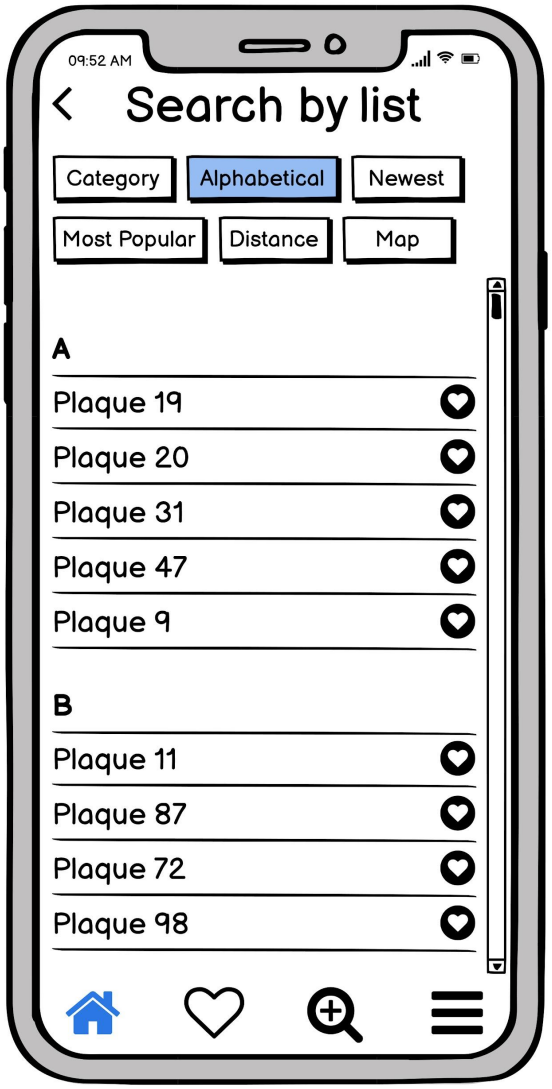


Fig. 30

Directions to next plaque

The directions to next plaque functionality can show the distance of the next plaque with 2D maps (Fig. 31) and 3D maps (Fig. 32). It also shows the restaurants and sights around. This satisfies Lily and Ming’s need to know the directions and distance to the next plaque but also the nearby places of interest or places to eat. These can be turned off by clicking on the camera and knife icons if the user doesn’t require them. ‘Norman’s Principles No.4 Mappings’ was used so the camera and knife buttons are consistent with the sights and restaurants in the map. Because the user

can click on the speaker icon, users can also use their sense of hearing to aid navigation and reduce divided attention as they are walking [3], [4]. The list functionality now supports searching by various filters, this reduces cognitive load and adheres to 'Shneiderman's 8 Golden Rules No.8 Reduce short-term memory load' [7].

Fig. 31

Fig. 32

Plaques visited

The plaques visited functionality shows plaques you have visited and your achievement ranking (Fig. 33). This satisfies Lily and Ming's need to record what they have seen. Heuristics proposed by Petrie and Power No.4 'Make key content and elements and changes to them salient' was used so changes to the page are clearly indicated [8]. When the plaques have been visited, they will turn green and become bold. 'Tog's First Principles of Interaction Design - Do not avoid colour in the interface just because not every user can see every colour' was also used here [6]. We made the

plaque turn bold to add differentiation that wasn't just colour. A high contrast design is advised by Cooper et al. [4] to aid everyone but specifically people with visual deficiencies such as deuteranomaly, deuteranopia, protanopia, achromatopsia or long-sightedness. We set the background colour to white, in contrast to the black font. This minimises the load on the users working and long term memory [1].

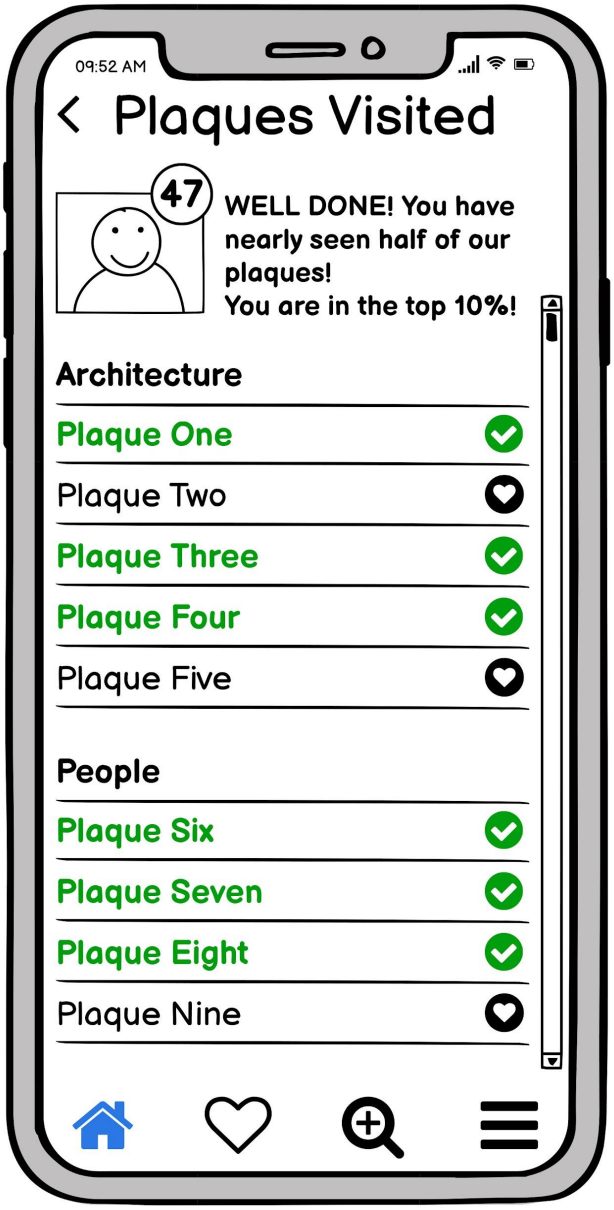


Fig. 33

‘Your Route Planner’

The ‘Your Route Planner’ functionality can plan a plaque route bespoke to you and share it (Fig. 34). This satisfies Lily’s and Ming’s need to plan and to share their favourites list and bespoke route. Heuristics by Petrie and Power No. 10 ‘Clear labels and instructions’ was used so users can easily understand the buttons of ‘Start’ and ‘Add More Plaques’ [8]. We also used ‘Norman’s Principles No.4 Mapping’ when users want to adjust the order of plaques. Finger swiping up and down on the plaque list, maps to the up and down adjustment of the plaque order. With the adding of arrows to the left of each list item to indicate clearly to the user of the ability of the system to allow this function, this adhered to Petrie and Power heuristics No. 19 ‘Interactive and non-interactive elements should be clearly distinguished’ [8]. This feature also lightens the load on the users working memory as the plaques are stored in the system ready to be linked to a route later [1].

Fig. 34

Part 1.3.2: Expert Inspection Evaluation of the Prototype

Collaborative Heuristic Evaluation (CHE)

We used the Collaborative Heuristic Evaluation (CHE), Petrie & Buykx [9], guided by design principles Petrie & Power [8].

Our CHE proceeded as follows:

1. Yuhao drove the system.
2. Chris wrote down any problems in a spreadsheet.
3. Huze, Suri and Yanni requested various actions in the system as Yuhao navigated around the app.
4. Various problems we found during the CHE were then discussed as a group.
5. Each expert individually recorded the severity rating privately.
6. We collated the ratings from different experts and calculated the mean.

The four tasks

Task 1 - Search List

You want to plan which plaques you want to visit in your afternoon off work and sit down at lunch to do so.

1. You want to find a plaque using the search bar and check the details of any of the plaques that come up.
2. None of them are interesting to you.
3. You decide you want to search plaques by what you are interested in, which is architecture and people. You like Plaques 1, 4 and 9 and so want to add them to your favourites list.
4. You realise it may be easier to find a few more plaques by alphabetical order instead.
5. You like the sound of Plaque 19 and so add it to your favourites list.

