Project 2

Human-Computer Interaction

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CHANGE THIS BEFORE HANDIN

Contents

1 Introduction

The aim of our project is to give users a unique virtual experience of walking around their own designed homes in 3d. this will be accomplished by using the existing in-built smart device sensors. A feature that is accessible in almost every modern smart device will be used - the gyroscope (along with other sensors that might compliment the product). Users will be able to experience their preferred designs in a 3d environment, being able to explore it with an additional feeling of Immersion. With a fast and busy lifestyle, it is hard not to think about time efficiency, especially with the tasks that people do not want to spend too much of their resources on. This is why it is important to establish pleasant experiences. The application that will be developed will help people to save not only time but expenses too.

1.1 Initial Problem Statement

How can we improve user experience in an interior design app using non-traditional mobile sensors?

2 | Analysis

2.1 Target Group

Good understanding of our target group helps to create a good concept and design requirements, to accommodate users specific needs and wishes. This project is targeting people who are IKEA's customers and who are newly decorating or changing furniture, decor of their home. This part of the research includes two parts - understanding people who has need for the application, and IKEA's target group - people that Ikea attracts and who are coming to shop for furniture or decor.

There are many ways to segment target audience. Probably most popular is Geographic or Demographic segmentation. In this case we will go deeper and have a look at Psychographics as we want to know specific needs of customers which will help to design a helpful app.

2.1.1 Demographics

write a small introduction

What is IKEA targeted customer's age ?

There is no official specific range of age that IKEA is targeting at. Contacting IKEA also did not result in finding out their specific age range. IKEA's target group's age range is really wide - there are lounges for children, considerations for disabled and old people. At "IKEA'S Accessibility Plan" (Accessibility Plan 2013) they mention that there are consideration to accept people from children to old people and disabled people.The Report states that IKEA's staff is trained to help people with disabilities, their equipment and even help-animals. All IKEA shops has mini restaurants where different range of age people can eat. They serve special menus for children, sell wine, and have quick walk-by coffee machines. An Assumption can be made that IKEA is trying to appeal to all age range and has not created clear concept design around specific life-cycle stage nor age range.

However, looking at IKEA's actual customers and considering that in general the furniture price is low, we can state that IKEA attracts young people, who cares about expenses. At our first interview with customers we interviewed 10 people and average age was 35 years. Danish people become parents pretty late, on average women give first birth when they are 29 years old (Statistics Denmark 2014). On average Danish men get married at late age of 35 and 32 as woman. A conclusion can be made that IKEA attracts young people - students, young couples and families, who has less income and priorities of expenses are probably somewhere else as taking care of children or study expenses. It means that we should target at range of age 25-35 which includes, students, young couples and parents.

put into littera-tureList (exam-stu-tor.com, 2015)

2.1.2 Psychographics

Since IKEA is targeting at young people with lower income level, it is possible to do more accurate analysis of social class, lifestyle and personality traits of our target group (Examstutor.com, 2015). According "examstutor" website, social class is categorized in grade class, where IKEA's targeted customers could be defined as class C1, C2, D or E:

small description of what Psycho-graphics are

The socio-economic scale

Social grade	Description of occupation	Example
A	higher managerial, administrative or professional	Company director
B	intermediate managerial, administrative or professional	Middle manager
C1	supervisory, clerical, junior administrative or professional	Bank clerk
C2	skilled manual workers	Plumber
D	semi- and unskilled manual workers	Labourer
E	state pensioners with no other income, widows, casual and lowest grade earners	Unemployed

Figure 2.1: Scale of the economic classes

If most of our target group has lower income level, it would be reasonable to assume that most of IKEA customers does not have expensive gadgets as leading-brand, expensive smartphones. However, our first interview showed that 9 out of 10 have smartphones. Further investigation of finding out which smartphones users have, would be useful to know how optimized an application needs to be for slower mobile devices. Analyzing lifestyle traits, means touching upon values, beliefs, interests and opinions. According age, and other statistical information on "Statistic Denmark" it is understandable that IKEA's customers are busy people - students, young parents and couples, people who are beginning their career life.

