

Usability Engineering Assignment

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Submission date: 17-Jan-2020 11:40PM (UTC+0000)

Submission ID: 118634860

File name: 4054_Runa_Bibi_Usability_Engineering_Assignment_227813_522524659.docx (6.28M)

Word count: 4233

Character count: 21692

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Health/fitness Interface Prototyping

Usability Engineering

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17/01/2020

Table of Contents

1. Introduction	2
2. Task Analysis	3
3. Paper Prototype	5
4. Human Factors Theory Analysis of Paper Prototype.....	6
5. Paper Prototype Walkthrough and User Feedback	10
6. Software Prototype	17
7. Evaluation	20
8. References.....	25

Table of Figures

Figure 1 - Active Lions App	2
Figure 2 - Paper Prototype page 1.....	5
Figure 3 - Paper Prototype page 2.....	5
Figure 4 - Paper Prototype page 3.....	6
Figure 5 - Step count page.....	7
Figure 6 - Forgot your password link.....	8
Figure 7 - Home icon.....	8
Figure 8 - Locations pins on map.....	9
Figure 9 - Chosen destination on map.....	9
Figure 10 - Search bar for destination.....	9
Figure 11 - Icons below screen.....	9

1. Introduction

Active Travel is defined as primarily cycling and walking as a means of functional travel rather than leisure travel [1]. In 2013, the Welsh government developed a piece of legislation called The Active Travel (Wales) Act which intends to introduce more ways for people to cycle and walk in Wales, in particular for “everyday journeys” [2].

Active Travel is beneficial not just for an individual's health, but also for society as a whole through helping the environment in reducing carbon emissions and increasing footfall to local businesses boosting the economy [3]. As Active Travel has become so important, we should find ways to make it easier for people to plan their routes with walking and cycling and encourage them to do so. One way this has been done is through active travel applications. An example of this is the Active Lions campaign based at a university in the United States which overall aim was to increase active travel to the campus and so Bopp et al. worked with researchers and developers in building the Active Lions app which did route planning, scheduling and logging trips, setting goals and finding bike parking locations on campus [4].

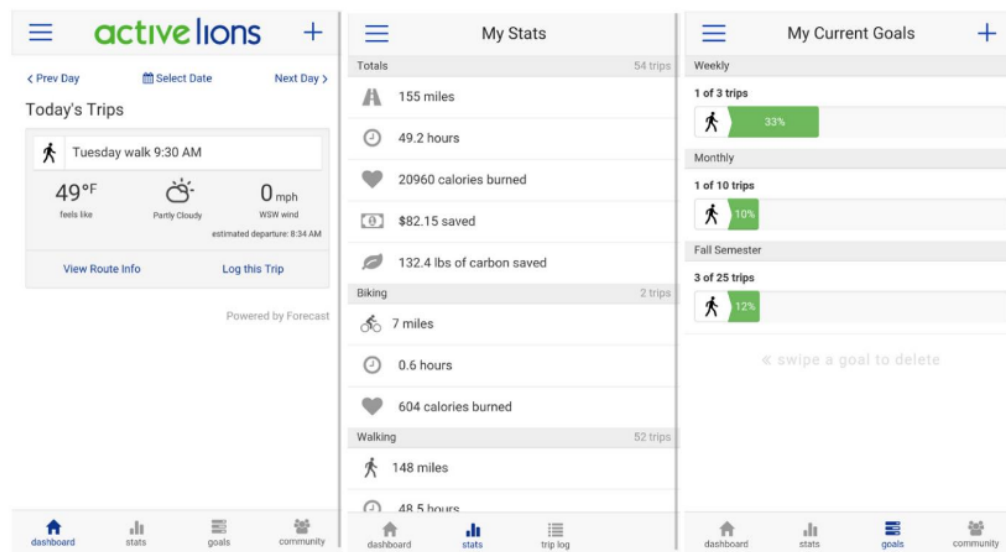


Figure 1 - Active Lions App [4]

When building any application, it is important to know what the target user requires which will be done in this report through task analysis. A paper prototype will also be

developed displaying user tasks as well as a software prototype. Human Factors theory will be applied and evaluated e.g. interface metaphors and affordance.

2. Task Analysis

Task Analysis is a method of finding out the user's requirements and how they perform certain tasks through observation [5]. Hackos and Redish say that task analysis helps to see how the physical environment affects the user, what experience the user already has to perform the tasks and the steps they take to achieve their goals [6].

To carry out the task analysis, questions were asked to a student who attends university using cars and public transport.

- **Who is going to use system?**

University students, ages 18-25+, those who use cars to travel to campus and wish to incorporate more walking into their daily journeys

- **What tasks do they now perform?**

Park at any location close by the university and walk the rest of the journey or catch a bus directly outside the university.

- **What tasks are desired?**

A step count and the ability to set my own step goals, a quick way to see how many calories I've burned, different rewards and notifications i.e. messages, discount vouchers and finding car parks close to my destination.

- **How are the tasks learned?**

Finding places to park the car from prior knowledge.

- **Where are the tasks performed?**

Home, on the move and at university.

- **What's the relationship between user & data?**

Personal data will be on their profile so they can access remotely.

- **What other tools does the user have?**

Smartphone, bus timetables and Google maps.

- **How do users communicate with each other?**

Social media

- **How often are the tasks performed?**

Weekdays during term time

- **What are the time constraints on the tasks?**

The step count needs to be viewable quickly as well as the calories burned so as not to take up any extra time.

- **What happens when things go wrong?**

Might be late or miss a lecture

3. Paper Prototype

Snyder defines paper prototyping as a version of usability testing where users of the proposed system interact with the interface on paper and perform tasks [7]. Below is a paper prototype design of the active travel application.