Task 2 - Planning a Route and directions

You want to plan a plaque route and share it with your friend as you have planned a trip to York together soon.

1. You are now happy with your favourites list from task 1, so now you want to use the list to plan a plaque route around York (you don't have to change your route requirements).
2. You actually remember that you like Plaque 6 so you want to add it to your list.

3. Plan your route.
4. Double check how many places to eat and how many general sights there are on your route.
5. When you are happy, share your route with friends.
6. You are happy with your route so please commence your journey!
7. You think the map is too basic - see if there are any options to rectify this.
8. You are not hungry or interested in the sights around you so you find the icons on the map distracting and unhelpful for you at this time.

Task 3 - Plaques Recorded
You are wandering around after finishing your plaque route and want to see what you have achieved.

1. After you have done your plaque route, you want to know how many plaques you have seen - how can you find this out?

Task 4 - Visual Deficiencies
You are planning to see a few sights in York at the weekend, you browse the app but find that a few words are a little too small for you to read as you have long-sightedness.

1. Can you find a way to make the text bigger?

Results

We used the York University severity rating of 1 to 5 (5 being the most severe) and the results can be seen in the table below. After careful analysis of the prototype by using CHE, there were six usability issues raised by the group. The results of this evaluation can be summarised in Table 1. It shows that the mean severity rating of each problem is between 1.4 and 3.8.

Table 1. CHE Recording

Problem No	**Problem**	**Location (screen)**	**Heuristic**	**Mean severity rating**
1	Your Route Planner only available via 'Your Favourites' This was because the 'Your Route Planner' was originally an add on to the 'Your Favourites' Feature. Not obvious to the user.	All screens	P&P No. 17	3.8
2	When adding a plaque to 'Favourites' - it didn't	All screens	P&P No. 13	3.6

	appear in the navigation icon as added.			
3	The buttons ‘Add Plaque’ and ‘Start!’ were too similar, no hierarchy. The user may not know which is the Go button straight away.	Your Route Planner	P&P No. 20	1.4
4	It's not clear that users can re-order the plaque list in order to be in control of their journey.	Your Route Planner	P&P No. 15 & 19	2.4
5	It's not obvious that the users can tap on a plaque item and get a basic pop up info box in order to make a decision.	Search by List / Your Favourites	P&P No. 15 & 17 & 19	2
6	There are no options to account for the needs of users to have larger text or account for colour deficiencies.	All screens	P&P No. 15 & 17	2.4

Discussion

After analysing the results, there were two major problems, three medium problems and a minor problem. The results of this analysis are summarised in Table 2 below along with possible solutions.

Table 2 Analysis and presentation

Severity rating	**Problem**	**Possible solutions**
3.6-3.8 (Major)	Problem 1	Make the 'Your Route Planner' its own feature and add to bottom navigation.
	Problem 2	Add real time counter markers in the bottom navigation for 'Your Favourites' and 'Your Route Planner'.
2-2.4 (Medium)	Problem 4	Add arrow icons to the left of the plaque items.
	Problem 5	Add 'i' icons where appropriate.
	Problem 6	Add a toggle for both larger text and colour deficiencies.
1.4 (Minor)	Problem 3	Change the shape and colour of ‘Start!’ button (making it more distinctive).

With problems 3-6 from the CHE, we took on board all the problems as most of them were quick fixes such as adding vision deficiency buttons (Fig. 36) and 'i' buttons (Fig. 38) and reordering arrows (Fig. 37) on plaque lists and making the 'Start' button more distinct on the 'Your Route Planner' (Fig. 37). We detail the main problems below which we sorted first due to the severity rating of them. Most of the problems affected the 'Your Route Planner' functionality.

Major Problem 1 - (3.8 Most severe)
According to the Petrie and Power Heuristics 17 'Provide the interactive functionality users will need and expect' [8], we added a map icon in the bottom navigation so users could access the 'Your Route Planner' functionality directly as we felt it was too hard to find out how to plan a route solely via the favourites list (Fig. 35).

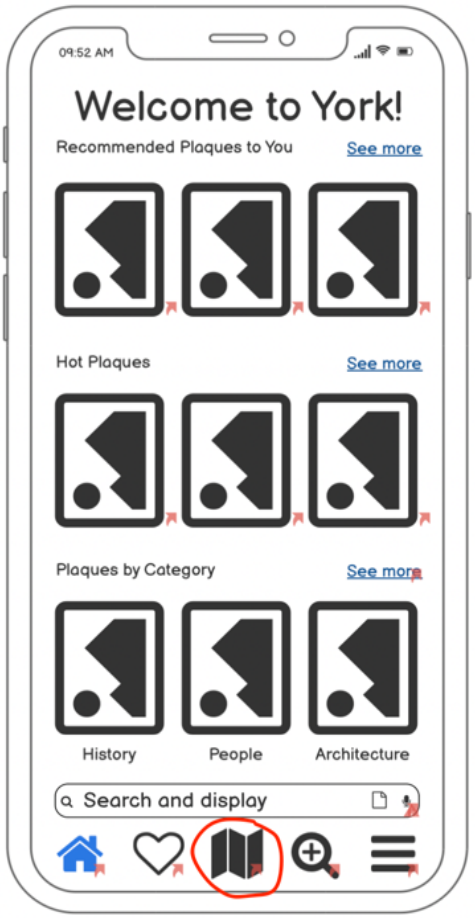


Fig. 35 Added icon for 'Your Route Planner' in the navigation.

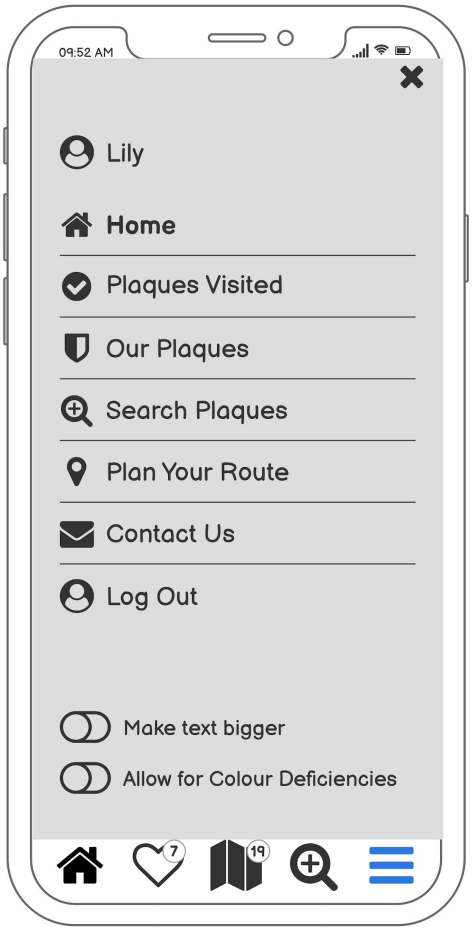


Fig. 36 Added vision deficiency buttons in the flyout menu.

Major Problem 2 - (3.6 second most severe)
According to the Petrie and Power Heuristics No.13 ‘Provide feedback on user actions and system progress’ [8], we added a real time counter markers in the bottom navigation for 'Your Favourites' and 'Your Route Planner'. After adding favourite plaques and route planner, the counter markers will increase. We felt that users will wonder if the plaques they were adding would have been recognised by the system or not and force them to check which would add inefficiencies in cognitive load. (Fig. 37).

Fig. 37 Added a real time counter markers. Created differentiation in ‘Start’ button. Added reordering arrows next to plaque items.