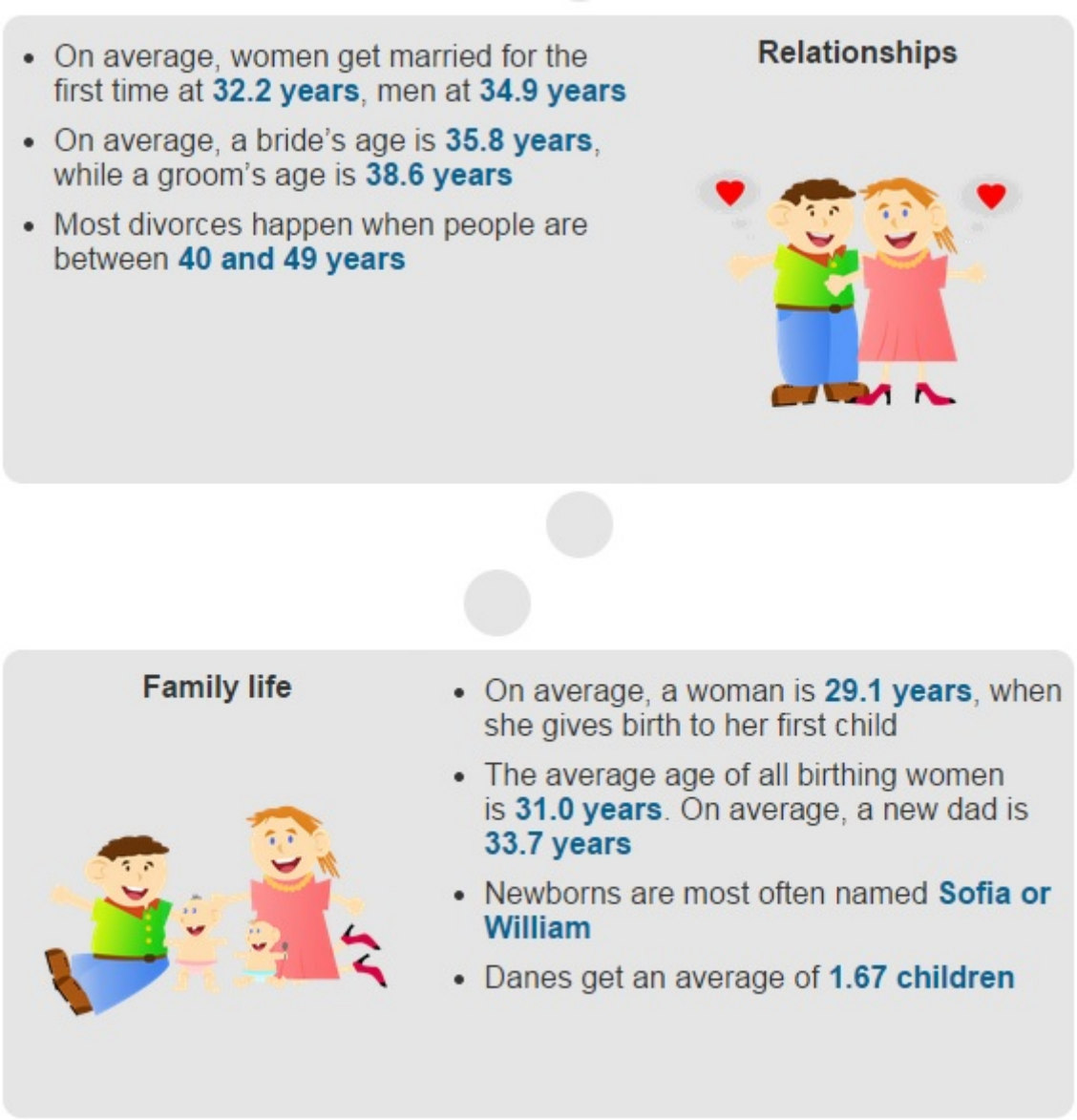

Figure 2.2: Relationship statistics

While interviewing customers we found out that around 50% count their expenses while shopping at IKEA. This only would put social class categorization in doubt. However, while interviewing employees, it was more clear that customers are actually concerned about the price of the product - in fact as employees stated, price is one of the most common topic to talk with customers about. This confirms social class categorization mentioned above.

2.1.3 Digital knowledge

Marc Prensky in his 2001 article categorizes his understanding of target group to two segments,when it comes to understanding or learning with digital technology. He categorizes them to "digital natives" and "digital immigrants".There are few more categorizations that people use as "Born digital" or "Digital Settlers", so it is common to separate people to "digital knowledge" groups.
Immigrant- is the one who was born and grew up before the technology revolution, so for example 65 years old man who did not have all the computers and digital tools or equipment as we do now. This person only adopted to technology at certain age or life point when it was needed.
Digital native is the one who grew up in technology era, where he had access for example to Internet, computers, probably experienced one or more ways of learning in digital environment.(Prensky, 2001). However, Prensky notices that time will make everyone a "digital native", as everyone will be born in world full of advanced technology, so old generalization terminology will not be suiting in future. He quotes Albert Einstein - "The problems that exist in the world today cannot be solved by the level of thinking that created them." Prensky later introduces "Digital wisdom" that is more general but suiting in this era.(M. Prensky, 2008). This "tag" is best suiting to our target group - if IKEA's customers are young students or people around 35 years of age it means that target group is on the edge of being called both- if person born in 80s or 90s he/she had a chance to learn or use modern technology, depending on geographical and social class of course. That is why terminology of "Digital wisdom" is useful - we can assume that most of our target group will be with digital wisdom. Therefore most of the targeted users should not have huge problems to start using any digital application. Interviewing our target group gave us knowledge that users plan and prepare before going to actual store. 100% of our interviewed people do some kind of measurements when buying furniture. 10/10 interviewed checked website before going to IKEA and 9/10 are shopping online. 7/10 had planned shopping the day before we interviewed.

2.1.4 Target group conclusion

Our target group are young and busy people - from age of 25-35 who are shopping at IKEA for new furniture or decor. Majority has access to personal smartphone and digital-wisdom in using it's applications. Our target group are careful with expenses and considering the price,

they also tend to know about the product before actually visiting the shop.

