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<b>Authors: Andrew McNeill, Lynne Coventry, Mladjan Jovanovic, Francesco Ferrari, Antonella De Angeli</b>	
<b>Internal reviewer: Ivo Ramos (ATOS)</b>	

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## Executive summary

### *Introduction*

As part of testing the ACANTO system prototypes, we conducted a series of usability tests of the user interface for the social network system and of the FriWalk guidance system. These tests are reported in this deliverable. The first section reports on the usability testing of the interface for the social network part of the Fritab app and is accompanied by the appendix which identifies changes that have been made in the interface as a result of the testing. The second section report on tests of the FriWalk guidance system. While it will have an advanced guidance system including visual instructions from the FriTab, this study examines how users interacted with different types of non-visual feedback. Further details are reported in the deliverable, but in this summary, the key findings are reported.

### *User interface testing*

Usability testing is recognised as a vitally important part of ensuring that systems are suitable for the end-user. In this case, because the ACANTO system will be used with older adults, we conducted numerous tests with this group. Some initial tests were conducted in Italy and are reported in D1.8. Due to the iterative nature of usability testing, we conducted additional testing on a revised version of the prototype interface with older adults in the UK. This interface relates specifically to the social network part of the Fritab app. Other interfaces have been developed (for the FriWalk in both clinical and non-clinical environments), but their testing is not reported in this deliverable.

13 participants (M=7, F=6) from North-East England took part in usability testing. Ages ranged from 61-89 years old with a mean age of 72 years. These participants had familiarity with the internet (having been recruited by email) and 8 said they had used some form of a social network before.

Participants were shown a mock-up of the prototype user interface for the social network part of the Fritab app on a 10.1 inch Android tablet. They were asked to perform a variety of tasks while being video-recorded and their performance on these tasks were monitored. Timings were not taken, since the purpose was simply to ensure that participants knew how to use the system to accomplish tasks that they were asked to perform. Comments made by participants were subsequently transcribed and analysed.

A full description of the results is beyond reporting here, but several key themes emerged:

1. Participants often expressed a preference for icons rather than words. This enabled them to understand interface actions more clearly, since icons can be ambiguous. While it would have been possible to replace all icons with text, or even use both icons and text, it was sometimes felt that this led to a very cluttered interface and could ultimately hinder performance. Our solution has been to use text where icons would not be obvious, to use icons and text where icons alone would not be clear, to make icons more semantically meaningful where possible, and to provide users with a list of icons to help them make sense of the interface.
2. While this latter decision (provide a paper-based list of icons) might seem unusual, it was requested by participants who thought it would be helpful. This links to other comments by participants who said that they liked to use paper-based records when interacting with systems. For example, one participant wanted to write out the navigation instructions provided by the system rather than taking the device with him to a suggested event. Participants liked the security of knowing that they had their information with them, that the battery of a device would not die, and that they would not get their device stolen. We suggest therefore, that our system should seek to integrate user-practices such as writing information down.
3. Users also expressed a concern that they would click something incorrectly and damage the system or their data. This led to an increase in the use of confirmation boxes and buttons to unlock editable fields so as to allay concerns for users that they might do something wrong by accident.

In the appendix, many of these changes are reported and discussed. There are still areas for work, and these include work on the privacy settings, and work on how to best persuasively present information about physical activity.

### ***Prototype FriWalk testing***

One of the key functions of the FriWalk is to provide navigation guidance to users. It does this in a variety of ways. One is by providing visual information to the user, but other modalities are available including haptic vibrations (via arm bracelets) and autonomous turning. The latter is accomplished by two alternative means: bang-bang braking and simulated passivity. Bang-bang braking is performed by locking the wheel adjacent of the direction of the turn and simulated passivity is a more gradual form of the same process whereby the wheel adjacent to the turn is gently slowed. To test users' experience of these different modalities, experiments were conducted with a total of 30 older adults in Trento, Italy.

Participants were asked to use the walker in a large hall where they had to follow the guidance of the walker. After walking for several minutes with a given modality, a short questionnaire was administered to assess the characteristics of the interaction (e.g. "Did you feel vibrations?"), the pleasantness of use (e.g. "The experience with the walker was pleasant"), the ease of learning (e.g. "It was easy to learn the walker with this mode of movement."), control over the walker (e.g. "I was sure the walker would always respond to my commands."), and adaptability of the walker (e.g. "The walker fits well with your movements.").

The results show that participants rated all the modalities as being quite pleasant to use, but simulated passivity received very slightly higher ratings for pleasantness. All modalities received similarly high ratings for ease of learning, and this augurs well for the acceptance of the guidance system in future use. Given that ease of use is one of the core factors predicting acceptance of technology (Heerink, Kröse, Evers, & Wielinga, 2010), this is a positive finding. Relatively high ratings of adaptability of the system and perceived control also suggest that the system should be acceptable to users.

Of course, these are only preliminary tests and further testing needs to be conducted. These tests were conducted in a laboratory and thus may lack some ecological validity. Further testing in more natural environments should help to understand users' perception of the guidance system.

Additionally, these tests only cover some of the guidance modalities (i.e. non-graphical guidance). In the final system, these non-visual modalities will integrate with the FriTab to provide visual feedback to the user about where to go. Together, we anticipate that the different modalities will help users navigate unfamiliar environments more successfully.

### ***Conclusion and future directions***

These initial findings suggest the usability of the ACANTO system for users. Users found the social network interface relatively easy to use, even though improvements were suggested. Similarly, interaction with the FriWalk was perceived favourably and the different modes of guidance were able to successfully guide users on an unfamiliar path.

Future work will continue to test the social network user interface and other interfaces directly linked to the FriWalk. Such interfaces will include guidance instructions for users of the FriWalk and this will enable testing of the graphical guidance instructions in conjunction with the other modalities. This integration will lead to testing of the FriTab and FriWalk together and will provide a holistic account of users' impressions of the system.

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# 1 Usability testing of ACANTO social network user interface

The ACANTO social network system (CPSN) is a social network that links older people together based on similar interests and recommends activities for them to do based on shared interests. The aim is to encourage physical activity via social involvement, which in itself has benefits to health and well-being. The social network will be displayed via a tablet interface that older adults can use to find recommended activities and agree to attend. Because older adults have specific requirements given the increased prevalence of vision problems, unfamiliarity with IT, and issues associated with fine motor control (among others), care needs to be paid to the design of these UIs (Johnson & Finn, 2017). Designing for such deficits is not posited as a way of designing a reduced-functionality UI, but a way of universal design (Carr, Weir, Azar, & Azar, 2013) whereby the design is made easier and clearer for all users. Usability testing is a key way of refining designs (Goodman, Kuniavsky, & Moed, 2012) and is employed here to understand the difficulties that older adults have with the existing mock-ups and to encourage them to suggest changes that would make it easier to use.

## 1.1 Aim

The purpose of this testing was to provide feedback for refining the CPSN UI mock-up for the FriTab. This UI had already been tested in Trento with Italian users, but had not yet been tested in the UK. This document reports on the feedback received from participants and identifies changes that can be made to the mock-ups. Following these changes, the UI will be implemented by a software developer. During that stage, additional changes may be required given constraints of the backend.

## 1.2 Method

### 1.2.1 Participants

13 participants (M=7, F=6) took part formative usability evaluations of the social network user interfaces (UI) for the Fritab app. All participants live in the North-East of England (12 urban, 1 rural) and described their nationality as British. Ages ranged from 61-89 years old with a mean age of 72 years.

A brief questionnaire administered at the start of the interview revealed that all apart from one had used a tablet or smartphone previously. The one participant who had not used a smartphone nevertheless owned and used a simple mobile phone. Participants also affirmed that they knew what a social network was (apart from one), 8 of whom said that they use a social network. The most commonly mentioned network used was Facebook, although some were not sure if WhatsApp constituted a social network.

*Table 1: Participant characteristics*

Participant code	Age	Gender	Used Tablet/Smartphone
P01	67	F	Yes
P02	65	M	Yes
P03	71	M	Yes
P04	61	M	Yes
P05	66	M	Yes
P06	66	F	Yes
P07	75	M	Yes
P08	72	F	Yes
P09	72	F	Yes
P10	72	M	Yes
P11	72	F	Yes
P12	89	M	No
P13	85	F	Yes



### 1.2.2 Procedure

Participants were invited to an interview at Northumbria University where they would use a tablet to try out a user interface for the social network part of the Fritab app. Participants were familiar with the concept of the system, having taken part in previous ACANTO research. After ensuring that participants were familiar with the system (and having given them some refreshments), they were shown the tablet and were told about the idea of usability testing of prototype interfaces. All unfamiliar terminology was discussed to ensure that participants were able to give fully informed consent.

During testing, a video camera recorded the participants from behind, in order to capture their interaction with the screen of the tablet. The tablet used was an ASUS ZenPad Z300M with a 10.1 inch screen. The experimenter used a checklist to guide the participant through a variety of tasks. Participants were encouraged to express their thoughts in the UI throughout the testing. During this time, the experimenter made some notes on the process. At the end of the testing (which lasted around 45-60 minutes), participants were paid £10 travel expenses.

Because there were more tasks than could be covered comfortably during a single session, the tests were divided between participants so that some tasks were tested with more participants than others.

Following testing, the experimenter watched the videos of the testing and filled out a checklist of tasks that were completed and tasks that encountered difficulty. Any relevant comments were transcribed.



*Figure 1: Participant and experimenter during testing*

### 1.3 Results

The results present a walkthrough of the activities associated with each screen and associated comments. Following each section of the interface (where relevant) there is a table indicating where and with what frequency problems were encountered. A table is then provided with a list of problems encountered and suggested changes. These suggested changes are only tentative, and as can be observed in the Appendix, they were often balanced against competing requirements when revising the interface (e.g. the use of text was balanced against the need for an uncluttered interface).

## 1.3.1 Authentication

### 1.3.1.1 Signing in

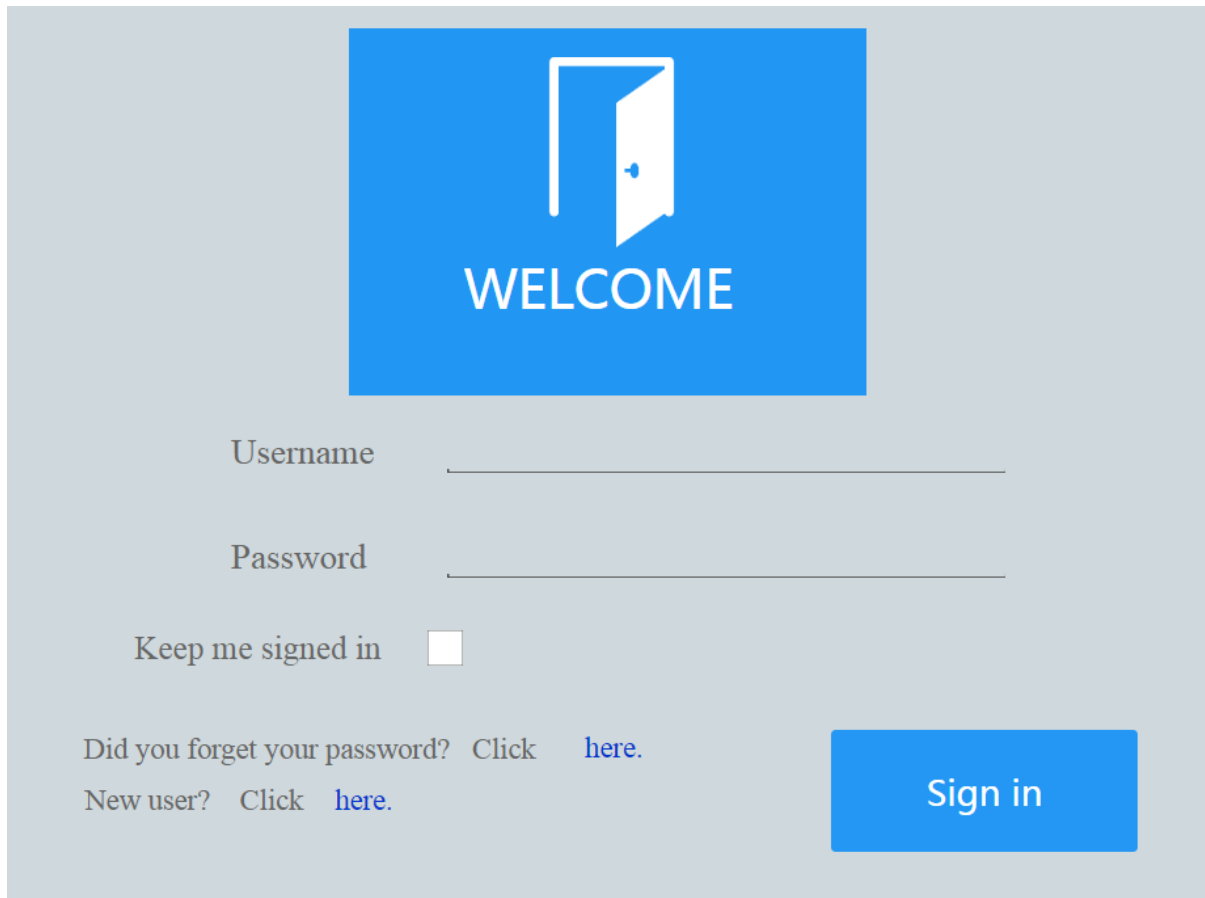


Figure 2: Authentication

Most participants were familiar with the login screen having used similar systems before. While the terminology of “authentication” was deemed too technical by most, the concept was familiar. Perhaps a more common term such as “secure login” would be helpful. One participant said,

*“Well it’s like a bouncer isn’t it. It’s stopping you going in. Security? A Gateway? I like that. Whatever the word is, I need to feel safe.” (P01)*

The implication is that the terminology is not so important as clarity and the communication of safety.

For the five participants who completed this task, no help was required in carrying out the sub-tasks related to signing in or retrieving the password, although numerous suggestions were made. Perhaps the most interesting comments related to the “keep me signed in” button. Some (2) participants felt that to stay signed in was a security risk given that someone might steal their tablet. One said that she would prefer to type in her password every time she logged in as long as the password field did not enforce difficult password rules. Two other participants said that they would prefer a “remember me” option rather than “keep me signed in” because they felt that this was a security risk (staying signed in):

*Does this “keep me signed in” mean that? Now that’s interesting because when I’ve seen that before I think that means it’s open all the time. And that makes me feel like that’s a security leak. I’m just letting you know. [Prefers “remember me” to “keep me signed in”] - Because it means it’s not watching me all the time. (P01)*

Similarly, another participant said,

*If this was my tablet I would say “remember my password” so I could just go in again... I tend to sign out of systems when I’m not using them. (P10)*

Allowing users the ability to click “remember me” rather than “keep me signed in” may allow greater feelings of control insofar as they can log out and easily log back in again, while still having the feeling that the system is “off”. Furthermore, it seems sensible to keep participants signed in by default if the device is owned by the participant. If participants were kept signed in, then they still have the freedom to sign out, but the presence of a “remember me” button allows them to easily sign back in.

### 1.3.1.2 Forgotten password

Participants were comfortable with the process of retrieving their password if they forgot it. They made some suggestions as to how it could be improved. Firstly, the “click here” words in the link to retrieving their password are too far apart; they should be made closer together. While one participant said he didn’t know where “here” was (P12), he was still able to access the feature by attempting to click on the “here” link. Perhaps the “here” could be made bolder.

After clicking on the link and entering an email address or phone number, users then see the following screen:

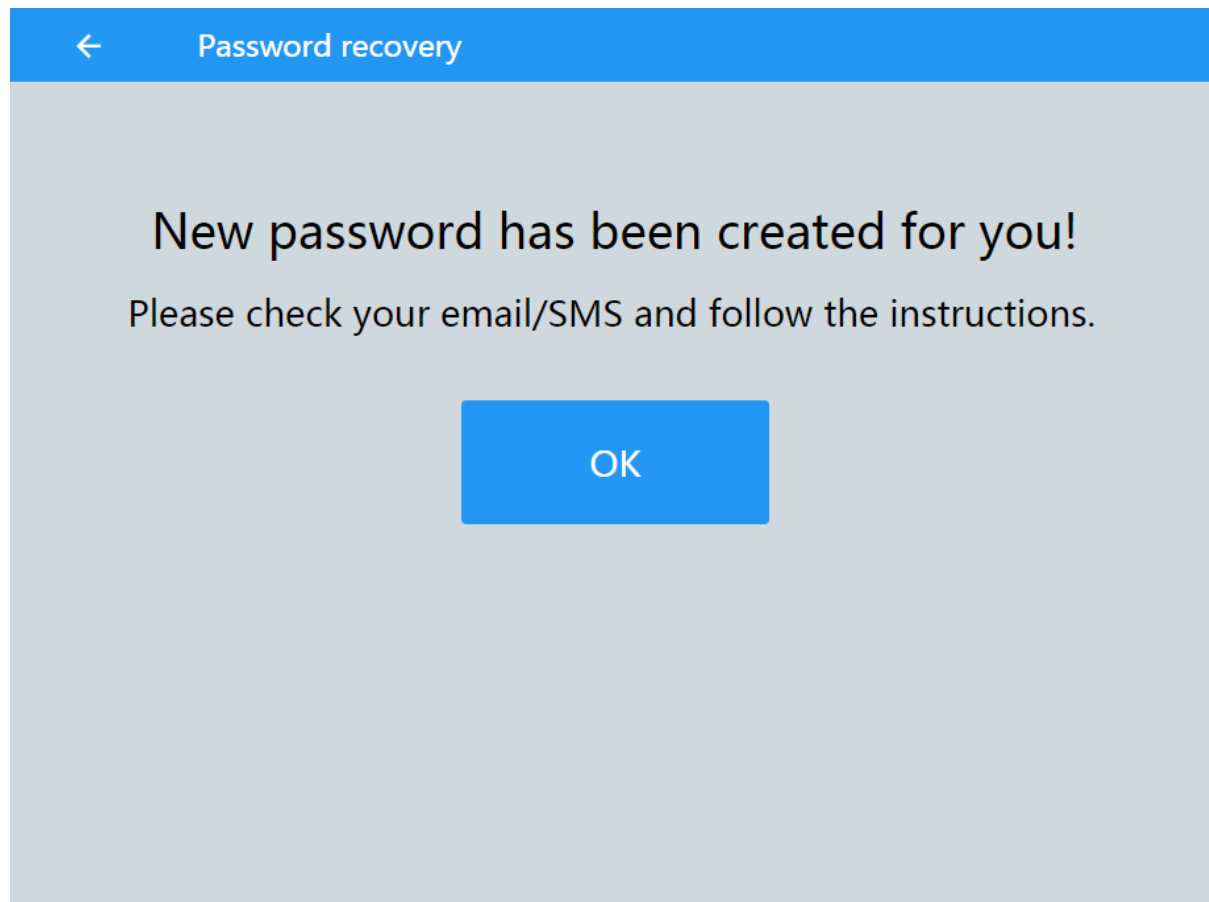


Figure 3: Password recovery confirmation screen

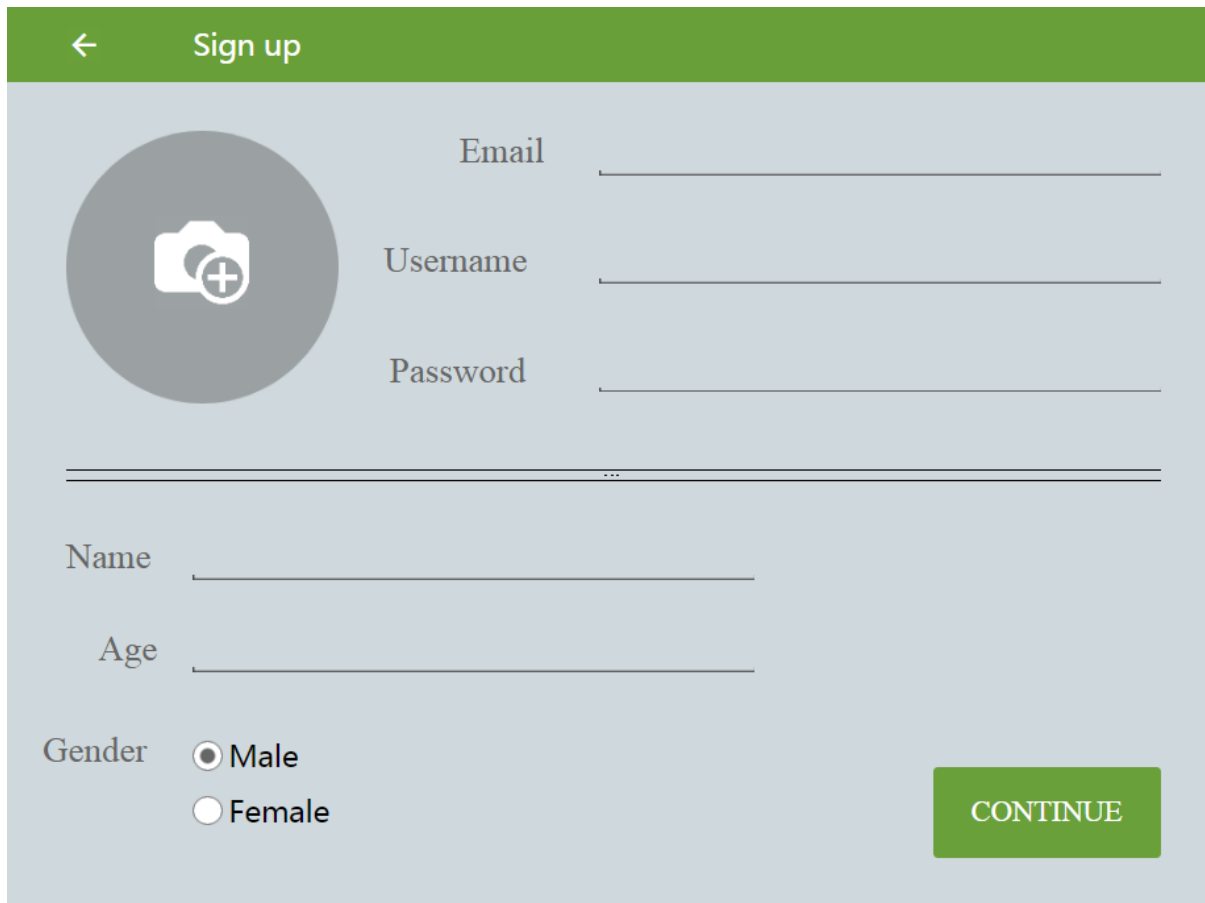
Some participants (2) indicated that they did not know what SMS stood for, and 2 said that “text” would be a better term. Another participant made the following observation:

*You would know whether it was an email or a text depending on whether you’d entered an email address or a text so why not say which one you have sent? (P10)*

Consequently, the screen should adapt to tell the participant whether or not a text message or an email has been sent.

### 1.3.1.3 Signing up

The screens for signing up and editing a profile are very similar but there are some significant differences so the two are discussed separately.



The image shows a mobile app sign-up screen. At the top is a green header with a back arrow and the text 'Sign up'. Below the header is a light blue-grey background. On the left is a circular profile picture placeholder with a camera icon and a plus sign. To the right of the placeholder are three input fields labeled 'Email', 'Username', and 'Password'. Below these is a horizontal line with three dots in the center. Further down are 'Name' and 'Age' input fields. At the bottom left is a 'Gender' section with two radio buttons: 'Male' (selected) and 'Female'. At the bottom right is a green 'CONTINUE' button.

Figure 4: Sign up screen 1

Three users made comments on initiating the sign-up screen. One said that there should be more clarity in the text:

*New user doesn't mean anything... It doesn't say that I have to register to enter. It should say, "If you're a new user, please register here." (P07)*

The other two users said that the "new user" section should be at the top of the screen so that new users will see it first:

*"new user" should be at the top of the screen... if you're a new user you might be completely lost by this time" (P10)*

Despite this suggestion, after users have signed up to the system, it may be more annoying to be constantly presented with the "new user" text so prominently than to have to look a little harder for it during the first time of use. However, one comment is worth noting:

*"Do we need something that says "past user" or words to that effect? [for the other fields]" (P12)*

Perhaps some kind of frame around the existing user elements and another around the new user elements would help to separate the two features.

Having entered the sign-up screen, participants were asked to enter a photo of themselves. One participant did not know how to do this, because he did not recognise the icon. Two participants said something to the effect of:

*"You should have words on there that say, "Please put a photograph here." (P07)*

While sometimes all that is required is to have a list of icons on a sheet to explain the meanings to participants, in this case it seems relatively straightforward to add some text saying, "Add photo".

The next two fields were the username and email address fields. Participants had no comments on the email address field, but wondered what they should do with the username field. Do they create a username or is one given to them? One said,

*"Where you've got username, I would say something like "choose username" or enter username." (P07)*

This raises the question of whether a username field is required. Email addresses are unique and more likely to be remembered by users. Usernames are not used to identify users to other users so their purpose seems only to provide a key field for the database. However, email address would do this just as easily. Consequently, the username field should be removed.

Again, the password field posed no problems, but users wondered if there were any format requirements they should be aware of:

*"And has the password got to be at least 8 digits? Characters? And have some got to be capitals? Does it need to a certain length or can it be three characters?" (P12)*

This should be considered and instructions provide as part of the text requesting a password.

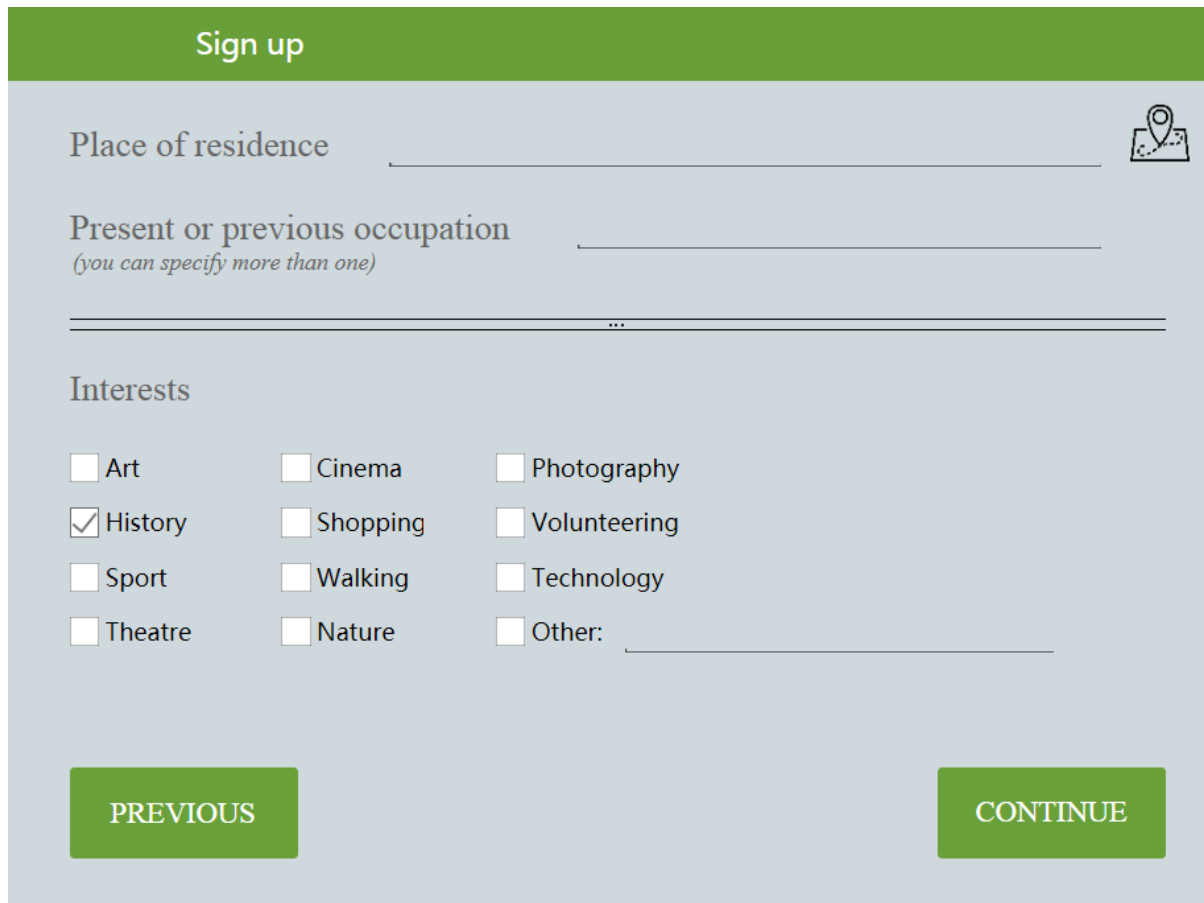
When the participants were asked to provide their name, one mentioned that it would be best to split name up into first and second names. This seems like a sensible proposal given that in some cultures, the family name is stated first, followed by the personal name. Other users of the system may be confused as to how to address such a user. Consequently, requesting personal name and family name seems suitable.

For the age field, one participant was pleased that it asked for age rather than date of birth:

*"I'm very comfortable with it because it doesn't ask me for my date of birth it just asks my age. So it's got a choice of 365 days. So that's a secure thing. I would have been a little bit unhappy if it had asked for my date of birth. And if I filled that in I would have lied... I would have kept the year the same." (P07)*

However, this raised the question of whether age was better to capture than date of birth since the latter is static but the former is not. Given the information provided by P07, however, it seems that date of birth is sensitive to some people at least. Perhaps asking for year of birth would be appropriate.

The gender field posed no problems for participants but numerous participants raised the issue of transgender persons. They suggested that an "other" option would be suitable. This should be considered.



The image shows a sign-up screen with a green header bar containing the text "Sign up". Below the header, there are three main sections: "Place of residence", "Present or previous occupation", and "Interests".

**Place of residence**: A text input field with a map icon to its right.

**Present or previous occupation**: A text input field with the subtitle "(you can specify more than one)" below it. Below the input field is a horizontal line with three dots in the center.

**Interests**: A section with a grid of checkboxes and labels:

<input type="checkbox"/> Art	<input type="checkbox"/> Cinema	<input type="checkbox"/> Photography
<input checked="" type="checkbox"/> History	<input type="checkbox"/> Shopping	<input type="checkbox"/> Volunteering
<input type="checkbox"/> Sport	<input type="checkbox"/> Walking	<input type="checkbox"/> Technology
<input type="checkbox"/> Theatre	<input type="checkbox"/> Nature	<input type="checkbox"/> Other: _____

At the bottom of the screen, there are two green buttons: "PREVIOUS" on the left and "CONTINUE" on the right.

