

Project A.W.E.S.O.M.E. shoes

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1. Introduction

The OUT - project: An open framework consisting of our own imagination, the concept of keeping it green, and a challenge to get people (and technology) *out* from their comfortable indoor habitats. When we started brainstorming, we only wanted to put a couple of constraints on our imagination and project. Those constraints were: it has to be green(promote the environment), and it has to promote physical activity through technology, get users out, and live up to the mobile aspect of the course. How can we make a project based on mobility, eco-friendliness and technology?

After a solid brainstorming, we eventually came to an idea about how we can harness the energy that we are already “producing” every day, store it for re-usage, sell it or directly use it in conjunction with another item. During the first phase (before the midterm presentation), our group employed the divergent approach [8] in order to explore as much as possible; options of several user groups, potentiality in existing technologies and incentive schemes, which can draw a user into our project. The methods we employed in this phase were observation and future workshop. The second phase of our project followed the convergent approach [8] where we tried to make decision based on the options we generated previously to zoom our project toward the right spot. The methods in this phase were expert and target interviews and focus group. The interview with a politician (section 4.3.2) brought a turning point into our project after seeing the whole picture of the health care situation in the society and the priority areas that require first attention.

In order to make sure that we designed the right product for the right user, we employed the User Centered Design approach in our project (More detail about UCD is explained under section 3.2). Throughout the course of the design process, we also tried to apply different universal design and mobility concepts whenever we have to make decision or design choice in our project. You can find more detail about the universal design and relevant mobility concepts under section 3.1 and 2.1 respectively.

2. Problem space

A current trend, as well as an emergent problem, is that people seem to get lifestyle diseases based on their lack of exercise and healthy living. An increasing amount of us has already felt some of these issues, and we as a group see the mobile course to be an excellent arena to look into this challenge, and encourage people to go outside. What we wish to accomplish with our project, is to create a mobile device that will stimulate use by offering motivation and incentives for exercise, and at the same time be a helpful supplement for any outdoor enthusiast. Essentially, it would be a tool for everyone to use, and one that we feel everyone would feel some benefits of using. Our focus is thereby on this tool, and what it should consist of. We wish to explore ubiquitous / context aware / wearable technology in association with this, and we wish to look into different options for incentives / rewards that could appeal to a smaller target group, and the general population. Universal design is typically a goal, but not a requirement as of now.

2.1 Review of literatures

Expanding the mobility concepts into our project

Article [10] expanded the concept of mobility by looking at three distinct dimensions of human interaction: spatial, temporal and contextual mobility. Although this article is quite old, the concepts are still valid for our problem space.

In terms of spatial mobility, the author[10] argued that the mobility should not only concern geographical movement of humans, but it should also consider the global flux of objects, symbols, and space itself, and such evokes complex patterns of human interaction. In our project, we can regard “awesome shoe” as a mobility of objects for “*it is virtually an extension of the skin. It is fitted and molded to the body itself...it is designed for movement- for mobility, for people who are always out and about, for traveling light*” [10]. As for the mobility of symbols, the workout data and the energy harnessed from walking can be seen as symbols in our context. Information and communication technologies (ICTs) play a critical role in the transformation of data between the shoes and other devices. About the space itself, geographical space is no longer an obstacle for user to share their performance data with others, with the development of ICT, there are multiple ways of transmitting data wirelessly.

Temporal mobility view [10] inspired us to think about how to involve temporal feature in our project and how to connect it with spatial mobility. We came up with providing a training reminder by which user would receive a notification when they were at home and did not work out for quite a long time.

About contextual mobility [10], the author emphasized that besides spatiality and temporality, it is equal importance in organizing human interaction. In light of this concept, the “personalized training plan” feature in our project provides a kind of interaction, which can let user “in what way”, “in what particular circumstance” and “towards which actors” specify their training modes.

Embedded devices and ecology concepts

We found that the articles [5] and [6] provides very good guidelines that fit perfectly with the purpose and type of artifact in our project. The article [6] opens us with a landscape of artifact design for the existing ecology of user’s digital devices. The concept of “*ecological factors*” is a very useful guideline for the design of our product in order to create a new artifact that lives sustainably in the existing ecology of user’s devices. Our first point of interest from the concept is about the compatibility with the user’s ecology. The factor about information sharing among devices, for example, brought an awareness about the standard protocol for information sharing that can be applied to a current user’s device into our project. The information of usages such as the statistic of user’s exercise and amount of electricity energy generated by the shoes should be able to seamlessly transmit to the current user's devices such as mobile phone or home PC. The Technical compatibility is also an important factor. A good example of this factor is to align with the current technology standards such as the USB or BLUETOOTH standards for connection between artifacts. In addition, making the embedded device that can fit with the existing shoe, e.g. the compatibility with the Nike shoes’ socket that already exists, would make it easier for user to integrate our artifact into their present lifestyle [5]. However, according to a quote from article [5], “*this physical disappearance and embedded sensing, actuation, and interaction can affect user’s perception and lead to the invisible dilemma*”. This invisible dilemma might make user unaware about the existence of the embedded device and impact the use. As a result, our group come up with the notification system that, we believe, could tackle this issue. This notification feature also opens up a new emerging challenge area of “*context dependence*” [5] into our project. We need to make choices about the proper context to give the

notifications to our target user group, e.g. at user's home where they will be potentially sit and playing video games all day. We believe that the models of combination between Ubiquitous and wearable computing presented by article [7] would be useful for the design of the notification feature in our project. The second point of interest from article [6] on "*ecological factors*" is about the influence of new artifact on changing user's behaviour. The aspect presented in the article perfectly supports our motivation for this project, to "change behaviour" in users - to help prevent lifestyle illnesses.

