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Supporting Snus Cessation Among Young Women in Sweden Through Digital Nudging and a Conversational AI

Design and Evaluation of a Mobile Application for Health
Promotion

Master's thesis in Biomedical Engineering

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Abstract

The rising prevalence of snus use among young women in Sweden has become a growing public health concern, especially with the increased popularity of tobacco-free nicotine pouches. Among women aged 16-29, daily snus use has increased by 500% between 2018 and 2024, highlighting an urgent need for tailored cessation strategies. Digital health interventions, such as mobile applications, offer a scalable and accessible alternative to traditional cessation methods. This thesis explores the development of a mobile snus cessation application tailored to young Swedish women aged 16-29, combining principles from nudge theory with support from a conversational AI chatbot. Through a literature review, state-of-the-art cessation apps, and semi-structured interviews with young female snus users, the study identifies key behavioural, emotional, and social factors influencing snus use and quitting attempts. The resulting application incorporates digital nudges such as milestone tracking and health progress visualizations, alongside conversational support from the chatbot. Usability testing revealed that participants responded very positively to the conversational AI chatbot, describing it as helpful and empathetic. The majority also expressed that the integrated features designed in line with nudge theory, such as the health timeline and achievement feature, would motivate them to use the app regularly as part of their daily routine. This study contributes to the growing field of digital health interventions and demonstrates the potential of combining nudge theory and conversational AI in promoting snus cessation among targeted populations.

Keywords: snus cessation, young women, digital health, nudge theory, mobile application, conversational AI.

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1

Introduction

Snus, a Swedish oral tobacco product, is a moist tobacco blend typically consumed in loose form or as pre-portioned pouches [1]. It is placed under the lip where nicotine is gradually released and absorbed by the body through the mucous membranes. In recent years, tobacco-free snus – also known as nicotine snus – has gained popularity by delivering nicotine without containing tobacco, often marketed in appealing flavours [2], [3].

The growing popularity of nicotine snus has significantly changed consumption patterns. In 2024, approximately 15.7% of the Swedish population aged 16–84 reported daily snus use, equivalent to 1.3 million people [3]. While usage was historically more common among men, recent years have seen a dramatic rise among young women. Between 2018 and 2024, the proportion of daily snus users aged 16–29 increased by 500%. Notably, 83% of female snus users use nicotine snus over traditional tobacco-based snus.

This trend raises growing public health concerns. While the harms of smoking are widely acknowledged, the risks of snus – particularly tobacco-free snus – remain less discussed [4], [5]. Nicotine is a highly addictive substance that can impair cardiovascular health, change oral tissues, and lead to long-term dependency [4], [6]. Withdrawal symptoms include restlessness, irritability, and low mood often appear within a few hours of cessation and can persist for several weeks [7]. In addition to physical dependence, conditioned behaviours, where environmental cues or emotional states trigger cravings, make quitting especially difficult [4].

Several approaches to snus cessation currently exist, ranging from pharmacological treatments like varenicline or nicotine lozenges, to behavioural counselling and digital tools [8], [9]. In 2024, Swedish health authorities updated national guidelines recommending counselling as the primary method of support for snus users, particularly adolescents, with pharmacological aid when necessary [10]. Despite this, access to personalized and engaging cessation support remains limited. Mobile applications for smoking and snus cessation also exist, offering features such as tracking, motivational messages, and health tips [11], [12]. However, few are tailored to the specific needs, habits, and preferences of young Swedish women – a group with rapidly increasing usage rates.

1.1 Aim

The aim of this study is to investigate how a mobile application can be designed to promote snus cessation among young Swedish women aged 16–29 by combining digital nudging strategies with conversational AI support. The study explores how nudge theory is implemented in existing health promoting mobile applications, analyses the role of chatbots in digital cessation applications, and applies these insights to the design of a mobile application. The study also evaluates how the resulting application is perceived by potential users in terms of usability, relevance, and impact. Through this approach, the study aims to contribute to the development of user-centered mobile cessation applications and digital behavioural change strategies for nicotine dependence.

