Addressing hearing loss in the elderly

Health Innovation and Design (HUB5028W)

Second Semester Final reports by Kristen Abrahams;

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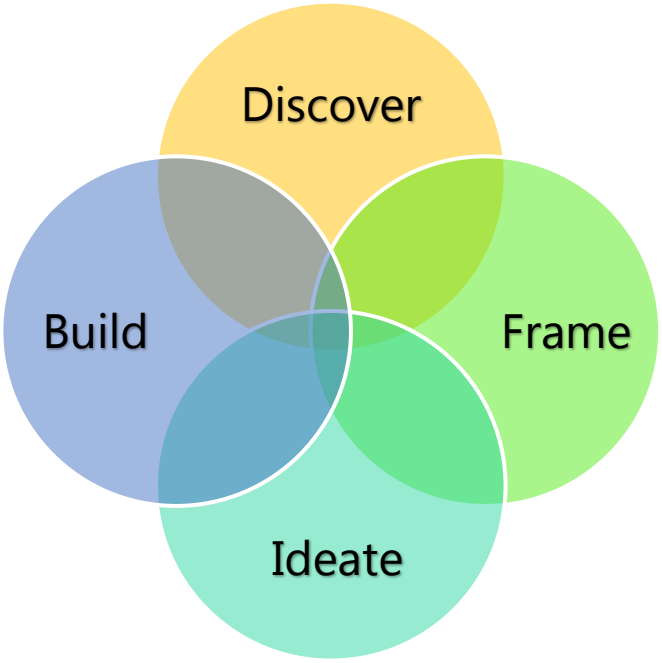

Addressing hearing loss in the elderly

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DESIGN THINKING

According to Tschimmel (2012), "design thinking is understood as a way of thinking which leads to transformation, evolution and innovation, to new forms of living…" (p. 2). Design thinking provides a platform to help advance, speed up and visualise all phases in the creative process through the use of toolkits, utilising a multidisciplinary approach. Based on the Philips cocreate toolkit (2015), design thinking incorporates the four phases: *discover, frame, ideate* and *build*. Each phase facilitates the planning of tasks, activities and timelines (Tschimmel, 2012) and each will be discussed separately throughout the report.

DISCOVER

In the *discover* phase, the main aim is to understand the client you are designing for and in so doing build empathy towards who they are and what they consider important (d.school, 2015). We were provided with the following design challenge: addressing the needs of the elderly with a hearing loss (HL). The following process were conducted in order to empathise with the client, Neighbourhood Old Age Homes (NOAH): an interview with an elderly person with a hearing aid (HA); literature on HL in the elderly; and research on available HAs.

Secondary research

Interview – elderly with HA

Before going to the client, we interviewed an elderly individual with a HA to understand his experience of wearing HAs. Based on the interview, the following themes emerged: difficulty with finding the most suitable HA; difficulty with hearing in noisy settings even with HAs in; HA doesn't completely restore hearing and therefore still need to adapt in different settings; and family encouraged him to get his hearing assessed. I think although the interview provided us with some insight into the life of someone living with a HA, it also left us with a lot of questions. As the interviewee was well educated, and living independently, it was difficult to see how his experience could relate to the people of NOAH. I felt that while experiences with HAs in general may be relevant to all, the fact that the contexts were so vastly different, it may have an influence on individual's experiences of HL and HAs.

HAs

Based on the research into HAs, we found that there are a number of different types of HAs available including bone conduction, air conduction and inner ear HAs. It was clear from the research that there has been vast changes in HA technology and major improvements have been made to the design and size of HAs. It was also clear that the costs of HAs can range vastly.

Literature review

In order to gain a deeper understanding of the HL and HA use in older adults, it was important to consider previous research conducted. According to Gopinath et al. (2011), only 10-30% of older adults with HL actually use HAs. Of those who have HAs, many do not wear their HAs regularly. In recent years, the statistic has remained unchanged, even though improvements have been made in HA technology.

Based on this information, it was important to consider the barriers to HA uptake and use. Based on a review of a number of studies (Gopinath et al., 2011; Guerra-Zúñiga, Cardemil-Morales, Albertz-Arévalo, & Rahal-Espejo, 2014; Jenstad & Moon, 2011), the following barriers were noted: severity of the HL, attitudes (e.g. 'I don't need a HA', HL seen as a part of ageing and therefore not necessary to seek help), personality characteristics, subjective thoughts on the benefits and costs of obtaining HAs, functional restrictions (i.e. not being able to handle the HA, not being to put it on etc.), stigma and comfort. Furthermore, Guerra-Zúñiga et al. (2014) noted that older adults generally did not perceive their HL, family and friends would make them aware of the situation and ask them to enquire about obtaining a HA (Guerra-Zúñiga et al., 2014).

Based on the literature, we found that even when HAs are accessible to the elderly, attitudes and perceptions, play a major role in help seeking behaviour and acknowledgement of HL. The literature review also highlighted the fact that in order to address HL in the elderly, the provision of HAs may not necessary be the first step in addressing the problem. Following the information obtained from the research around the HAs, it was clear that although there has been improvements to HAs, there was still stigma attached and literature still indicating that elderly people were not willing to wear HAs. Design thinking constantly considers context and therefore it was also important to keep in mind that the majority of the research available is based on Minority world countries, whose cultures and ideals are vastly different to those of the Majority world and therefore the result found, should be interpreted with caution.

Interviews at NOAH

We had a number of assumptions before going to NOAH, based on our own experiences of the interview and research we had previously conducted. I assumed that the residents who we would interview would all have a HL and the majority of participants would have a HA.

Following the interviews and subsequent collation of information, the following themes emerged: lack of awareness of HL/denial of HL – individuals indicated that they did not have a HL but would constantly ask for repetition of question, lean towards person talking; not eager to get a HA; HL not the biggest health problem; previous bad experiences with ear care. In general, it was found that the majority of the NOAH residents were very active, independent, self-sufficient individuals. Based on further conversations with the nurse at NOAH, we gained further insight into literacy rates at NOAH, the referral process to obtain HAs and information on a resident's experience of wearing her HA.

I think the main take away message we got from the interviews at NOAH was to note that the majority of the residents interviewed did not have a HA. Although this was aligned with what has reported in the literature, I think I was surprised because based on the design brief, I assumed a larger number of people would be using HA. I was also unprepared for the majority of residents to say that they did not have a hearing problem, when externally you could tell that they were struggling to hear based on their body language and constantly asking for repetition. We then concluded that maybe the HL, while present isn't as transparent to the person with the HL as it is to their communication partner. Logistically, the fact that no one perceived themselves to have a HL, provided us with a problem, as we had to think on our feet about how to discuss HL in a more discrete, indirect manner as to not offend anyone. We also had to make use of nonverbal cues such as body language to gain further insight into their difficulties. I think the major thing we learnt from the interview process with Ada specifically was that

residents needed to self-identify that they had a HL and then would be referred for assessment. Based on our findings that residents didn't acknowledge their own HL, self-referral was therefore ineffective. The final thing I think we took away from the interviews was the stigma attached to wearing HAs was clear, especially for women.

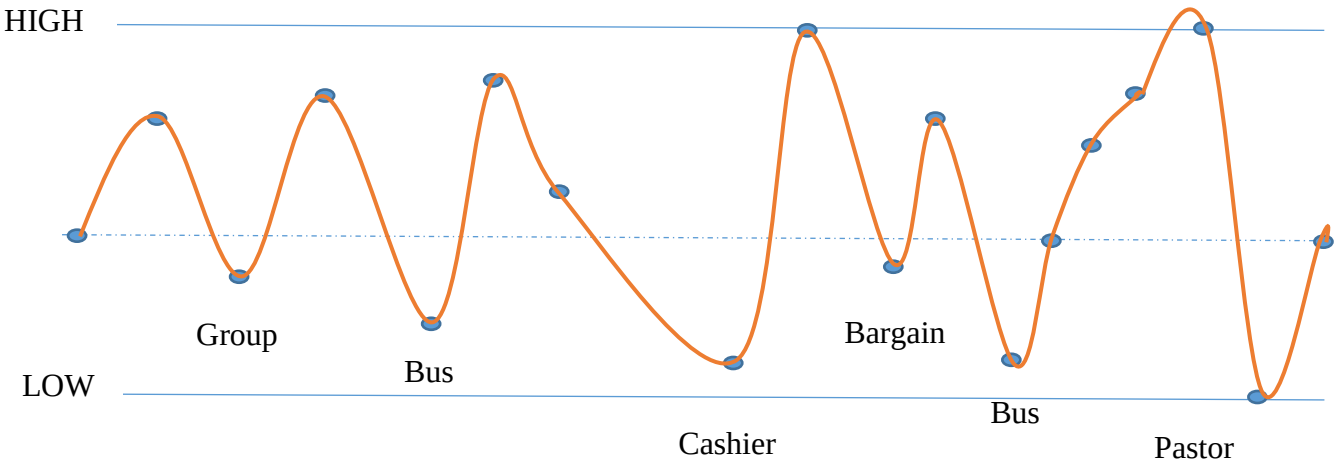

Figure 1. Experience flow map depicting low points. Low points provided opportunities for identification of problems to potentially ideate around.

Based on our empathy map, journey map and experience flow diagrams (see Figure 1), we found some opportunities to improve the experiences of people with a HL: sounds in church such as head phones for people with a HL; communication barrier; inclusive design for contained environments; screening; and addressing stigma towards HAs.

FRAME

According to the Philips cocreate toolkit (2015), the framing stage is when you synthesise your insight and understanding you gained in the *discover* phase to define a meaningful challenge or opportunity that needs a solution. Based on our experiences and the insight gained from the *discover* phase, we developed a vision statement, which aims to reframe your design challenge into a problem statement from which ideas can be generated (d.school, 2015). Following a number of iterations in order to ensure clarity, ease, and concision, the following vision statements were developed:

(1) *Improving the attitude towards and acknowledgement of HL* – making HL more socially acceptable and highlighting the importance of screening
(2) *Improving the quality of life* – adjusting a contained environment to improve hearing

We decided to eliminate the following vision statements: *removing the communication barrier between people with HL and public environment;* and e*liminating security threats due to the HL and old age.* We felt that the chosen vision statements adequately addressed the findings of the *discover* phase and were directly related to addressing hearing.

