Persuading People - Using Technology to Change Health Behaviour

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Abstract

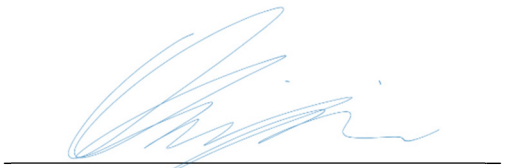
This report contains two papers, which covers a literature review and a paper describing our research study.

In the literary review paper, we look at research conducted within the domain of HCI and health behavior change.

This pre-specialisation project explores the possibility to use different types of content and recommenders through a mobile persuasive technology to persuade users into changing their behavior within the context of smoking cessation. This was conducted by designing, implementing and deploying a mobile web application probe to 10 participants in Australia.

The findings shows multiple themes, which are being discussed and concluded throughout the report, that leads to the future work needed within the field.

Lars Christian Vagner Lichon



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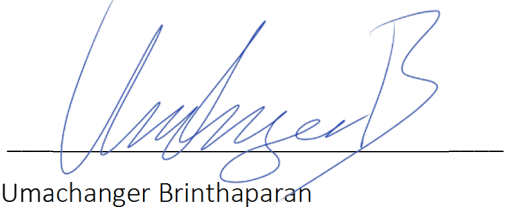

Umachanger Brinthaparan

Preface

This report is part of a university project on the 9th semester of Informatics at Aalborg University. The majority of the project time was spent in Melbourne, Australia as part of ongoing collaboration between Aalborg University and the University of Melbourne.

The main purpose of this project is to try out different informational content types within the area of smoking cessation to find out if they have potential of persuading users to a health behaviour change. As part of this, a literature review was conducted and 56 papers were reviewed to gain an insight into health behaviour changing research. The purpose being to get an overview of this research area and to draw motivation and understanding from their experiences and findings. Then a mobile web application was created by the use of an analytic and theoretical approach, which then were given to 10 participants for a 3-week field study. The findings from this project has been condensed into two research papers, which can be found in this report.

We would like to thank the 10 involved participants for their time and interest in the study. We would also like to thank our volunteering participants for their involvement in a pilot test and expert evaluation to help improve the research design and study approach. Furthermore, we would like to thank Dr Bernd Ploderer, Dr Wally Smith, Dr Greg Wadley, Dr Jon Peace from the University of Melbourne and Prof Ron Borland and Luke Akin from Quit Victoria for their helpful support and feedback during the study. Lastly, we want to thank our supervisor Dr Jeni Paay for constructive support and feedback.

The mobile app can be accessed at http://tiny.cc/quittymobile. It is also possible to access the app on a desktop computer by entering http://tiny.cc/quittydesktop. You can gain access to the app and its content by using the login ID: 000.

The project period lasted from 2nd of September 2013 till the 2nd of January 2014.

Reading guidance

In the introduction part of this report, a description of the purpose and themes of the study resulting in a definition of the problem area.

The following part of the report contains two research papers, which can be read individually. These papers are found in this report as chapter 2 and 3.

"Changing Health Behaviour using Technology: a review of HCI literature" is a literature review, which was carried out in order to gain an insight of the HCI research that have been conducted within the domain of health behaviour change.

"Using Mobile Phones to Persuade People Undergoing a Smoking Cessation" describes our research project, which describes the theory, process, system description and findings from our work within smoking cessation.

Each of the papers are written in an ACM HCI Archive Format, which is used when submitting CHI Papers and CHI Notes for conferences[1].

Following the two papers, we reflect on the experiences gained from our semester at the University of Melbourne. Furthermore, we will introduce additional work on a conference support system for the OzCHI 2013 conference in Adelaide as additional experience within the period of the study.

In the final chapter, we describe the conclusion of the project, which also contains possible future work, based on our findings.

The appendices are listed in the end of this report and can be found on the attached CD.

There will be a reference list for each paper and one separately for this report.

The referencing method used in the papers follows the IEEE standard while the rest of the report uses the Harvard standard.

[1] http://chi2013.acm.org/authors/format/

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1 Introduction

Health is an important topic, due to the increasing amount of health risks surrounding individuals and the society. Over the recent years there has been an increased focus on these risks caused by serious effects, such as obesity, smoking, alcoholism, medication abuse, improper diet and diabetes. Our increased understanding of the cause and effect of these issues has proven how important it is to prevent them from happening.

Recent studies have suggested that personal behaviour caused more than 50% of illness across different age groups (Ryan, 2009). People are most likely not prepared to assume their own responsibility in the context of healthcare, which indicates a need to assist and help them to take care for themselves. One approach is to make use of persuasive technologies, which have been a focal point for a lot of research within the domain of HCI as shown in our literature review paper. B. J. Fogg, the founder of Standford Persuasive Technology lab, defined persuasive technology as *"Technology that is designed to change attitudes or behavior through persuasion and social influence, but not through coercion"* (Fogg, 2002). The work within persuasive technology has previously been applied to multiple domains, e.g. sustainability (Paay, et al., 2013). The knowledge of persuasive technologies in a domain like this, have shown a great potential for making use of human-computer interaction in the pursue of behavior change.

A prime example of a health issue is the case of smoking. In Victoria, Australia, the rate of people killed by smoking is higher than people killed in car accidents, alcohol and other drugs combined. (Better Health Channel, 2011), due to the increasing understanding of the negative effects that smoking cigarettes can cause. Statistics show that nearly six million people are killed each year, due to their intake of chemicals that exist in cigarettes (World Health Organization, 2013). Examples of health issues that can be caused by the behaviour of smoking are an increased risk of getting cancer, lung disease, heart disease and poor blood circulation (Quit Victoria, u.d.). Besides the health risks, the issue also has a great impact on the economy within social welfare systems, in terms of treatment payments to people afflicted by diseases (Ruff, et al., 2000). Due to the effects caused by smoking, an increasing list of anti-smoking organizations worldwide spend money and effort to reduce the number of smokers, both in terms of preventing people from starting and make people quit.

This report consist of a study and literature review conducted on our 9th semester in a collaboration between Aalborg University and the University of Melbourne. In the study, we work with health behavior change through a mobile device application in the context of smoking cessation. In the literature review we gain insight into the field of health behaviour change. Our work is an extension to an ongoing study at the Department of Computing and Information systems at the University of Melbourne to understanding and help users in their attempt to quit smoking[2]. The contribution and findings from this study will be used to further both their and our work within this topic.

1.1 Problem area

Based on the issues described, this project focusses on applying a mobile technology probe to persuade users into changing their smoking behaviours. The study introduces three content types; stories, tips and motivators that contributes with different ways to handle the situation of quitting. Furthermore, the study makes use of two labelled sources; experts and community, to gather information on whether these sources influence the users' perception of the contributed information within the system.

A literature review was conducted to gather and discuss knowledge on health behaviour changing research. This was done to create a foundation of knowledge on how other researchers approached this topic. This led to the design of a study where a mobile application was designed following an analysis, design, implementation and evaluation phase.

[2] http://www.cis.unimelb.edu.au/research/groups/interaction-design/project-ambivalence.html

Paper 1:

Changing Health Behaviour using Technology: A review of HCI literature

Changing Health Behaviour using Technology: A review of HCI literature

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ABSTRACT
This paper provides a brief overview of what Human Computer Interaction (HCI) researchers have contributed with within the field of health behaviour change. The purpose is to provide insight to other researchers wanting to work in this field, in order for them to get an overview of current state and challenges. We review 56 research papers within this branch of research which we categorise into eight themes based on their approach and health domain. The eight themes are based on an affinity diagram approach, looking at the overall theme of each paper. We discuss current research contributions and approaches to health behaviour change, their opportunities and gaps and come with suggestions on what researchers could focus on in the future in relation to extending previous work. Findings indicate an imbalance in previous research focus, leading to our recommendation to focus on other health domains such as alcohol abuse. Furthermore, we suggest exploring the use of other persuasion approaches than previous studies.

Author Keywords
Persuasive technology, Behaviour change, Health, Literature classification

INTRODUCTION

Our health has always been a topic of conversation to every one of us and throughout the decades, health technology has evolved and our understanding of the importance of our health has grown. A prime example of the latter is our cigarette consumption which for example has been on a steady decline in the US since the 1965 [49], as the understanding of the negative effects of smoking has increased. Partly as a result of all this effort, our life length expectancy has increased significantly [31]. But we still have health issues that can have serious effects on the individual and on the society and many of these health issues could have been avoided as for example obesity, which has doubled worldwide since 1980 and smoking, which kills nearly 6 million people each year [67]. This is why a lot of time and effort is spent in order to try to persuade people into change their behaviours. An example of this can be seen in Australia where cigarette packages now have mandatory chock images on them.

Researchers suggest that personal behaviour causes more than 50% of illness. It is estimated that approximately 12% of children have some kind of special need, when it comes to healthcare, and 7% of people younger than 65 are living with a serious life-altering chronic condition [62]. In these cases, the people are most likely not prepared to assume their own responsibility, which indicates that there is a need to assist and help them take care of themselves.

A lot of research within HCI focus on persuading people into a changed behaviour, for example, the work of B. J. Fogg who wrote the book "Persuasive Technology: Using Computers to Change What We Think and Do" (Fogg, et al., 2002). In this book Fogg presents different persuasive principles that can be used when wanting to persuade people and suggestions to how these can be implemented in a wide array of contexts including health.

In this paper we review the research that have been done within HCI and the field of health behaviour change using technology. This has been done to try and map current understanding and practices, thereby helping future researchers working within this field of research.

HEALTH BEHAVIOUR CHANGE

In the recent decade, health practitioners have become more aware of how much patients can do, in order to achieve personal improvement on health [47]. By applying new knowledge and technology, it is now possible to manage conditions such as asthma and diabetes and thereby reduce the risk of compromising their own health.

Among the area of health behaviour change, the most frequently encountered focuses are topics such as eating less or differently or drinking less alcohol or abstain altogether. Each of these focal points can have different sorts of negative impact on the human body, such as the risk of heart disease, overweight or obesity, chronic pain and lung problems.

A behaviour change is thereby only something that the individual is able to engage in and thereby influence the outcome, making behaviour change a way to reduce current or future health risks.

When working with behaviour change, it is important to consider that it is not just the patient's problem, according to Mason and Butler [47]. How this is handled has a crucial impact on the outcome and whether or not

the patient will succeed in changing their behaviour. Fogg (Fogg, et al., 2002) describes his behavior model, which implements three elements that are needed in order to make a behaviour change [62]. This includes Motivation, Triggers and Ability. If either of these are not present, the person is less able to change his/hers normal routines.

A behaviour change can both be applied by healthy, as well as people with chronic conditions in order to improve their health, according to Ryan [62]. He argues that people with pulmonary conditions who smoke, needs to change behaviour as much as a healthy person who smokes.

The topic also concerns the risk of failing in behaviour changing. In "Introducing the Ambivalent Socialiser", Ploderer et al. introduces a user group named, the ambivalent socialiser [57]. This user group is described as people who are simultaneously keen but also reluctant to engage with others via social media. In this paper it is outlined that users who want to change their smoking habits, have the concern of potential failed attempts to be exposed to others on social media.

METHOD

In this paper we are looking at the use of technology in the domain of health behaviour change. The criteria of the papers included in the analysis are as followed: The study described in the paper has to make use of a technology designed with consideration to HCI principles, the papers' focal point has to be on behavior change within healthcare, it has to be published on acknowledged conferences (ACM MM, ACM SIGHIT, BCS-HCI, CEUR, CHI, CHI EA, CSCW, C&T, IDC, ICEC, IHI, MUM, OZCHI, SSIS&T, UbiComp and WSM) in the domain of human-computer interaction, it has to have been published in the past 10 years in order to be considered.

Throughout this paper we make use of the affinity diagram approach [63] in order to categorise the different themes that appeared during the reading process. The first step of the analysis involves a reading process of 56 papers. Each of these papers are assigned different themes and a short resume of it was written including title, summary and key words. Following this, we abstract the found themes into fewer, broader ones.

FINDINGS

This section presents the findings from our review of 56 research papers

After reviewing 56 papers we outline 8 themes that describes the work within health behavior change using technology, in HCI literature (See table 1). The themes are as follows: mobile platform, tracking/self-monitoring, reminding/interrupting, gaming, social networks/social support online, the use of agents, guidelines/strategies and evaluating health behavior change systems.

Major themes	HCI papers
Mobile platform	[2], [51], [14], [21]
Tracking/Self-monitoring	[46], [18], [7], [23], [29], [1], [12], [13], [17], [42], [40], [21], [45], [60], [8], [33]
Reminding/Interrupting	[38], [29], [4], [23], [40], [19], [7], [21]
Games	[3], [26], [41], [7], [55], [24], [36], [9], [65], [27], [22], [56], [34], [35], [36]
Social networks/Social support online	[34], [7], [9], [23], [54], [35], [9], [37], [43], [59], [11], [58], [25], [36], [57], [64], [12], [58]
The use of agents	[16], [56], [52], [61], [4]
Guidelines/Strategies	[48], [35], [12], [44], [14], [50], [15], [68], [37]
Evaluating health behavior change systems	[39], [34], [6], [53], [24]

Table 1 – Theming of read papers

Mobile platform

Designing health behaviour changing systems on mobile devices has its advantages. Mobile phones are very popular amongst the general public which means that the majority of people owns one. Mobile phones also have the capability of providing relevant information at the *right time and place* (Fogg, et al., 2002).

