Building a Multi-Modal Habit Reward Chatbot

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I hereby declare that this dissertation is all my own work,
except as indicated in the text:

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Date _____/_____/_____

Definitions

Human-Computer Interaction (HCI) - Field of computer science that studies how people interact with computers.

Modality - In the context of Human-Computer interaction, a mode is the classification of a single independent channel of sensory input/output between a computer and a human.

Multi-Modal Interaction - Provides the user with multiple modes for interacting with a system.

Chatbot - A method of communicating with a computer system via a conversation using natural language.

1 Executive Summary

Habits are automatic actions that require little effort. Forming new positive habits gives us lots of benefits, such as washing our hands after using the toilet. Forming a new habit requires repetition, contextual cues and positive reinforcement and on average takes 66 days to become automatic. Mobile technology can help form habits, by reminding and rewarding us. But, most existing systems are not grounded in theory and build repetitive actions rather than habit automaticity. People then become dependent on the technology, rather than the habit. This is bad because when we remove the system, the habit stops. Therefore, successful habit forming systems need to build habit automaticity.

Interaction with these systems is often with a mobile app which creates a mental link with the app and the user. When removing an app, the mental link is also removed, which decreases habit automaticity. This project aims to explore a different method of forming habits, with a chatbot. Chatbots are a method of communicating with a computer system using natural language. They provide a better mobile phone integration for users, as they hook into messaging services users are familiar with. When removing the system, instead of removing an app, the users stops having a conversation with the chatbot.

The literature presents us with design requirements for habit forming apps that build habit automaticity, focused on routine-based remembering strategies. Studies have also shown that good reminder/remembering systems should also interact with the user across different modalities. This would allow delivery of triggers and rewards across a modality to suit different types of users. This project will base the design of the chatbot on these requirements delivering reminders and rewards across multiple modalities.

This project aims to build a successful habit formation chatbot, one which should build habit automaticity via multi-modal interaction over 66 days. After removing the chatbot users should continue to perform the habit. The chatbot will provide habit tracking with reminder messages as triggers, and rewards in three modalities, visual, auditory and haptic. A 66 day user study, and a 1 week follow up study, will test the success of the chatbot by evaluating effectiveness of each modality on habit automaticity. Chatbot interaction will be removed during the follow up study to test if users continue with the habit. Three groups, and a control group, will each receive reminders and rewards from a different modality.

The project will deliver a chatbot, design recommendations for building habit formation systems and analysis of the effectiveness of different modalities on habit automaticity.

Contents

2 Introduction

Background

Habits are actions performed with almost no conscious thought in a automatic-like way. People want to form positive habits for lots of reasons (Lally, Promoting habit formation [1]), for example health benefits, such as remembering to exercise everyday or medicinal benefits, such as remembering to take medication. The 3 elements of habit formation are, repetition, contextual cues and positive reinforcement (Kathys, 2.3.2). Associating the cue with performance and grounding the process with a reward encourages regular repetition, leading to automatic behaviour (Lally, Experiences of habit formation [2]). Building a new habit requires three steps. A contextual cue, that triggers the start of the habit (action), then finishes with a reward with positive reinforcement (Kathys disso). For example, when you eat breakfast (trigger), you might write in a journal (action), and then reflect on last week (reward). Studies have shown that the process of creating a new habit takes on average up to 66 days of repetitive use (Lally). This is a long time for people to remember, perform and sustain a new habit without any help.

Motivation - habit formation

Technology can aid this problem, by reminding and building motivation. Mobile phones provide us with an interactive platform that can help with habit formation. Existing habit formation apps guide users through a series of experiences to form a new habit. Although, literature shows these apps are bad at forming habits because they are not grounded in habit formation theory (Kathys: Beyond self tracking reminders). They get people dependent on the technology and do not build the automatic reaction to a trigger (habit automaticity). For example, when people stop using habit forming mobile apps, they also stop performing the habit.