Figure 5: Sign-up screen 2

For the second sign-up screen, participants were asked to type in their place of residence. This was felt to be too formal:

*"That looks rather formal. Can't you have, 'Where I live'?" (P07)*

Alternatively, a simple request for "address" would be suitable, or "town/city" depending on how the data will be used. However, as one participant pointed out, more than one line is required if address is required:

*"That is not clear whether you are talking about the country, the town or the precise address. You might need more than one line [if it's address]" (P12)*

Beside the "place of residence" textbox there is a map icon for locating the user, which brings up the following screen:

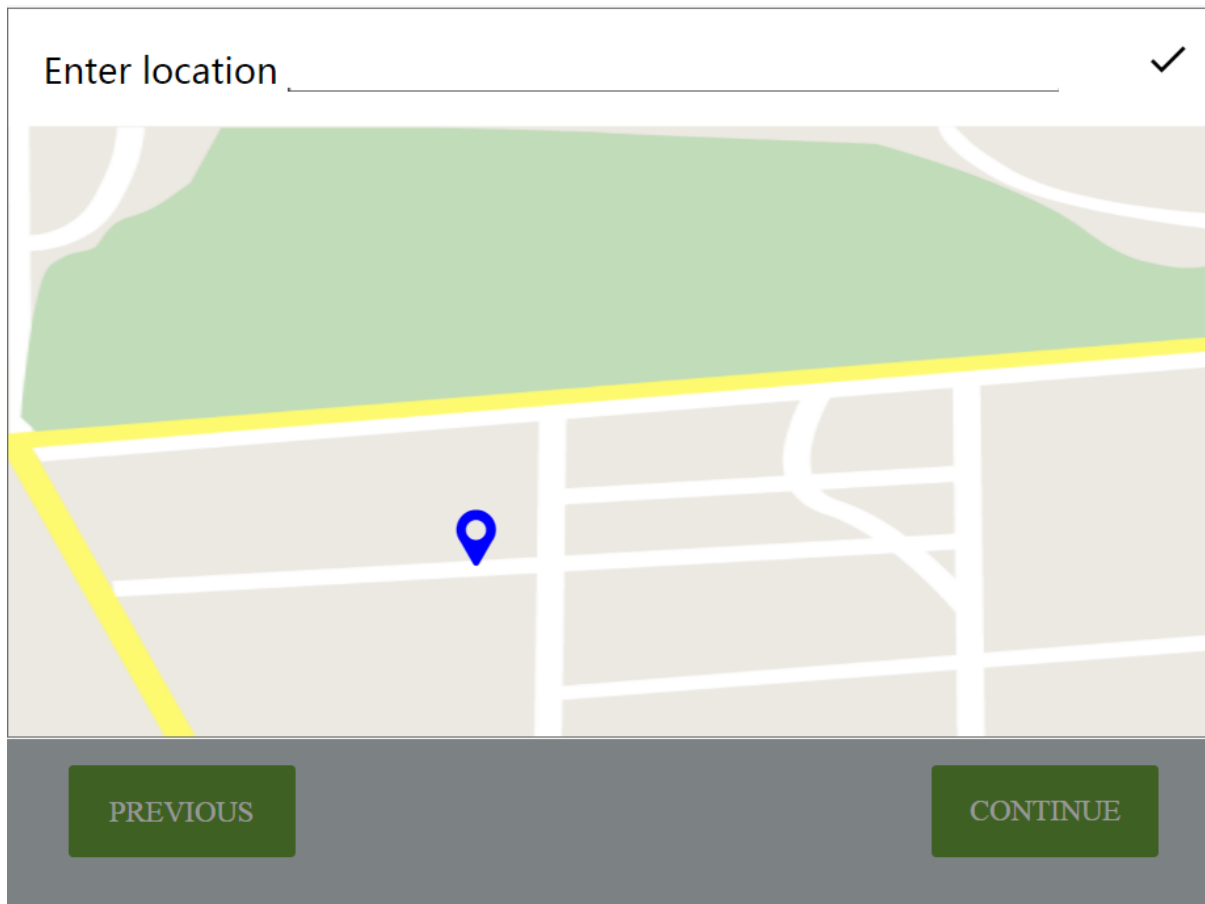


Figure 6: Location finder on sign-up screen 2

Users were not very familiar with the map icon. This can be resolved by providing an icon list at the start of using the system. Common icons like this would be explained and would allow users to easily access the features without wondering what the icons meant. There were numerous other issues with this feature. Firstly, the presence of the “previous” and “continue” buttons beneath the map confused some users. These should be hidden. Secondly, the tick button was not meaningful:

*“Just a tick is not very meaningful. I’m not sure what the tick button does.” (P12)*

Perhaps this could be changed to a “confirm” button. Thirdly, this screen raised security concerns:

*“Personally, I wouldn’t have that [map feature]. ... I wouldn’t narrow it down to one street. That’s an invitation [for problems]... From a security point of view, I wouldn’t want to narrow it down.” (P07)*

This raises the issues of (a) whether the map/location screen is needed and (b) whether it imposes unnecessary detail in data-collection from users. The answers seem to be no and yes respectively; a map is not needed to locate a user’s house since they already know their address/town. And to collect their precise location is more data than is needed for the system to function. Generating localised recommendations only requires a rough location. It is suggested therefore, that the map feature here is removed.

The occupation field was easily completed by users, but one participant noted that multiple occupations were possible but did not know how to input multiple occupations and how to format the multiple entry (commas? semi-colons?). Another said,

*“it should be a drop-down list rather than free-form entry. ... The problem with free-form entry is you could put in teacher with an e rather than an ea. If it’s going to be used to connect people, there needs to be a common understanding of what it means.” (P10)*

This is a crucial point and means that participants should be able to select occupations from a pre-populated list. Perhaps they can scroll through a list, tick a box beside an occupation, and the screen would then display a row of selected occupations above the drop-down list. A similar solution would

work, even if not identical, as long as the rationale is upheld (i.e. free-form entry allows duplication and makes matching difficult).

After entering occupation, participants enter a couple of interests. While this was easy to do, one participant said,

*"It probably doesn't matter how you list these - alphabetically, intellectually - ... I don't suppose it makes any difference how you list them." (P07)*

While this point is acknowledged to some extent (the exact ordering does not matter), on reflection, with an increasing number of interests, this list will need to be restructured. Similar to the solution suggested above, a list (drop down or scrolling list) with check-boxes would allow several options to be selected. Selected interests should be displayed beside the list of options to identify what options have been selected (since the scrolling of the list occludes many of the options that have been already selected).

While an "other" option is provided for interests, it was pointed out that,

*"It says 'other' - I can think of lots of things." (P01)*

Clearly, more than one "other" option should be provided. A text field allowing for a comma separate list may be suitable.

After clicking "continue", participants moved to the third sign-up screen.

Sign up

Recommend events for me within  kilometres

Usual transportation modes

☐ Car

☐ Taxi

☐ Public transportation

☐ Other:

PREVIOUS FINISH

Figure 7: Sign-up screen 3

Participants understood how to enter a distance for recommended events, but most said that they would prefer to state the distance in miles rather than kilometres. This point was raised at several locations in the interface.

One participant also suggested that walking be added to the list of usual forms of transportation. Because this is such a common form, it should be added as an option.

For each of the features, we present the following table in which the feature is broken down into a series of tasks and sub-tasks. In the table below, the authentication feature is shown, broken down by subtasks. Only the sub-tasks requiring assistance are noted, given that problem-areas are most important when considering how to best improve the UI.



Table 2: Task completion for signing up

Task	No. of subtasks	Subtask	No. needing help	Description
Signing up	20	Photo button	1/3	Participant did not know to click on the icon to access photo options
Page 2		Map	1/3	

Table 3: Authentication suggested changes

No.	Old	New	Justification/Description
1	Keep me signed in	Remember me	It seems natural to keep users signed in. They are however, concerned whether the system remembers their password or not (for ease of use and security reasons)
2	Click here	Click <b>here</b>	Reduce spacing between words and make "here" bold.
3	SMS	text message	Text message is more familiar terminology. Make screen adapt to identify what kind of message has been sent.
4	New user? Click here	If you're a new user, click here to register	Provides more clarity to users
5	New user feature	Place frame around new user feature text and frame around existing user elements	This will allow clearer distinction of what to do as a new user and what to do as an existing user
6	Click here	Click <b>here</b>	Reduce spacing between words and make "here" bold.
7	Photo button	Add text saying, "Add photo" beneath icon	This will make the button clearer to users
8	Username field	Remove	Email address is a unique field that can be used instead of username
9	Password field	Provide format instructions if necessary	If the system requires a specific format of password, this should be clearly specified
10	Name	Personal name and family name	Split the field into two to allow for clear identification of personal and family names
11	Age	Year of birth	Age is a changing variable whereas date of birth is not. Some pps prefer providing less detailed information than full date of birth hence, year of birth
12	Gender	Add "other" option (or similar)	Participants raised the issue of transgender persons.
13	Address/residence	Address (multiple lines) or town	Place of residence was too formal. More than one line is required if address is required

14	Previous + continue buttons beneath map screen for location (but see 16)	Hide buttons/maximise map window	The buttons beneath the map confuse users
15	Tick button (map window); but see 16	Confirm button	Change tick to a “confirm” button for clarity
16	Map window	Remove map	Map is not needed for users to specify where they live
17	Occupation	Provide pre-populated list	Free-form entry can create duplication through synonyms or errors
18	Interests	Sort the list (probably alphabetically) and put in a list	Too many checkboxes will not fit on the screen and they would need to be sorted in some way to make finding interests easy
19	Interests	Provide multiple “other” options	Perhaps a text field allowing multiple entries separated by commas would work. But the instructions should be provided beside the text box (separating interests by commas)
20	Distance for recommended events	Change to miles rather than km	British users are more familiar with imperial units (esp. older people)
21	Usual transportation modes	Add “walking”	This is a common form of transportation

### 1.3.2 Garden/Activities after login

Immediately after signing in, participants are shown the following screen:

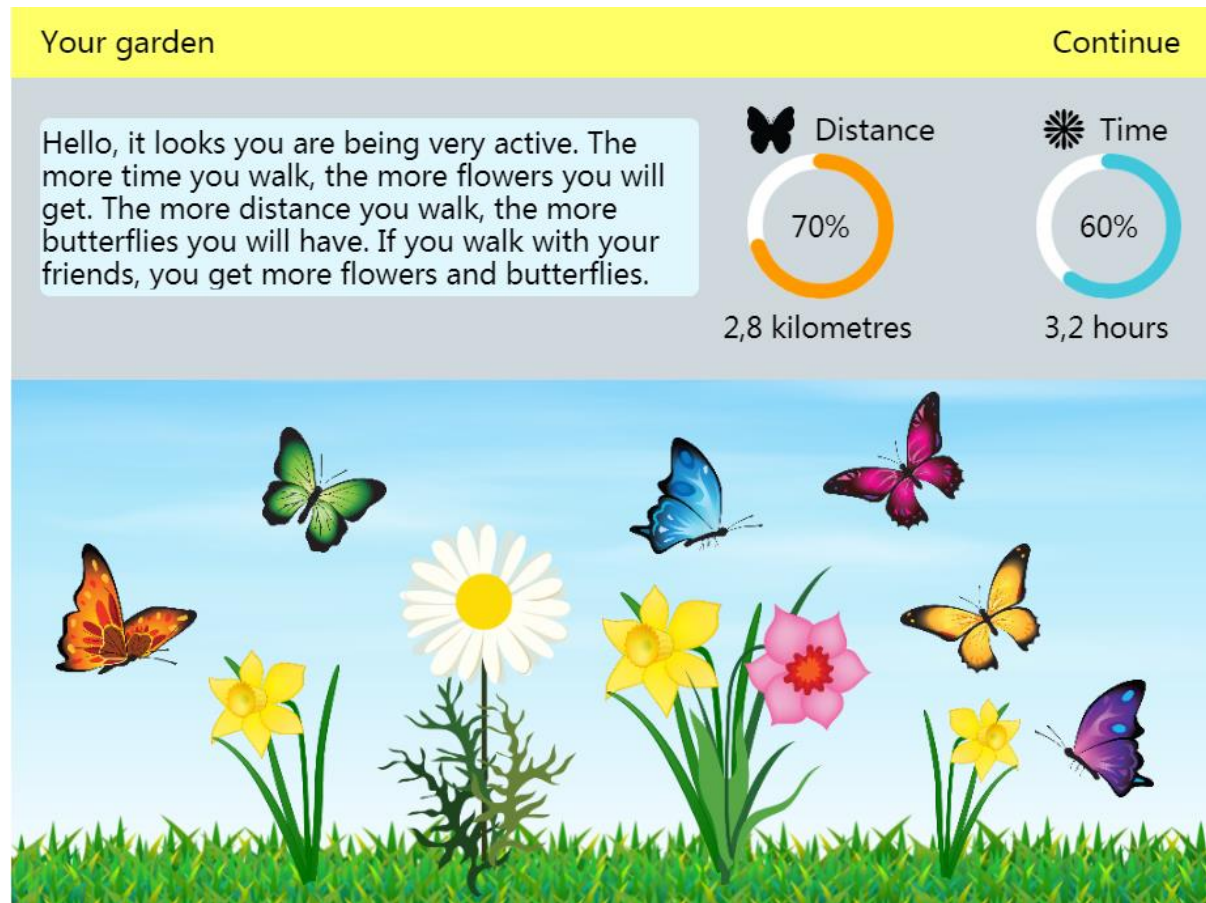


Figure 8: Post sign-in activity screen

While further comment on this screen is reserved to a later stage (where it reappears in the Events section), for now some comment can be made on the structure (i.e. having it appear immediately after signing in). Numerous participants (3) expressed surprise that this was the first screen. One said:

*"If there was a diary, I'd expect the diary would be the first thing to see what's coming up today, tomorrow, etc. That would be my priority."* (P10)

Another said,

*"I would expect like a main page, an index or something. I would expect a general thing, not a specific thing [after logging in]"* (P07)

Given these concerns, it is worth revisiting whether this should be the first screen that participants see when they use the system. As P07 says, it makes more sense to see a general overview to begin, rather than something more specific. Indeed, this has the potential to frustrate users if they are trying to quickly access a section of the system (e.g. events).

Table 4: Suggestions for changes in login sequence

No.	Old	New	Justification/Description
22	Show garden screen after login	Show home screen after login	Participants expressed a preference for this and it seems natural given that they may be trying to quickly access a different part of the system

### 1.3.3 Home screen

The following is what users see next, after signing into the system.

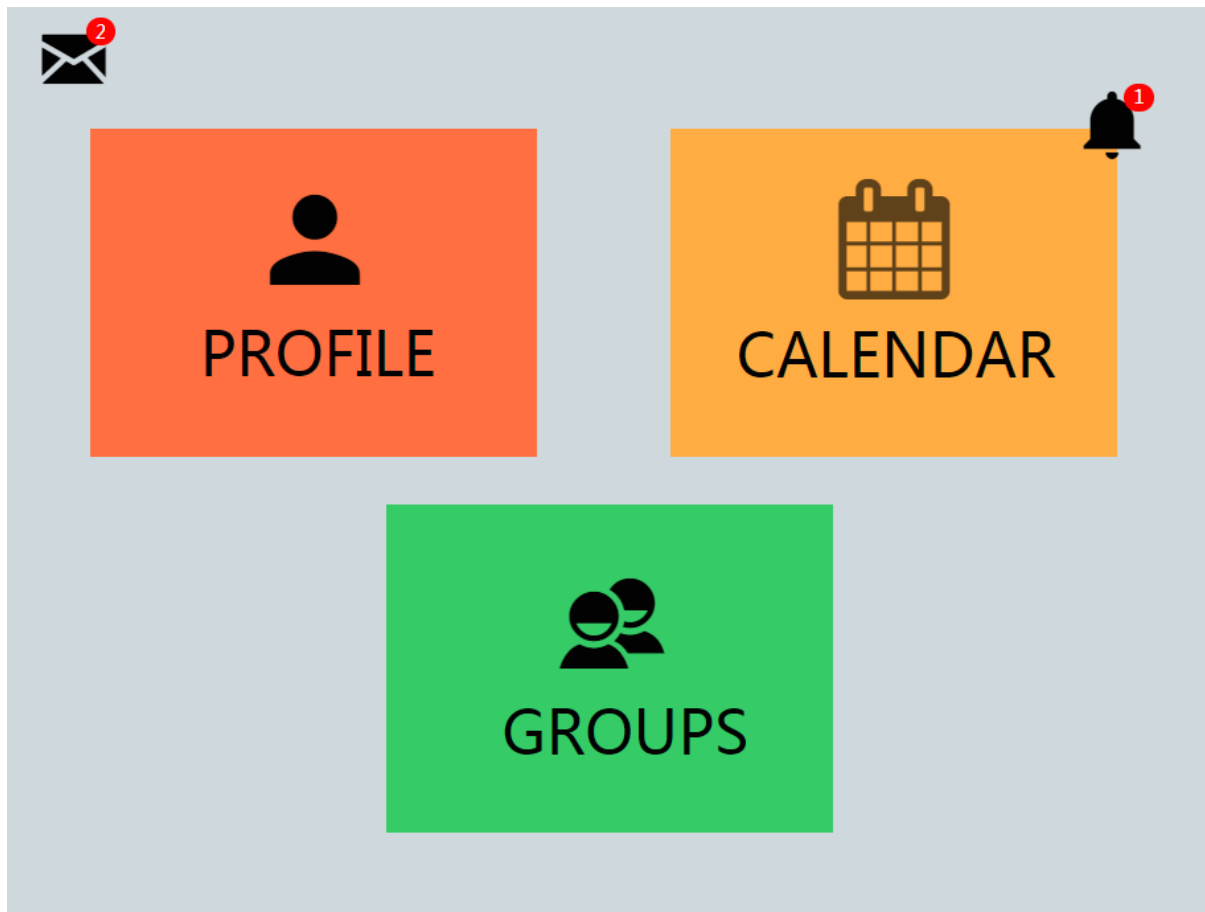


Figure 9: Home screen

Users made some general comments about this. One participant, reflecting on the login sequence and the garden screen said:

*"If the activity log is significant then have a hot button saying, "view your current activity"."*  
(P10)

Given that another participant did not think that the "my achievements" screen (i.e. garden screen) fit with the events section, it may be best to have a fourth button on this screen linking to this.

Another participant was puzzled by the prominence of the profile button. He said:

*"Why would I want to look at that all the time? Why would I want that so prominent? I know who I am, I know what I like. ... So, I would make the profile bit smaller and stuck in the corner out of the way"* (P07)

Potentially, the profile feature could be moved to the menu option on the navigation bar, because as the participant points out, it is not a feature that would be regularly accessed.

Two other, more aesthetic issues were raised. One participant said that the orange and red buttons were too close in colour and should be made more distinct. Another said that the notification numbers were too small. These should be made larger.

Table 5: Suggested changes for Home Screen

No.	Old	New	Justification/Description
23	Structure and placement of garden screen	Place garden (achievements) screen button on home screen	Some participants found it unusual to place the achievements screen either at the beginning (after login) or in the events section. Because it is conceptually distinct from the events

					section, it seems best to put in on the home screen
24	Profile button on home screen		Move profile button to link on navbar menu dropdown		Profile is not going to be regularly accessed by users so it should have less prominence
25	Red and orange buttons		Make colours more distinct		Participant preference and it is easily done
26	Notification numbers are small		Bigger numbers		This makes it easier for participants to read the numbers

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### 1.3.4 Profile

The Profile section of the interface allows users to view the details of their profiles (such as interests and personal details) and to edit these. As noted above, because this is unlikely to be heavily used, it may be better to move it to an option on the menu. This was corroborated by several participants:

*“Does the profile button need to be so big because once you’ve set that up you won’t want to go in and change that too often.” (P05)*

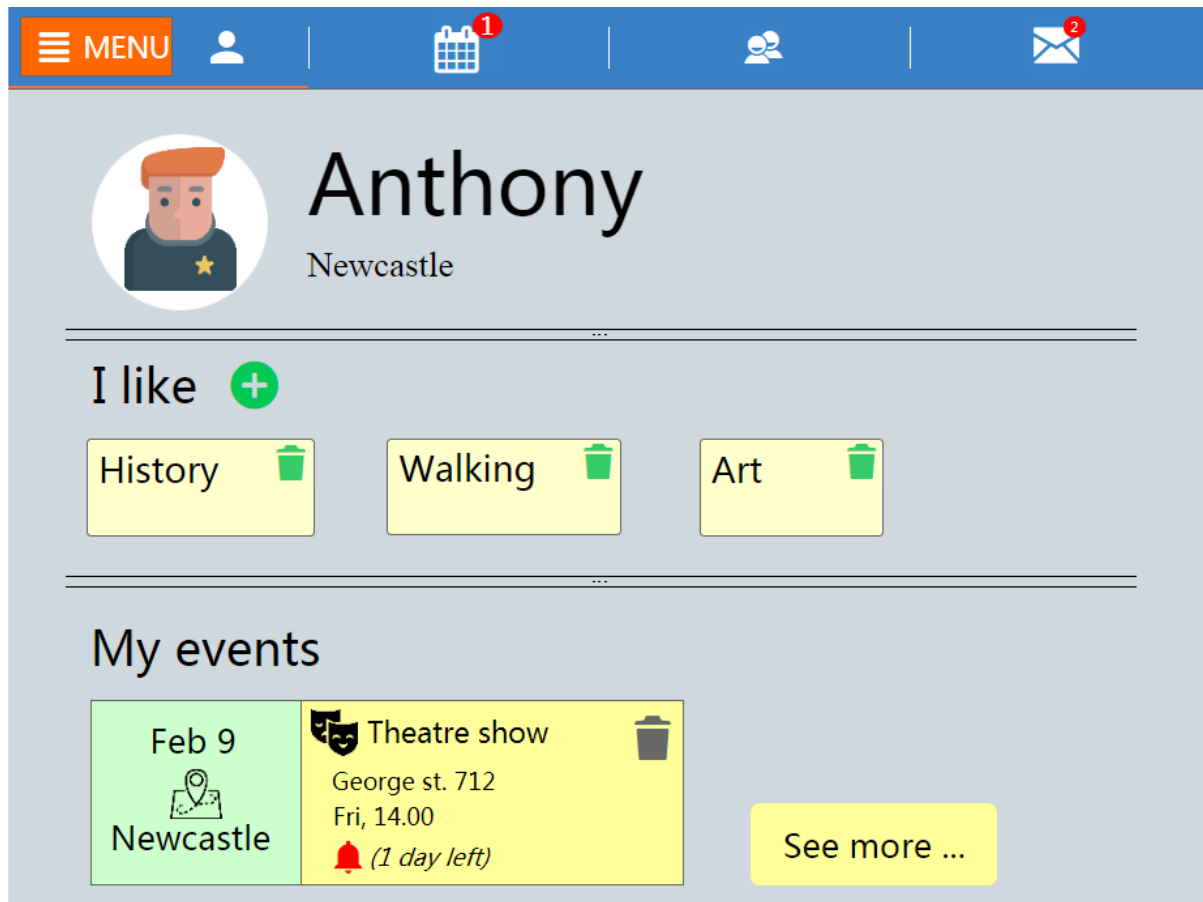


Figure 10: Profile screen

Participants managed to independently complete all tasks required for editing the personal details of their profile, but made numerous suggestions for improvement.

No participants were aware how to access their personal details (via screen shown in Figure 10) but both stumbled on the solution. This requires some indication that by clicking on the name or photo, the profile details are displayed. Perhaps adding a button that says “edit” or a pencil icon button would assist participants.

The next screen is shown in Figure 11.

← Personal ✓

Email \_\_\_\_\_

Username \_\_\_\_\_

Password \_\_\_\_\_

...

Name \_\_\_\_\_

Age \_\_\_\_\_

Gender ☒ Male ☐ Female

CONTINUE

Figure 11: Edit Profile Screen 1

Again, as in the sign-up stage, participants found it difficult to add a photo, even though they eventually figured it out. One said:

*"I haven't a clue how to take a picture. [Afterwards sees how to do it] If those things were there, you know, then I could click on the thing, but I'd forgotten that they were there. If those three options were there now, that would be better" (P04)*

His suggestion is that the menu options (displayed after clicking on the photo) be displayed permanently. While this would assist users in finding the options, an easier solution might be to provide an icon sheet<sup>1</sup> that would inform users that clicking on the "add photo" icon provides a list of options.

For the email field, both participants said that they would want an edit button (like the pencil icon) to be displayed beside the field:

*"With master data, I'd prefer to have a button that says, 'change the information' rather than just to click on the field so that if the thing was to go like that [falls out of hands] and you think oh I got rid of that and I didn't [mean to]. So, click to say I want to change this." (P10)*

This is an important point and an edit button (or pencil icon) should be provided beside the field to change it to avoid accidental deletion or editing. While one participant said he would want a button with words on it, many participants agreed that an icon sheet would be just as helpful.

As with the name field in the sign-up screen, this should be split into two separate fields for first name and second name. Likewise, Age should be replaced with date of birth or year of birth. Additionally, gender should have an "other" option.

The second profile editing page raises similar issues as the corresponding sign-up pages.

<sup>1</sup> This suggestion came from a participant who said, "Maybe to begin with, you do need a page of symbols. Something that people can check back if they're not sure. All the different symbols saying what it is. So that if you're completely new to it there's something to go back to." (P09).

Figure 12: Edit Profile Screen 2

Again, the issue was raised that “place of residence” would be better as “address” (multiple fields) or “town” (depending on what solution is adopted for the sign-up page). Similarly, participants did not think that having a map option was useful:

*“Personally, I would find this a bit unnecessary and over complex. Most of the time I just put in my postcode and then it would give me a list of addresses under that postcode and you select which one. Whereas if you’re selecting from a map [it’s complicated].” (P10)*

Probably, the map option should be removed since it only makes more development work with no advantage to users.

As with comments previously made about occupations, one participant said that this should be restricted to pre-defined options if it is used to match participants. Likewise, recommended events radius should be in miles and transportation modes should include walking.

Editing interests (accessed via the profile screen) encountered more difficulties. The screen can be viewed in Figure 10. One participant found it difficult to add additional interests:

*“If you were wanting to add an interest, what would you do?”*

*I would click on see more [events button]. No, that’s all events. [Back to profile page] So should there be a button like that saying see more there [beside interests]?*

*Have you any idea how you would add more interests?*

*Try clicking on the thing [interest]. Plus! Plus sign [found it]. It wasn’t difficult to find it was just that I was being stupid.*

*I would change the plus sign to use the words, “additional likes” and I think it would be more obvious.” (P04)*

The lack of consistency between the use of the “see more” events button and the “plus” icon beside “I like” has confused the user and these should be made consistent. While the two buttons do not perform identical functions (one adds interests and the other shows more existing events), one uses words and is beside the events while the other uses an icon and is above the existing interests.



Perhaps the plus sign should be moved down beside the interests (to the right-hand side) and a word added to clarify it. Alternatively, an icon sheet may be all that is required.

When the add button is clicked, the available interests are displayed:

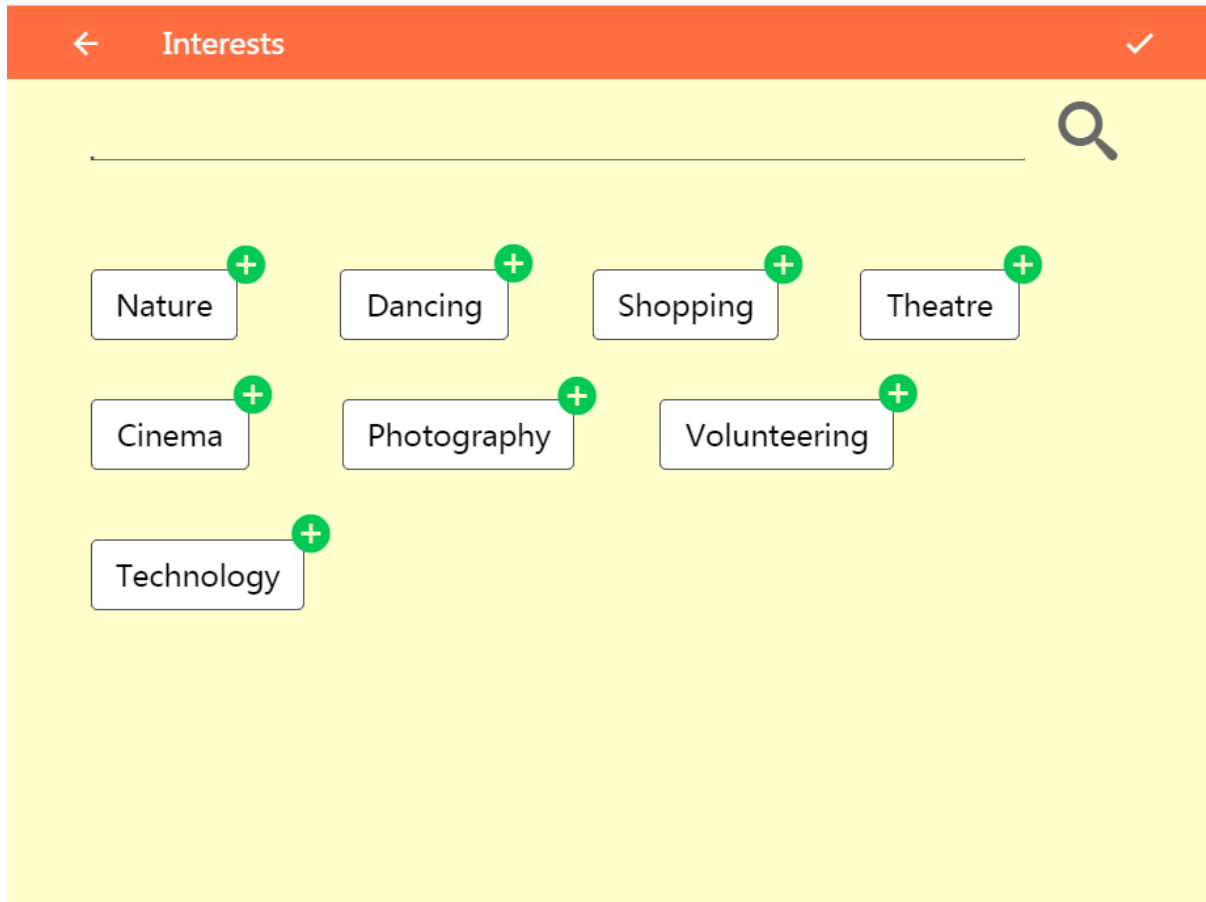


Figure 13: Add interests screen

Participants were asked to search for an interest. One participant found this difficult and tried tapping on an interest to see if it displayed subcategories of interests. When shown the search field, he said:

*"It doesn't say search facility there. That line is a search facility? Ah right, it's like something on my computer that I've seen before - when you put something, when you're searching for something, when you're on my computer screen, tap on internet explorer, instead of entering a website, I put in shoes and then the enter sign. So that's similar to that."* (P04)

He suggested that some words would assist in identifying the search bar. Something like, "Type here to search for other interests" may be appropriate.