Many mobile applications supporting personal behaviour changing have been designed and evaluated. Several of these [2] [51] [14] [21] incorporates self-awareness as an approach for motivating behaviour change. They use different approaches to this, such as making the user take pictures of situations from their daily routines where they had to choose between (un)healthy decisions *(VERA)* [51]. *UbiFit* by Consolvo, et.al. [14] presented the user with their physical activity over the past week as a flower garden by automatically collecting data from a wearable tracking device. Baumer, et.al. [2] do however combine self-awareness with what they call *open-ended social awareness* being awareness of others. The study by Freyne, et.al. [21] conclude that users were more engaged using an interactive app rather than an informative app. By prompting the users to input data several times a day and sending them tasks to perform, they keep the user engaged and motivated in changing their behaviour. Common for all of these studies is the use of a mobile platform, which is a necessity for their designs to work.

But the mobile platform is also used in other ways as in the study by Morris, et.al. [51]. In their app, they offer in-the-moment support for their users by using mobile

therapy inspired by cognitive therapy interventions, utilising the advantages of the mobile platform.

The *UbiFit* app makes use of the mobile platform by facilitating self-tracking from automated data but in this particular study [14] also has an element of goal setting for the user. The user would either receive or set their own goal for a week of physical activity. While this could easily be implemented on another platform such as desktop computer, they have chosen the mobile platform, likely due to the convenience of it. Looking at these examples of health behaviour changing apps and the general increasing development of mobile apps indicates a major advantage of the mobile platform as a persuasive technology.

Tracking/self-monitoring

A very sought out approach to how technology can assist in health behaviour change, revolves around the concept of tracking and self-monitoring. Fogg defines the principle of self-monitoring as "*Applying computing technology to eliminate the tedium of tracking performance or status helps people to achieve predetermined goals or outcomes."* (Fogg, et al., 2002).

The approach of self-monitoring has been used over a wide range of health topics such as healthier lifestyle in general [42] or with a focus on specific health topics such as physical activity [29] [1] [12] [13] [40] [45] [60], correct water consumption [7], diabetes [46], emotional wellbeing [18], healthy dietary and weight management [23] [17] [40] [21] [60] [33] and sleep behaviour [8].

Consolvo et al. created a system prototype called *Houston* [12]. *Houston* was a software running on a phone which tracked movement with the use of a pedometer. Users were then able to get data on their physical activity and compare and share this with other users. A few years later Consolvo et al. developed a system called *UbiFit* [13]. Like *Houston*, this system also ran on a phone and used an accessory to record movement, but data was represented with the use of a metaphor, in this case a garden. The more physical activity the user did within different categories, the more the garden flourished. Another example of the use of metaphors representing data collected by self-monitoring can be seen in the system *Playful Bottle* created by Chiu et al. [**7**], where users were presented with a tree metaphor, were the healthiness of the tree depended on the water intake by the user, measured by a mobile phone. The *BALANCE* system developed by Denning et al. [17] helped users establish balance in their diet, by giving them advice when manually inputting information on eaten food.

By tracking and presenting this data to users it made them reflect on their own eating habits and physical activity, which in some cases made users maintain or change a health behavior [13] or showed promising potential for changing people's health behavior [40].

Reminders/Interrupting

One often used method to persuade users, when using mobile phones as a platform to change health behaviour, is to send reminders. We found eight studies that used reminders to persuade users to do healthy behaviours. Two studies reviewed [38] [40] used Short Text Messages (SMS) messages as a reminder and interruption. In [38] the focus was to influence the users' snacking behaviour by using SMS's as prompts once per day. These messages were designed based on some of the influence strategies identified by Cialdini [10] and the goal was to find out how well these strategies help creating effective persuasive text messages.

Another way of using reminders is to use in-system push messages and alarms. In [29] the goal was to change the users' behaviour to increase physical activity. To do so, they triggered an interruption, in the form of phone vibration if the users did not move for 30 minutes, to remind them of their inactiveness. The vibrations were designed to become stronger for each half hour of inactivity to make them more difficult to ignore.

In [4] they have built a mobile PDA-based health advisor that was able to provide real-time reminders. The study explored strategies for interrupting users at work to perform a healthy behaviour. The goal with the interruption was to remind the users to take occasional breaks when they are working at a desktop computer to avoid repetitive stress injuries. Four alerts were selected for use in the study, which varied from very polite sound to very impolite sound and the users were asked to rate the interruption agent. In a mobile persuasion system called Playfull Bottle system [7] to motivate office workers to drink healthy quantities of water, the in-build games sent computer generated reminders and computer-mediated social reminders from the members of the group playing the game.

Games

The majority of health-oriented games have been applications which encourage physical activity. Some of them include a variation of motion tracking to encourage physical activity [3] [9] [41] [27] [22] [56]. In [9] they designed a game called *Shadow Boxer*, a boxing game in which the players control their characters by physically moving their arms to punch a virtual target. Playing the game significantly increased the participants' heart rate and for most of the participants, the heart rate was at the optimal exercise level after playing the game. *Fish'n Steps* [41] is another game that aims to increase physical activity. This system links a player's daily foot step count to the growth and activity of an animated virtual character, a fish in a fish tank. Some of the players' fish tanks included other players' fish to create an environment of both cooperation and competition. In [56] they explore the possibilities of using an interactive toy in encouraging children to become more physically active. To do so they built a cuddly toy called *Gum* that stimulates young children to care for it. The child's mission is to make his/her Gum healthier and happier by moving with it, feeding it and playing with it.

Another game that uses user inputs, but in a different health domain, is a game called *Playful Bottle* [**7**]. In this system the phone was attached to an everyday-mug to detect how much water the user drank and used this

information in a hydration game to encourage users to drink more water. In the game, watering a virtual tree was a metaphor for caring for the body by regularly drinking water. If the user did not drink enough water, the tree would transform from green to one with bare and withered branches.

Educational games is another popular game strategy to persuade users to change health behaviour [26] [55] [36] [65]. An example of this is a game called *OrderUP!* [26] where players learn how to make healthier meal choices. The player assumes the role of a waitress in a restaurant and her goal is to make meal recommendations to customers as quickly and healthy as possible. The player gets points depending on how healthy their choice of meal is. Another example of an educational game is a health game called *Cytarius* [24] which focuses on cancer in order to teach children about the particularities of the disease. In *Cytarius*, the player takes the role of a strategic commander. To win the game it is crucial to coordinate the activities of the warriors, who are equipped with different weapons, designed based on different cancer treatments.

Social networks/Social support online

Social support can play an important role in order for people to make a health behavior change. Take for example support groups where people meet and discuss their health behaviour in order to maintain or change current health behaviours. A lot of the HCI contributions within health behaviour change using technology focuses on the aspect of social support or the usage of social networks [34] [7] [9] [23] [54] [35] [37] [43] [59] [11] [58] [25] [36] [56] [64] [12] [58]. Kamal et al. created their own social network called *VivoSpace* with the aim of encouraging users to change their health behaviours with for example the use of social gaming [34] [35] [9] [36]. Chuang and Yang compared different communication tools and found that forum users were more likely to seek and provide informational support than emotional support [9]. Similar to the research conducted by Chuang and Yang, Ploderer et al. [58] examined a public smoking cessation group on Facebook and found that the kind of support exchanged correlated to the users' quitting stage and that users who just started their behavior change took on the role as leaders in the group [58]. The self-monitoring application *Playful Bottle* developed by Chiu et al. [7] used social reminders where participants were able to remind each other in order to encourage drinking water. Both Sohn, et al. [64] and Consolvo et al. [12] created systems that monitored the users behavior making them able to compare this with other users using the same system.

The use of agents

The use of an agent to communicate a message of behaviour changing matter is seen in various studies and is also one of Fogg's persuasive principles (Social actor) (Fogg, et al., 2002). We have looked at different studies [16] [56] [52] [61] [4] that make use of these in the field of health behaviour changing.

Besides one of these, the rest makes use of the agent in a normal manner: using the agent to tell the user what to do directly. The study by Nguyen [52] compared the use of an agent delivering a message with delivering the message by plain text and how this changed the user's perception of it. Others explored different approaches to using an agent. Bickmore et al. [4] explores whether a message will have different level of persuasion according to the level of politeness of the agent. This is relatable with the study by Creed [16], which describes experiments of using emotional and unemotional agents. They both use human factors to differentiate their agents.

A study that is different from the others mentioned, is one by Penados et al. [56]. They developed *Gum* – a cuddly toy designed to motivate children to do more physical activity. Their agent differs a bit from the others mentioned as Gum does not tell the child what to do. Instead it worked by lighting up stars placed in its ears according to the level of physical activity the child performed. In order to persuade the child, Gum would tell the child that it was hungry or state other needs. Gum was persuading by the effect of guilt and gaming theory. These studies all shows an advantage of using agents in order to persuade user in the field of health behaviour change.

Guidelines/strategies and evaluating for health behavior change systems

Another alternative approach within this field of research is to create guidelines or strategies for other researchers to follow when creating systems to promote health behaviour change [48] [35] [12] [44] [14] [51] [15] [68] [37].

Morris [50] has created a set of seven guidelines to promote health behavior change in a broad spectrum of health topics, which are as following: 1) *Remind people of who they want to be; 2) Foster an alliance; 3) Apply social influence;, 4) Show people what they could lose; 5) Put the message where the action is; 6) Raise emotional awareness; and 7) Reframe challenges* [50]. Consolvo et al. [12] identified a set of four key design requirements based on three-week in situ pilot study of a system that encouraged physical activity: 1) *Give users proper credit for activities; 2) Provide personal awareness of activity level; 3) Support social influence; and 4) Consider the practical constraints of users' lifestyles*. Consolvo et al. argues in another the usage of *goal-setting* in persuasive technology in order to encourage physical activity [14]. Medynskiy et al. [48] reviewed strategies that were currently used in effective health self-management interventions and comes with suggestions to how these can be implemented in systems that promote health behavior change [48]. Like Consolvo et al. [14], Medinsky et al. also use the concept of goal-setting as three out of their five strategies for supporting health behavior change: *1) Set specific, short-term goals, 2) Set actionable goals, 3) Set goals the user is confident she can attain, 4) Use cues-to-action to trigger positive behaviours and 5) Allow users*

to increase their self-understanding through small-scale experiments [48].

Guidelines or strategies can be proven useful in order to design systems that promote health behaviour change. Kamal et al. designed a social network called *VivoSpace* [35]. The network was designed based on the *ABC Framework (Appeal, Belonging, Commitment)* created by the authors themselves. A case study shows that the ABC framework was beneficial when designing and evaluating a social network that leads to a committed user base and to motivate health behavior change.

Some of the papers in this literature review also focus on the evaluation of systems that promote health behaviour change [39] [34] [6] [53] [24]. Klasnja et al. [39] argues that HCI contributions that revolves around health behaviour change should focus on efficacy evaluations tailored to the specific intervention strategy (e.g., self-monitoring). As mentioned above, Kamal et al. created the ABC Framework, whose secondary purpose was evaluating social network systems designed to help people change health behavior [34]. Chang et al. [6] have created a framework on the evaluation of mobile apps in accordance to users' reasons for using a particular app. The framework includes *attractiveness, value, ease-of-use, trust, social support, diffusiveness, fun and excitement.*

With this focus on techniques and frameworks for evaluating technologies on their ability to affect health-related behavioural change, researchers are able to utilize these in order to measure the efficacy of their systems [39] and to evaluate the possible explanations to why a system might not or has not been taken into use [6].

DISCUSSION

In this section we will discuss the papers in this literature review on a more general level and then discuss each of the themes in more detail. The discussion is written on the basis of the papers chosen for this literature review.

It is positive that so many researchers spend their time and effort to explore how technology can improve people's lives within a wide range of health topics. Though the majority of the papers included in this literature review focus predominantly on getting people to be more physically active (e.g. by creating systems that tracks people's movement [13]) or to get people to eat more healthy (e.g. by creating systems that monitors the balance in one's diet [17]). Only a few papers focused on other health topics such as smoking cessation and sleep behavior, whilst no papers focussing on persuasive systems for people with an alcohol problem were found. We were surprised to find that the issue of alcohol abuse, as an important health topic, seems overlooked within this area of HCI research, which is why we suggest that researchers consider this topic (or other unexplored health topics) when researching how human interaction with technology can persuade people into a more healthy behaviour.