1.2 Research Questions

The study seeks to answer the following questions:

1. How has nudge theory been applied in existing health promoting mobile applications?
2. What are the primary functions of chatbots in existing tobacco and snus cessation applications?
3. How can a mobile application that encourages behavioural change of young Swedish women aged 16-29 toward snus cessation be designed by leveraging nudge theory and a conversational AI chatbot?
4. How is this application perceived by potential users?

2

Theoretical Framework

This chapter presents the theoretical foundation of the study and introduces key concepts that inform the design and development of the mobile snus cessation application. The first section focuses on nudge theory, which provides the behavioural framework followed by an overview of digital nudges. The final part of the chapter explores the lifestyle, motivations, and social contexts of snus consumption among young Swedish women. Together, these sections provide the theoretical background for the research.

2.1 Nudge Theory

Nudge theory was first conceptualized in the book *Nudge: Improving Decisions about Health, Wealth, and Happiness* in 2008 by Richard Thaler and Cass R. Sunstein [13], and is a concept about encouraging positive choices by subtly guiding behaviours rather than imposing restrictions [14]. It does not ban any options, limit freedom of choice, or give orders. Instead, nudge theory changes people's choices in a predictable way by changing the way they make decisions, without adding costs [13]. Nudge strategies that are designed to subtly guide people toward better decisions without restricting their freedom of choice include designing environments that make better choices easier, like placing healthy foods at eye level in stores, or presenting information that highlights benefit, such as emphasizing how many people quit smoking rather than how many fail. These strategies work by making desirable behaviours more intuitive and effortless rather than relying on strict rules.

Thaler and Sunstein [13] argued that nudge is important in human decision-making because people do not always make purely rational choices [13], [14]. Instead, human behaviour is shaped by cognitive shortcuts and biases, making decision-making less logical than it appears. Irrational behaviour can be understood through four aspects: cognition, emotion, action, and willingness. Cognitively, human decisions rely on two systems: system 1, which is fast and intuitive, and system 2, which is slower and analytical [14]. While system 1 is efficient in familiar situations, it can also lead to cognitive biases that people are unaware of. If system 2 fails to correct these biases, poor decisions can result. Emotionally, people tend to be overly optimistic, believing they are exceptions to risks. They also fear losses more than they seek gains. When it comes to action and willingness, individuals often prefer to maintain the status quo, struggle with self-control, and are easily influenced by social norms, herd behaviour, and peer pressure. These biases highlight the need

for nudge strategies, which subtly steer people toward better decisions by making positive choices easier and more intuitive.

2.1.1 Applying Nudge Theory

Numerous studies have shown that applying nudge theory can positively influence decision-making in areas such as public health and finance [15]. By subtly guiding individuals toward better choices, nudging has helped improve outcomes in a low-cost and non-restrictive way, making it an attractive approach for policymakers and organizations [13]. One area where nudge theory has been particularly successful is public health. For instance, research on increasing hepatitis screenings found that reminders designed using nudge theory increased hepatitis screening rates compared to reminders without nudge theory incorporated [16]. Similarly, studies have shown that implementing nutritional labelling on food led to an increase in healthier dietary choices [17]. While it may seem intuitive that individuals will make right decisions relating to their health, many still choose short-term pleasures despite knowing the long-term detrimental effects on their health [18]. Encouraging people to prioritize long-term benefits over short-term temptations is of particular interest for governments, as a healthier population reduce healthcare costs and improves overall well-being [19]. People also generally fear losses more than they value equivalent gains, which means that if a behaviour is associated with potential loss, individuals are more likely to avoid it in order to minimize that perceived risk. This nudge strategy is already widely used, such as graphic warnings on cigarette packs to discourage smoking [20], [21].

