QuittyLink: A Mobile Application that helps people Quit Smoking

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Abstract
We have developed an application called *QuittyLink* that helps people quit smoking. *QuittyLink* is inspired by the known value of personal face-to-face counseling as an effective means to help people quit, and provides personal counseling on mobile phones based on self- and system-tracked data about smoking habits. The application collects time, location and situations that trigger the smokers to smoke or crave cigarettes and presents it to them in the form of simple charts/graphs. Users are also sent personal counseling messages written by experts from the quit help line Stoplinien, and is based on their individual smoking behaviors. The demonstration of *QuittyLink* adds to our MobileHCI'15 paper [7] with more details about the system.

Author Keywords
Smoking cessation; health behavior change; personal counseling; self-tracking; mobile interaction design

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Health has always been an important domain in Human Computer Interaction (HCI). Recently, there has been increased focus on the role that technology can play in

helping people to change the kinds of unhealthy behaviors that lead to health risks such as obesity, smoking, alcoholism, poor nutrition and diabetes. Studies show that 50% of all illness across different age groups is caused by personal behavior [11]. Despite growing knowledge about health risks and their causes, many people worldwide have not changed their behaviors, indicating an opportunity to discover how technology might play a role in assisting people to change their behaviors toward better health.

One major unhealthy behavior that has been fought against for years is smoking. In a small nation like Denmark, the death rate of smokers surpassed 14,000 in 2014 (not including the 2,000 dying from passive smoking) [3]. Worldwide this number was 6 million in 2013, plus 600,000 from passive smoking [17].

Mobile phones, and in particular modern smartphones, provide a particularly interesting technology platform for addressing health behavior changes for people. Features such as Internet connectivity, sensors and touchscreens make it possible to develop a range of versatile applications, and at the same time low prices have made them available to most people. Hence, smartphones have become a part of our daily life and follow us throughout our day, making information and services available everywhere and anytime.

Related Work

Several studies have shown the efficacy of tailored-tailored content in both general health domains and in smoking cessation [12][13][15]. Many of these systems were web-based, but there are a few studies exploring different aspects of the use of the mobile platform to support smoking cessation.

Txt2stop by Free et al. [5] found that sending helpful text messages to participants doubles the quit rate in the short term. Distract Me by Ploderer et al. uses distractions and tips to keep people from smoking [10]. Distractions would attract the user's attention in the short term, while tips would keep them engaged for a longer time. In our own previous research, we found that users preferred the smartphone platform to desktop applications, and that users wanted content they could relate to, contact with a "quitline", and some form of tracking their own habits in order to better engage with the smoking cessation app [8].

In a review of the 50 most popular smoking cessation apps, we found a general use of calculations as a type of self-tracking. These calculations (cigarettes saved, money saved, smoke-free days etc.) were based on estimates input by the user. Four apps also added an element of "achievements" that would be unlocked based on the calculations, for example that a user had stayed quit for 10 consecutive days. Most apps were aimed at users who had already stopped smoking and were trying to stay quit. None that we reviewed were suitable for users who were considering quitting or preparing to quit.

Common to all was that none appeared to be evidence based or a product of empirical research. This aligns with the findings by Abroms et al. [1] who reviewed 98 apps for Android and iPhone and categorized them according to their approach towards smoking cessation This study found that almost half of the reviewed apps used calculations based on estimates input by users and that the apps generally had low adherence to evidence-based practices.

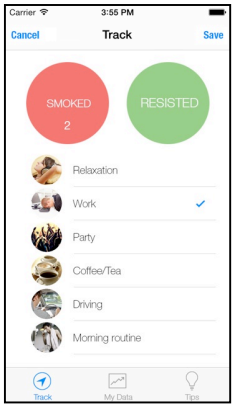

Figure 1. Main screen showing Smoked/Resisted buttons and trigger choices

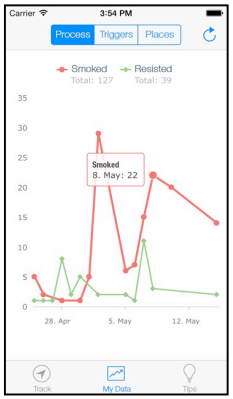

Figure 2. My Data screen showing Process graph with smoked/resisted cigarettes

The *QuittyLink* App

QuittyLink is a smartphone app designed to help people quit smoking. It combines self-tracking with personal counseling, and is based on empirically proven health behavior change and smoking cessation techniques.

