

03/12/2018

# IMD11112 Design Dialogues Assessment 2

Richard Plant – 40329421

## Contents

1. Introduction .....	1
2. Design Process .....	2
3. Understanding.....	4
3.1 Potential User Survey.....	4
3.2 Brainstorming.....	5
3.3 Interviews/ User Stories.....	7
4. Envisionment .....	8
4.1 Personas.....	8
4.2 Scenarios.....	10
4.3 Prototype .....	11
5. Evaluation .....	14
5.1 Cognitive Walkthrough .....	14
5.2 Heuristic Assessment .....	14
6. Testing.....	15
6.1 Usability .....	15
6.2 Accessibility.....	16
7. Conclusion.....	17
References .....	17
Bibliography .....	19

## 1. Introduction

The Lion’s Gate project located in the Merchiston campus of the Edinburgh Napier University is a participatory permaculture space intended to provide agricultural, scientific and relaxation space to academics and members of the local community (Napier University, 2018). A key theoretical and practical design method employed by the project volunteers is permaculture, “a design system for sustainable living and land use” (Holmgren, 2011), which builds on systems theory with radical ecological principles in an attempt to create sustainable agriculture and development (Rothe, 2014). Principles of the system are in the below figure.

Permaculture principle	Eco-system
Observe/interact	Effective design begins by observing how components in the system want to naturally interact
Catch & store energy/produce no waste	Endeavor to design with a predisposition toward wasting nothing and replicating nature’s ability to gather today what might be needed tomorrow
Apply self-regulation and accept feedback	Design so that inappropriate activity is discouraged and the normal, ongoing functionality of the system is advanced.
Design from patterns to details/integrate rather than segregate	Design so that complementary system components are in close proximity and can work together to maximize productivity
Use/value diversity	Interactions between diverse system components can provide fertile growth to other parts of the system.
Use edges/value the marginal	Design with an awareness that system productivity can be at its maximum in transitional spaces – that is, in areas where one zone meets another as in where a forest abuts a meadow.
Obtain a yield	Design systems such that what is labored for and produced is enjoyed.
Use/value renewable resources	System design should aim at using what is readily and regularly available
Use small/slow solutions	Use caution and care during design changes; moving too quickly can exacerbate a problem.
Creatively use/respond to change	System design should be mindful of change; rather than seeking to inhibit it, the goal should be to observe its cyclical nature, prepare for it and use it for positive impact.

Figure 1 - Permaculture principles (Jelinek, 2017)

The aim of this paper is to propose and evaluate a theoretical system to be installed on the project’s grounds for the benefit of visitors, and demonstrate how a user-centred design process can be applied in generating and testing design concepts. The success of the proposed design, modified by user feedback during the process, will be evaluated based on how well it has incorporated those needs and priorities, and how successful it has been in implementing permacultural principles and other priorities such as accessibility to a range of users.

In order to narrow down the design space given by the brief, a brainstorming session modelled on the PACT (People, Activities, Context, Technology) framework (Batagoda, 2018) was carried out.

Table 1 - Initial PACT findings

People	Activities	Contexts	Technologies
Children	Relaxing	Urban	Screens
Elderly	Learning	Garden	Speakers
Visitors	Playing	Plants	Lights
Volunteers	Gardening	Animals	Wireless communications
Students	Exploring	Traffic noise	Smartphones
Blind/deaf	Infrequent	Smells	GPS
	Disturbing others	Weather	NFC
	Short duration		

The specific design being proposed is a system for involving garden visitors in exploration of the space and varieties of plant and animal life on offer. Visitors will be engaged in scavenger-hunt style activities, with centrally-placed billboard style interactive screens giving out tasks and information. Guests will be tasked with finding hidden items and bringing them back to the information point, which will reward them with new information and a visual representation of progress towards the goal of exploring the whole garden. The items will be physical objects tied into the specific contexts in which they should be found, and should include near-field or wireless communication capabilities so that the visitor system can track their position and reward the user for successful completion. The system will give out rewards to the user, such as vouchers for fresh produce, and allow easy online sharing of results or pictures to social networks.

Gamification of educational systems such as the one proposed can impact participants' behaviour, making them more likely to stick with a task until completion (Karagiorgas & Niemann, 2017), and can also show significant benefits in positive attitudes towards learning tasks (Caporarello, Magni, & Pennarola, 2017). The introduction of digital metaphors into a physical project also invokes the presence of a blended space (Hoshi & Waterworth, 2009), which may help generate new experiences not accessible to a purely physical space (Benyon, 2012).

## 2. Design Process

The design methodology followed in this paper will be a version of iterative design, based on the persona theory propounded by Alan Cooper (Cooper, 2004), in which fictional character profiles are generated from data gathered from the prospective audience (Pruitt & Adlin, 2005). These personas are then combined with the prospective design in order to generate scenarios that represent the system in action, and will serve to highlight deficiencies in the design (Carroll, 2002).

Design fictions, including scenarios, are valuable tools as they may enable designers to envision usage contexts from alternate perspectives, and bring to light alternative and more efficient solutions to design problems (Eilouti, 2018). Scenarios also help promote effective communication among stakeholders by focusing conversation on the needs of users and the potential impacts of design decisions (Carroll, 1999).

Particular attention will be paid in evaluating and testing the design to the usability and accessibility of the system to visitors beyond the group identified as the target audience during the PACT phase. This approach is valuable, since designing for a diverse group of user needs carries certain distinct advantages, including increasing the portability and reusability of a design solution (Obrenovic,

Abascal, & Starcevic, 2007), and generating increased focus on responsibly and sustainably meeting the needs of real people (Steffan, 2012).

Final evaluation of the prospective design will be carried out in theoretical form, since implementation of the system will not proceed beyond strictly limited prototyping. To avoid error through personal fixation, a standardised testing methodology will be used, in which evaluators will be asked to grade the solution against the Nielsen principles for heuristic evaluation as follows:

**1. Visibility of system status**

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

**2. Match between system and the real world**

The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

**3. User control and freedom**

Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

**4. Consistency and standards**

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

**5. Error prevention**

Even better than good error messages is a careful design which prevents a problem from occurring in the first place.