Furthermore, adding a new role of the energy generator in the shoes could be seen as a method to increase the "*Purpose of use*". Therefore, it also increases the overlapped "*layer in an ecology*" of the shoes [6]. According to article, "*It could be said that the more layers are overlapped for a certain artifact, the more important or essential they are considered representing more connections to users' activities and to other artifacts*"[6].

To be aware about the context

In article [14], we seek inspiration in the context of ubiquitous computing, and how we can create more of a context aware product. From the article, they explain; "*This article describes how the changing information about an individual's location, environment, and social situation can be used to initiate and facilitate people's interactions with one another, individually and in groups.*"[14]

From our work, we have found out that the information one could get about location and environment could be helpful for our device. An example would be the function to measure how often they were used, and when they left the house. What we have gathered from article [14] is a greater understanding to the context awareness / ubiquitous computing aspect, as well as inspiration from the experiments that were given. We do see several aspects of the examples could be incredibly exciting to have in our product - like the ability to screen calls away by being busy outside jogging, perhaps your facebook would automatically update and say you were out doing just this. We do, however, not rule out that the shoes would be able to be used in a context where they could transmit your ID to a company to reveal if you were at work or not (not in the intention of finding out who's skipping work, but with the intention of context aware mailing lists [14] and such technology). The shoes are always with you, and are not meant as a chain, but as a liberating technology! The article [14] has served a great source of inspiration, and we have

gained a much deeper understanding of what context aware technology is actually capable of (this article is even 10 years old!).

Palpable computing for the healthcare sector

Article [13] touches upon how it is to design technologies for personal use in the healthcare sector (and seeing as health is what we want to improve upon with this project, it can be relatable through different concepts).

A challenging aspect in all design, is ethics. Users should feel safe, have control over privacy, understand what they are doing, or even contribute through open (design) solutions and user centered design. This aspect was something that was very important for the insurance-spokesperson from the interview, so it is something we definitely want to address. We want to see if we can relate article [13] to how we need to access our own medical data (in conjunction with «awesome shoes») to help the validation and security of the users. Or rather, it is a challenge to validate any data from shoes, and this article might offer some insight into ways of doing just that. If we can use concepts from the article, the gap between user and insurance agency or perhaps health-policies would be lessened.

We have talked about solutions with logins by “MinID” with an insurance agent and a political advisor, and whenever we bring up security around data, and validating data, they all seem to relax a bit more, because it is a major problem. “MinID” or a “Bank-ID” would be a familiar solution for most users, and also may be considered at least somewhat safe. We also talked about a secure connection between home network and shoe (maybe via some docking station or wireless).

This article might not be directly translatable to our project, seeing as we are not working with pregnant women specifically, but it still raises some solid points when talking about palpability «[...] *palpable computing is essentially about doing pervasive computing right, i.e. designing IT that is intended to be easy to grasp, modify and understand for users* » [13, p 104].

Challenges in wearable and ubiquitous computing would be lessened by combining the best of both worlds [7], and stresses the importance of having control over your own information – which any ethical product should support. Having health-related information being spread out around different databases and technologies that do not necessarily work together, is a bad idea - and something the memory stone is trying to combat. The points we've mentioned here also have to be taken into consideration for our own project. The user has to feel in-control, and that his or

her data is safe, when using our “soon-to-be” product, as the people who use the data has to be confident that it is correct.

If we were to provide a safe and easy way to collect, and store personal data, the difficulties with government-funded (or insurance-funded) subsidiaries (or monetary motivations) would be lessened, and they might actually contribute if we were to have policies similar to what they have in Germany [9].

The article [13] states that design projects of all sorts would benefit from a user-centered approach – to work out design proposals that benefits all, not only to learn what the users themselves want, but also us the designers, and the experts (doctors, engineers ++) would like, and/or advise. This article may not be extremely important to our project, but it surely serves as a comparison and reassurance that we have at least done something right with researching and inventing «awesome shoes».

Having the data in the shoe itself, and not in the environment, serves to keep data safe[7] and personal, although it opens doors as to how it should be used/utilized (a person that wants to use his data for health-related issues, would benefit from sharing them with other branches of the healthcare sector).

If you switch out memory stone [13] with awesome shoe, you can still see a line of highly relevant issues when designing for connectivity, palpability, flexibility and especially for personal health of others. And as the memory stone wants to connect with the tv and computer via usb, our shoes wants to connect to other ubiquitous nodes either by docking or wireless solution. A lot of our function would come via smart phones as well [15] (or something similar that people like using, and that can run the apps needed to calculate data - **see focus group section 4.5**).