Fogg's persuasive principles are recognized principles on how to persuade people into doing a target behavior using technology (Fogg, et al., 2002). A lot of the papers in this literary reviews either refer to the work done by Fogg or even uses some of his principles in their research, for example in the case of self-monitoring/tracking. Since Fogg is such a driving force in persuasive design, we suggest that researchers consider how more of his proven principles can be used in health behaviour change research, such as the *Principle of Cause and Effect* or the *Principle of Simulation in Real-World Context*.

When it comes to persuasion, the principle kairos which states that communication with the users at their most favourable and advantageous moment can maximize the persuasion (Fogg, et al., 2002). It is all about knowing the users and their context. Context is important because it provides information about e. g. the present status of people, places, activities and the environment and these information can be used to provide services that are relevant to the particular place, time, event etc. [30]. The knowledge about when and where a user will do a certain behaviour we want to change, can be used in the persuasion strategy to increase its effectiveness. However none of the papers included in this review have done any research on context awareness in health behaviour change. This therefore seems to be an important unexplored research area within this field.

Mobile platform

Mobile platforms is used a lot in HCI research and to little surprise also used within this branch of research. The mobile platform has its many upsides such as its obvious mobility and the widespread usage of mobile platforms such as mobile phones. An immediate downside to the mobile phone is the limited screen size, although the screen size on mobile phones are becoming larger [5]. The term mobile platform is not limited to that of mobile phones but also cover other devices such as tablets (e.g. the iPad created by Apple). The immediate benefit to the tablet is the larger screen size (compared to the mobile phone) which researchers can capitalise on when creating systems for health behaviour change. These devices are also becoming quite popular in the general public, where for example Apple has sold a total of 170 million iPads world wide [32]. None of the studies in this literature review focus or use this mobile platform. Therefore we suggest that researchers start to consider how these devices can be used within this domain.

Tracking/Self-monitoring

When self-monitoring or tracking with the use of technology, a user would either have to input data manually or it can be collected automatically by using technology. Most of the papers used in this literary review use some sort of accessory to gather the actual data, such as a pedometer [12] or accelerometer and barometer [13]. These kinds of accessories are able to gather accurate data, but it on the other hand make the systems less accessible to the general public [1]. As mobile phones become more advanced with a wide

range of inbuilt sensors, (i.e. their own accelerometer) researches could consider how these phones can play a bigger role in changing people's health behavior.

When the monitored data are presented to users, they are able to reflect on own health behavior and perhaps maintain or change accordingly. But some users might need more than just a data presentation to have an actual effect on their health behavior change. Hirano et al. [29] found out that users did become more aware of own activity patterns, but this was often ignored unless it was coupled with for example advice or guidance regarding how to improve one's health. Doyle et al. also had participants noting that getting beneficial feedback from their inputs into the system would motivate them to keep manually inputting data, hence motivate them to use the actual system [18]. Information such as advice or guidance provided to the user based on their data should perhaps even be tailored to the specific user in order for it to be more persuasive. Fogg calls this concept *The principle of tailoring*: *"Information provided by computing technology will be more persuasive if it is tailored to the individual's needs, interests, personality, usage context, or other factors relevant to the individual."* (Fogg, et al., 2002).

Reminding/interrupting

Many of the studies that use reminders to persuade users make use of SMS messages. While the majority of the studies use these SMS messages as reminders and as a tool in the study, very few studies have focussed on exploration of these messages and how to design them to maximize their effectiveness. We only found one study that focussed on strategies to design persuasive text messages [38]. Their findings show that personalised, tailored messages are more effective than random messages and the behaviour changes depends on the right choice of influence strategy which was different for each participant. However, the study only lasted for two weeks with a limited number of participants. There are no studies that explore how these daily SMS text messages affect users over a longer period.

There are several studies that use in-app reminders in different ways, for example vibrations, sound and push notifications. There are two studies [4] [29] focussing on interruption level when prompting users. A very annoying interruption may be effective at gaining compliance for a short time but individuals may be likely to use the device less frequently resulting in an overall loss of persuasion. The studies show that using impolite and annoying interruptions made the user frustrated and even made them ignore or turn of the device. This indicates that an appropriate level of politeness must be used when interrupting and persuading users in order to maximize long-term effectiveness. But no larger studies have been conducted in this area and there are no framework or guidelines describing the relation between the level of politeness in interruption and the persuading effectiveness.

Games

Our findings show that many health-related games are "exer-games", that involve physical exercise or movement and almost all of them focus on changing behaviour to prevent obesity and increase physical activity. The studies indicated increased physical activity and lead to healthy behaviour change. However, the length of the games in many of these studies is very short meaning that the games must be repeated several times to reach the recommended levels of physical activity. More research is needed on how the continuous dimension of gameplay and physical activity can be combined to promote engagement and exercise on a regular basis.

Educational games and roleplaying games that explore behavioural alternatives and their outcomes are also often about obesity and physical activity. Only few research studies have been conducted when it comes to games that support other health issues. Only [24] and [7] have focused on different health issues such as cancer and drinking healthy amounts of water. More research on games supporting other health domains e. g. smoking cessation is needed.

Many studies are aimed at children and young teenagers. Very few of them have managed to design games that support health behaviour change for adults. How to create games that engage adults and lead them to behaviour change is almost an untouched research are.

While "exer-games" and games that requires external devices and sensors seem to be a popular research area, casual mobile games tend to reach a broader audience, including adults [26]. Unlike traditional video games, mobile casual games are appealing because they act as an easy way for people to fill time and kill boredom, for example when waiting for someone or while riding public transport. Therefore, the effectiveness of mobile casual games for health behaviour change can be explored further to support broader demographics.

Social networks/Social support online

An issue regarding the use of social network or social support in order to make people change their health behaviour emerges when people have to share health information in some way. Kamal et al. [36] found in their study that users were reluctant to share particular types of health information. Ploderer et al. [57] [59] found that smokers were reluctant to share their quitting attempts with people online such as friends or family. So while social support can assist people into a more healthy behaviour, researchers in this field need to consider the issue of sharing information that might be considered personal. However, Kamal et al. also discovered that people were fond of sharing health information when it was in the context of group challenges and/or participating in group health activities.

Ploderer et al. [58] also raises the issue of the perception that some users have towards some social networks such as Facebook. Users feel that Facebook does not have a culture of support, while users on anonymous online

communities are perceived to be more empathic and more likely to respond in a supportive manner. Researchers in this field should consider the impact of anonymity when doing social support research in relation to health behaviour change.

Many of the social sites presented in the papers in this literature review focus on tracking (e.g. inputting meals and activity manually) of health data and different approaches to how this data can be shared with other users (e.g. friends or relatives). There is an apparent lack of research on alternative social interaction designs. Another social interaction method that can be used to persuade people is narrative communication [28]. Because it is a basic type of human communication and we communicate through narrative and storytelling in our everyday life, it can be used to persuade as well [28]. Furthermore, research within psychology shows that writing about personal experiences in an emotional way for as little as 15 minutes every day in three days can bring improvement in mental and physical health [66]. Research has revealed that when people put their emotional upheavals into words, their health improves markedly, but no research within HCI has explored this possibility in depth. This knowledge about narrative and storytelling can be used in the field of HCI when designing for health behaviour change. How to create systems that support storytelling and engage users to write their own stories in order to persuade users to health behaviour change is an interesting research area that needs to be explored.

Around half of the papers in this literature review create their own social network in order to examine the efficacy of different design ideas or persuasive techniques, take for example *VivoSpace* created by Kamal et al. [36]. Researchers could easily focus on already existing social networks such as Facebook or Google Plus and use these to carry out research with the focus on health behaviour change. As these social services are already well-established and highly popular amongst the general public.

Guidelines/strategies and evaluating for health behavior change systems

Guidelines/strategies or even frameworks are useful tools that can potentially lead to promising and potential systems. In the case of *Vivospace* created by Kamal et al. [35] the *ABC Framework* helped create a social network that showed a lot of potential. However, the guidelines/strategies or frameworks reviewed in this paper have no clear indication of the efficacy of some of these since some of them have only been applied once by the creators of the guidelines/strategies or frameworks and this might be due to some of the papers being relatively new. Researchers should consider how well these guidelines/strategies or frameworks work across a wide range of health topics.

Klasnja et al. [39] raises the issue of evaluating technology with the aim of changing people's health behaviours. The reason being that most technologies are evaluated on their ability to alter people's health behaviours, which might first occur after several months - in some cases years. Secondly, they are assessed on their ability to actually change a person's behaviour since there is always the risk that they might regress back into former unhealthy behaviours. The problem, therefore, in regards to current HCI contributions to this field, is that most user-studies are conducted on a short term basis, typically not spanning for more than a few weeks. Therefore, it would be difficult to ascertain whether or not the system in question altered or changed a person's behaviour in the long-term. We found some truth to this observation, as it was observed that the vast majority of user-studies in this literature review only spanned over a few weeks, therefore a gap exists between short-term and long-term results. There is an apparent need to conduct longitudinal user-studies, in order to receive a more holistic and complete understanding of the role that technology plays in people's lives to help maintain and/or remain committed to a healthier behavioural change.

CONLUSION

This paper provides some of the current state of research within health behaviour change in HCI. By reviewing 56 HCI research papers from the last decade with health behaviour change as its focal point, a clear picture is drawn of the different themes within this field and approaches researchers have taken. Eight themes have been found based on their research approach and the chosen health domain. Based on this, the opportunities and gaps in this research area are discussed. This can help us examine what has been done so far and possible future research areas that need to be covered and explored. The studies found in this paper have focussed on different health topics such as physical activity and healthy dietary, but the findings show that the vast majority of the studies focus on persuading people into more physical activity. As discussed in this paper, research could and maybe should focus on more topics such as alcohol abuse, which seems to be less explored. The most popular strategies used in the research studies found in this paper to persuade users, are tracking, social networking and gaming. Other approaches such as context awareness seem to be less explored and may have interesting outcomes why this could be a future research work.

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Paper 2:

Using Mobile Phones to Persuade People Undergoing a Smoking Cessation

Using Mobile Phones to Persuade People Undergoing a Smoking Cessation

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ABSTRACT
In this paper, we report on a study designed to get a better understanding of how a mobile application can play an important role in persuading users to quit smoking. The study introduces three content types: stories, motivators and tips supported by two labelled sources of recommendation: experts and community. This content was provided using a purpose-build mobile application. This study contributes with new knowledge on the perception of stories that may be perceived as fake if not in the right structure. The study confirms that, tailored content is an important factor when persuading users to stop smoking in order to make it relatable and achievable for them. Furthermore, this study stresses the importance of push messages, reminding and persuading users to perform a certain task. Proposals on how to improve these are also described. We suggest that the findings from this study can be applied to other domains within behaviour changing mobile applications.

Author keywords
Persuasive technology, Smoking cessation, behaviour change, online participation.

INTRODUCTION
It is a well-known fact that smoking cigarettes can have serious health risks. Smoking can cause cancer, lung disease (COPD), heart disease and poor blood circulation, to mention a few of the many health risks [19]. Besides the health risks, smoking also have economic impacts on social welfare systems in terms of paying for treating people afflicted by diseases caused by smoking [22]. Because of the effects caused by smoking, multiple anti-smoking organizations worldwide spend money and effort in trying to reduce the number of people smoking.

According to the latest data on tobacco usage by WHO (World Health Organization) 22% of the world's population aged 15+ are smokers [25]. Smoking has been steadily decreasing, for example in Victoria, Australia where smoking rates for adult smokers has reduced by 15% since 1983 [20]. This decline can be a result of a number of reasons, for example: A greater knowledge about smoking and its health risks and anti-tobacco campaigns conducted by the many anti-smoking organizations (e.g. [19]). An example of effort in reducing the number of people smoking are the warning labels found on cigarette packages in selected countries. By having these warning labels on the package, smokers are more likely to be aware of the health risks associated with smoking cigarettes [7].

"Mobile technology can layer information into our moment-by-moment lives in a way that changes our behaviour" (Fogg, et al., 2002) This quote by B. J. Fogg describes the benefit of using mobile devices in a behaviour changing field. The mobile phone has become a device that everyone carries with them and therefore makes a good platform to reach users in multiple situations. Furthermore, the amount of functionalities in a smartphone makes it a useful tool for people, improving the impact and engagement of health behaviour changing applications.

The book "Persuasive Technology: Using Computers to Change What We Think and Do" by B. J. Fogg (Fogg, et al., 2002) presents different persuasive principles usable to persuade people into a behaviour change. His principles has led to the discovery of new persuasions in the field of health behaviour change such as the work by Morris [13], stressing the increased interest of persuasive technology. When taking into account smokers' struggle when attempting to quit, persuasive technologies could be helpful in accomplishing their goal of becoming smoke-free.

This paper is structured as follows: First, we present related work that has been done in the field of smoking cessation. This includes both an ongoing study regarding the subject, as well as the use of mobile devices as a platform to change people's behaviour. We present details about the design process, implementation and deployment of a mobile application prototype using principles of persuasion in order to support the users in their quitting attempt. Finally, we present the findings of a conducted field study, which is discussed and reflected on. We conclude by considering future work within smoking cessation and the use of mobile devices in this context.