**6. Recognition rather than recall**

Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

**7. Flexibility and efficiency of use**

Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

**8. Aesthetic and minimalist design**

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

**9. Help users recognize, diagnose, and recover from errors**

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

**10. Help and documentation**

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

*Figure 2 - Nielsen usability principles (Nielsen, 1995)*

In addition, a cognitive walkthrough will be carried out, in which an external auditor will evaluate the solution for potential issues.

### 3. Understanding

#### 3.1 Potential User Survey

Building on the initial PACT data generated prior to the design concept, the first step in iterating and refining the system was a questionnaire targeted at potential users of the project. The object was to add constraints to the design space by determining what users did not want in a garden space, as well as some guidance towards the kinds of media they would find acceptable.

Users were asked to rate their answers according to a five-point Likert scale, with a verbal description for the endpoints (wouldn't like to have = 1/would like to have = 5) and without an explicit neutral midpoint, which should provide higher reproducibility than a more detailed response format (Dolnicar & Grün, 2013).

Dissemination of the questionnaire through peer networks and student social media elicited 29 responses, the full detail of which can be found in Appendix A. Ethical considerations prevented the gathering of personally-identifiable information, but demographic questioning shows high homogeneity among the respondents—in general, users were white, did not consider themselves to have a disability, and were under the age of 44. It should be noted that the relatively small number of responses and the lack of diversity will limit the reproducibility of the results, and the data must be considered in that light.

Those caveats in place, the key findings of the questionnaire were as follows.

Respondents were in favour of:

- Maps of the area
- Information about plants and animals
- Pictures
- Written information
- Guidance on routes
- Directions
- Games or scavenger hunts

However, they were not on balance in favour of:

- Ways to contribute to the project
- Opportunities to volunteer
- Video
- Audio descriptions

Table 2 - Survey response data

Question	1	2	3	4	5
<b>What's in the garden</b>					
Map of the area	0	1	3	12	13
Information about plants/animals	0	0	1	11	17
History of the area	0	0	1	16	12
Guidance on routes	0	2	8	12	7
Game or scavenger hunt	1	5	9	7	7

Contribute financially	3	4	13	7	2
Volunteer/promote	2	2	17	5	3
<b>What can we see</b>					
Written info	0	1	0	15	13
Pictures	0	0	2	7	20
Video	4	7	9	5	4
Audio	3	6	11	8	1
Directions	1	0	1	16	11

In order to obtain more high-quality and specific data, a second iteration of the questionnaire process is advised, specifically targeted to populations excluded in the design of the initial survey, such as non-English speakers, older people and those with disabilities. Omission of the 'neutral' or 'don't know' response option may also provide clearer result patterns, by forcing a clear choice upon the respondent (Dolnicar, Asking Good Survey Questions, 2013).

### 3.2 Brainstorming

A group of potential users of the visitor system was assembled to carry out a brainstorming session, with the goal of expanding on the areas identified as fruitful in the previous stage, while also introducing new elements that may have been overlooked in the initial design. Due to time constraints, a small group of four participants was gathered along with the facilitating researcher. These participants were gathered from the student peer group, however none had been respondents to the previous survey. Demographically, most aligned closely with the previous group, ranging in age from 24-38 and reporting no serious disability, aside from one member who reported mobility issues affecting their ability to stand and walk for long periods.

The group was shown pictures of the Lions' Gate setting and read a short introduction drawn from the project website. Participants were then presented with four basic categories (Relax, Explore, Learn, and Play), and ideas were elicited along these basic themes. Ideas generated were recorded via Post-it Notes, which were thematically grouped by colour and finally given an order of importance at the end of the session. Notes with more agreement were moved towards the top of the board. Further comments were sought on the highest-priority notes.

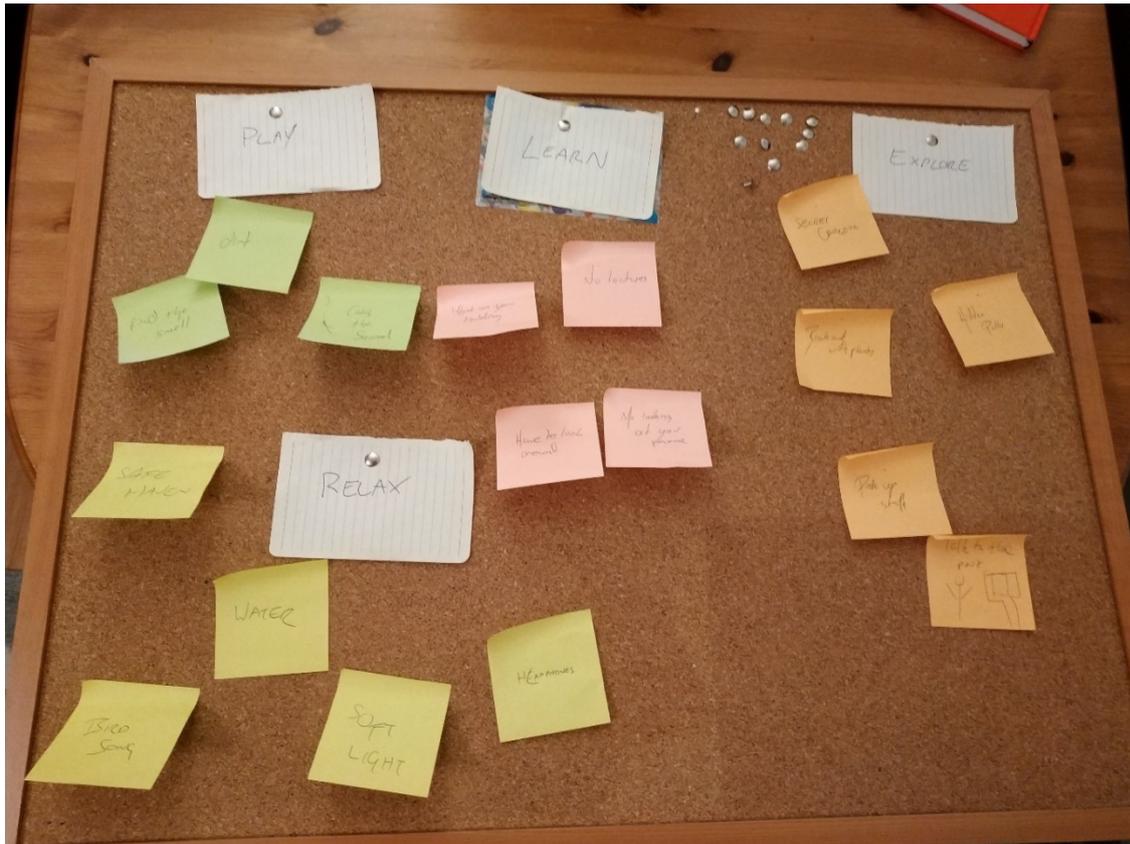


Figure 3 - Brainstorming note board

Most participants were able to agree that highest importance should be assigned to the following concepts:

- Safe haven—visitors shouldn't be tracked or bothered when they're trying to find a place to retreat from the world
- Secret garden—there should be a feeling of discovering some kind of hidden insider information, a sense of magic
- Grubby—any activities should be physical instead of artificial, you should be able to feel the dirt in your hands
- Hidden paths—reconfiguring the space of the garden so as to make finding interesting parts feel like making a discovery
- No Lectures—while participants were enthusiastic about learning more about the gardens, they were put off by the idea of listening to lectures or reading significant text
- Water/bird song—when the idea of sound abatement was introduced, participants liked the idea of soft recordings of water and bird song, but were put off by artificial sounds, like white noise

Drawing on these and other comments made during the session, the design was altered to include the following principles: it should make as little impact on the experience of people who do not want to participate as possible, it should encourage people to explore more deeply than simply following an obvious path, and it should be as physical as possible—the objects of the hunt must have pleasant tactile properties.

### 3.3 Interviews/ User Stories

In order to produce actionable information of use when designing the scenarios required to evaluate the suitability of the design and highlight areas for improvement, it was necessary to conduct more in-depth interviews with selected members of our target audience. Four participants were gathered from former Napier University students who had previously received training in UX methods.

Unfortunately, this group continued to hew closely to the demographic type identified as an issue in the previous stages of investigation. While there was significant diversity in language proficiency, with only two of the interviewees being native English speakers, in other respects they showed remarkable consistency. The group was wholly white and of European background, and were all in the 24-31 age range. One member reported partial deafness, but otherwise disability was not a concern for the group.

Questions were preceded by a preamble explaining the general project setting and background as follows:

*You've been invited to visit an urban garden project that some volunteers have created in the middle of the city. They've stocked it with some interesting plants and have attracted some animal life too. While it's a working garden that produces some great produce in the form of fruits and vegetables, they would also like it to be a place people can come to relax and learn more about nature. They're planning to open it up to the public, and they would like to understand what people would want there when they visit.*

Questions were designed following a semi-structured pattern; a checklist of general questions was prepared ahead of time, with the interviewer inserting more detailed enquiries and altering the order of questions as required during the interview. The list of pre-prepared questions is as follows:

1. When and where was the last time you enjoyed contact with nature in an urban setting?
2. What kind of thing captured your attention while you were there?
3. Did you feel compelled to stay for a while, or was enough to just pass through?
4. Was there anything there you'd like to know more about?
5. If so, how would you go about finding that out?
6. Do you think you'll go back any time soon?
7. If someone tried to get you more involved, say by pointing out interesting hidden features of the space, would that make you more or less likely to visit again?
8. If there were something you could pick up and hold, would that make you feel more involved?
9. Would you be interested in something you could take away to remind you of the feeling you had there?

Selected findings from the interviews have been excerpted and grouped thematically.

#### **Peace**

*Subject 2: "I try sitting on the benches in Princes Street Gardens when I'm having my lunch [...] It's not like... connecting with nature or anything, there's all the traffic going past behind your head, people walking everywhere."*

*Subject 1: "I try to go find places but here there are always people, you can never feel really alone."*

#### **Exploration**

*Subject 3: "I wouldn't like it for someone to come up to me, but if there was some way to just have a gentle wee Bob Ross voice tell you all about it, I'd love that [...] I've always liked the idea of having my own secret garden that's just for me, where I can sit and watch everyone passing by."*

*Subject 4: "Sounds like I'd be into it if I had kids or something, I could imagine sending them off to go find the magic carrot while I have a kip on a bench. Actually, that's probably a good idea, just get people to work out they can dump the kids there and you've got guaranteed visitors every day."*

*Subject 2: "Yes, I love it! You could have a little special grotto in like a maze, where if you notice and you can find it you get a reward."*

### **Physicality**

*Subject 1: "What do you want me to do, crawl around in the dirt? [...] Personally, all I want is somewhere to have a think or something like that. "*

*Subject 3: "They don't usually like you picking the flowers or touching whatever's there, but I think that's just a natural thing to do [...] So if you could feel it between your fingers and smell it, whatever it is you're doing, do that."*

### **Mementoes**

*Subject 1: "Sorry, I'm not really that interested in taking anything away. If it's look at a squirrel up a tree, fine, very nice, but I don't want to carry some bark around."*

*Subject 2: "I don't want to be selling something. If capitalism is going to get into even looking at a flower, just kill me now. It's supposed to be wild, not wrapped in plastic."*

These findings indicate that selling mementoes or items to fund the project is a non-starter with regards to this design element and the idea of physical contact proved somewhat divisive, but however there is a particular attachment to the idea of exploration and finding something hidden that could be a productive field of inquiry.

## **4. Envisionment**

### **4.1 Personas**

Personas, a form of design fiction wherein the designer generates composite user profiles based on data gathered through research, can provide strong benefits in terms of audience-focused thinking and the generation of user-centred requirements (Miaskiewicz & Kozar, 2011). In this case, three separate personas were designed, and their initial contact with the Lion's Gate project described.