However, the effectiveness of nudges depends largely on the environment in which they are applied [22], [23]. Individuals from different countries may respond differently to the same intervention due to cultural, social, or economic factors. Even within the same country, people's reactions to nudges can vary based on their personal experiences and surroundings. For example, a nudge that works well in an urban setting may be less effective in rural areas due to differences in lifestyle and access to resources. Taking context into account is crucial for understanding why certain nudges succeed while others fail, allowing for more tailored and effective intervention strategies.

2.1.2 Digital Nudges

As technology plays an increasing role in daily life, nudge strategies have also evolved to fit digital environments, called digital nudges [24]. Digital nudges apply the principles of nudge theory in digital contexts, using user interface design, status quo bias, and messages, among other, to guide user behaviour [25]. Unlike traditional nudges, digital nudges can be highly adaptive, leveraging real-time data and user preferences to tailor interventions more precisely. For example, streaming services like Netflix use recommendation algorithms to suggest movies based on a user's viewing history, subtly encouraging prolonged engagement with the platform [26]. Another example of a platform that uses digital nudges is fitness tracking wearables

like Fitbit or Apple Health, which send reminders to move, celebrate milestones, and provide personalized activity goals, motivating users to maintain a healthier lifestyle [27]. Also, educational mobile applications such as Duolingo use features such as streaks, rewards, and reminders to push users to continue learning, and adapts difficulty which keeps users encouraged [28].

2.1.3 Types of digital nudges

Digital nudges can take many forms, each leveraging different psychological principles to guide users toward desired behaviours. By understanding these types of nudges, designers and policymakers can implement more effective strategies in digital environments. Table 2.1 provides an overview of common types of digital nudges and how they influence decision-making.

Framing is a digital nudge where certain options among several alternatives are presented more appealingly to users [25]. One example of framing is when a website presents the offered benefits and advantages of a subscription service rather than the cost of it.

Status quo bias describes the tendency of users to maintain their current situation, explained by the fact that perceived disadvantages of change outweigh the potential benefits [25]. This bias can manifest in various ways in digital environments, such as users sticking with default settings, avoiding new features, or remaining with a familiar service even when better options are available.

Social norms refer to how users are influenced by the behaviour of others [25]. An example of this bias can be seen in e-commerce, where positive reviews or the number of purchased products can influence others to buy the same product. Products labelled as best sellers or those with numerous positive reviews often appear more valuable, encouraging more users to choose them.

Messenger effects describe using messages while making a decision to influence users [25]. These messages can include text messages, email notifications, or notifications through an app. For example, an online calendar allows the user to set reminders for upcoming events or tasks, where the reminders can be sent to the user's device through push notifications, making it more likely that they will remember to attend or complete the task.

Priming shapes user decisions by creating a context that influences their choices, such as by highlighting the consequences of a decision [25]. An example can be found in online donation platforms that display images of people in need or success stories of previous donations. By evoking empathy and highlighting the impact of contributions, users may feel more inclined to donate.

Loss aversion refers to the tendency for individuals to perceive potential losses as more significant than equivalent gains [25]. One example is fitness apps that high-

light the potential health setbacks of missing a workout. For instance, an app might notify users that skipping a scheduled session could slow their progress toward a goal or reduce their weekly activity streak, making the perceived loss more significant than the effort required to exercise.

Hyperbolic discounting describes that individuals value the present more than the future, even when future effects would be more beneficial [25]. When online shopping, especially during sales events like “20% off”, users are often encouraged to make a purchase by the time-limited nature of the offer. Even if a shopper doesn’t initially need new items, the immediate discount creates an incentive to buy now, prioritizing the present benefit of saving money over the future benefit of making more thoughtful, need-based purchases. The appeal of a current deal leads users to prioritize short-term satisfaction over long-term financial responsibility.