Cognitive behavioral therapy recommends that smokers write down the kinds of activities and associated contextual attributes that trigger them to smoke or crave cigarettes [9]. Contextual attributes like time and place while smoking can become conditioned cues to smoke. Certain situations trigger strong cravings, for example, working, drinking coffee or dealing with stress and keeping track of these triggers and other contextual attributes can help smokers to increase the awareness of their behavioral patterns and help to make strategies to change them [[16]. Based on this, *QuittyLink* uses system-tracking of time and GPS location and self-tracking of the situation that triggered the user to smoke or crave a cigarette. In reviewing their own tracked data, users are made more aware of their activity patterns. Since Hirano et al. [6] found that self-tracked data can be ignored unless it is coupled with advice or guidance on how to improve their health behavior, *QuittyLink* uses the self-tracking data to give smokers regular and personalized counseling from a quitline expert, delivered directly into the app. Stoplinien, the largest Danish quitline, has collaborated with us to provide personalized weekly counseling messages to our users based on their self-tracking data. Personal counseling has proven the most effective technique for quitting smoking, irrespective of how it is delivered [14]. However, face-to-face counseling is limited by high costs and low accessibility, whereas, an effective stop smoking app with personal counseling has the potential to reach a much wider population.

The Design of *QuittyLink*

The graphical and functional design of *QuittyLink* aims at simplicity and ease of use. We wanted to ensure that entering self-tracking information would be quick and hassle free for the users. Based on our previous work, tips, personal graphs/charts and individual counseling messages needed to be easy to find to encourage regular use, or as a distraction from smoking.

We developed *QuittyLink* as native apps for iOS and Android. This ensured graphics appeared as intended, and we were able to better exploit the smartphone platform and make the application run faster. Making an app for each platform also made it possible to design with respect to the design principles of each operating system, taking advantage of people's interactive familiarity with their own phone, so that the apps would be more intuitive to use.

QuittyLink has three tabs corresponding to the three different areas of the app: Track, My Data and Tips.

Track

Track (figure 1) has very few elements and very simple interaction. There are two major entry buttons labeled Smoked and Resisted. Beneath these are 10 triggers to choose from. The user selects whether they just smoked one or more cigarettes or resisted a craving for one. Multiple taps on the Smoked button registers multiple cigarettes. The user is then asked to choose what triggered them to smoke a cigarette. They are able to choose as many triggers as are relevant to that situation. If they resisted they are given the same list of triggers to find out what triggered them to feel like a cigarette. The "Other" option allows them to choose at least one. To complete the input, the user presses Save

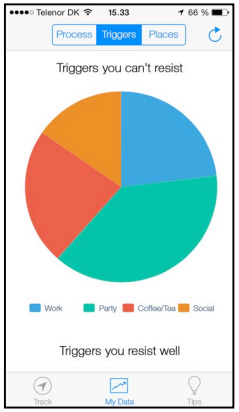

Figure 3. My Data screen showing Triggers chart of things that trigger smoking

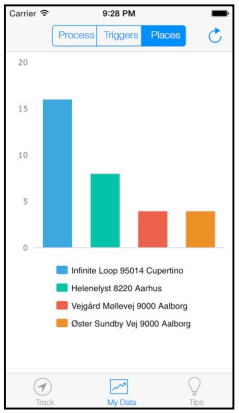

Figure 4. My Data screen showing Places chart of places where you smoke

at the top of the screen. At the same time the system registers the current location with coordinates and address, and current time and date of the episode. This bundle of data is then sent to a server monitored by the researchers.

My Data

My Data (figure 2, 3, 4) presents three different visualizations of recent smoking behavior to the user. This includes a *process* line graph (Figure 2) showing the number of smoked and resisted cigarettes per day. The two lines smoked (red) and resisted (green) match the color on the data entry buttons for easy recognition. Totals are given in numbers above the graph for accuracy. Users can see how the number of cigarettes smoked or resisted has changed over time. By tapping any point on the line chart, the number of cigarettes smoked or resisted that day is shown. The time frame shown is three weeks. There is also a *triggers* pie chart (Figure 3) showing the relative amounts of times different situations have triggered a smoking episode. Smokers can use this to see which situations trigger them to smoke the most. The link "Triggers you resist well" is used to toggle the pie chart that shows the situations for cigarettes resisted. Tapping a pie segment shows the exact number of smoked or resisted cigarettes for that situation since their use of the system began. The third is a *places* bar chart (Figure 4), which shows how many cigarettes have been smoked at different locations. From this, users can see where they tend to smoke the most. Common to all charts is the intention of provoking self-awareness of a person's actual smoking habits. Research in health behavior change suggests that self-tracking can lead to behavior changing as people become more aware of their existing habits [2][4].