#### **Persona 1 – David**

- Age: 25
- Profession: Postgrad student
- Lives in a shared flat
- Limited personal space
- Uses public transport
- Contact with nature is minimal during weekdays
- Likes to take walking trips
- Dyslexic, so finds reading long passages difficult

1. David sees the volunteers at work on the project while he's studying in the library

2. He decides to check out what they're up to, but misses them and visits while no one is around
3. He's interested in getting to know more about what the project means
4. He searches some related terms at home, and comes up with the project website, but is distracted and only retains a vague impression of eco-friendliness
5. He wants to visit again, but is put off by the impression that he would have to volunteer to get anything from the space
6. His goal is to get more exposure to nature, and perhaps pick up some new knowledge he can show off to friends

### **Persona 2 – Sarah**

- Age: 38
  - Profession: Dentist
  - Is married with one small child
  - Lives in a detached house
  - Has a garden
  - Has taken time off work in order to have children
  - Recycles and is very concerned with the environment
1. Sarah lives across the road from the campus and has seen people walking around in the Lions' Gate project
  2. Recently having a child has increased her sense of responsibility for combating climate change, so she is immediately interested in urban agriculture
  3. She visits the site briefly and chats to a volunteer, but spending large periods of time away from home and doing manual labour is impractical for her
  4. She would like to bring her child and spend some time in the garden
  5. Her goal is learning about the plants/animals/insects
  6. Since she has garden space at home she doesn't use, acquiring some techniques to use that in an ecologically friendly way is a secondary goal

### **Persona 3 – Talat**

- Age: 41
  - Profession: Warehouse worker
  - Has 2 children
  - Lives in a small family flat
  - Works long and irregular shifts
  - Immigrant from Pakistan
  - English is not his first language
1. Talat was told that the project is a nice place to have lunch by a colleague
  2. He finds the atmosphere of being hidden despite being surrounded by the urban landscape quite soothing
  3. He returns several times, and is curious about why this place exists
  4. He would like to bring his children along, but is unsure if that is allowed
  5. Talking to volunteers might be embarrassing, so he is unlikely to ask for help
  6. His goal is to learn more about the space, and to help his children learn more about the physical life around them

## 4.2 Scenarios

The process of refinement at this stage of design involves the creation of conceptual scenarios—essentially describing user goals drawn from the personas and how the design should accommodate them, stripped of context or details of implementation. These are then iterated on with the application of concrete details from the specifics of the personas, and proposed implementation details are added.

In the case of this paper, constraints of space preclude the inclusion of the conceptual steps, instead concrete scenarios will be used as the basis for further development and evaluation.

### **Scenario A – Find new routes to explore**

Talat wants to bring his children along to the garden, but is worried that they won't be interested in just passively observing. He notices that there are unobtrusive stations with screens they can use to get more information and play games, so he brings them with him on his next day off. Helping his kids to press the large handprint button on the panel, he finds that there are areas of the garden that he's never seen off the beaten track, and is provided with some highlights his kids might find and enjoy in that space—a herb that smells very strongly, a flower that attracts a lot of bees.

### **Scenario B – Get children involved**

Sarah wants to get her young son interested in and comfortable with nature as soon as she can. She brings him into the project, but she needs to keep him active and engaged. She starts up the scavenger hunt by pressing her hand onto the information panel and choosing the area of the garden to look at. The system shows her the thing she's looking for (a soft and nicely tactile representation of a friendly vegetable in this case), and tells her to bring it back for a reward. She hunts with her son for a while, which also brings them into contact with parts of the garden they haven't already seen. On bringing back the vegetable and placing it near the screen, the reader picks up its presence and plays a reward – a fanfare and some interesting details about the species. It also prints out a ticket that Sarah can collect.

### **Scenario C – Gain some knowledge about nature**

David grew up in the city and hasn't spent a lot of time around big open spaces or un-managed natural land, but he likes the idea of learning more about the natural world. He pokes around the garden, and finds a terminal that invites him to place his hand on the screen to learn more. It opens up with a visual representation of the garden, broken down into sub-areas. Touching any of them shows suggested routes to find interesting things to see and points out things that can be touched, smelt or held, as well as animals/insects to look out for. Touching one of these example pins brings up a more detailed text description, as well as a high-resolution image that can be touched, panned and moved around with his fingers.

### **Scenario D – Share with others**

Sarah would like to share and promote the project, since she supports its ecological aims. She'd also like to promote the idea of getting small children involved with nature as soon as possible. After visiting and engaging in the scavenger hunt, the system offers her the ability to send her a package of assets to share on her social networks. Using her phone's near-field communications capability, she can hold it over the reader and receive photos and video clips pre-packaged for easy sharing.

### **Scenario E – Find a reason to return**

Talat would like to keep returning, since he enjoys finding a peaceful spot in the city. He'd like to bring his family, and to convince them, he can get them interested in collecting all the tickets from the scavenger hunt game. On collecting the whole set, the family will be able to trade them in for a branded soft toy version of one of the hunt collectibles.

### 4.3 Prototype

A prototype was created for the purposes of evaluation and user testing, in order that the concepts could be demonstrated and possible avenues of implementation considered. Two major artifacts were created and gathered, a workbook representing the screen interface of the kiosk-based application, and soft toy prototypes for the scavenger hunt items.

#### Interface prototype

Each screen of the interface was represented by a sheet of paper, which were manipulated by hand during evaluation to provide a simulation of the working system.