Once we knew what our vision statement was, it was then important to frame our challenge, as it assists you in organising how you think about your solutions and when there are times of

confusion, it assists you in clarifying which track your design should follow (IDEO, 2015). In terms of addressing the first vision statement (i.e. addressing attitudes and acknowledgement), we developed the following framed challenges:

1. How do we promote the acceptance of HL?
2. How do we promote the understanding of HL?
3. How do we disguise HAs?
4. How do we promote the use of assistive devices and other solutions

In terms of the second vision statement (i.e. addressing the environment), we developed the following framed challenge:

5. How do we adjust the contained environment (i.e. a predictable environment in terms of sound) to be more conducive to communication?

IDEATE

In the *ideation* phase, the aim is idea generation and therefore the phase encompasses the generation of potential solutions for the challenges identified in the *frame* phase (Philips. 2015). According to Phillips cocreate toolkit (2015), divergence before convergence is a key aspect of the phase. It therefore requires the designers to think broadly about concepts and potential outcomes, through the exploration of a wide solution space (d.school, 2015). In so doing, it encourages designers to think of a large number of ideas and great diversity between those ideas (d.school, 2015). Therefore many ideas will be generated, some of which will be kept and others discarded (IDEO, 2015). In order to make the solutions tangible, rough prototypes of the ideas will developed and shared with stakeholders and experts (in this case an audiologist) to incorporate their feedback (IDEO, 2015).

We generated a number of different ideas including hiding HAs in everyday accessories such as glasses or earrings to constructing an awareness day specifically for NOAH to thinking of employment opportunities for people with a HL. All of the ideas were then grouped according to our two framed challenges (Refer to Figure 2).

Once all of our ideas were described in more detail, we presented our findings to an audiologist for expert feedback. She assisted us in refining our ideas and provided us with constructive criticism about each solution to assist us in making the solution more viable.

I think we learnt a lot about presenting and how to make our solutions more tangible for the listener. Our audience member really struggled to understand the essence of our solutions and how they fit into the bigger scheme. I also think we were too concerned with creating a novel experience for her and in trying to do so, we struggled to convey our ideas effectively. Following her comments, it was clear that our ideas were not refined enough and that we had too many different ideas within one idea. We then had to try and think of ways to make our ideas more concrete, more streamlined. In so doing, we hoped that the listener would be able to follow our presentation much more clearly and understand the core of our ideas. In the end, it is important for our client to gain a grasp of our ideas and I think at this stage, not achieving that with our first presentation was our biggest downfall and our greatest learning curve.

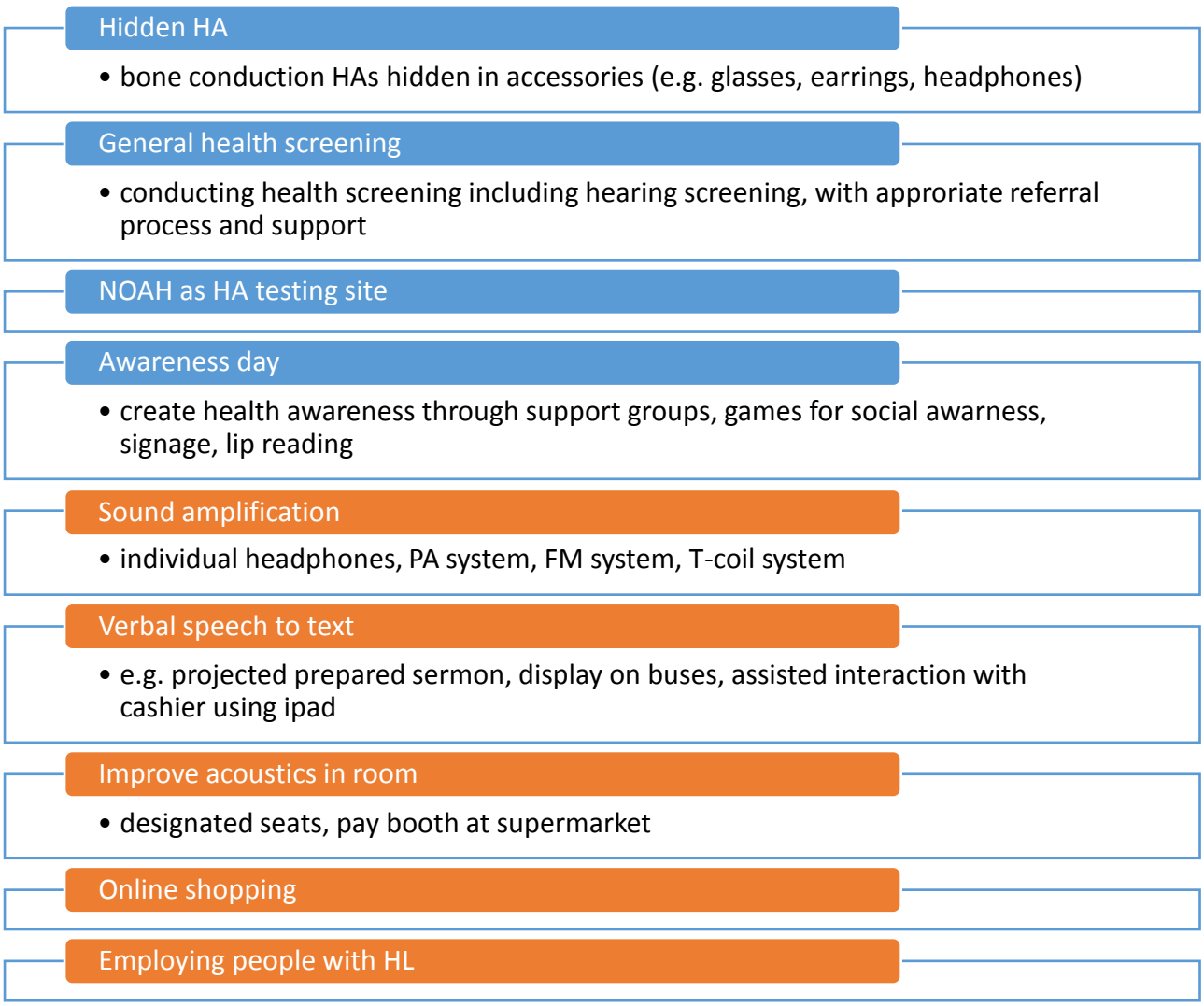

Figure 2. All ideas categorised according to two framed challenges. Blue shading depicts solutions related to attitudes and acknowledgement and orange shading depicts solutions related to contained environments.

BUILD

The *build* phase is concerned with making ideas more concrete and physical by constructing a prototype of the viable solutions (Philips, 2015). By this stage, we realised that our rough prototypes we developed in the *ideation* phase were not sufficient to get our idea across. We also had to be realistic about the number of potential solutions we could prototype in light of time constraints. As a result, we made the decision to concentrate on building solutions we thought would be most suitable for the current context, NOAH.

In terms of addressing attitudes, we felt that adapting HAs may not be the best solution as there have been many technological advances in HAs and there is still a body of literature indicating that elderly people are less likely to wear HAs due to a number of reasons previously highlighted.

The Integrated Theory of Health Behaviour Change (Ryan, 2009), provides a lens into changing health behaviours. According to the model, "health behaviour change can be enhanced by fostering knowledge and beliefs, increasing self-regulation skills and abilities, and enhancing social facilitation" (Ryan, 2009, p. 165). Through engaging in self-management, in the long term, it may have a positive influence on their health status (Ryan, 2009). As such, we decided that changing attitudes rather than adapting devices may be more suitable and realistic for the current client. When we considered changing attitudes, we thought that health screening and awareness were essential aspect, both equally important to address and therefore we combined the two to form the new concept *The day is HEAR*.

For *The day is HEAR,* we thought that to address HL, we wanted to make the solution as discrete as possible and therefore decided to make the day a general awareness and screening day as opposed to one specifically for hearing. In this way we would be obtaining the relevant information about the individuals hearing status without overtly stating so. We also felt that individuals would be more likely to attend if they their needs or what they want would be met. Therefore a person may attend because they are interested in learning more about their blood pressure but they would also learn about their hearing. By promoting the health awareness and screening days as social events, we would hope that the residents of NOAH would be interested in attending. The day would include screening stations for various health conditions such as hypertension, hearing, diabetes etc. At each station, there will be a health practitioner who will screen for the different conditions and provide counselling and appropriate referral as necessary. As each NOAH resident will have a complete a physical, a database can be generated. This would serve to update their current records and potentially provide additional information they may not have.

In order to ensure that health awareness becomes imbedded in the NOAH culture, we decided that organising monthly awareness day, aligned with the Department of Health calendar, may be beneficial. In this way, individuals would have access to the information on more than one occasion, helping to solidify their understanding.

In terms of changing the environment, we did not feel that an online shopping platform for elderly would be suitable as we did not want to promote social isolation. Furthermore, many of the NOAH residents interviewed indicated that they were not very up to date with the newest technology and therefore using an online website may be too difficult and frustrating. It was also unclear as to whether the NOAH residents had access to the internet or a communal computer. The buy-in from other stakeholders such as supermarkets, would also be a challenge that would need to be overcome. When considering all of these limitations, we decided not to develop the idea further. In term of employing people with HL, the idea was scrapped early on because all of the NOAH residents are on old age pension and therefor job opportunities may not be a major concern for them besides what they do within the NOAH house for extra money. In light of that, we decided to try and incorporate the remaining three ideas, *verbal speech to text, changing the environment* and *sound amplification*. We thought that even though all of these ideas incorporate different elements, they are all concerned with the environment and therefore could be categorised as one thing, namely *Acoustic Audit*.