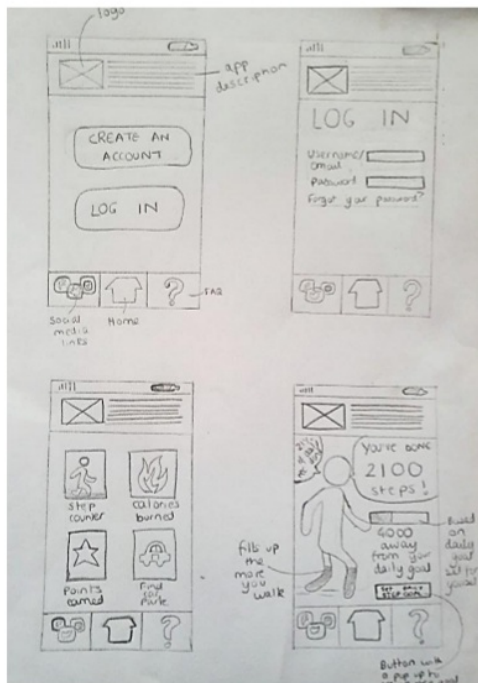


Figure 2 - Paper Prototype page 1

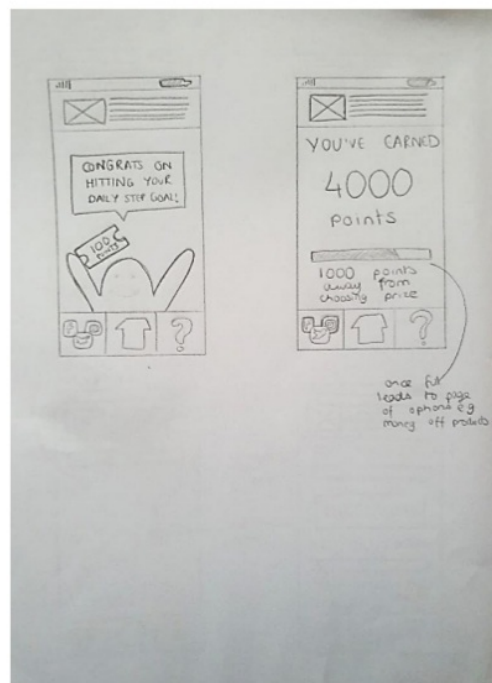


Figure 3 - Paper Prototype page 2

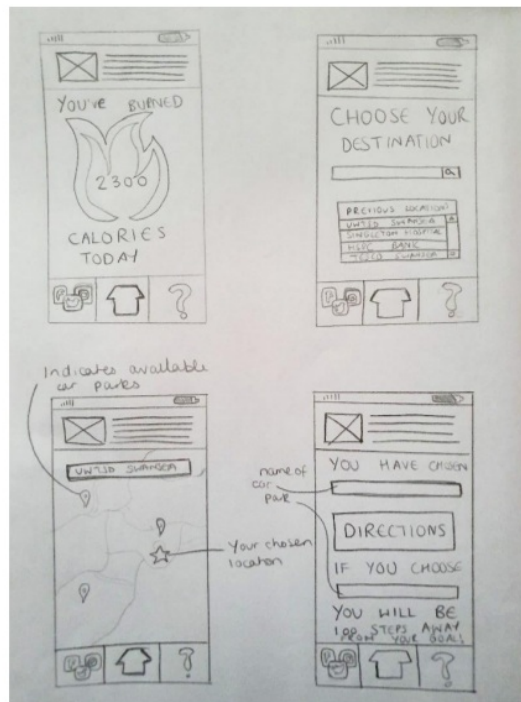


Figure 4 - Paper Prototype page 3

4. Human Factors Theory Analysis of Paper Prototype

Visual perception is the way a person's brain interprets what it is seeing [8]. An important element of design is to avoid visual stress e.g. too much content on screen or no logical organisation [9]. This has been done in the paper prototype with the use of straightforward buttons that are labelled with images. Another aspect to look at as part of visual perception are the Gestalt principles [10]. One of the principles that were followed in the prototype is the principle of proximity where items that are close to each other are perceived as a group and items that are separate are seen as the opposite [11]. An example of this is in the step count page where all the step count information can be found together. The principle of similarity wherein things that are similar to each other are thought to be in groups [12] has been followed with the buttons being the same size showing they carry out the same function i.e. taking you to the according page.



Figure 5 - Step count page

Sensory memory is the memory that conserves the features of a “particular sensory modality” e.g. how something feels and looks [13]. In order to avoid sensory overload, so the user can pass information to short-term memory [14], the menu is kept simple and each page is concise. Short-term memory is a temporary store of information needed for comprehension, learning and reasoning [15]. It has a limited capacity of approximately seven $\pm$ two items [16] with visual short-term memory being around four items [17]. The prototype has been limited to seven or less items on the screen at once, e.g. the goals page, so new users are not overwhelmed, and the layout can be committed to long-term memory with consistent use. Long-term memory has the largest capacity and lasting retention [18]. Recognition is easier for people than recalling things [19] which is what brought about the GUI and the idea to show users their choices rather than recalling and typing [20]. This is done throughout the prototype with clearly labelled choices and pathways and the use of recognisable menu conventions e.g. home button, link for if the user has forgotten their password.



Figure 6 - Forgot your password link

There are three types of reasoning to consider when designing mobile applications: deductive, inductive and abductive [21]. Deductive reasoning is logic gathered from general facts to a specific conclusion [22]. Inductive reasoning is where previous cases that are believed to be accurate are used to come to a general conclusion [23]. Abductive reasoning looks at a result and comes up with hypotheses to explain this result based on limited knowledge of it [24]. The prototype assumes the use of deductive reasoning where the user will look at what options are available and make a logical conclusion to what each one will do e.g. clicking the home icon will take them back to the home screen.

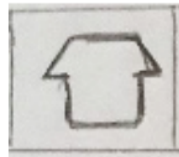


Figure 7 - Home icon

Interface metaphors are used to present users with a familiar concept in an unfamiliar area [25]. The advantage of this is that the user may not need as much training to use the system as they can apply what they already know to the task [26]. One metaphor used in the prototype is the maps for the car park locator. By using a familiar image, the user will be more comfortable with using the system. The map has known symbols such as the location "pins" which show possible car park options, that when clicked on say the address, and the star to show their

intended destination. The home symbol used throughout the interface is also a metaphor used in many applications to take the user back to the home screen.