RELATED WORK
Several studies regarding changing people's behaviour in a smoking cessation context have been conducted. This study extends the work of Ploderer et al. [14] [15] [16] within this field. Their work introduces the

ambivalent socialiser as being a person who is simultaneously keen but also reluctant to engage with others via social media due to failing a quitting attempt is highly likely [14]. It is assumed that contact with peers through a persuasive technology can offer support and guidance within smoking cessation. In their study, they discuss the rationale for applying four different types of user involvement (structured socialising, incidental socialising, eavesdropping and trace sensing) and suggestion on how to facilitate these in a social media application. When working with ambivalent socialisers it is important to consider their current individual needs, as their behaviour may change over time.

In another study conducted by Ploderer et al. [15] they examined the relationship between stage of change and social support by analysing messages posted on a public Facebook support group for people trying to quit smoking. The study shows that the type of support is related to the stage where the users find themselves. The supportive response and leadership in the support group mainly came from people who just started their quitting attempt rather than from people who considered themselves as ex-smokers.

Their latest work introduces a distraction app, which makes use of different kind of distractions and tips for the user to apply when experiencing cravings [17]. The findings from the study shows that distractions and tips complement each other in interesting ways. While the distractions attracted users to the app, the tips kept the users engaged for longer periods of time in order to prepare for quitting, cope with cravings and strengthen commitment to stay quit. The popularity of personal stories throughout the application suggested that they may have a value as a separate feature to the app, which could be implemented in another version of the system.

In this study, we want to incorporate the findings from previous research, by implementing stories and tips in a mobile application to get a better understanding of their value and impact in the context of smoking cessation. Furthermore, we add a third type of content, motivators, to study the perception and usefulness. The main goal is to explore these different types of content in the context of health behaviour change. The study also looks at two labelled sources of recommendation of different types of content to see whether they have an impact.

RESEARCH DESIGN

This study examines the motivating qualities of three sources of content (stories, tips and motivators) presented on a mobile device. The study also introduces two sources of recommendation (experts and community). Each of the three content types are labelled as recommended by one of two recommenders, resulting in six different types of content being sent to participants during the study. (see Table 1). Each of these content types were examined in respect to how effective they were in persuading people to change or reflect on their smoking habits. The content was provided through a mobile web-application (app) called Quitty. The prototype app was developed and deployed to 11 people (living in Australia), who were interested in or currently trying to quit smoking.

	Recommenders	
	Social proof (**Community**)	Expertise (**Expert**)
Stories	Stories Recommended by **community**	Stories Recommended by **expert**
Tips	Tips Recommended by **community**	Tips Recommended by **expert**
Motivators	Motivators Recommended by **community**	Motivators Recommended by **expert**

Table 1 - Table showing the six different types of content sent to the users

Each participant was asked to fill out a survey prior to a three-week field study. The purpose of the survey was to get a better understanding of the participants' demographics, smoking habits, attempts to quit smoking, reasons to quit and also if they previously used a quitting application and/or website. After completing the survey, the participants were given a link to the app, which also gave them an introduction and purpose of the system. The app explored different ways of supporting users in their quitting attempt with information to give them better knowledge on how to quit and change their current thinking and/or behaviour. Following the three-week field study, the participants were invited for a post-interviews which focused on the usage of the app and their reflections on the different content types and sources of recommendation.

Quitty

The main aim of Quitty was to explore whether people who were interested in, or attempting to quit smoking, found it supportive to be given helpful information about quitting. Furthermore, we investigated the potential impact and benefits when participants received content from different types of recommenders. We asked the participants whether they found the content and its source of recommendation trustful, and how they responded to the given content.

One of the key functions of this study was to utilise realistic content for the users to explore. Therefore, we contacted Quit Victoria in order to obtain information and stories written by smokers, ex-smokers and experts on the topic. Thus, the content was reliable and from a trustworthy source - aiming to persuade the participant with its sense of genuineness, whilst providing information that is assured by Quit Victoria to not be detrimental to their health. Despite the fact that the app presented in the paper may be perceived as a technological probe, the central goal of this study was to explore various content types used whilst advising

participants, rather than exploring the technical aspect or usability of the software itself.

Expert evaluation

Before the participants were given access to the app, an expert evaluation was conducted with lectures, PhD students and researchers from the University of Melbourne in the Department of Computing and Information Systems. They were able to access the app, familiarise themselves with it, and then asked to perform a set of simple tasks to find usability problems and obtain useful feedback.

DESIGN OF THE QUITTY APP

The Quitty app has been designed to prompt the user upon their first log in to the app, enabling them to be guided via a walkthrough tour, highlighting both the purpose and how to use the app. This walkthrough contains a welcome screen, a description of the content, an explanation of recommenders and a description of the rating system (see figure 1). The user will only encounter this walkthrough on the first login. However, users are able to access this information via the help menu within the app.

The home screen of Quitty has three menu items: Stories, Tips & Motivators (see figure 1). Each day a user would receive one piece of content within each of these menus.

Stories menu

The 'Stories' menu provided a vast selection of real-life, first-hand experiences of quitting smoking, written by smokers and ex-smokers. The app provided a variety of stories, which were each aimed and focused at different stages of quitting.

We included stories as a central part of our content sources, due to the fact that the use of stories as a health behavioural change strategy has increased [8]. Hinyard argues that stories are a comfortable, familiar and non-confrontational way of receiving information, that supports people to make a behavioural change [8]. According to Diamond et al., storytelling is how people learn and exercise agency, shape identity and motivate people to act [3].

Tips menu

The 'Tips' menu provides the user with helpful advice and guidelines on how to quit and/or maintain their non-smoking habits. These tips were written by experts from Quit Victoria, which takes into account different stages and situations that smokers may experience when attempting to Quit (note: the Quitty app, however, does not take into consideration the individual quitting state of a particular user).

We included Tips as one of main content types, as studies show the effectiveness of using tips to support people in a healthcare environment. Tsang [26] argues the usefulness of these tips, however also stresses the importance of delivering these tips carefully, in the right way and at the right time. Tips are also widely used by major quitting cessation organisations and websites such as Quit Victoria[3] [26]. Another study by Langford et al. describes informational support or tips, and validates the use of these to better achieve a behavioural change [10].

Motivators menu

The 'Motivators' menu contains different reasons and motivations that remind a user as to why they are/should be quitting. The motivators were written by experts from Quit Victoria and considers different topics such as health reasons, social reasons, statistical reasons, facts etc.

We have included motivators as a content type as Morris [13] argues through her paper that reminding people of what they can gain or lose as a result of smoking versus quitting smoking, has a significant impact on user behaviour. This is further supported by Mann et al. that illustrates that gain and loss messages is an efficient communicator of both positive and negative persuasive appeals within a healthcare context [12].

For each of the menu item pages, it is possible to view previous content by clicking on the 'All' button; this gives participants the ability to look at all of the content,

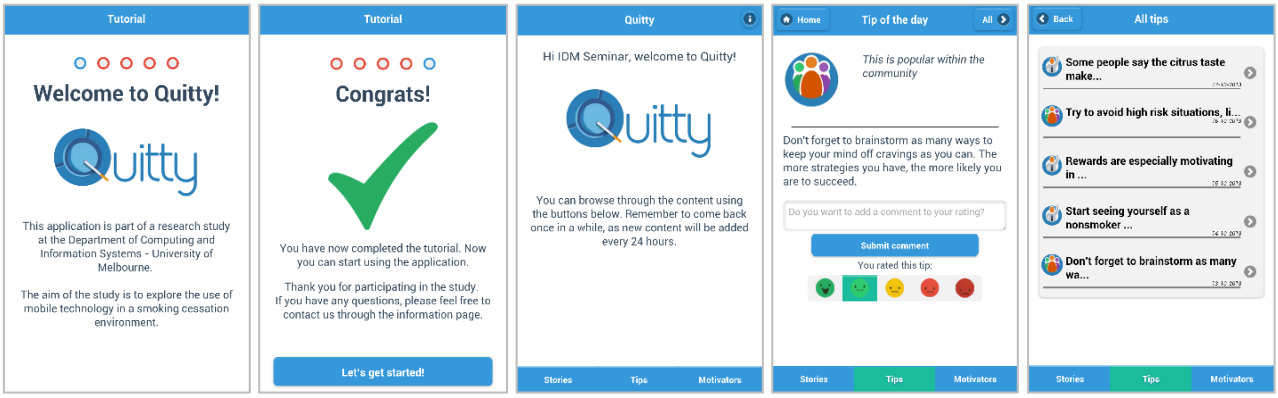

Figure 1 - From the left: Quitty tutorial page 1, tutorial page 5, Quitty start screen, tip of the day screen and all tips screen

[3] A joint initiative in Victoria, Australia established in 1985 set to reduce the consumption of tobacco

in case they miss it one day, or perhaps want to review content that they have previously read.

Two recommendation sources
Each of the content types were labelled as recommended by either an expert or the community, which is illustrated by two different icons on the type of content (see figure 2).

Figure 2 - The Quitty icon for the Expert recommendation (LHS) and the icon the community (RHS)

Expert recommendation
The expert recommendation represents a recommendation from an expert within the health organization, Quit Victoria. We have used this because Fogg explains in his book *Persuasive Technology* (Fogg, et al., 2002) the use of expertise as a way to persuade people to do a specific behaviour. He argues that advice from a credible source such as an expert, authority or verifiable figure, has the potential of appearing as trustworthy, which is an important factor (as credibility and reliability are essential) when attempting to persuade a person's behaviour.

Community recommendation
The community recommendation, as included in our design, represents the popularity of the content within the Quit Victoria online community. Cialdini argues in *Influence: Science and Practice* [1] that the principle of social proof determines what is right by finding out what other people think is correct. This specifically applies to the way in which people make decisions in order to constitute and justify correct behaviour. A behaviour is observed to be correct in a specific situation by the degree to which we see other people performing it as well.

Pathamanathan et al. [18] built two mobile apps to encourage pro-environmental behaviour in two different contexts: watering gardens, and electricity usage in households. The systems used both expert and community information to advise the users. The study showed that using expert and community information was a useful way to persuade users' behaviour.

The labelling of content as being either recommended by an expert or the community was randomised, allowing us to determine whether this characterisation had an impact on its perception and rating by a user.

The rating system
To gather data during the three-week study period, the system makes use of a rating system. This system

Figure 3 - Five smileys used in the Qutitty app to gather user feedback on the content provided, from extremenly happy (far left) to very unhappy (far right)

contains of five 'smileys', wherein the icon on the far left indicates the highest rating, and the icon on the far right illustrates the lowest rating (see figure 3).

The app asks the user, 'How helpful was this motivator/tip?' and 'What did you think of this story?' This allows us to gain feedback on the content; furthermore, through the addition of optional comments to a users' rating, we are able to get a better understanding of the rational of their rating. During the three weeks of using the system, a user has the ability to re-rate a particular content, if they happen to change their minds in retrospect. This was a mechanism put in place on the basis that a particular content might have been helpful on one particular day, but not on another day, for an infinite amount of possible factors and reasons.

Incoming messages
During the three-week study period, the participants received a text message each day on their mobile device, notifying them that new content had been added to the app. Each of these messages had different phrasings to incite some interest for the participant to return to the application, and avoid seeming monotonous. According to Fogg, who conducted a healthcare study, using SMS-messages to notify people as an enormous potential to trigger users to a proposed behaviour [4]. Other research points to text-based messages as being the most effective in order to avoid psychological reactance [21]. To help participants believe that these text messages were not automated, we included their names at the beginning of the message, personalising it so that the user would feel it was more directed towards them.

Technical design
The app was designed in a four-week period by the researchers. In order to avoid dependence on a single mobile platform and operating system, the system was designed as a web-application. The prototype was developed by using an open-source framework called Appery.io[4] that offers a cloud-based rapid development environment that integrates backend services and API plugins.

A database was used to ensure that the actions from the users were logged by the system. The database contained content extracted from Quit Victoria's database and also data from logging usage of Quitty.

USER STUDY
The prototype was deployed in a study with 11 participating smokers and ex-smokers. The objective of

[4] http://appery.io/about-us/

the study was to explore how the participants would interact with the probe and what types of content and recommenders they preferred. Furthermore, we were exploring if any of the app's content and recommenders would persuade the participants to reflect on or even change their current behaviour.

We also conducted a pilot study with a Ph.D. student from the university to ensure overall quality and to gain an insight on the finding we would potentially gather.

Participants

The participating smokers and ex-smokers were recruited through the Melbourne Universities student and staff portal. We also made use of people at the Department of Computing and Information systems as advertisement to people in their social network by mentioning the project at seminars and on Facebook. Furthermore, we advertised the study through posters around the university.

Each of the participants had to meet a basic set of criteria in order to be included in the study. They either had to be currently or previously smoking. The participants were required to have either a smartphone or a computer. The participants were also required to have a mobile phone, which was able to receive SMS-messages for the notifications about new content in the Quitty application.