When participants want to add an interest, they click on the plus symbol beside the interest. However, this does not provide feedback to the user that the interest has been added and there is no way of seeing what interests have already been added aside from going back to the previous screen. This was pointed out by one participant:

*"I wouldn't know it had been added. Should it not say that in the real thing - 'nature has been added to your interests'?"* (P04)

Therefore, feedback should be added to show that selected interests have been added to the list of user interests.

To remove an interest, users can click on the green bin (Figure 10) beside the interest to remove it. One participant said he would want a confirmation request before deleting:

*"Would you want confirmation when you press the green bin as to whether or not you want to delete it?"*

*Yes. "Are you sure you want to delete this interest?"* (P10)

This should be added to prevent accidental deletion.

The last part of the profile screen (see Figure 10) deals with upcoming events. The only significant comment here is that the text announcing “1 day left” is not meaningful. As one participant said:

*“What does the bell with one day left mean? Is it because it's February the 8th now? What does the bell and what does the phrase “one day left” mean? Is it one day left to do what? Is the booking going to exp[ire]- the deadline for booking is there only a day left?” (P04)*

This should be made clearer to enable users to identify what the countdown of days refers to.

Table 6: Suggested changes for Profile feature

No.	Old	New	Justification/Description
27	No cues for editing personal details	Add button to provide access to editing screen	Users do not know how to access editing screen
28	No editing buttons/pencil icon beside every field	Add editing buttons/pencil icon beside every field	To avoid accidental deletion/editing of data
29	Single name field	Split into two fields	Provides easy separation of first and second names
30	Age field	Date/Year of birth	Age can be calculated from DOB. Age changes so is an inappropriate variable to collect.
31	Gender field	Add “other” option	To accommodate other options
32	Place of residence	Address/Town	To be less formal and clearer about what it required
33	Map icon	Remove map feature	Users do not want it and it requires additional work to implement
34	Occupation field	Provide pre-defined options	Needs to be restricted to specific options to allow for matching (see sign-up page comments for suggestions)
35	Recommended events radius (in km)	Change to miles/offer choice	For English usage, miles is preferable
36	Transportation modes	Include walking	This is a common form of transport
37	“Add interest” icon	Move to same level as interests	This may make it more obvious. Also, add words or use icon sheet
38	Search for interests	Add words to search bar	This will help explain the functionality to users
39	Add interest	Provide feedback. Show existing interests.	Feedback is important for users to see that the action has been accomplished. Existing interests allows them to see what they still need to add
40	Remove interest	Provide deletion confirmation	To prevent accidental deletion
41	1 day left countdown	Provide clarification	Users do not know what the day countdown refers to

Table 7: Task completion for editing profile

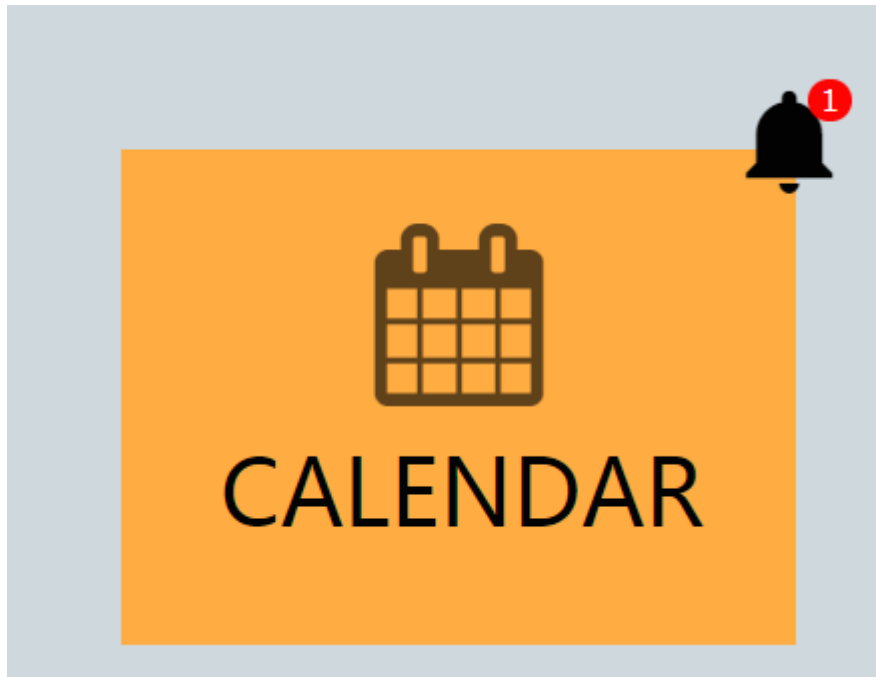
Task	No. of subtasks	Subtask	No. needing help	Description
Edit interests	6	Click add interest icon	1/2	User found it hard to identify plus icon

Enter data in search field	1/2	User doesn't recognise the search field as a search facility
Click search icon	1/2	As above

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### 1.3.5 Calendar

The calendar feature allows participants to add, view, and edit events. It is accessed via the Home screen:



*Figure 14: Calendar button on Home screen*

One participant said that they did not know what the bell icon meant and the accompanying number. This can probably be resolved by adding it to an icon sheet provided to participants.

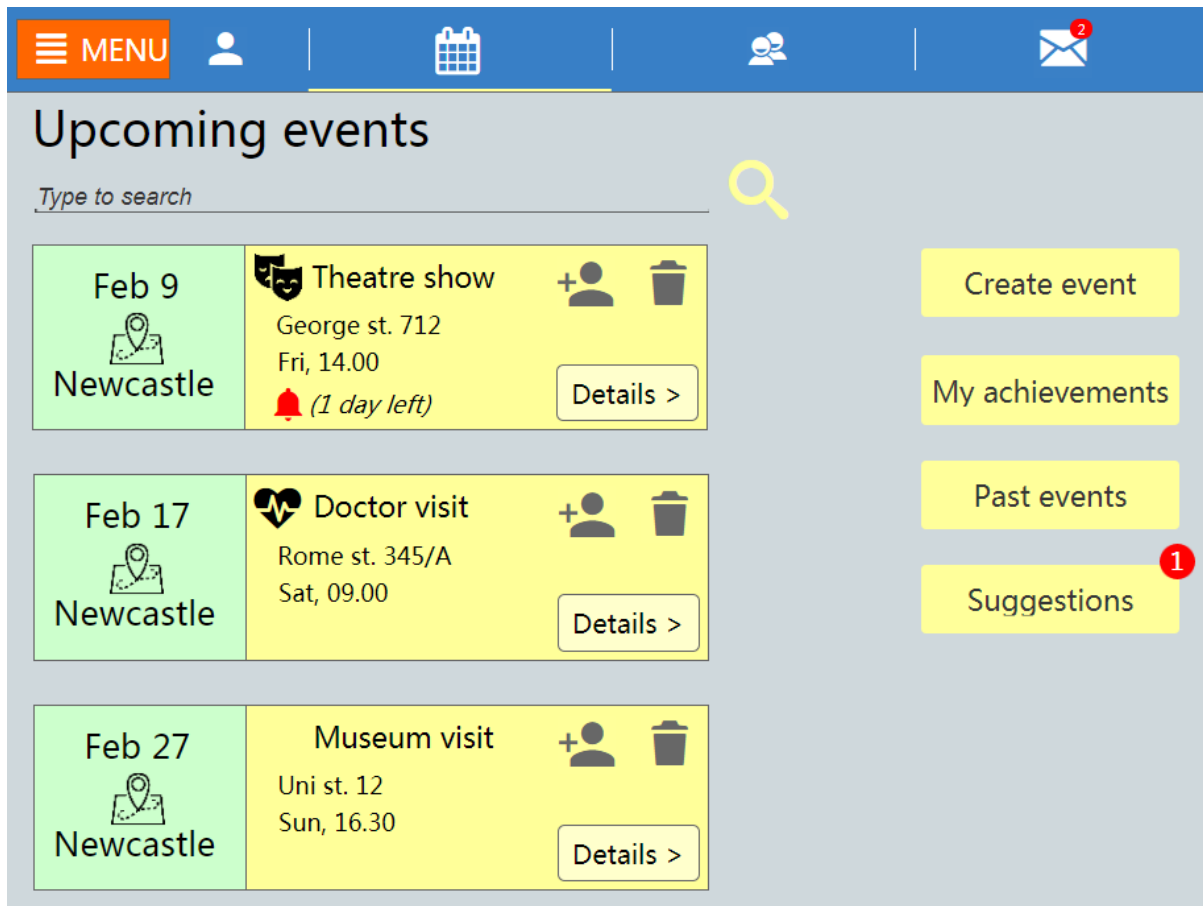


Figure 15: Calendar screen

Some general comments were made about the Calendar screen (as shown in Figure 15). A frequently made comment (3/5 participants) related to the inability to see days when the user was free:

*"It doesn't give me a picture of busy-ness. So, if I pull it open for the month of February I can see I've got something there, something there, something there."* (P10)

This led one participant to say that it was not a calendar, but more of a schedule or list of events:

*"It's not a calendar, is it? It's just a list of events. Which is fair enough ... I think you'd have to have a visual calendar there. Say you've got the calendar there, you could say, press that and it would change to a calendar [view] on there."* (P07)

This is one option: to provide a separate calendar view. Another alternative may be to place markers between the events so that empty days are represented visually in the schedule. Whatever solution is adopted, the requirement from users is clear, that empty days should be represented in some way.

An already addressed comment relates to the 1 day left notice for the Theatre show. It was noted on the Profile screen that this is not clear. Somewhere, either on an icon sheet or on the screen, it should say what the 1 day left is counting down towards – 1 day left until the event or one day left until a reminder is triggered.

Moving on to the more specific tasks accomplished using the screen, the first task involved editing an event. To do this, they clicked on the "details" button of an event, upon which, the following screen was displayed.

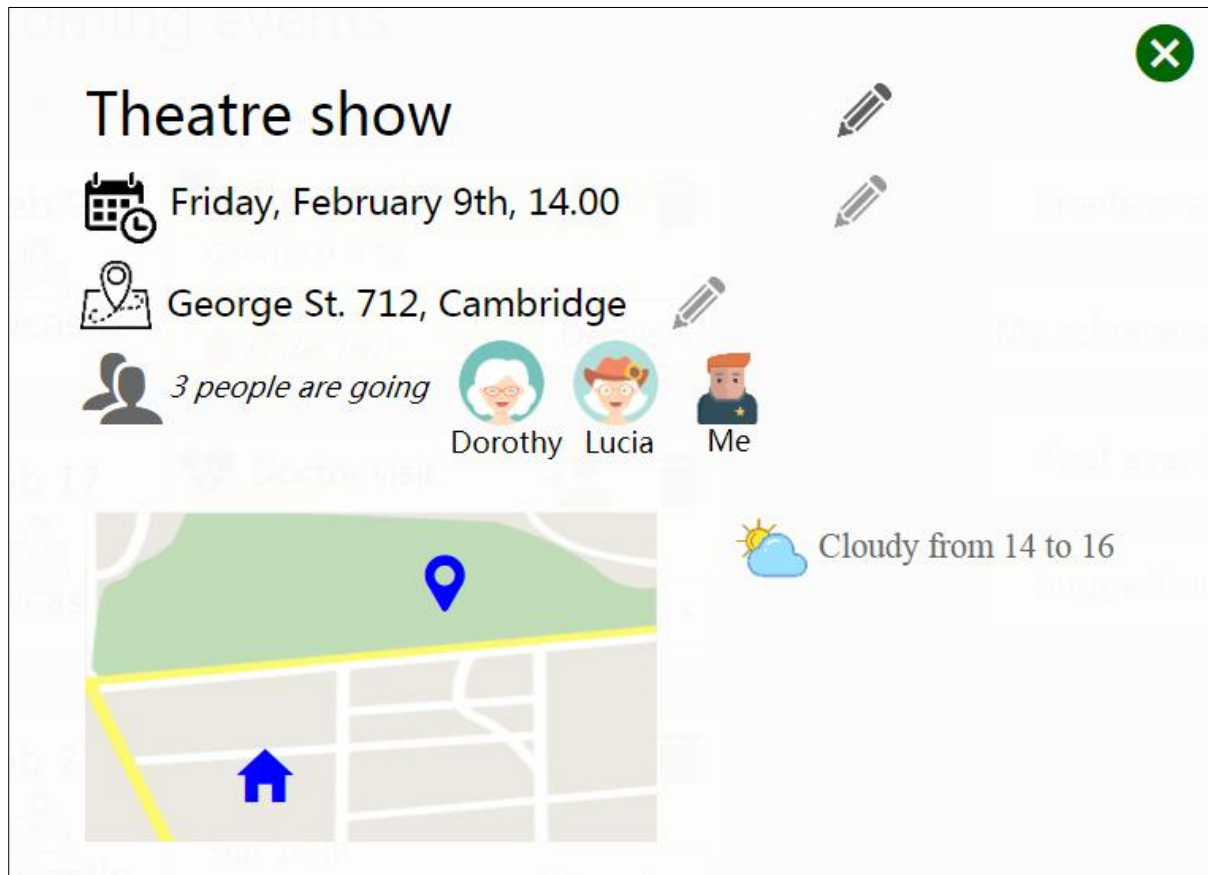


Figure 16: Edit event screen

Participants were asked for general comments on this screen and whether it included all information they want. Several additional pieces of information are required:

*"I'd like to know whether there was an admission fee or whether it was free." (P13)*

*"Accessibility - if you had anyone who has any wheelchair needs or stairs or anything like that, I think a little bit of details on accessibility would help." (P13)*

*"If it was possible, where you've entered this information in there [where the date and location info is], a website address for the theatre? Or a one-line description of what it is? Theatre show, Victorian theatre show, where you can write two or three words which trigger something in your mind." (P07)*

These three comments point out three details that need to be added to an event details screen. Firstly, mention should be made of whether there is an admission fee/cost for the event. Secondly, there should be information on accessibility (as described in D4.8 under the term "mobility tags", p.11). Thirdly, there should be a description of the event (since a description is provided during event creation).

Aside from these user-generated comments, one other comment is worth making from a heuristic perspective: events should only be editable by an event owner and not by an attendee.

#### 1.3.5.1 Edit event details

Moving on to the tasks participants were asked to perform, participants were asked to edit the event title. One participant had difficulty editing the title and said the pencil icon was not meaningful. This would be rectified by an icon sheet. But editing the event had knock-on effects and participants were cognisant of this:

*"[Regarding changes:] But then obviously the participants might actually change. If I change the date to the following Friday, will the system then go to Dorothy and say, 'Hey, we've changed it to the 16th are you still OK with that?' And allow her to confirm. And if Freddy and George had been invited and said they couldn't make it on February the 9th, could you then*

say, "Hey we've changed it now, can you make it on the 16th?" So you could have a grouping [in the UI], for accepted and declined." (P10)

This comment highlights the fact that after editing events, the system will need to (1) alert other users who have agreed to attend, (2) alert users who said they could not attend, and (3) avoid discarding events simply because users say they cannot attend (i.e. it will need to ask users why they are not accepting a request to attend). Regarding the latter point, this is why P10 says that there could be a grouping in the UI for accepted and declined events – so that users can see the events they have declined.

Participants were then asked to edit the location of the event. While they were easily able to do this, it is worth noting that the map is not linked to the event navigation feature. Clicking on the map should lead to event navigation.

One participant said that it would also be helpful to be able to click on a profile image and access the profile of the selected user:

*"If I click on Dorothy will it bring up Dorothy's page?" (P05)*

This not only raises the need to be able to access another user's profile by clicking on their image, but it requires the need for profile pages for other users. While users can currently view their own profile, there is no way of viewing another user's profile.

After closing the event details, participants were asked to navigate to the event. This is accessed by clicking on the map icon (Figure 17).



Figure 17: Event as seen in Events/Calendar screen

2 out of the 5 participants found this difficult. Two participants said that they would click on "Details" and find a navigation option (this will be implemented as suggested above). By creating these two routes (via map icon and via details) to access navigation, this will assist participants in accessing navigation.

After clicking on the map icon, the navigation window appears (Figure 18).

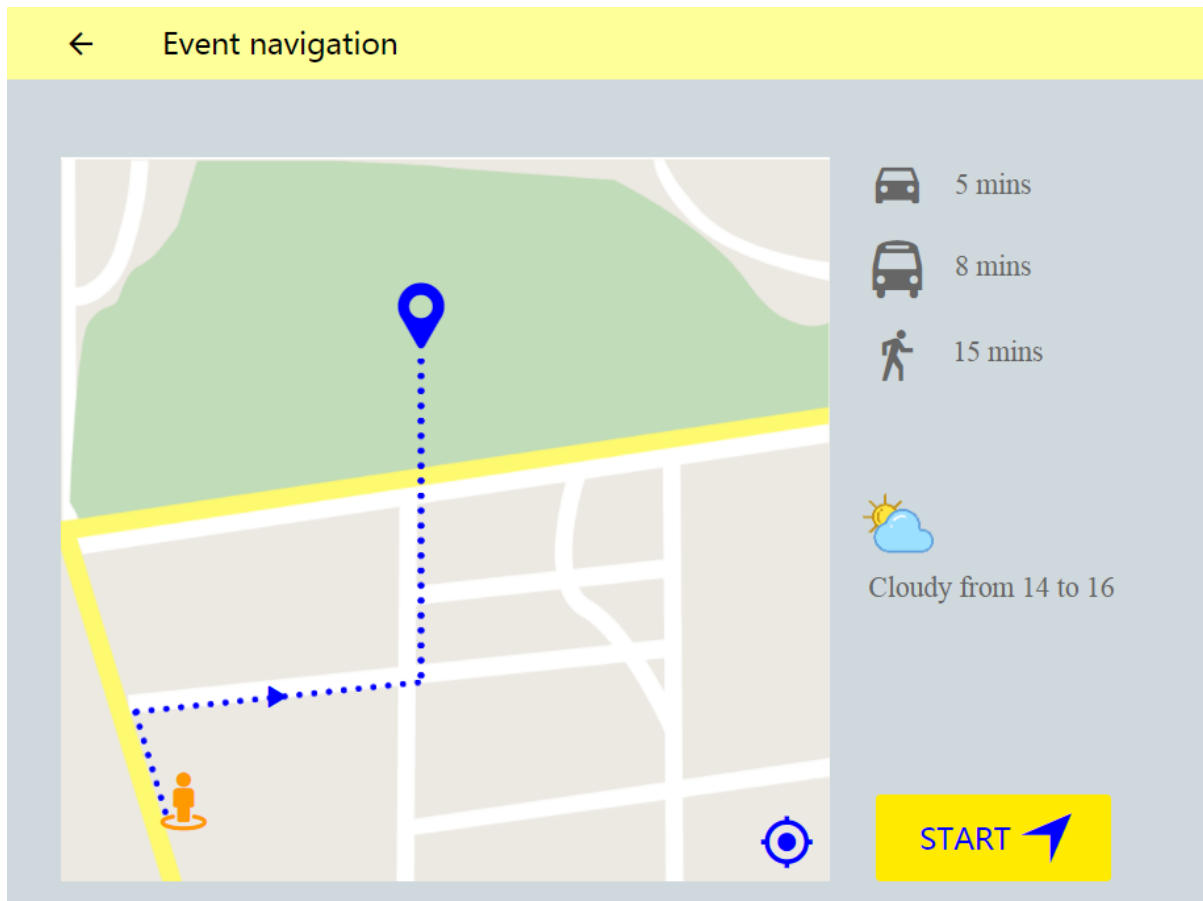


Figure 18: Event navigation screen

Participants were asked to “start” navigation but only 1/5 participants were easily able to do this. Some participants said they did not know what the start button did and one did not notice it. It was suggested that it should be changed to “journey instructions” or something similar. Allowing participants to access the journey instructions before they travel fits more closely with the behaviour of older adults:

*“I would get a bit of paper, I would press the button for going on the bus [bus icon], and you know the way on Google maps you click details and it lists what bus number, I would write that all down on a piece of paper and I would give it to the wife for safe keeping. I lose things. I wouldn't take this with me.” (P07)*

Allowing users to access instructions that they can transcribe onto a sheet of paper is a more natural practice for older adults than having to carry the device with them as it gives step-by-step instructions. Furthermore, the different transport options should be accompanied by radio buttons to allow users to select a form of transportation before getting navigation instructions.

When asked to delete an event from their calendar (by clicking on the bin icon in Figure 17), participants generally knew what to do. Certainly, providing a list of icons would be helpful for those who did not recognise the bin icon. More importantly, however, is the need to have a confirm dialog after clicking it:

*“I would press the dustbin, and probably the words would come up, “Are you sure” And I would say, “Ethel, are you sure we aren't going to the theatre?”” (P07)*

This would ensure that events are not deleted accidentally.

Participants were also asked to add (invite) a person to the event. While one said they would just invite people by phone, they were generally able to use this feature. Adding the icon to an icon sheet is important (some did not recognise it), and it would also make sense to provide a way of adding people from the details view.

After clicking the invite button, the following screen appears:



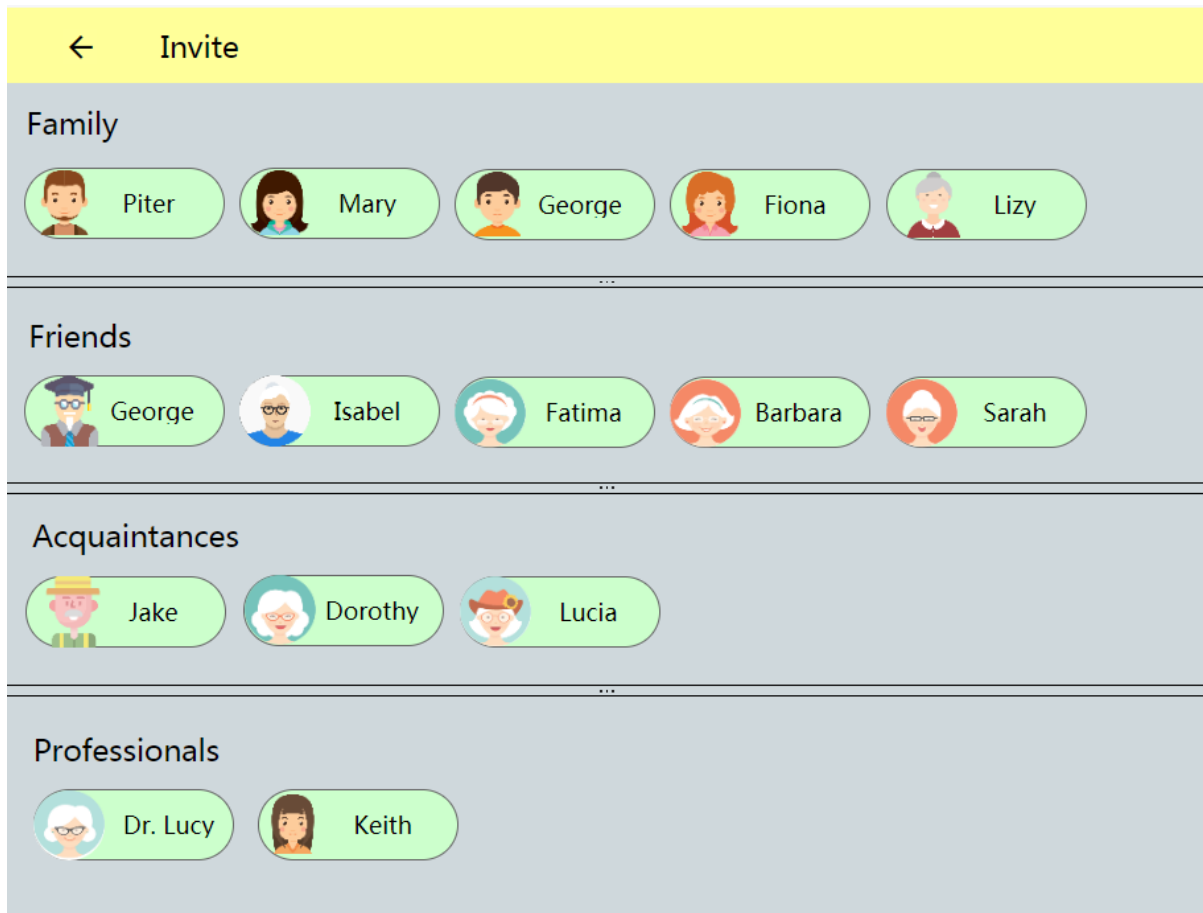


Figure 19: Add/invite friend screen

Participants understood that they should click on a person to invite them. But this window does not show who has already been invited (this should be displayed) and it is not clear how the invitation will appear to the invited person:

*“So that sends a message to him on this website? It doesn't send an email?” (P01)*

There needs to be feedback provided to the user that tells them if a user has been invited (after clicking on their name) and how that invitation will be delivered.

### 1.3.5.2 Search for event

When users were asked to search for an upcoming event, they typically had no difficulties, although one participant said:

*“I don't know what the type to search is. [after explanation suggests]: type to search for planned event or something of that sort.” (P12)*

The current search field (as seen in Figure 15) only says, “Type to search”. It makes sense to expand this for the clarification of users, to something like “Search for upcoming event”.

### 1.3.5.3 Create an event

Participants were then asked to create an event using the system. This is accomplished by clicking on the “Create event” button on the main events screen (Figure 15). The following screen then appears.

Figure 20: Create event screen

Firstly, a heuristic comment: the create event screen should include all mobility fields, interest fields (as specified in D4.8) as well as a cost/fee field. For the system to match users to events, the event creation facility should allow users to specify mobility characteristics of the event, the area of interests that the event would appeal to, and should allow users to see how much the event will cost (if anything).

Another missing field is the “Title”. Users were unable to type a title for the even because this field was missing.

When entering the date and time, participants mentioned that the time field had poor contrast and should be improved:

Figure 21: Date and time entry fields in Create event screen

This is probably just an issue with the mock-up and availability of widgets, but it is noted here for the sake of completeness.

Participants had mixed feelings about the usefulness of the map feature when creating an event. While some thought it would be useful to help people find events, another person said:

*"Which map do you show? Is this my current location?... I would see the map would only be useful after I've told, after I've put in the location. I would just have "enter your location", and then when you've entered the location it would show you the map of where that is in relation to where you are currently." (P10)*

The participant felt that it would be best to get people to enter the location of the event, and then the system might show the location on a map. But prior to entering the location, it was felt to be confusing. However, despite the small amount of confusion, the text field would still allow the user to enter the desired location and then the map would display the location. In other words, it would function in much the same way as the participant requested.

While one participant did not know how to confirm the location of the event (by pressing the tick button), it seems likely that in a working UI, a user would know that they have to do something after choosing a location. Since the only button is the "tick" icon, it seems likely they would select this. However, to avoid confusion, the greyed-out buttons behind the window should either be disabled or occluded. An additional comment, that was not picked up by the participants, is worth mentioning: when the location has been typed in, does the map automatically update the location? Or do users have to press another button to update the map? Presumably the "tick" button will close the window, but this is not helpful if the user simply wants the map to update. Consequently, the map updating should be taken into consideration.

When participants were asked to create a reminder for the event, many of them (3/5) clicked on the icon (which is not an active link). The icon and the text should both be active. There was also some confusion over who was receiving the reminder. Was it reminding the user or the recipients of the event? One participant wanted to set a reminder for attendees of the event, but it would probably be sufficient to clarify that the reminder is for the user. Hence, the text should read, "Click to add a reminder for yourself" or something similar.

Participants could use the link to invite people, although one participant commented that the icon should be active as well as the text. Another participant said that creators of events should be able to set maximum and minimum numbers of attendees:

*"You would say, "I'm thinking of going to the theatre a week on Tuesday. Anybody interested?"... and maximum [numbers of people] to accept.*

*Anything else?*

*Minimum number? [for example] If I can't get three or more people then I'm not going to go."*  
(P10)

This makes sense and it would be wise to allow users to be able to say how many people are needed for an event to run and how many people would be too many. Consequently, optional fields should be provided for this information.

As with editing an event, users should be able to see who they have already invited to the event at the invite screen. There should be some way (whether by greyed out buttons or by moving the person icon to a separate part of the screen) to communicate to users that selected people have already been invited.

After inviting people to attend an event, users are then presented with the option of clicking either the back button or the tick button. It is not clear whether these are different or the same. Consequently, the back button should be replaced with the words "discard" (or similar) and a confirmation message should be produced when it is clicked.