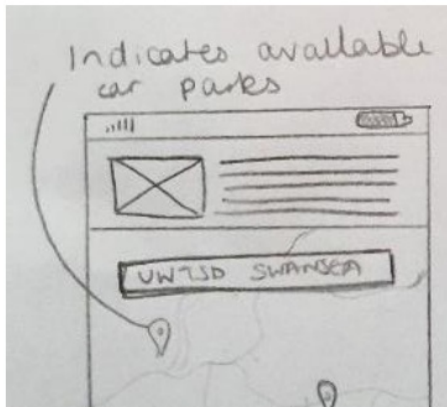


Figure 8 - Location pins on map

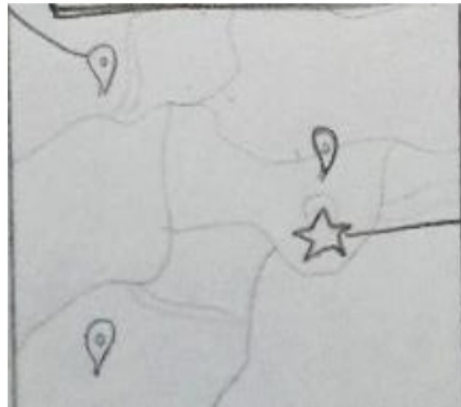


Figure 9 - Chosen destination on map

Affordance was first defined by Gibson as what the environment provides to the user, whether it be good or bad [27]. Norman then brought it to the Human Computer Interaction (HCI) environment and described it as the relationship between a physical object and an agent; the capabilities of the agent and the object properties determines the object's affordance [28]. An example of affordance in the interface is the search bar for destinations which is a commonly used symbol for search engines and the user can interpret that they type in the search bar to find their destination. There is also affordance in the icons shown below the screen, such as the social media icons leading to the app's media pages and the question mark leading to a frequently asked questions page. The login page also shows explicit affordance with the create an account and log in buttons i.e. it is clear they are buttons. Hidden affordance can also be found on the map page wherein you need to click on the location "pins" to see the address.

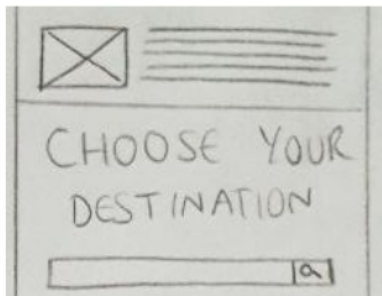


Figure 10 - Search bar for destination

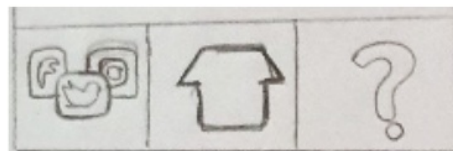


Figure 11 - Icons below screen

For this app to persuade the user to partake in active travel, elements of a persuasive system have been incorporated into the app. A persuasive system is one that is designed to alter or reinforce either behaviours or attitudes or both without the use of deception or coercion [29]. One way this is done is through self-monitoring in the step goal and calories burned daily. There is also personalised content with setting up a user profile to keep track of goals and points earned. Dialogue support is also provided when viewing the step count progress and once your car park location is chosen, you are also given an encouraging message which suggests another car park to take so you can reach your step goal so it all links together. The user also receives praise when they reach their step goal and a certain number of points, which when built up enough, allows the user to choose from certain rewards e.g. money off food, health and beauty etc.

5. Paper Prototype Walkthrough and User Feedback

After a walkthrough of my paper prototype with a classmate I received some feedback:

FEEDBACK
My peer's active travel application focuses on encouraging the user to choose further away parking facilities in order to generate more steps, burn more calories and earn points. It is a good concept; however further task analysis would improve the app functionality. The app seems to have two purposes; to improve user fitness (through step count and calorie burn) and to suggest car parks further away from the users desired destination. The app user audience is limited to car-users and those who want to increase their steps or burn calories. Only car-users would benefit as it only suggests car park locations rather than utilising other forms of transport, for example it could also suggest an early bus stop. Also, users are only motivated through steps and calorie burn, which may not interest all potential users. There is no motivation to reduce c02 emissions or save money. This is limiting the app audience and it should ideally promote more sustainable transport methods, rather than focusing on car use. Furthermore, there is no indication of how car parks are suggested i.e. does this consider cost of parking or car park opening hours? Where is information gathered from, is this based on Google maps? The app could use further user input to create more 'intelligent' suggestions i.e. user decides maximum parking charge or whether they require disabled or child parking spaces. The design includes the use of interface metaphors and affordance to enhance user friendliness. Interface metaphors have been applied effectively, allowing the user to clearly understand the symbolisation of the button. For example, the button containing the house icon returns the user to the app home page and calories burned is represented by a flame, these remove the need for text. However, this home button is shown on the sign-up, log-in and homepage – pages where it is not required or unusable.

Furthermore, affordance has been applied appropriately. For example, progress bars have been implemented providing an update of the users progress throughout. Affordance has also been used through drop-down boxes and a search bar. These implementations provide the user with visual cues on the app functionality.

After reviewing, arguably the most effective feature is the progress bar, which fills up as steps are generated. This feature provides the user with live feedback on their progress and can be utilised as a persuasive technique. In addition, text notifications are given in the form of speech bubbles which provides the user with another form of interactive feedback. Lastly, the figure used to symbolise that the user has hit their daily goal is a good use of a persuasive system, as it alerts the user with a visual representation of a points token. The use of multiple feedback is positive, however arguably is excessive and would benefit from one clear form of feedback. Steps and calorie burn are recorded daily; however, it would also be useful to show long term progress through weekly and/or daily feedback reports or summaries.

Users are rewarded and motivated through points; these can then be traded in for money off products. However, the app would have to generate some form of funding to offer this i.e. by charging to use the app or through advertising.

The application would benefit from the implementation of an accessibility menu or screen, providing further support and assistance to those users who require it. For example, a colour scheme more friendly to colour blind users or larger text for those with sight impairments.