All of the participants were asked to use the Quitty application at least once a day to view the daily added content. The estimated daily usage of the application was approximately 5-10 minutes. The participants were also asked to check their mobile phones for incoming SMS-messages, which notified of new content added. They participants were allowed to use the Quitty application freely at their own leisure.

The study had 11 participants who were smokers or ex-smokers. 8 of the participants were male and 3 of them females. The age range of the participants were from 23 to 47 with an average age of 34. All of the participants had tried to quit smoking before, 3 were currently trying to stay quit, 2 were thinking about quitting and 6 were preparing to quit. The nicotine dependency of the participants, as based on the Fagerström test [6] showed that 4 participants scored 0 (no dependence), 2 participants scored 1-2 (very low dependence), 2 participants scored 3 (low to moderate dependence), 2 participants scored 4 (moderate dependence) and 1 scored 5+ (high dependency).

METHOD AND DATA COLLECTION

In the initial part of the study, each participant was given access to an online survey in order to gather information about them. The first part of the survey asked demographical questions such as gender, age, occupation, marital status and if they had children. The second part asked information about the participants' smoking habits. Here we made use of a shortened version of the Fagerström test to measure the participants' nicotine dependence. We were also interested in knowing which smoking stage the participants considered themselves of being at, how long they had been smoking, in which situations they were motivated to smoke, when they were most likely to smoke and their reasons for quitting. The third part of the asked questions about their quitting attempts, which included the number of times they have tried, how long their longest quitting attempt lasted and what tools they have used to help them in their quitting attempt. We were also interested in knowing if they had used a quitting app or website before. The last question in the survey considered the time of the day where the participants were not able to check their phones for SMS-messages. The reason for this was to find a good timeframe for the push messages in order to give the participants the information at the right time without interfering with their daily routines.

The study was conducted during spring 2013 in Australia over a period of seven weeks. Each participant was asked to use the application once a day and received a reminding SMS-message. The participants had their own personal login which was based on the three last digits of their phone number. All participants would receive the same content but randomly labelled as recommended by either a community or an expert. The participants were not aware of this randomization of recommendations during the study. They were all asked to give feedback of the content through ratings and comments.

During the study period, Quitty was monitored remotely. If a technical issue should occur during the trial, the researchers would be aware of it so it could be solved as quickly as possible. The participants could also contact the researchers directly through email, if they found problems when interacting with the system. Every time the participants logged into the system their input was saved in a database to monitor user behaviour.

After the three-week deployment with the user, a semi-structured interview was conducted with each of the participants. In this method we used an interview guide with topics that we wanted covered. If the interviewee made an interesting point during the sessions, the interviewer could always chose to pursue this further [9].

The purpose for this interview was to discuss the different types of content and recommendations that they had received each day: what types of content the participants liked and did not like, what their thoughts of the recommendations were and whether it had an impact on their thoughts of the content? Another purpose was to discuss the usage of the application and also the push messages.

The first couple of questions were about reflections on the use of the app as a supporting tool for quitting smoking which were followed by questions about the different kinds of content and recommenders and how they were interpreted and used throughout the study. We

were particularly interested in whether the source of recommendations had an influence on their rating decisions and the reasons behind their decisions. We were also interested in the participant's reflections on their smoking habits and whether they changed during the study.

Based on their interactions with the system and comments made during the three-weeks study, we also asked which effect the content had on them when it came to motivation and inspiration and how useful they found the content. Furthermore, we wanted to know if the participants used the application as a substitute for smoking.

Each of the participants was presented with the table of content and recommenders and how they interacted with the system.

All the interviews had an approximate duration of 45 minutes and were all recorded and transcribed.

DATA ANALYSIS

For the data analysis a selection of coding techniques were applied from Grounded theory to analyse the data [11] [24].

During the analysis, we used Open Coding to mark significant and important points made by the participants. Each of the interviews were coded by two members of the project team in order to get different perspectives and to make sure that all the important aspects would be covered. It was randomised which interview each member was given, to make sure that they were not coded by the same people.

By using Affinity Diagrams [23], 40 different phenomena were categorised. Most of these were divided among 8 main themes – the rest were considered of minor or of no relevance.

FINDINGS

Our findings were derived from the 10 interviews with the participants and their interaction with the Quitty application (1 participant dropped out during the study).

Mobile usage of the Quitty application

The study shows that 9 out of 10 participants used their mobile phone as their platform to access Quitty. The participants made a total of 98 logins during the three weeks of deployment with an average of personal logins at 0.47 per day. In the study period we logged a total of 792 browsing interactions, the highest number for a single participant being 192 entries and the lowest being 16 entries. During the study, the participants indicated that a mobile device was preferred within a smoking cessation context. One of the reasons being that it can be easily accessed everywhere when you are having a craving for a cigarette: *"I prefer it on the phone. It is like maybe if you are in a bar and you like, you can actually ask, what do I do if I actually see someone smoking and I am in craving."* Another participant addressed quitting smoking as being a very private thing, which means that using a mobile device offers a possibility to look at the phone secretly: *"If you associate with smokers they will go "Oh come on, what are you doing, you are not going to do something as stupid as quitting! […] Qutting smoking is a private thing […] And having an app on your phone means you can kind of look at it, secretly."*

The participants used the Quitty app in different locations and situations. This includes being at work, at home, when socializing etc. As instructed, the participants used the application throughout the entire period. However, we discovered major differences in how often they used the system. For example, a participant logged in to the system two or three times per week, while another participant only used the system twice.

Incoming messages

Once a day the participants received a SMS-message from the Quitty team reminding them to check the app, read and rate the content. These messages were sent at different times each day and about half of the messages were personalized to include the participants' name. 8 out 10 expressed that they liked the text messages. Only 2 did not like them because they found them annoying, especially when receiving the texts at inappropriate times. However, 9 out of 10 participants found the messages usable and it made them use the application more. *"These were good reminders. So If I did not check it that day so it was like 'oh yeah that's what I have to do'. Because you do forget especially if you are busy or you are tired."*

One of the participants mentioned that he found the text messages even more motivating and encouraging when he discovered, by coincidence, that the messages were from a real person and were not computer-generated: *"They were good […] It was nice that it was an actual person sending the message. I only realized when I wrote back to it and someone responded. After that, knowing that there were someone there, I found the messages encouraging and positive and friendly and that was my main motivation for checking the app, was getting that text message."* This indicates that using real person to write the messages to user can have a bigger impact.

The participants often logged into the app after receiving the text message, because it reminded them that the application exist and what they are trying to accomplish. *"No, generally if I would receive a text message and I was having a cigarette or I just had a cigarette it would make me feel a little bit guilty."*

Some of the participants also mentioned that it was a good thing that the messages did not arrive at the same time each day, e.g. one of the participants mentions creating strategies to avoid them, when knowing the exact time it arrives each day. *"I have already developed a strategy for it, but I still haven't quiet gotten myself to take it off. But getting those messages it wasn't at a set time, there was no "Oh that message is going to come, if I put my phone away I won't see it" it would come*

through and I would go "Oh I got a new message! Uh it's from the app! Cool", "oh I just had a cigarette I feel kind of bad, I will quickly stub it out, then I will go look at the app, just in case the app will know!"

It was addressed during the interviews that it is important that the messages should be interesting and maybe funny in order to keep the participant engaged. *"Because then it will keep me interested in the application and in what it actually are going to say next."* The text messages should not be repetitive, because that will lead the user to start ignoring them. It is therefore important to be creative and inventive when writing these messages in order to keep the user engaged. A participant mentioned that a way to do this could be to include a teaser of the content in the message.

Another important aspect, that almost all of the participants mentioned, was that it would be useful if the messages included a link to the app, which would make it easier and quicker to access. By including a link, it would potentially have made them use the app more, according to the participants.

Design of the application

The participants indicated that they liked the clean and simple design of the app. One participant said that he liked that the app was optimised for different resolutions and devices. Overall, the participants thought that the app was reasonably useful with its content and functionality.

Content

During the study it was discovered that the participants in general were more fond of content that had a gain framed message rather than a loss framed message. An example of this would be a message saying, how much their lungs will improve by quitting rather than having a message telling them how much their lungs would deteriorate from continued smoking. *"I think it was a week or something, the effects on the body and I thought that was a very good way to kind of 'wow I didn't realize it was only that long before you see positive effects' you know and things like that, rather than ones that were you know […] talking about damage."* According to the participants, they would be more likely to ignore the "negative" content, as they felt they had seen enough of this already and thereby have become immune to this type of content. A few participants mentioned that they would rather receive negative or edgy content or a mixture of both negative and positive content in order to help them quit smoking.

Six of the participants expressed that the application did not provide them with enough information. Both in terms of the amount of content released each day, but also because of the lack of in-depth content.

The study indicated that the users were most fond of receiving tips (6 out of 10), while stories and motivators were equally split across the rest. An interesting aspect of this is, if a participant was more fond of tips, he/she would most likely also have an interest in the motivators and a lesser interest in the stories. Vice versa, if a participant was more fond of stories, he/she would not necessarily find tips and motivators as useful. Although, in general the participants thought that the content types supported each other well. This was also indicated by the ratings given in the app where each of the content types had an almost equal score. Furthermore, the study implies a confusion of the content types, tips and motivators, which were difficult to differentiate from each other, due to the similar structure.

Fake/Genuine content

5 of the participants stressed the importance of genuine and realistic content. 3 of the participants thought that the content seemed fake, where it seemed like it was made up, which is both due to the impersonal nature and structure of some of the stories. *"Some of the stories I found to be, almost to the degree that they read as if they were just made up. 'Today I am going to quit, I've decided I am going to quit today'."* This is interesting as all the content supplied in the app are from the Quit Victoria website and not made up for the purpose of this study. Another participant pointed out that when a story does not cover how hard it is to stop smoking, it does not seem real.

Condescending content

4 of the participants found some of the content in the app condescending. This occurred when content being comprised of knowledge that they already knew; in this instance, they felt patronised as this information was not new to them. *"…and that was as well condescending that I felt like. Yeah, you know having tried it or like, you know 'Good little smokie you get a sweetie'."*

Tips

The tips were described by the participants as practical, concise and simple. A typical tip is easy to implement, but it may not work for everyone. *"Probably a tip might not work for everybody. When it comes to tips and it comes to quitting smoking I think really basic things are quite good, […] you don't necessarily think 'If I really want a cigarette, If I just takes some deep breaths and just wait that minute, that might help', you don't necessarily actively think that."* Even if a tip does not work for the user or it is a tip that they are already aware of, it still helps reinforcing their behaviour. *"To change your routine, go for a walk, take your mind off it, do something else. Most of the time you have a cigarette because you're bored as well. So, it's kind of reinforcing behaviours that you already know you should be doing, but to actually see it written there as well it also reiterates it."* One of the participants indicated that a tip should not only be focusing on the quitting aspects, but also try to come with ways to get healthy again. *"Yeah and it would also be good if like receiving tips, not just about like smoking, not smoking cigarettes, but also to receive like some sort of tips about actually getting yourself healthy again. Because that is one of the main things that drives you to stop smoking cigarettes, is to get healthy."*

For a tip to be considered useful and good, the study shows that it should be easy to implement. This means that it has to be realistic and achievable for the user, which also involves instruction and examples. *"Actually tips would also be about how realistic I found them. Like how I could actually implement them realistically. Those would be my three things, you know if I can relate with it, is it easy to implement or not, if you are starting off, it should be very… You know like someone who is a heavy smoker he wants to quit either he's got to be really mentally prepared for it or you actually need to like, get him ready, you have to get him psyched and mentally ready to bring really, really small changes into his smoking habits."* This statement also indicates that if a user can relate to a tip and actively apply it in their life, it is more likely to be considered a good tip. Another aspect that would make a good tip is to make use of content that is original. *"I think a good tip would be something people are unlikely to have thought of. I don't know how possible that would be, but yeah something that people haven't really thought about would be a great tip. "*

In contrast to the good tips, a bad tip is when you do not supply the user with much detail on how to actively apply the tip. It is thereby important to come with possible ways and examples on how to implement it. Some of the participants stated that when a tip was psychological, such as "Think of yourself as a non-smoker and the benefits you would gain", was not a helpful tip, which indicates that a tip should be practical. If a tip is not relevant to the user, it is also considered bad. Relevance are when the participant can apply a tip or it focusses on their quitting stage. *"You know and I mean once you go and do it, you do feel better, but you know, that fairly common tip 'Just go for a walk or something' initially when you quit smoking, that's the last thing you feel like doing, because you don't feel right. Tips like that it's like "no! I am not going to go and do any exercise, this is hard!"*

Stories

The stories were described as being content telling personal experiences, which gives an opportunity to relate to the people who wrote the story. *"So you know, I can't relate to this, but, I'm listening to someone, whose not trying to scare me into something, 'I'm not trying to do this', just telling me her experience, and sharing that with me, and encouraging me to go on my own journey. So, I respond to that positively."* Stories also offer hope to people who are trying to quit smoking. A participant explained that even a small hope, that it will get better, can have a huge impact on the reader. *"I think for me personally if I had read stories about, you know, 'I quit smoking after 20 years and it was horrific and I hated it and I thought I could never live without cigarettes, but eventually it got better and I thought about like every day' a story like that I would have gone 'Yeah, I guess there is some sort of hope.'"* Stories did also differ from the other content types by offering emotion, rather than being factual, according to the participants.