2.2 User Experience for mobiles

2.2.1 Introduction to user experience

A study of user experience[1] is a study of how a user feels when interacting with a system. The field encompasses a whole range of different and seemingly unrelated topics. The most known part of UX is probably the concept of usability which will be discussed later in the chapter, other things make up UX, such as: Design, Accessibility, System performance, Ergonomics, human factors and more concepts. The term user experience was originally coined by Dr. Donald Norman, who was the first to describe the importance of user-centered design. User-centered design is a design concept that lets the users dictate(to a certain degree) what the system should contain and what form it should take. Before user-centered design the general design process looked like:

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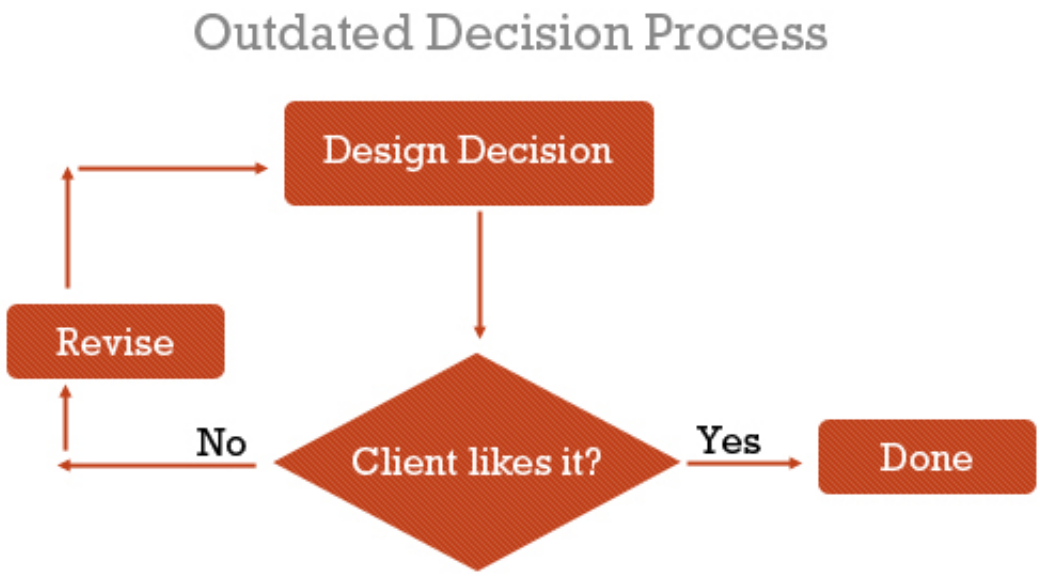

Figure 2.3: old decision process, Jacob Gube 2010

nowhere in the design process was the users a factor, the design was simply made according

[1] hereafter referred to as UX

to how the designers as well as the client felt it should be. making the same kind of chart for a user-centered approach would look differently:

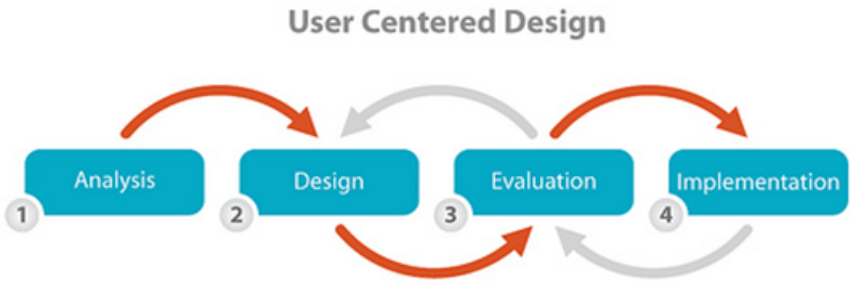

Figure 2.4: a chart of how user-centered design could function, Usabilla 2014

as this chart shows, user-centered design can be an iterative process. the grey arrow represents the user feedback, which shows that the users should be involved in the evaluation of a design. This method can be overwhelming if the evaluation is only being done on implemented prototypes. source

User Experience and usability is often confused since a large portion of the guidelines for proper usability also applies to giving a good user experience. What sets the user experience apart from usability is the feelings that the user is subjected to while using the site, app or programme. An example of which could be the iBooks app for iPad, which is basically an application for reading and browsing E-books. The layout is simple, it provides an overview of the owned books with a visual representation of the covers which is common for such apps and as such, do not set itself apart from the state of the art when it comes to usability, however the user experience is greatly improved simply by changing the background to resemble a bookshelf, it gives a "cozy" feel to the app, you can almost imagine yourself sitting in front of the fireplace sitting with a good book. source for the example