Acoustic Audit would analyse the properties or qualities of a room to determine how sound is transmitted. Changes would be made to the room so that the room will be more 'sound friendly'. The audit would be limited to contained environments i.e. environments in which we

could predict more or less how the sound in the environment would be at any given moment. There were three things we thought would be useful to consider when conducting an audit of the sound: changing the environment; sound amplification i.e. making the sound louder; and using written text to supplement verbal speech. An audiologist could be contacted to come to NOAH to assess the environment and provide potential solutions to improve the sound in specific rooms. Once NOAH residents are familiar with conducting an Acoustic Audit, they will be able to apply the same principles to other rooms in the NOAH house – therefore empowering the NOAH residents to help themselves. The idea could be further applied to other environments as the church, buses, shops etc.

FEEDBACK FROM FINAL PRESENTATION

During our final presentation, the following information concerns about the solutions were brought up: not including the communication partner in the solution; and how to actively include the NOAH residents in improving the solutions; and who will form part of the awareness days. In terms of addressing the communication partner, I think that we aimed to indirectly address this aspect through getting many people involved with the screening and subsequent awareness days. By involving individuals with and without a HL, those who do not have a HL are able to better understand the difficulties with communication when a HL is present. The awareness games i.e. edutainment that will be played, are used to physically illustrate to the participants the communication breakdown and potential frustration of the person with a HL. I think this also addressed the question related to who should form part of the awareness day activities. In terms of including the NOAH residents in the improving the solutions, I think this is an important aspect to consider. Following each awareness day, the input from all stakeholders, and most importantly the NOAH residents should be taken into consideration and amendments should made to the subsequent awareness days to follow to constantly update and improve the service provided. Although we did not overtly state this in our solution, we did take this into consideration in our planning as we wanted to find out from the NOAH residents which health conditions they would be most interested in, while brainstorming in the *ideation* phase.

In terms of the NOAH residents who attended, I felt that the presentation was pitched at a level where they struggled to follow what was being discussed. Although we tried to make it as client friendly as possible, this proved to be very difficult. As clients who are interested in the solutions more than how we came to those solutions, I think it may have been better if we had a separate presentation for the NOAH residents where we discuss the potential solutions with them alone. Although this problem surfaced in the end, I think that it was a core problem throughout the whole process and when we went to NOAH initially, they already had misconceptions about what we were doing there and what they would get out of the participating. From that platform, I think we were always going to struggle to convey our ideas and objectives to them.

CONCLUSION/REFLECTION

During our research the importance of being a reflective practitioner has become clearer. It is essential to take a step back and consider what has happened, how we have influenced the

outcome, and what we did well or could have done differently. Tarrant (2013) aptly describes the importance of reflection: "Through reflecting on our practice, we become more aware, more in control, more able to see our strengths and development needs" (p. 2). I think that the design thinking process showed both my strengths and weakness and through reflection, it helped to acknowledge my strengths and address my weakness.

Working through the design thinking process without having the background knowledge, it allowed to me have a fresh perspective and not have previous experiences cloud my judgement. In saying that, I also feel that I was placed at a disadvantage as I needed to learn what the process was about while incorporating the information we were obtaining throughout the different stages. In a sense, I had to simultaneously learn. Although challenging, I feel that at the end of the course, I have been able to gain the same experience and knowledge as the other students.

I also found it interesting working with such varying disciplines, with completely different mind sets. As a health professional, multidisciplinary practice is always encouraged but it can be challenging. I think the course reinforced the importance not only of multidisciplinary practice but multi-sectoral collaboration to make a difference to a community. Through working together, we were able to pool all of our ideas together to create solutions which I believe are viable and sustainable. Working with different mind sets was also a challenge in that we needed to put our own ideas aside and try and consider the other person's point of view and then come up with a compromise which suits both views, but was still highly relevant to the client.

I think that one strength that I brought to the table was that I had a more in depth knowledge of hearing, audiology and HAs than everyone else and therefore was able to guide everyone in the right direction.

As a researcher, we are taught to be critical thinkers so every article that you read you need to critique for its merit, weakness and overall contribution to the literature. In design thinking, especially during the *ideation* phase, you need to open to any ideas, free of criticism, and need to appreciate the ideas for what they are and not what they are limited by. I really struggled with this aspect and found myself writing off ideas before we even began to develop them. As the process continued, I found myself opening up more and therefore becoming more accepting of all ideas.

In conclusion, I felt that design thinking has changed the way I see problems and provides professionals with a novel way of finding solutions to social problems. The strength of design thinking for me lies in its engagement with the user and is underpinned by its user-centred design principles. The importance of having an in depth understanding of the context in which you are working in is highlighted by the relevance of the solutions to your client and I feel that through the design thinking process we were able to achieve this.

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Health Innovation and Design (HUB5028W)

Second Semester Final report

11/27/2015

Student:
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1. Introduction

The Health Innovation and Design course revolves around the principles of Design Thinking to identify, understand and solve problems within a specific community. Design thinking is a human-centered approach to Innovation which differs from conventional innovative practise. Focussing on adapting the solution to the specific needs of the end-user/client will increase the probability of the successful implementation of the solution.

The Design thinking process focusses on developing a solution through four main stages. All four stages are crucial in developing a solution that is most appropriate for the client/end-user. Figure 1 illustrates a summary of the four stages of Design Thinking.

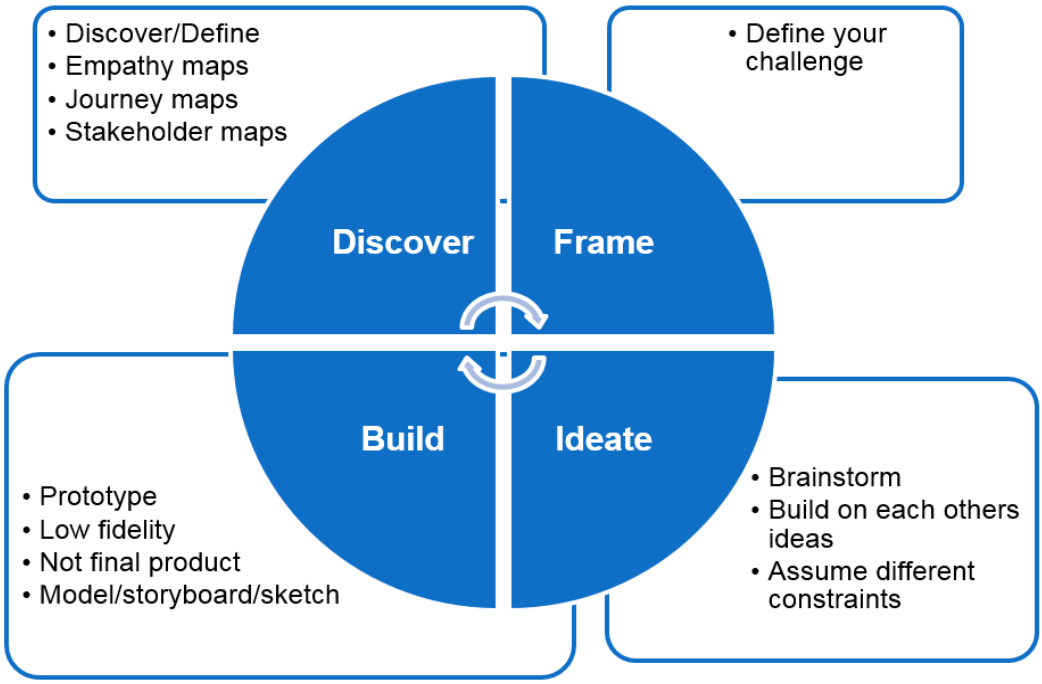

Figure 1: Four stages of Design Thinking

The Discovery stage requires the team to research the needs and desires of the end-user. The research methods could be interviews with the end-user; existing journal articles; the internet; persona, empathy, stakeholder as well as journey maps and personal experience and/or knowledge. Based on the research outcomes, the team would be able to identify opportunities for improvement or problems that, when solved could potentially assist the end-user. The potential opportunities and problems identified could be universal, however, human-centered design aims to primarily meet the needs and desires of the end user and thereafter, the solution may be adapted for universal purposes.

The Framing stage is the design definition stage. The challenges are defined to ensure that the ideas, to be generated, are appropriate and contextual for the specific end-user. This stage would include the design of a vision statement as well as a framed design challenge to focus the ideation phase on the opportunities and problems of the specific end-user. A well-defined vision statement and frame design challenge would more likely result in the development of the most appropriate solutions.

The Ideation stage is the portion of the project where the team's creative and innovative minds would be required to brain storm and produce radicle solutions to the opportunities and problems identified in the Framing stage. All solutions would be considered and recorded. Each solution would then be elaborated upon by the team members as well as potentially combined with other solutions in an attempt to tailor the solution to be more appropriate for the end-user. Thereafter, all solutions would be grouped as seen fit by the members of the team. The group may decide to filter the solutions in various ways to find the most plausible solutions.

The build stage requires the team to prototype the various solutions that were filtered out to be the most plausible and appropriate for the specific end-user. The prototype need not necessarily be a device or technology. Depending on the solution, the prototype could be in the form of an idea, strategy or process that, if implemented, could solve the identified end-user opportunities or problems. The prototypes would then be presented to various stakeholders to finally filter out the most appropriate and suitable solution for the end-user.

2. NOAH

The end-user for the project was Neighbourhood Old Age Homes (NOAH). NOAH is a registered non-profit organisation (NPO) that provides affordable and secure housing, access to cost effective health care and social support to independent State pensioners of Cape Town, South Africa (NOAH, 2015). The organisation provides various services for over 700 senior citizens annually, in the form of housing, quality and affordable healthcare as well as nutritional meals and social support (NOAH, 2015).