The study indicates that, for a story to be considered useful, it has to grab the reader's attention and offer something different. Many of the participants talked about stories missing the middle part, which should elaborate the struggle of quitting, the reason being that this makes it easier to relate to the person in the story and create a feeling of reality. *"Look there's always the stories about, across the board, there is always stories about people who smoked for 20-30 years and "then I decided I had enough" and that is all well and good and okay that's how the story panned out and you have got to that end point now and after 30 years you have quit. Did you feel really horrible in the middle? Was it really bad? Now you have reached that endpoint. Stories like that I just found no resonance at all."* The participant described the "struggle" as being inspirational, which increases the usefulness and quality of the story.

A story was considered bad if it was not relatable to the participants. Elements that make it relatable includes, but not limited to: demographics, experiences and quitting stage. *"I think to me, the bad stories were, a lot of them were then, things I really couldn't relate to like quitting for my children or quitting because you got really sick…"*. This is closely related to stories not being realistic, which is important for a story to be considered useful. *"Just sort of, not like 'I could and it was so easy, I can't believe I didn't do it sooner', because it is not realistic to me. I have tried to quit a lot of times and that is not easy at all."*

Motivators

The motivators were considered as being factual content that could add both new information and things that the participants were already aware of. *"A good motivator is things like knowing that, things I already know that I sort of needs to be reminded of, if I quit smoking I could exercise more easily and I wouldn't get puffed walking on the street or whatever."* The participants were fond of these insight which made them reflect on themselves. A participant stated that motivators help on a subconscious level. The study indicates throughout the surveys and interviews that the biggest motivator within smoking cessation involves money and the earnings from quitting.

Most of the participants stated that for a motivator to be motivating, it has to be positive. This means that the motivators' focus should be on the gains of quitting. *"The good ones I found in that were positive saying like 'after a week..' or whatever you know "these are the health benefits' you know, the positive effects that you can get rather than the necessarily shock tactics."* The participants also indicated that these positive motivators help to give more confidence because they usually focusses on the achievements they have reached. Like the tips and stories, a motivator also has to be relatable in order to be considered useful.

A motivator is perceived as bad when the focus and phrasing is negative, the reason being that these motivators are not considered motivating. Some of the

participants indicated that if a motivator was long-term focused, they had difficulty in relating. *"15 years seems like a very long time, you know and to think like, it's like in 15 years I will be 50 or something. It's too far away, it's not like… it's kind of discouraging to think that I have done that much damage and that is going to take that long to get any kind of benefit."* A motivator then has to be short-term focused, so that the participant can see the immediate effects of quitting smoking.

Recommenders

In the app, the participants received content recommenders by either an expert or popularity within a smoking cessation community. When asked if the participants noticed these recommenders only 4 out of 10 said that they did. The rest of the participants either misunderstood this concept or overlooked this.

During the interviews, the concept of having a recommender was discussed, where 5 of the participants preferred having community based recommenders. *"Where I found it, like, easier if something that was a community kind of driven, that I knew was correct information, I found more accessible, because it was from people going through the same struggle."* This indicates that the users find it more useful to receive content recommendations from people in the same situation, which may not be the case with an expert. *"I don't know if being expert requires having experience of reality addiction but it doesn't necessarily imply that they have been though it. Maybe they know the facts and figures, but they haven't lived it. Experts do not know how it is."* 2 of the participants preferred an expert recommender and the last 3 wanted both or either. However, it was discussed that these recommenders could compliment each other. 1 participant stated that he had high expectations when something was labelled as being recommended by an expert.

A few participants mentioned that it was important to know the source of the content, the reason being that it helps the user to trust the content more.

Relatability and tailoring

The study showed that relatability is an important factor in order to determine the usefulness of the content. All the participants mentioned that they liked content that were relatable. If the participants could not relate to a type of content in any way, it was disliked and not found relevant. Even though that all of the participants agreed on the importance of relatability, they did not agree on what it should be based on. 5 out of 10 participants expressed that they could only relate to content that focused on people with the same demographics and quitting stage as themselves. If the age gap was too big or the content was describing a different quitting stage, they found the content irrelevant. *"There is no bad stories. Relevant stories. To someone's personality. You know what I mean. I don't care about 18 years old kids. I don't care about this mother who has two kids and harming her to give up smoking. It's not my life it is your life honey."* 4 out of 10 participants said that the demographics were not the key factor to determine relatability. Instead the relatability was determined based on the content itself, how genuine it was and how well it engaged and involved the participants. *"Whilst a lot of them didn't relate to me directly in anyway, because I don't have children or I don't have this… it felt genuine enough that I could access it. It felt that there was enough in it that I felt I could make an emotional connection, it wasn't preachy, it wasn't this… it was just an experience that someone was sharing."*

9 out of 10 participants mentioned tailored information as something they would like to see more of. The two main aspects that should determine the tailoring was demographics and quitting stage. 6 out of 10 mentioned the quitting stage as having a significant influence on their perception of the content. *"Some of them I found frustrating to read, because, hearing other people having succeeded, when you are still struggling is difficult."* 2 of out 10 thought that the demographics was important while the rest did not mention it or did not find it important in relation to relevance or value of the content in relation to tailoring.

Social interaction

9 out of 10 participants showed interest in having some sort of social functionality in the application. Some wanted the ability to write to the authors of the content, in order to ask questions about the content. Others wanted to be able to contact a smoking cessation expert to get personal advice or ask simple questions. One participant mentioned that this functionality would give him a bigger motivation to use the app as a substitute for having a cigarette. Most of the participant mentioned the importance of being a part of a community while trying to stay quit. This could both be as an online community or someone to arrange social activities with. 5 of the participants stated an interest in sharing their own experiences with other people online.

Tracking and feedback

Another topic that immerged throughout the interviews was tracking and feedback. 6 out of 10 participants mentioned that they wanted a type of tracking within the app in order to measure progress of their quitting attempt. *".. I don't necessarily count the days, but then I can perhaps with a tracker go "Oh it's been nine days and twelve hours! This is great! I feel better now, it felt like it was only two days!" I think that would probably be the only thing that I feel would improve it, just something like a tracker to monitor your own progress."*

By being able to self-monitor their progress, the participants wanted it to be combined with positive feedback, which could be a type of achievement or badges based on the users' activities and actions. *"Things that would be encouraging would be sort of again a tracking kind of stuff like motivation of, congratulations you have gone a day or week or months. Sort of focusing on the positive."* This form of rewarding could help motivate in order to stay smoke free.

DISCUSSION

Our aim was to study different content types within a smoking cessation context to get a better understanding of the potential use of these. We found that the content types where somewhat useful in helping people to quit smoking. The study also shows that quitting is a very personal area, in which each individual has their own needs.

During our analysis, 8 interesting themes emerged. Even though these themes were elicited from empirical data about smokers, we suggest that they may also be relevant for designing persuasive mobile technology in other domains.

The 8 themes are as follows and will be discussed: Relatability and tailoring, reminding messages, gain and loss framed content, genuine/fake, the content types, sources of recommendation, tracking and social.

Relatability and tailoring

One of the big discoveries from the study is the phenomena of relatable content. The study indicates that when the users received a piece of content that they cannot relate to or make us of, it is considered less useful. This is closely related to that of tailoring where participants mentioned that tailoring could be based on their demographics and quitting stage. However, it is important that this process is made simple in order to achieve the wanted result. A participant stated the following: *"I think users wouldn't really want to be having to input a lot of stuff each time. If there was just a simple slider though of showing where someone thought they were at that might change every day, that might give the app an idea of which tips and motivators to show them."* This support earlier studies in this and other domains, such as Dijkstra [2] and Paay et al. [18] This further supports the theory of credibility by Fogg. According to Fogg it is especially important within a HCI contexts, when systems, such as the Quitty app, has to instruct or advice a user (Fogg, et al., 2002). This can lead to an increased power of persuasion, which can be achieved by contextualized information that fits the user's quitting stage, such that they only received content that are relevant to their situation.

Reminding messages

During the study we discovered that the text messages where considered an important and useful functionality within a smoking cessation context. The participants perceived these as a positive reminder. The study indicates that the messages are a useful tool to get users to perform a specific task, even when they think that it can sometimes be annoying. Both the data logging and the interviews points out that it made the participants use the app more. The usage of these text messages also supports Fogg's theory about triggering the user to do a specific behavior (Fogg, et al., 2002).

Gain and loss framed content

In general the study indicates that the users are more fond of receiving content focussing on the gains of quitting smoking (e.g. the improvement of general health) rather than content focussing on the negative aspects of smoking (e.g. risk of diseases). This does not mean that loss framed messaging are not helpful in order to stay quit or obtain a realisation of quitting. The study shows that even though the participants dislike loss-framed content more, they still paid attention to these in the Quitty application. This can indicate that these type of content have an impact, despite the users opinion. Secondly, even though that the gain-framed messages were liked more, it does not mean that it is the right type of content to show the smokers in order to get them to stop smoking. It may be the case that different type of messaging can be applied at different stages throughout the quitting process to achieve maximum impact. This is supported by Professor Ron Borland from Quit Victoria who states that negative or shock-inducing types of content may be a useful tool in order to get the user to realise that they should quit – such as the images and messages currently displayed on cigarette packets in Australia, while positive content has the best impact on smokers who have already decided to quit. [Borland, personal communication]

Genuine/fake

An interesting finding throughout the study was the topic of fake content. This was particular interesting, due to the origin of the content was from real people who had, or are currently trying to quit. The study implies that for a piece of content to seem real, it has to describe the struggle of a smoking cessation and what can be achieved by quitting. Furthermore, if the message is not seen as achievable by the participant, it may seem unrealistic and fake. It is therefore important to describe the process of quitting and what the user can expect from quitting.

The content types

The study made use of three different content types: tips, motivators and stories, which had different impacts on the users. The study implies that the majority of the participants were most fond of the tips, due to the reason that they were practical and easy to implement in their attempt to quit smoking. However, the numbers show a small difference between the motivating effect of the different content types, which could imply that they support each other well.

The way these content types were perceived, matched the results from previous studies in order to make a behavior change within health care. We cannot say that these help users to successfully quit, based on a three-week study, but the study shows a potential of using these, which may lead to a change in behavior.

Sources of recommendation

In the design of the study we labelled the content as being recommended by either an expert or a community to see if this had an impact on how it was perceived. The study indicates that these recommenders do not affect their opinion. The post-interviews revealed that most participant either did not notice the different recommenders or did not understand these, due to e.g.

the design of the app. When asked what which recommender they were most fond of, community came out as the most preferred, because it originates from people in the same situation. Experts was perceived as being people who are not in the same situation. Furthermore, the title of being an expert creates a higher expectation, the reason being that they would only recommend high-quality content. This supports concept of social proof as an effective persuasive principle [1]. However, the opinions of the recommenders indicated that content from either recommender has a value to the user depending on different contexts.

Tracking

A closely related topic to the tailored information, was the idea of tracking. The participants suggested that an application that measured their achievements would keep them engaged with the application. The reason for this was, according to the participants, that it would keep them motivated with a visualisation of what they have achieved, which supports the principle of self-monitoring by Fogg [5].

Social

The social aspect of quitting was a topic that was considered important by the participants, the reason being that it can be helpful and motivating to communicate with people in the same situation. This helps users feel that they are not alone and may offer hope to successfully quit smoking. The participants also stated that they wanted to be able to submit content about their own tips and experiences while trying to quit. Previous study by Ploderer et al. [17] shows that even though the users says they would like to contribute with personal content, research indicates that this may not be the case when given the opportunity. Participants from this study implied that quitting is a personal thing and that when quitting, you often tend to isolate yourself.

LIMITATIONS

An important consideration regarding this study and the findings is the ecological validity. The participants' motivation of quitting, may have been the vouchers, which was promised for participating in the study or the actual fact that they are participating in a study. A participant interestingly mentioned this issue during one of the interviews: *"When you have the app and it is in the market or whatever, people that use it is actually people who want to quit. Here like for instance you have a consentive that it is 40$ and it is like an experiment. It is not like I wanted to quit and I didn't even thought of that before you told me this experiment. So maybe you have to think of that. The people that are going to use this system is different than we are."* This is also known as the Hawthorne effect where when participants knows that they are being studied might in worst case scenario distort the results of the study [23].