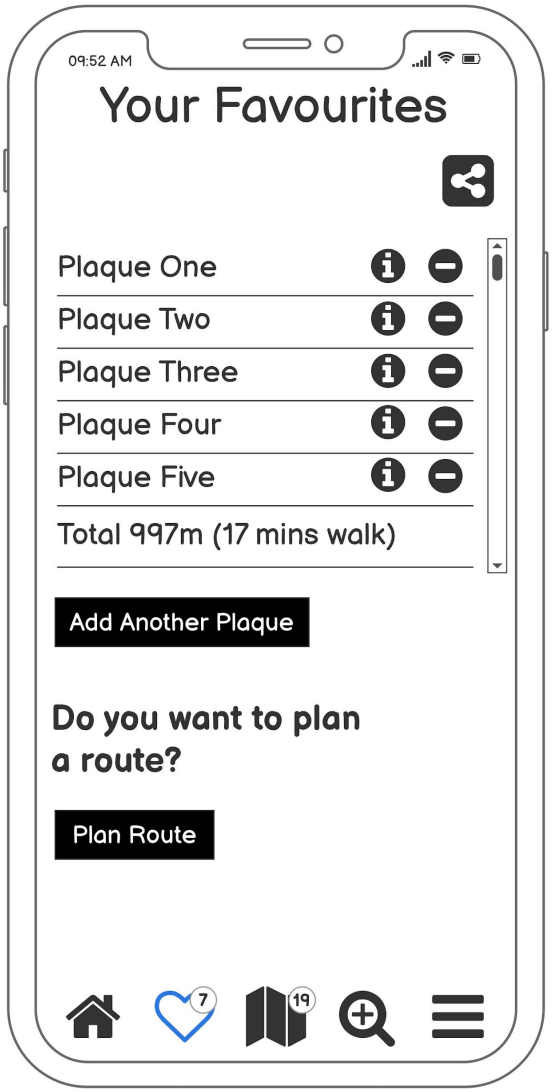


Fig. 38 Added ‘i’ buttons.

Part 1.3.3: User Evaluation of the Prototype

User evaluation

The team re-examined the prototype with a series of task-based evaluations by users. The team members each invited two real users each (N = 10) and gave them the task list from the CHE to complete (see **here**). All participants signed a short online consent form (**Fig. 46**) having read an information sheet (**Fig. 47**) outlining the reason for participation prior to conducting the evaluation. We explained to the users the objectives of the task and the motivation for the assessment. The users were fully informed that the assessment was voluntary and confidential.

The evaluation took place over Zoom, with the participants sharing their screen and performing a 'concurrent thinking aloud' session to describe what they were thinking as they were performing the tasks, so the components and functionality of the prototype could be tested. During the Zoom meeting there was a facilitator who prompted the participant when necessary, and a scribe who noted down any problems the participant was having. The four user tasks designed by the team members contain a series of operational flows that are an integration of the requirements of most users. After the tasks were completed the facilitator quickly gave a confirmation of the issues they had during the tasks to clarify for the observer.

Tasks

The tasks were used from the CHE (see **here**).

Result

Each assessment contains one user, a scribe and a facilitator. The facilitator is responsible for introducing the users to the process and providing them with real-time prompts, but absolutely not instructions on how to complete the task. The users described any frustrations they were having and the scribe took notes on the suggestions made by the users. After the testing process, the scribe confirmed the problems with the participant. Problems are recorded and amalgamated into a group spreadsheet and rated by the group based on severity (1-5).

Task	Screen/Functionality	Problem description	Solution	Functionality Affected	Agreed rating
1	Home screen	Search bar at bottom (used to top)	Move to top.		**1.8**
1	Home screen	User was a little confused about the search bar.	Maybe put at the top		**1.6**
2	Directions	Camera was confusing - could be take a picture icon.	Change to another icon.	**Directions**	**2.6**
3	Home screen	User thought maybe about going to the favourites sections to see if they have been checked off. The user then figured out to go through the menu.	Add a tick behind the plaque in the favourites	**Favourites**	**2**
1	Home screen	When the user uses the application for the first time, the user cannot understand the meaning of each icon in the navigation bar.	Add text descriptions to the icons in the navigation bar		**3.8**
1	Search interface	Users do not know what they want to search in the search interface.	Add the following recommended information to the search interface: the most popular, the nearest		**3**
1	Home screen	Users don't know what the magnifying glass on search page means	Add text notes for this function (show all plaques)		**3.2**
2	Directions	Users cannot choose different routes for navigation: for example, the smoothest route, the fastest route.	Add different route planning: the smoothest route, the shortest route.	**Your Route Planner/Directions**	**2.6**
2	Directions	The user does not know the time to reach the destination using different types of transportation	The application can display the time to reach the destination using different types of transportation	**Directions**	**2.2**
2	Directions	Users cannot collect their favorite restaurants or attractions	Users can bookmark their favorite restaurants and attractions	**Your Route Planner**	**2**
1	search interface	There is no prompt when typing a letter	Add a fuzzy searh feature		**2.6**
2	Directions	The route is not optimal	Automatically calculates the optimal route	**Your Route Planner/Directions**	**2.2**
1	Home screen	users can't understand some icons	Add a help document		**3.4**
1	Home screen	The background is monotonous	Add some pictures		**1**
2	Directions	In the plane map, there is no user's current orientation. Moreover, there is a common problem between 3D map and 2D map, that is, there is no North compass.	Add a north arrow in the upper right corner of the interface of the two maps.	**Directions**	**2.4**
2	Directions	More route recommendations are needed, such as the nearest route, the best choice, the route recommended in peak hours, etc.	Add the function of multiple route selection.	**Your Route Planner/Directions**	**2.4**
3	Achievement system	The conditions for achievement are not clear enough.	You can set up a sharing community, write comments in the community, send photos, share them with everyone, get achievements, and let more new users see relevant information.	**Recording Plaques**	**2.2**
4	All	Search magnifying glass with plus is confusing to the user - they think it is the button to make the text bigger.	Remove the plus in the middle of the magnifying glass.		**3**

Fig. 39

Discussion

The Directions/'Your Route planner' functionality has received a lot of problems from users, so we decided to make it the first target to address and improve it. More than 70% of the users found the same problem when they first tested this interface, as shown in Fig. 39. There is only one route to choose from (Fig. 40) and users were unable to use the map in the Directions/'Your Route planner' functionality to select the best and most appropriate route. Another issue that was mentioned second only to the single route issue was that the map did not have a north arrow. After some consideration, we have added a north arrow to the map screen and added several alternate routes to the map (Fig. 41).

In response to a number of questions about the Directions/'Your Route planner' functionality (Fig. 39), we have also added a button to the top of 'Your Route Planner' to toggle between transport types before starting the route (Fig. 41), in response to user comments about the screen not having multiple transport options. Also, based on this feature, 'YOU' text has been added to the map so that users can know their current location (Fig. 41).

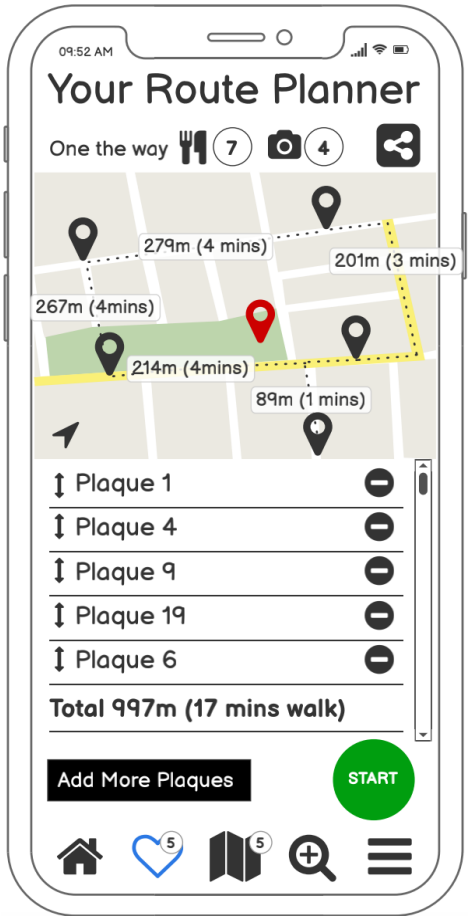


Fig. 40 Single route map in the Directions/'Your Route planner' functionality.