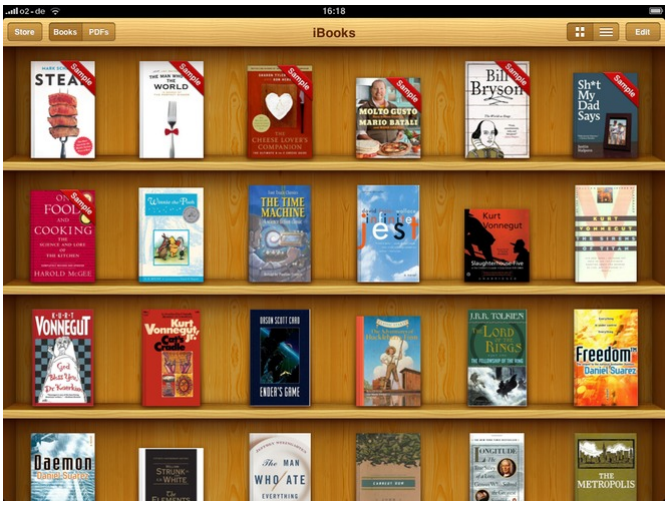

Figure 2.5: Apple iBooks for comparison

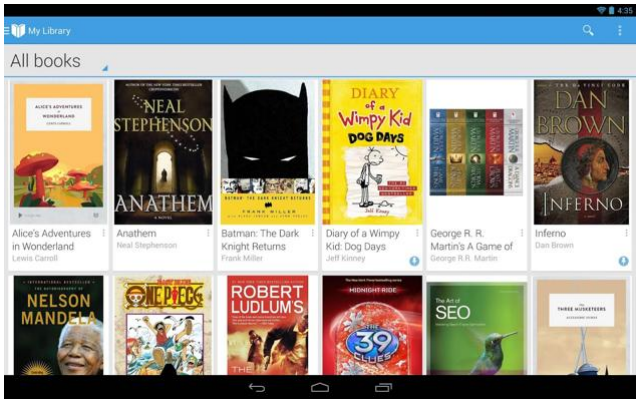

Figure 2.6: Google Play Books for comparison

2.2.2 User experience for mobiles

when designing a mobile app with UX focus, the unique challenges of the mobile platform has to be considered. A brief look at three of the most outstanding challenges:

- Screen size
  as opposed to a traditional computer screen the general mobile platform has a much more limited amount of screen space. This restriction will force the designers to eliminate as many redundancies as possible so as to not clutter the screen with unnecessary information. [3]

- User input
  user input is according to Giorgio Sardo one of the smartphones weakness. it is mentioned that "Entering text on a mobile phone is hard, and people tend to avoid it if they can"[3]

- Loading times
  Mobile devices are generally slower than a PC or Mac, both when it comes to processing power and internet speed, assuming they're using a mobile network [5]

When attempting to improve usability and user experience, for people using a site or a programme on a phone, the optimal way to do so is to make an actual app where you either port the mobile site or the web application so that it can be downloaded and accessed directly from your phone or tablet instead of via the internet browser. Some of the guidelines for optimizing for mobile devices are cutting features, reduce word count and enlarge interface elements to accommodate the "fat finger problem".[5] an example of poor simplification used in the book is IKEA where they simplify the mobile site by only showing a single item when browsing for bedframes.

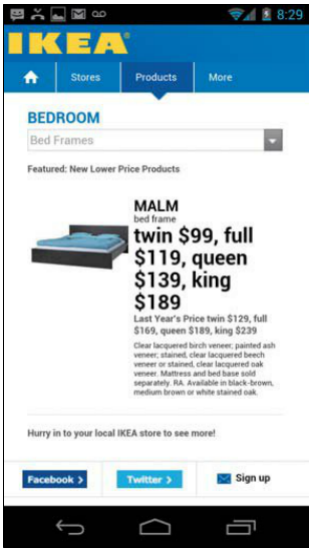

Figure 2.7: the mobile website from IKEA, anno 2013

2.2.3 Understanding our Users

Even though we have previously analysed out target group, when we want to focus on the user experience, further target group considerations has to be made, that is why this paper will next

talk about the concept of understanding the users. Georgi Sardo provides three points that will help with the design process of the app:

- What are your users' digital device skills? Are they used to working with digital devices and software applications?[3]
- What are your users' skills in using your application? Does the application revolve around their professional area?[3]
- Is the application the focal point for your users? Or is their attention limited?[3]

these three points can help develop an app that will be focused on the users needs, which is at its core what UX is all about.

2.3 Interaction Design

A very important part when developing the application to fit a pleasurable user experience is to make sure that it works as flawless as possible, and there are no misinterpretations when using the product. For the product that is going to be developed, the "traditional" interaction methods do not cover the functionalities that are needed to cover our initial concept needs. To assure that the alternative interaction is integrated in a convenient manner, knowledge about different sensors and possible combination of two or more to make more intelligent outcomes should be established.

needs intro ease-in

2.3.1 Traditional interaction methods and their replacement

As technology evolves, new ways of interacting with computational devices are constantly built. With that, people's needs also change. The transition from the classical buttons on a cellphone to a touchscreen has made new ways of interaction possible - the delimitation of physical buttons made it available to have any customised graphical interfaces on the screen possible. This made life easier for casual tasks - like zooming a photo using two fingers as multi-touch input, which is much more intuitive than the classical button alternative. The smartphone technology evolved further, where different sensors have started finding their place in smart devices. Soon enough there were devices with GPS, WiFi, Bluetooth, Light sensor, Camera, and other sensors. The implementation of these sensors in the smartphone allowed new forms of interaction, such as video calling, flashlight and screen orientation.

SOURCE

2.3.2 Sensors

needs an introduction

The Accelerometer

The accelerometer is capable of detecting the force and the movement in a three-dimensional space. This feature is most commonly used to adjust the display to match the position that the device is held in by the user (Chong, r.(year?)). If the accelerometer is rotated at the center of the system, however, it will not detect the movement. Accelerometer, along with other sensors is commonly used in the augmented reality concepts (examples 1, 2).

The Gyroscope

A gyroscope is a device that uses Earth's gravity to help determine orientation. Its design consists of a freely-rotating disk called a rotor, mounted onto a spinning axis in the center of a larger and more stable wheel. As the axis turns, the rotor remains stationary to indicate the central gravitational pull, and thus which way is "down."(Ryan Goodrich, 2013). Gyroscope, in comparison to magnetometer and accelerometer, is the physically largest and most expensive sensor, so the possible limitations in the smart devices in-built Gyroscopes have to be considered.