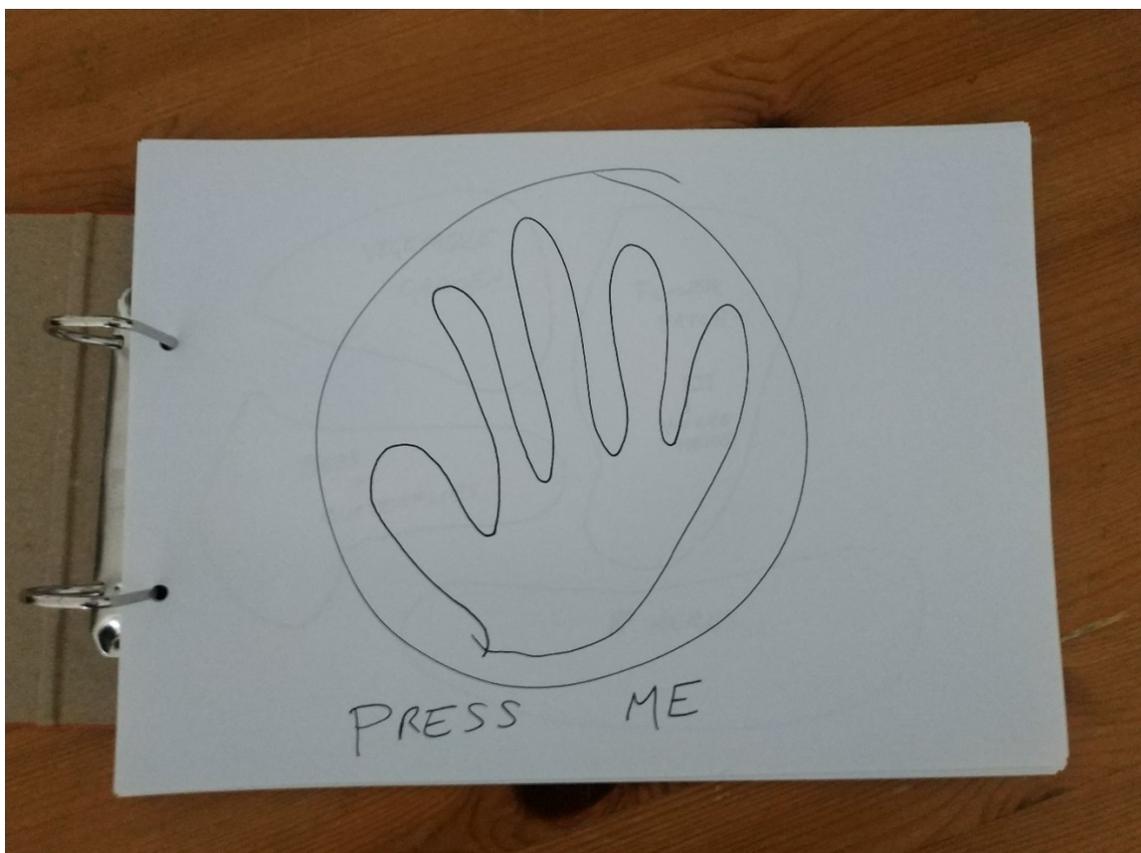


Figure 4 - Initial screen

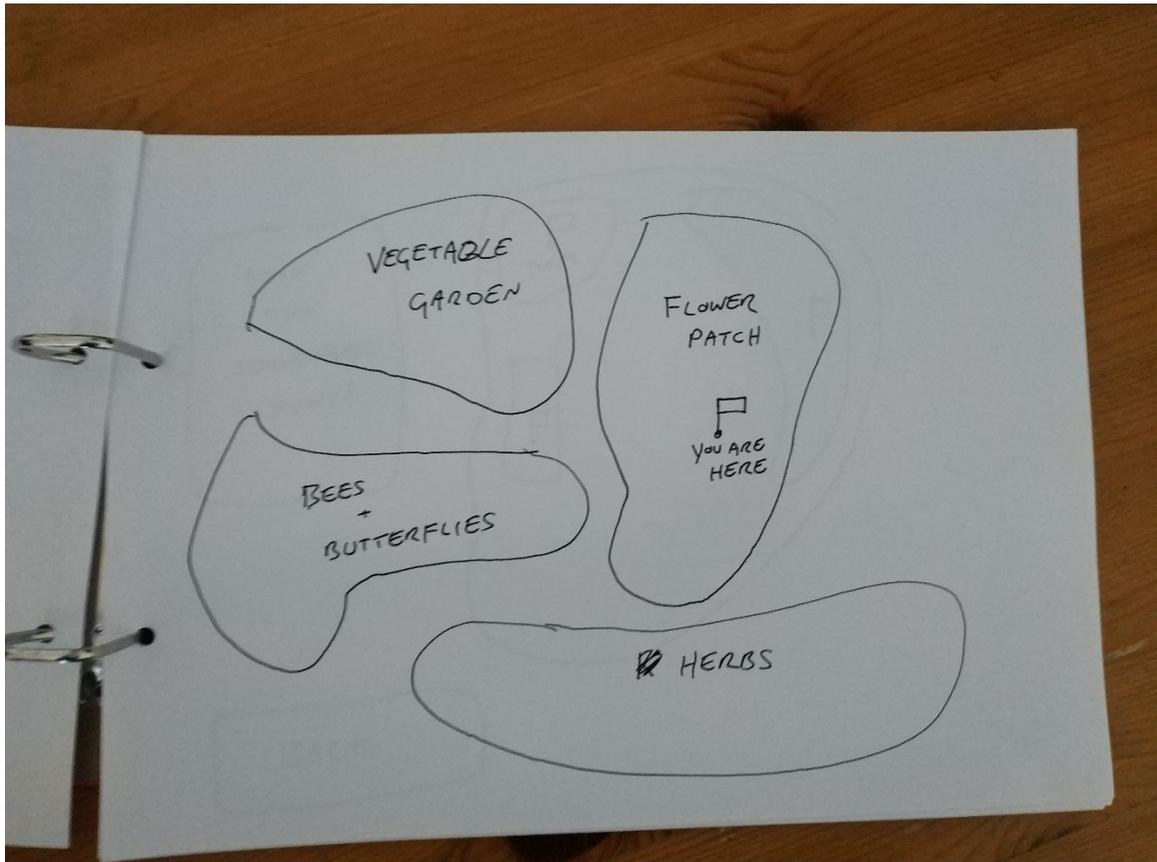


Figure 5 - Map screen

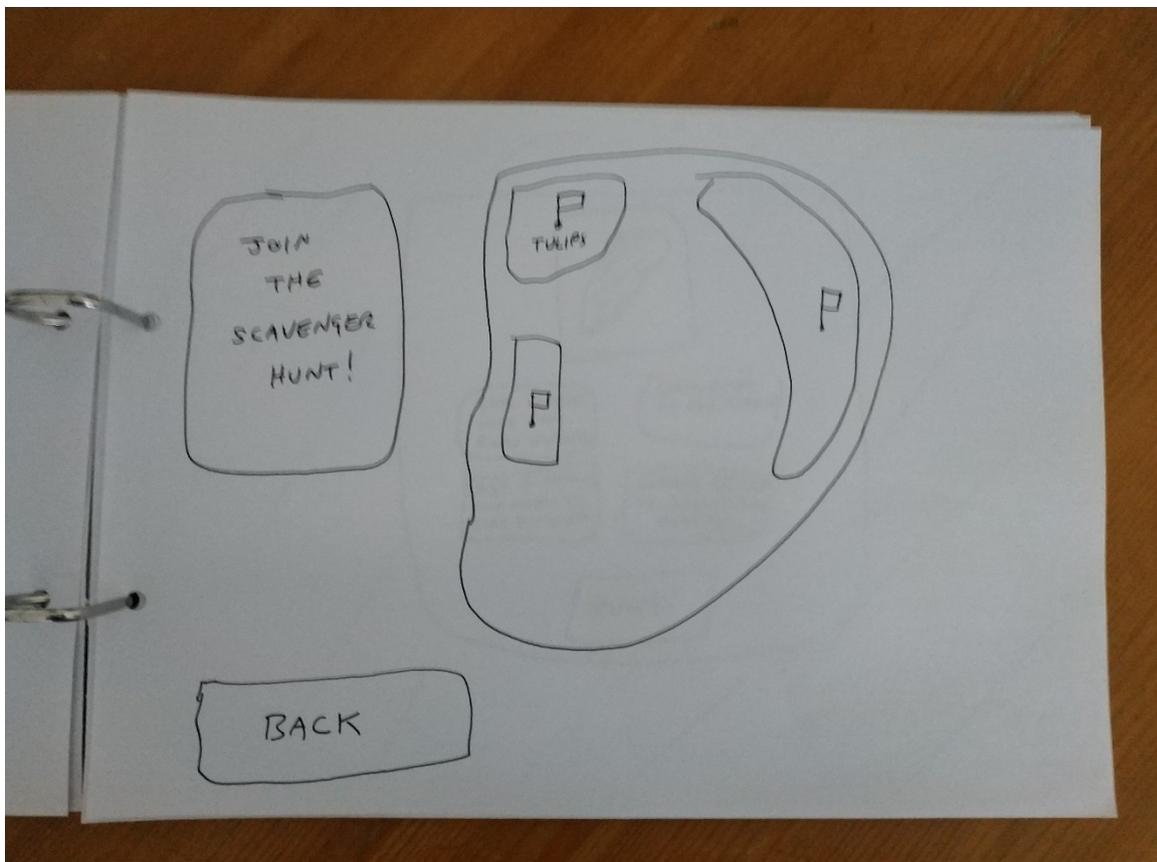


Figure 6 - Area screen

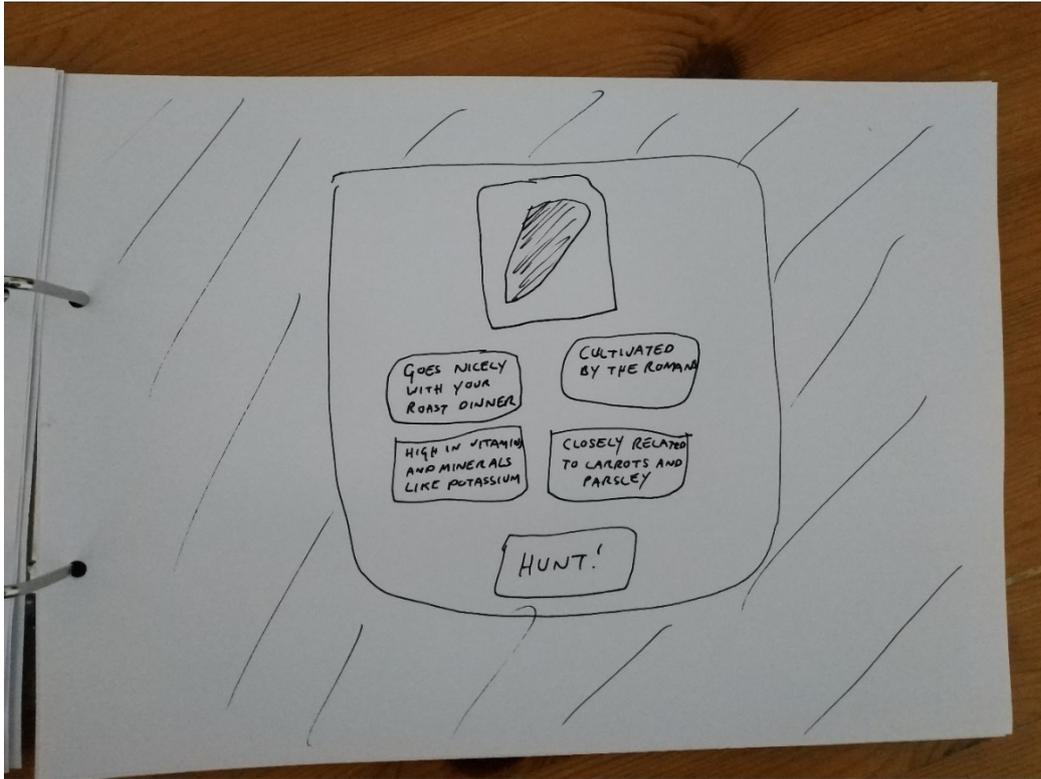


Figure 7 - Scavenger Hunt screen

### Toy prototypes

Usable prototypes of the objects to be found were available commercially, and did not need to be created.



Figure 8 - Hidden object prototypes

## 5. Evaluation

### 5.1 Heuristic Assessment

Heuristic assessment of the proposed design was carried out with the assistance of usability and UX experts drawn from several UK firms. Design of the assessment forms followed the specification recommended by Benyon (Benyon, 2019), with the experts provided with the personas and scenarios developed earlier in this paper, and asked to evaluate the design's effectiveness against the Nielsen schema. Data including the form design can be found in Appendix B.

No results can be provided however, given that the experts contacted were unable to provide meaningful ratings based on the information provided. Providing multiple scenarios and personas in the form meant that focus was dissipated, and responses indicate that the experts contacted were unable to connect the heuristics to the scenarios, and were unable to conceptualise the design from the provided text description.

To mitigate the effect of this in the subsequent steps, a physical prototype was generated to help explain the solution in practice and reduce the obvious confusion caused by providing too much conceptual information.

### 5.2 Cognitive Walkthrough

A cognitive walkthrough, that is a structured assessment of how well the design supports the activities of an individual attempting to complete a list of tasks broken down from the constructed scenarios, was conducted with the assistance of Harry Robbins, co-founder of digital agency Outlandish.