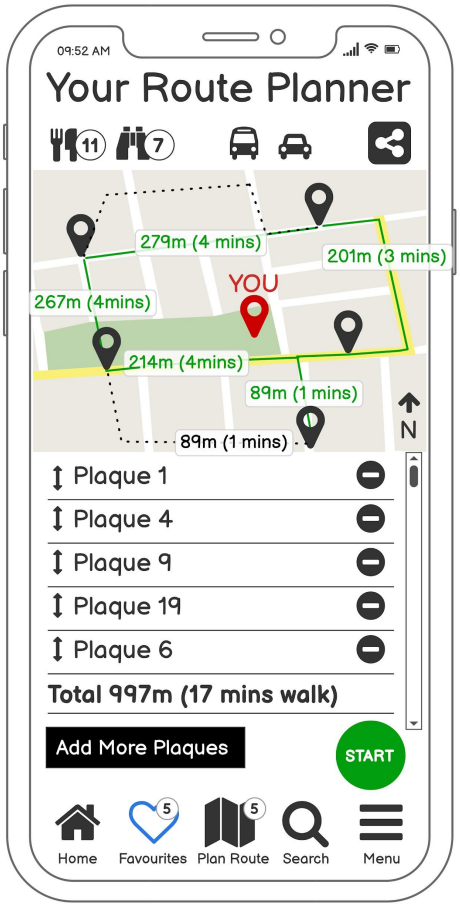


Fig. 41 Various routes added. North arrow added. 'YOU' added above the current location marker. Alternate transport options added at the top.

Fig. 42 Unclear coordinates without immediate location display after starting navigation.

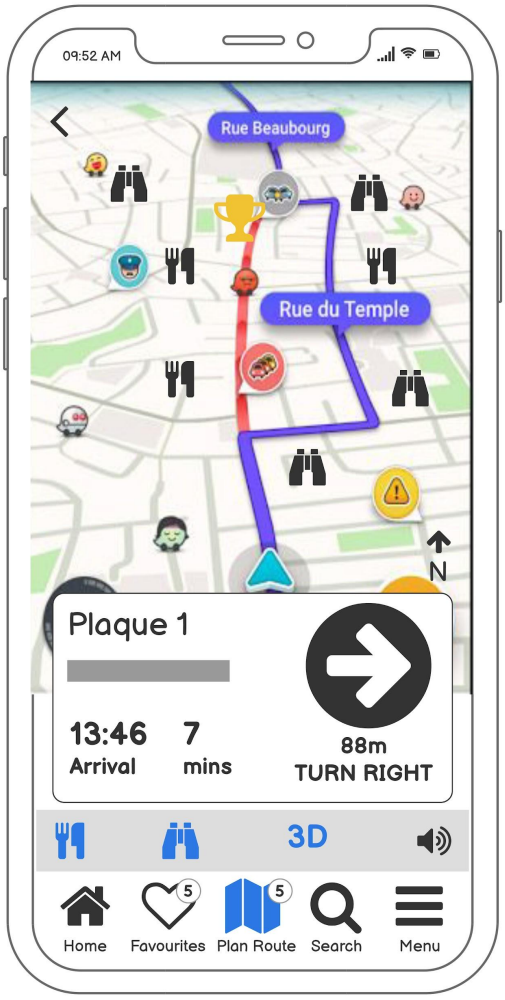


Fig. 43 Camera icon replaced with binoculars. North arrow added. Search icon changed. Descriptive navigation text added.

For the ‘other sights’ icon below the map (Fig. 42), we replaced the camera icon with binoculars (Fig. 43), which are better suited to the ‘other sights’ and less related to taking pictures which was causing confusion.

The second set of problems was one of the first things users noticed. Some users found that the navigation bar icons were confusing (Fig. 42), which prevented them from correctly selecting the function they wanted to reach. So we added text descriptions under each icon in the navigation bar (Fig. 43). We also changed the magnifying glass icon on the other search screen, which users thought was to make the text bigger, from ‘Magnifier+’ to ‘Normal Magnifier’ (Fig. 43). Because these two problems related to the navigation we felt this was critical to the user journey so we amended these as well.

Appendix

[Back to 1.1 User requirements gathering]

Fig. 1 Q1 - What is your age?

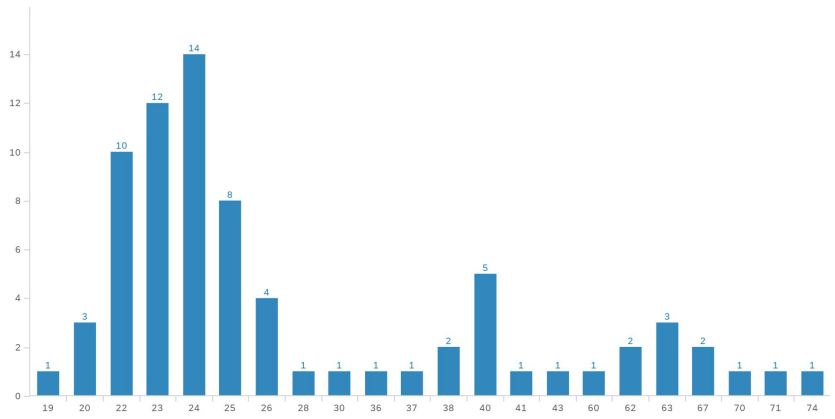


Fig. 2 Q2 - What is your gender?

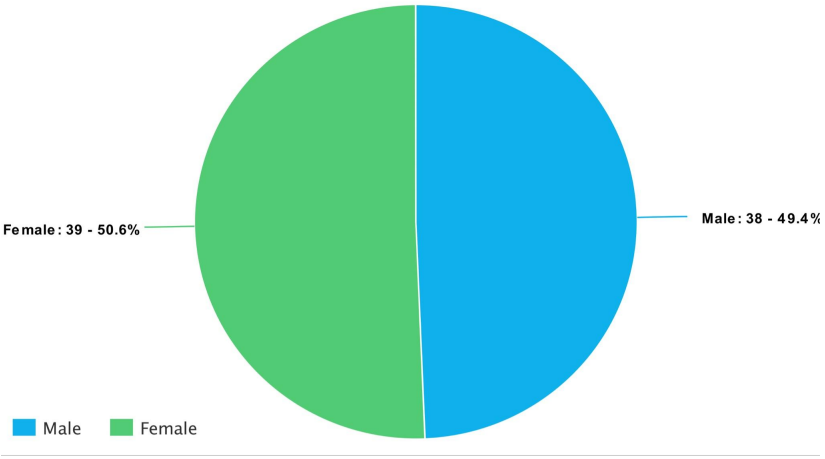
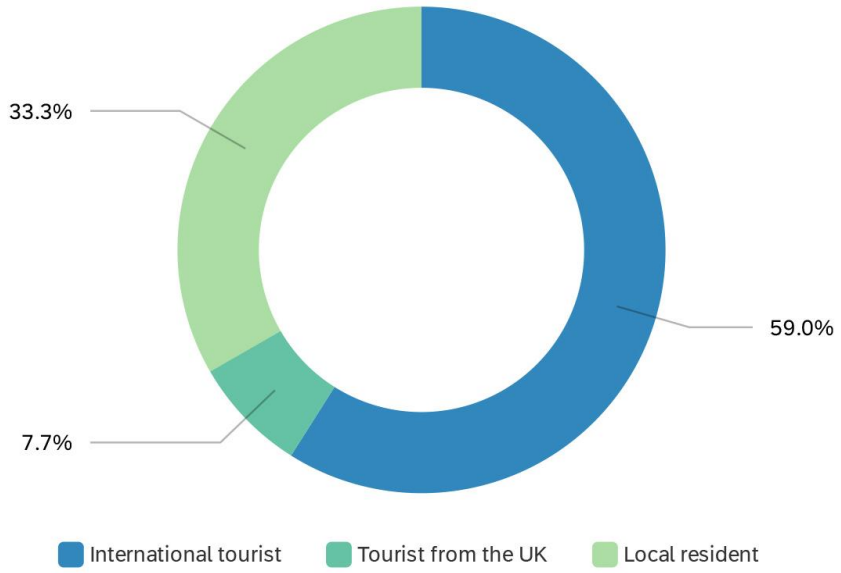


Fig. 3 Q5 - What best describes you?