NOAH's support model promotes the independence of their residents to alleviate family, community and State burdens of care. Furthermore, the independence of NOAH residents would potentially lead to more enjoyable and fulfilling lives. The residents feel independent, secure, connected to the community and remain active in the hope that the residents do not experience a feeling of abandonment or loneliness.

The organisation currently has twelve homes, one assisted living facility, two primary health care clinics and two community centers. The number of residents in each home varies between six and twelve people. The age requirement for NOAH residents is a minimum of 60 years. The organisation generates a reasonable income by selling homemade soaps, candles and bread which contributes to the necessary funds to sustain the NPO. The residents assist in the fund raising activities of NOAH. Figure 2 illustrates a group of NOAH residents and an official.

Figure 2: NOAH group photo (image credit: (Wetu, 2015))

3. Problem Statement

At the start of the semester, the course coordinators presented the team with a project aimed to assist the senior citizens at NOAH who have partial or complete hearing loss. The project for the semester would be focused on the NOAH community and assisting their residents with the difficulties they face as a result of their hearing loss. Furthermore, Mr Graham Murray proposed a solution that would make use of Google glasses to assist the hearing impaired. This solution, however innovative and useful, was not suitable for the NOAH community. The reasons for unsuitability include the following:

- Most seniors aren't interested in learning to use new technological devices and
- Google glasses cost approximately R10000, which is too expensive for seniors living on a State pension to afford.

Human-centered design focusses on the needs of the end-users, which in this particular case were the hearing impaired senior residents at NOAH. Therefore, this proposed solution could not be further considered for the project.

Hearing impaired seniors find it challenging to communicate with others due to their disability, which leads to an unpleasant social interaction. Prior to the interviews, a number of assumptions were made based on personal experience and general knowledge of the team members. Additionally, information regarding seniors that struggle with hearing loss was provided by Ms. Myrna van Pinxteren. The Discovery process was attempted with the general knowledge and assumptions of the team members, however, the knowledge gaps were too great to properly ideate. This pointed out the importance of the Discover stage of Design Thinking on the actual end-user and not simply based on assumptions. However, this initial iteration made the team aware of what the knowledge gaps were and prepared the team for the interviews with NOAH.

The initial iteration of the Discovery stage was interesting and insightful. All the ideas generated by the group members were combined to complete the persona, empathy and journey maps to identify potential opportunities. The initial iteration seemed almost unnecessary as it did not reflect the actual situation at NOAH. However, the team came to understand that the initial iteration helped to identify the knowledge gaps which would prove to be advantageous for the interviews with NOAH.

4. The processes followed

4.1 Discover stage

The Discovery stage covered a number of various activities that needed to be completed to obtain information regarding the needs and requirements of the NOAH residents. The initial step was to gain information in the form of research and interviews and thereafter map out the information using the persona, empathy and journey maps.

4.1.1 Dr Douglas' interview

The second iteration involved interviewing Dr Douglas to understand his experience as a senior with hearing loss. Dr Douglas is an active senior that wears a hearing aid to assist with his disability. He has embraced the use of the aid and he is pleased with the device and its functionality. Furthermore, Dr Douglas was kind enough to indicate the cost of his hearing aid (R12000). This was an eye opener for the team and brought forward a potential opportunity to ideate around.

The information obtained from the interview with Dr Douglas was used to update the empathy and journey maps. Although the interview with Dr Douglas was insightful and informative, the information gained from the interview was later found to not be applicable to NOAH residents.

4.1.2 NOAH's interview

The third and final iteration of the Discovery stage involved the interviews with the NOAH residents. A number of residents participated in the interviews, which gave the team a better understanding of the number of residents with partial or complete hearing loss and the extent of their disability. The team was able to successfully fill all the knowledge gaps that had previously prevented the progress of the project. The team found that Dr Douglas' circumstances were substantially more fortunate than the residents at NOAH and therefore, the empathy and journey maps were drastically modified to represent a typical NOAH resident with hearing loss. A major issue identified by certain team members was that there was a stigma attached to losing one's hearing as well as wearing a hearing aid. Furthermore, it was clear that the loss of their sense of hearing was not a priority. The team discovered that only a few of the residents at NOAH struggle with hearing loss.

From personal experience, the three gentlemen I interviewed on day one weren't all co-operative. My colleague and I made an effort to motivate the gentlemen to contribute to the interview, however, they were reluctant. Additionally, two of the three gentlemen had obvious hearing loss. However, they were in denial and simply stated that their hearing capabilities were fully functional. Due to this denial, all questions and enquiries regarding hearing loss could not be asked. All questions were directed towards their daily activities and previous careers. On the second day of interviews, I had the pleasure of interviewing a lady who had been struggling with hearing loss since the age of five. She currently resides in the Parrow home and has made numerous efforts to find a solution to her problem. She also provided information regarding her daily routine and a brief overview of her life leading up to the interview. Her situation and the information obtained from her interview was vital in helping the team to fill the knowledge gaps and move on to the Frame and Ideation stages. She was one of the only participants that provided valuable information that was then used to populate the various maps and identify opportunities for ideation. In addition, it was further discovered that NOAH residents have access to second-hand hearing aids that cost R70. This is an affordable alternative for the residents as opposed to the hearings aids used by Dr Douglas. As a result, ideating around more affordable hearing aids was no longer considered.

The empathy map was populated using the combined information from the different interviews. Thereafter, the journey map was used to plot a typical pension collection day for a NOAH resident. The day started with the resident collecting his/her monthly pension, shopping for groceries at a supermarket, taking a bus to a market, purchasing a small item of clothing and finally a church service in the evening. A number of opportunities were identified according to the potential low points in the day that the team identified. Low points refer to moments or situations throughout the day where a hypothetical NOAH resident would struggle, be uncomfortable or distressed as a result of their hearing loss. All opportunities were then grouped into one of five themes as illustrated in Figure 3. The more opportunities allocated to a theme, the more the theme was prioritised. As is evident from Figure 3, themes 2 and 3 were associated with the most number of opportunities and were therefore the focus of the Framing stage.

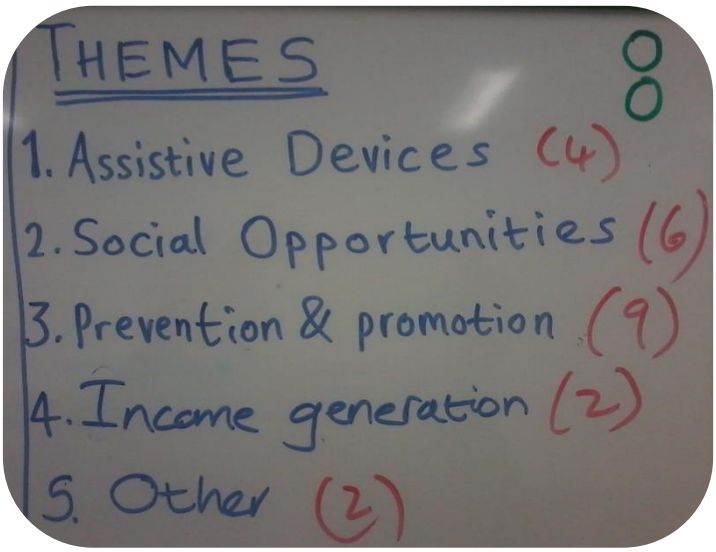

Figure 3: Theme used to group opportunities

4.2 Frame stage

The Framing stage is aimed at defining the design challenge so that the ideas generated are more focused on solving the problems experienced by the residents living at NOAH. The Framing stage is divided in two parts i.e. the vision statement and the framed design challenge.

The vision statement describes “the clear and inspirational long-term desired change resulting from the program’s work” (TOPNONPROFITS, 2015). The statement needs to be clear, memorable and concise. A number of iterations were carried out to design the most appropriate vision statement for the project. The final vision statement used for the ideation phase of the project was:

- Improving the attitude towards and acknowledgement of hearing loss.
    - Making it more socially acceptable
    - Importance of Screening
- Improving quality of life
    - Adjusting a contained environment to improve hearing

The framed design challenge part consists of short statements, phrased as questions, to prepare the team for the ideation stage. The design challenge would need to strive towards ultimate impact, allow for the generation of a variety of solutions as well as be contextual. A number of iterations were carried out to determine the most appropriate framed design challenge. The final framed design challenge was as follows:

- How do we promote the acceptance of hearing loss?
- How do we promote the understanding of hearing loss?
- How do we disguise hearing aids?
- How do we promote the use of assistive devices and other solutions?
- How do we adjust the contained environment to be more conducive to communication?

These statements prepared the group for the ideation stage and focused the ideas on the most important needs of the NOAH residents with hearing loss.

4.3 Ideate stage

In the Ideation stage, the team brainstormed a number of potential solutions to the challenge defined in the framing stage. All ideas were considered no matter how radicle the solution. A number of filters and iterations were carried out to filter out the more plausible solutions for NOAH to implement. The ideas were plentiful and creative and as a result, the team grouped the solution ideas into seven main ideas. Thereafter, the team combined similar solutions to reduce the number of main ideas to five. The five main ideas were:

- Senior Essentials
- Talk Write
- Head Gear
- Hear Canal
- Awareness and Screening Day

The team, based on each member's individual opinion, felt that the Hear Canal and Awareness and Screening Day were the two most plausible solution ideas for NOAH to implement.

4.3.1 Senior Essentials

Senior essentials was an idea that kept developing and evolving the more the team worked on it. The initial idea was a website that would enable a senior citizen to purchase their monthly groceries online and have it delivered to their residence. However, the following assumptions were made that lead to the alteration of the idea:

- Seniors would not be willing to use technology/ internet.
- The internet services, required for online shopping, at NOAH are limited to the offices of the NOAH officials.
- The social interactions involved when going to the supermarket and the outing would be eliminated with an online shopping service.