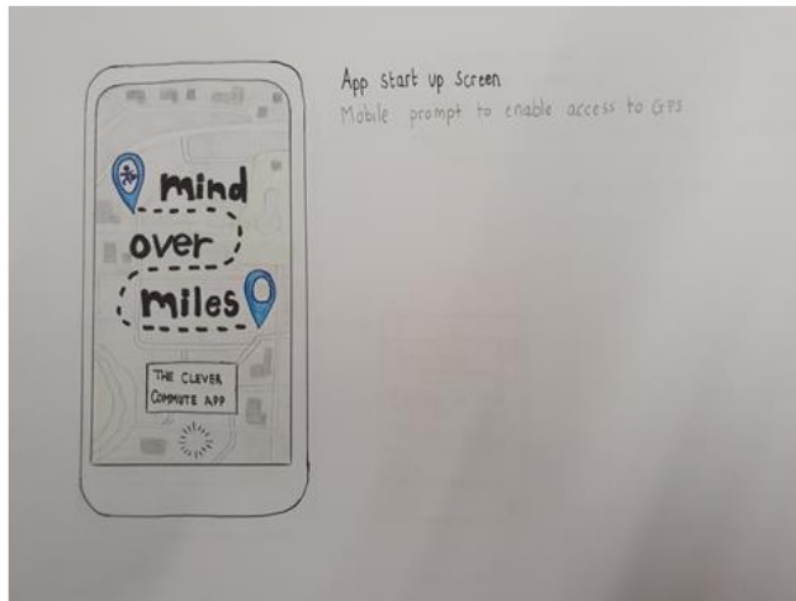
It would also be advisable to review some of the app screens as they could be seen as overcrowded with information which may affect the STM. For instance, there is no need to include the app description on every app screen as this takes up valuable space and increases clutter. Lastly, the application would benefit from considerations to a colour scheme, name and logo design.

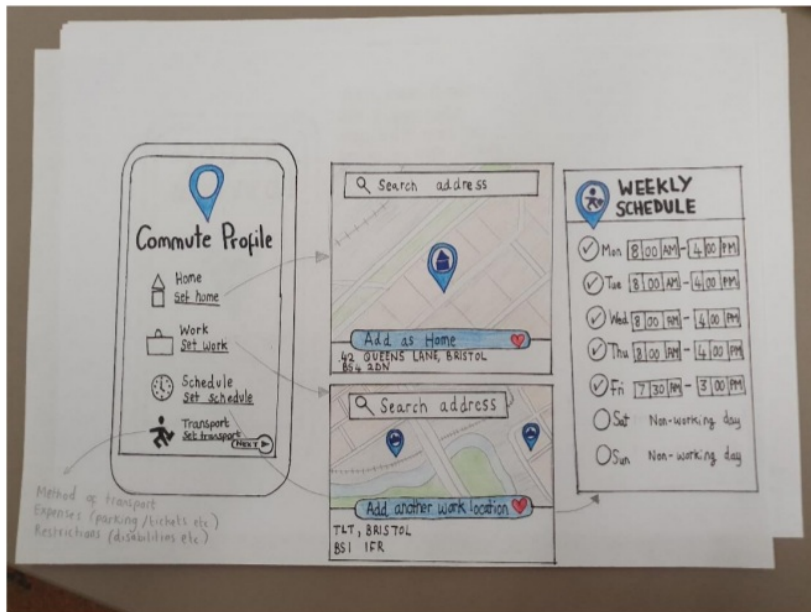
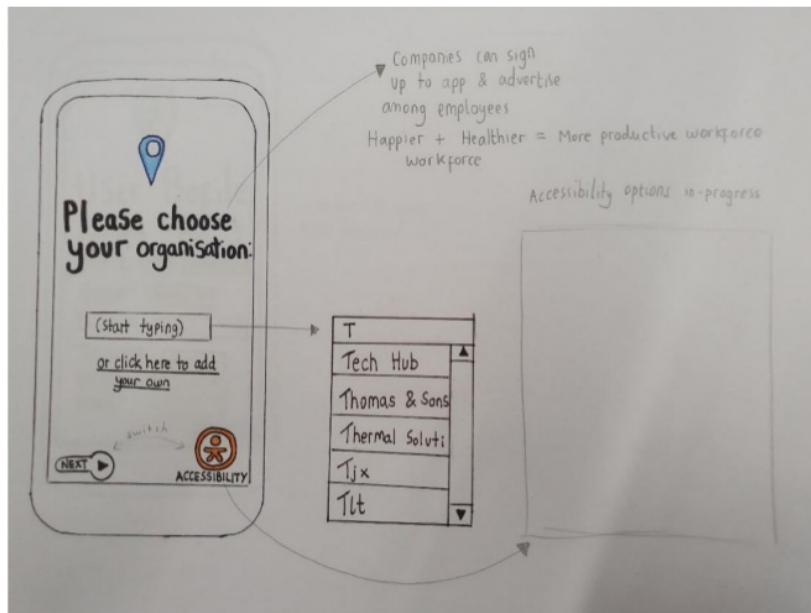
Overall, the concept of encouraging car users to park further away to increase their fitness on their daily commute is very good, especially when most commuters today use car. Further task analysis, described above, would help improve the delivery of this idea.