Anchoring influence users by presenting an initial reference point, which affects following decisions [25]. In e-commerce, companies often display an original price alongside the sale price (e.g., “500 SEK, now only 200 SEK”). This higher initial price serves as an anchor, making the discounted price of 200 SEK appear more attractive. Users perceive the sale as a better deal due to the contrast with the inflated original price.

Simplification refers to the simplification of options which influences users’ decision-making. By presenting information such that it fits the user’s processing capabilities, the energy needed to make a decision for the user decreases [25]. An example where simplification occurs is in mobile banking apps, where users are often presented with a simplified budget overview that categorizes spending (e.g., groceries, entertainment, bills) and provides visual graphs showing where the money is being spent. This simplification of complex financial data helps users make quick and informed decisions about their spending habits without overwhelming them with excessive details.

Decoupling describes how users are influenced by separating the cost of a choice from its consumption, thereby reducing the perceived impact of spending [25]. In subscription-based services like streaming platforms (e.g., Netflix or Spotify), the cost of the subscription is often decoupled from the individual consumption of content. Users may not directly associate the cost with the content they consume since the monthly fee is fixed. This decoupling of cost from consumption encourages users to access more content without immediately considering the financial cost, leading to higher engagement and retention.

Table 2.1: Types of digital nudges [25], [29].

Type of digital nudge	Explanation
Framing	Presents choices in a way that makes certain options more appealing.
Status quo bias	Emphasizes the drawbacks of changing from the current state, making users more likely to stick with the default option.
Social norms	Influences users by giving the information about the behaviour of other users, provoking herd behaviour.
Messenger effects	Uses messages from specific sources (e.g., notifications or reminders) to influence decision-making.
Priming	Prepares users for a decision by exposing them to relevant cues, such as visualizing potential outcomes.
Loss aversion	Leverages the tendency of users to fear losses more than equivalent gains, making users more cautious about undesirable outcomes.
Hyperbolic discounting	Takes advantage of people’s preference for immediate rewards over larger future benefits, even when future effects would be more beneficial.
Anchoring	Influences decisions by presenting an initial reference point, which affects subsequent judgements.
Simplification	Influences users by reducing the complexity of choice options yet still provide the entire choice set.
Decoupling	Separates the cost of a choice from its consumption, reducing the perceived impact of spending (e.g., subscription models).

2.2 Chatbots for Behavioural Change Support

While there are existing platforms that incorporate nudges to encourage behaviour change, another powerful approach is the use of chatbots to deliver personalized and interactive nudges [30]. A chatbot is a computer program designed to simulate conversation with human users, typically through text or voice interactions [31]. AI-powered chatbots can be programmed to deliver tailored digital nudges based on user behaviour, preferences, and progress, making behavioural change tools more contextually relevant and personally motivating [30]. By dynamically adjusting their tone, content, and timing, these chatbots can reinforce positive habits, offer motivation, and guide users through personalized cessation journeys. Studies show that people might feel more comfortable disclosing personal information to a chatbot compared to a human, as chatbots are not able to form judgement [32]. This makes them particularly well-suited for supporting individuals through text or voice with sensitive and often stigmatized challenges, such as tobacco and snus cessation, where users may feel ashamed or reluctant to discuss their struggles openly with others. In addition to providing a safe space for communication, research has shown that cessation

apps featuring AI-powered chatbots more than doubled user engagement compared to applications without a chatbot [33]. The interactive and conversational nature of chatbots keeps users more actively involved in the quitting process, increasing their likelihood of sticking with the program over time.

2.3 Young Women in Sweden and Snus Consumption

In recent years, the use of snus among young women in Sweden aged 16-29 has increased dramatically, rising by 500% since 2018 [3]. This trend raises concerns about the factors driving snus consumption among young Swedish women, including social influences, perceptions of risk, and their lifestyles.