The solution continued to evolve until it was decided that a volunteer would assist the senior with his/her grocery shopping at the supermarket, thereby eliminating all concerns. In addition, special counters would be allocated to senior citizens particularly on pension collection day to avoid the long queues.

The aim of the idea was to eliminate the need, for a senior with hearing loss, to communicate with the teller or any other person at the supermarket. An issue that arose during the interviews was the difficulty of communication. The need for a senior with hearing loss to continually ask the person he/she is speaking to, to please repeat or speak louder results in the person feeling frustrated. This causes a discomfort for both parties and leads to the senior with hearing loss feeling embarrassed and upset. A number of seniors with hearing loss would simply just smile and nod instead of asking the other person to repeat.

4.3.2 Talk Write

Talk Write was an idea that made use of technology to assist seniors with hearing loss. A mobile device or tablet would be used in conjunction with an application which would convert spoken word to text. The person speaking to the senior with hearing loss would speak into the speaker of the device and the senior would be able to read the text on the screen.

The aim of the idea was to improve the communication between the senior with hearing loss and the surrounding population. The aim of Talk Write was motivated by the same issues indicated in Senior Essentials. As a result of iterative development of the solutions, Talk Write was later included as part of Hear Canal and renamed Acoustic Audit.

4.3.3 Head Gear

The Head Gear idea involved embedding the hearings aids (audio enhancement technology) in personal items that seniors with hearing loss would potentially use on a daily basis. The personal items that would potentially be considered for the Head Gear idea include:

- The ear piece of spectacles
- Earrings
- Headbands
- Scarfs
- Headphones/Earphones

The idea aimed to combat the stigma of wearing a hearing aid and being hard of hearing. From the team's observations during the NOAH interviews, the residents were in denial with regards to their inability to hear clearly. Based on this denial, the team came to a conclusion that there was definitely a stigma around hearing loss amongst the NOAH residents that needed to be addressed. Therefore, to combat this stigma, the team thought that perhaps the hearing aids could be embedded into personal items, thereby disguising the aid, which would improve their hearing ability as well as remove the stigma of hearing loss and wearing a hearing aid.

4.3.4 Hear Canal

The Hear Canal idea focused on altering the environment of the senior citizen to improve his/her hearing ability. The idea consisted of a number of various aspects including the installation of a PA system, Coil system and loop system. Additional aspects of the idea involved allocating the front most seats in a public events area, such as a church service, to seniors with hearing loss as well as covering the walls of contained environments with egg cartons and installing curtains and carpets in contained environments for sound proofing in an attempt to improve the quality of the sound in the room.

The aim of the Hear Canal idea was to alter contained environments to improve the quality of sound within that environment for communication. The idea originated as a result of changing ones frames of thought. The Hear Canal idea was a solution to a problem that arose in the interviews. One of the residents at NOAH complained that he/she could not hear the pastor at church. The Hear Canal idea would potentially ensure that seniors with hearing loss do not experience difficulties hearing the pastor at church or hearing someone speak when in a crowded but contained environment.

4.3.5 Awareness and Screening

The Awareness and Screening Day would be an organised event for all members of NOAH and the surrounding community. The seniors would attend the event and be informed of hearing loss as a disability and the resultant symptoms, available treatment options and assistive devices. Additional information would be provided in the form of brochures and/or pamphlets. Educational games would be played, which would potentially illustrate to the public, the challenges faced by the hearing impaired. In addition to creating awareness, a screening process would be incorporated into the idea to assist NOAH residents that experience hearing loss with their disability. Healthcare professionals would be requested to carry out the screening process and provide basic immediate treatment such as cleaning the wax build up in the ear. A referral process would then be implemented to assist seniors with hearing loss by referring them to the appropriate specialist. Counselling was a service that was assumed to be in conjunction with the screening process.

The Awareness and Screening Day idea would address the lack of understanding of hearing loss as well as the challenge of promoting the use of assistive devices and treatment options (as defined in the Framed stage). Furthermore, the screening process would help to identify the hearing loss disability in the residents of NOAH. This would potentially lead to the residents making use of devices or treatment options and combat the stigma of hearing loss. Identifying the individuals with hearing loss and assisting them would improve their lives and as a result, these individuals would potentially influence others to make use of these devices and treatment options as well.

4.3.6 Final interviews and feedback from NOAH

Once all ideas had been developed, the team presented the solution ideas to Gouwa (an Audiologist). Furthermore, a number of question arose which were then sent to Ada (the nurse in charge at NOAH). It was essential that the feedback from Gouwa and Ada be considered and integrated into the final solutions.

The feedback from the Gouwa and Ada allowed the team to confidently reduce the number of solutions for the Building stage to two final solutions. The Hear Canal as well as the Awareness and Screening Day solutions were considered for the Building stage of Design Thinking. The feedback from the Audiologist and Ada identified a key flaw in the Awareness and Screening day solution. There are very few residents at NOAH that would be interested in a hearing loss awareness and screening day. Therefore, this issues would need to be addressed in the building stage by modifying the solutions.

All statements indicated in the framed design challenge section were answered by the five solutions mentioned above.

4.4 Build stage

Due to the nature of the two solutions chosen for building/prototyping, the build stage focused on further developing the solution ideas. The solutions were better defined and modified according to the feedback from Gouwa and Ada.

4.4.1 Acoustic Audit

The Hear canal solution was combined with Talk write and renamed Acoustic audit. The solution was divided into three sub solutions as illustrated in Figure 4.

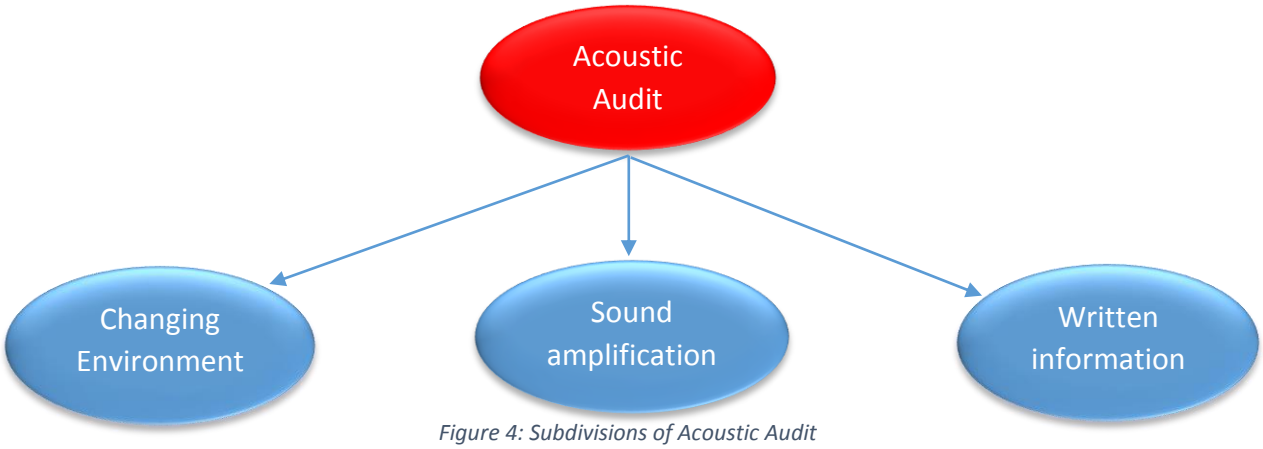

Figure 4: Subdivisions of Acoustic Audit

The team went on to better define the Acoustic Audit solution prototype as illustrated in Figure 5. Mapping the solution helped the team to understand the gaps and uncertainties in the solution. As a result of the mapping process, the team was able to design a properly defined, viable and plausible solution for NOAH.