A more general comment about the create events screen (Figure 20) was that the contrast should be improved between the text and the background:

*"The actual colours [grey on grey] are awful. Very hard for people to read. There's not enough contrast there." (P05)*

Finally (with regards to creating events), after the event is created, the "OK" button is not active and fails to take users back to the events screen:

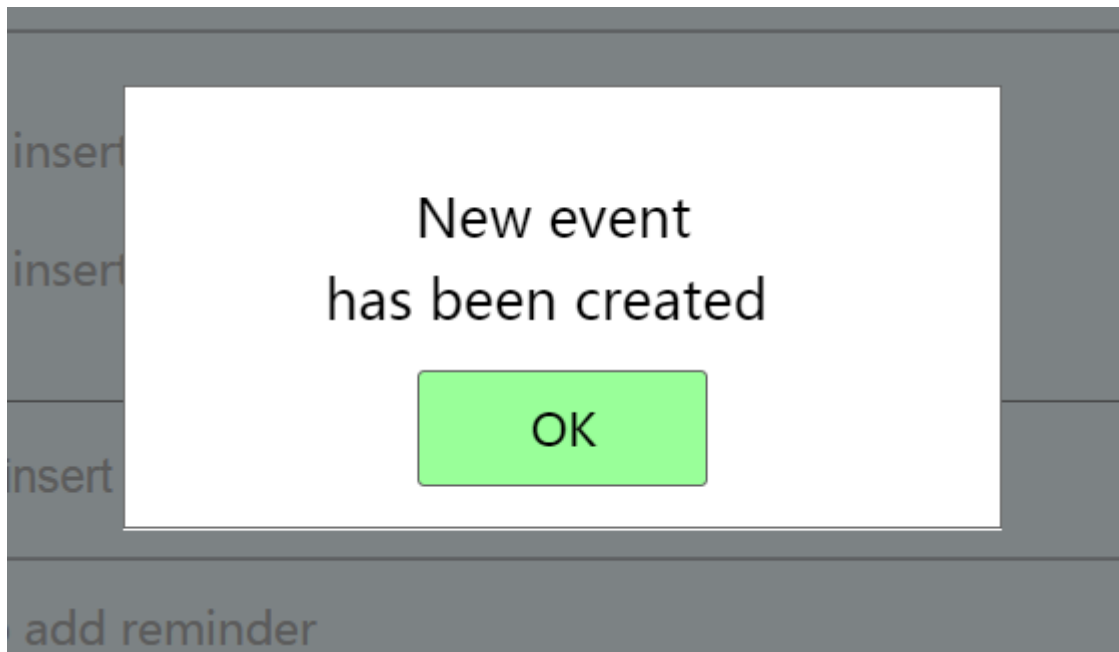


Figure 22: Confirmation of event creation

#### 1.3.5.4 Personal achievements

In the personal achievements screen, users can see the records of their physical activity, set goals for activity, and chat with friends about activity. The central component is the “garden” that grows in accordance with the user’s activity. This is drawn from the work of Consolvo, McDonald and Landay (2009) who drew on extensive theoretical reasoning to produce a behaviour-changing design that would motivate users to be more physically active. However, nearly a decade has passed since this work and there have been rapid changes in technology. Consolvo et al. (2009) used the “garden” on a mobile phone with rather limited graphical capabilities and a very small screen. Furthermore, recent uptake of activity-tracking devices (such as FitBit devices) have produced expectations for how physical activity should be represented visually. The design of the UI that we used is seen below:

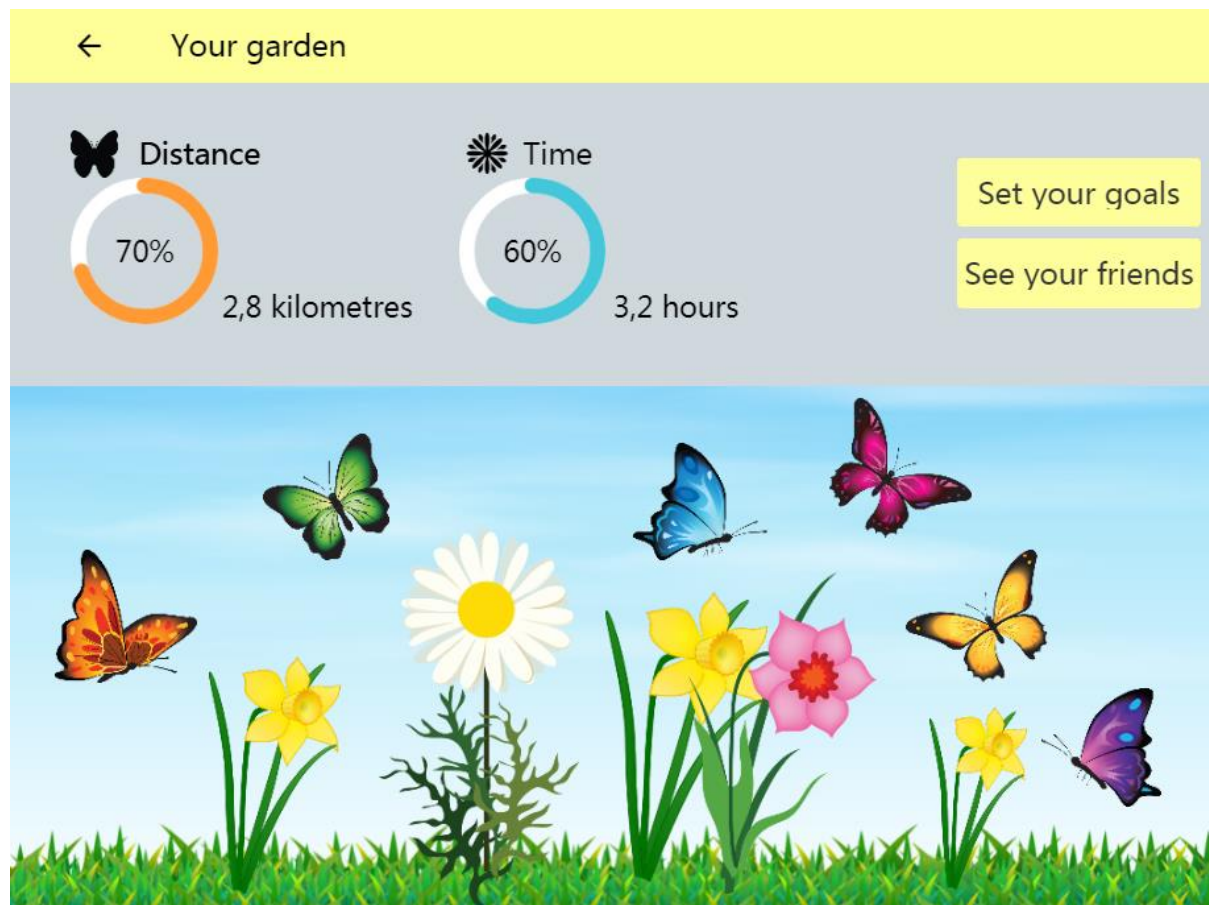


Figure 23: "My achievements"/Garden screen

Opinions about the design varied. One said:

*"Anyone who's not familiar with graphs or designs like this, that is quite a good representation for them." (P11)*

More commonly the reaction was negative:

*"I don't get that honestly. If I wanted to do anything, I would put a heart. Or something representing health. Or have a body. ... Red is healthy, white is.. [i.e. gets stronger or paler colour]. Or sitting lying back, sitting upright, standing, walking, running. You know the evolution one up through the animals, that type of thing of evolution from sedentary to athletic." (P10)*

*"I think it's aimed for the rather senile - the simplicity of butterflies and flowers. And from what I gather, you're expecting your clients to be fairly active on IT. But it looks childish. The bright colours I don't like that either. ... I think straightforward information. And you've got actual daffodils and daisies but I've no idea what this is. And the butterflies aren't authentic either." (P08)*

*"Why does the amount of time I spent walking, how does that equate to a garden? As far as I'm concerned, I haven't a garden, I probably do quite a lot of walking but it's got nothing to do with a garden." (P04)*

These comments show that, at least for some, the garden metaphor is "childish". This may be due to the advances in UI design and graphical displays over the past decade; designs received favourably in previous years may not receive the same reception now. The final comment (P04) noted above is significant (and was echoed by another participant) insofar as it shows a misunderstanding that arose for some participants. These thought that the garden was somehow connected to "walking in the garden" and thus completely misunderstood the purpose of the visualisation. But even for those who understood it, the use of a garden was seen as strange insofar as it did not communicate a message about *health*. It seemed a stretch to translate physical activity into the growth of a garden.

To revise this presentation of physical activity, two thoughts should be kept in mind: (1) The garden does not communicate clearly any ideas about optimum activity levels or any clear measures of progress (the growth of the garden is not clear because the growth of a flower or appearance of a butterfly bears no clear connection to a specific amount of activity). Any visualisation of activity that aims to incentivise achieving a goal should have clear indicators of progress and a goal state. (2) The visualisations most commonly associated with physical activity are presented at the top of the garden screen and these were most readily accepted by participants.

As for the placement of the garden screen in the events screen, a user said that since this was the “achievements” screen, it does not belong to the “events” screen. This was only mentioned by one user but it is a valid point. Perhaps a better placement would be a link at the home screen. This way, it could be avoided as a page before the home screen and would be more accessible than being a sub-page of the events screen.

Afterwards, participants were asked to set their goals using the interface. When they clicked on the “set your goals” button, the following pop-up screen appeared:

Figure 24: Goals pop-up

After seeing it, one participant said,

*“It’s walking I assume?” (P13)*

This raised the question of whether it measures different activities (e.g. walking, running, and cycling) or includes all activities. This should be specified in the UI and different goals should be possible for different activities if this functionality is intended by the system.

Additionally, not all participants knew what would be an appropriate target to set:

*I would anticipate putting in age, general fitness ... I would expect it to come up with a recommendation or an optimum, minimum, maximum, well not maximum but this is your optimum, this should be your minimum. (P10)*

Currently the goal is set entirely by the user without any guidelines. Perhaps some should be provided. For example, some research has suggested 30 minutes moderate activity for most, if not all, days of the week (Pate et al., 1995) while more recent health promotion strategies have focussed on ten minutes of brisk walking per day (Brannan, Varney, Timpson, Foster, & Murphy, 2017; NHS UK, 2017).

Regarding the goals set, participants noted that steps would be a more useful goal than distance or time:

*“I think more people would be interested in steps. I think health professionals recommend you do 800 steps. Is it? ...” (P05)*

While recommendations vary, the 10,000 steps target often suggested (Choi, Pak, Choi, & Choi, 2007) is a useful target with health benefits for overweight older adults (Schneider, Bassett, Thompson, Pronk, & Bielak, 2006). Perhaps steps ought to be added to the list of possible goals.

Again, for distance, participants expressed a preference for miles instead of kilometres.

One participant asked if the targets were cumulative or alternative. While the radio buttons suggest that daily, weekly or monthly targets are alternatives, the participant expressed a desire to have cumulative targets:

*“So you could say I want to do this each month, and ok there will be some weeks when I'm more active than other weeks and similarly within a week there might be five days where I beat my target hands down and two days where I slob out. So I can miss my daily target but still meet my weekly target.” (P10)*

However, this would require a more complex interface, preferably with separate sections for daily, weekly and monthly targets. While this may be preferred by some users, our current preference is for simplicity and thus we will keep the targets mutually exclusive.

There is, moreover, another issue with the targets, and this relates to whether the weekly and monthly targets run for calendar weeks and months, or whether they run for 7 days and 28 days respectively. This should be made clear in the interface.

After setting goals, the circles in the “my achievements” screen display the extent to which the user has achieved their goal. But one participant asked:

*“Say I've achieved my 2.8 and I go over it, what happens? I'd have flashing or something that I've achieved it. ... I'd like some little reward or something.” (P13)*

Clearly, there needs to be some way of marking the achievement of a goal, and some way of indicating performance that exceeds the goal.

In the personal achievements screen, users can also view their friends' activity and chat to these friends. This screen is shown below.

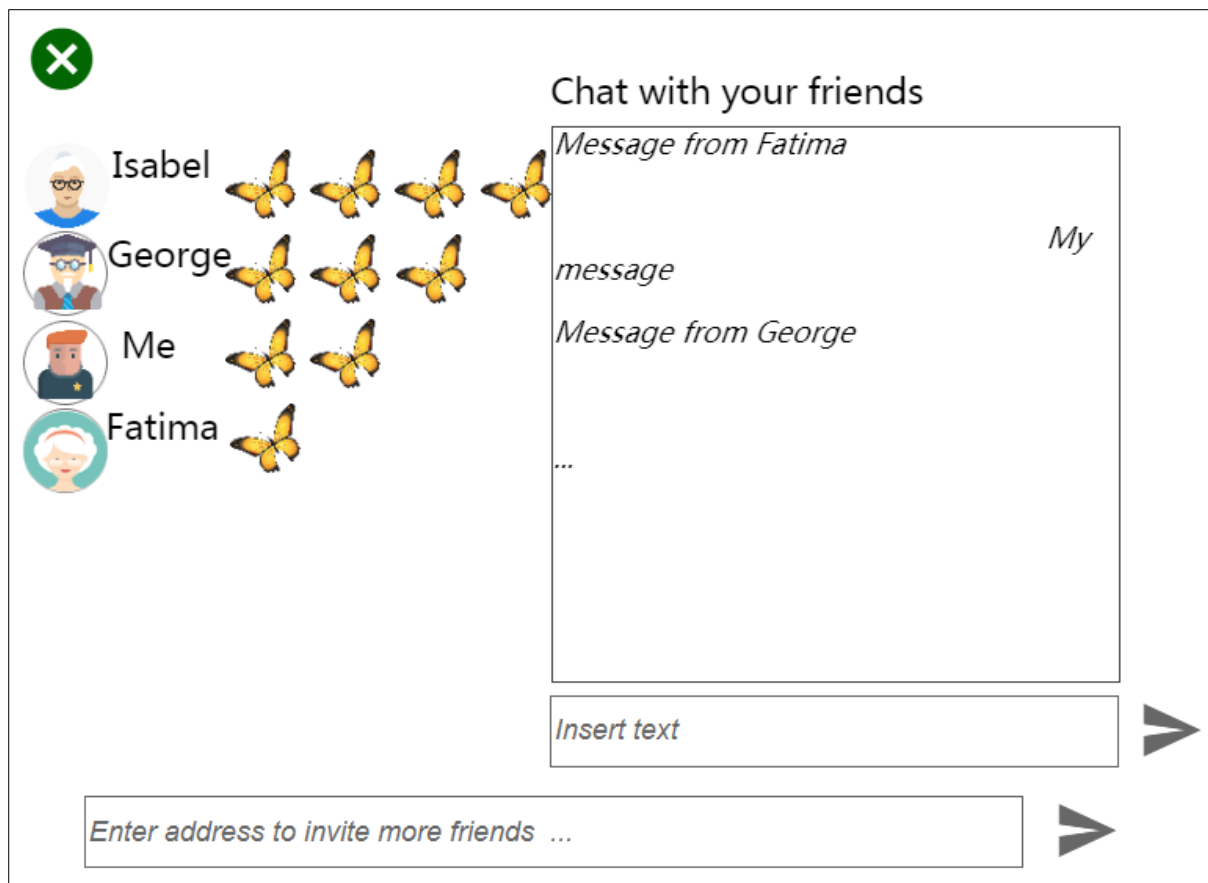


Figure 25: View of friends' activity and instant messaging

One of the issues that emerged when discussing this interface was what the butterflies represented. 3/5 participants said that they did not like or understand the butterflies. One said that simple numbers would suffice (e.g. “4.2 miles”), another said that footsteps might work, while another suggested stars. At any rate, a key should be provided to indicate what each butterfly represents. A less serious



comment suggested that the space between each user should be increased and the butterflies lined up more precisely with each user.

While this issue was not picked up by participants, it remains unclear what happens when someone types in an address to invite more friends. Presumably the recipient would receive an invitation to join the chat, but this request would need to be designed.

Another issue, this time picked up by a participant occurred when using the “enter address to invite more friends”. One participant thought that “inviting” a friend meant that you were inviting them to an event:

*“Say I wanted to invite Fatima out for coffee, because she doesn't look as though she's active, [I'd type], would you like to meet me for coffee on Tuesday.” (P13)*

For clarity's sake, it would be best to change the text from “invite more friends” to “invite more friends to chat”.

Another confusion arose when sending messages to friends. One participant thought that to send a message, she would click on the icon of the person, and then type a message to them. Perhaps it would be best to change, “chat with your friends” to “chat with these friends” to make it clear that people on the left can see the chat. Perhaps, the incomplete nature of the interface (i.e. only placeholder text in the interface) did not help to provide cues to participants about how this feature works.

After participants typed a message to their friends, they were asked how they could invite more friends to the chat. To do this, they had to enter an email address and press the send button. However, 3/5 participants said it would be easier to write their friend's name rather than their email address:

*“Instead of address, enter username because you're more likely to remember a person's name than their email address. ... And I've got 5 email addresses.” (P05)*

Participants could also access more detailed charts of their physical activity via the “my achievements” screen. It was accessed by clicking on the circle diagrams at the top of the screen (Figure 23). This opened the following screen:



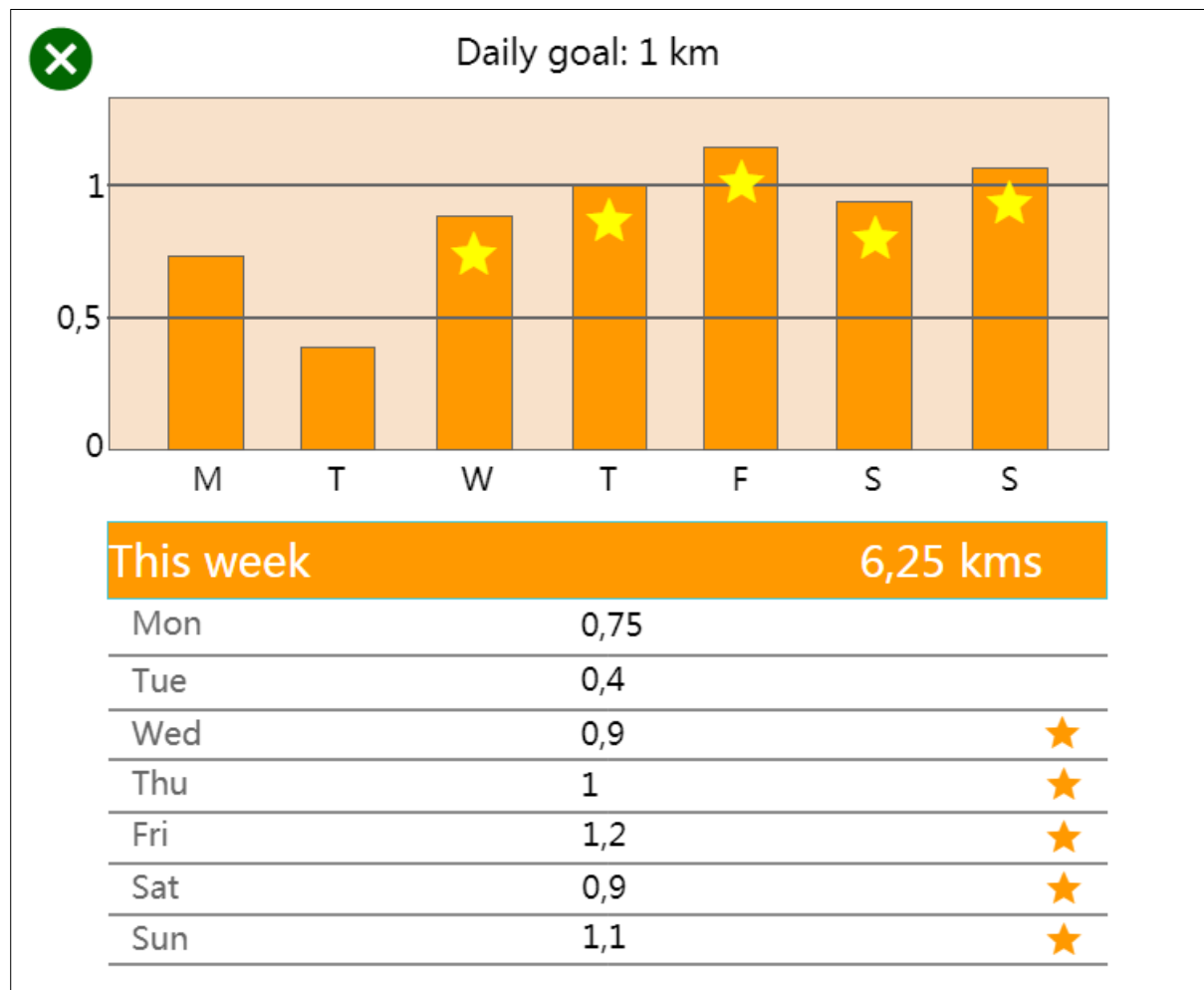


Figure 26: Detailed physical activity chart

The main difficulty with this was that it was not clear that clicking on the circle diagrams would open these charts. While some participants found it, all participants remarked that it was not clear:

*"I know you suppose, this is why kids master computers because they're prepared to tap where they're not supposed to tap. Old people won't because they'll break it. So, it's got to have instructions - tap for bar chart."* (P08)

To help users, there should be clearer instructions on the "my achievements" screen on how to access this "history" or "detailed chart" of activity.

### 1.3.5.5 Edit past events

Users can view their past events and submit ratings of those events and perform other actions such as adding photos of the event. The past events screen is displayed below:

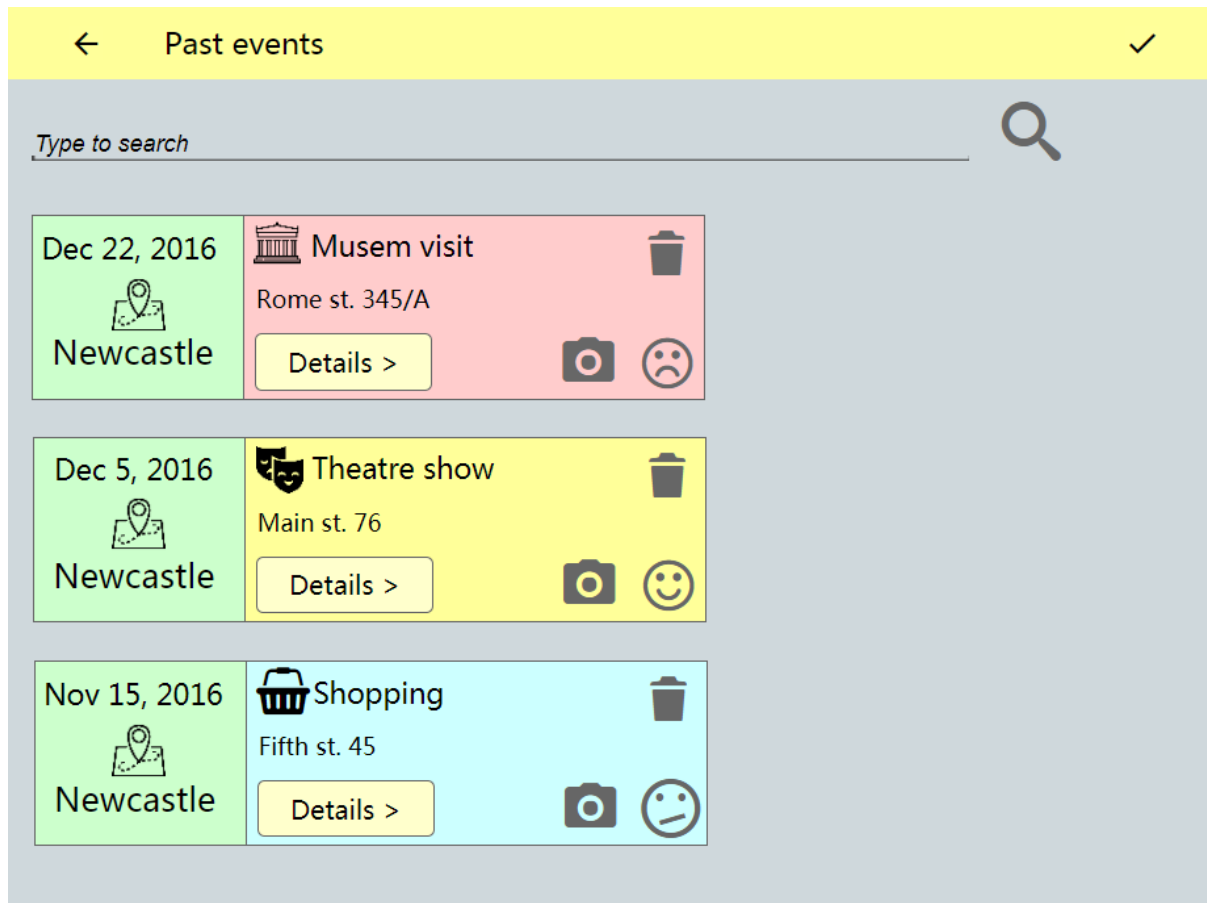


Figure 27: Past events screen

While some participants found it difficult to use the search facility, this would probably be alleviated by including the magnifying glass icon on a list of icons for users to consult.

After clicking on the details button, users see the following screen:

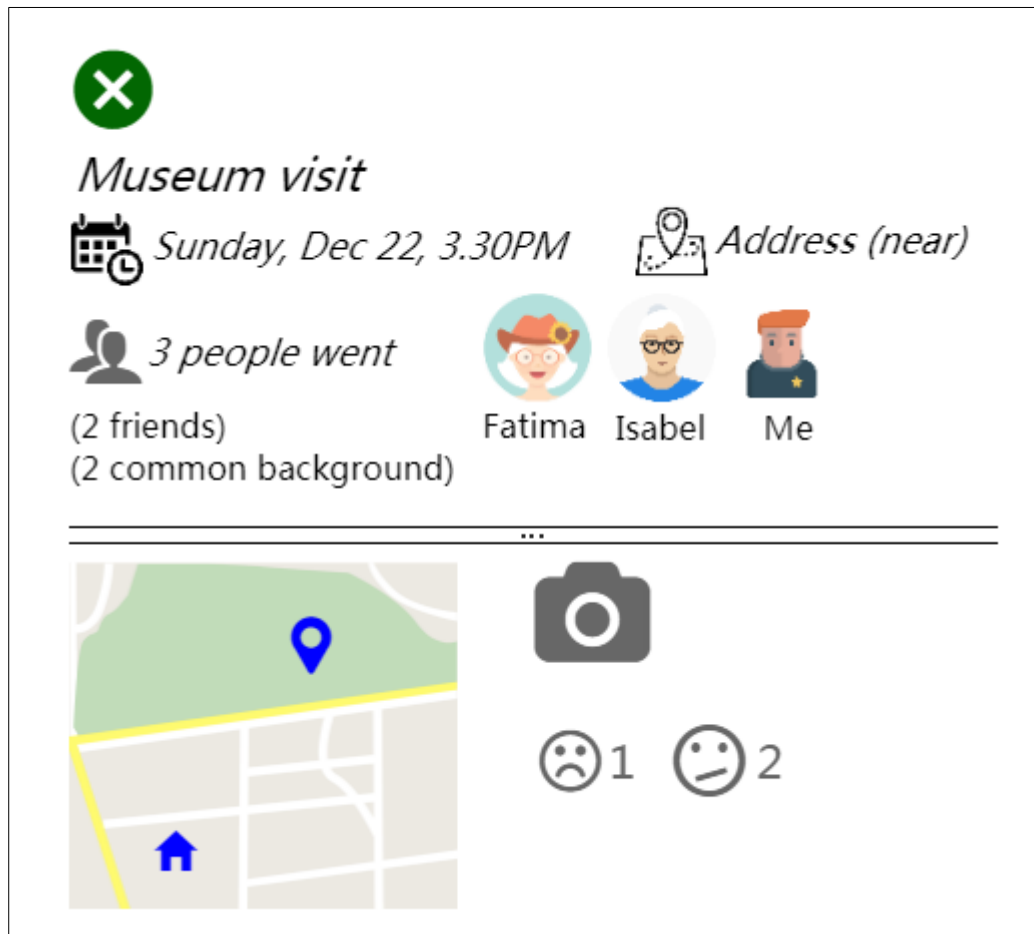


Figure 28: Details of past event

When users were asked whether the details satisfied their requirements, they suggested the addition of information on the cost of the event (to see if the price had gone up over time) and information about what exactly the event was about (e.g. a museum visit about dinosaurs). Both these pieces of information would be required to match the past event details with the details of an upcoming event, which have been revised in line with suggested change no. 62.

Using the event details window, users can view photos of the past event by clicking on the photo icon:



Figure 29: Photos of past event

When accessing the photos, one participant commented on the camera icon and said:

*"A little script alongside saying "access your photographs here" because they might think if you click on that it's going to take a photo of whatever you're looking at." (P11)*

Another way of addressing this would be to distinguish between camera icons with a plus symbol and those without a plus. On an icon sheet, this could help participants see that clicking on the camera icon will only take them to a gallery of photos.

When viewing the photos, several comments were made. One participant said they would like the ability to enlarge photos:

*"What I like doing is making the photos as big as possible - the ability to enlarge. And I like when you get every photo on one page." (P08)*

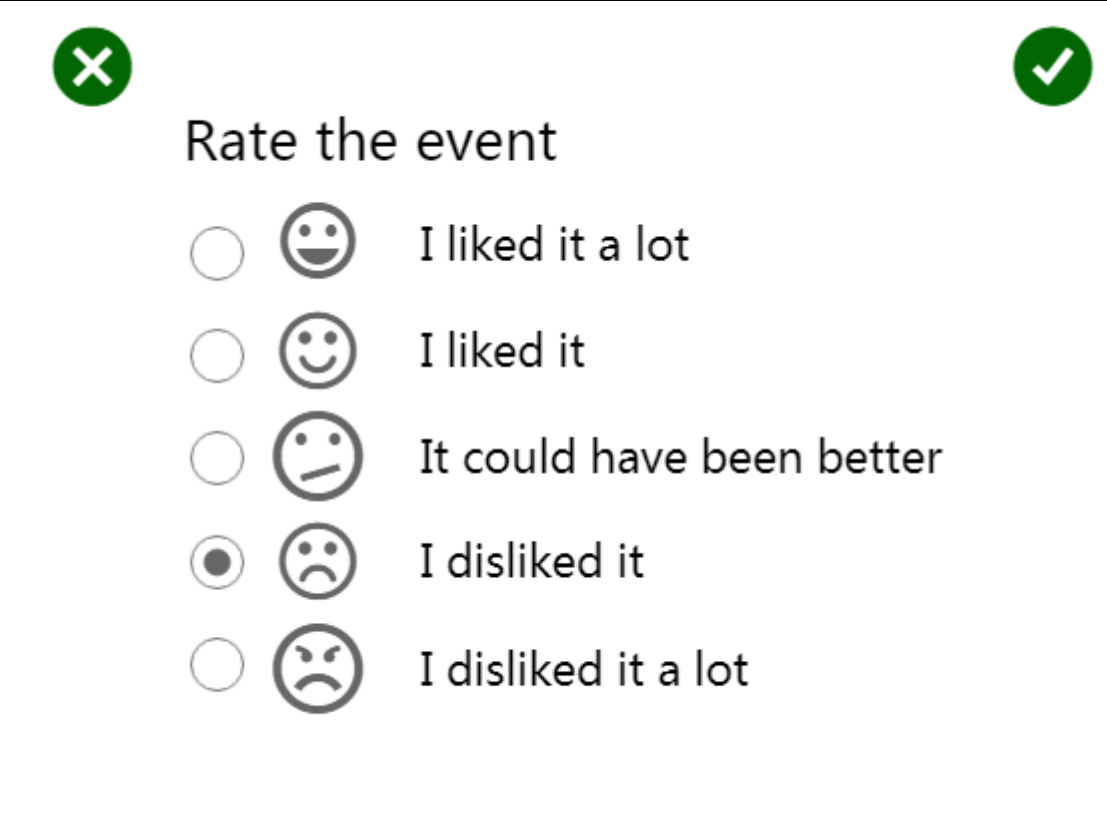
Another said that it would be better if the photos did not auto-scroll and users could navigate between photos manually. This requires the addition of some buttons to allow navigation between photos.