2.3.1 Daily Habits and Integration in Life

Snus use among young women in Sweden is not only influenced by social settings but also by how easily it integrates into daily life. For some, snus remains an occasional indulgence, while for others, it becomes a routine habit woven into their everyday activities. Understanding these consumption patterns provides insight into how snus becomes a regular part of daily life for many young Swedish women.

To gain deeper insights into young people's attitudes and experiences with snus, the Public Health Agency of Sweden conducted an interview study with 25 participants aged 13-19 from various regions of the country [34]. One key finding from the study is that snus has become an ordinary part of daily life for many young people, with little discussion or reflection on its use. One girl mentioned that snus is so common that it often goes unnoticed, with conversations about it being mostly limited to casual exchanges like "Can I have a pouch from you?". Nearly all young adults reported having people in their social circles who use snus, including friends, classmates, and family members such as parents or siblings. One young female noted that snus is visible everywhere – in schools, on public transport, at parties, and in urban settings. The widespread presence of snus contributes to its normalization, making it a routine aspect of daily life.

The frequency and quantity of snus consumption among young women in Sweden vary widely depending on individual habits, social environments, and dependency levels [35]. Some occasional users take a pouch only in social settings, such as at parties or when offered by friends, while regular users incorporate snus into their daily routines, often consuming multiple pouches throughout the day. Research indicates that daily female snus users tend to use between 5 to 15 pouches per day (median 10 pouches) [36]. Many young women report that their snus consumption fluctuates based on their activities and mood [37]. They tend to use less snus when occupied with tasks but increase their intake when feeling bored. Similarly, they consume more snus when in a negative mood and less when feeling happy. The ease of use and discreet nature of snus contribute to its habitual consumption, making it

difficult for some individuals to track or limit their intake [38].

The duration of use also varies; while some Swedish women keep a pouch in for 20 minutes, others may use one for 1 hour or longer before taking out the snus (mean 47 minutes) [36]. This pattern often depends on personal preference, nicotine dependency, and the setting in which snus is used [37]. The majority of women use one pouch of snus at a time, and on average, women in Sweden use snus for a total of 7.5 hours per day [36].

2.3.2 Perceived Identity and Social Image

The use of snus among young women in Sweden is not only a personal habit but is also tied to identity, self-expression, and social perception. The interview study by The Public Health Agency of Sweden gathered that peer influence plays a significant role in snus initiation [34]. Many participants agreed that hearing others talk about or use snus makes it more accepted and, in turn, more appealing. Social settings, particularly parties, often serve as the starting point for trying snus. Young people perceive snus as cool and popular, with most first-time users trying it in the company of friends. Curiosity and the desire to fit in are key motivators, as many experiment with snus simply to experience its effects. Furthermore, studies reported that friends and peers contributes to the continuation of female adolescent's snus use due to social acceptance and peer pressure [34], [39]. Young females describes experiencing a social dependency on snus, associating its use with a sense of belonging within their peer groups [37]. This feeling of togetherness could make quitting more challenging, as snus became a shared activity that reinforced social connections.

2.3.3 Emotional Connection and Justifications

Snus use among young Swedish women also carries an emotional and psychological dimension. Many users develop a personal justification for their consumption, often comparing it favorably to other nicotine products, such as cigarettes [34], [37]. The Public Health Agency of Sweden noted from their interview study that many young women perceive smoking as significantly more harmful than snus, citing its detrimental effects on disease risk, physical fitness and oral health [34]. This perception reinforces a more negative attitude toward smoking while making snus seem like a safer alternative [39]. However, many remain uncertain about the exact health consequences of snus use. While some acknowledge the health risks, they rationalize their use by emphasizing the benefits of snus, such as stress relief or increased energy, and its social aspect, as it is commonly used among friends and at social gatherings [34], [37]. Some users also cite personal preference, particularly enjoying the taste of certain snus products. This internal negotiation creates a complex relationship with snus, where enjoyment and dependency coexist with concerns about long-term consequences.