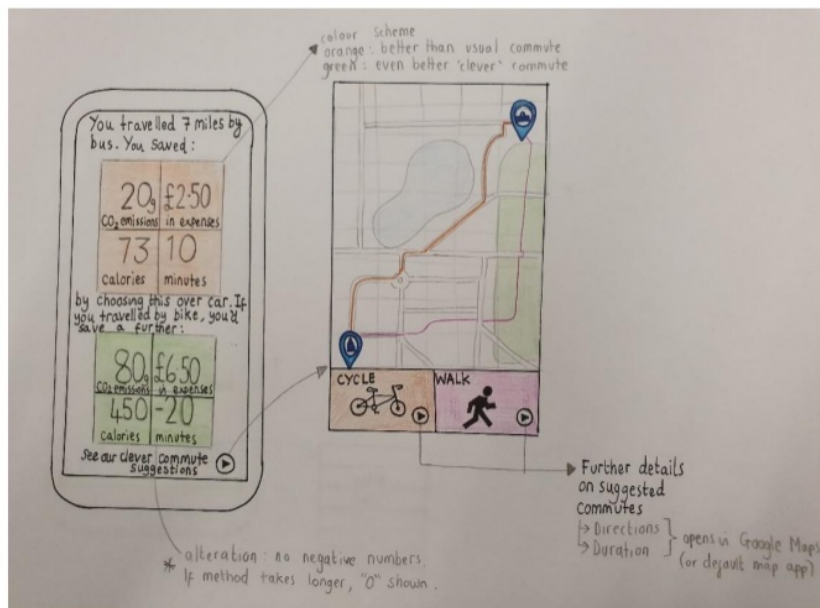
From this feedback it is clear that I have missed some aspects that would make the application more user friendly. While the application was initially built for car users, it would make it more accessible to add more transport options as suggested by my classmate e.g. the bus. I also previously thought of adding information on CO² emissions, but this was not discussed in task analysis, so I chose not to add it to my app. However, there may be users more interested in looking after the environment and/or saving money so I will consider adding these options to the application.

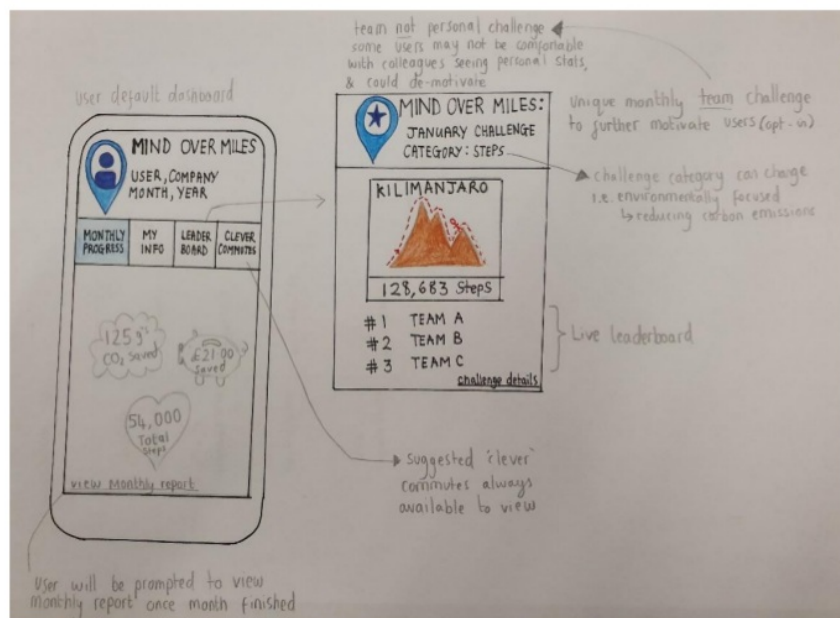
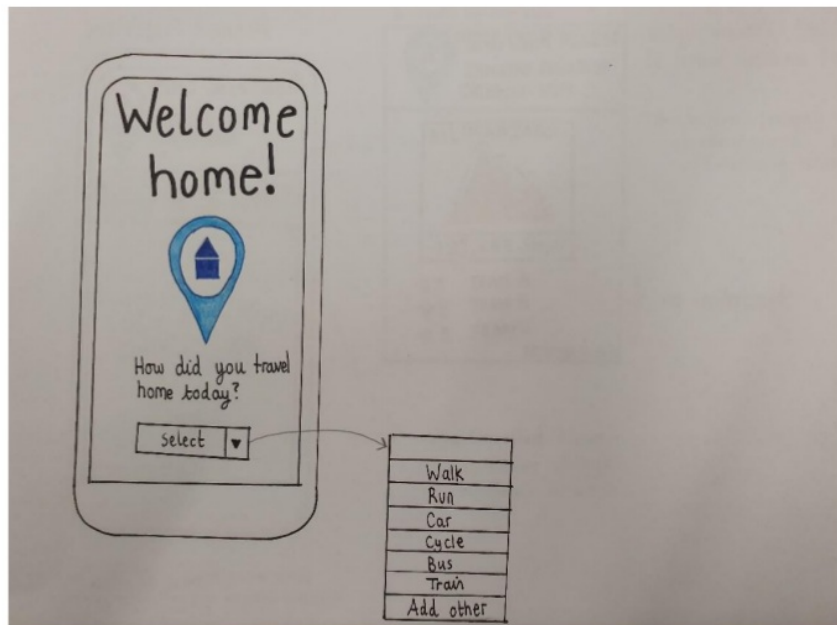
Further input can also be added for car parks rather than simply choosing ones closest to the location. The home button can be removed from the sign up, login and home page which was also suggested by my classmate that I did not think of. I also need to consider how funds will be gained regarding the prizes for the users and how/whether to include a way to keep progress of calories burned and steps taken. Accessibility options also need to be added as required by law [30].

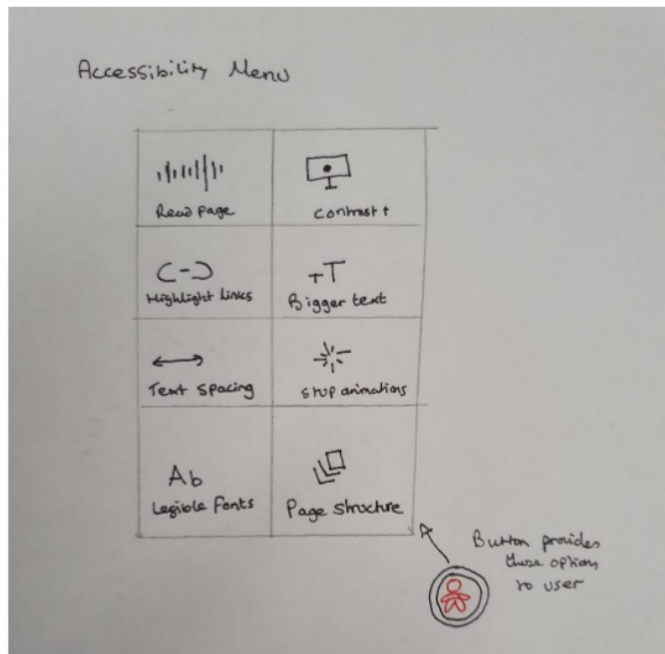
I also went through a walkthrough of my classmate's app and provided feedback to them.