CONCLUSION

This paper has explored how to design a mobile technology in order to persuade the user. We have described and discussed the design, implementation and deployment of a technology probe in the form of a mobile application. The study elicited several themes that supports new insight into the context of smoking cessation. The study implies that the participants found the tool reasonably useful with different preferences on the content types. The results indicates that to increase the power of persuasion for these content types, they have to be tailored to the user's situation, which then makes the content more relatable. The SMS-messages that were sent out in order to get the participants to return to the app, turned out to be useful and considered to be a positive reminder. The study outlines different ways to strengthen this persuasive technique, based on the participants' opinions.

FUTURE WORK

This study suggests the importance of tailored content within a smoking cessation context. This was not covered in the Quitty app. This could lead to a future study of the phenomena in order to get an understanding on how to tailor information within a smoking cessation context and what impact it would have on the user.

Another area that could be studied further, is the SMS-messages that were send out to the users. Throughout the study we discovered the positive aspects of push messaging, which resulted in the app being used more. The study implies different ways to increase the power to persuade, which could be interesting to explore further.

A third theme that emerged throughout the study was the social aspect of quitting. Many of the users implied that they wished to interact with other people in the same situation or have the possibility to ask an expert for advice, which could be studied further. Furthermore, the idea of contributing with personal content could be interesting to study, to see if the users would actively do this and how to make them do so.

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4 Reflection

This chapter will cover our reflections on the project and the experiences gained from studying overseas. We will also present a side project that was conducted during our stay from which we gained experience in e.g. project management and system development.

4.1 Work within smoking cessation

When arriving at the University of Melbourne, we were given an introduction into the research group's previous studies for a better understanding. Both the introduction and our study showed that working within smoking cessation can be a touchy subject, due to personal reasons for starting smoking and the difficulties of quitting. Our study showed that some of the content in the app came across as condescending, which can indicate that it is important to be careful when operating within this domain. It is thereby important to contribute with content that is respectful to the users in question. When discussing the shock images on the Australian cigarette packages (see figure 1), the participants showed negative attitude towards these, because it supplies them with information they already know of, but do not want to think about. Instead, the participants wanted gain-framed content when in the stage of quitting. Furthermore, one of the participants stated, that quitting is a very private thing, especially when socialising with people who are not trying to quit. The option of having an application on a mobile device could then help in these situations, due to the reason that you can hide what you are looking at on a phone.

[5]

Figure 1 - Australian cigarette packages

The study also showed that the participants had different preferences on what has the most impact when trying to quit. This involves both the phrasings and focus of the content. It is thereby difficult to create a system that suits every ones needs, which is the reason why tailored information is so important within this domain.

We also learned that in order to be sure that the content makes an impact on the user, users have to be engaged in wanting to quit smoking. If users do not find themself in the position of wanting to quit, the content will not be perceived as being useful. This was indicated by the participants in our study, who were very keen on becoming smoke free, which resulted in the content being more useful than to the participants not at the same stage.

Previous studies (Ploderer, et al., 2013) has implied that, when giving users the ability to contribute with own content and be part of a community, they do not make use of this. It is thereby interesting to see from our gathered findings, that the social part was something the participants were fond of. This opens a discussion on the topic of what the user says they want in a system, in contrast to how they actually use it. The increased use of social media does form the basis to further study the use of social interaction within this field.

[5] http://www.healthista.com/health/jeremy-hunt-backs-down-on-plain-packaging-for-cigarettes/

Working within the health domain was a new experience to all of us, which was proven to be a challenge at times, especially with the case of smoking cessation. None of us smokes which meant it was difficult to get a full understanding of the struggle that presents itself when quitting smoking. This meant that it was at times hard to design for smokers, as we did not have any first-hand experience with smoking. Furthermore, it was difficult to express more than sympathy for the participants during interviews when they expressed hardship during their quitting attempt.

4.2 Using a web application

During our research study, we developed a mobile web application instead of a native smartphone app. This was decided because web applications can run on multiple platforms, whereas native apps have to be designed specifically for each type of device. This decision furthermore helped avoiding the use of app publishing portals (e.g. App Store and Play Store) which involves a long processing time.

The study taught us some of the limitations when using a web application as a research tool. These limitations were both met during development and the post-interviews. One of the big issues was the loading time. We did not think it would turn out to be a problem to the participants, but our study shows that it had an impact on their user experience. It even resulted in the application not being used at some occasions as some participants found it frustrating, which meant missing potential feedback from the users.

Furthermore, it was also noted that it would have been better if the application could send direct notifications to the user. This would have improved the interaction, because of the direct linking to the system, which potentially could have made the user interact more with the system.

4.3 Multiple supervisors

In the project we had multiple people with interest in contributing to the project with different ideas and suggestions. It was difficult at times to decide the direction of the project, due to these different opinions taken into consideration. Furthermore, we had to make sure that our project both met the goal set by Aalborg University and the wishes from the University of Melbourne for their future work within smoking cessation. What we learned from this, is to have a clearer chain of command. Later in the process, we were assigned one supervisor from the University of Melbourne, which made decision-making easier. This experience can be useful in our future careers where multiple stakeholders' needs may inflict the same issues.

4.4 Weekly meetings

During the project, we had weekly meeting with the involving people at the University of Melbourne. An important goal of the meetings was to set milestones that made it easy to keep track on the development and discuss challenges that occurred. These meetings kept all involved people up to date.

The meetings did also add the possibility to get constructive feedback on our work, which could involve survey questions, interview questions, approach, findings etc., which helped in both terms of improving and get different perspectives on the topic in question.

Another experience gained from the meetings was doing presentations to show sketches, research design, usability results and findings from the study. This included presenting to different audiences in different contexts, which can be helpful in the future.

4.5 Friday seminar

During our stay the University of Melbourne, we were invited to present our work to the entire department, which they usually organise every Friday afternoon. The purpose of these seminars is to give an insight on work currently being performed within the domain of human computer interaction at the university. The date of the presentation meant that we could not present the findings, as it was at an early stage of the user

involvement. The purpose was to show the department the process of our project and show what we hoped to find out. Furthermore, the seminar was an opportunity to get feedback from people not involved, which could give new points of view. This also worked as preparation and practice to the exam.

4.6 Work across continents

The study was conducted in Australia at the University of Melbourne, which meant that we had to work across two continents and time zones. This turned out to be a slightly difficult process, as some communication was misunderstood due to phrasing, languages and not being able to have a face-to-face conversation. This resulted in a major delay in the beginning of the project. It was difficult to include our supervisor in Denmark in our thoughts and questions, because our view of the project was different from their impression, due to the experiences gained in the design process.

Our primary communication tool was e-mail, which was a useful tool in most occasions, despite the delay in responses, caused by major time differences. The problem appeared particularly in the process of deciding the research design and focus of the project. During the project development one topic kept causing confusion; the table used in the research design, which was difficult to explain through e-mail. This resulted in having a Skype meeting with our supervisor from both Denmark and Melbourne to solve the confusion and make the important decisions for the project. In hindsight, we should have invited for a Skype meeting earlier on in the process to overcome all confusion or maybe even determine the direction of the project before leaving for Melbourne.

4.7 Expert evaluation

Before the participants were given access to the application, an expert evaluation was conducted at the Department of Computing and Information Systems[6] at the University of Melbourne to make sure that the application worked as intended. The evaluation was set up as a focus group evaluation in order to get all the feedback possible within an hour-long session.

The focus of the evaluation was to discover potential usability problems in the system. The evaluation also gave the opportunity to try the application on multiple devices and browsers.

The evaluation gave us a lot of useful feedback, including issues we had not considered. A list of all the results is available in appendix 22. The findings covered usability errors, system problems, design issues, spelling errors, suggestions of improvement and new functionality.

The expert evaluation was more useful than originally anticipated, the reason being that we did not expect a lot of feedback, due to the limited functionality of the system. The findings involved the amount of information given to the user, to ensure a better understanding of the research's purpose. The information that needed to be added were an introduction, sources of the content and explanation of the app, which particularly involved the rating functionality. According to the attendees, the users would need to know the purpose of the ratings and what influence their responses would have both in the study and in the system.

Due to the study involving participants getting daily SMS messages through their mobile phones, an expert stated that it should be possible for the user to indicate what time of the day they would like to receive these. This is both to ensure a higher usage and trying not to give messages at inappropriate times. We applied this option through our survey, asking what times during the day it would not suit the participants to receive text messages.

Furthermore, the evaluation suggested that we should extend the ratings options from 3 to 5, the reason being that it can be difficult to see what pieces of content the user are most fond of with few options. Another

[6] http://www.cis.unimelb.edu.au/

important aspect is the ability to re-rate content, because opinions may change. Some content may be useful one day, but less useful another day.

4.8 Three-week user study

4.8.1 Recruitment of participants

In the recruitment process we made use of the student portal at the University of Melbourne. This process introduced a short delay, due to the advertisement having to be approved first. Because of this we also used Facebook advertisement and posters around university campus to raise awareness of our study.

We were contacted by 17 people who were interested in taking part of our study. Three of them never responded, another three chose to drop out of the study and one was used in a pilot test. Our recruitment process had to be extended in order to get enough participants for our study.

During our project planning we expected to have all our participants recruited by a specified date, so that they all received access to the application at the same time. This turned out not to be possible, which meant that we had to get people started, while still recruiting.

Experience learned from this is to start recruiting process as early as possible and to use as many advertisement channels as possible.

4.8.2 User study

Conducting a user study of three weeks was new to us. One of the experiences gained from this, is the difficulty in keeping the participants engaged in using the study throughout the whole period. We found ourselves spending a lot of time to try and come up with possible ways to encourage user engagement and making sure that each participant was presented to at least each content type and recommender once. During the study, the data gathered indicated a lack of motivation nearing the end of the study, due to the lack of functionalities and content in the application. We were not able to change these aspects due to the design of the system as a research tool, rather than a full-fledged application.

4.9 Interview approach

During our interviews we presented data on how they had interacted with the system to the participants. Figure 2 illustrates an example of the post-interview session. At each interview we showed personal statistics of ratings and user clicks for each content type and recommender. It was important that the user was not presented with these statistics until after we asking them of their overall impression of both the system and each content and recommender type. The reason for this was that we wanted to make sure whether they noticed the recommenders and what they thought of the distributed content, so that the statistics did not influence this. This turned out to be a good approach, due to the reason that some participants could agree on the statistics gained from the database.

Figure 2 – Typical interview setup

The presented data also included the most interesting comments and ratings made by the participant. The participant could then easily recognise the content and give a more in-depth explanation to their comments and rating. The study showed that this approach was helpful to the participants in order to content, comments and ratings. Furthermore, this helped encouraging a discussion on the content in question, which in some cases, made the user change their opinion during the interview. This approach helped strengthen the understanding of the content types and how these fair within a smoking cessation context.

4.10 Affinity diagram

When analysing our findings from the study, we used the affinity diagram approach to help getting an overview. This turned out to be a helpful method in order to find emerging topics in our interviews. Furthermore, it was an easy way to see what the general feedback was for each of the illustrates our office when practising the method.

Another advantage of using this approach is that it is easy to move quotes around into bigger or smaller topics when appropriate. This approach might seem old-fashioned but turned out to be of great value due to its flexibility and straightforwardness. Although this method wass very useful in a smaller sized study like this, we do not see it appropriate to larger studies.

Figure 3 – Afiinity diagram applied in office room

4.11 Ethics

Working at the University of Melbourne has taught us about the limitations of ethics when doing a project, which is different from experiences from Aalborg University. The purpose of ethics approval, provided by The National Statement on Ethical Conduct in Human Research (NHMRC), is to promote responsible research that accords human participants with the respect and protection needed for them, which also can benefit to a wider community (Office for Research Ethics and Integrity, 2012). The Statement clarifies the responsibility of researchers within the process of a project, involving design, conducting, analysis and results of human research. Furthermore, the University of Melbourne is also committed to the highest standard of integrity in research by a Code of Conduct for Research, which prescribes the responsibilities and ethical conduction expected of the people engaged in a research project.

At the University of Melbourne we had to write a plain language statement, explaining the aim and approach of the project. We also had to write a consent form for the participants to sign and agree on, in order for them to participate in the study. Furthermore, we had to outline the advertisement methods and also create a website for the project, where the users could get more information if need be. All these documents and files then had to be approved by the ethics committee at the University of Melbourne, before the recruitment process could commence. The approval may in some cases take several months, which means that it has to be handed in as early as possible, especially when a project has a short lifespan.

The process of getting an ethics approval, means planning ahead and making sure of approaches used. Furthermore questions to the participants has to be prepared upfront. We found this a positive aspect of ethics, because it makes you consider different approaches before involving participants.

Because ethics had a long approval time, we had to work on the development of the system and make all the preparation in the meantime. The ethics approval definitely slowed us down due to the reason that we could not start recruiting before it was approved.

4.12 Additional experiences

4.12.1 Chifish - an application for exploring the conference program of ozchi 2013

During the semester, we worked on an unrelated project, called "ChiFish", during a three-week period. The purpose of this project was to develop a web application that could be used at the Human Computer Interaction conference, OzCHI 2013[7], as a way to explore presentations.