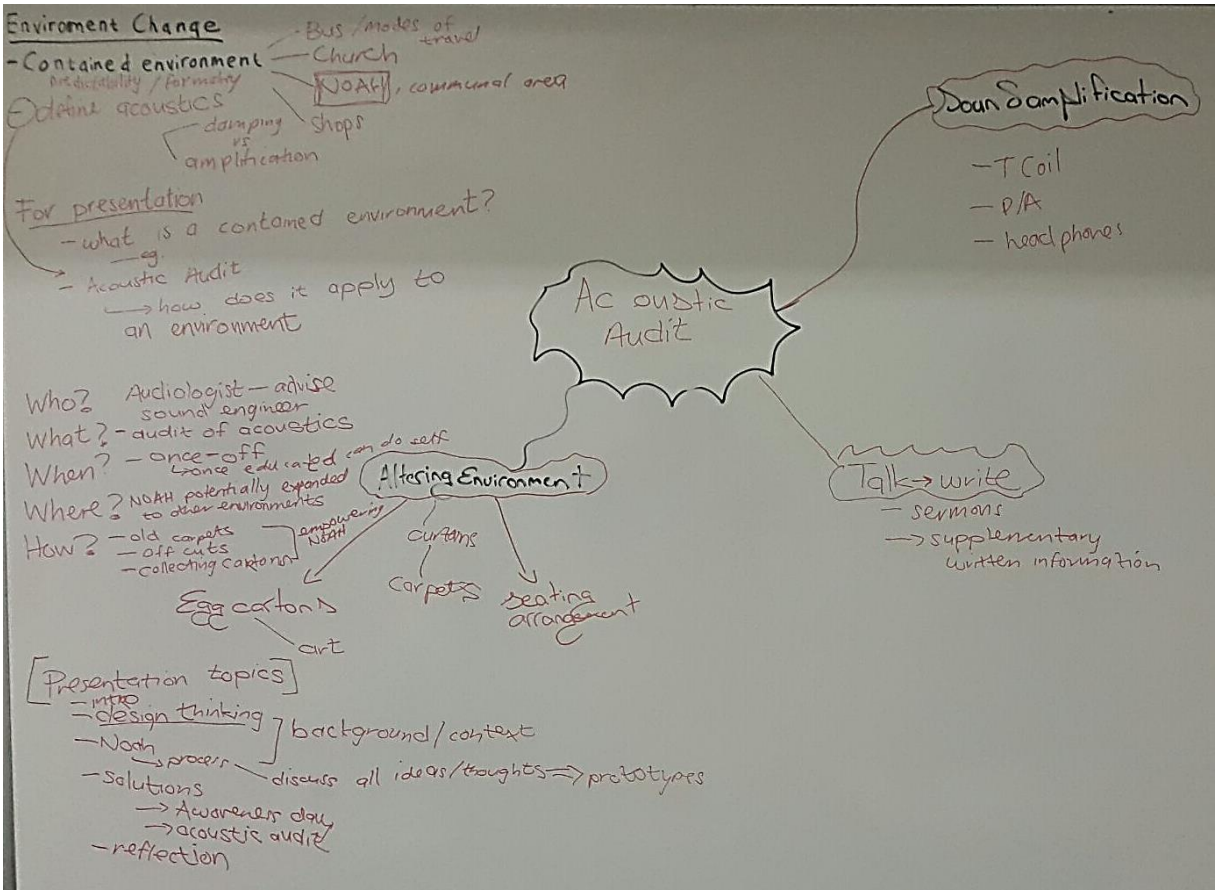

Figure 5: Mapping out and planning Acoustic Audit

4.4.2 Awareness and Screening day

The Awareness and Screening day was voted as the most important solution for NOAH to implement. The solution would potentially impact a large number of seniors that struggle with hearing loss. Identifying the disability in the NOAH residents would improve the care that the patient would receive from the nurses and health workers at NOAH. The residents who experience hearing loss can then receive the necessary treatment or assistance.

The team addressed the issue raised by Ada and Gouwa by modifying the design. The awareness and screening day would be sold to the residents and the public as a social event where they have the opportunity to engage in conversation with friends, family and other seniors within the community. The participants will receive free food and something to drink on the day. Furthermore, instead of only screening hearing loss, the participants will undergo a general screening process with an emphasis on hearing loss. The food will be offered to the participants as a reward for completing the entire screening process. It was evident from the interviews that seniors are very concerned about their health, however, the loss of hearing was not a priority. Eyesight and illnesses were considered to be more important for the residents at NOAH. The participants would therefore be more likely to attend the Awareness and Screening day if it covered the problems that seniors are more concerned about (such as loss of eyesight etc.) as well as hearing loss. Furthermore, the referral process would be implemented for all illnesses and health problems screened on the day. All the information retrieved from the screening process would be stored in a database for NOAH officials to keep record of the various health problems of each resident. In addition, each month would be dedicated to creating awareness of a number of other common health problems according to the Department of Health awareness calendar. This will potentially make seniors aware of the various health problems and provide advice or assistance. Figure 6 illustrated the map of the Awareness and Screening Day solution prototype.

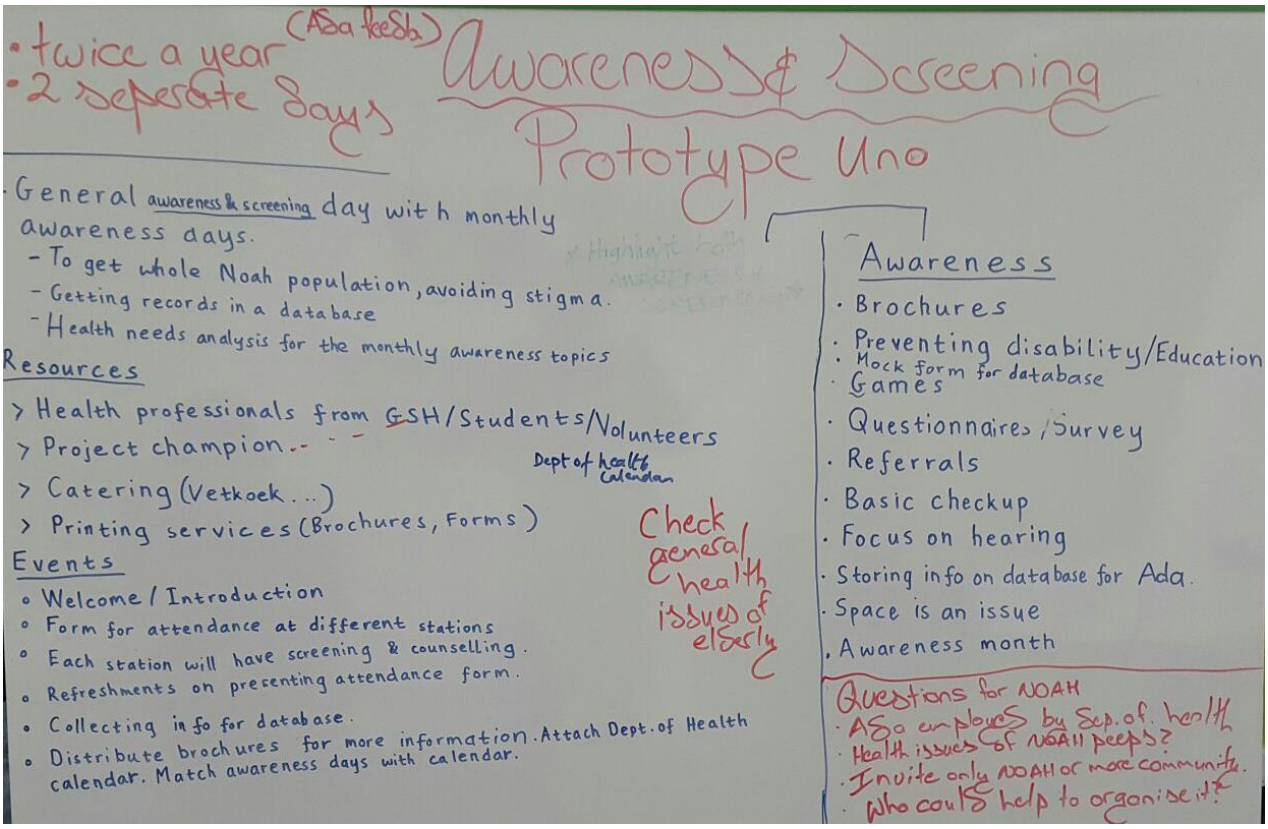

Figure 6: Awareness and Screening day map

5. Overall personal reflection

I felt that the project was an overall success. Prior to the NOAH interviews, the number of iterations seemed to be unnecessary. The team had no information regarding the situation at NOAH and to complete the persona, journey and empathy maps seemed unnecessary. I did not understand why the maps needed to be completed before conducting the actual interviews with the NOAH residents. However, completing the maps prior to the NOAH interviews identified the knowledge gaps regarding seniors with hearing loss. Furthermore, the team was able to use the identified gaps to form the questions that would be asked during the interviews with the NOAH residents as well as the interview with Ada. The initial iterations were crucial preparation for the interviews and I would recommend that it be done for every Design Thinking project.

There were a number of scheduled presentations throughout the semester. Initially I could not understand the reasoning behind so many presentations. However, the only additional presentation that took place (apartment from the final examination) was the presentation to Gouwa. After having received the feedback from Gouwa, I completely understood the reason for the additional presentation. The presentation was not only an opportunity to practise presenting, it also allowed the team to obtain valuable feedback from a specialist that would assist the team in bettering the final solutions. This presentation was crucial in assisting the team in improving the solutions as well as filling the gaps in the solutions that were previously not considered.

As an engineer, I primarily focus on developing a device or system that would potentially assist people in need. The Health Innovation and Design course taught me the process of better understanding the end user's needs and developing a solution accordingly. A human centered-design approach results in the solution being more appropriate for the client/end user. This is a tool that I wish I had learnt at an earlier stage of my engineering education. Focusing on the people you are designing for instead of simply focussing on the problem. Furthermore, being formally challenged to investigate the needs and requirements and identify the problems faced by the client was a first for me. I have always been provided with the requirements. Engaging with the end-user was a necessary learning experience and I feel that this is a necessary skill for all professions.

6. Conclusion

The Health Innovation and Design course was a success. Through the process of Design Thinking and Human-centered design, the team was able to produce a number of solutions that could potentially assist the hearing impaired senior residents of NOAH. The process was challenging due to the stigma of hearing loss and wearing hearing aids. Furthermore, hearing loss did not seem to be a priority for the NOAH residents. Therefore, the team needed to find a means of eliminating the stigma and indicating to the residents that they need not struggle with the disability. There are a number of various solutions that either treat or assist in improving hearing capabilities.

The course provided me with insight into the Design Thinking process and the advantages thereof. Furthermore, working with non-engineers made the course more worthwhile. The only time I have ever done multidisciplinary work was in the Health Innovation and Design course. Working with students that specialise in occupation therapy, speech therapy and genetics resulted in better solutions due to the different thought processes and skills of the team members. Through the various iterations and processes of design thinking, the team was able to design and develop various solutions that address the problems faced by the hearing impaired residents of NOAH.

7. References

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Who We Are

Our class consists of 7 students, 4 of which (myself included) are completing a master's degree in Biomedical Engineering, 1 is a postdoctoral fellow in the Institute of Infectious Diseases and Molecular Medicine with a focus on genetics, 1 is an occupational therapist with a focus on mental health, and 1 is doctoral student in speech therapy. This diversity in backgrounds was instrumental in coming up with different ideas and critically evaluating our solutions.

The Problem We Were Given

The problem we were tasked with was to identify and solve issues faced by members or NOAH who were hard of hearing. NOAH is a neighbourhood old age home, situated in Woodstock, which provides affordable and secure housing as well as access to health care.

Along with the NOAH, we were also provided with some insight and ideas from Graeme Murray, who has a passion for developing alternative technologies for seniors suffering from hearing loss.

Our Process

The Health Innovation and Design course focuses on user centred design. This process involves 4 main stages of design thinking, (1) Discover, (2) Frame, (3) Ideate, and (4) Build.