Another user commented on the text field and asked if her comment was limited to the size of the text field. Perhaps a larger text field would enable users to see more of what they are writing in the field. Another one asked if the comments would change as the photos changed, or if the comments were on the album of photos as a whole. The participants expressed a preference for being able to comment on individual photos and this should be implemented in the design because it makes good sense.


While some participants liked the idea of having photos of the past event, others did not. However, most expressed appreciation for the idea and it seems sensible to keep it.


When users were asked to remove the event from their history (by clicking on the dustbin icon in Figure 27), several users had some difficulty. One user tried to swipe the event, another said it was not a "normal" icon, and another said that it "didn't register" with her. However, when the users discovered it, they were able to perform the action without difficulty. Perhaps the best way to resolve this problem is to ensure that the dustbin icon is clearly explained in an icon sheet.


Another feature of the past events screen is the ability to rate events. This rating system is used to adjust future recommendations to the user (in line with Deliverable 4.8). Users access this rating system by clicking on the face icon beside the event, and the following screen appears:




**Rate the event**

☐  I liked it a lot

☐  I liked it

☒  It could have been better

☐  I disliked it


☐  I disliked it a lot

Figure 30: Past event rating window

Most users were able to access the rating window without difficulty, but one participant was unsure whether or not the face icon represented someone else's rating:

*"I wasn't sure what that meant. I thought it was someone [else] rating it. I'd like some words but I don't know." (P13)*

It may be a good idea to change the icon to a word, but then there would be no feedback from the past events screen as to what rating the participant gave, it would simply be words such as "Provide feedback". Given that, it seems best to have an explanation of the icon in the icon sheet. Moreover, given that only 1/5 participants had difficulty, it seems that the current icon is not too unsuitable. A more significant criticism concerned the wording of the ratings:

*"And the funeral, you couldn't really say it was a great funeral, but it was. How about, 'Was this a worthwhile experience?' Not whether you like it or didn't like it. Did you get any value from this event? Was this event valuable to you?" (P08)*

Of course, organising funerals via the system is probably ill-advised, but the criticism makes sense. Not all events are to be liked; a commemoration of war-deaths, or a trip to the cinema to see a sad film may not be events that are intrinsically "liked", but nevertheless are perceived as valuable. The participant suggested that "worthwhile" is a better adjective to assess experiences, and this seems apt. Consequently, it is suggested that the scale could range from "Very worthwhile" to "Not very worthwhile". The mid-point, "It could have been better" can stay the same.

One issue that was not mentioned by participants, but deserves attention, is the privacy of participants who leave ratings. To enable privacy, if less than 3 users attend an event, the rating of the event should not be shown (as in Figure 28) because it would be easy to deduce what rating the other person (other than yourself) gave.

With regards to Figure 30, two users mentioned that there was redundancy between the tick and the cross icons. While one could be used for discarding the change and the other for saving the change, users did not always see a distinction in the function of the two buttons so it would be best to have only one – a tick icon.

### 1.3.5.6 Suggested events

Another feature of the events screen, is the ability to view suggested events, as seen below:

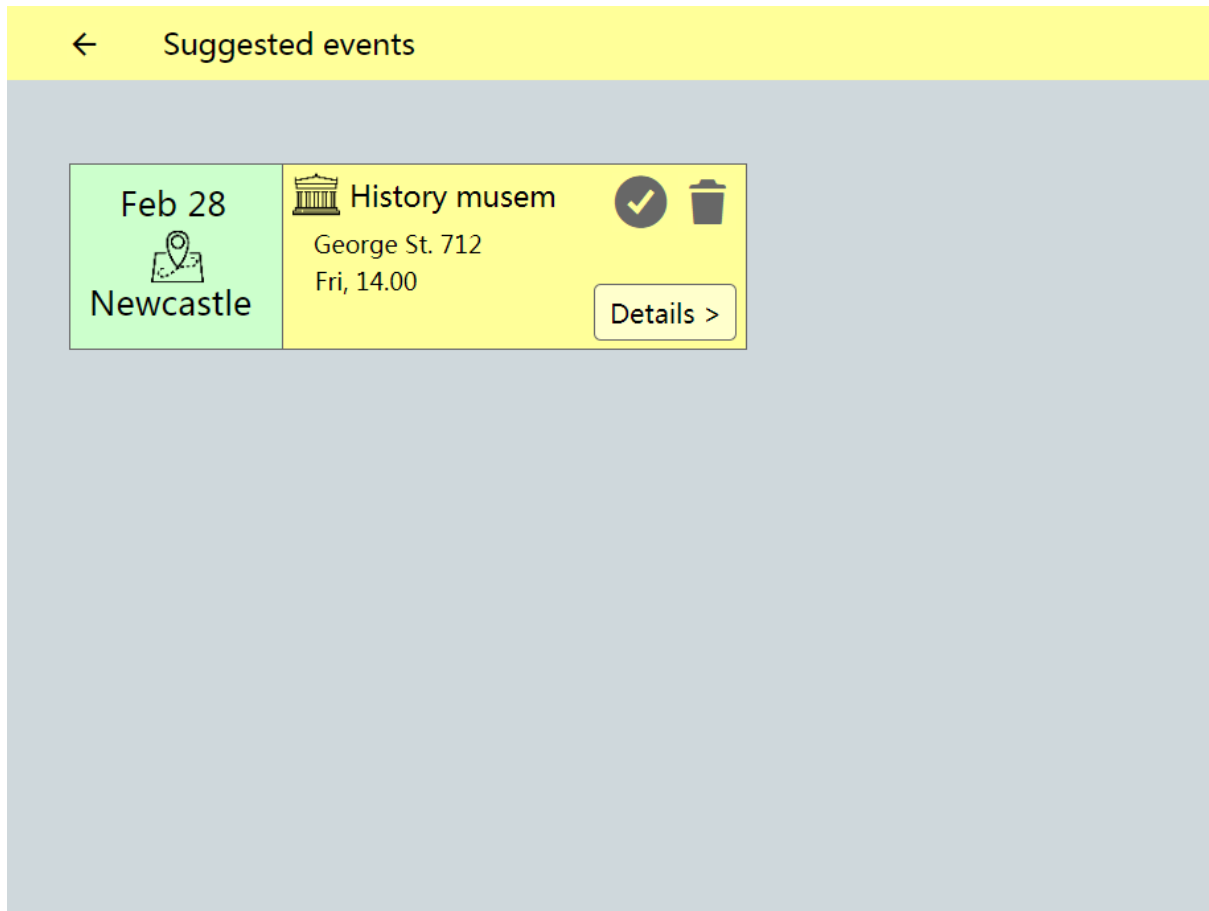


Figure 31: Suggested events screen

Clicking on the details for the event brings up the following screen:

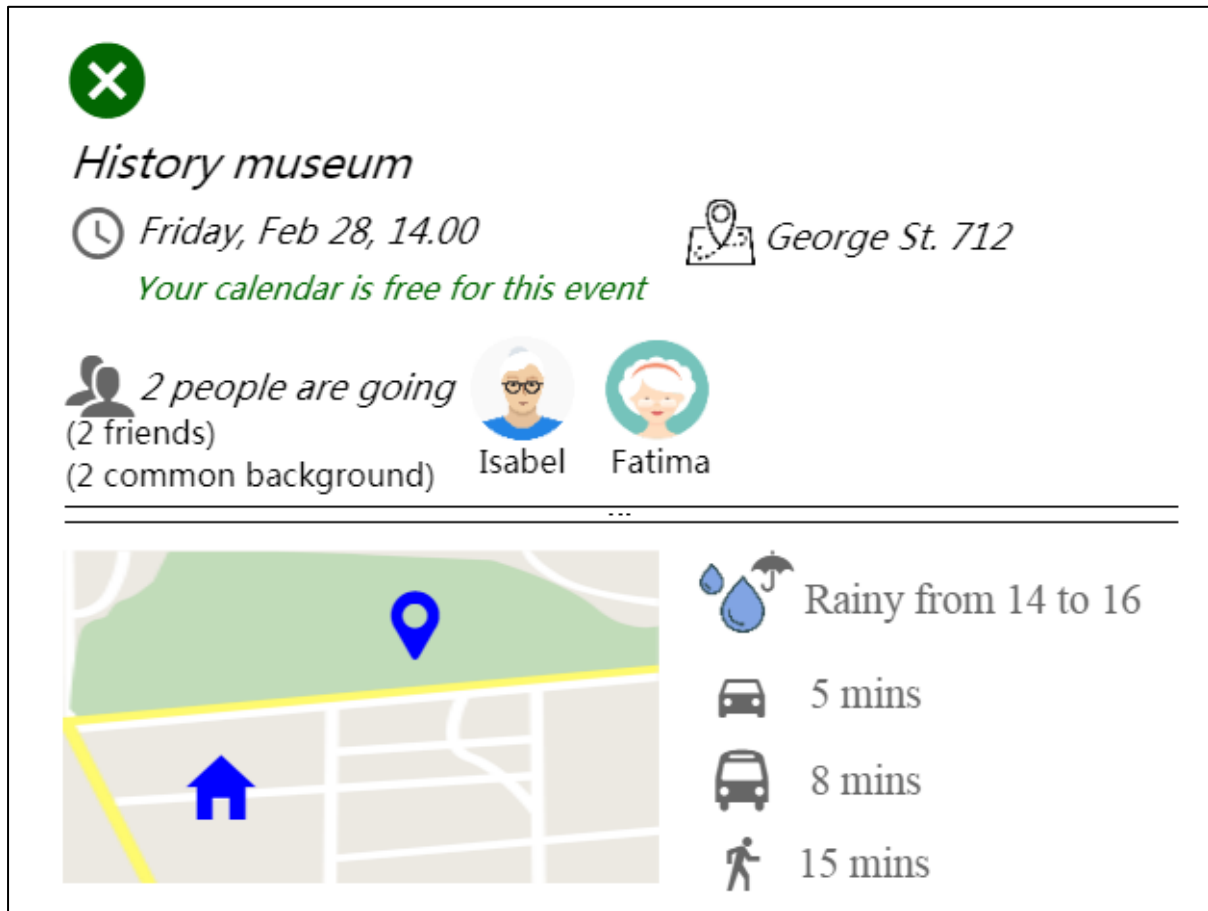


Figure 32: Suggested event details

Participants were asked about their thoughts on what was displayed here. The majority of participants found the details helpful, while expressing caution about some elements (e.g. the weather, because it is so changeable in the UK). One said:

*"Maybe [include] a little bit about the museum. ... It could be the history of anything couldn't it?" (P11)*

This points to the need for additional fields such as the details field, which are already present in the event creation feature. Other fields, not mentioned by participants, include cost and accessibility (as with changes 44-46).

Users are able to accept and reject recommended events by clicking on the tick or "bin" icons as shown in Figure 31. Two participants felt that the use of the "bin" was inappropriate. One said,

*"Well I suppose the rude thing to do would be to just hit the dustbin and get rid of it" (P11),*

while another said that it,

*"feels like I'm throwing something that's important for other people in the bin" (P02).*

Perhaps it would be best to change the "bin" icon to an "x" icon that would allow users to reject events without the feeling that they are destroying something.

Another significant comment related to the reasons for rejecting an event:

*"Interviewer: Would it be helpful for people to have the option to say why they're not able to attend?"*

*Participant: Yea. Not interested, busy (although it's already told me that I wasn't busy that day - but then something else might have cropped up), so yes, if there's a little selection box for why you can't go. Because then it might say, 'Oh you're not interested in museums so we're not going to send you any more invites.'" (P11)*

If users reject an event, not because they are not interested in the event, but because of some other reason, then the system needs to take care not to use that rejection as data for calibrating future recommendations. It would be helpful, therefore, to have a window to appear after clicking reject that

would ask the user why they are rejecting the event. Reasons such as “I am busy” can be discounted as data for the recommender system.

No other problems were observed with the suggested events feature, but two participants did not recognise the map icon (in Figure 31). Again, this problem can be rectified by including the icon in an icon sheet given to users.

*Table 8: Suggested changes for calendar screen and sub-screens*

No.	Old	New	Justification/Description
42	No representation of empty days	Represent empty days	Participants want to see when they are available
43	1 day left	1 day left until event	Participants did not always understand what the 1 day left was counting towards
44	No cost details	Cost details provided	This is required to fully inform users
45	No accessibility details	Accessibility details provided	This is in line with information stored in the database (see D4.8)
46	No details provided	Details provided	This will match event creation where details are provided
47	Events can be edited by anyone	Events can only be edited by owner	Essential for system integrity
48	No alerts if an event is changed	Alerts users who are attending if the event has changed. Request confirmation for new details.	Changing the place, time or substantial changes to the description, will require users who have agreed to attend to reconfirm that they are happy to attend.
49	No alerts to users who decline events if the event changes time/place	Alert users if the event has changed and ask if they will now attend	Users who decline an event because they cannot attend (even though they want to) should be offered another chance to attend if the details change
50	Event requests/recommendations	Ask users why they decline if they decline	Understanding if users cannot attend because they are busy will allow events to be re-offered if the event time changes and separate interest in an event from availability
51	Event requests/recommendations	Show both available and declined events (if available)	This allows users to see if they can attend certain events if their schedule changes
52	Location map in event details	Click on map to access navigation	This allows multiple routes to access navigation. Currently navigation is not accessible from the event details.
53	Attending user image in event details dialog	Click on user image to access their profile	Users should be able to find out more information about who is attending the event
54	No screen to view other users' profiles	Create an “other user” profile screen	Users should be able to view the profile (e.g. interests) of other users
55	Start button	“Journey instructions” or similar	Users want to see a list of navigation steps that they can write down
56	Transport mode	Radio button	Users need to select a form of transport



		beside each transport mode	before receiving navigation instructions
57	Bin icon for deleting event	Add confirm dialog after clicking bin	To avoid accidental deletion
58	Invite people to event	Include an add icon within details view	To provide full functionality with details view
59	Invite people to event screen	Show who had already been invited	To enable participants to decide who else to invite
60	Invite people to event screen	Provide confirmation after clicking on a friend to invite	To provide feedback to users so that they know an invitation has been sent (and how it will be delivered)
61	Search for event ("Type to search")	Change text to "Type to search for upcoming event"	For clarification
62	Missing fields in create event screen	Add fields for mobility, interest, cost, and title	To match back-end and other screens in the UI
63	Time field (create event)	Make bigger and increase contrast	To make it easier for users to see
64	Enter location window	Ensure that buttons in the screen beneath (create event screen) are not available/are occluded when location window is open	To ensure that users know to click on the tick window to confirm the location
65	Enter location window	How does the map update? Should there be an update button?	To allow users to match the map to the specified location (in text field) without closing the window
66	Reminder icon	Make icon and text active links	Many users click on the icon rather than the text
67	Reminder icon and text	Expand text to say: "click to add reminder for yourself"	Users get confused over who the reminder is for
68	"Click to invite people" text active, not icon	Make icon and text both active	To enable ease of use
69	Invite people	Provide minimum and maximum people fields	To enable users to enter important information to plan an event
70	Invite people	Allow users to see who has been selected to receive an invitation	For feedback and easy selection of additional people
71	Back and confirm buttons on invite people screen	Replace back button with	To enable clear differentiation between the back and confirm buttons

72	Create event screen contrast	"discard" button Make contrast between text and background greater	Contrast is too low
73	"OK" button after event creation	Make "OK" button take user back to the events screen	Non-functioning button
74	Garden screen	Revise use of garden	Participants generally do not like the garden
75	Garden screen	Move to be a sub-page of the events screen	This seems to be a more logical structure
76	Set goals	Identify what activities the goal relates to	Users were not sure what activity the goal related to
77	Set goals	Provide recommendation for goal	Users do not always know what is an appropriate goal
78	Set goals	Provide option for steps	Users want to set goals for steps as well as distance and time
79	Set goals	Use miles instead of km	British users are more familiar with miles
80	Set goals for weekly and monthly	Make clear if these are for calendar weeks/months or for 7/28 days	For clarity
81	Circular goal diagrams	Provide a way of highlighting when the goal is achieved and a way of indicating performance above goal	To provide positive feedback to the user
82	Activities chat window	A key should be provided to indicate what butterflies represent	The significance of a butterfly is unclear
83	Activities chat window	Increase spacing between user names and line up butterflies with names	For visual clarity
84	Activities chat window	Unclear what happens when a friend is invited	A request for a friend to join the chat should be designed
85	Activities chat window invite friends	Clarify that it is "invite more friends to chat"	To avoid confusion for users
86	Activities chat window	Change, "chat with your friends" to "chat with these friends"	To make it clear that people on the left can see the chat

87	Activities chat window invite via email	Change email to name	Users are unlikely to remember their friends' email addresses
88	Detailed activity chart accessed by clicking on circle diagrams	Make link clearer	Users do not know to click on the circle diagrams to access charts
89	Past event details	Add additional fields based on back-end (e.g. cost, event description)	To match change no. 62 and to assist users
90	Past event photos	Add ability to enlarge photos	To enable users to see more details in the photos, especially those with poor eyesight
91	Past event photos (auto-scroll)	Allow manual browsing of photos and add button controls	To provide more control to users
92	Past events comments text field	Increase size of text field	To allow users to see more of what they are typing
93	Past events comments on photos	Change comments for each photo	To enable users to comment on individual photos
94	Past event rating scale	Change rating scale to "Very worthwhile" to "not very worthwhile".	To allow for participants to assess events that are not inherently happy
95	Past event rating display	Only display ratings of others if there are 3 or more ratings.	To enable user privacy
96	Past event rating dialog box	Only show tick icon (remove cross)	To avoid confusion about the functions of the two buttons
97	Suggested events details window	Add cost, accessibility and details fields	To match the rest of the system
98	Suggested events accept and reject options	Change reject icon from bin to an "x"	To allow users to express refusal more politely
99	Reject suggested event	Provide dialog box for reasons after clicking reject icon	To allow accurate categorisation of what data is relevant for future recommendations

Table 9: Task completion for calendar

Task	No. of subtasks	Subtask	No. needing help	Description
Edit event details	12	Click (and enter) title	1/5	
		Click navigation icon	2/5	
		Click start	4/5	
		Click delete icon	1/5	

Create an event	16	Click invite icon	1/5	
		Enter data in title field	5/5	No title field present
		Click confirm icon (map)	1/5	PP did not understand tick button
Personal achievements	14	Click message text field	1/5	User would click on a person's icon to chat with them
Edit past events	15	Click progress bar (icon or text)	2/5	No clear link to access activity charts
		Enter data in search field	1/5	Mistakenly clicks on "details" of event
		Remove event	2/5	Some participants did not recognise the "bin" icon
		Click rating icon	1/5	Mistakenly thought that the icon represented someone else's rating

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## 1.3.6 Groups

### 1.3.6.1 Edit user groups

Another key component of the system is the ability to form groups. This is different from the system's concept of "circles" (generated by the system to group users of similar interests) defined in D4.6 (Marchese, Britez, Ramos, & Brauckhoff, 2017); The relationships here are based on edge properties in the system database (a "type" property of the CONNECTED\_TO edge). The view of the groups screen is shown below:

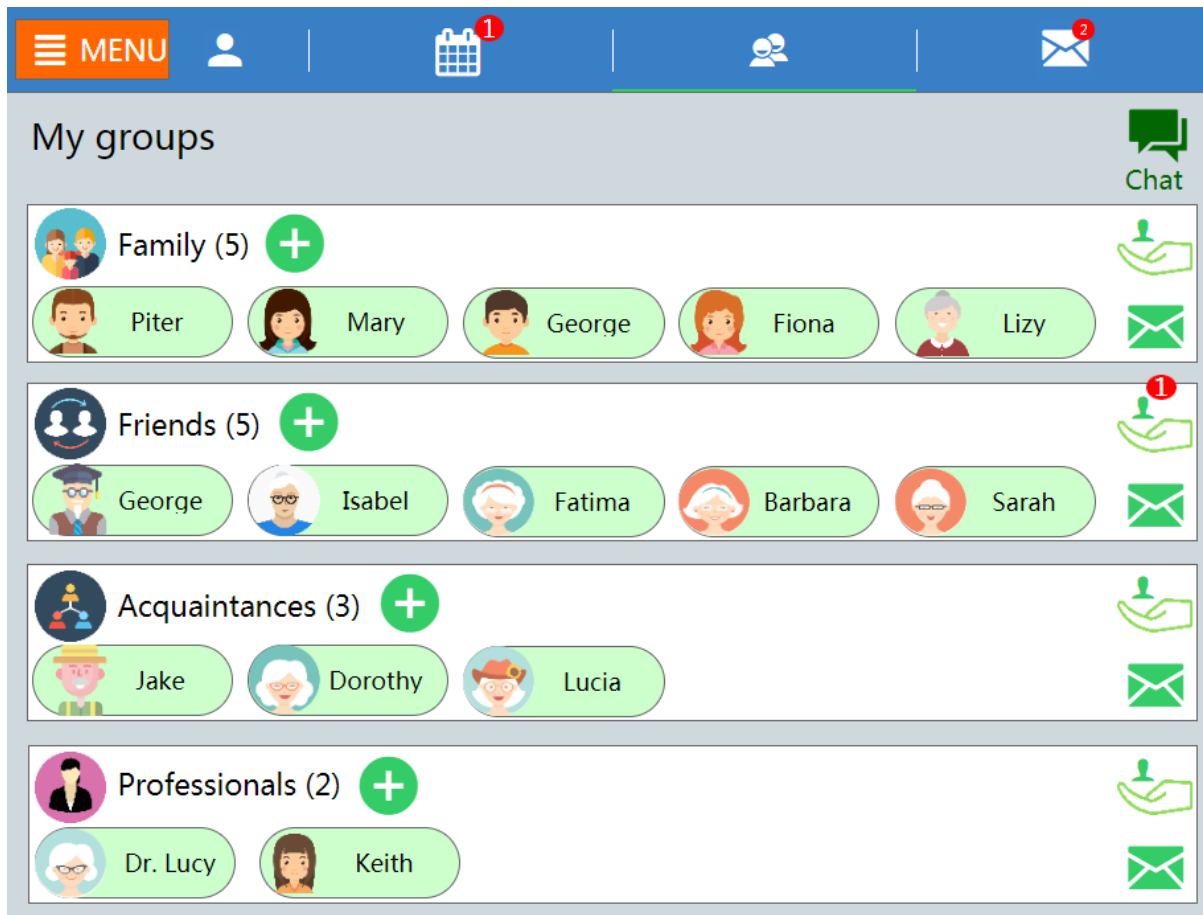


Figure 33: Groups screen

There were more serious issues with this aspect of the system because (a) users want to sort people by interests rather than relationship (e.g. “I might want to know who’s interested in history. I’d want to search by history,” P02) and (b) relationships are primarily relevant to privacy settings so these groups may be incorporated into the privacy feature. How to move forward with this feature is a more difficult issue because of the substantial changes suggested. If possible therefore, the feature should be changed to allow users to create groups based on interests (e.g. a “walking” group) but this should be raised with the developers to enable appropriate edges to be defined in the database. This would mean that the “Groups” feature refers to activity groups (but could refer to other user-defined groups such as family, if so desired). If this change is implemented, a group-creation feature would need to be added (including the option to name a group and add members to it). A related issue, identified by one participant, is whether the relationships are unilateral or bilateral:

*“Does he know that he’s my friend?” (P06)*

This question remains whether the feature is changed to activity-based groups or not; if the relationships are bilateral, a “request” needs to be sent to members who are added to a group. A placeholder for “friend requests” appears in the messaging interface so the assumption is that bilateral relationships are intended, but fuller details of this “request” need to be provided. More will be discussed on this issue in the messaging feature section.

A more general comment relating to the interface emerged when asking participants to access certain features. One participant tried to click on the icon to the left of “Friends” and was puzzled that it didn’t do anything. She said:

*“It was the fact it had arrows on it, it looked different.” (P09)*

Knowing which icons are buttons and which are not is something that most users will learn through engaging with the system. Nevertheless, it may be wise to distinguish more carefully between active elements and inactive elements. Given the explanation provided by the participant above, it may be sufficient to simply remove arrows from the icon for “Friends”.

Users can use the groups feature to access details about people in their groups. By clicking on a user's name or icon, the following window appears:

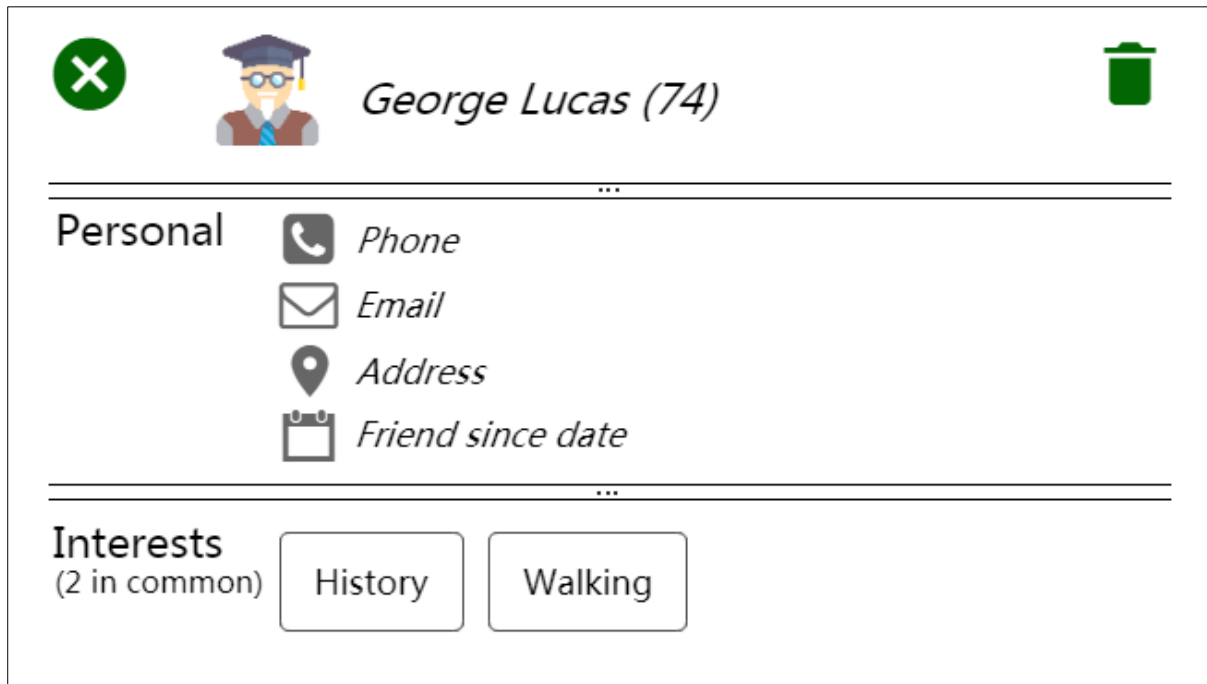


Figure 34: User details window

Several comments were raised about the information presented here. Firstly, there are not enough reasons to include the user's age:

*"There might be situations where I didn't want my age displayed. ... I put neither [age nor DOB] on my Facebook account."* (P11)

Probably, age should not be displayed since this can be inferred to some extent from the user's profile picture and beyond this general impression, does not seem to have a useful purpose.

Regarding the address, one user said:

*"And as far as address goes, the only thing I would want to put in there is [the area]. I wouldn't want to put my full address in."* (P11)

This is a helpful observation and thus, the address should probably only refer to the general area rather than the specific home address of the user. This avoids security risks.

While no user mentioned it, the phone number displayed here is not requested from users at any part of the sign-up process. Either this should be removed, or it should be requested during sign-up.

When users were asked to remove a user from a group by pressing the "bin" icon, they suggested that a confirmation request should appear to ensure that they really want to remove the person. Curiously, one other user did not recognise the icon used as a dustbin:

*"Presumably I'd press that. Is that meant to be a delete button? I would change it to make it look like a usual dustbin like you see on iPads."* (P09)

This points out the importance of using familiar icons, but a problem like this should be easily rectified by showing a list of icons on a sheet to assist them while using the system.