Figure 2.8: iPhone game using a gyroscope sensor

The Magnetometer

The magnetometer can be combined with an accelerometer (to complement in measuring the gravity) to get the input of the 3d orientation the phone is being held in. It can be useful in determining the absolute orientation of directions in the North/East/South/West plane. The issue with the magnetometer is that magnetic interference can disturb its flow, making the device output unpredictable results.

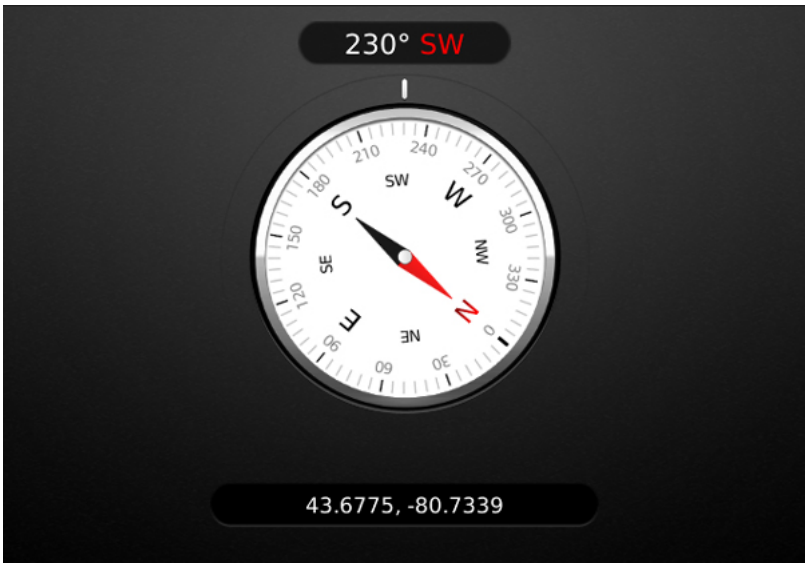

Figure 2.9: a simple compass app that establishes the magnetometer sensor

Combined Sensors (6-axis approach)

Combining accelerometer and gyroscope allows measurement of 6 orientations on X, Y and Z axis, allowing the apps to calculate orientation of the device in the 3D environment more accurately.

9-axis approach

Accelerometer, magnetometer, gyroscope could be all combined together for even more valuable user experience. For instance - enabling an online feature with more precise positioning in relation to other users could be considered. The data gathered from accelerometer, magnetometer and gyroscope can accurately position the artefact in the world, including the changes

in position and rotation. On top of that, multiple sensors could fill individual sensors blind spots.

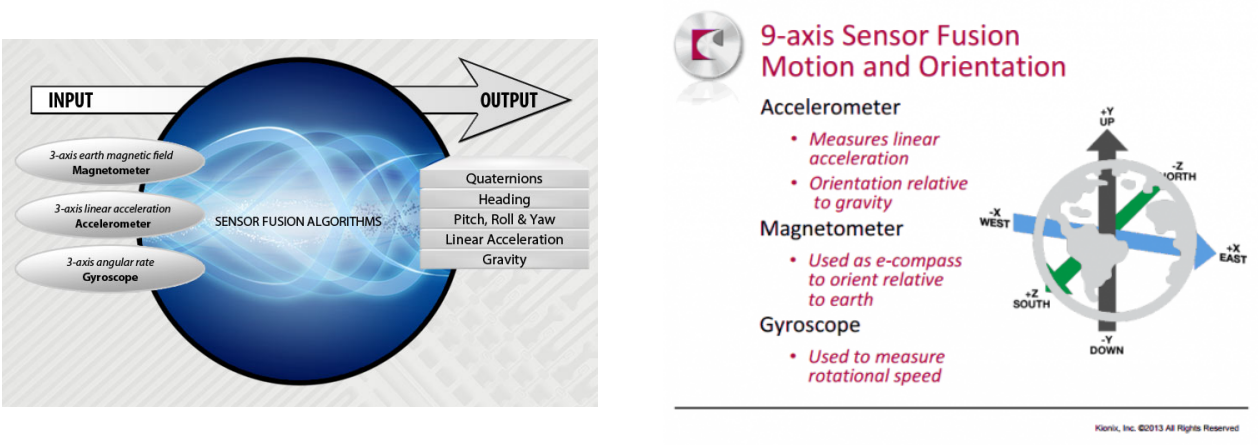

Figure 2.10: uses of sensors

2.3.3 CONCLUSION

After gaining more knowledge it can be seen that there is a variety of options how to use sensors in apps. Whether it is all of them together or using only few of them, it is mandatory to take all the options into consideration. As the project theme mentions it, the project has to be with non-traditional user interface, meaning that this project should aim for more complex or more "interesting" choices regarding sensors or user input.

2.4 GRAPHICAL DESIGN

In graphical design, like any other design, there are many options to be considered. Colours, fonts, balance and many more factors should be chosen carefully. Most importantly, how to mix these elements together without making a mess. This will reflect greatly on how a design is being perceived. [?]