Background

The application was built using iFish engine, designed and developed by Dr Jon Pearce from the University of Melbourne. The concept of iFish is to explore content, when you do not know exactly what you are looking for. Instead of searching content, the system allows the user to explore by interest. iFish is about using an engaging, effective interface to attract and maintain a person's attention, while at the same time trying to keep their focus on the task presented. The way iFish works, is by using sliders that contains two contradictions and topic selections. The user can freely choose to change the sliders and remove topics completely, in order to meet their own interests. The system then shuffles the content, so that the content meeting the criteria the best will come on top (Pearce, 2013).

iFish has previously been implemented through different types of domains to see whether it works in these contexts, such as exploration systems for children's books, restaurants, nectar projects, Majors in the BSc, people in the Interaction Design Lab research group at the University of Melbourne, exhibitions in a museum etc. (Pearce, 2013).

The system

Our work was to incorporate the iFish system, so that it could be used for the OzCHI 2013 conference as a way to explore presentations and find the one to suit peoples' different interests. Figure 4 shows a screenshot of ChiFish, which can be accessed on ozhi.ifish.io.

[7] http://www.ozchi.org/

Figure 4 – ChiFish screenshot

To the left, we find the different presentations from the conference. Each of these presentations is differentiated by colour, based on the conference session. A session is the timeframe and day where the presentations are held. The colouring scheme is illustrated by the numbers to the right of the screen to help the user understand the meaning of these. Each paper contains the most important information relevant to the user. This includes day and time of the presentation, room number, title, information about the paper length (long or short) and the authors of the paper. When clicking on one a paper, the users are met by a pop-up window, which shows a description of the paper, a Tweet button, a button to save as a favourite and a link to the paper in PDF format (which could only be accessed during the conference days), see figure 5.

Figure 5 – ChiFish paper popup

The filters and sliders are located in the right side of the application. When entering the system, all the sessions will be shown. The user can select sessions or days to filter by. Beneath this, the user can choose four different categories; short, long, Australian and international papers. The last function is the four sliders, which slides

between four sets of contradictions. The four contradictions are as following: Theories and practice, experiments and reflections, in the wild and in the lab and understanding and design. Each time the user access the application, the sliders changes randomly in order to encourage exploration. The user can also choose to remove one of these categories, if they are not important in their decision-making.

It is also possible to search by title in the system by clicking on the magnifying glass in the top right corner. Due to the way that the iFish system is configured, it is not yet possible to search by author.

When saving a presentation/paper to favourites, the system stores the data, so that these are not lost when re-entering ChiFish. When clicking on the heart icon in the top-right corner, a calendar styled setup is presented, to make it easy for the user to get an overview of saved presentations (See figure 6).

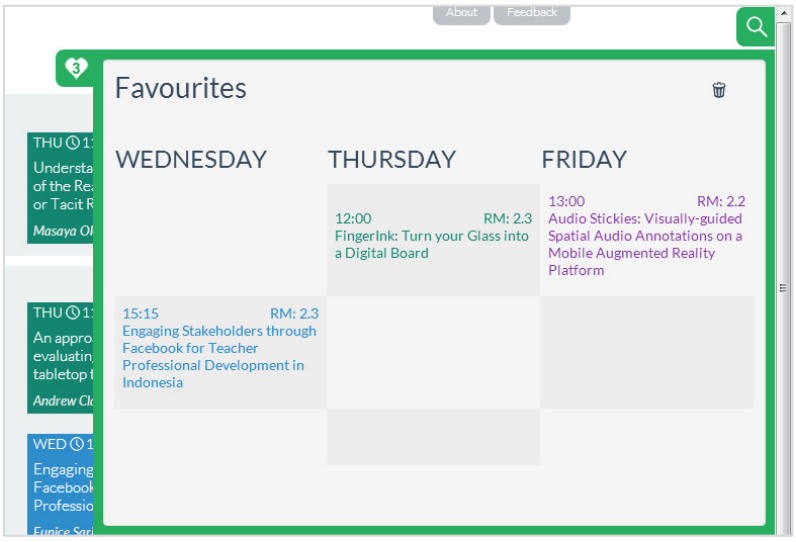

Figure 6 – ChiFish favourites function

ChiFish also makes use of social media: Twitter and Facebook, which could be used before, during and after the conference. The Facebook page was used as a source of getting latest news and changes in ChiFish and to share pictures and opinions.

If the users choose to access ChiFish on their smartphone or smaller tablets, they will access the mobile version (see figure 7). This version has reduced functionalities, due to the limitations found on a mobile device. The mobile version gives the user the possibility to use the four sliders and choose one session in order to find out what presentation to go to.

Figure 7 – ChiFish on smartphone

Distribution of tasks

Due to the timeframe and the scheduling of this side project, we temporarily had to split into two groups. While one group worked on the ChiFish system, the other continued working on the main project.

Despite splitting into two groups, we were still able to support each other with feedback on design of ChiFish during its development. The group working on the main project made sure that the ChiFish group was getting insight on the progress of the smoking cessation project. The experiences gained from the division in tasks, is something we can apply in the future, when multiple tasks are in play. At some occasions, we had to move group members for different tasks in order to meet deadlines, which was a valuable experience in project management.

Expert evaluation

Before releasing the application for the conference, an expert evaluation at the University of Melbourne with the Department of Computing and Information System was conducted to find usability problems, design issues and system suggestions. The session lasted for an hour, where the participants could freely interact with the system, in order to get their first intuitive impression. Later during the session, the participants were handed a list of tasks to try out the different functions of the system.

They discovered bugs in the system which made functions not work as intended. The evaluation also showed a need for supporting planning before and during the conference.

Figure 8 – Expert evaluation of ChiFish

User feedback

During the conference, we observed people use ChiFish on different platforms and situations. We also talked to some of the attendees to get further feedback on how they perceived the system for future development and improvement. The overall impression was that the users liked the concept, clean design and colours.

Some of the attendances discussed the possibility to search by author, the reason being that you often tend the presenters you know are good. This last feedback indicates that the users tend to use the system as a search tool, rather than an exploration tool. A solution could be to remove the search function in order to better encourage exploration. Another important discovery was that some users tended to forget the sliders, while trying to figure out what too see next, which may indicate that the tool works better before going to the conference. This was also indicated in the way that the conference was put together, since the attendances tended to stay in the same room for a whole session, rather than changing rooms midway.

Figure 9 – ChiFish at OzCHI 2013

Jon Pearce was later contacted by one of the attendees at the conference, who was interested in using ChiFish at another conference in 2014. The results from OzCHI are now being evaluated, while an agreement is currently being considered with the interested user.

4.12.2 What we learned from developing chifish

Even though developing ChiFish was not a part of our main project for this semester, we learned multiple things by being involved in this side project.

Through this project, we gained a lot of experience on how to develop a system within a limited timeframe. This both involves project management across two groups and daily meetings with Jon Pearce about the process and changes that needed to be made. Due to these meetings, we had to be prepared of sudden changes, which we previously have encountered throughout our education.

We also gained an insight on how the system was used in contrast to how we thought it would be used. This involves both the concept of the iFish system and the conference context. Throughout the user involvement, we saw an indication that the users wanted elements from systems they already knew, such as searching functionalities and planning tools. These thoughts contradicts the concepts of iFish, which as previously mentioned may indicate a need to remove certain features in order to encourage exploration.

Furthermore, it was interesting to be part of an ongoing research project within the domain of human computer interaction. This includes both the understanding of the iFish concept and the developed backend, in order to incorporate the design and functionality needed for a conference tool. Our findings from this side project are also contributing in a continued effort to make iFish the best possible exploration tool.

5 Conclusion

By reviewing literature a foundation and an overview of contributions to this field was created. Major themes from research papers within the last decade were found and papers categorised according to these. An inequality in health domains and persuasive strategies were discovered. This helped justify choosing the topic of smoking cessation and trying out other persuasive strategies.

This project focuses mainly on the use of mobile persuasive technology, within the context of smoking cessation, to raise the awareness of the issue and thereby persuade people to change their behaviour. The study conducted, introduced three content types: stories, tips and motivators that contributes with different ways to handle the situation of quitting. Furthermore, the study makes use of two labelled recommenders: experts and community, to explore whether these recommenders influenced the users' perception of the contributed content within the system.

The study shows a small difference between the preferred types of content, which indicates that they work well in supporting each other. The research study provides insights on the elements necessary, regarding the three content types in order to be considered useful to the user. This involves the content to be relatable and tailored to the user which supports earlier literature in this and other domains by Dijkstra (Dijkstra, 2006) (smoking) and Paay et al. (Paay, et al., 2013) (electricity and water usage). If content is not applicable or irrelevant to a user's situation, it is considered less useful.

Another topic emerged from our study was that of genuine content. If content (e.g. stories) does not explain the struggle that exist, when trying to quit smoking, users considered it fake. This element both involves content skipping the struggle and overcoming this. We see this as a new contribution to the field of using stories in a health behaviour changing matter, based on the literary read for this project.

An interesting finding during the study was the discussion of gain- and loss-framed content. The findings indicate that the participants in general were fonder of receiving gain-framed content, due to it being more motivating when trying to give up smoking. According to Dr Ron Borland, the loss framed focused content is most effective when convincing people to start quitting. When they have started their smoking cessation, both the study and Ron Borland implies that gain-framed content helps more within this domain.

Our findings implies that the recommenders did not influence the participants' opinion of the content, due to it either being overlooked or misunderstood. When discussing who they wanted to receive recommendations from, the community came across as being the most preferred, because they were perceived as people being in the same situation as themselves, while the experts are not considered a person who experienced quitting first-hand. This supports concept of social proof as an effective persuasive principle (Cialdini, 2008). However, the opinions of the recommenders indicated that content from either recommender has a value to the user depending on different contexts.

The surprising finding that was highlighted in our study, was the effect of using pushed text messages, which only played a small part of our research design. The findings showed that the participants used the application more, because of the text messages confirming earlier findings by Paay et al. (Paay, et al., 2013) and Fogg (Fogg, 2002). The findings implies that this approach is considered very helpful when trying to quit smoking, as it works as a good reminder to what they are trying to achieve. The participants suggested possible ways to improve this feature, such as using humour and interesting information to keep them engaged. Adding to this, the participants liked receiving messages at different times of the day, making it difficult to ignore them. These findings are considered new to the field and should be considered in future work, making use of push messages in the field of behaviour change and smoking cessation.

During our study, we acquired an insight into the context of smoking cessation, which can be used in further research within this field. An interesting finding is the issue regarding quitting as being a private and sensitive

topic. The study implies that the usage of a mobile platform helped in the context of being co-located with people who are not trying to give up smoking. Furthermore, the mobile platform is a useful tool, when experiencing cravings, since it is often nearby. Another important finding within this topic is the engagement of wanting to quit. If the user is not in the position where they want to give up smoking, the chances of behavior change decreases.

5.1 Future work

This research implies multiple areas which could be studied further, in order to gain greater knowledge. This involves the concept of tailored information, where a greater understanding is needed to find out which elements are needed in order to tailor successfully. This also involves creating a design, that can gather the information from a user, in order to properly determine their quitting stage and other factors.

Another concept worth looking into is that of pushed messages, which according to our findings, has proven to be an effective tool when persuading users within this context. This concept was not the main focus of the research, which means that further understanding is needed. The things that needs to be studied are the amount of messages sent to the users, the phrasing of the messages, the time messages are sent and the content provided. It would be interesting to find out what has the most effect when persuading the user to do a specified behavior.

As previously mentioned an interesting finding was the perception of having a social interaction within the app. Previous studies have shown that there is a difference in what people say they want and how they actually act. It would be interesting to see if the way of interacting with social media have changed within this context and measure the impact.

The finding gathered regarding the different content types would be interesting to try out, in order to see if they have an effect in persuading the user to quit smoking. This involves the topic of supplying users with content that mentions the struggle, gain and loss framed content, innovative content etc.

Due to the limitations of the study, we had a confined amount of time to include participants. This means that we cannot ensure if the findings are guaranteed to work, when trying to give up smoking. It is thereby necessary to conduct a longitudinal study with a larger participant pool in order to see a behavior change and to validate our current findings.

We imply that our findings on the use of push messages, gain-/loss-framed material, tailored material and genuine material can be implement in other domains aiming to persuade users into a behavior change e.g. the case of alcohol abuse.

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7 Appendix

(The documents are found on the attached CD).

7.1 Application documents

1. Access to Quitty
2. System codes
3. Content used in the system
4. Database files
5. Design files
6. Early sketches
7. Screenshots of the system
8. SMS messages

7.2 Participant documents

9. Table of participants
10. Participant documents
11. Consent forms
12. Overall stats from database
13. Survey documents
14. Interview transcriptions
15. Interview transcriptions (coded)
16. E-mails
17. Participant content table
18. Participant tracking

7.3 Study documents

19. Ethics documents
20. Pictures from the study
21. Seminar presentation
22. Expert evaluation documents
23. Activities conducted
24. Study findings
25. Affinity Diagram table
26. Project findings presentation
27. Recruitment posters