My classmate's active travel application 'Mind Over Miles' is designed to provide users with healthier travel routes to work and home and allows them to view their monthly progress and take part in a monthly team challenge to compare their results with their work colleagues, which is optional. It is suitable for companies to sign up employees which promotes a happier workplace.

The interface was clear and concise and made it simple to follow what needed to be done to complete whatever tasks are required. Colour is also used appropriately to indicate different routes making them stand out. The use of consistent symbols throughout make the appearance more pleasing and are a good example of a metaphor in the system making it easier for the user to commit the system to long-term memory. The maps are also a good metaphor and emulate a real map with the paths and symbols for work and home made clear.

There are several good features in use that show this is a persuasive system. For example, social support with the team challenge, self-monitoring with the monthly progress and dialogue support with the suggested route. The application also provides good affordance with the use of menus and navigation that make it easier

to use. There are also accessibility options which make the app more user-friendly for those with reading or hearing difficulties.

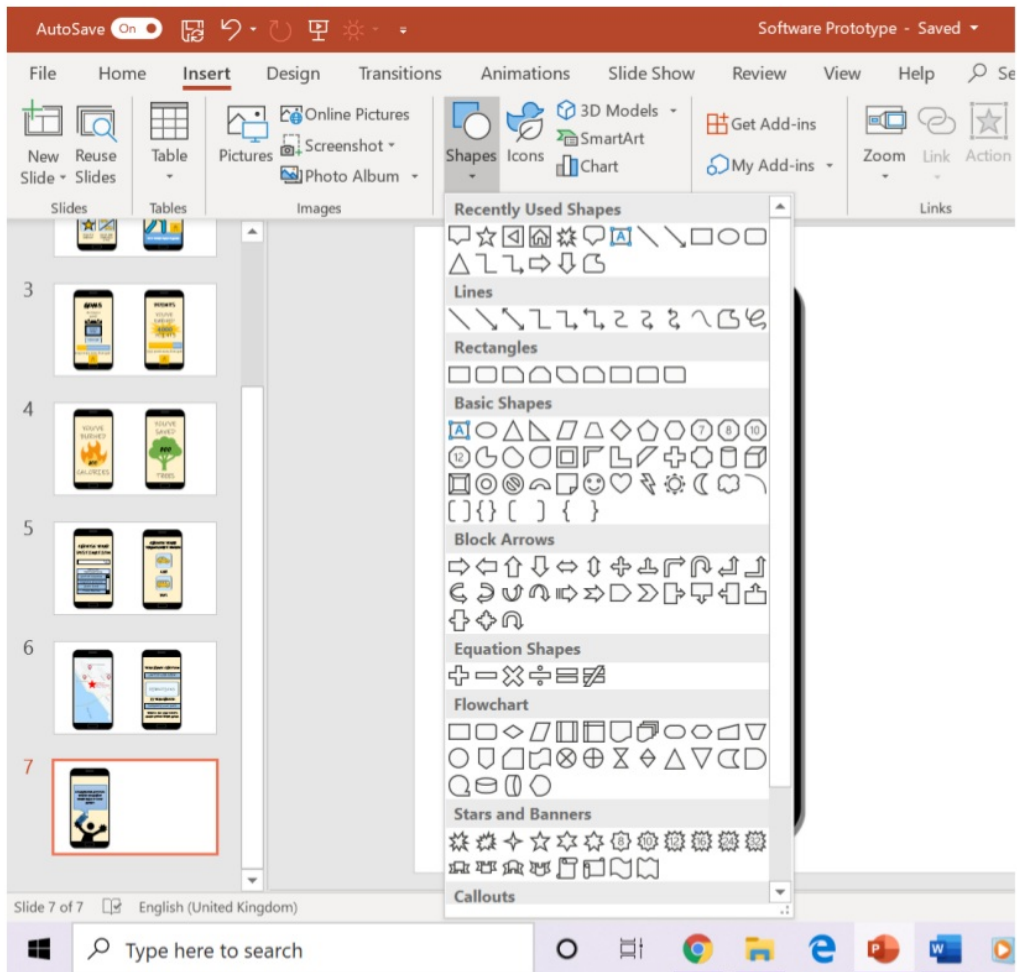
The app also follows the 7 ± 2 rule, with only necessary information displayed on the screen at a time so as not to overwhelm the user's senses and affect their short-term memory. The user is also given helpful prompts such as to view their monthly report once the month is completed and once they arrive at work or at home, they are automatically given a notification which takes them to a page to select their mode of transport. This means the user does not have to remember to do this themselves and eventually they will see it as part of their daily routine. It also means they are not losing any valuable time at work.

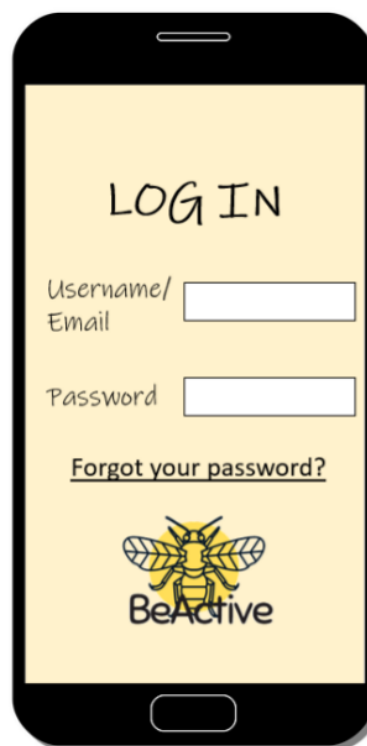
One thing I was unsure of is the use of the weekly schedule and where it links to the application. At first, I thought it may be to give the user their prompt to choose how they travelled to work at the time they set their arrival to work, but this is done through the phone's GPS system. My only thought is that it could be another extra feature just so the user is able to see their work schedule and if not, perhaps it could be made clearer what this is used for or even to remove it from the application if it is excess.