Two of the things people often complaint about in applications is a confusing interface design and poor navigation. [4] This can be prevented by using design patterns. These has been created to avoid a messy and untolerable app. First, navigation. There are two ways to make navigating through an app easier. Persistent and transient. Persistent navigation is list menus and tab menus or menu structures. Transient navigation has to be revealed through a

tab action or the likes.[4] Consider if the user needs to see the menu at all times and if not, an off-canvas solution like a side-bar could be preferred.[4] This way, the app is able to hold many informations without being confusing or plastered. Too much text in one page or a simple form taking up several pages will make the app confusing. A sign in for example should only be one page. A way to not get an over lapping look is by using vertical labels instead of horizontal. [4] Or you could have the horizontal labels where the text disappears as soon as the user starts typing, but you risk that the user forgets what they should fill in.[4] Some apps, like Instagram, shows the "sign in" and "sign up" option all the way through the tutorial. This also insures that the user do not have to go through a whole tutorial if they do not need it.

Keeping these patterns in mind there are still many things to consider. First of all, remember the size of the screen that is being designed for. Avoid using big scaled photos and put to much information on one page. This will make it look cluttered and make it less intuitive. [2] In short, make everything as clean and simple as possible.

Colors

Colours are not just colours when designing a brand, an app or a website. Colours are perceived in various ways and is a big part of how the design is coming across to the user. **[?]**

There are two primary colours. Additive and subtractive. Additive is used on screens as it gives away light and subtractive is used for e.g. book covers as it reflects light. [8] These are also known as RGB(Red, blue and green) and CMYK(Cyan, magenta and yellow). In additive colours white is colours mixed together where black is the absence of colour. In subtractive white is the absence of colour and black all the colours mixed together. Since subtractive colour do not fully absorb light a fourth element has been added, hence the K in CMYK. K stand for 'key' which essentially is black.[8]

The colour wheel can help see which colours are complimentary, adjacent and triadic.

Figure 2.11: The colour wheel. [8]

Colours are defined by hue, saturation and brightness. Using a colour gamut can help see all the different shades available. The RGB is much more limited than CMYK. This is because there is a limit to how much a screen is able to show.

It is important to remember that when choosing the colour palette for a design, that how we perceive colour is very different. Also, colours can change according to what it is next to. Yellow might look different next to grey than it will next to purple for instance. [8]

When it comes to colour psychology the truth is, it is too dependent on personal experience. There is no one right answer to which color falls into what mood. [10] There is, however, many studies conducted on this matter. One study shows that 90% of people make snap judgement based on colour alone. [10] Another study shows that an intend of purchasing is linked with how a brand is perceived i.e. what kind of "personality" does the brand have?[10]

Figure 2.12: Overall image of how colours are generally percieved. [10]

But all in all, the concept of the app is key. Almost every study shows that it is greatly

more important to choose a colour that shows the personality of your product than picking a stereotype colour. [10] This app is directed towards interior design and therefore it is fitting to give the app a inspiring and creative personality. According to fig. 2.12 the color purple is the inspirational and creative color. This is very feminine but mixing it with a neutral colour like grey might just take it down a notch.

Colour preferences differ between genders as well. A study shows that women prefer soft colours and tints while men prefer bright colours and shades. [10] Since the target group of this app is not gender specific it is important to make the app gender-neutral i.e. not to soft and feminine but at the same time not to bright.

So how does one find the best way to coordinate different colours? Research indicates that the isolation effect is very useful.

Figure 2.13: "The sign-up button stands out because it's like a red "island" in a sea of blue." [10]

Using the isolation effect will help the user have a more efficient experience because the most important feature e.g. a "sign up" button, stands out. [10] (See fig. 2.13)Research suggests that a colour scheme that consists of analogues colors and combine it with a accent complimentary color or a tertiary color is preferred among users. [10]

Last but not least; make sure that the colours are bright enough and that the contrast is sufficient since the weather can affect the UX. [2]

Fonts

Fonts is also a part of a graphical expression. A cool website or app can quickly turn into the myspace page of a 13-year old girl with the wrong font.

Dan Mayer, a designer who specialises in visuals and ux-design, has created a set of guidelines to choosing a font and typeface. This consist of 5 simple rules that will make the art of choosing the right font a little easier. First thing Dan mentions is that picking a font is like picking out an outfit for the day. Appropriateness is key, as he says "While appropriateness isn't a sexy concept, it's the acid test that should guide our choice of font." [9]

There is a huge list of fonts to choose from. Mayer suggests only to look at 5 key groups. The most popular combinations of fonts is sans serif and a serif body type. [6]

Figure 2.14: Mayer's five groups of fonts. [9]

- Geometric Sans
  Geometric sans is a "less is more" typeface; it is minimalistic.

  "At their best, Geometric Sans are clear, objective, modern, universal; at their worst, cold, impersonal, boring. A classic Geometric Sans is like a beautifully designed airport: it's impressive, modern and useful, but we have to think twice about whether or not we'd like to live there." [9]

- Humanist Sans
  These Sans faces are based on hand writing. Even though some of them look clean and modern they still have a human touch. One one hand it manages to both be clear and modern but also human and empathic. One the other hand it might come across as wish-wash and and fake. [9]

- Old Style
  These are the oldest typefaces there are, hence the name. They are classic and traditional which can be a good or bad thing given the context.

- Transitional and Modern
  These typefaces emerged as type designers experimented with more geometric sharp and virtuosic typefaces. These can seem strong, dynamic and stylish but at their worst too baroque and to stodgy. [9]

- Slab Serif
  Slab serif is hard to generalize. It goes in many different directions and can both seem hard (Rockwell) but also friendly (Archer). As Mayer says " .. their distinctive blocky serifs function something like a pair of horn-rimmed glasses: they add a distinctive wrinkle to anything, but can easily become overly conspicuous in the wrong surroundings." [9]

Third principle - The principle of decisive contrast. When combining typefaces either go with the exact same or make a big contrast. The official name for this is Correspondence and Contrast. As the name suggests, it means that you either stay with the same typeface(correspondence) or you do something completely different(contrasting).[9] There is no general rule to decide how to fonts go well together, they just do. But a general rule of thumb can be to choose two fonts that have one thing in common, like x-height or stroke, but are different in all other aspects.