Studies have shown that routine-based remembering strategies are good for forming ?automaticity? (Kathy disso, table 7.1, also [3]) has produced a set of design requirements for building mobile apps grounded in habit formation theory. These requirements aim to facilitate the formation of reliable routine-based remembering strategies.

Motivation - chatbot

Interaction is often via a mobile app. This creates a notable difference in the person when removing the app from the phone, as people personalise their phone and it becomes a part of them (My phone is my soul). Removing the habit formation app, has shown to stop people performing the habit. Chatbots are a method of communicating with a computer system via a conversation using natural language. They provide a better mobile phone integration for users, as they hook into messaging services users are familiar with. When removing the system, instead of removing an app, users stop messaging a person (the chatbot). This could be the answer for solving user habit automaticity.

Motivation - multimodal

[Reward theory is mainly based on a single modality,] Studies (Designing multimodal reminders for the home, pg2, par1) have shown that good reminder systems should also interact with the user across different modalities. This would allow delivery of reminders and rewards across a modality to suit a user.

Motivation

Therefore, a successful habit formation system should build habit automaticity via multimodal interaction over 66 days. After removing the system users should continue to perform the habit.

Aims

This project aims to build a successful habit formation chatbot that uses multi-modal interaction.

Objectives

The chatbot will provide habit tracking with reminder messages as triggers, and rewards in three modalities, visual, auditory and haptic.

The rewards will provide the user with the satisfaction of completing the habit action and encourage them to build user habit automaticity. The visual reward will be a photo, the auditory reward will be a audio clip and the haptic reward will integrate with a wearable to provide tactile haptic feedback.

Methodology

To net the largest amount of users to test, the chatbot will be implemented using a popular messaging platform, Facebook Messenger.

A 66 day user study, and a 1 week follow up study, will test the success of the chatbot by evaluating effectiveness of each modality on habit automaticity. Chatbot interaction will be removed during the follow up study to test if users continue with the habit. Three groups, and a control group, will each receive reminders and rewards from a different modality.

The user study will gather the following:

- quantitative analysis of chatbot interaction
- qualitative survey of habit interaction at the end of the study, and end of follow up study
- automaticity test at beginning and end of study

Deliverables

This project will produce the following:

- A chatbot that tracks habits and provides the above rewards
- Analysis of the effectiveness of different modalities on habit automaticity
- Design recommendations for building a habit formation chatbot

Added value

The design recommendations will assist the HCI community for building habit forming chatbot systems. The user study will show how effective chatbots are and show how different types of reward deliveries through different modalities effect user habit automaticity.

This research review looks at the literature around multi-modal rewards and habit formation,

summarising with design guidelines and a project plan, to test if multi-modal rewards provided by a chatbot support habit formation.

3 Habit Formation

- What is a habit - What does it mean to form a habit - Examples

3.1 Benifits

- How can we benefit from knowing how to form this? - How does CS benefit - Health benefits - Problems with forgetting thing @TODO kathy

3.2 Theory

- General theory for forming habits - Time to form, 66 days, @lally

3.2.1 Trigger

- What is this - Kathys research

3.2.2 Action

- List of habits - Types of habits that are effective - Using this?

3.2.3 Reward

- General info - Types - When users stop doing this automaticity is reduced

3.2.4 Automaticity

- What is it - Why is it needed - Big up needing technology for this process, 'if only we could do this automatically'

3.3 Technology

- How can we use tech for this problem

3.3.1 State

- Current apps available - Kathys Research

3.3.2 Problems

3.3.3 - Not grounded in science

- Kathys research, state

3.3.4 - Lack of automaticity

- Doesn't develop when you remove the system

3.3.5 - Dependant on tech

- To do with lack of automaticity - However, chatbots are not dependant on tech, as everyone will have a messaging platform, e.g. fb messenger

3.3.6 Existing Research

- Trigger, Action, [Reward]

3.3.7 - Kathys Research

- Design requirements

3.3.8 - Taxonomy of...