The walkthrough form was built in the format recommended by The Interaction Design Foundation (The Interaction Design Foundation, n.d.), in which scenarios are broken down and assessed following a strict user-centred rubric (Blackmon, Polson, Kitajima, & Lewis, 2002). Full details and responses can be found in Appendix C.

There were several minor issues and two major problems identified—the minor issues being primarily interface related, as paraphrased below:

1. The touchscreen will need to be responsive, to avoid users becoming confused and having to retry actions
2. Orientation on a two-dimensional map is difficult without pointing out landmarks
3. A maps-like interface may not immediately appear interactive, to someone who doesn't use Google Maps or similar
4. Silhouetting the item to be found may be too hard to recognise, adding colour may help
5. Users might collect more than one item
6. The user may become confused if the kiosk just recognises the found item, a pointer showing them where to scan it might be clearer
7. Users may not understand a "share" command in this context doesn't actually post anything
8. Users may find sharing difficult if instructions aren't available on their device – redirecting to a web page may be preferable

The major issues were more implementation-related, but should be addressed in the next design iteration. These can be paraphrased as:

1. Finding the object of the game may be frustrating if the user searches in the wrong area, and could lead to destructive behaviour. Signs could help direct attention to the right location.

- NFC is not a widespread technology that many people have access to on their phones, and users do not immediately know what it is when prompted. Using a QR code that redirects to a webpage with Twitter/Facebook share buttons is a more comfortable and known interaction.

## 6. Testing

### 6.1 Usability

Usability testing was conducted with the prototype interface and hidden objects developed previously in the design process. The prototypes were presented with commentary to experts from the Freakworks agency, who recorded their evaluation according to the System Usability Scale (Brooke, 1996), an example of which follows in Figure 7.

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

Figure 9 - System Usability Scale

Aggregated results found high levels of agreement on using the system frequently, and that most people would be able to learn to use it quickly. Participants also agreed that they would not need technical assistance and that it was not unnecessarily complex.

However, multiple testers expressed concern about the lack of explanation of the scavenger hunt as a concept, and suggested that the steps to complete the hunt and get the reward should be posted on the kiosk façade itself, so users would not be confused by the reference in the interface. Concerns were also expressed over the ability of children to use the system on their own—simplifying the process of getting to the hunt from the main map screen and using more icons instead of text buttons may help eliminate the need for adult supervision.

## 6.2 Accessibility

Accessibility issues with the design were evaluated based on the following rubric:

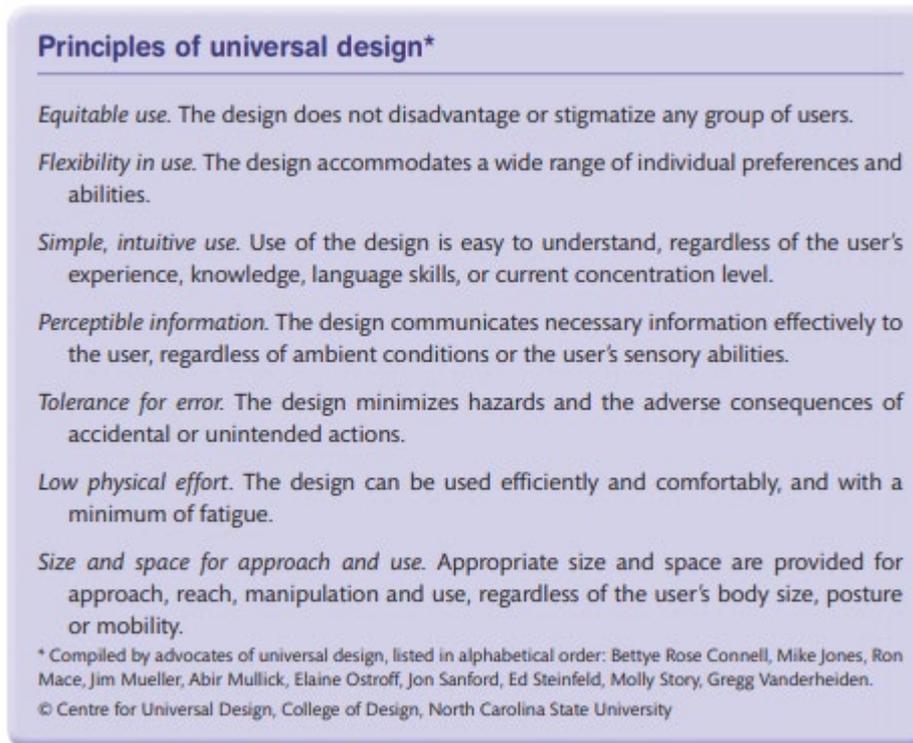


Figure 10 - Principles of universal design (Benyon, 2019, p. 105)

The design supported a degree of accessibility in the intuitive use and tolerance for error categories, since the interface relied heavily on maps and pictographic icons to drive interactions. It was also tolerant of error, since accidental actions could not lead to uncomfortable or destructive outcomes.

However, equitable use and perceptible information were particular areas of concern. The design as it stands is almost wholly exclusive of blind or partially-sighted users, since there is no option for an audio-described version of the interface and the scavenger hunt method requires searching visually.

The size and space category also presents difficulties—the design of the kiosk would be difficult to comfortably support multiple height options. That is, if one were to set the screen and reader at a comfortable position for people who use wheelchairs or small children, then it would become uncomfortable or unusable for standing adult users, or vice versa.

## 7. Conclusion

The use of the iterative design process certainly allowed refinement of the project and avoidance of usability pitfalls. Initial user testing also conditioned the design space away from didactics and towards play and exploration, which proved a productive field.

The absolute failure of the heuristics gathering attempt should be noted, the experience of which indicates that providing too much context in the form of multiple personas and scenarios can prove counter-productive, and that heuristics may need significant tailoring to project specifics to prove meaningful. Producing the physical prototype for the next stage in testing proved a valuable resource—despite the time and resources required to do so, prototyping is essential to testing user behaviour and response to interactions (Vegte & Horváth, 2012).

However, weaknesses in the user requirements data gathering stage cannot be overlooked: demographic data reveals a remarkably homogeneous user base, tending towards young, white and non-disabled users. Drawing conclusions based on this sample will theoretically result in a design which does not cater to the needs of groups not represented in the research (Teasley, Leventhal, Blumenthal, Instone, & Stone, 1994). Further research is indicated into the needs and preferences of those groups before any kind of implementation could be considered.