Tips

The Tips screen (Figure 5) has three circular buttons to select between the three content types: Daily Motivations (carrot icon using "carrot on a stick" metaphor), Daily Tips, (light bulb icon indicating "bright ideas") and Personal Advice (person in magnifying glass icon, indicating focus is on you). Selecting one sends the user to a separate content page with motivational messages, or a set of quick tips, or the weekly personal counseling message sent from Stoplinien. Each has a back button to return to the tips menu.

A new "Daily Motivation" and a new "Daily Tip" are automatically sent each day. These are placed on top of a scrollable list of previously received content, so all past content is accessible at any time. Daily Motivations and Tips used in the app were taken from various online sources including QuitVictoria[1], Sundheds-styrelsen[2], e-kvit[3], WebMD[4] and LiveScience[5]. A Motivation is a factual statement about the negatives of smoking, for example, *"Cigarette smoke contains over 4000 chemicals and 69 of these are known to cause cancer. Even if you don't smoke you can still get sick from these poisonous chemicals just by breathing in other people's smoke."* In comparison, a Tip is a simple piece of advice, for example, *"Some smokers say that the taste of citrus reduces cigarette cravings. Start your day with a big glass of orange juice or half a grapefruit.*

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[1] http://www.quit.org.au/

[2] http://sundhedsstyrelsen.dk/

[3] http://ekvit.dk/

[4] http://www.webmd.com

[5] http://www.livescience.com/

Figure 5. Tips screen

Figure 6. Counseling message (in Danish)

In previous research, we found the content types Tips and Motivations had a positive effect on behavior change towards stopping smoking. This inspired our design of system-tracking to record the locations and times that individual people smoke most, with the idea that prompts and messages could be sent to smokers at these places and times to give them appropriate advice and help, when and where they need it.

Counseling

The counseling messages (figure 6) arrive once a week and include the logo of Stoplinien, so that users are reminded that this message is from an expert counselor, and the date the message was received. The messages contain the participant's name and are initiated with a follow up, rewarding text. The message contained personalised advice, tips, guides and motivation written specifically to fit the participant's situation. Each message also included Stoplinien's free quitline phone number, promoting direct contact with Stoplinien as a follow up, if the user wished.

Technical Implementation

Both apps (iOS and Android) were designed and developed in native language. The iOS app was developed using Objective C in XCode for OSX. Eclipse was used to develop the Android version in Java.

As we were using the participants' location to distinguish between places where the participant would smoke, we needed to collect precise location information. This meant using the phone's GPS, which causes a massive power drain if not used sparingly. At the same time, it takes some time for the phone to receive signals from GPS satellites and calculate coordinates. To overcome this, the app only starts fetching location information when one of the Smoked/Resisted buttons is pressed. The GPS antenna is then turned off immediately after the smoking input is saved or discarded. This gives the phone time to receive and calculate the current position, while the user is selecting the triggers.

A service called Parse was used as the backend for *QuittyLink*. This acted as a database for all user data collected by the app (smoking amount, triggers, time and location). Parse also held all Tips and Motivations that were sent out to participants.

In a previous study we found that sending reminders by SMS made participants use the app more regularly. We also found that when a person, and not a machine sent messages, participants were more likely to respond to the reminders. Informed by this, *QuittyLink* has an in-built function of receiving push notifications. This means that the researchers can send individual (not system generated) short messages to the user's smartphone at any time. Push notifications are shown at the top of the screen, even if *QuittyLink* is not open. Clicking on the message will open *QuittyLink*. We used push notifications when the user received a new counseling message from Stoplinien. This way, users did not have to complete any interim steps to get their personal message, just click on the SMS notification. This ease of operation was to encourage users to read their counseling messages as they arrived.

Extensive testing and an expert usability evaluation of the app were conducted before it was deployed. The app was made publically available in both the Apple App Store and Google Play Store. By April 2015 it had been downloaded more than 1,000 times.

Field Deployment

We deployed the *QuittyLink* system in Northern Jutland, Denmark, in the spring of 2014, with 13 participants, for a period of 3 weeks. Participants were required to be either currently smoking or recently quit and trying to stay quit. They must also have their own iPhone or Android phone with GPS capabilities. There were 13 participants, 4 males and 9 females with ages ranging from 22 to 52 years old, with an average of 35. Seven had an iPhone and 6 had an Android device.