- Reward focused

3.3.9 Requirements for Habit Reward system

- List of combined requirements - However still lack of retention, but, there is hope, ¡ table of requirements - Foucs on just rewards - I will use kathys reqs for tracking requirements ¿ - @TODO multimodal research says using multiple modalities improves retention / automaticity

4 Multi-Modal

- What is a Modalitiy - Research into how multiple modalities improve retention - Different types, most common and @TODO research says these are most effective

4.1 Types

4.1.1 Audio

- What is it - Why are we choosing it - Examples

4.1.2 - Why is it good?

- What does it give to us - @TODO research

4.1.3 - Reward

- Cross check with my requirements

4.1.4 Visual

- What is it - Why are we choosing it - Examples

4.1.5 - Why is it good?

- @TODO research

4.1.6 - Reward

- Cross check with my requirements

4.1.7 Vibration

- What is it - Why are we chosing it - Examples - Wearables, Fitbit

4.1.8 Why is it good?

- @TODO research

4.1.9 Reward

- Cross check with requirements

4.2 Table of multimodal reward implementation strategies

- Table of requirements matched with modalities - If you could implement this, you could increase users automaticity for habits

5 Building the System

5.1 Design Implications

- Setup: - Setup the bot via a messaging platform, such as fb messenger - Trigger: - Either A, certain configured time of the day - B: No trigger - C: Around a specific time - Action: - Choose habit from list of habits - Perform - Use app to track the action - Reward: - You get one of these rewards, based on modalitiy selected - Vision - Through message, of an image or gif - Could be: App, or message, gif - Audatory - Through phone via bot, link to mp3/spotify/apple music - Could be: App - Tactic - Through wearable - Could be: App, bot triggers wearbale alarm

5.1.1 Example user flow

- Pre-Start - Choose daily habit type from list of X, e.g. 1 press up before breakfast - Enable notifications or fitbit if chosen - Time action / reward, variable rewards, e.g. then work out average time to send, or none - Start: - New day - @ trigger time, send reminder, if set, notification - Open notification, do habit, press tracked - Get reward type

5.2 Implementation

- Web app could be chosen because its easiest and achievable, however the ease of use with a chatbot, integrated into fb messenger means everyone can use it on multiple devices. The addition, means that people get used to the UI.

5.2.1 Technology

- 3 Types: 1. specific apps - Bad cuz takes a long time 2. Web Apps - Still another app 3. Chatbot - Good useful - Android/iOS/chatbot specific notifications from web app - Save to home screen

5.2.2 Reward Modality implementations

- Vision - Send notification - Show nice visuals - Audio - Send notification - Play uplifting music - Tactic - A.P.I. sets wearable alarm - Wearable (fitbit) issues and tracks alarm times

5.3 Component overview

[app] ——-¿ (Database) ——¿ at certain time —¿ Send notification to trigger type of reward [big button that says track] taskname textbox

6 Implementation old

Habit formation, Don't Kick the Habit [4], stopping the behaviour when one stops using behaviour change apps. Measuring Habit strength [5] [6].

Multi-Modal interaction, using multiple modalities for habit formation [], using wearable devices, such as a Fitbit device is plausible for a study [7].

Gamification elements [8], can we use any elements from Free-To-Play games?

7 Evaluating the System

7.1 User studies

7.2 Testing automaticity

8 Conclusion

Will this be a successful project?
Can we obtain the value that this project adds?