Health care incentives and policies

In addition, we have also looked into research done with rewards and incentives done for the sake of promoting personal health responsibilities. In the article; “*Bonuses as Incentives and Rewards for Health Responsibility: A Good Thing?*” by Harald Schmidt [9], we’ve tried to gain some insight into our idea of something similar. The energy is one thing, but the data is another. We wish to use this data in a way that people can prove their efforts done through walking or running, and use this data for a range of different things. It might even serve as an alternative for yearly checkups - as this incentive in Norway alone could result in over 4 million checkups. As

the government might be a bit hard to convince(politics), we've also swayed into the domain of life insurance policies, and perhaps getting bonuses here. This is why this article is so interesting for us. There seems to be a focus in Germany, on the responsibility one has on his own health. Schmidt refers to; *"Article 65a SGB V permits providers of statutory health insurance to offer bonuses for those who take an active part in a range of primary and secondary prevention measures. One may qualify by taking part in age related checkup programs[...] These may include attending dieting, smoking cessation, or yoga courses. Some sickness funds also accept active membership in a sports club as evidence of efforts to maintain one's health."*[9] The quote is actually very interesting for us, as it shows that by law insurance companies can offer incentives. You can prove your efforts to maintain your health, and thereby get rewarded. One can only but wonder why this is not a thing in Norway already. The rewards in Germany take many forms, but seem to mostly be focused around points one can earn - and trade in to items or money. I refer again to the article; *"a 45-year-old person living in the western parts of Germany, [...] can save 6.97% of monthly contributions (or € 5.83) by demonstrating that indices such as body mass index (BMI), blood pressure, blood sugar, and cholesterol are in an acceptable range over a period of at least 1 year"* [9]. We believe this to be an excellent incentive for healthy living, and are inspired greatly by the Germans. 7% of ones monthly contribution can be a significant amount of money at the end of the year, and there is definitely room for data generated by our idea in this scheme. If a membership to a sports club is enough, then surely the data one could provide with these shoes would be more than sufficient to qualify as validation.

It is funny and enlightening to read that through exercise and vegetables - with some other measures, can give around 14 years extra to your life expectancy, but they can not actually prove that this makes the system save any money. A test they referred to in this article even showed that the healthy individuals cost more than the non healthy for society[9], but that the obese category was not too far from it. There is however constant debate on this, and one does not know if the healthcare provided over the extra 14 years is actually close to that provided over a shorter duration for those with a unhealthy vantage-point. The treatment given to the unhealthy could just be concentrated over a shorter amount of time, but actually accumulate about the same expenses as for the healthy. We mentioned this during the interview, and the feedback was that they did not care if it cost more(indeed the opinion of the politician, and not the insurance agency).

2.2 Review of existing technologies

We started our project by searching and reading the articles in the same field. By doing that we can see other attempts to solve the equivalent problem, and some work done by others that somehow tie in with our own work. We seek to gain knowledge from even minded individuals, doing research in the same domain as us. The harnessing of energy and storing of such has been a large factor of our study material.

Other articles have also been acquired for the sake of a broader perspective. The articles [1], [2] are basically about principles and state in motion-driven miniature energy harvesters, current development, trends and suitable applications. Both articles mentioned that in the field of motion-energy harnessing, the most promising way to extract energy more innocuously from people, is by tapping their movement. In the articles [3] and [4], we find out how to harness energy by using shoes and how to use the energy, once collected.

In article [3], the author points at how the idea of harnessing energy by using shoes came out by mentioning that *“the average person spends a significant part of the day on foot, dissipating abundant energy into the insole of a shoe. Harnessed unobtrusively, this wasted energy could be used in a variety of low-power applications, such as health monitors, RFID tags and emergency beacons or locators. And a battery could be trickle-charged at the shoe and manually moved into the devices.”*[3]

Both articles [3] [4] presented three different devices, which can be built with a shoe to generate energy while walking. The first device taps energy by harnessing the bending of the sole (They call this a PVDF stave). The shape of stave was chosen to conform to the footprint and bending distribution of standard shoe sole. The second was called “PZT unimorph”, and was attached to a curved steel plate, which flexes under the pressure of a heel strike. Both of these devices are piezoelectric systems, which is basically a type of material that creates a charge whenever mechanical pressure is applied. The third one is a magnetic rotary generator. By mounting it on the shoe, it is mechanically coupled to the sole’s dynamics or foot strikes. After the performance of these three devices was tested, the conclusion was that *“Although the magnetic rotary generator that we have tested produces 2 orders of magnitude more power than either of the piezoelectric systems, it is much harder to integrate smoothly into the design of conventional footwear without interfering significantly with the form factor of the shoe and / or gait. Both the PVDF stave and PZT unimorph were easily integrated into a standard jogging*

sneaker and sufficient energy could be accumulated across several steps to power useful functions.”[4]

One use case that was important for the ubiquitous aspect, which we found in this article - was that energy was used to; *“transmit the users’ identities to the local surroundings. The IDs can enable a central server to make dynamic, near-real-time decisions to personalize the environment or route appropriate information to mobile users.”[3]*

What we gathered from these articles though, is that the technology has not quite come far enough to create the energy needed to make our plans come true. But that they are headed quickly in that direction, and could within a few years be at a stage where our project would be a lot closer to becoming reality.