[Back to 1.1 User requirements gathering]

Fig. 4 Q6 - Are you?

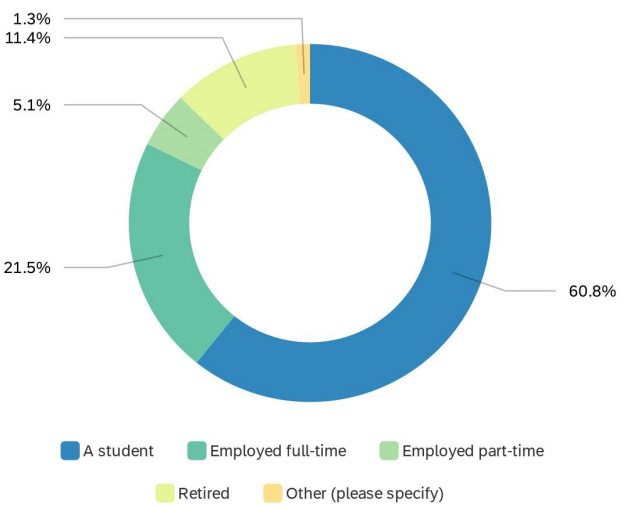


Fig. 5 Q7 - Do you have any impairments or disabilities?

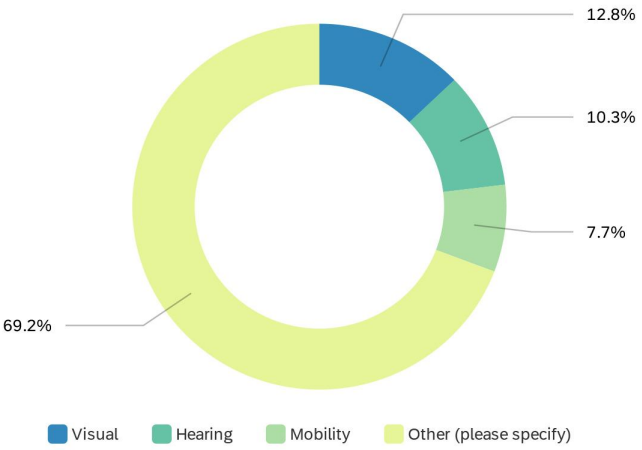
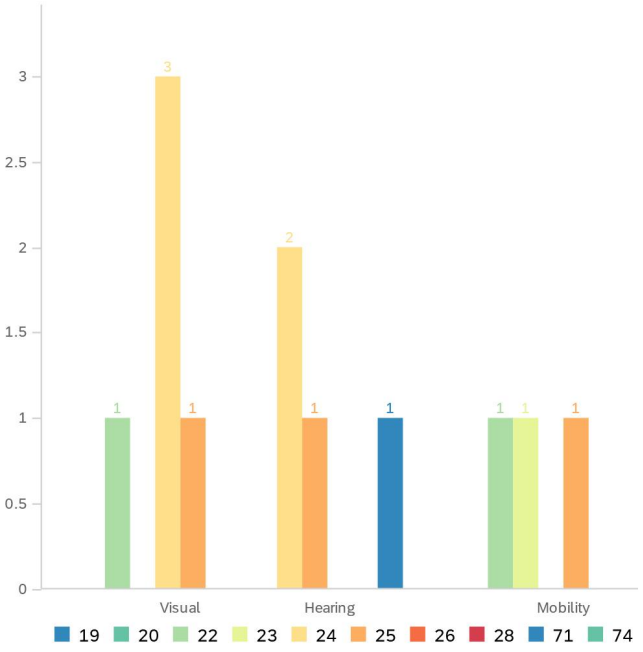


Fig. 6 Disability or impairment by age



[Back to 1.1 User requirements gathering]

Fig. 7 Q13 - Do you currently use an app when you go sightseeing?

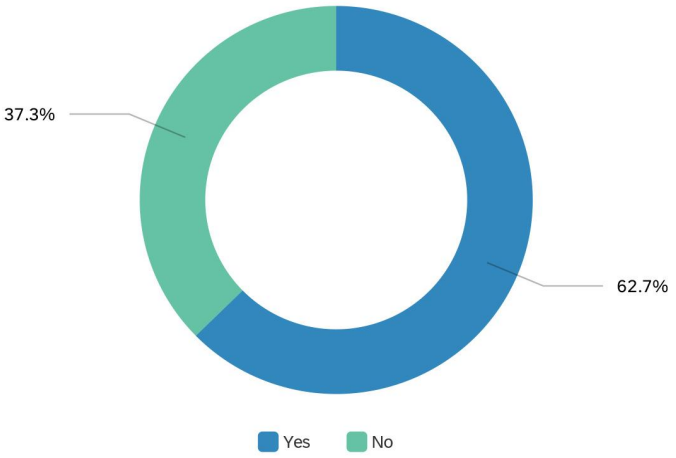


Fig 8 Q10 - How often do you use apps to inform you of places of interest whilst sightseeing?

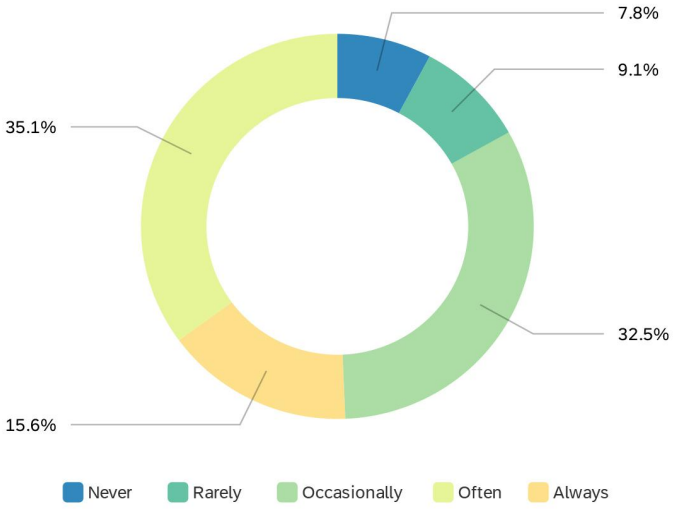
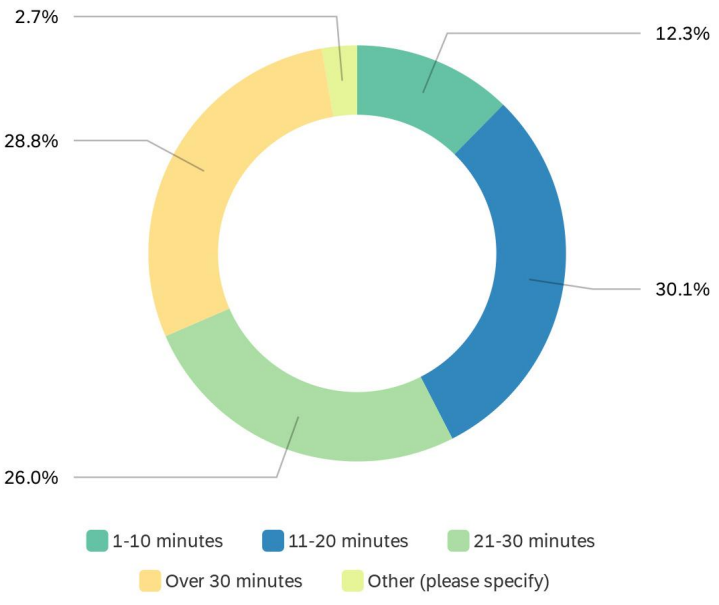


Fig. 9 Q26 - Ideally, how long do you spend walking between sights?