9 Work Plan

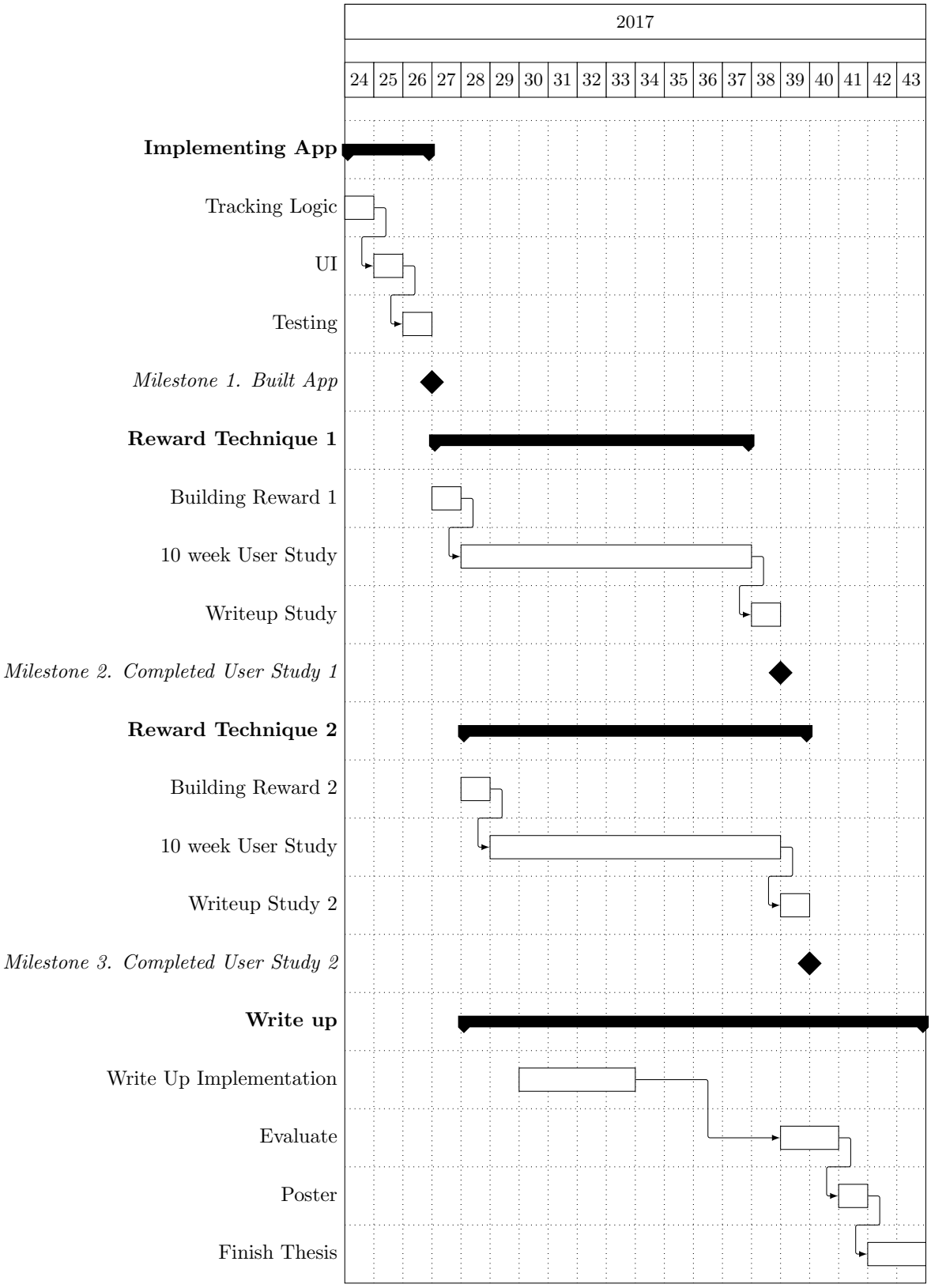
For this project there are X number of milestones to achieve.

Scope

Expected Timeline

The app is to be built, then two 30 day user studies will test the effectiveness of the app techniques.

@TODO find a way to add a title, and 'week' label @TODO only have 1 user study, but have 1 added week as a follow up study with no system interaction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Implementing App
Tracking Logic
UI
Testing
Milestone 1. Built App
Reward Technique 1
Building Reward 1
10 week User Study
Writeup Study
Milestone 2. Completed User Study 1
Reward Technique 2
Building Reward 2
10 week User Study
Writeup Study 2
Milestone 3. Completed User Study 2
Write up
Write Up Implementation
Evaluate
Poster
Finish Thesis

Deliverables

9.1 Risk Analysis

Table of risks and mitigation techniques.

10 References

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