The wholly conceptual nature of the design process up until this point must also be considered. Important factors that were not considered in this paper such as cost, availability of materials, lack of reusability and protecting parts of the system from theft or damage may prove insurmountable, or contravene permacultural principles in an unacceptable way.

## References

- Batagoda, M. (2018, January 27). *Usability for designers, P-A-C-T framework*. Retrieved from UX Planet: <https://uxplanet.org/usability-for-designers-p-a-c-t-framework-20509afcff57>
- Benyon, D. (2012). Presence in blended spaces. *Interacting with Computers*, 24(4), 219-226.
- Benyon, D. (2019). *Designing User Experience: A guide to HCI, UX and interaction design*. Pearson.
- Blackmon, M. H., Polson, P. G., Kitajima, M., & Lewis, C. (2002). Cognitive walkthrough for the web. *CHI '02 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 463-470). New York: ACM.
- Brooke, J. (1996). SUS: a "quick and dirty" usability scale. In P. W. Jordan, B. Thomas, I. L. McClelland, & B. Weerdmeester, *Usability Evaluation In Industry*. London: Taylor and Francis.
- Caporarello, L., Magni, M., & Pennarola, F. (2017). Learning and gamification: a possible relationship? *EAI Endorsed Transactions on e-Learning*, 4(16), 1-8.
- Carrol, J. M. (1999). Five reasons for scenario-based design. *Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences* (p. 11). IEEE.
- Carroll, J. M. (2002). Making use is more than a matter of task analysis. *Interacting with Computers*, 14(5), 619-627.
- Cooper, A. (2004). *The Inmates Are Running the Asylum: Why High Tech Products Drive Us Crazy and How to Restore the Sanity* (2 ed.). Pearson Higher Education.

- Creative Scotland. (n.d.). *Equalities Monitoring*. Retrieved November 12, 2018, from Creative Scotland: <https://www.creativescotland.com/resources/our-publications/funding-documents/equalities-monitoring>
- Dolnicar, S. (2013). Asking Good Survey Questions. *Journal of Travel Research*, 52(5), 551-574.
- Dolnicar, S., & Grün, B. (2013). "Translating" between survey answer formats. *Journal of Business Research*, 66(9), 1298-1306.
- Eilouti, B. (2018). Scenario-based design: New applications in metamorphic architecture. *Frontiers of Architectural Research*.
- Holmgren, D. (2002). *Permaculture: Principles & pathways beyond sustainability*. Holmgren Design Services.
- Holmgren, D. (2011). Weeds or wild nature: a permaculture perspective. *Plant Protection Quarterly*, 26(3), 92-97.
- Hoshi, K., & Waterworth, J. A. (2009). Tangible Presence in Blended Reality Space. *Proceedings of the 12th Annual International Workshop on Presence*, (pp. 1-10).
- Jelinek, R. (2017). A permaculture primer: Using eco-theory to promote knowledge acquisition, dissemination and use in the sales organization. *Industrial Marketing Management*, 65, 206-216.
- Karagiorgas, D. N., & Niemann, S. (2017). Gamification and Game-Based Learning. *Journal of Educational Technology Systems*, 45(4), 499-519.
- Miaskiewicz, T., & Kozar, K. A. (2011). Personas and user-centered design: How can personas benefit product design processes? *Design Studies*, 32(5), 417-430.
- Napier University. (2018, November 15). *About*. Retrieved from The Lions Gate: <http://blogs.napier.ac.uk/thelionsgate/about/>
- Neilsen, J. (1995, January 1). *10 Usability Heuristics for User Interface Design*. Retrieved November 20, 2018, from Nielsen Norman Group: <https://www.nngroup.com/articles/ten-usability-heuristics/>
- Obrenovic, Z., Abascal, J., & Starcevic, D. (2007, May). Universal accessibility as a multimodal design issue. *Communications of the ACM - ACM at sixty: a look back in time*, 50(5), 83-88.
- Pruitt, J., & Adlin, T. (2005). *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. Morgan Kaufmann Publishers Inc.
- Rothe, K. (2014). Permaculture Design: On the Practice of Radical Imagination. *communication +1*, 3(1). doi:10.7275/R58913S2
- Steffan, I. (2012). Sustainability and accessibility: the Design for All approach. *Work*, 41(Supplement 1), 3888-3891.
- Stonewall Scotland. (n.d.). *Getting Equalities Monitoring Right*. Retrieved November 12, 2018, from Stonewall Scotland: [https://www.stonewallscotland.org.uk/sites/default/files/getting\\_equalities\\_monitoring\\_right\\_0.pdf](https://www.stonewallscotland.org.uk/sites/default/files/getting_equalities_monitoring_right_0.pdf)

SurveyMonkey. (n.d.). *Consent*. Retrieved November 12, 2018, from SurveyMonkey:  
<https://www.surveymonkey.com/r/consent>

Teasley, B., Leventhal, L., Blumenthal, B., Instone, K., & Stone, D. (1994). Cultural Diversity in User Interface Design: Are Intuitions Enough? *ACM SIGCHI Bulletin*, 26(1), 36-40.

The Interaction Design Foundation. (n.d.). *How to Conduct a Cognitive Walkthrough*. Retrieved November 25, 2018, from The Interaction Design Foundation: <https://www.interaction-design.org/literature/article/how-to-conduct-a-cognitive-walkthrough>

Vegte, W. F., & Horváth, I. (2012). Theoretical underpinning and prototype implementation of scenario bundle-based logical control for simulation of human–artifact interaction. *Computer-Aided Design*, 44(8), 791-809.

## Bibliography

O’Neill, S. J. & Benyon, D. (2015). Extending the Semiotics of Embodied Interaction to Blended Spaces. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, 11(1), 30-56.

Jung, Soon-Gyo & An, Jisun & Kwak, Haewoon & Ahmad, Moeed & Nielsen, Lene & Jansen, Jim. (2017). Persona Generation from Aggregated Social Media Data. *The 2017 CHI Conference Extended Abstracts*, 1748-1755.

Fichter, D. (2004). Heuristic and Cognitive Walk-Through Evaluations. *Online*, 28(3), pp. 53-56.