[Back to 1.1 User requirements gathering](#)

Fig. 10 Q32 - How important are the following features to you in terms of the York Civic Trust Plaque app?

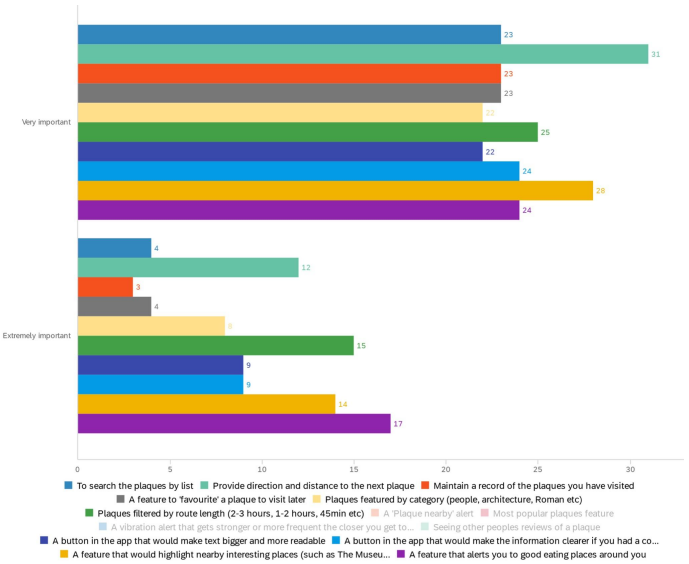


Fig. 11 Q27 - What best describes your behaviour as a tourist?

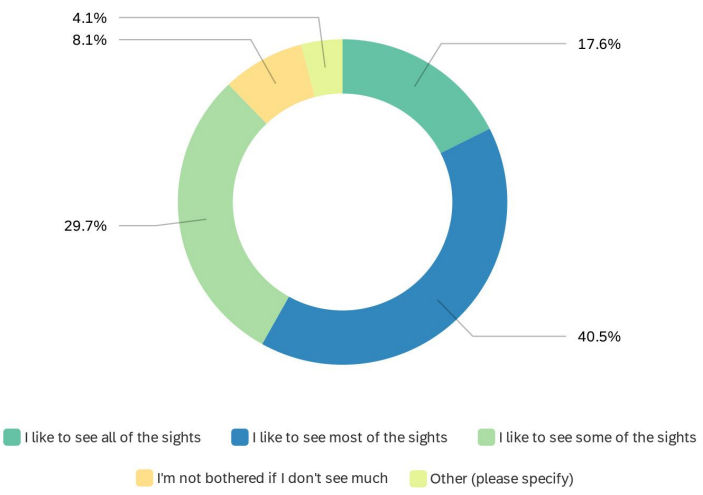
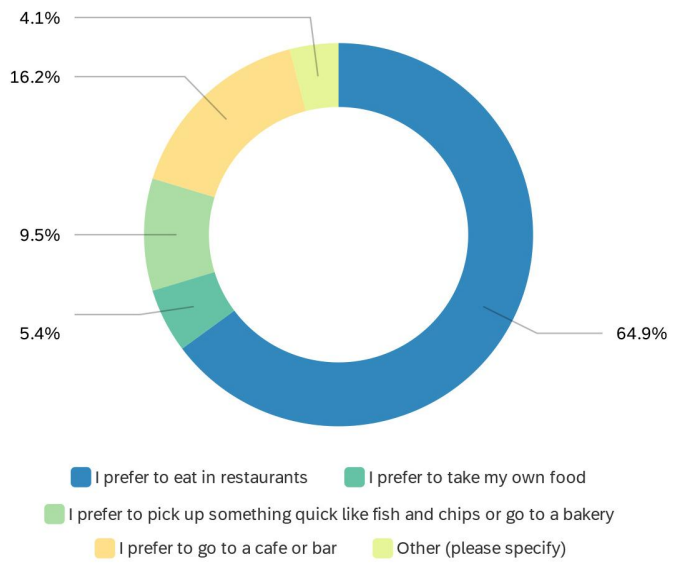


Fig. 12 Q24 - When you are sightseeing, what do you prefer in relation to eating?



[Back to 1.1 User requirements gathering]

Fig. 13 Q29 - Before you travel, do you plan your own itinerary?

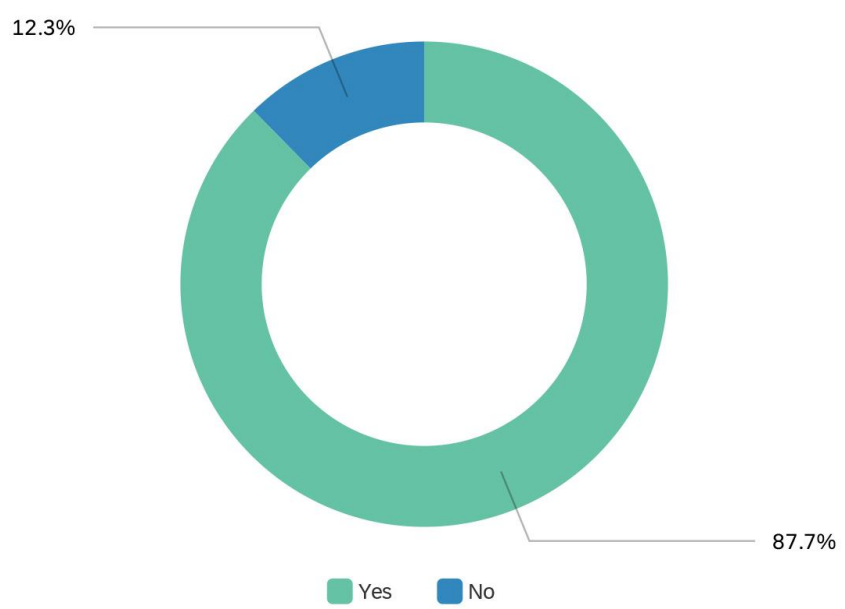


Fig. 14 Q3 - What is your nationality?

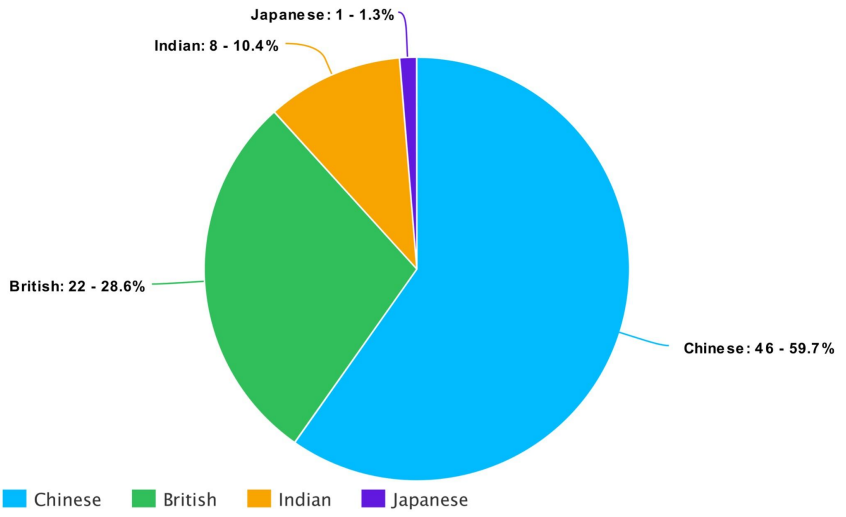
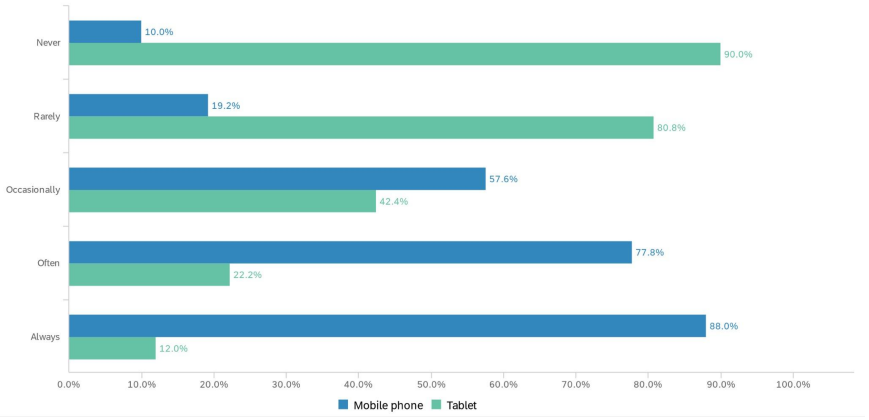


Fig. 15 Q9 - When you are sightseeing, how often do you use these devices?