Overall, the app does well to achieve its goal of providing a more "clever commute" to the user. It is not restrictive and accounts for all modes of transport e.g. bus, bike and walking. It makes the process of choosing an active travel route much simpler and persuades the user to choose these routes by describing how much more time and money they could save and calories they could lose. By keeping monthly progress reports, they can see how they are improving their active travel and compare it with colleagues to keep motivated.

6. Software Prototype

The software tool chosen for the software prototype of the application is Microsoft PowerPoint. The available features seemed fitting and appropriate enough for to complete a software prototype. The main feature utilised is the shapes tool which helped layout the buttons and text boxes. The shape effects could also be used to help emulate a "real" button in the interface.





Changes were made from the original paper prototype:

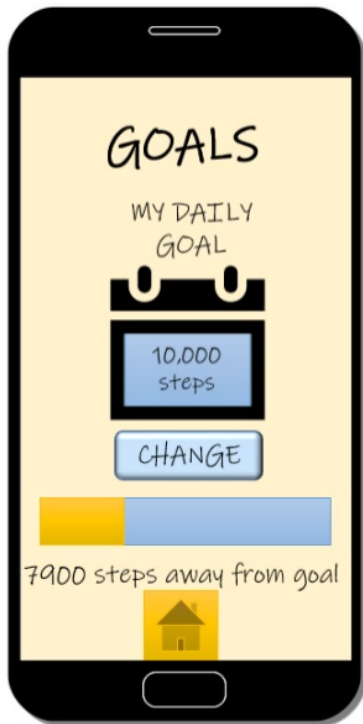
- Accessibility options were added to the homepage using the web accessibility icon to indicate
- The login page also no longer had the app statement and just kept the logo
- The 3 icons originally under all the pages were removed from these pages



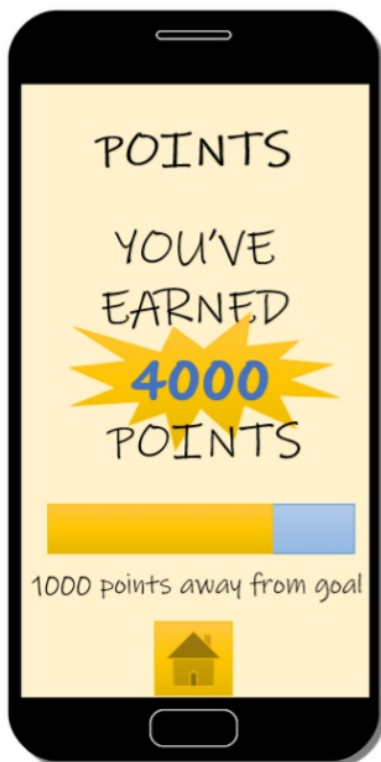
- This page now also has a bus stop option



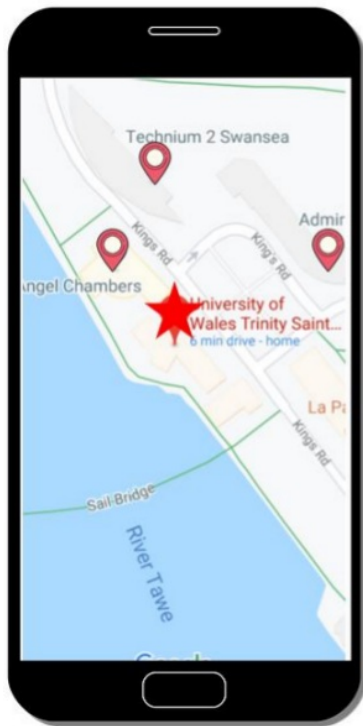
- The goals progress bar that was originally here will be moved to another page so as not to overwhelm the user. I also removed the social media and FAQ button.



- This page was a new addition







- This page works through Google maps and the app pinpoints either car parks/bus stops close by the destination





7. Evaluation

The task analysis did not initially help with creating the prototype as there were several things, I did not think about including. However, if I had spent a bit more time going into depth with the tasks, it may have been more helpful. When designing the prototype, I tended to think about the design first and human factors later which may have been what made my paper prototype lack several features which make it more user-friendly, as pointed out by my classmate. The aspect I found most helpful in this process was the walkthrough of my paper prototype with a classmate. This helped me notice many things I missed and gave me an unbiased take on my prototype from an actual user's perspective. This was what made me change several things in my paper prototype to my software prototype e.g. a separate goals page, incorporating travel by bus and the carbon emissions page where it says how many trees you have saved by not taking car etc. Overall, if I had started off with a clearer task analysis and thought more on human theories my initial design may have needed less changes and made the application more user-friendly.

8. References

- [1] L. E. Saunders, J. M. Green, M. P. Petticrew, R. Steinbach and H. Roberts, "What Are the Health Benefits of Active Travel? A Systematic Review of Trials and Cohort Studies," *PloS ONE*, vol. 8, no. 8, pp. 1-13, 2013.
- [2] Swansea Council, "Active Travel (Wales) Act 2013," [Online]. Available: <https://www.swansea.gov.uk/activetravelact>. [Accessed 18 November 2019].
- [3] Welsh Government, "An Active Travel Plan for Wales," [Online]. Available: <https://gov.wales/sites/default/files/publications/2017-09/active-travel-action-plan.pdf>. [Accessed 18 November 2019].
- [4] M. Bopp, D. Sims, S. A. Matthews, L. S. Rovniak, E. Poole and J. Colgan, "There's an app for that: development of a smartphone app to promote active travel to a college campus," *Journal of Transport & Health*, vol. 3, no. 3, pp. 305-314, 2016.
- [5] A. Basharat, J. A. Sheikh and A. Arshad, "Enhancement of User Experience by Task Analysis: A Proposal," Gujrat, 2016.
- [6] J. T. Hackos and J. C. Redish, *User and task analysis for Interface Design*, New York: John Wiley & Sons Inc., 1998.
- [7] C. Snyder, *Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces*, San Francisco: Morgan Kaufmann Publishers, 2003.
- [8] D. E. B. Stanton, "Visual Perception: An Overview," *American Journal of Occupational Therapy*, vol. 22, no. 2, pp. 82-85, 1968.
- [9] S. Srinivasa, "How visual perception affects visual design," UX Collective, [Online]. Available: <https://uxdesign.cc/how-visual-perception-affects-visual-design-e0a845876d7b>. [Accessed 18 November 2019].