Users can also add more people to their groups by clicking on the plus icon beside each group (Figure 33). When they do this, the following screen appears:

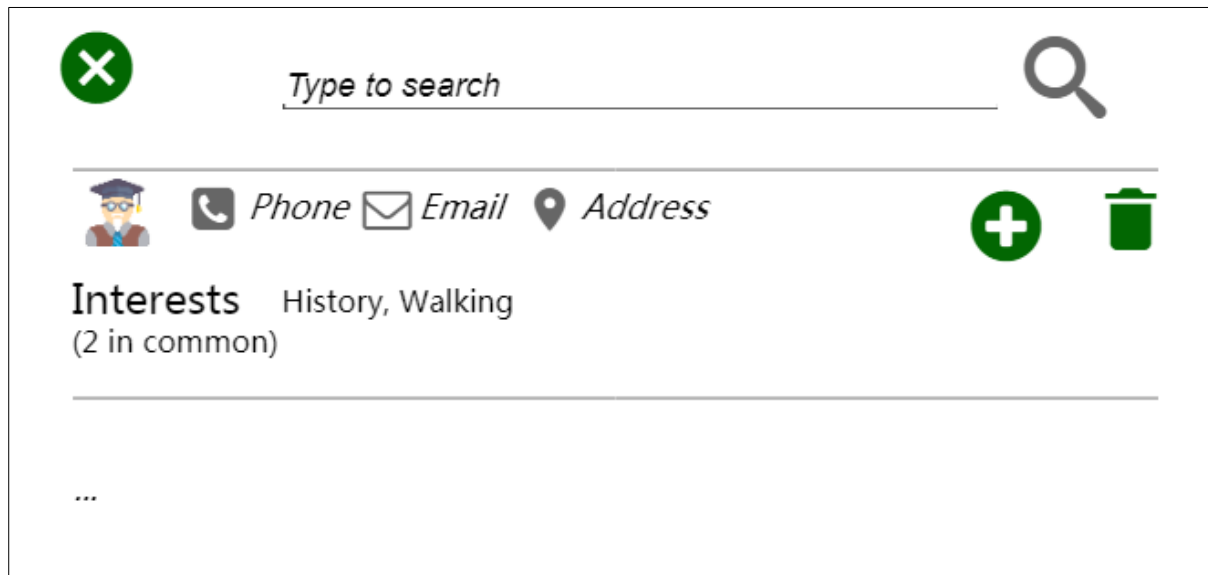


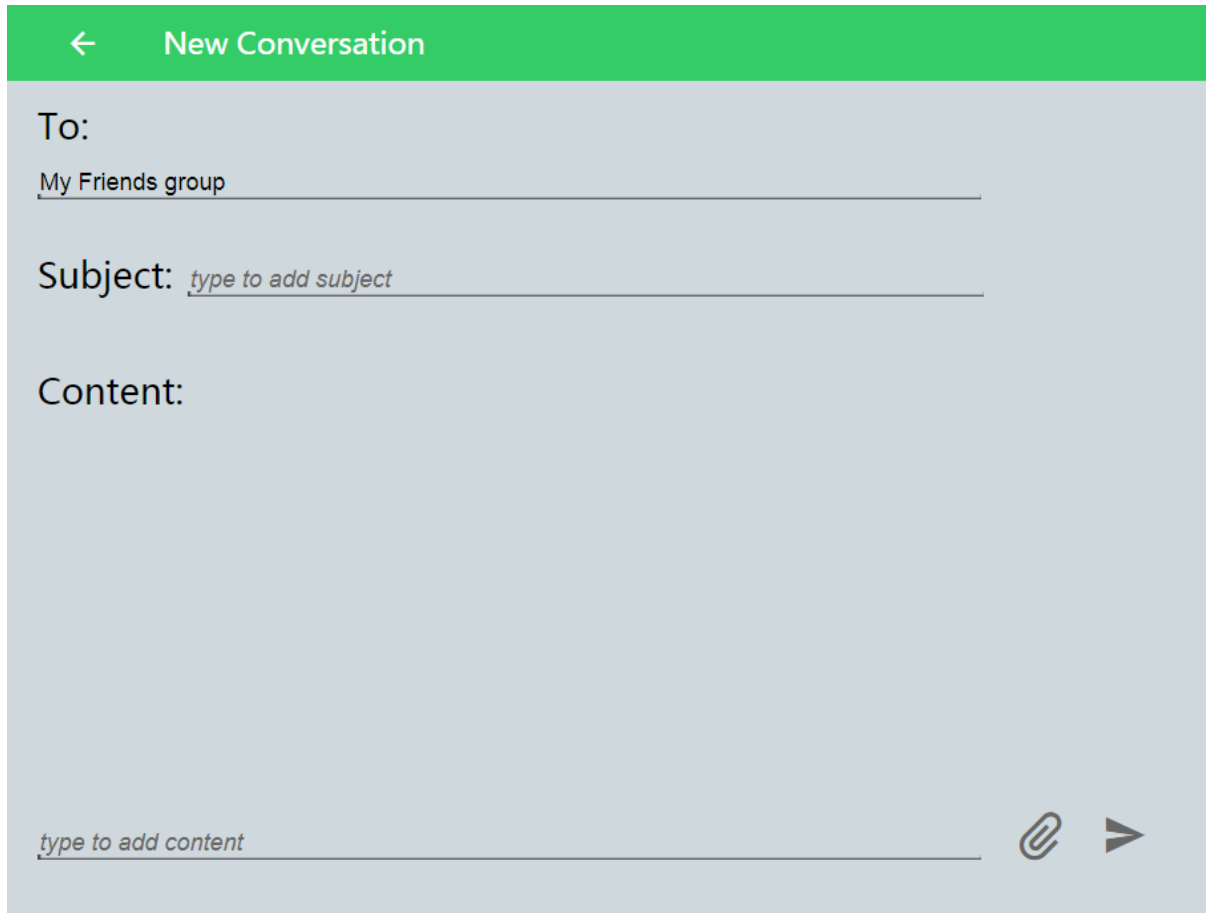
Figure 35: Search for user window

Users said they would type in the name of a person in the search box and then the person's details would appear in the section below. While users understood how to add the person thus displayed, they did not understand the purpose of the bin icon. One suggested that it would clear the search and allow for a new search. Another suggested that it would remove the user from search results:

*"I assume that if you clicked on that [dustbin], the next time you searched for someone with a similar name, he wouldn't come up. [but you don't need the dustbin] because if you want them, you would click on the plus button. And if you don't want them you could just go back."*  
(P11)

Still another user simply did not know what was the purpose of the bin icon. Because of this confusion, it seems better to remove the bin icon.

The groups feature allows users to send messages to all members of a given group. When the "letter" icon is clicked beside a group, it opens the following screen:



← New Conversation

To: My Friends group

Subject: type to add subject

Content:

type to add content

📎 ➤

Figure 36: Groups messaging feature

Using this was straightforward for participants, although the content field should begin higher up the page, beside the “content” label.

### 1.3.6.2 Group recommendation

By clicking on the “hand and face” icon to the right-hand side of each group, users can see who has been suggested to join their group. Some users did not understand the icon, but again, this can be added to an icon sheet. A more germane comment is related to the design of the icon, which some participants saw as being comprised of disconnected elements. A more unified icon would be better. Other confusion stemmed from a lack of understanding of how the system could recommend friends, and the significance of the number beside the hand. The significance of the number (the number of suggested friends) should become apparent through use, but also merits inclusion on the icon sheet.

The view that users see when accessing recommended friends is as follows:



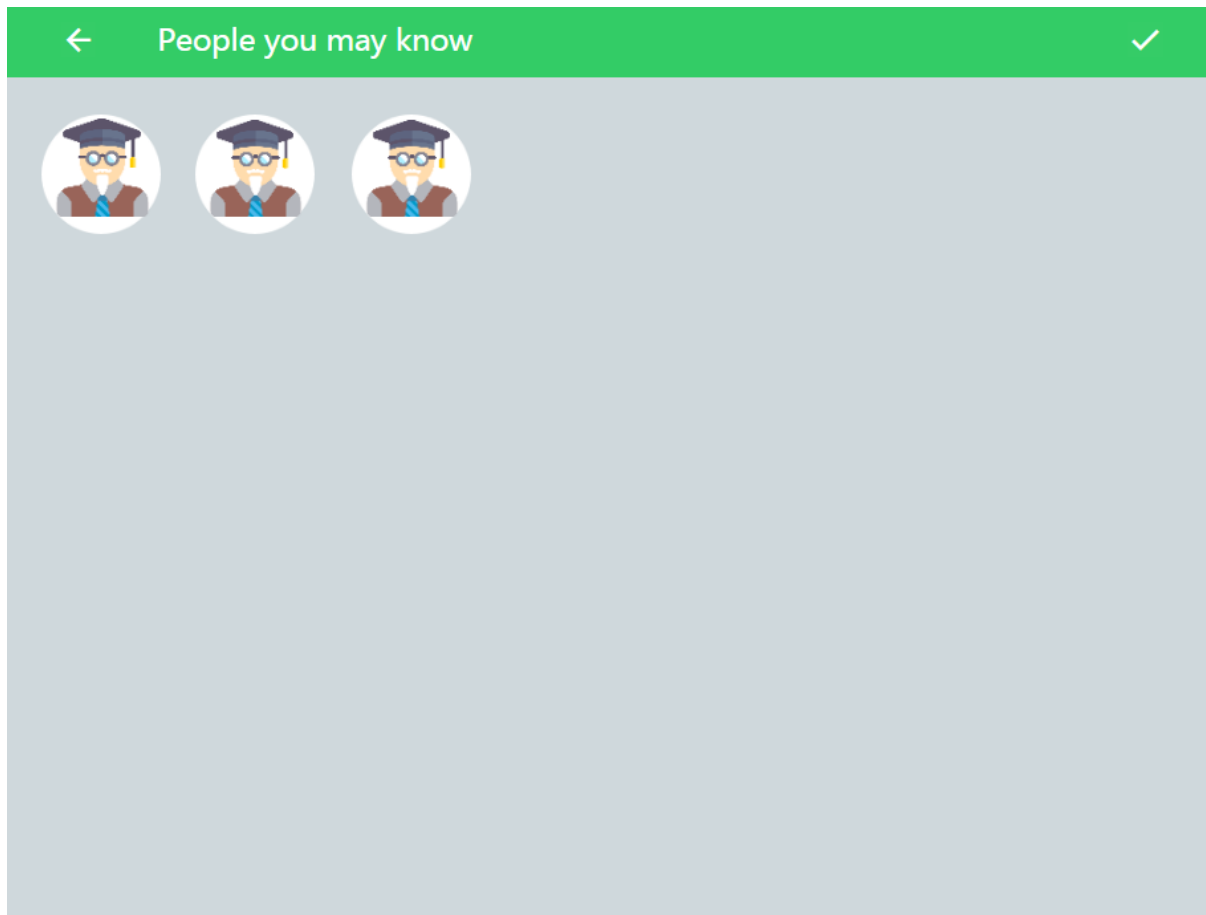


Figure 37: Recommended/Suggested friends

Participants can then click on a person to see more about them. But as one participant observed, it would make sense to include their names beneath the images:

*“If you put, Dr Andrew or Fred Smith underneath. There's no point in just looking at photos and saying do I know that person if I don't know their name.” (P03)*

Presenting names underneath the images helps users to quickly identify if they know a person or not.

### 1.3.6.3 Chat facility

The groups feature also includes a chat window that allows users to chat with their contacts:

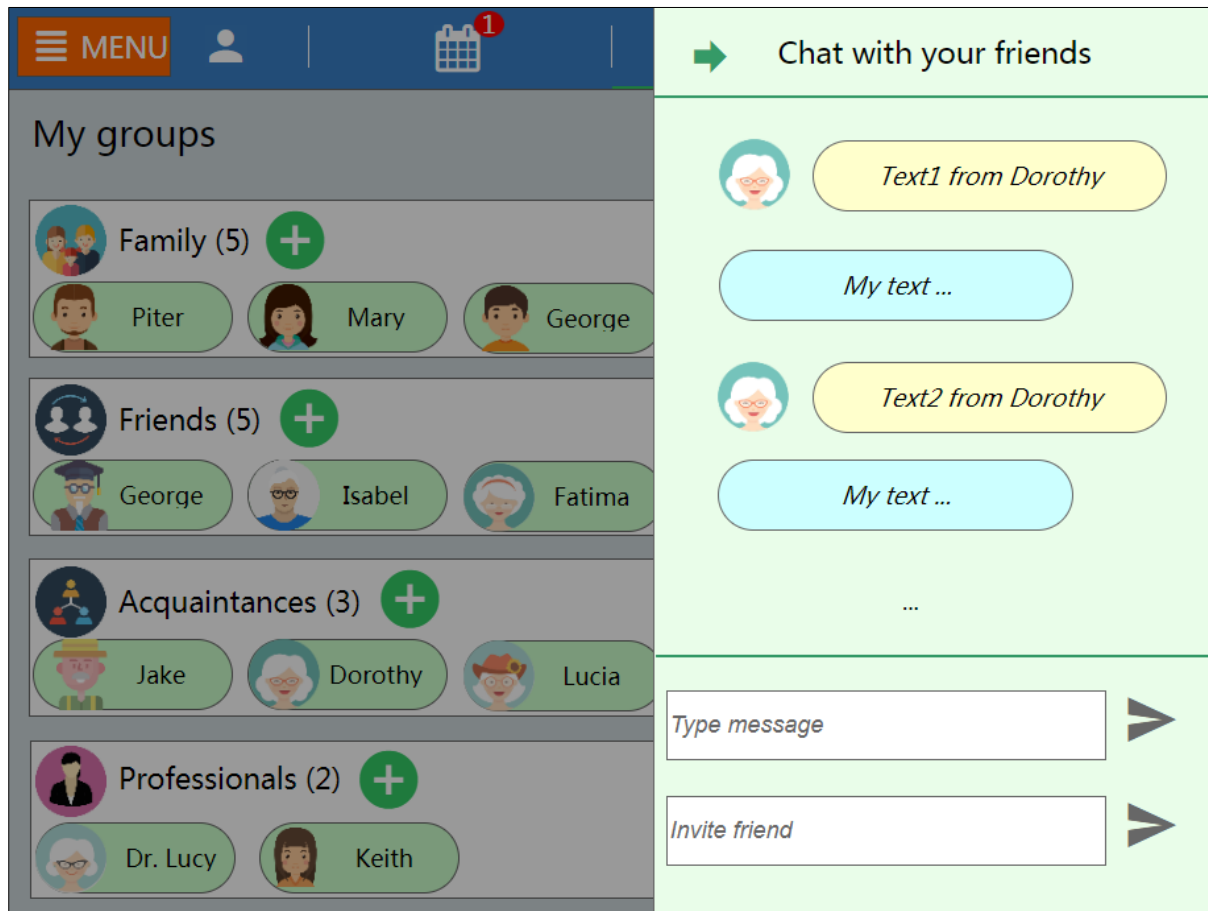


Figure 38: Chat facility

When participants were asked to type a message, they were not always clear whom it was being sent to:

*“If I’m going to type a message in here, who’s it going to go to?” (P11)*

This lack of clarity is due to the lack of information on who is present in the conversation. There should be a section of the window that displays who is present.

Another user thought that to send a message, you would type the friend’s name, and then type the message to them, thus failing to see the connection of the text boxes to the chat window. Another thought that “inviting” a friend meant inviting them to an event rather than to a chat. Clearly there was some confusion around this particular part of the interface. Perhaps a section at the top of the chat window could display who is present in the chat, and as part of that section, a “plus” icon could appear alongside the other elements to allow users to add another user (as suggested in Figure 39).

This arrangement may help users to see more clearly how this section of the interface functions. It specifies that users are “added” to the chat (avoiding the terminology of “invitation” which is

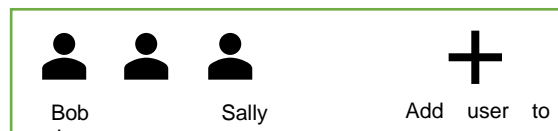


Figure 39: Suggested participant section for chat window

associated with events) and shows clearly who is in the chat. It also avoids confusing the bottom of the chat window with two very similar looking sets of components (i.e. two text fields and two send buttons) by reducing the bottom part of the chat window to a message field and a send button.

While not raised by participants, it should be considered whether users should be able to (a) leave a chat, and (b) view multiple chats with different users.

Table 10: Suggested change for groups screen and sub-screens

No.	Old	New	Justification/Description
100	Groups as defined as family, friends, acquaintances and professionals	Allow users to create activity-based groups	This was preferred by participants
101	"Friends" icon with arrows	Remove arrows from icon/use alternative icon	The arrows have the potential to make the user think that it is a button
102	Age displayed in user details view	Remove age	Some users do not want it to be displayed and it serves no important purpose
103	User address displayed in user details view	Display only general area (e.g. town)	Users do not want their full address displayed for privacy and security reasons
104	User phone number in user details view	Either remove or collect during sign-up	This data is not collected previously
105	Delete user from group	Display confirmation dialog after pressing delete	To avoid accidental deletion
106	"Bin" icon in add user window	Remove bin icon	The function is not clear
107	Content field in messaging facility appears at bottom of page	Move content field closer to "content" label	To avoid user confusion about where to type the message
108	Hand and face icon for friend suggestions	Make the icon more unified	The icon appears as disconnected elements to some
109	Suggested friends screen	Add user names underneath images	To enable users to identify the displayed users
110	Chat window	Display who is present in the chat	To allow users to see who will receive the message
111	Chat window invite	Change to add and move to top of chat window	This avoids confusion with inviting people to events and moving it avoids confusion with the similar-looking message fields
112	Chat window	Consider whether users should be able to open multiple chats and be able to leave chats	These may be desirable features (not discussed with participants)

Table 11: Task completion for groups

Task	No. of subtasks	Subtask	No. needing help	Description
Edit user groups	14	Content field (send message to group)	1/4	User clicked on subject field rather than content field
Groups recommendation	6	Click icon	1/4	Does not recognise recommendation icon

Chat	4	Enter invitation (to join 1/4 chat)	User thought that the recipient name should be entered in invitation field and message in message field to send a message to that specified user
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### 1.3.7 Messaging

A separate messaging facility is available in the UI to enable users to share messages with other users, and receive invitations to events:

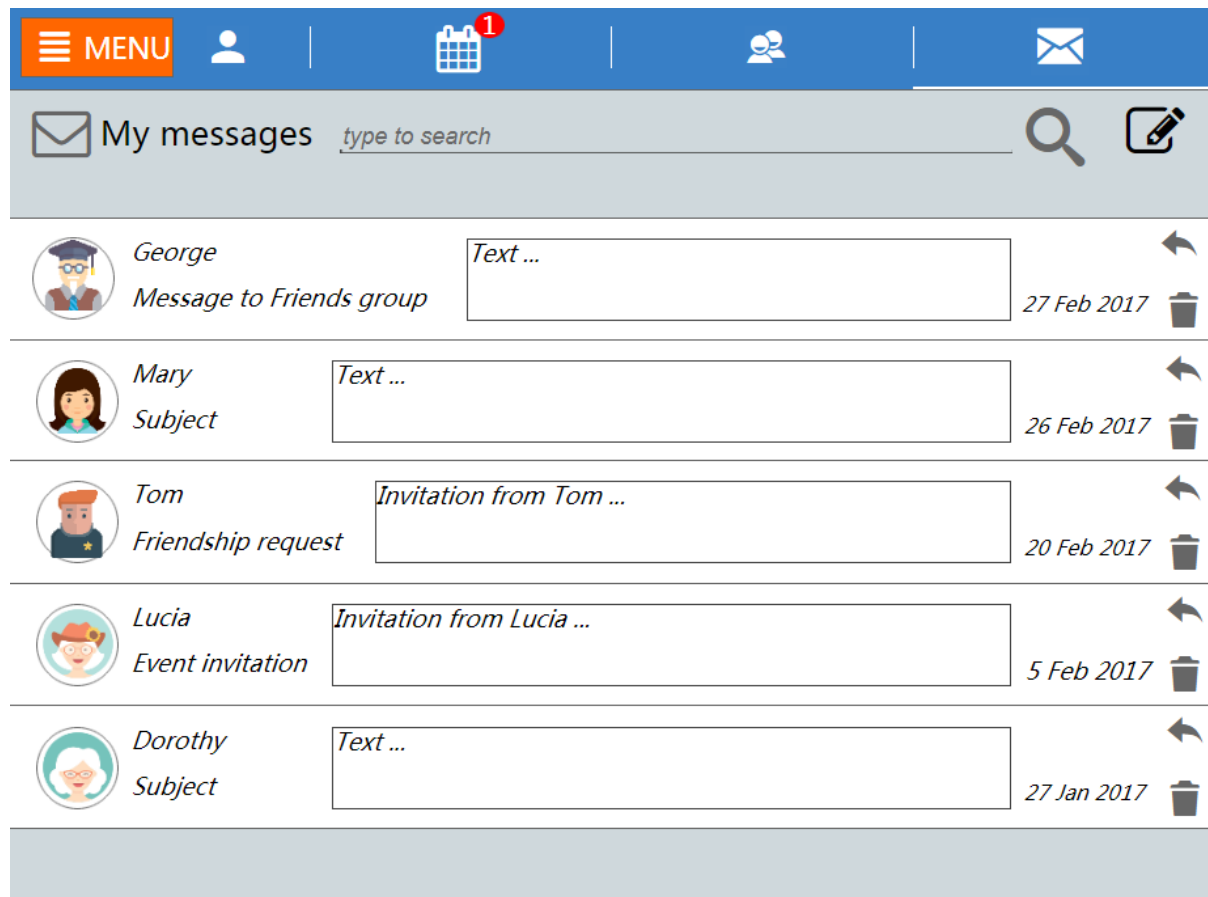


Figure 40: Messaging screen

While placeholders for “Friendship requests” and “Event invitations” are present, these have not yet been designed and need to be. Additionally, a chat request for chatting about activities (in the “my achievements” screen) should be implemented, asking users if they are willing to share their activity data with the other users. A chat request for chatting in the groups section may not be necessary since no additional data is shared.

#### 1.3.7.1 Write a message

Most participants found it easy to write a message to another user using the interface provided. One user (P06) had some difficulty writing a message. At first, she looked for the person to send the message to (and thus had a different model for how to send a message). After abandoning that strategy, she was asked to look for where she might create a new message. At this point, she suggested the message icon on the top left-hand corner (beneath menu). This was wrong and she had to be shown the icon on the top right-hand corner. She said that this was not sufficiently clear, and given her difficulty in finding it, this seems apparent. Consequently, the left hand message icon

should be removed to avoid confusion, and the new message icon should be made more prominent. Again, including this on the icon sheet should help somewhat.

The new message interface is similar to others that have been presented in the groups section:

Figure 41: New message screen

Again, users found this easy to use, but one user said regarding the content field:

*“Why type to add content down here?” (P09)*

Other users concurred with this and the content field should be moved closer to the content label.

Another user said that the back arrow looks like it is associated with the “new conversation” label, thus telling the user to go back to create a new conversation. While this seems like an unlikely error (given that the new conversation window is open), it may be better to make the “New Conversation” text more central.

The user also was puzzled by the terminology:

*“You’ve said you’re going to write an email so why this new conversation?” (P09)*

Perhaps this terminology should be changed to “New Message” or “New Email” to maintain consistency throughout the interface.

The “send” icon was not universally familiar to participants:

*“Could it not say send? When I first saw that, I thought it meant there was another page to follow. To me that doesn’t mean send.” (P06)*

While changing the icon to a word is an option, it is also possible to provide users with an icon sheet to get them used to the icons. While words are easier to learn initially, they can clutter the interface and make it slower to use for some users. Curiously, even among users that know what the button does, they did not always know what it was:

*“[I’d click] the tepee or whatever it is, the arrow.” (P03)*

As a more general comment, it is worth using icons that are somewhat identifiable to users. While they may associate the icon with a function, it is probably easier to learn that association if there is a

relation between the icon and the function. On the contrary, a “tepee” is unlikely to evoke the meaning of “send” and may be harder to learn.

### 1.3.7.2 Reply to a message

Similarly, there was confusion over how to reply a message (using the screen in Figure 40) with one user trying to type in the “Text...” field. Of course, this problem would be avoided if there was a real message present rather than placeholder text. But the icon should be added to the icon sheet.

Again, when replying to a message (using the screen below), users commented about the positioning of the content field and requested that it be moved up:

Figure 42: Reply to message screen

### 1.3.7.3 Find a message

To find a message, users can search for content using the search bar in Figure 40. One user tried to click on the mail icon at the left of “My messages” to find other messages. Given suggestion 115, this error should be avoided in future.

### 1.3.7.4 Delete a message

As for deleting messages, while users knew how to do this, they wanted confirmation after pressing the delete button:

*“[Interviewer: would you want confirmation when you press delete?] Yes, I would. Are you sure you want to delete this message, Yes or No? Or do you want to archive it or whatever. Is there an archive? You could maybe put a little folder as well. Whether you'd want it as a separate entity to that [the bin icon] or whether you would just hit that and it would come up delete message or archive.” (P03)*

As noted in this extract, the participant also wanted an “archive” for saved messages. This may be a separate icon, as the participant says, or it may be part of the confirmation after pressing the delete

button. Additionally, while the participant does not mention this, there should be some way of accessing deleted messages (such as a “deleted messages folder”).

Table 12: Suggested changes for messaging screen and sub-screens

No.	Old	New	Justification/Description
113	No designs for friendship requests or event invitations	Design invitations to events and friendship requests	These need to be designed
114	No design for chat request regarding activity	Design invitation to chat about activity	The “my achievements” screen allows users to invite users to chat and share activity data. An invitation for this should be designed.
115	Message icon in top left	Remove icon to avoid confusion	This confused one participant because it is similar to the new message icon
116	New message icon	Make icon more prominent	One user took a long time to find it
117	Content field at bottom of page	Move content field further up page towards content label	To avoid confusing users
118	“New Conversation” label	Move label to centre of title bar	To avoid misleading users into thinking that a new conversation is accessed by clicking on the back button
119	“New Conversation” label	Change to “New Message”	To maintain consistency and familiarity
120	Send icon	Consider how to make this clearer	Not all users recognise the “send” icon and even those who do, do not always know what it is
121	Content field in reply screen	Move up closer to content label	To avoid confusion
122	Delete button	Confirm delete after pressing button	Users do not want to accidentally delete messages
123	Delete messages	Add archive option	To allow users to store messages in a separate place from the inbox
124	Deleted messages	Allow users to access deleted messages	In case the user wants to retrieve a deleted message

Table 13: Task completion for messaging

Task	No. of subtasks	Subtask	No. needing help	Description
Write message	6	Click compose button	1/4	User tried to click on mail icon to the left of “my messages”
Reply to a message	3	Press the reply button	1/4	User tried to type in field for received message text
Find a message	1	Type in search field	1/4	User tried to click on mail icon to the left of “my

### 1.3.8 Privacy

This was one of the least developed sections of the interface and clearly needs more work. The screen is presented below:

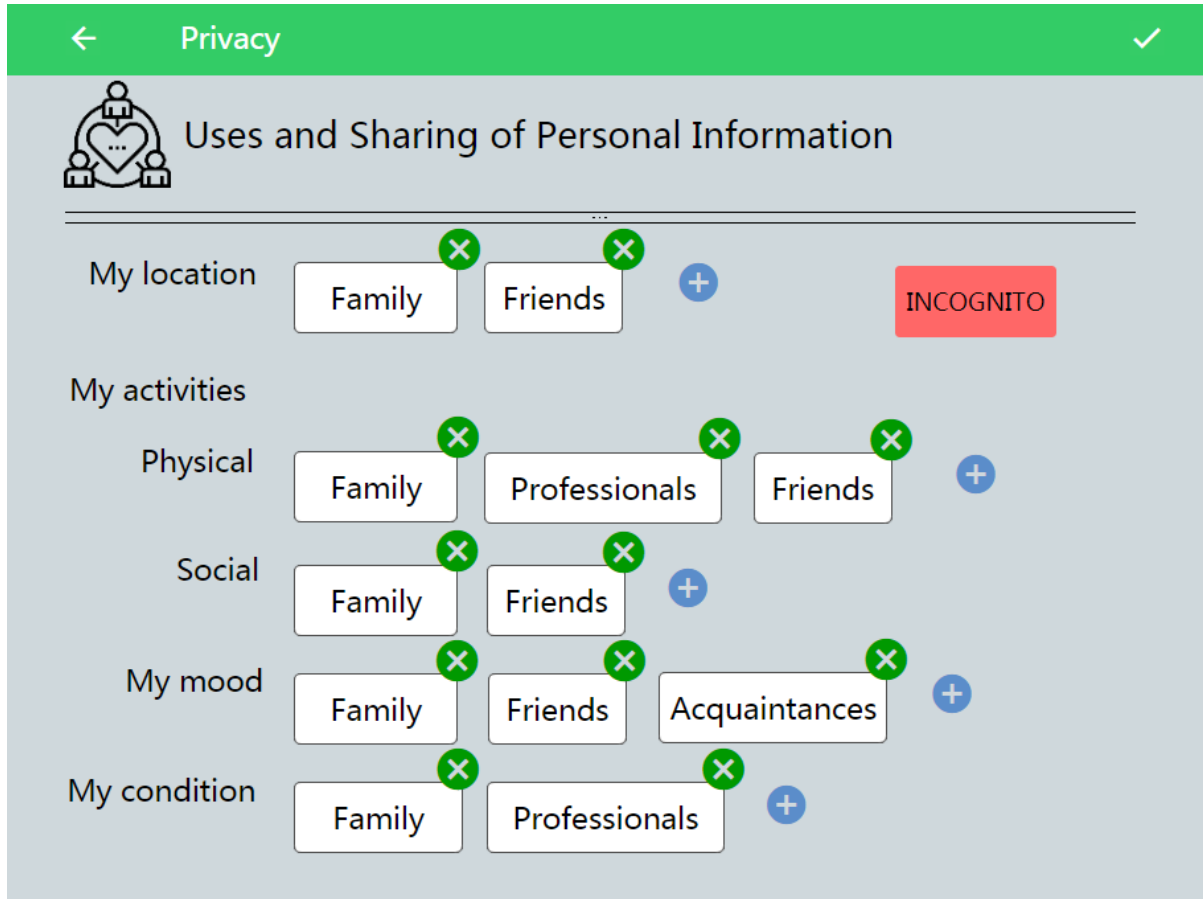


Figure 43: Privacy settings screen

The categories of information were derived from D1.1 v1 (Coventry, McNeill, & Pywell, 2016) but given that D1.1 was produced early in the project, not all the categories are entirely relevant. For example, mood was proposed as a way of collecting data about whether users were enjoying activities or not. While we discussed in D1.1 v1 whether participants would share this information, upon further reflection and development, it was decided that while mood data could be collected, it was not helpful to share this with any person in the system; rather, it could be used as one way of gathering data for the recommender system on whether a user enjoyed a given activity.

Participants generally found this interface quite complicated and said:

*“I think it's too detailed.... Just a bit messy. Too much on the page. I would get rid of all this stuff - social, mood, condition. I don't think people would want that.” (P09)*

Given that the current UI cannot display all this information to users, it seems more appropriate to work backwards from what users can see, to considering what, of all that information, do users want to share or keep private. This requires further work.