2.3 Users

In the beginning, we let our brains go bananas on ideas, but no matter how many ideas we had, the concept of universal, palpable design always stayed. We wanted technology that everyone could use, no matter if they were blind, deaf, physically or mentally handicapped in some way or another, on their feet, in a wheelchair etc. A problem we found with having a diverse user group though, was that it is very hard to focus in on concrete solutions for a base-prototype to work with. Knowing what choices would be the right ones, both from our side, and from the users' point of view would be very tough. After some thought, and encouraging from outside sources, we found out that focusing in on a specific user group would further the progress of the project.

So, what age, which user group to choose? Seeing as we wanted to improve health, stimulate use and motivate the user, we had several discussions about what kind of people we feel sorry for here in the world and of course we went with students. Harr harr. But no, students show more and more lifestyle-related illnesses at an early age (we knew this both from interviews, talks, and personal experiences), and if we are to change behaviour, and if the user is going to get some good quality long time effects out of this, we have to start relatively early with changing behaviours. Students are a good start, seeing as technology are not foreign to most students, and yet it is perhaps early enough for them so that they can still have long lasting effects from this. (it was a logical choice, considering most of the participants in our already

conducted workshop were students, we had relatable data - later backed up by a focus group consisting of students as well).

We would want to have a divergent usergroup (everyone), but this is now something we would incorporate in the future, given time/resources.

3. Design Methodologies

3.1. Universal design

Ideally universal design is adapting your design to a user group as large and diverse as possible, exclude as few people as possible, and still make it better for everyone at the same time. A nice example of universal design is curb cuts. Curb Cuts was originally engineered for the handicapped so that they could more easily navigate curbs, but in turn they have made navigating curbs more easy for bikers, skateboarders and even average walkers [12]. So in this case, universal design improved the curbs for a much larger groups than what was originally intended. In a similar fashion we thought about making the awesome shoes into an accessory that can be fitted into as large amount of shoes as possible, instead of making it one particular shoe type that the user have to buy. This way people can still use their shoes of choice, they can move the awesome shoe accessory between shoes, and make every shoe a.w.e.s.o.m.e! We believe this will include a larger user group than any customized shoe could hope for. There has also been thoughts for those who can not walk, where perhaps our technology would come in the form of a dynamo for wheels, or the likes.

3.2. User centered design

Despite being a thought experiment, we have tried to use scientific approaches to make our work a “space” designed with the possible users, and us. User centered design seemed like a good choice for our work, as we argue this possible product has to be something the users will actually want to use, and that is created by themselves to validate just this. This section is based on an article called “User Centered Design” by Chadia Abras, Diane Maloney-Krichmar and Jenny Preece.[11] We argue that perhaps the next steps, the ones after our work is done - creating software and designing the devices will, to a much larger degree, require this user centered

design. For us, we have included possible users throughout the methods of requirements-gathering and most planning stages that have had an impact on the actual idea.

The article goes in to suggestions on how design should be, and lists four points. We have not designed the product yet, merely worked on specifications and use. We have however tried to keep the simplicity of the product and the visibility of the system (model of system, alternative actions, results of actions) in focus. For example, the system would be aware of surroundings and, being not used in a long time, it could give you audio feedback that perhaps it was time to do something about that. From the article, we quote; *“These recommendations place the user at the center of the design. The role of the designer is to facilitate the task for the user and to make sure that the user is able to make use of the product as intended and with a minimum effort to learn how to use it.”* [11] From the starting point of our journey, we have involved the users. From observations, interviews, workshops and focus groups. These have all been centered around the user, and made in such a way that their opinions will define our project and its requirements.

Further guidelines from the article states [11];

- Use knowledge of the world, and in the head - which we argue has been done by our literature reviews and methods to gain insight.
- Simplifying the structure of the tasks are attempted incredibly simple by our design, but can take a turn for the more complex when it comes to using the data gathered for different purposes. We have yet to design that system though, but the aim is to have as much autonomy as possible, without confusing the user.
- Making things visible is done in a manner of both making the system itself very simple (with a mat, wireless transfers and automated functions as such) and also by enriching the idea with communications with public screens and stations[16].
- Using the mat at the house will create the feeling that there is one place to put the shoes, and that this is what you should do.
- Designing for error has been a difficult topic. We’ve mostly focused on the security aspect of this and the errors that could entail from such issues. Error with software and such is a bit too far away as of yet.
- Standardization has been a very wanted aspect for us, as we want this to be done in a universal design type of way, that will let absolutely everyone be able to use this

technology to mold their own experiences, and for whatever purpose they themselves would want. It has not yet been tested on any handicapped in our situation, based on our convergent approach on students, but this could be done in the future, given time and resources.

From the definitions of users in this article [11], we have students as a target group, where the IT students have been a primary focus, and the general student body has been secondary focus. We do however again emphasise that in the future we wish for the general population to be the primary users, in which case we imagine the government, healthcare sector and the electricity providers to be the tertiary users.

To further improve our research, we considered Usability testing, which this article also includes. We considered making mockups and in some way use this, but the general consensus was that we needed a high fidelity prototype to make the information we would acquire valuable.

4. Design Process

4.1. Observation

During the course of our observation of people's outdoor activities, we observed the following activities that would be of interest to our project.