Before deployment, participants completed a survey covering basic demographics and smoking habits. The first part asked questions about, age, occupation and place of residence. The second part asked about how long they had been smoking, why they smoked, in which situations they were most likely to smoke, how motivated they were to quit and what their reasons were to quit smoking. The survey included a short version of the Fagerström test to measure the participant's nicotine dependency. During the three-week deployment, participants were asked to use the app every day whenever they smoked a cigarette or had a craving. All participants received a new Daily Tip and Daily Motivation through the app, as well as a daily SMS message to remind them to use it. Data collection was monitored remotely to ensure that any technical problems were solved as quickly as possible. Participants could also contact the researchers directly through email and SMS message if they encountered any problems. Once a week, the tracked data for each participant was sent to Stoplinien. This information combined with a person's initial survey responses was used to create a personal counseling message for them, typically 15-25 lines long, sent to the mobile app.

After the deployment, semi-structured interviews, approx. 45 minutes long, were conducted with each participant to discuss their experience with the app and the role it played in their smoking cessation. Questions included general impressions of the app, what they liked and disliked most, usefulness of the tracking screen, and the graphs, what they learned from them and the impact this had on their smoking behavior. Participants were also shown their use pattern of interactions with the app and asked questions in regard to their specific use of it. We also discussed the personal counseling messages and their perceived impact. Finally, we were interested in their reflections on their smoking habits and whether they felt they had changed during the study period. We again asked how motivated they were to quit smoking to see if their motivation had changed after using *QuittyLink*.

Lessons Learned

The participants used the app differently ranging from 6 entries to 198 entries (with an average of 57). They all found the app easy and fast to use. Unfortunately, some forgot to enter their data at the time of the smoked/resisted episodes and did so retrospectively at the end of the day, thus registering incorrect place and time data. Generally, participants were interested in tracking their smoking habit. No matter the age, all participants were keen on using a smartphone app in their smoking cessation. After the deployment, 6 participants said that they had reduced their consumption and changed their routine, 3 said that the app had supported them in staying quit, and the other 4 stated that *QuittyLink* had made them reflect more on their habits and think about their consumption, for example "I have found out where my weakness lies. I think more about it every time I light a cigarette."

Feedback
In respect to the charts/graphs, 7 out of 13 participants reported that they learned something new about their habit that they did not know. Others agreed that it was highly motivating to get a visual representation of their smoking habit. Some were genuinely surprised when they saw their actual smoking habits represented on the charts, indicating that self-tracking is considerably more accurate than smokers' own perceptions of their smoking. All participants found the charts simple and informative. However, they also said that they wanted to be able to better see their behavior over time.

Counselling
Participants appreciated that the counseling messages were personalized and written specifically for them and their current situation. All participants were willing to share their data with the counselors in order to get quality feedback. They stressed the importance of the fact that they were written by real people, and not just computer generated. Participants also liked the convenience of receiving counseling directly to their mobile phone. We also noticed that there was a direct correlation between participants' motivation to quit and their perception of the counseling messages. The 8 participants who took quitting seriously were very positive and found them motivating and helpful. However, those not ready to quit and not seeing smoking as a problem felt pressured by the counseling.

Resisting
The "Resisted" button was welcomed differently depending on participants' quitting stage. Those trying to stay quit found it useful and liked how they could see their progress of craving fewer cigarettes over time, keeping their motivation high. Ironically, participants who were thinking of quitting said that inputting resisted cigarettes made them crave a cigarette even more, indicating that the Resisted button is only helpful to those trying to stay quit, and can be counter-productive for people who are still smoking.

Demonstration
We have presented *QuittyLink* that helps people quit smoking through personal counseling on mobiles based on self- and system-tracked data about smoking habits. In the demo session at MobileHCI attendees will be able to try out the *QuittyLink* app on their own mobile device or on one provided at the demo stand. Using ones own smartphone is very simple and only requires the user to download the free app following a link that will be provided on a poster. There will also be an A0 poster describing *QuittyLink*. The researchers at the stand will be able to simulate personal counselling messages and reminders being sent to the smartphone. On the smartphones provided by the researchers people will be able to see different examples of realistic data collected over a longer period of time.

Conclusion
QuittyLink, a mobile app combining self-tracking and personal counseling, offers self-awareness and personalized guidance to people wanting to quit smoking. The self-tracked data gave users detailed insight into their smoking behaviors and was used by counselors from Stoplinien for providing individualized guidance and advice. This motivated people to manually track their smoking episodes and increased their awareness of their actual smoking behaviors. Thus, QuittyLink showed that mobile technology offers great potential to help people to stop smoking. Our findings are further illustrated in [7].

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