2.3.4 Barriers to Quitting Snus

Quitting snus can be challenging for many young women in Sweden due to a combination of psychological, social, and habitual factors. While some acknowledge the health risks, the immediate benefits of snus use such as stress relief, social bonding, and routine use, often outweigh concerns about long-term consequences [37]. Many female snus users in Sweden develop a strong association between snus and daily activities, making it difficult to break the habit [34]. Additionally, peer influence plays a significant role, as being surrounded by friends who use snus can create pressure to continue [39].

One significant barrier to quitting is the deeply ingrained role snus plays in social interactions [34], [37]. Many young women describe snus as a way to bond with friends, feel included, and participate in group activities. This sense of social belonging makes quitting more difficult, as it may create feelings of exclusion or fear of missing out. Some users report that simply being in an environment where snus is commonly used, such as schools, workplaces, or social gatherings, makes it harder to resist cravings [34].

Another key factor is the perception that snus is a relatively harmless nicotine product compared to smoking. Many young women justify their continued use by believing that snus is a better alternative to cigarettes and, therefore, not as urgent to quit [34], [37], [39]. The discreet nature of snus also contributes to this mindset, as it can be used in more settings without drawing attention and the ability to be used anywhere, unlike smoking [39]. As a result, there could be less immediate pressure or motivation to quit. Also, there is an absence of strong external restrictions or social stigmatization around snus use. Unlike smoking, which is banned in many public places and carries a more negative social perception, snus use is widely accepted and integrated into daily life [34], [40].

The addictive nature of nicotine further complicates quitting efforts. Many young women report experiencing withdrawal symptoms such as irritability, restlessness, and difficulty concentrating when they attempt to stop using snus [41]. Information gathered from the interview study from the Public Health Agency of Sweden noted that some users had increased stress or a decline in mental well-being when they do not have access to snus [34]. These physical and psychological discomforts can quickly lead to relapse, particularly in situations where snus has been used as a coping mechanism for stress or anxiety.

3

Research Approach

This chapter outlines the methods used to design, develop, and evaluate a mobile application intended to support snus cessation among young women in Sweden. The study used a qualitative and user-centered approach that combined theoretical exploration with practical implementation. The chapter begins by detailing the research design, followed by a description of the literature review and state-of-the-art analysis. It then presents the approaches for the user interviews, application development and design, as well as the integration of a conversational AI chatbot. Finally, the chapter describes the usability testing process used to assess the application's functionality, user experience, and potential for supporting behavioural change.

3.1 Overview of Methods and Approaches

This study involved a user-centered, qualitative approach involving multiple complementary methods to explore snus cessation among young women in Sweden and to design an effective mobile intervention. Each method was chosen based on its suitability for the study's exploratory and design-oriented goals.

The literature review served as the foundation for understanding snus use, nicotine addiction, and behavioural change strategies such as nudge theory and chatbots. It also informed the development of application features and chatbot dialogue. Literature reviews are essential for grounding design decisions in established theory and are widely used in design research [42].

To understand the current landscape of digital cessation tools, a state-of-the-art (SOTA) review was conducted focusing on health-related mobile applications, specifically those using nudge theory and chatbots. A SOTA review is a structured method for examining the most recent and relevant technological or scientific developments within a specific field, allowing researchers to benchmark innovations and identify research gaps [43]. This helped identify gaps in current solutions and best practices to guide the app's development.

Semi-structured interviews were carried out with young female snus users to gather qualitative data on their behaviours and motivations related to snus use, and expectations for a cessation app. Interviews are a core method in human-computer interaction research for capturing rich, contextual information from users [44].

Thematic analysis was used to analyse the interview data and was chosen for its flexibility and ability to uncover patterns and themes relevant to app design and user behaviour [45].

The design and development of the mobile application followed a design science methodology. This approach focuses on the iterative creation and evaluation of digital features intended to solve real-world problems. It is particularly suited for research where both theory and practical implementation are important [46].