- People were jogging and running. Of course, from this activity, the devices described in [3] and [4] can possibly be used to generate the electrical energy.
- People usually have backpacks with them. We believe that these backpacks could be a place to implant some specific equipments to generate energy (e.g. Solar backpack)
- We also found many people running with their dogs and running in groups. Based on these findings, an electricity generating device could be placed to these pets. This is also aligned with one of the results from the future workshop (please see more detail in section 4.2).
- We also observed many wheels related activities, e.g. parents with a baby carriage, roller skiing, bicycling and traveler dragging their baggages. we think that we could use the small dynamo attach the wheels to generate energy

4.2. Future workshop

This section describes the result we got from our future workshop with five participants. At the start of the meeting, we showed our participants some sample pictures of the current technologies that could be used to generate energy. After that, we told them briefly about the purposes of our project and possible applications of the technologies before starting the critique phase of the workshop.

4.2.1. Critique-Phase

In the critique phase, the participants pointed out these potential problems:

1) Discomfort caused by wearing the electrical energy generator device: The device that's embedded in shoes needs to be more comfortable for running and should not be too heavy or clumsy. The device should also look nice and fashionable when they are integrated to the shoes.

2) Technology limitation: There were a lot of comments and questions about the limitation of the technologies. For example, the technologies we showed seem to be easy to break. A participant also thought that the devices could only generate a small amount of energy, and they were curious about the way to store the energy for later uses.

3) Issues about adaptation to different environments: The technology such as a solar backpack may not be useful in the winter time in Norway because the daytime is very short. These technologies should be able to be used in harsh conditions, e.g. very cold weather in winter or being water proof.

4) Security issue: There was also a question about how to identify the owner of the generated energy. (This was before we thought about using already existing standards as "MinID" eller "BankID").

5) Other: Apart from the categories above, a participant also mentioned their concerns regarding how to motivate people to use the technology and the feasibility to make them as commercial products.

4.2.2. Fantasy-Phase

In this phase, participants helped each other to generate ideas without concerning about current reality. Then, we used the ideas generated from this phase as the basis for the Realization-phase which will be explained in the next section.

4.2.3 Realization-Phase

This is the phase that we came down to the reality. The realistic solutions for the problems from the critique phase can be categorized as follows:

1) How to generate the energy: We agreed that it's seemed feasible to have an embedded device in shoes and use it for generating data. The heat energy from the PC, engines in motorcycle are also a good source of energy.

2) Energy transmission: We thought that wireless transmission was the best and the most convenient solution to transmit energy from the generator directly to a device (consumer) or a storage(e.g. battery).

3) Usages of the generated energy: We agreed on the following uses of energy generated from the technologies:

- Using it right away after it generated, e.g. charging cell phone while running
- Selling harnessed energy to the state
- Use the data to get life insurance discounts
- Upload/share data to social media like facebook or twitter. This could motivate other people into our project as well.
- Use the amount of stored energy as an evidence for tax deductions

Further improvements are around the idea of a second workshop, where we thought that perhaps we could do this through the Nike and Addidas products, and use the data collection technology they had, to in some way present our product. Alas, the decision was made that our project was not at the stage where we felt confident enough to test this product and relate it to our work, due to the complexity of our idea as a context aware environment of artifacts(shoe, mat, network, phone), and the simplicity of the Nike / Addidas technology.

4.3 Interviews with experts

4.3.1. Interview session with insurance company

We decided it was a good idea to interview a representative of a major norwegian insurance company to get his insight about how this technology could tie into a insurance

scheme from someone who knew the system. Our interview was semi-structured and lasted about 30 minutes. The interview was conducted by phone.

By interviewing this man, we learned a number of things about how life insurance currently work, some of the complexities and problems, and about how the awesome shoes could tie into that. What happens when you apply for a life insurance is that the customer submits documentation and information about the state of his health. The company will, to a large degree, trust that the information is correct. They have their way of making sample tests, but all in all they will trust the customers information in their health declaration. In order to make money they have to balance the price and take into account differences in the health status of their customers. If customers get incapacitated and it can be proven they had symptoms at the time they applied for their life insurance, the insurance company will make a big case. If the customers are claiming to have a condition and can't prove it, they also can cash in their insurance.

What does exist today of discount solutions is that certain groups in society with lower risk, will get a lower price than the higher risk groups. For example office workers, doctors and groups that doesn't have much physical wear down in their work will get a cheaper life insurance. On the other hand, for example nurses that move and do a lot of physical activities in their work, will get a higher price, because they have a higher degree of incapacitation. Insurance companies in Norway are not allowed to discriminate the genders, even if the fact is that men generally dies earlier but women have a higher degree of incapacitation.

The interview subjects biggest concerns against the awesome shoes, were the security issues. Can you know for sure which person has generated the data ? Can you know the data represents the truth? There are also complexities regarding what is truly healthy. For example bodybuilders will have a high body mass index (bmi), because muscles weigh more than fat, so it isn't uncommon that people that get rejected because of their high bmi send in complaints even with pictures to show how healthy they are. But you can also question how truly healthy it is to exercise in that way, maybe they are using drugs to increase their muscle mass or maybe they put more strain on the body by working out a lot. So there is a lot of complexities. He did however mention that they had special forms for these people.

So in the end, he wasn't entirely dismissive, but he was critical of the idea. Data is sorely needed in the insurance industry, but it has to be **reliable** data quality.