- [10] D. J. Peterson and M. E. Berryhill, "The Gestalt principle of similarity benefits visual working memory," *Psychonomic Bulletin & Review*, vol. 20, pp. 1283-1289, 2013.
- [11] L. Graham, "Gestalt Theory in Interactive Media Design," *Journal of Humanities & Social Sciences*, vol. 2, pp. 1-12, 2008.
- [12] D. Todorovic, "Gestalt principles," *Scholarpedia*, vol. 3, no. 12, pp. 53-45, 2008.
- [13] P. Jolicoeur, C. Lefebvre and J. Martinez-Trujillo, *Mechanisms of Sensory Working Memory: Attention and Performance XXV*, London: Academic Press, 2016.
- [14] The Human Memory, "SENSORY MEMORY," 27 September 2019. [Online]. Available: <https://human-memory.net/sensory-memory/>. [Accessed 19 November 2019].
- [15] W. C. Shiel Jr, "Medical Definition of Short-term memory," MedicineNet, [Online]. Available: <https://www.medicinenet.com/script/main/art.asp?articlekey=7142>. [Accessed 19 November 2019].
- [16] E. T. Rolls, L. Dempere-Marco and G. Deco, "Holding Multiple Items in Short Term Memory: A Neural Mechanism," *PLoS ONE*, vol. 8, no. 4, pp. 1-13, 2013.
- [17] T. J. Buschman, M. Siegel, J. E. Roy and E. K. Miller, "Neural substrates of cognitive capacity limitations," *Proceedings of the National Academy of Sciences*, vol. 108, no. 27, pp. 11252-11255, 2011.
- [18] S. McLeod, "Long-Term Memory," SimplyPsychology, 2010. [Online]. Available: <https://www.simplypsychology.org/long-term-memory.html>. [Accessed 19 November 2019].
- [19] J. Preece, Y. Rogers and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, Chichester: John Wiley & Sons Ltd, 2015.

- [20] J. Johnson, *Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines*, Waltham: Elsevier Inc., 2014.
- [21] Merriam-Webster, "'Deduction' vs. 'Induction' vs. 'Abduction'," 25 July 2019. [Online]. Available: <https://www.merriam-webster.com/words-at-play/deduction-vs-induction-vs-abduction>. [Accessed 19 November 2019].
- [22] J. S. B. Evans, *The Psychology of Deductive Reasoning (Psychology Revivals)*, New York: Routledge & Kegan Paul Ltd, 1982.
- [23] B. K. Hayes and E. Heit, "Inductive Reasoning 2.0," *Wiley Interdisciplinary Reviews: Cognitive Science*, vol. 9, no. 3, pp. 1-13, 2017.
- [24] R. Taylor, N. A. Torugsa and A. Arundel, "Leaping Into Real-World Relevance: An 'Abduction' Process for Nonprofit Research," *Nonprofit and Voluntary Sector Quarterly*, vol. 47, pp. 206-227, 2017.
- [25] M. Howell, S. Love and M. Turner, "The impact of interface metaphor and context of use on the usability of a speech-based mobile city guide service," *Behaviour & Information Technology*, vol. 24, pp. 67-78, 2005.
- [26] A. Marcus, "Metaphor design in user interfaces," *Journal of Computer Documentation*, vol. 22, no. 2, pp. 43-57, 1998.
- [27] F. Pucillo and G. Cascini, "A framework for user experience, needs and affordances," *Design Studies*, vol. 35, no. 2, pp. 160-179, 2014.
- [28] N. Masoudi, G. Fadel, C. Pagano and M. V. Elena, "A Review of Affordances and Affordance-Based Design to Address Usability," *Proceedings of the Design Society: International Conference on Engineering Design*, pp. 1353-1362, 2019.
- [29] H. Oinas-Kukkonen and M. Harjumaa, "Persuasive Systems Design: Key Issues, Process Model, and System Features," *Communications of the Association for Information Systems*, vol. 24, pp. 485-500, 2009.
- [30] GOV.UK, "Understanding new accessibility requirements for public sector bodies," 9 May 2018. [Online]. Available:

<https://www.gov.uk/guidance/accessibility-requirements-for-public-sector-websites-and-apps>. [Accessed 20 December 2019].

Usability Engineering Assignment

GRADEMARK REPORT

FINAL GRADE

65/100

GENERAL COMMENTS

Instructor

Introduction: Good explanation of Active Travel and one example app is shown. An improvement would be to include even more info sources and to briefly discuss usability challenges.

Task Analysis: A brief Task Analysis was shown. Some topics could benefit from more discussion - for example Who are the Users could include an outline of knowledge and skills in this area. Do they know their way around? Do they already use a range of phone apps?

Paper Prototype: An effective Paper Prototype is included - a good feature of your assignment!

Human Factors: Good use of info sources and application to specific examples discussed, especially for affordance. Bear in mind that you hidden affordance is not helpful!

Review of Classmate's Design: Sometimes it's more difficult to review a good design but you correctly highlighted the good features and made a constructive suggestion. References could have been included here, even for topics just discussed under Human Factors.

Software Prototype: Good paper prototype with an attractive implementation. Bear in mind that upper case text can be harder to read. Some explanation of updates made.

Evaluation: You correctly suggested more depth for the Task Analysis. The feedback was also evaluated, more elements could have been included.

Overall a good application of theory to create an attractive prototype with some good application of theory.

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25