One user (who was quite adept at using technology), did not understand how to switch off data sharing for given groups. He suggested that one would press the name of the group (in the category of data), and then press “incognito” to switch off data sharing for that group. Perhaps, “Hide location” would be a better term to use for the “incognito” button.

This user also desired to have more granular controls:



*"I would prefer to see, "mum" incognito, "dad", no he's ok. Although I don't know how that would work out you've got quite a bit of [gestures to screen space] it'd need another page wouldn't it?" (P03)*

This is an astute observation, and one that was picked up on in D1.1 v1: people do not necessarily trust all of their family or all of their friends; rather, trust is an individual matter. One proposal for change is to have two screens:

1. On screen one, users sort other users they are connected to into three groups: high, medium and low trust. All users should appear as low trust by default unless the user changes this (thus following the principles of privacy by design (Cavoukian, 2012)).
2. On screen two, they then sort data types into these three groups: information they will share with high trust people, information to share with medium trust, and likewise for low trust.

Again, the second screen should only contain data that can be shared in the system: e.g. Physical activity data, address, and interests.

Regarding the labels used, participants generally got confused as to what they were referring. To give some examples:

- Location was often confused for "address". In fact, the latter is more appropriate since it is all that is currently shared in the FriTab UI.
- Physical was often confused for "activities that are physical", for example, whether they partake in an exercise class. This should be changed to "steps data" or something similar.
- Social was understood to refer to events that involved social elements such as going to the theatre. One participant said, "Events would be better than social." (P09) This is more consistent with the terminology used in the rest of the UI.
- Mood was understood, but perhaps "event ratings" would be more consistent with the rest of the UI.
- My condition was often understood, and "health condition" was reported as a better label. However, this information is not currently shared in the system. Mobility characteristics are used in the system for classifying events. Perhaps, if participants enter mobility details during sign-up, "mobility details" would be a better label for this category of data, but again, this will probably not be shared with other users.

Various other confusions appeared when participants tried to use the privacy settings. Some participants were not aware that pressing the blue "plus" button would open a menu and said:

*"Now I'm confused. If I press the blue button, who am I saying?" (P09)*

If recommendation 127 is followed, this issue will not be present. But it is worth noting that drop down menus should be obvious and not hidden.

The incognito button was also unclear and one participant expressed preference for a slider button that would clearly indicate whether it was off or on.

Similarly, there was some confusion over how to confirm the settings. Ideally these should be saved automatically so that pressing the back button or the tick accomplish the same function.

*Table 14: Suggested changes for privacy screen*

No.	Old	New	Justification/Description
125	Privacy settings	Work backwards from what users can see, to what settings should be displayed	There is no need to ask about data sharing if the data is never shared
126	Incognito button	Change to "Hide location"	This will avoid confusion with its relevance to other categories of data
127	Privacy settings	Consider changing to two screens: one for sorting users into trust categories and one for sorting data into	This should help with simplifying the process of sharing, and should enable more granularity

		those categories	
128	Physical activity label	Change to "steps data" or something similar	It was often confused for types of physical activity (e.g. walking)
129	Social activity label	Change to "events" or similar	For clarification
130	Mood label	Change to "event ratings" or similar	For consistency
131	My condition label	Change to "Mobility profile/details" or similar	Only mobility data is used in the system; it probably will not be shared
132	Plus button	Drop down menus should be clearly indicated	The drop down menu is hidden and not obvious to participants
133	Incognito button	Change to a button that is clearly off or on	There is no way of knowing whether incognito is off or on
134	Confirm tick button	Ensure that back button and tick button perform the same function	To avoid accidental loss of preferences

Table 15: Task completion for privacy

Task	No. of subtasks	Subtask	No. needing help	Description
Meanings	6	Indicate meaning of "my location"	2/3	Confused with address
		Indicate meaning of "physical"	2/3	Confused with events that involve physical activity
		Indicate meaning of "mood"	1/3	Did not understand
Changing privacy settings	5	Indicate that they would press the "x" icon on the "family" button in the "physical" row	1/3	Believes that "incognito" button is how to switch off any type of data sharing
		Indicate that they would press the "+" button in the "my location" row	1/3	Did not realise a drop down menu appears
		Indicate that they would press the "incognito" button	2/3	Some users not sure what it means

### 1.3.9 Navigation

The navigation bar sits at the top of the screen and provides access to the different parts of the system.



Figure 44: Navigation bar

Currently, when a part of the interface is open (Profile, in Figure 44), a thin coloured line is drawn underneath the item. Participants found this difficult to see and said:

*“It would just be better if the whole block was illuminated” (P11)*

If the entire segment of the navigation bar was highlighted, this would be much clearer for users.

While the navigation bar is present in most parts of the interface, it is not present on the home page. While this would be slightly redundant, without the home page having a navigation bar, there is no access to the menu option and the dropdown list. The menu bar (even if not the full navigation bar), should therefore be present in the home screen.

The menu list presents the following options:

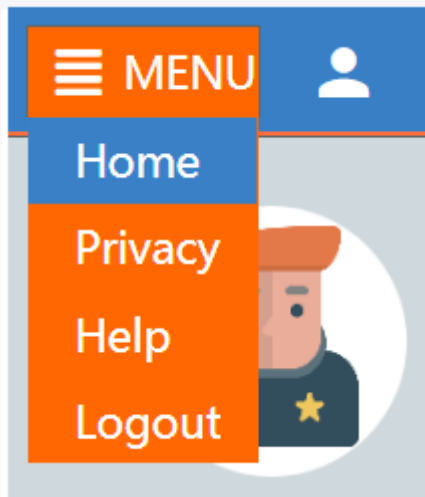


Figure 45: Menu list

To test the ease of accessing these menu options, participants were asked to find their way to various options. While the home screen made it difficult to access the options, various other comments were made about making it easier to access some options. For privacy, one user suggested that it could also be accessed via the profile screen:

*“Maybe a link from your profile [would help]” (P11)*

Because privacy settings are an aspect of a user’s profile, it may be good to include a link from the profile.

Again, because the help button is not accessible from the home screen, a participant said:

*“Often the home page has a little help button... Have a help button so that it could help you in every section.” (P11)*

It may be helpful for users to have access to the help screen from any part of the UI. Perhaps the best way to do this would be to include a help button on the navigation bar. However, this should be balanced against the need to keep the navigation bar as simple and decluttered as possible.

One participant found it hard to access the logout button due to it being difficult to find. While they suggested including it on the navigation bar, this could lead to accidental logouts and it is unlikely to be a frequently used feature. It seems best therefore, to keep it in the menu.

Table 16: Suggested changes for navigation bar

No.	Old	New	Justification/Description
135	Navigation bar thin underline	Highlight entire segment to show open feature	This enables users to see more clearly what part of the interface is open on the navigation bar
136	No menu bar in home screen	Provide menu bar in home screen	Several options are only available via the menu bar, which is not present in the home screen
137	Access to privacy via menu only	Provide access via profile also	Privacy conceptually belongs to the profile and could be linked to via the profile

138	Help access via menu	Consider adding help option to navigation bar	This may be helpful for users, but should be balanced against need for a decluttered navigation bar
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*Table 17: Task completion for navigation bar*

Task	No. of subtasks	Subtask	No. needing help	Description
Menu	6	logout item (go back)	1/3	User could not find logout button

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## 1.4 Discussion

In this part of the deliverable, we have presented the results of usability testing of a prototype of the FriTab user interface; in the next part we deal with some results of testing the FriWalk. Usability testing is a crucial component of user-centred design (Abrás, Maloney-Krichmar, & Preece, 2004) and enables users to identify their problems with and desires for a system. This is particularly important with designs for older adults. These users do not often have the familiarity that younger users have, and usability testing takes on an extra level of significance. Furthermore, the distance between the end-user and the designer is increased with older compared to younger participants, insofar as the older user may not approach the interface in the same way as a younger user (of whom the designer is likely to belong) (Hawthorn, 2007). Consequently, extra attention has to be paid to usability testing with older adults.

In this research, we became very aware of this difference in perspective and a range of issues are summarised below. The issues discussed here seem particularly relevant to designing for older adults.

Firstly, participants often expressed a preference for words rather than icons in the UI. This enabled users to easily identify the meaning of a button, whereas icons were often ambiguous and difficult to interpret. Even icons that seemed intuitive (e.g. the bin icon) were not always understood. In one case, the bin icon seemed too unlike the iOS bin icon (with which the participant was familiar) and therefore was not recognised. In another case, even when it was recognised, it was interpreted as being dismissed and rude – why would you “bin” an invitation to an event? Thus, there were numerous issues around the use of icons. Other research has found that older adults prefer icons to be labelled (Sulaiman & Sohaimi, 2010) and our research confirms this finding. Additionally, we show that the meaning of icons (e.g. the bin as a discarding gesture) also is subject to generational differences. However, while initial use of an interface might have better performance with a text-interface or icon+label interface (Wiedenbeck, 1999), and while some suggest that UI design for older adults incorporate icon+label designs as much as possible (Leung, McGrenere, & Graf, 2011), we have opted not to completely replace or supplement all icons with text. This is because we want to have a simple and uncluttered interface, something that a text-heavy interface can interfere with. Furthermore, research has suggested that icon-based interfaces can be faster (Schröder & Ziefle, 2008) as long as the icons are semantically related to their function. Therefore, in this deliverable we have pointed out areas where icons need to be improved to be more meaningful to older users. We have also incorporated an additional user suggestion, namely, that we include an icon-sheet that specifies the meanings of the different icons. While we have yet to test this, we expect that it will be helpful in assisting users to use the system.

This observation that a paper-based sheet of information might prove useful to users brings us to a second point regarding older-adult use of the system: older adults often like to supplement digital technology with paper-based systems. Not only was there the suggestion about using a list of icons that the user could consult to begin with, but one user talked about how he would want to write out the navigation instructions from the system so that he could travel to his destination without using the system’s live instructions. He said that doing this was more prudent because he might lose the tablet device. Thus, the system should not be entirely screen-based. Older adults often prefer having some information on paper, and this should be facilitated.

Thirdly, older adults sometimes express a fear that they will accidentally do something wrong to the system, leading to a desire to have some method of preventing accidental damage. For example, when editing profile information, users wanted to have buttons to “unlock” fields that they could then edit. They also expressed hesitancy about pressing certain buttons in case it led to a wrong consequence, thus, they wanted confirmation dialog boxes after significant actions. While these kinds of features are good practice anyway, they are particularly desirable for older adults to give them the confidence that they can use the system without making significant mistakes.

Aside from these issues that seem to relate particularly to older adults, there were other issues that arose in the analysis. The two that are most significant are the design of the display of activities, and the design of the privacy settings screen. While some participants liked the view of the “garden”, some participants also disliked it and preferred something that was less childlike, more masculine (for some), and did a better job of conveying information about steps. This suggests that as technology has developed since the initial design of a similar interface (Consolvo et al., 2009), expectations of users have changed. Many of the participants were familiar with the kinds of interfaces provided by other systems such as FitBit and MisFit, and thus, expected a more descriptive interface.

Regarding privacy settings, some difficulties emerged because of lack of clarity on what information would be shown to other users and how. Thus, the labels were not clear to participants who could not see how the proposed information would be shared. Furthermore, interaction with the interface was difficult and some participants were not aware of how to access drop-down menus (that were hidden). Also, the conceptual distance between the organisation of groups (which was done for messaging purposes) and the use of those groups in allocating privacy preferences (in the privacy screen) meant that participants would have to rearrange groups in a separate screen before returning to the privacy screen to assign those groups to categories of data sharing. Conceptually, it makes more sense to sort groups with a view to privacy, and then, in another step, to allocate data-sharing preferences to those groups (rather than assigning groups to data). In short, a more thorough redesign of this section is anticipated to enable users to interact more with their privacy settings.

This section of the deliverable has presented an analysis of a prototype of the FriTab UI and has learned important lessons from the older adult participants. Moving forward, this data is being used to revise the UI design and to make a more user-friendly system for the anticipated users. The Appendix details how these results have been implemented and provides some insight into the rationale for why some changes have been made, while others have been postponed or declined.

## 2 FriWalk prototype testing

### 2.1 Introduction

The FriWalk is designed as a way of guiding an older adult through an indoor environment such as a museum or shopping centre. While feedback will be provided through the user interface on where the user is and where they are going to, other feedback will be provided to help guide the user. This is particularly helpful in cases where the user may be partially sighted or even where they are distracted by something else in the environment and need a prompt to help them follow the desired path. The feedback provided in such cases can either be in the form of haptic vibrations (via bracelets worn on the arm), bang-bang/on-off controllers that slow the wheel on the side of the direction of the turn, or in the form of simulated passivity (a gentler form of guiding a turn). In the haptic condition, bracelets are worn on both arms. The turn is signalled by vibrations in the arm corresponding to the direction of the turn. In bang-bang modality the FriWalk brakes/blocks the wheel on the inside of the direction of the turn, whereas in simulated passivity the wheel is slowed. In the bang-bang modality, the walker is propelled entirely by the user, whereas in the simulated passivity modality, the walker is partially autonomous during the turn.

### 2.2 Method

We conducted an experiment to collect people's impressions toward the robot walker and its guidance modality. In two studies, participants were invited to complete a series of paths using the robot walker in three different modalities. The order of trials, as well as the different modalities of the guide, were randomized. A questionnaire was also developed to conduct a structured interview and to collect the impressions and opinions of participants.

In the first study participants tested the bang-bang and the simulated passivity modalities (counterbalanced). In the second study they tested all three modalities (bang-bang, simulated passivity, haptic) and these were counterbalanced.

#### 2.2.1 Participants

A total of 30 people took part in the studies. These were recruited as part of two separate studies. In the first study, 14 participants took part but 2 of them were excluded from the analysis as they did not understand the instructions of the tasks with the walker. In the second study, there was a total of 16 participants, but one was excluded from the analysis as she did not speak Italian fluently and had difficulty understanding the instructions and the questionnaire.

#### 2.2.2 Procedure

Participants were contacted via email and invited to take part in the study which was carried out at a laboratory of University of Trento located in Pergine (Trento). Before starting the experiment, participants signed an informed consent form and it was explained to them that all information was confidential and data collection would be anonymous. Participants were all aware they had the right to stop and leave the experiment at any stage without penalty.

When they provided us the informed consent, they were invited to perform the tasks with the robotic walker in one of several modalities.

Before using the robotic walker, an experimenter provided instructions to the participants on the path they had to follow describing also the robotic walker, its features, and its movement's modality.

Every participant first had to complete a trial to build confidence with the robot walker and after that, at least one experimental task. When they had carried out the tasks with the robotic walker, participants sat next to another experimenter who conducted the structured interview/questionnaire.

#### 2.2.3 Measures

The structured interview aimed to collect the impressions of participants on the robotic walker and the guidance modality. Different kinds of questions (open ended and closed ended) were included in the questionnaire. In the present work, we describe the results of closed-ended questions, which required participants to answer using yes or no and/or a 5-point Likert scale (1 "not at all", 2 "a little bit", 3



“moderately”, 4 “very much”, 5 “extremely”). The questions focused on several features of the interaction with the robot walker, followed by items concerning the pleasantness and the ease of learning in using the robot walker, the control over the walker, and its adaptability to the individual. All the items and questions were analyzed separately.

#### 2.2.3.1 Characteristics of the interaction with the walker

We asked participants different information about their experience with the robot walker and specifically if they felt vibration using the robot walker (“During the performance of the task have you felt vibrations?”), if it was clear that the walker provided indication on the path to follow (“Was it evident that at some moments the walker chose the path to follow?”) and if they felt pushed or blocked (“Have you ever had the sensation to be pulled, pushed, pulled, or stuck?”). If participants answered yes to any of these questions, they were requested to indicate how much unpleasant or annoying was that specific element (e.g. “How unpleasant/annoying were these vibrations?”).

#### 2.2.3.2 Pleasantness (in using the robot walker)

Three items to measure the impressions of people on pleasantness in using the robot walker were created: “The experience with the walker was pleasant”, “It was frustrating to carry out the task with the walker”, and “I am satisfied with how I did the task with the walker”.

#### 2.2.3.3 Ease of learning

We assessed the ease of learning to use the robot walker using three different items: “It was easy to learn to use the walker with this mode of movement”, “I was able to use the walker properly in a short time”, and “I had trouble understanding how to move around with the walker”.

#### 2.2.3.4 Control over the walker

As the robot walker provided cues on the path to follow, we decided to investigate the perception of control over it by creating three items: “I was sure the walker would always respond to my commands”, “I had the impression I could suddenly lose control of the walker”, and “I had the impression I did not have full control over the walker’s movements”.

#### 2.2.3.5 Adaptability of the walker

Finally, we considered that the speed of the walker could affect the normal walking pace of the participants. For this reason, we included three items to measure how much participants had the sensation they had to adjust to the robot and its speed or, conversely, the robot adapt to their way of walking: “The walker fits well with your movements”, “I had to adjust to the movement of the walker”, and “The walker hindered/prevented my usual way of moving/walking”.

### 2.3 Results

#### 2.3.1 Bang-bang guidance (Study 1)

##### 2.3.1.1 Characteristics of the interaction

Five participants (41.7 %) declared they felt vibrations during the tasks with the walker, however, they estimated these vibrations “not at all” or “just a little bit” unpleasant or annoying ( $M = 1.60$ ,  $SD = .55$ ).

All twelve participants (100 %) reported it was clear that the robot walker decided the path. Overall, participants reported this element was not annoying for them ( $M = 1.92$ ,  $SD = 1.00$ ). Most of them declared that this characteristic was “not at all” (5 participants, 41.7 %) or “a little bit” (4 participants, 33.3 %) negative, whereas only three participants stated that be guided the robot walker was “moderately” (2 participants, 16.7 %) or “very much” (1 participant, 8.3 %) annoying for them.

Finally, the majority of participants (7 persons, 58.3 %) declared they felt pulled, pushed, pulled, or stuck during the tasks with the robot walker but they evaluated this sensation only as slightly annoying ( $M = 2.43$ ,  $SD = .98$ ).



### 2.3.1.2 Pleasantness

Participants reported the experience in using the robot walker as pleasant ( $M = 3.42$ ,  $SD = .67$ ) and they felt satisfied for how they carried out the tasks ( $M = 3.58$ ,  $SD = .52$ ). Moreover, they stated that the interaction with the robotic walker was not frustrating ( $M = 1.58$ ,  $SD = .90$ ).

### 2.3.1.3 Ease of learning

Participants evaluated as moderately easy to learn to use the robot walker ( $M = 3.58$ ,  $SD = .60$ ).

### 2.3.1.4 Control

Participants reported they have moderately the sensation that the robot was responding to their commands ( $M = 3.08$ ,  $SD = 1.08$ ) and they did not have the feeling that they could suddenly lose the control over the walker ( $M = 1.33$ ,  $SD = .65$ ), but they had “a little bit” the sensation they did not control completely it ( $M = 1.83$ ,  $SD = .72$ ).

### 2.3.1.5 Adaptability

We found that participants had the feeling that the robot walker did not represent an obstacle to their usual way of walking and it adapted very well to their speed, ( $M = 3.92$ ,  $SD = .63$ ).

## 2.3.2 Bang-bang guidance (Study 2)

### 2.3.2.1 Characteristics of the interaction

Only three participants (20 %) declared they felt vibrations during the interaction with the robot walker, but that these vibrations were not at all disturbing for them ( $M = 1.00$ ,  $SD = .00$ ). With the exception of two individuals and one missing, all participants (80 %) reported that they were aware that the robot walker decided the path, but this was not annoying for them ( $M = 1.27$ ,  $SD = .47$ ). Finally, six participants (40 %) reported they had the sensation to be pulled, pushed, pulled, or stuck while they were using the robot walker, but this feeling was evaluated only as slightly unpleasant or annoying ( $M = 2.00$ ,  $SD = .89$ ).

### 2.3.2.2 Pleasantness

We found that participants reported the experience with the walker moderately pleasant ( $M = 3.47$ ,  $SD = .74$ ), and that they felt satisfied with their performance ( $M = 3.53$ ,  $SD = .74$ ). Moreover, they stated they did not feel frustrated for the interaction with the walker ( $M = 1.13$ ,  $SD = .51$ ).

### 2.3.2.3 Ease of learning

Results showed that for participants was easy to learn to use the walker ( $M = 3.83$ ,  $SD = .61$ ).

### 2.3.2.4 Control

Analysis conducted evidenced that for participants the robot walker responded moderately well to their commands ( $M = 3.31$ ,  $SD = .95$ ), and at the same time they did not experience the sensation of suddenly lose the control over the walker ( $M = 1.21$ ,  $SD = .58$ ) nor the feeling to not have the complete control over it ( $M = 1.53$ ,  $SD = .74$ ).

### 2.3.2.5 Adaptability

Results showed that participants reported that they had the sensation that the robot walker adapted well to their speed and that it did not represent an obstacle for their walking style ( $M = 4.10$ ,  $SD = .54$ ).

## 2.3.3 Simulated passivity (Study 1)

From the subsequent analysis, data of two participants were excluded as they did not understand the indications provided by the experimenter to carry out the tasks with the walker.

### 2.3.3.1 Characteristics of the interaction

We found that six participants (33.3 %) reported they feel vibrations during the tasks with the walker, but they evaluated these vibrations “not at all” or “just a little bit” unpleasant or annoying ( $M = 1.75$ ,  $SD = .50$ ).

With the exception of one person, all the participants (91.7 %) declared they were aware that the robot walker decided the path but this element was only “a little bit” negative for the most of them ( $M = 1.82$ ,  $SD = .98$ ). Only two participants reported that it was “moderately” and “very much” unpleasant that the robot walker decided the path.

Finally, three persons (25 %) reported they felt pulled, pushed, pulled, or stuck during the tasks with the robot walker but at the same time, they declared this sensation was just “a little bit” unpleasant ( $M = 2.00$ ,  $SD = .00$ ).

### 2.3.3.2 Pleasantness

The analysis of the scores for the items concerning the pleasantness in using the robot walker highlighted that participants evaluated the experience as pleasant ( $M = 3.58$ ,  $SD = .79$ ) and they felt satisfied for how they carried out the tasks ( $M = 3.83$ ,  $SD = .72$ ). Moreover, they reported the experience was not frustrating ( $M = 1.17$ ,  $SD = .58$ ).

### 2.3.3.3 Ease of learning

Participants stated it was easy to learn to use the robot walker ( $M = 3.75$ ,  $SD = .45$ ) and that they could use it correctly in short time ( $M = 3.67$ ,  $SD = .49$ ). At the same time, they declared they did not have problems to understand how to move with the robot walker ( $M = 1.17$ ,  $SD = .39$ ).

### 2.3.3.4 Control

As participants during the introduction to the trials with the robot walker were explained about its functionalities and features, they reported a high impression of control over it ( $M = 4.17$ ,  $SD = .91$ ).

### 2.3.3.5 Adaptability

Participants declared they had the sensation that the robot walker adapt very well to their speed and it did not represent an obstacle to their usual way of walking, ( $M = 3.83$ ,  $SD = .86$ ).

## 2.3.4 Simulated passivity (Study 2)

Data of a participant was excluded from the next analysis as he/she was not Italian mother tongue.

### 2.3.4.1 Characteristics of the interaction

Eight participants (53.3 %) reported they felt vibrations during the interaction with the robot walker, but that these vibrations were not strongly unpleasant or annoying ( $M = 2.00$ ,  $SD = .76$ ). With the exception of one individual and one missing, all participants (93.3 %) stated that was clear to them that the robot walker decided the path, however, this was not disturbing to them ( $M = 1.31$ ,  $SD = .63$ ). Finally, ten participants (66.7 %) reported they had the sensation to be pulled, pushed, pulled, or stuck in using the robot walker, but they indicated that this feeling was only slightly unpleasant or annoying ( $M = 1.80$ ,  $SD = .79$ ).

### 2.3.4.2 Pleasantness

Results showed that participants evaluated the experience with the walker moderately pleasant ( $M = 3.47$ ,  $SD = .74$ ) and that they feel satisfied with their performance with the robot ( $M = 3.47$ ,  $SD = .74$ ). Moreover, they reported they did not feel frustrated for the interaction with the walker ( $M = 1.20$ ,  $SD = .56$ ).

#### 2.3.4.3 Ease of learning

We found that for participants was easy to learn to use the walker ( $M = 3.80$ ,  $SD = .68$ ) and that in their opinion they used it correctly in a short time ( $M = 3.80$ ,  $SD = .56$ ). At the same time, they stated they had no problems to understand how to move with the walker ( $M = 1.13$ ,  $SD = .35$ ).

#### 2.3.4.4 Control

Analysis conducted highlighted that participants reported a high impression of control over the robot ( $M = 4.3$ ,  $SD = .82$ ).

#### 2.3.4.5 Adaptability

Participants indicated that they had the sensation that the robot walker adapted well to their speed and that it did not represent an obstacle for their walking style ( $M = 3.73$ ,  $SD = .70$ ).

### 2.3.5 Haptic guidance (Study 2)

Haptic guidance was only tested in study 2 and was not part of study 1.

#### 2.3.5.1 Characteristics of the interaction

Excluding one missing participant, all the other fourteen individuals reported they felt vibrations during the interaction with the robot walker, but this was not disturbing at all for them ( $M = 1.36$ ,  $SD = .50$ ). Except for three individuals and one missing, all the other participants (73.3 %) reported that they were aware that the robot walker provided indications to follow a certain path, but this feature was considered as not disturbing ( $M = 1.27$ ,  $SD = .47$ ). Finally, all fifteen participants declared they did not have the impression to be pulled, pushed, pulled, or stuck while using the robot walker.

#### 2.3.5.2 Pleasantness

Participants evaluated the experience with the walker as moderately pleasant ( $M = 3.27$ ,  $SD = .59$ ), and they felt satisfied with their performance ( $M = 3.50$ ,  $SD = .76$ ). Moreover, they reported they did not feel frustrated for the interaction with the walker ( $M = 1.07$ ,  $SD = .26$ ).

#### 2.3.5.3 Ease of learning

Results showed that participants had the impression it was easy to learn to use the robot walker ( $M = 3.87$ ,  $SD = .52$ ) and that they used it correctly in a short time ( $M = 3.80$ ,  $SD = .68$ ). Finally, they reported they did not have problems in moving with it ( $M = 1.27$ ,  $SD = .46$ ).

#### 2.3.5.4 Control

We found that for participants the robot walker responded well to their commands ( $M = 3.40$ ,  $SD = .74$ ), and at the same time they did not experience the sensation of not having a complete control over the robot walker ( $M = 1.21$ ,  $SD = .58$ ), nor of suddenly losing control over ( $M = 1.13$ ,  $SD = .35$ ).

#### 2.3.5.5 Adaptability

Participants reported they had the feeling that the robot walker adapted well to their own speed ( $M = 3.73$ ,  $SD = .80$ ). Moreover, they declared that they did not have to adjust to the robot walker ( $M = 1.43$ ,  $SD = .85$ ) and it did not represent an obstacle to their movements ( $M = 1.29$ ,  $SD = .61$ ).

### 2.3.6 Comparisons

To illustrate the differences between conditions, graphs are presented below to show participant views.

### 2.3.6.1 Characteristics

Across the conditions, participants were asked about the degree of unpleasantness experienced when they felt vibrations, felt aware they were being guided, or felt that they were being pushed or pulled. Not all participants reported feeling these phenomena, but for those who did, the degree of unpleasantness experienced is reported.

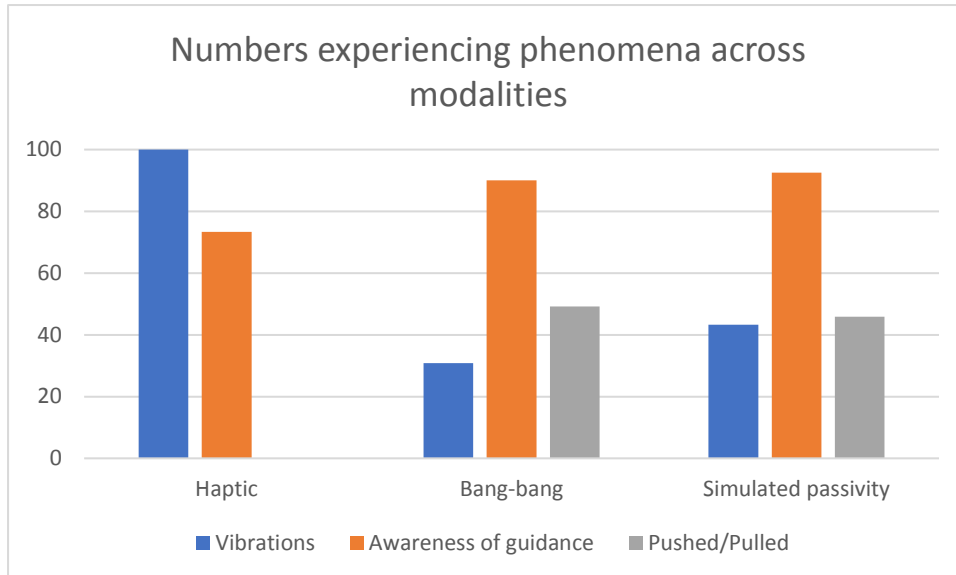


Figure 46: Numbers experiencing phenomena across modalities

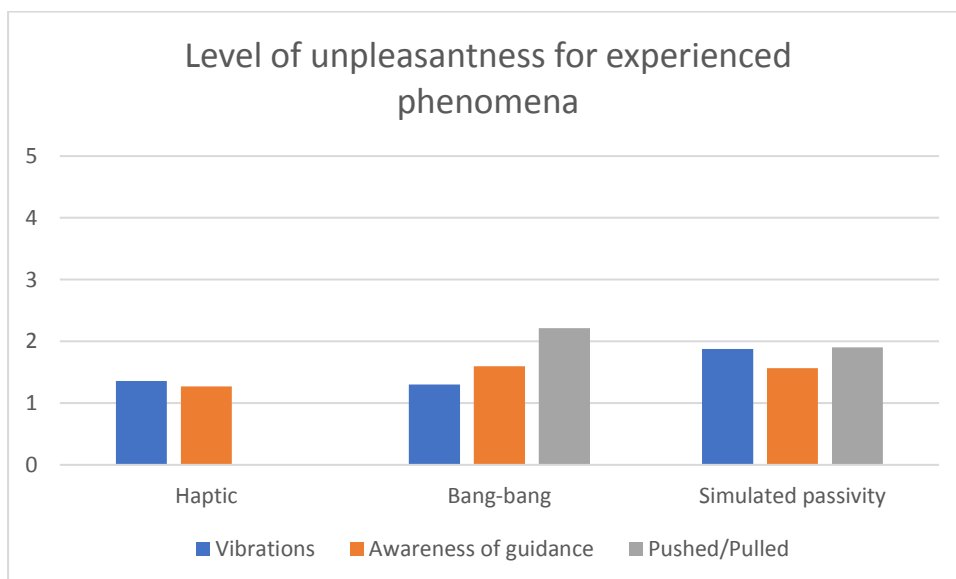


Figure 47: Levels of unpleasantness for experienced phenomena

### 2.3.6.2 Pleasantness

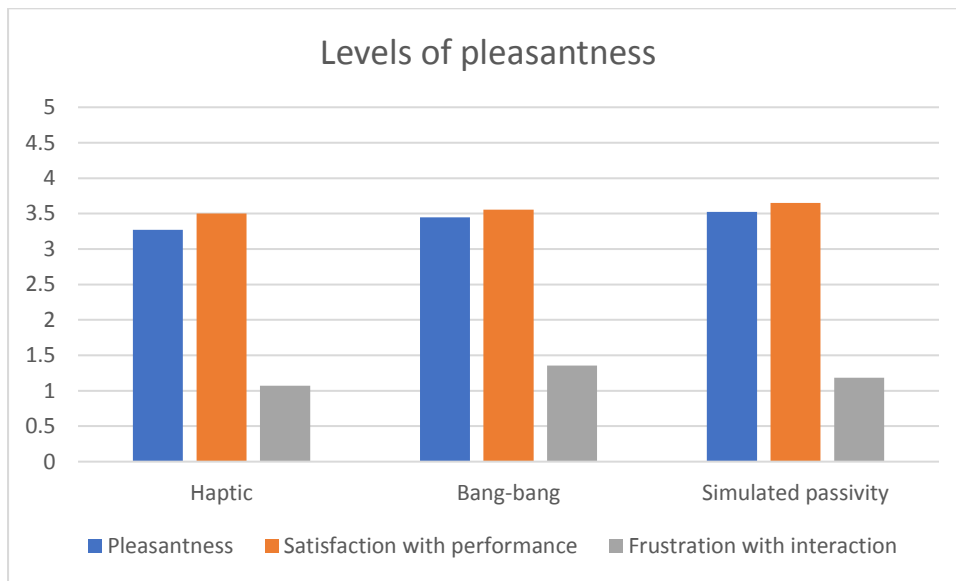


Figure 48: Levels of pleasantness across modalities

As can be seen from the chart, the different modalities were similar, but simulated passivity received slightly better ratings.