[Back to 1.1 User requirements gathering]

Fig. 16 Q22 - Who do you normally go sightseeing with?

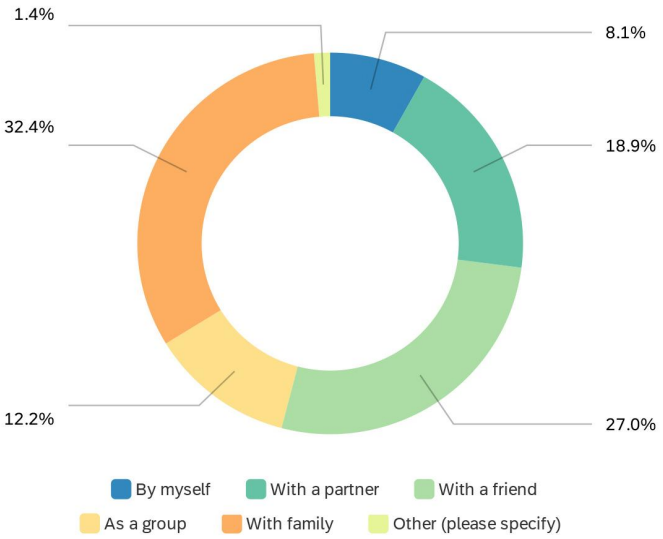


Fig. 17 Q25 - When you go sightseeing, how long do you spend doing so in a typical day?

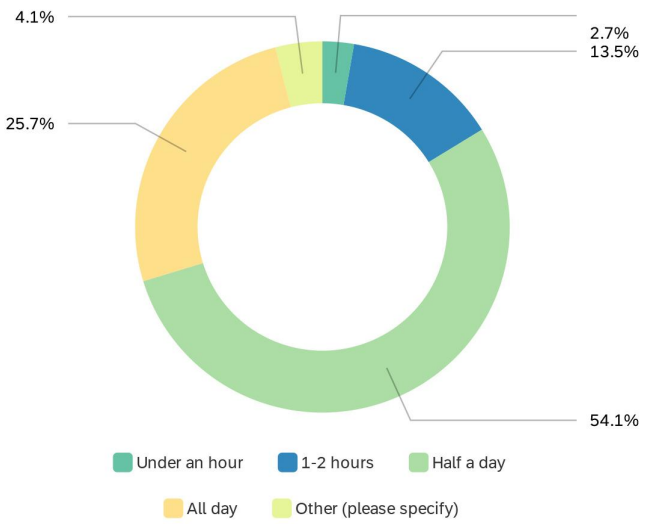


Fig. 18 Q28 - What best describes your behaviour when walking to the next sight?

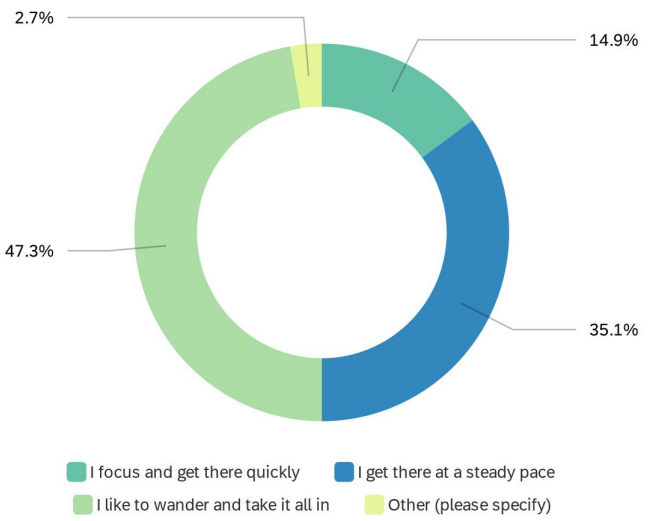


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Fig. 19 Q32 - How important are the following features to you in terms of the York Civic Trust Plaque app?

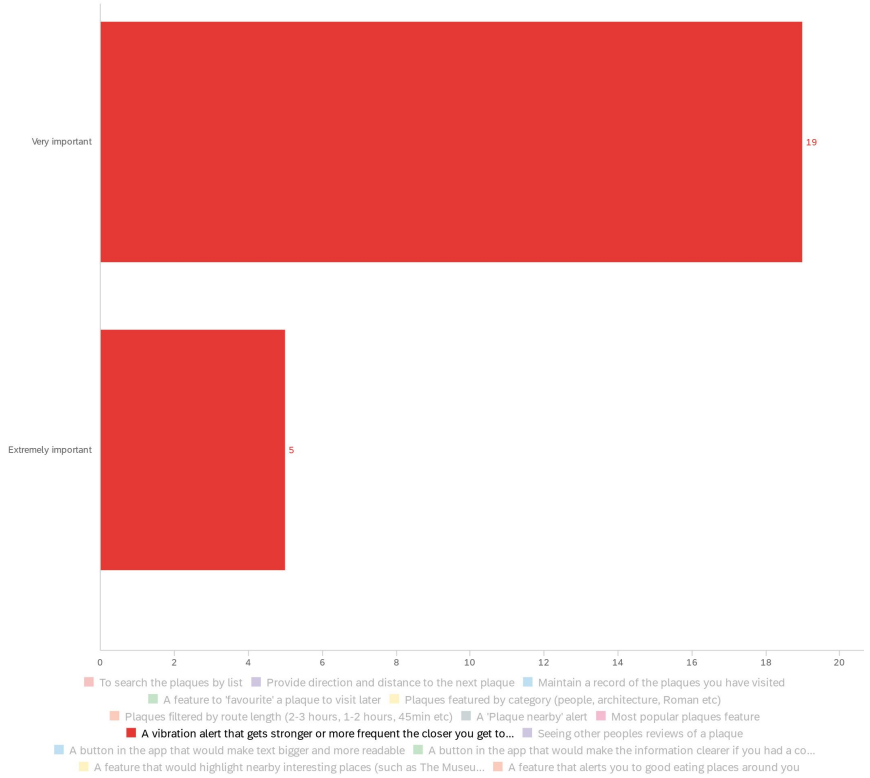
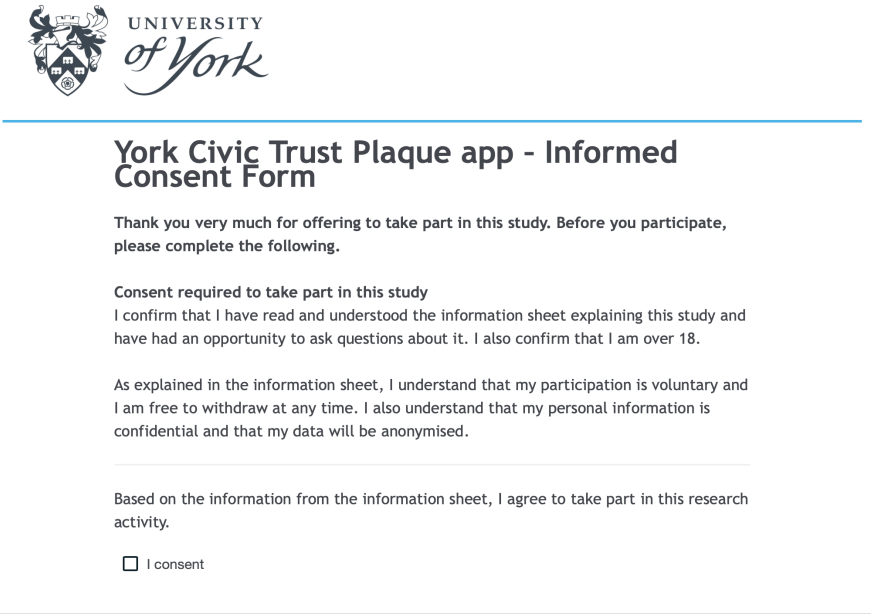


Fig. 44 Informed consent for user requirements data collection.