Discovery involves empathy and trying to understand the problems your client faces. Through fully understanding the problem and all underlying issues a more effective solution can be developed. This stage involves completing a *persona map*, an *empathy map*, and a *journey map*.

Frame involves creating a vision statement based on some of the opportunities identified during the discovery stage. Using this vision statement we then develop framed challenges which are questions that help us to come up with specific tasks or activities that will allow us to achieve our vision statement. We can use these framed challenges to ideate around.

Ideate involves coming up with as many ideas as possible based on the framed challenges and vision statement. These ideas can be grouped to form more coherent and complete solutions, while other ideas can be discarded. The ideas can be evaluated using a *stakeholder map*, or an *idea template*. The ideas can also be scored and ranked as a way of evaluating them.

The ideas are then prototyped using methods such as acting them out, creating an experience, or creating a physical or electronic prototype.

Discovery Phase

The initial problem that was presented to us focused a lot on the ideas that Graeme had come up with. His idea included real time speech-to-text devices, which would be used either on a mobile device, or on head-up display devices. Graeme also emphasised the flaws with existing hearing aids, which further drove our focus towards technologically orientated solutions.

As an engineer I could see the merit in Graeme's suggestions; however, from my experience with the *Health Innovation and Design* course and considering that our client was actually NOAH, I realised

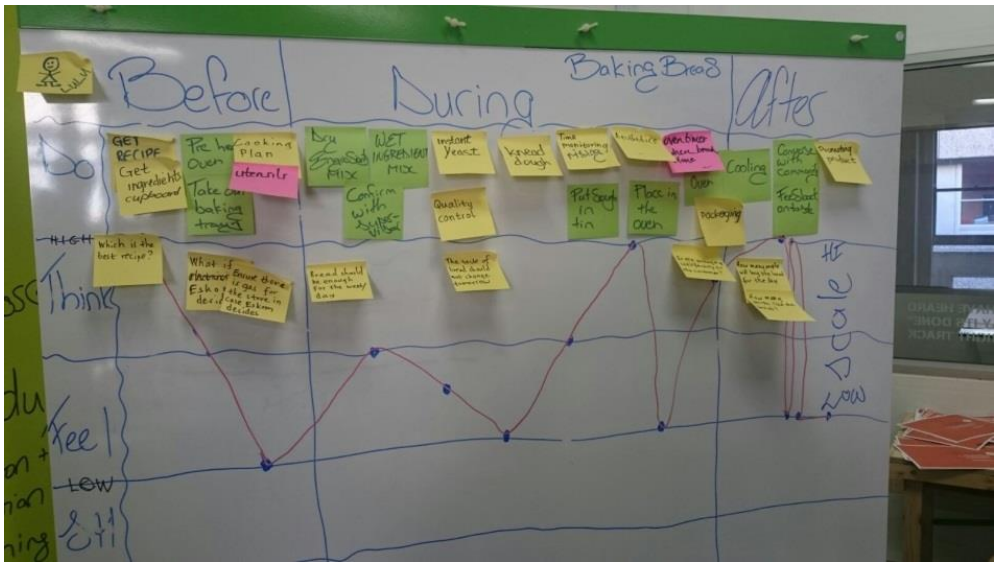
that a technical solution might solve some people's immediate problems, but probably wouldn't help the residents in the long run. As a class we initially felt that Graeme's ideas were also financially unfeasible, considering that most of the NOAH residents were living on a state pensions of R1410 per month.

One member in our class, Fadia, always makes the point that although we like to refer to people as being physically disabled; it isn't their physical disability that disables them, but rather their environment. For example, stairs make certain areas inaccessible to someone in a wheelchair, but if we only used ramps or elevators, then that area would be equally accessible to all. I think this idea is what we tried to focus on a lot during the course: rather than putting the responsibility of carrying a complicated device with a person who is hard of hearing, we felt like it is more important to make environments more suitable for effective communication.

Early on during this phase we also had a presentation from Myrna van Pinxteren about her own research which involved interviewing deaf participants. Myrna detailed the difficulties of this communication as a large proportion of the deaf community are also illiterate. This made us very concerned about how we would be able to communicate with the NOAH residents.

During this time we were still awaiting ethics approval, and thus tried to obtain a lot of information about the group of people we were going to be designing for. This included reading "*Insights from the experiences of older people with hearing impairment in the United Kingdom: recommendations for nurse-led rehabilitation"* (Bennion & Forshaw, 2013) and "*Qualitative interviews on the beliefs and feelings of adults towards their ownership, but non-use of hearing aids"* (Linssen et al., 2013).

We then started trying to complete *empathy* and *journey maps* for NOAH, which was very hard to do without any concrete ideas of what activities they were involved in and which activities they felt were important. We read an article in the People's Post detailing how they NOAH residents baked bread for extra income, we then tried to map this activity, which didn't yield any clear opportunities.



We eventually got the ethics approval and interviewed NOAH. This was very difficult due to everyone interviewing at the same time resulting in a very noisy environment. It was also a challenge for some of the students to interview certain residents as they weren't willing to participate.

Another challenge with these interviews was managing the expectation that the NOAH residents had. Although it was explicitly stated that they would be receiving no benefit, and they acknowledged this fact, some were still under the impression that we would be providing them with new hearing aids. I think this experience really reinforced the idea that the expectations of your clients need to be very carefully managed.

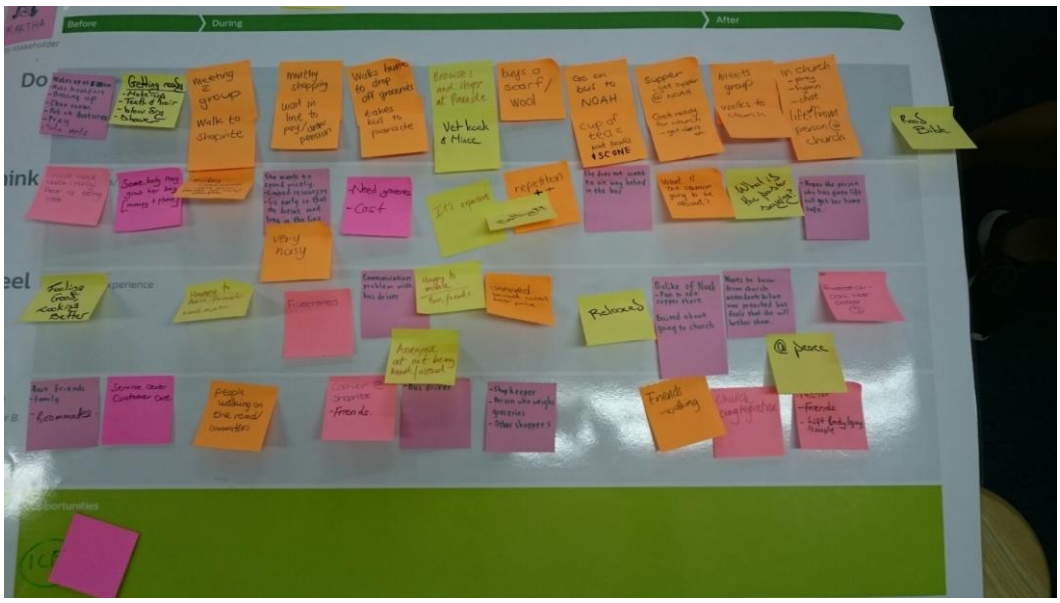
I think the interviewing techniques that we learnt last semester were applied really well this semester and we were able to draw a lot more information from our clients. However, similar to last semester everybody had very different insights on what the situation was at NOAH. I think this is an unavoidable problem as people all perceive the same situation very differently. However I think this semester these different perceptions was a strength rather than a weakness, and we had multiple viewpoints. Last semester our clients' viewpoints seemed to always be at odds and we were very unsure of how to progress.

Recurring feedback that we go from all our research was about the ease of telephonic communication, that communication was difficult in crowded area or place with background noise, and that people who were hard of hearing needed people to face them during conversation. Facing someone not only ensures that the sound will be louder and clearer, but also allows the listener to lip read and pick up on the speaker's body language. During interviews we also found that the NOAH residents had several other unrelated medical issues, and most residents actually felt that they did not suffer from any hearing loss or were uninterested in wearing a hearing aid because it was aesthetically displeasing.

After the interviews with the NOAH residents we repeated the process of completing the *persona map*, *empathy map*, and *journey map*. This semester we also used a method which involved plotting the daily activities on a high-low graph which gave a much clearer idea of what the issues were that needed to address.

It was interesting to see how much we learnt from interviews and how speaking to the NOAH residents changed our perspective. The students who missed the interviews had a very different perception of what the underlying problems might be. We for instance were able to empathise with how important the group of people felt their appearance was, whereas others thought it was a minor issue.

I think that this semester the toolkits had less of an influence on helping us to develop solutions. Last semester we used low points to ideate around. This semester we developed journey map based on what we already knew were low points. The *journey map* however, was specifically useful in helping determine the context of these low points.



Frame Phase

After completing the discovery phase of the project, we then started with the frame phase. The frame phase is a phase that usually goes the quickest and we can agree on all the points after 1 session, thus this section is the shortest phase.

The 2 vision statements for this project were (1) “Improving the attitude towards and acknowledgement of hearing loss” and (2) “Improving quality of life by adjusting a contained environment to improve hearing”

The following 4 framed challenges were developed and aimed to address the first vision statement:

- How do we promote the acceptance of hearing loss?
- How do we promote the understanding of hearing loss?
- How do we disguise hearing aids?
- How do we promote the use of assistive devices and other solutions?

The following framed challenge was aimed to address the second vision statement.

- How do we adjust the contained environment to be more conducive to communication?