4.3.2. Interview session with politician

In order to get some contrasting views and get additional insight into the possibility of incentives for a healthy lifestyle, we decided to interview a political advisor. The interview was conducted in person at the workplace of the interviewee.

Firstly, the interviewee gave us the general idea of the current health care situation in Norway. The key issue right now are the non-transmitted disease such as diabetes and obesity. There are political intention and existing policies to tackle these issues by supporting the healthy activities of organizations, for example the financial support given to all sports clubs. The interviewee also give a very interesting information that these policies aim at “*changing behaviour*” of the people who have lifestyle illnesses, not the people who already are healthy. This information influence the direction of our project to focus on “*changing behaviour*” of the existing lifestyle illnesses in people. It also help us narrow down our target user group to it-students or people who have to use the computer for a long time in their daily life which could cause potentially the problem to their health.

At the end of the session, interviewee also gave us suggestions about our project as follow:

- Make it easy to access by all user group equally. We think that this is also link to the concepts of Universal Design (Section 3.1).
- Good security for data owner and protection
- Focus on changing behaviour of risky group
- Incentive scheme that are easy, fair to all and practical to implement (this is almost impossible- given the nature of policies, but would be nice)

4.4 Interviews with target group

In order to confirm that we aim our focus correctly, we decided to conduct semi-structured interview session with 8 participants. These participants usually have/choose to use computers in their daily life, ranging from 4 to 10 hours a day. It turned out that 7 out of 8 participants have some lifestyle-related health problem from using the computer for a long period. The common problem among them are headache, eye problem and muscle issue at their neck, wrist, hands, shoulder and back. They also feel that they have some problem from not having enough exercise. This information help us to gain more confidence that we focus our

project on “*changing behaviour*” of the right user group. In addition, we also found information which would be of interest for our incentive schemes. We found that all of the participant have a demand to change their shoes at least once a year. Seeing an opportunity arose from this demand, we believe that the incentive scheme to give free new shoes yearly for regular user might be of interest for our target group.

Four out of eight participant show obvious interest to the idea of harnessing the energy from shoes. Some participants seemed to be suspicious about the amount of energy that the shoes can generate.

4.5 Focus group

The goal of conducting a focus group was to define more clearly several aspects of our theoretical prototype. More specifically, we divided it into four parts:

First, the data we need to collect, some of which can be collected or provided by ubiquitous computing and some of which can be directly from wearable shoes. Which type of data would the users want from our technology?

Second, where and when the users want to read this data and how can they be read? examples are; Cell Phone application, home computer, screen on the wall.

Third, the model of notification feature, how will they get the notifications and what type of notifications will they be? Visual, audio?

Fourth, the model of incentives and motivations could be the essential key for “changing behavior” of the existing illness lifestyle in people. What would it take to motivate them and change their behavior?

We rephrased these four points into four “user friendly” questions and each of them with a list of optional answers which we figured out from the former findings. By doing this, we hope to let our participants work out their thoughts and feelings about current context we provided, get inspired - and then narrow down the options(or come up with new) into the most prospective ones.

Most of the same participants from the workshop joined our focus group. It turned out that the participants want to see the information about mileage, time span per session and the amount of energy harnessed per session. They want to know their workout data during the exercise through some portable devices like mobile phone or ipod and statistic data of some time

span afterwards. As to the notification model, they prefer to have some kind of reminder when they are lazy or forget to do exercise. They also liked the personalized trainer idea (user input the data like age and weight into the system, then it calculates how long you should walk with the shoes per day in order to give a proper notification to user). To the incentive model, the participants like “the charging gadget on the way” most. Some of them said they can be cheered and motivated to go further by sharing their performance live to family and friends. And some of them prefer “public display to cheer up when a hard worker move nearby” (i.e. runner jogs by and a “Good Work!” is heard).

Effects on our theoretical prototype

In the light of the focus group, we could find “wanted” answers to our questions (goals).

First, in the view of wearable computing, some of data like mileage, time and amount of energy can be provided from shoes.

Second, the sensors can be put in the users’ home or at a public place, which can be seen as ubiquitous computing for when a user is at home or within the scope of public space they can, in our context, read the statistic data of exercising, make the workout plan and receive the notification and show the performance data on the public screen. However, with some concern on the user’s privacy protection, we decided to drop the scenario of using the public screen from our scope for now until we find a more appropriate techniques to deal with the issue. Thus, the main focus of our prototype is in the home environment.

Third, the solutions of contacts between shoes and other devices could be the Bluetooth, RFID, Wifi or other technologies. The Bluetooth connection would consume too much energy from the mobile device, which contradict with our plans. We want to create more energy than we spend! As a result, we concluded that most of the data transmission should perhaps happen at home through the door-mat(docking station) - at least for now.

Fourth, in terms of charging gadgets, the wireless electricity charging can be considered. In addition, we also think that the sharing of some statistic on user’s exercise might be useful to persuade user’s friends to feel guilty about not exercising, and join in[15].

5. Discussion

5.1. Ethics and security

When talking design and imagining the technology of the future, it is always important to be aware of ethical challenges, choices and consequences that might arise somewhere along the project. One cannot see technology in our society without also seeing ethics. Technology is all around us, in our everyday lives. In a network where we both influence and get influenced by technology, through use and interaction, the challenge of keeping the walls of technology opaque by promoting visibility, information and usability, is very important.