A short questionnaire was used before usability testing to collect background data on participants' demographics, digital habits, and initial attitudes toward behaviour change apps. Questionnaires are a simple and efficient way to gather structured information from users [44]. During usability testing, participants were asked to verbalize their thoughts while interacting with the application, called think-aloud. This method is effective in uncovering users' reasoning and mental models, and it helps researchers understand how users experience an interface [47]. Following the think-aloud sessions, participants took part in short interviews where they reflected on the app's functionality and emotional support features. These interviews complemented the usability data and provided insights into the app's perceived usefulness [44]. To quantify perceived usability, the System Usability Scale (SUS) was used. SUS is a standardized and validated tool that is widely adopted in usability evaluation due to its simplicity, speed, and reliability [48].

All methods and approaches employed in this study is presented below. See Table 3.1.

Table 3.1: Methods/approaches employed in this study.

Methods/Approaches	Research topic
Literature Review	Theoretical foundations of snus and its health impact, nudge theory in digital environments, and young women’s snus use
State-of-the-Art (SOTA)	Functions of chatbots and nudge theory in existing mobile applications related to health promotion
User Interviews	Behaviours, motivations, and social influences of young women who use snus
Thematic Analysis	Identifying key themes and user needs for a snus cessation mobile application from interviews
Design Science	Designing and developing a user-centered mobile application
Questionnaire	Understanding participants’ demographics, digital habits, and general opinions on chatbots and behaviour change apps
Think-Aloud	Capturing user reasoning and interaction with app features during task-based usability testing
Usability Interview	Exploring participants’ perceptions of the app’s supportiveness, clarity, and encouraging aspects toward snus cessation
System Usability Scale	Measuring the perceived usability of the application through standardized quantitative scoring

3.2 Preparatory Research and User Study

This study takes a qualitative and exploratory research approach as an instrumental case study. The purpose was not only to develop a functional mobile snus cessation application but to explore the broader applicability of nudge theory and conversational AI in promoting behavioural change among young female snus users. The chosen approach enables an in-depth understandings of the motivations, challenges, and preferences of the target group, thereby providing insights to inform a digital health intervention.

3.2.1 Literature Review

In the initial phase of the study, a comprehensive literature review was conducted to establish a theoretical and contextual foundation. Literature was examined to understand the short- and long-term physiological effects of snus consumption, as well as the health benefits of cessation. Research on nicotine dependence and withdrawal symptoms was explored to inform the design of supportive app features. Current snus cessation approaches, including pharmacological, behavioural, and digital interventions, were analysed with a focus on strategies addressing withdrawal symptoms and habit disruption. Additionally, literature was reviewed to identify emotional, behavioural, and social factors that drive continued snus use in young women.

The literature review also included a deep exploration of nudge theory, with a focus on its relevance and application in digital contexts. Various types of digital nudges were studied to inform app design in order to promote healthier decision-making in digital environments.

3.2.2 State-of-the-Art

In parallel with the literature review, a review of state-of-the-art digital health applications was conducted. This included an analysis of existing health-promoting mobile applications, focusing on the integration of nudge theory. A review of tobacco and snus cessation applications was also performed, with attention to the use of chatbots. The primary functions of these conversational agents were examined to assess best practices and identify gaps in current tobacco and snus cessation applications.

The findings from the SOTA review were used to identify best practices, current limitations, and gaps in existing solutions. These insights helped shape the design direction and functional goals of the app developed in this study.

3.2.3 Interviews with Female Snus Users

To gain a deeper understanding of young women’s snus consumption, social influences, and expectations for a mobile snus cessation application, interviews were conducted with young female snus users in Sweden. Participants were recruited through purposive sampling using personal networks. A total of five Swedish women, all current snus users within the age range from 18 to 28, were interviewed. This demographic was selected to ensure the study reflects the target users of the intended mobile application. An overview of the participants’ demographic information is presented in Table 3.2.