Ideation Phase

We then worked on coming up with as many ideas as possible and then grouped these into 7 major ideas, which we scored and ranked based on feasibility and creativity of the ideas. These 7 ideas are in order of lowest score to highest score:

1. Senior Essentials
2. Talk Write
3. Head (G)ear
4. Hear Canal
5. Check Me Out
6. Environment Change
7. The Day is Hear

Senior Essentials is an online shopping platform that would allow the NOAH residents to avoid the difficulties when communicating with shop tellers. Talk write was an idea that would translate spoken words into text. Hear (G)ear included several ideas for alternative hearing aids, such as hearing aids hidden in accessories. Hear Canal was implementation of PA and T-Coil loop systems in community venues such as churches, etc. Check me out was an improvement of the medical referral system, as well as the inclusion of self-screening and emotional support groups. Environment change was an acoustic audit which allowed for better quality sound in common areas within NOAH. The Day is Hear was an awareness day for presbycusis which included educational games.

During this ideation process our focus was on improving contained environments, which are environments which we could predict, such as a bus, a church, or a supermarket. We could predict typical questions that a shop teller would have to ask a shopper, such as “Do you have a loyalty card?” or “Would you like a plastic bag?”, and we would know the route a bus follows, and the church sermon would include some hymns, communion, and a planned sermon. We focused on these contained environments because these were situations which we could create effective and efficient solutions. I realised that our ability to come up with solutions requires us to be able to predict behaviour. And thinking back to our attempt at trying to complete the *journey map* before our interview with NOAH, I realised even our ability establish problems requires us to be able to predict the behaviour of our clients.

After a few iterations we finally had only 4 main solutions, and those were the following:

1. Senior Essentials
2. Head Gear
3. Acoustic Audit
4. The Day is Hear

Senior Essentials was the same as before but we included a “pre-order” and “personal shopper” option which would prevent the social isolation that an online shopping platform promotes. Head Gear was also the same as before. The acoustic audit was a combination of Talk Write, Hear Canal and Environment Change and The Day is Hear was the same as before but included the Check Me Out solution.

After evaluating these 4 solutions we felt like only the Acoustic Audit and The Day is Hear were feasible solutions for NOAH to implement. However, because we were presenting to a wider range of people, we felt it important to present all 4 our final solutions. I think our unwillingness to discard ideas is also because we grow attached to them and would like to show our audience our work and hope that in some way our solutions might benefit them.

Build Phase

The build phase differed a lot from last semester and it went through multiple iterations. Last semester the students worked in 2 groups, and this semester all the students worked in 1 large group. This was very beneficial during ideation as it allowed us to come up with a lot of different ideas, however, it made it very difficult for us to get criticism on our work from outsiders, which is especially important when developing a presentation.

Last semester we experienced a problem during our final presentation which was that our clients seemed to miss the concepts we were presenting and took a lot of our solutions at face value. As a result, this semester we focused a lot more on presenting a very clear message to our audience. We spent almost as much time practising and refining our presentation as we did on ideation.

When it came to creating a prototype for our solutions we were much better at presenting our solutions in a creative manner. For me it was beneficial to keep reminding myself that the ideas were something we wanted them to experience, and trying to determine how best we could achieve that. The experience of the solution is what you want your audience to remember and to take away.

This semester we started prototyping our solutions a bit before deciding on which solutions were most feasible. It was good because the solutions we originally thought were completely unfeasible could actually be reworked and developed to become more feasible as was the case with Senior Essentials.

For the Senior Essentials, the original presentation format was us acting out an infomercial which described the product and all the various aspects of it. The online shopping platform would include different packages that the user could choose from, removing the technical difficulty of navigating a shopping website. An example of these care packages can be seen below.

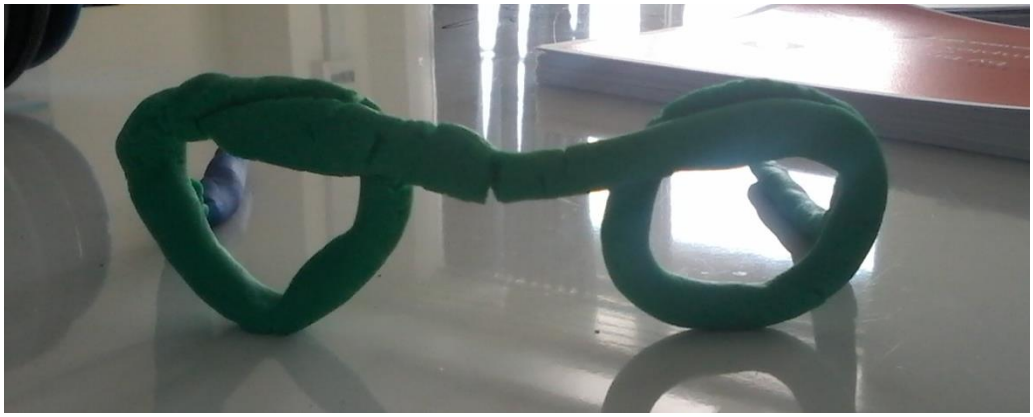
Option A

Option B

As previously stated the idea went from just a simplified online shopping platform to one which included a “pre-order” and “personal shopper” option. A big issue with this solution was that the NOAH residents had limited access to internet and the solution required buy-in from supermarkets.

Talk Write included hymns and sermons being displayed on a projector so that the congregation could follow. The idea also included cellphone Apps that would be linked with bus services, allowing the user to know when and where the busses are, as well as having a visual display of the next stop in the bus. It also originally included real-time speech-to-text devices, however this was later omitted as it was criticised for not being able to translate all languages or accents. It was interesting for us to see during out presentation that Graeme had developed the idea of real-time speech-to-text much more than we had.

Head (G)ear aimed to give people who felt insecure about wearing a hearing aid the option of having a more discreet device, by hiding it in common accessories such as jewellery, headphones and glasses. We originally made a prototype out of clay as can be seen below. We later managed to 3D print a pair of glasses and stick a hearing aid onto this.



Hear Canal involved setting up PA systems, FM systems, and T-coil loops in certain community locations such as supermarkets and churches. This would allow for easier communication but required implementation by external stakeholders, and thus was not really something we felt was feasible for NOAH to implement. The idea also included having an intercom system in common areas in NOAH homes or rooms which would allow the NOAH staff to make announcements. This specific aspect was criticised for being too invasive and was subsequently discarded.

Check Me Out was originally developed to try and address the failures in effectively referral of people to the correct medical specialists. This came about after a discussion with one of the NOAH residents who had been diagnosed with a hearing problem but did not receive any medical attention, and clearly did not understand the diagnosis she had been given. There were also residents that on some level knew they have a hearing problem but did not actually seek any medical attention. After doing some research and realising the ethical dilemma of not being able to force NOAH residents to divulge their medical records, we concluded that we could do little to improve the referral system using NOAH’s resources.

The idea then developed to include a self-screening process. Our logic was that if people could identify hearing loss among themselves, and accept that they had a hearing problem, they would

then take more responsibility to ensure that they got medical attention. The self-screening was also expanded to include a screening form for family or friends of a person struggling with hearing loss.

After our interviews with the NOAH residents, some people also mentioned how much better they felt about their own hearing loss, after hearing about everyone else's experiences. This made us feel like a support group would also be an important aspect of Check Me Out. During the initial presentation of this idea included a skit during which a senior receives and initial diagnosis from a medical practitioner and is referred to a specialist. During this skit the senior is very confused by this diagnosis as he was actually seeking a medical consult on his foot. This skit aimed to demonstrate the need for self-diagnosis as well as emotional support.

Environment change included ways in which a room's acoustics could be improved. Originally we suggested sticking egg cartons on the wall, but this was criticised for not being aesthetically pleasing. During the final presentation we only suggested using soft surfaces such as carpets or curtains to improve the acoustics of the room. The difference in including these soft surfaces was demonstrated by placing a phone playing music into 2 containers, one with a cloth and the other without. The difference in the quality of the sound could then be easily perceived by the audience.

Lastly The Day is Hear was originally only an awareness day on hearing problems, but was expanded to include other health issues. This expansion would draw people who didn't necessarily have hearing problems, and allow for education of people who might be trying to communicate with people with hearing difficulties. The awareness day would also include educational games (which would help others to understand what it was like to live with hearing difficulties), as well as information pamphlets and contact details of medical specialists. This was presented to the audience by trying to recreate the idea of there being several stalls all highlighting a different medical issue.

As previously stated the final solutions were (1) Senior Essentials, (2) Head Gear, (3) Acoustic Audit, and (4) The Day is Hear where Senior Essentials and Head Gear were the same as before. The acoustic audit was a combination of Talk Write, Hear Canal and Environment Change, and The Day is Hear was the same as before but included the Check Me Out solution.

Going Forward

This section includes things I really took from this course besides the project specific things, such as what seniors view as important. These are insights that I learnt throughout the course and will help me to grow as an emerging professional.

I think some things that the course really focuses on is frugal innovation (trying to utilise the sometimes limited resources that are available to make a large impact), trying to tackle the underlying problems that certain people face rather than the obvious problem you might initially be faced with, as well trying to make the solutions fit to the client rather than force the client to conform to your disruptive solution.

I think a big positive for me has been that the course has really taught me how to empathise. By putting yourself in the client's shoes, your perspective on what a "good solution" is really changes. And with that also come the realisation about how little you know about a certain group of people, or even how wrong your perceptions of people can be.

I think massive challenge for me has been to come to grips with solutions that are more abstract. I think this is because of my background as an engineer and we are trained to deliver tangible solutions. Our one lecturer is always trying to discourage all the engineers from developing a cellphone App for every problem we face, which admittedly is something the engineers are always trying to do.

I think another challenge for our entire class has been to try really include the feedback we've gotten from clients, and getting them to buy into and take ownership of our solutions. It's often a problem if you try to take a solution too far; the clients will end up feeling alienated from it and not implementing the solution that you came up with. So it's really hard to find the balance of developing a solution, but leaving enough space for them to make the solution their own.

I think the course is really worthwhile, especially if you want to innovate in a resource limited country like South Africa. The health sector in our country is one of the many sectors that need a lot of work, and the solutions implemented in developed countries are often not suitable or feasible for us.

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