"A little can go a long way" is the fourth rule. In short, this teaches us that when you need something with personality only use it in a small amount. E.g. use a fun font for a headline and combine it with another more simple font for the main text.

Mayers fifth rule is that there is no rule - the best way of finding a great fit is to try a lot of different styles. [9]

To sum up, do not overdress your text and always keep it simple. Combining a maximum of two fonts should hit the spot.[6]

Be careful when choosing a font type. You cannot control the devices fonts and thus try to pick an common type font. [2] To make the text easy to read make sure that the contrast between text and background is present. Either black and white or a light coloured background with dark text. [2]

When designing your layout it is, once again, key to keep everything simple and streamlined. Follow the general rules, left-to-right and top-to-bottom. Make sure the most important feature is in the top left corner where the user will look first.[2] Be careful, yet not boring, when choosing a colour scheme or font type. In general, keep the graphics clean and simple. No muss, no fuss.

2.5 Mobile Hardware Considerations

2.6 State of the Art

2.7 Evaluation

The evaluation is conducted to conclude whether the problem stated in this report is being solved. The answer will be acquired when the data gained from evaluation is analysed and concluded upon. This section will attempt to evaluate the control schemes and will cover methods and different approaches planned to be used when conducting the evaluation. It will be discussed why usability testing and performance testing methods were chosen for evaluation of the prototype and why it seemed the most efficient and suitable choice.

2.7.1 Usability testing

This testing method can reveal various errors that could occur when a user interacts with a product. Usability testing is a method that seeks to test five areas. [**?**]

- Efficiency How quickcan the user complete certain tasks when they know the design. [**?**]
- Satisfaction How satisfied are the users with the desing. [**?**]
- Errors How many errors do the users make. Is it severe errors and how quickly will they recover. [**?**]
- Learnability How easy is it for the user to complete certain tasks when they first encounter the design.[**?**]
- Memorability How well do the user remember the design after some time away from the design. [**?**]

The benefits from usability testing is that it identifies major usability issues from a few number of participants. [**?**] According to Jakob Nielsen it is enough to have only five participants as the problems will show clearly based on this alone. [**?**]

There are several ways to conduct a usability test e.g. focus groups, user testing etc. The following will describe the methods we chose to carry out.

Performance testing

Performance testing is a method that focusses on, as the name reveals, performance. This can be measured in different ways. For instance, time and numbers of errors made. It allows the facilitators to obtain measures of effectiveness and efficiency. [?]

The benefits of performance testing is that it reveals major problems including problems related to the users skills and expectations. [?] Tell the user how to achieve the goal but not how to do it [] Observe and measure without commenting[]

Card Sorting

Card sorting is a method for discovering latent structured. [?] It allows the test participant to give critical feedback without having to do it directly to the testers. You will need fifteen participants for a card sorting test [?]. Normally a usability test only need five users but this testing method needs more participants to get a full view of the users preferred structure. This can not be accomplished by five participants. [?] As Jakob Nielsen says [?], this test differs from other usability tests by being a generative method. This means that we do not yet have a design and need to establish user needs first as we tested for the navigation before we designed the actual app.

According to Jakob Nielsen, the classic way to ruin a card sorting test is to give the user familiar command names. This will make the user look for that specific command name instead of acting as they normally would.[?] E.g. Do not say "now you will use a joystick" and thus giving them the information that this should be controlled as a joystick and the usability problems there might be will not be revealed. It will not be certain if the test participant actually came to the conclusion that it should work as a joystick themselves.

Card sorting can be used in various ways. To group words, to name groups of words, to describe a product and more. We used it to make the test participant feel more comfortable choosing a critical word rather than interviewing them. Here is how we used it together with the performance test.

2.7.2 First test - Navigation

The first thing that is tested is the navigation. This needed to be established before making the actual design and to make sure that the app is usable. It is a usability test that will consist

of two parts; performance and sort-carding. The test is set in a controlled environment where the participants need to go from A to B, testing the control schemes, rotating the order of what control scheme they start out with.

Before the test starts, the test participants will watch us go through the level so they know where to go. This should eliminate some bias when it comes to getting to know where to go and should help keep the focus on how to get there. Otherwise the first control scheme would be slower every time as they would have to find their way through the level.

We will time them to see which control scheme is the easiest to control. We will also observe how much they struggle and how fast they get from A to B. Also we will estimate how long time it takes them to have a grip on the controls.

After each control scheme we will ask them to do a card sorting. They pick 5 words and afterwards they would be asked why they chose those particular words. This will help us getting them to say something critical about the controls to us.

We will make a scoreboard so the test participants can see how fast they completed the course compared to the other people who tested it. This should add a competitive element and some fun to the test.

Analysis of data

The first thing that was done after testing, was color coding the cards. This way we could sort them out into categories. Then we made bar charts to get a visual and clear image of the results from the card sorting. The cards were sort after:

- Intuitive/familiar UX
- Positive feelings
- Negative feelings
- Complaints
- Unusable. These cards made no sense and could not be used.