One of our focuses has been trying to reduce the risk for our users when considering privacy and access to data, as well as imagining how our technology might affect our users' lives. Change may be for the positive or the negative, either way we have to try to understand the product of our actions. Our goal is to have easily useable technology for all, and if it is to be used by an enormous usergroup, each with their own translation of how you can use this awesome shoe, we will meet tons of different scenarios we would probably never have foreseen. This is why testing would also be such an important aspect of our project, although we never came that far (we don't actually have a tangible prototype).

By talking to fellow students, a political advisor, an insurance agent, and inwards in our own group, as well as listening to the critique from our mid-term review, we found the largest problem would lie in finding a feasible login-system that was trusted both by users and by private or public actors (insurance and political policies i.e.). To secure the data for our users, we addressed the shoe as wearable, but connectable to ubiquitous nodes, trying to give the user as much control over her own information and data as possible.

By using some sort of a login system, like "BankID" or "MinID", systems which are already trusted and used today, we could further the security of the data, and also assure insurance-agents (and doctors and whoever else we wish to share our information with) that the data has not been tampered with. This is important for insurance policy-issues, but also for the validation of political policies as well. When considering coverage for people with health-related issues, we need to have trust between user and provider, but it helps that you can be sure the data has not been tampered with, and a person has jogged as far as they say they have - for example.

5.2. Universal design, UCD

When thinking about the awesome shoes, we always tried to make it as user friendly and inclusive as we could. This was an overlaying theme throughout our research. Originally we had thought of making the awesome shoe a customized shoe, but then we thought how much better it would be if we made it an accessory that can be used in any shoe. Some of our reasons for this is that it would make transferring the device between shoes easy, keeping your statistics. It would also lower the threshold of using the awesome shoes, cause the users can still use the shoes of their choice instead of using some customized shoes. In order to make the awesome shoes even more universally applicable, in the future we would also have awesome shoes accessories that would work on wheelchairs, bikes, skateboards and other devices with wheels.

In order to narrow down the project, we decided to focus on students as users as our first priority. We brought this user group in the design process. Students participated in a workshop, interviews and then a focus group, so we could get their input.

In regards to the data part of the idea, we cooperated with both a political insider and a representative of a major insurance firm to get their input in the design process. By involving those who would potentially use the data(stakeholders) gathered from the awesome shoes we acquired valuable insights that helped us in further developing the concept. The political interview gave us the idea of trying to target those who would benefit the most from being more outside, and exercise more. The insurance interview gave us insight in how sorely information is needed in the industry, and how important data quality and reliability is if it is to be used as additional information and validation for insurance companies.

5.3. Wearable and ubiquitous theoretical models.

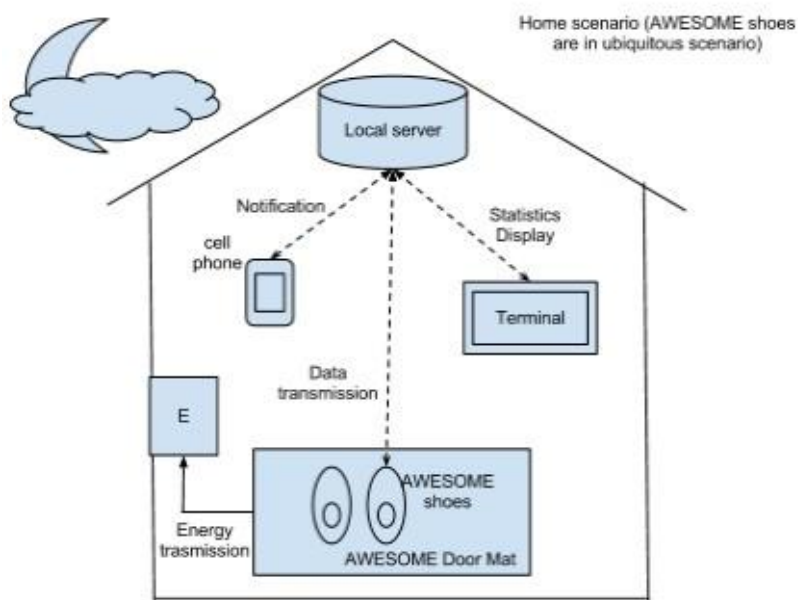
One of the original scenarios for our project was a student who put on the awesome shoes and started his (or her) wonderful day. He does not need to worry about his portable devices running out of power as long as he keeps walking, all his gadgets could be charged wirelessly. At the end of the day, when he gets home, the shoes come off and are placed on the doormat. The workout data and energy harnessed during his walking will be automatically transmitting to the home's local server. There might be some motivational feedback, if he has deserved it. He can access the statistic data like the sum of mileage, time and amount of energy etc. by taking look at

his cell phone or television where he will also have the opportunity to sell the energy in his shoes back to the grid with the click of a button.