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York Civic Trust Plaque app - Informed Consent Form

Thank you very much for offering to take part in this study. Before you participate, please complete the following.

Consent required to take part in this study
I confirm that I have read and understood the information sheet explaining this study and have had an opportunity to ask questions about it. I also confirm that I am over 18.

As explained in the information sheet, I understand that my participation is voluntary and I am free to withdraw at any time. I also understand that my personal information is confidential and that my data will be anonymised.

Based on the information from the information sheet, I agree to take part in this research activity.

☐ I consent

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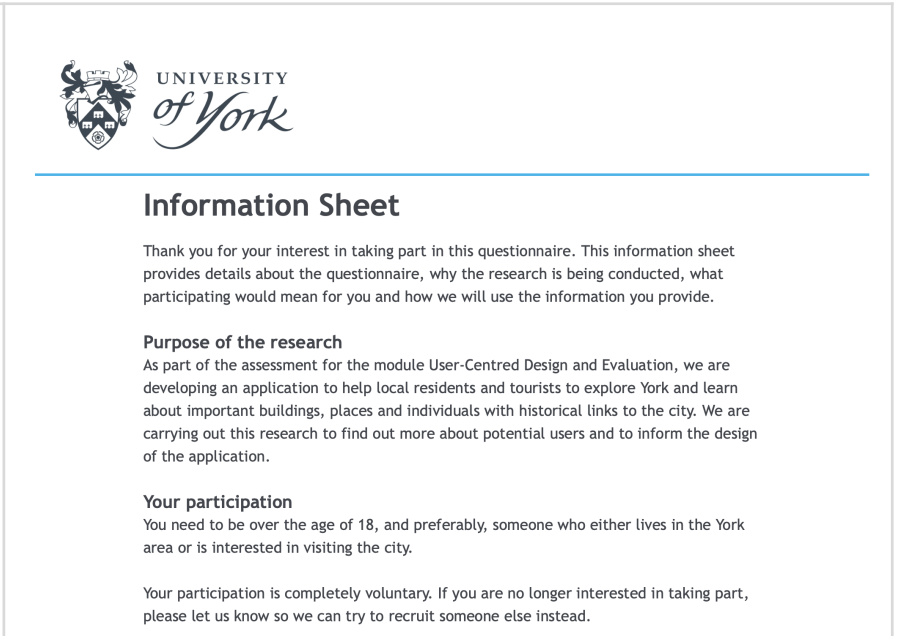
Fig. 45 Information sheet for user requirements data collection.



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Information Sheet

Thank you for your interest in taking part in this questionnaire. This information sheet provides details about the questionnaire, why the research is being conducted, what participating would mean for you and how we will use the information you provide.

Purpose of the research

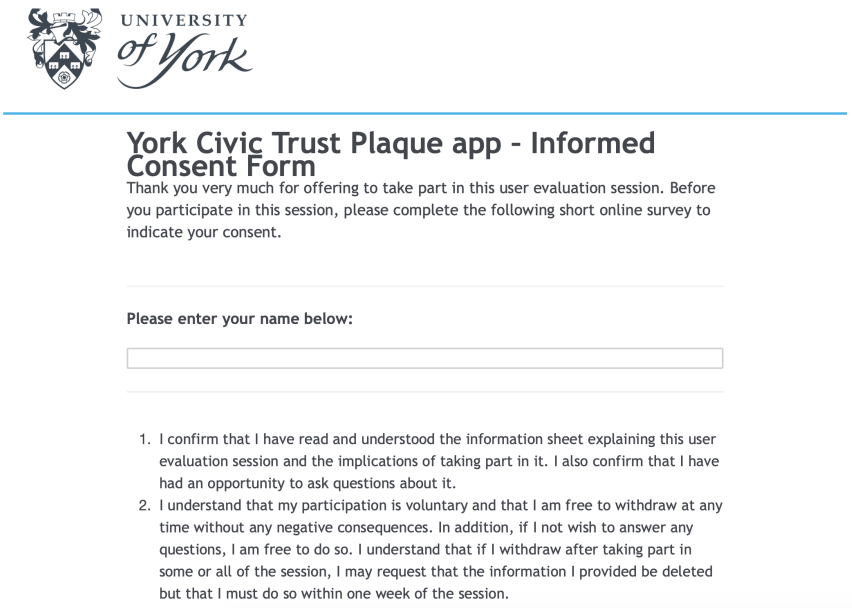
As part of the assessment for the module User-Centred Design and Evaluation, we are developing an application to help local residents and tourists to explore York and learn about important buildings, places and individuals with historical links to the city. We are carrying out this research to find out more about potential users and to inform the design of the application.

Your participation

You need to be over the age of 18, and preferably, someone who either lives in the York area or is interested in visiting the city.

Your participation is completely voluntary. If you are no longer interested in taking part, please let us know so we can try to recruit someone else instead.

Fig. 46 Informed consent for user evaluation.



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York Civic Trust Plaque app - Informed Consent Form

Thank you very much for offering to take part in this user evaluation session. Before you participate in this session, please complete the following short online survey to indicate your consent.

Please enter your name below:

1. I confirm that I have read and understood the information sheet explaining this user evaluation session and the implications of taking part in it. I also confirm that I have had an opportunity to ask questions about it.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without any negative consequences. In addition, if I not wish to answer any questions, I am free to do so. I understand that if I withdraw after taking part in some or all of the session, I may request that the information I provided be deleted but that I must do so within one week of the session.

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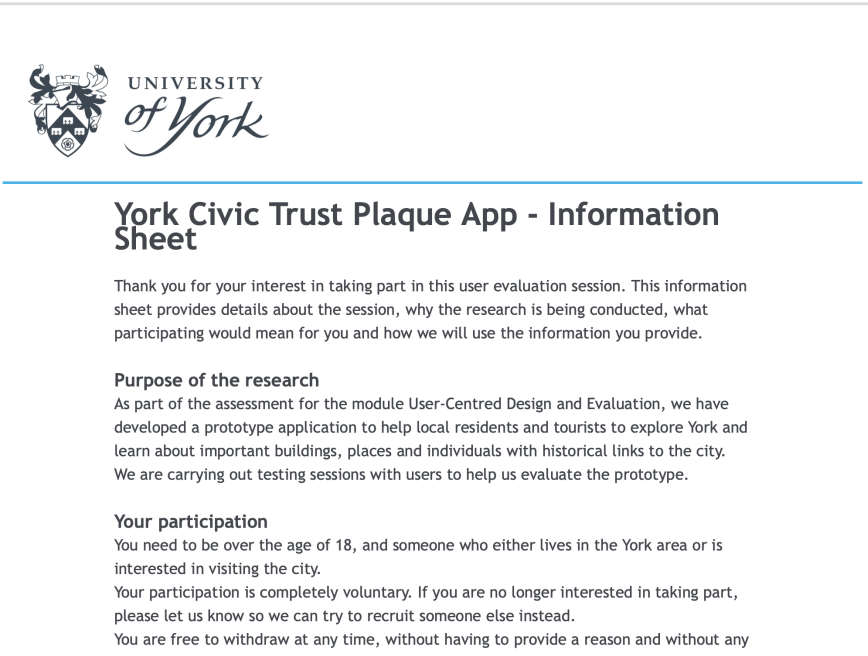
Fig. 47 Information sheet for user evaluation.	

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