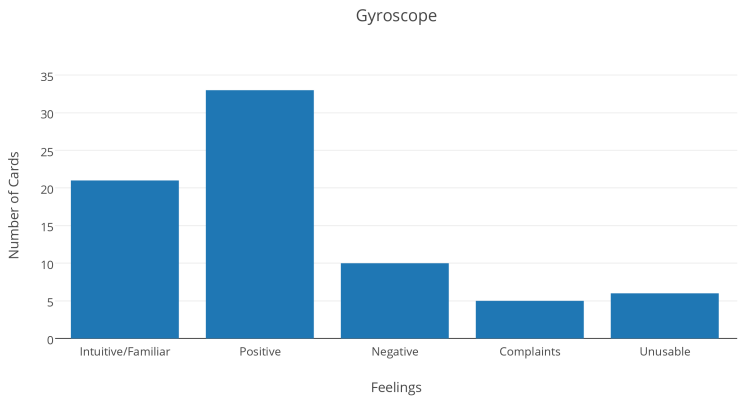

Figure 2.15: Categorisation of the cards for the gyroscope control scheme.

The gyroscope turned out to be very intuitive and quite fun for users. It has a a small amount of negative feelings and a few complaints. These were mostly based on ...

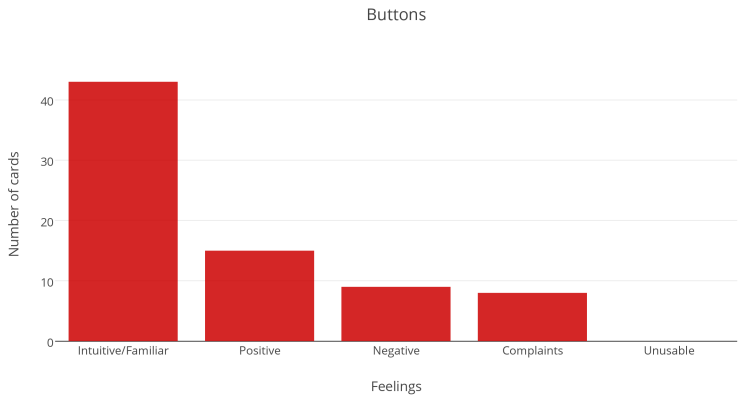

Figure 2.16: Categorisation of the cards for the button control scheme.

The button control scheme has the absolute highest number of intuitive/familiar feelings. This makes sense since it is common for users to use buttons. It has about the same amount of negative feelings and complaints as the gyroscope. These feelings were directed mostly to ...

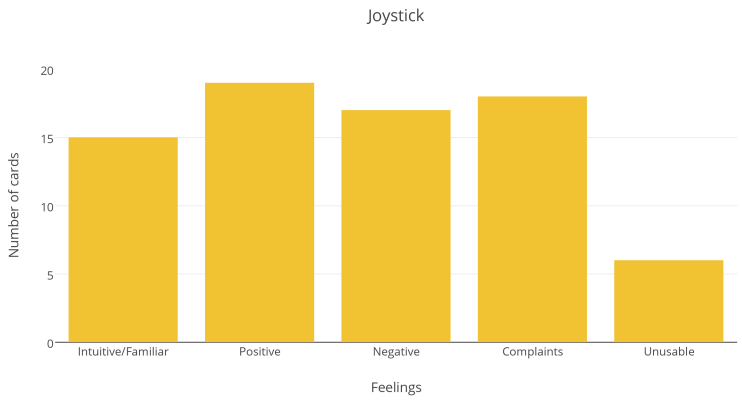

Figure 2.17: Categorisation of the cards for the joystick control scheme.

Lastly, the joystick has a lot of negative feelings and complaints. Even more than it has intuitive/familiar feelings. This clearly shows that the users did not enjoy using this controlling scheme as much as the others and was quite frustrated with it. This could also be provoked by the way we chose to implement this and the fact that it did not resemble a joystick well enough.

The time from the performance tests was calculated to find the mean and made graphs to visualize this as well.

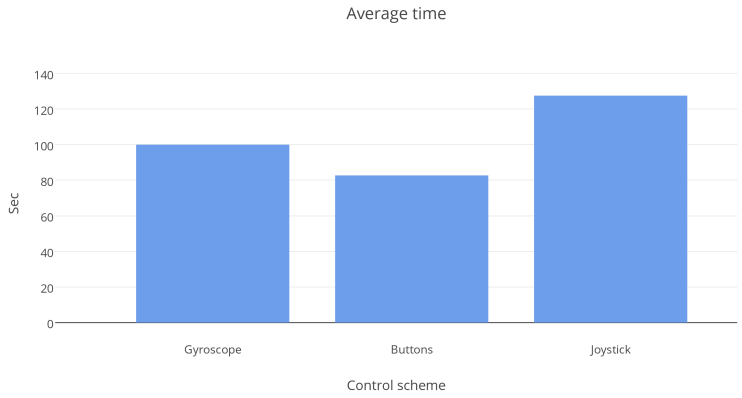

Figure 2.18: The average time it took for the participants to complete the level within the different comtrol schemes.

It is fairly easy to conclude that the buttons were the most efficient and the joystick the most problematic for our users.

2.7.3 Conclusion of results

It shows very clearly that the users favourite is the button scheme. And the one they had the hardest time coping with was the joystick.

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