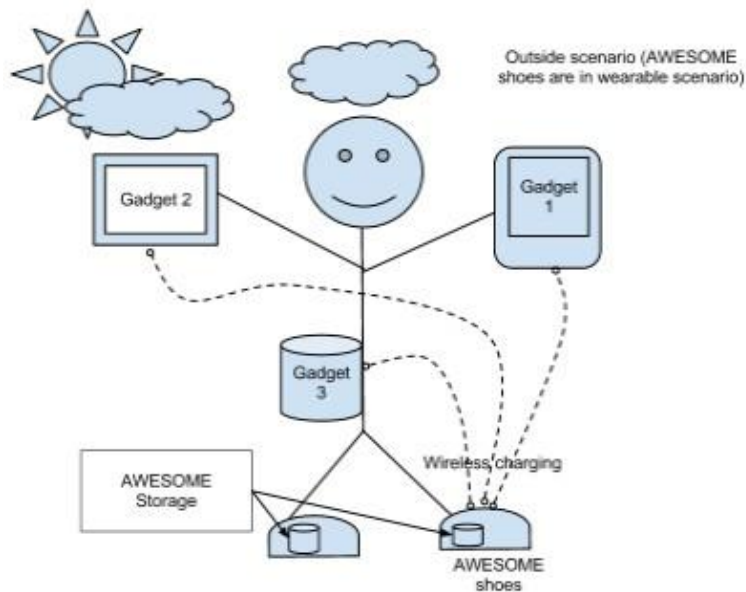
By review of existing technology and review of literature, we have designed a conceptual model combining wearable and ubiquitous computing. Our model can be seen as conceptual because the technology is not yet at that stage where it is feasible.

As the concepts from [7] and ethical issues (see 5.1 Ethics and Security) said, we consider the shoe as wearable computing, which is connected to the home network of ubiquitous technology. Whenever a wearable enters his room, the “shoe agent” running on the sensors which are embedded inside the shoe is trying to find the “energy agent” that’s connected to energy storage (E) and local server. If it finds one, and if the data has not been transmitted, it will start transportation process. And then the local server will send notification to the terminals like cell phone or television, so the user can view the data in multiple forms.

With smart phones, the boundary between ubiquitous computing and wearable computing is vague, especially for another scenario in our project. When the user wishes to see his/her workout data during walking, the cell phone would be the ideal choice. Then the issues would be how to make shoe and cell phone communicate with each other. However, even if there is a way to solve this problem, cell phone could inherently leak the user’s privacy. So we still need to investigate into more technical knowledge to find a trade-off solution.



Home scenario



Outside Scenario

5.4. Future work & ambitions

Our status is a stage of an idea that has a somewhat complex structure, which is held together by ubiquitous, context aware and wearable computing. Every step up to this has been explored with the potential user group, and the available technologies we've found that would fit our project. We feel we've reached as far as we can get without having the actual technology needed for our plans. Once the technology has been realized, it can be adapted and shown to the different stakeholders. It would be expected that new experiments would be conducted on the actual technology, to really see if what we've explored is achievable. Creating something that the vast majority of a population can use, and will use, is probably the ideal goal. Not to make money, but to promote healthy living. The universal design principles are always with us, and everything is thought of in a manner that would support some kind of device that could accommodate the technology, and make it feasible for you, no matter what you struggled with – whether it be cognitive or motor(not engine, but body) issues.

From our current standpoint, we would love if this idea we have created, actually saw the light of day in one form or another. We want to have hikers bring our shoes up to the top of the mountains, and use them to heat their food, recharge their MP3 players or even throw them off a cliff from all the blisters if that's what they'd prefer. Who are we to limit what they use them for?

We try to constantly wrap new ideas in this bundle of mobile technology that is our project, and expand our concepts to be even more ubiquitous, more mobile or to include more people, but we understand that we had to narrow our view, and keep our goals at something that was achievable within the timeframe. What we want to say with this chapter, is that we believe there could be a future for this, and that it has so incredibly many aspects to it that could be explored and worked with. It might be a pocket watch or a shoe, it might be a solar panel on your back, or something extremely clever that we were unable to think of... Whatever it is, they will know from our paper, that there is a definite interest from politicians to cure the lifestyle illnesses and to generate data like this. They will see students who have problems with their ways of living, they will read newspaper articles about training applications that pushes you just that little extra mile - and they might be inspired by our approach to how this technology could work with the greater ecology of artifacts. Our hope is that they will. They will share their accomplishments on social sites like facebook, and brag about what they've done. As someone recently said on a webpage, *"If I ran a half marathon but didn't make a Facebook post about it, did I actually run a half marathon?"*[17] (referring to thought experiments like schrodinger's cat and more, where it's not true unless someone can see or hear it)

6. Conclusion

This project started with the main idea of project OUT to bring people outside with technology. At the beginning, we were faced with overwhelming design choices such as possible technologies, user groups and potential incentives schemes. However after receiving feedbacks from both our midterm presentation and the interview with different stakeholders, we decided to narrow our goal to the idea of "changing behavior" of the "risky population". This goal is still aligning very well with the original goal of project OUT. Using the UCD and as the vehicle for our journey and with some guidances from Universal Design and mobility concepts, we discovered several emerging challenge-areas along the path, e.g. the challenges on data security and ethics, the appropriate and practical incentive schemes and the feasibility of technologies in the near future. Even though we didn't come up with any tangible prototype, we believe that the result we got from this project will be helpful to any possible successors who want to pursue the same journey as us.

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