### 2.3.6.3 Ease of learning

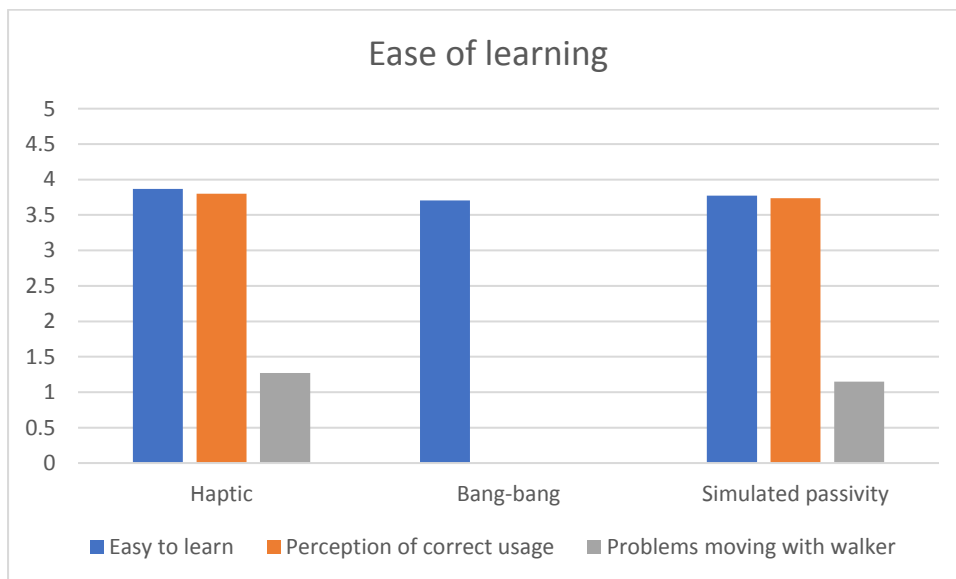


Figure 49: Ease of learning across modalities

All the conditions received similar ratings for ease of learning.

### 2.3.6.4 Level of perceived control

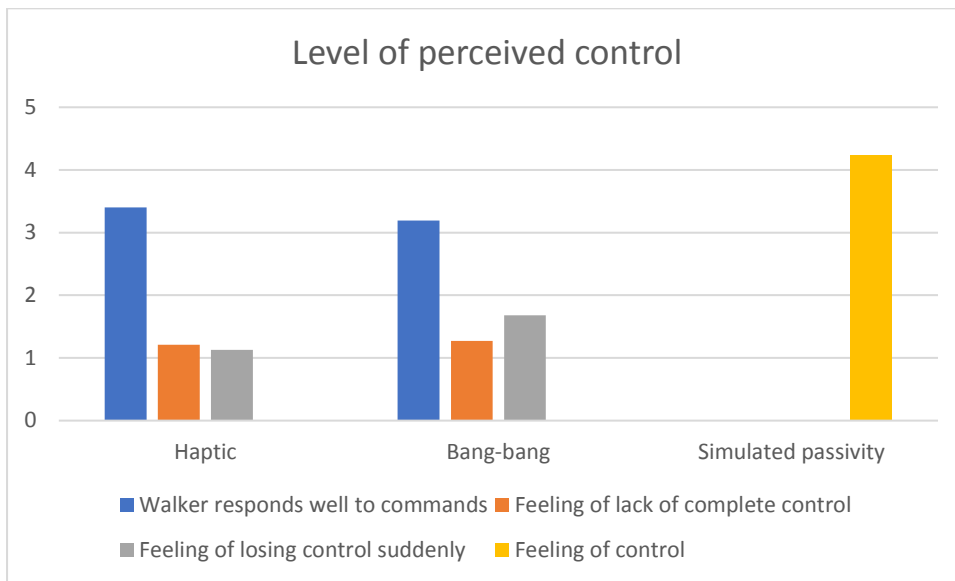


Figure 50: Level of perceived control across modalities

While the measures are not directly comparable, the simulated passivity condition receives slightly higher ratings for perceived control.

### 2.3.6.5 Adaptability

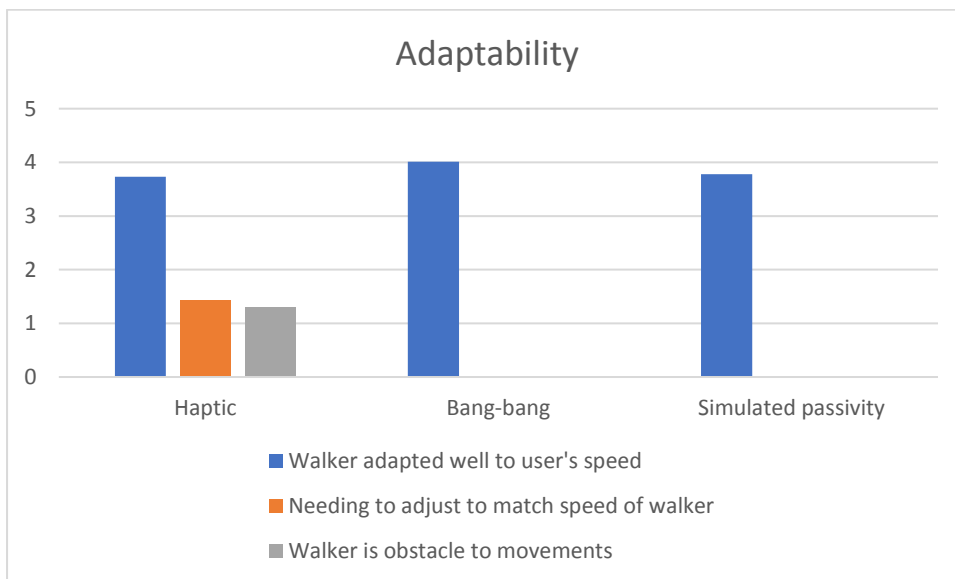


Figure 51: Levels of adaptability across modalities

The participants saw the different modalities as having comparable adaptability to the user's walking speed.

## 2.4 Discussion

Across these two studies, tests were conducted on the different modalities used for guidance on the FriWalk. The results show that participants rated all the modalities as being quite pleasant to use, but simulated passivity received very slightly higher ratings for pleasantness. All modalities received similarly high ratings for ease of learning, and this augurs well for the acceptance of the guidance system in future use. Given that ease of use is one of the core factors predicting acceptance of technology (Heerink, Kröse, Evers, & Wielinga, 2010), this is a positive finding. Relatively high ratings

of adaptability of the system and perceived control also suggest that the system should be acceptable to users.

Of course, these are only preliminary tests and further testing needs to be conducted. These tests were conducted in a laboratory and thus may lack some ecological validity. Further testing in more natural environments should help to understand users' perception of the guidance system.

Additionally, these tests only cover some of the guidance modalities (i.e. non-graphical guidance). In the final system, these non-visual modalities will integrate with the FriTab to provide visual feedback to the user about where to go. Together, we anticipate that the different modalities will help users navigate unfamiliar environments more successfully.

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### 3 Appendix: Changes made to UI based on usability testing

Based on the study reported above (usability testing of the social network UI in the UK), several changes were made to the UI. While the process of refining the UI is iterative, these changes are reported here to show how the feedback translated into changes to the UI. The sections below correspond to the sections reported above, and the tables are based on the tables of suggested changes above. The columns of the table are the same as above, except the final column, "Result" in which a description of changes is provided. The changes implemented can be viewed in a revised version of the interface here: <http://run.mockplus.com/SowmvpE1Ju701Ajk/index.html>

#### 3.1 Authentication

Feature evaluated with 5 participants (5 sign in; 3 sign up). The issues that participants faced with this feature are listed in Table 18.

Table 18: Authentication suggested changes and implementation

No.	Old	New	Justification/Description	Result
1	Keep me signed in	Remember me	It seems natural to keep users signed in. They are however, concerned whether the system remembers their password or not (for ease of use and security reasons)	Done
2	Click here	Click <b>here</b>	Reduce spacing between words and make "here" bold.	Done (reduced space only)
3	SMS	text message	Text message is more familiar terminology. Make screen adapt to identify what kind of message has been sent.	Done; no possibility of the adaptation in the mock-up
4	New user? Click here	If you're a new user, please register here	Provides more clarity to users	Done
5	New user feature	Place frame around new user feature text and frame around existing user elements	This will allow clearer distinction of what to do as a new user and what to do as an existing user	-
6	Click here	Click <b>here</b>	Reduce spacing between words and make "here" bold.	Done (reduced space only)
7	Photo button	Add text saying, "Add photo" beneath icon	This will make the button clearer to users	Done; Icon sheet included instead of help page; We have similar case in the Profile
8	Username field	Remove	Email address is a unique field that can be used instead of username	Left because they may not have an email
9	Password field	Provide format instructions if	If the system requires a specific format of password, this should be	This depends on the setup of the technology

No.	Old	New	Justification/Description	Result
		necessary	clearly specified	used to implement the UI and can be done later
10	Name	Personal name and family name	Split the field into two to allow for clear identification of personal and family names	Done
11	Age	Year of birth	Age is a changing variable whereas date of birth is not. Some pps prefer providing less detailed information than full date of birth hence, year of birth	Done
12	Gender	Add “other” option (or similar)	Participants raised the issue of transgender persons.	Done
13	Address/residence	Address (multiple lines) or town	Place of residence was too formal. More than one line is required if address is required	Done
14	Previous + continue buttons beneath map screen for location (but see 16)	Hide buttons/maximise map window	The buttons beneath the map confuse users	Done
15	Tick button (map window); but see 16	Confirm button	Change tick to a “confirm” button for clarity	Done
16	Map window	Remove map	Map is not needed for users to specify where they live	Done
17	Occupation	Provide pre-populated list	Free-form entry can create duplication through synonyms or errors	This can be solved by the UI technology, such as Ajax (dynamically populated list while the user types in), not supported by the mock-up tool
18	Interests	Sort the list (probably alphabetically) and put in a list	Too many checkboxes will not fit on the screen and they would need to be sorted in some way to make finding interests easy	If a list is used, then there needs to be several of them if they want to choose more, and if the list is long they need to scroll down. They can type in Other (see 17)

No.	Old	New	Justification/Description	Result
19	Interests	Provide multiple "other" options	Perhaps a text field allowing multiple entries separated by commas would work. But the instructions should be provided beside the text box (separating interests by commas)	This can be provided as part of training or put in help pages. For now, there is a hover text when over the text field
20	Distance for recommended events	Change to miles rather than km	British users are more familiar with imperial units (esp. older people)	Done
21	Usual transportation modes	Add "walking"	This is a common form of transportation	Done
22	Show garden screen after login	Show home screen after login	Participants expressed a preference for this and it seems natural given that they may be trying to quickly access a different part of the system	- (below)
<p>22 - 3/5 suggested this. It also depends on how the system is presented to the user (in the procedure it said that the aim is to be more physically and socially active). There was the diary idea (as P10 noted) but this was not discussed in detail. In the Italian study it was 10/12 in favour of this. There are also demographic differences. It has been left as an option for users to choose whether they want to see it after login (from home page) and how they want to have it displayed in general (garden or diagrams; setting as part of sign up and profile, or from home page or events).</p>				
23	Structure and placement of garden screen	Place garden (achievements) screen button on home screen	Some participants found it unusual to place the achievements screen either at the beginning (after login) or in the events section. Because it is conceptually distinct from the events section, it seems best to put in on the home screen	-
24	Profile button on home screen	Move profile button to link on navbar menu dropdown	Profile is not going to be regularly accessed by users so it should have less prominence	Button made smaller and less highlighted (it is in the navbar, it shouldn't be put in the menu)
25	Red and orange buttons	Make colours more distinct	Participant preference and it is easily done	Done
26	Notification numbers are small	Bigger numbers	This makes it easier for participants to read the numbers	Done

### 3.2 Profile

This feature evaluated with 2 or 3 participants. The issues that participants faced with this feature are listed in Table 19. The profile button is made less prominent in the home page and put in the end of the topbar (on the right) for the same reason, instead of making it a menu item.

Table 19: Profile suggested changes and implementation

No.	Old	New	Justification/Description	Result
27	No cues for editing personal details	Add button to provide access to editing screen	Users do not know how to access editing screen	Done
28	No editing buttons/pencil icon beside every field	Add editing buttons/pencil icon beside every field	To avoid accidental deletion/editing of data	- ; Too many pencils on the screen
29	Single name field	Split into two fields	Provides easy separation of first and second names	Done
30	Age field	Date/Year of birth	Age can be calculated from DOB. Age changes so is an inappropriate variable to collect.	Done
31	Gender field	Add "other" option	To accommodate other options	Done
32	Place of residence	Address/Town	To be less formal and clearer about what it required	Done
33	Map icon	Remove map feature	Users do not want it and it requires additional work to implement	Done
34	Occupation field	Provide pre-defined options	Needs to be restricted to specific options to allow for matching (see sign-up page comments for suggestions)	This can be solved by the UI technology, such as Ajax (dynamically populated list while the user types in), not supported by the mock-up tool
35	Recommended events radius (in km)	Change to miles	For English usage, miles is preferable	Done
36	Transportation modes	Include walking	This is a common form of transport	Done
37	Add interest icon	Move to same level as interests	This may make it more obvious. Also, add words or use icon sheet	Done
38	Search for interests	Add words to search bar	This will help explain the functionality to users	Done
39	Add interest	Provide feedback. Show existing interests.	Feedback is important for users to see that the action has been accomplished. Existing interests allows them to see what they still need to	The page displays only interests that are not added already; Done

40	Remove interest	Provide deletion confirmation	add To prevent accidental deletion	Done
41	1 day countdown left	Provide clarification	Users do not know what the day countdown refers to	Done (1 day left until the event)

### 3.3 Calendar

Feature was evaluated with 5 participants. The issues that participants faced with this feature are listed in Table 20. Some of the changes suggested require implementing certain UI logic, behaviour, or interactivity which is not supported by the mock-up tool. These can be mentioned together with the mock-up to the developer.

Table 20: Calendar suggested changes and implementation

No.	Old	New	Justification/Description	Result
42	No representation of empty days	Represent empty days	Participants want to see when they are available	Complicated to put in the mock-up regarding space available, etc. A pop up calendar has been provided.
43	1 day left	1 day left until event	Participants did not always understand what the 1 day left was counting towards	Done
44	No cost details	Cost details provided	This is required to fully inform users	Done
45	No accessibility details	Accessibility details provided	This is in line with information stored in the database (see D4.8)	Done
46	No details provided	Details provided	This will match event creation where details are provided	Done (Description added)
47	Events can be edited by anyone	Events can only be edited by owner	Essential for system integrity	Yes, but it is very specific requirement that requires certain logic that can be implemented in the real frontend, not in the mock-up
48	No alerts if an event is changed	Alerts users who are attending if the event has changed. Request confirmation for new details.	Changing the place, time or substantial changes to the description, will require users who have agreed to attend to reconfirm that they are happy to attend.	Same as previous, maybe message as notification can be sent for this
49	No alerts to users who decline events	Alert users if the event has	Users who decline an event because they cannot attend	If the activity changes

	if the event changes time/place	changed and ask if they will now attend	(even though they want to) should be offered another chance to attend if the details change	time/place will still be recommended to the user in the future.
50	Event requests/recommendations	Ask users why they decline if they decline	Understanding if users cannot attend because they are busy will allow events to be re-offered if the event time changes	Again the same; if the time/place changes the activity will be again recommended to the user in the future.
51	Event requests/recommendations	Show both available and declined events	This allows users to see if they can attend certain events if their schedule changes	-
52	Location map in event details	Click on map to access navigation	This allows multiple routes to access navigation. Currently navigation is not accessible from the event details.	Done
53	Attending user image in event details dialog	Click on user image to access their profile	Users should be able to find out more information about who is attending the event	Done
54	No screen to view other users' profiles	Create an "other user" profile screen	Users should be able to view the profile (e.g. interests) of other users	They can now see them from event details, otherwise they have Groups
55	Start button	"Journey instructions" or similar	Users want to see a list of navigation steps that they can write down	The map is supposed to be interactive once implemented, with the details
56	Transport mode	Radio button beside each transport mode	Users need to select a form of transport before receiving navigation instructions	Done
57	Bin icon for deleting event	Add confirm dialog after clicking bin	To avoid accidental deletion	Done
58	Invite people to event	Include an add icon within details view	To provide full functionality with details view	Done
59	Invite people to event screen	Show who had already been invited	To enable participants to decide who else to invite	There is too much information in a small space
60	Invite people to event screen	Provide confirmation after clicking on a friend to invite	To provide feedback to users so that they know an invitation has been sent (and how it will be delivered)	Done

61	Search for event ("Type to search")	Change text to "Type to search for upcoming event"	For clarification	Done
62	Missing fields in create event screen	Add fields for mobility, interest, cost, and title	To match back-end and other screens in the UI	Done
63	Time field (create event)	Make bigger and increase contrast	To make it easier for users to see	Done
64	Enter location window	Ensure that buttons in the screen beneath (create event screen) are not available/are occluded when location window is open	To ensure that users know to click on the tick window to confirm the location	Done
65	Enter location window	How does the map update? Should there be an update button?	To allow users to match the map to the specified location (in text field) without closing the window	This a mockup of the static map; the real interactive map updates
66	Reminder icon	Make icon and text active links	Many users click on the icon rather than the text	Done
67	Reminder icon and text	Expand text to say: "click to add reminder for yourself"	Users get confused over who the reminder is for	Done
68	"Click to invite people" text active, not icon	Make icon and text both active	To enable ease of use	Done
69	Invite people	Provide minimum and maximum people fields	To enable users to enter important information to plan an event	-
70	Invite people	Allow users to see who has been selected to receive an invitation	For feedback and easy selection of additional people	This logic can't be implemented in the mockup (for developer)
71	Back and confirm buttons on invite people screen	Replace back button with "discard" button	To enable clear differentiation between the back and confirm buttons	The arrow is used in all pages like this. When they click confirm they get the message
72	Create event screen contrast	Make contrast between text and	Contrast is too low	Done

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73	"OK" button after event creation	background greater Make "OK" button take user back to the events screen	Non-functioning button	Done
74	Garden screen	Revise use of garden	Participants generally do not like the garden	Done; they can choose garden or diagram; IT participants liked the garden (10/12) and we need to try accommodating all.
75	Garden screen	Move to be a sub-page of the events screen	This seems to be a more logical structure	See 74
76	Set goals	Identify what activities the goal relates to	Users were not sure what activity the goal related to	All the activities that include walking and doing steps. This should be part of the system introduction and description at some point.
77	Set goals	Provide recommendation for goal	Users do not always know what is an appropriate goal	I think they should be defined by the users to be effective, maybe with previous consultation with doctors. This information can't be generalized, and is hard to personalize. They can simply adjust.
78	Set goals	Provide option for steps	Users want to set goals for steps as well as distance and time	Done, but still open (this was removed because it is not kept in the backend, and you also need to measure this information)
79	Set goals	Use miles instead of km	British users are more familiar with miles	Done
80	Set goals for weekly and monthly	Make clear if these are for	For clarity	-

			calendar weeks/months or for 7/28 days		
81	Circular diagrams	goal	Provide a way of highlighting when the goal is achieved and a way of indicating performance above goal	To provide positive feedback to the user	Don't have the possibility to do something like this in the diagram (for developer)
82	Activities window	chat	A key should be provided to indicate what butterflies represent	The significance of a butterfly is unclear	Done (stars used)
83	Activities window	chat	Increase spacing between user names and line up butterflies with names	For visual clarity	Done
84	Activities window	chat	Unclear what happens when a friend is invited	A request for a friend to join the chat should be designed	Can't be designed in the mockup – message should be sent to the invited person
85	Activities window friends	chat invite	Clarify that it is "invite more friends to chat"	To avoid confusion for users	Done
86	Activities window	chat	Change, "chat with your friends" to "chat with these friends"	To make it clear that people on the left can see the chat	Done
87	Activities window	chat invite via email	Change email to name	Users are unlikely to remember their friends' email addresses	Done
88	Detailed activity chart accessed by clicking on circle diagrams		Make link clearer	Users do not know to click on the circle diagrams to access charts	Done
89	Past event details		Add additional fields based on back-end (e.g. cost, event description)	To match change no. 62 and to assist users	Done
90	Past event photos		Add ability to enlarge photos	To enable users to see more details in the photos, especially those with poor eyesight	Done
91	Past event photos		Allow manual browsing of	To provide more control to	Done

	(auto-scroll)	photos and users add button controls		
92	Past events comments text field	Increase size of text field	To allow users to see more of what they are typing	Done
93	Past events comments on photos	Change comments for each photo	To enable users to comment on individual photos	Done
94	Past event rating scale	Change rating scale to “Very worthwhile” to “not very worthwhile”.	To allow for participants to assess events that are not inherently happy	-
95	Past event rating display	Only display ratings of others if there are 3 or more ratings.	To enable user privacy	- (for development)
96	Past event rating dialog box	Only show tick icon (remove cross)	To avoid confusion about the functions of the two buttons	It serves to close the dialog (now in the icon sheet)
97	Suggested events details window	Add cost, accessibility and details fields	To match the rest of the system	Done
98	Suggested events accept and reject options	Change reject icon from bin to an “x”	To allow users to express refusal more politely	Done
99	Reject suggested event	Provide dialog box for reasons after clicking reject icon	To allow accurate categorisation of what data is relevant for future recommendations	This information was present in one of the previous versions of the mockup, but the recommendation system doesn't take into account this kind of information and there is no field in the backend to store it.

### 3.4 Groups

Feature evaluated with 4 participants. The issues that participants faced with this feature are listed in Table 21.

Table 21: Groups suggested changes and implementation

No.	Old	New	Justification/Description	Result
100	Groups as defined as family, friends, acquaintances and	Allow users to create activity-based groups	This was preferred by participants	Activity groups are removed from one of the previous version of the mockup after pilot study in IT and

No.	Old	New	Justification/Description	Result
	professionals			series of discussions. Something like this doesn't exist in the backend. The users are not able to create activity groups. Interest-groups are created in the user clustering process (as part of recommendation component). So, in this case we have a conflict between what certain users want (creating activity groups) and what is currently supported by the backend.
101	"Friends" icon with arrows	Remove arrows from icon/use alternative icon	The arrows have the potential to make the user think that it is a button	A better icon will be designed in due course.
102	Age displayed in user details view	Remove age	Some users do not want it to be displayed and it serves no important purpose	Age will be removed from the group view or incorporated into privacy settings.
103	User address displayed in user details view	Display only general area (e.g. town)	Users do not want their full address displayed for privacy and security reasons	General area only will be displayed.
104	User phone number in user details view	Either remove or collect during sign-up	This data is not collected previously	Done (added); Phone number is an attribute of the ContactInfo class which is contained by the UserProfile, it may be collected later
105	Delete user from group	Display confirmation dialog after pressing delete	To avoid accidental deletion	Done
106	"Bin" icon in add user window	Remove bin icon	The function is not clear	Done
107	Content field in messaging facility appears at bottom of page	Move content field closer to "content" label	To avoid user confusion about where to type the message	Done
108	Hand and face icon for friend suggestions	Make the icon more unified	The icon appears as disconnected elements to some	Icon sheet

No.	Old	New	Justification/Description	Result
109	Suggested friends screen	Add names underneath images	To enable users to identify the displayed users	Done
110	Chat window	Display who is present in the chat	To allow users to see who will receive the message	Done
111	Chat window invite	Change to add and move to top of chat window	This avoids confusion with inviting people to events and moving it avoids confusion with the similar-looking message fields	Done
112	Chat window	Consider whether users should be able to open multiple chats and be able to leave chats	These may be desirable features (not discussed with participants)	Leaving is similar to Whatsapp (closing the dialog with the close icon explained in icon sheet)

### 3.5 Messaging

Feature evaluated with 4 participants. The issues that participants faced with this feature are listed in Table 22.

Table 22: Messaging suggested changes and implementation

No.	Old	New	Justification/Description	Result
113	No designs for friendship requests or event invitations	Design invitations to events and friendship requests	These need to be designed	Done; They are designed to be messages, Accept icon instead of Reply for invitations and requests (with hover message)
114	No design for chat request regarding activity	Design invitation to chat about activity	The “my achievements” screen allows users to invite users to chat and share activity data. An invitation for this should be designed.	Done
115	Message icon in top left	Remove icon to avoid confusion	This confused one participant because it is similar to the new message icon	Done
116	New message icon	Make icon more prominent	One user took a long time to find it	Done
117	Content field at bottom of page	Move content field further up page towards content label	To avoid confusing users	Done
118	“New	Move label to	To avoid misleading users into	Done

	Conversation" label	centre of title bar	thinking that a new conversation is accessed by clicking on the back button	
119	"New Conversation" label	Change to "New Message" or "New E-mail"	To maintain consistency and familiarity	Done
120	Send icon	Consider how to make this clearer	Not all users recognise the "send" icon and even those who do, do not always know what it is	Done
121	Content field in reply screen	Move up closer to content label	To avoid confusion	Done
122	Delete button	Confirm delete after pressing button	Users do not want to accidentally delete messages	Done
123	Delete messages	Add archive option	To allow users to store messages in a separate place from the inbox	- (development)
124	Deleted messages	Allow users to access deleted messages	In case the user wants to retrieve a deleted message	- (development)

### 3.6 Privacy

Feature evaluated with 3 participants. The issues that participants faced with this feature are listed in Table 23.

Table 23: Privacy suggested changes and implementation

No.	Old	New	Justification/Description	Result
125	Privacy settings	Work backwards from what users can see, to what settings should be displayed	There is no need to ask about data sharing if the data is never shared	Done
126	Incognito button	Change to "Hide location"	This will avoid confusion with its relevance to other categories of data	Done
127	Privacy settings	Consider changing to two screens: one for sorting users into trust categories and one for sorting data into those categories	This should help with simplifying the process of sharing, and should enable more granularity	Done
128	Physical activity label	Change to "steps data" or something similar	It was often confused for types of physical activity (e.g. walking)	Done
129	Social activity label	Change to "events" or similar	For clarification	Done
130	Mood label	Change to "event ratings"	For consistency	Done

131	My condition label	or similar Change to “Mobility profile/details” or similar	Only mobility data is used in the system; it probably will not be shared	Done
132	Plus button	Drop down menus should be clearly indicated	The drop down menu is hidden and not obvious to participants	Done
133	Incognito button	Change to a button that is clearly off or on	There is no way of knowing whether incognito is off or on	Done (button removed)
134	Confirm tick button	Ensure that back button and tick button perform the same function	To avoid accidental loss of preferences	Done

### 3.7 Navigation

Feature evaluated with 3 participants. The issues that participants faced with this feature are listed in Table 24.

*Table 24: Navigation suggested changes and implementation*

No.	Old	New	Justification/Description	Result
135	Navigation bar thin underline	Highlight entire segment to show open feature	This enables users to see more clearly what part of the interface is open on the navigation bar	Not possible in the mockup (for developer)
136	No menu bar in home screen	Provide menu bar in home screen	Several options are only available via the menu bar, which is not present in the home screen	The page will be cluttered with the same options
137	Access to privacy via menu only	Provide access via profile also	Privacy conceptually belongs to the profile and could be linked to via the profile	Done
138	Help access via menu	Consider adding help option to navigation bar	This may be helpful for users, but should be balanced against need for a decluttered navigation bar	Topbar will be visually cluttered

### 3.8 Discussion

Most of the issues raised during usability testing have been addressed, as evidenced in the comments above. Some issues were not addressed due to aesthetic issues (it was felt that some changes might make the interface too cluttered) and mock-up limitations (such issues will be raised with the development team).

As stated earlier, these changes represent the ongoing process of engaging with users and future testing should further refine the usability of the system.