Table 3.2: Demographic information of participants.

Participant	Age	Occupation	Snus use duration
P1	24	University student	5 years
P2	28	Preschool teacher	2.5 years
P3	22	Store employee	1.5 years
P4	18	Upper secondary school student	1 year
P5	23	University student	2 years

The interviews were semi-structured, audio-recorded and conducted in person. This ensured consistency across interviews while allowing flexibility for areas to be followed up. The interview questions, listed in Section A.1 in Appendix, addressed areas such as motivations and contexts for snus use, perceived social pressure, health beliefs, experiences with quitting, and desired features in a mobile cessation application.

The data was transcribed verbatim and analysed using thematic analysis following Braun and Clarke’s approach [45]. This method was chosen due to its flexibility and suitability for exploring subjective experiences and identifying themes and patterns across participants. The goal of the analysis was to identify patterns in participants’ experiences and attitudes toward snus use and cessation, with the specific purpose of providing input for the design and functionality of a mobile snus cessation application.

In the initial phase, transcripts were read and re-read to achieve data familiarization. This was followed by the generation of initial codes (labelled data), which captured recurring elements in the data such as triggers for snus use, social influences, and app feature preferences. These codes were then examined for similarities and grouped into potential themes, which reflected broader patterns across the dataset. Sub-themes were included within these themes, which helped provide nuance to each main theme. Codes that did not immediately fit into a main theme were categorized as “miscellaneous” to ensure no data was excluded. Themes were iteratively reviewed, refined, and defined through multiple rounds of analysis to ensure internal coherence and clear distinctions between them. This process allowed for a deeper and nuanced understanding of the factors influencing snus use among young women, and informed design principles for a targeted snus cessation application.

Prior to the interviews, participants were provided with a consent form outlining the study’s purpose and their rights. The consent form can be found in Section A.4.1 in Appendix. Written informed consent was obtained from all participants. To ensure anonymity, no identifying information was collected, and each participant was given a number (1 to 5) during transcription and analysis. Participants were informed that they could withdraw from the study at any time without providing a reason.

3.3 User-Centered Design

User-centered design is a human-focused design approach defined by the ISO 9241-210 standard as a process that “aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors, usability knowledge, and techniques” throughout the development process [49]. This section outlines how user-centered design principles were applied throughout the development of the mobile application. Based on insights from the literature review, thematic analysis, and theoretical framework, the design process focused on aligning technical decisions with the specific needs, preferences, and behaviours of the target user group. The sections below describe the development environment, chatbot integration, and interface design choices made to support a personalized and engaging cessation tool.

3.3.1 Application Development Environment

In preparation for developing the mobile application, various tools, frameworks, and approaches for cross-platform mobile development were researched. This prepara-

tory phase included evaluating native development environments such as Android Studio and Xcode, as well as cross-platform development frameworks such as Flutter, React Native, Kotlin, and Ionic.

After consideration, React Native was chosen as the development framework in combination with the Expo framework, implemented using the Visual Studio Code (VSCode) editor. React Native was selected for its ability to build high-performance, cross-platform applications using a single codebase in the programming language JavaScript, while Expo was favoured for its simplified setup and integrated tools for testing and deployment. VSCode was used as development shell due to its robustness, community support, and seamless integration with both React Native and Expo.

3.3.2 Integration of a Conversational AI Chatbot

As part of the application’s personalized cessation support, a conversational AI chatbot was integrated to offer a motivational and emotionally aware dialogue. The goal was to provide users with supportive feedback aligned with the principles of nudge theory.

Several integration strategies were initially explored. A key technical requirement was that the chatbot had to be compatible with integration into a React Native application. Initial attempts focused on using the open-source platform HuggingFace which offers pre-trained AI models, including conversational agents. However, these models lacked the contextual awareness needed for creating an emotionally aware dialogue for snus cessation support. Primarily, the models did not understand the concept of snus and were unable to provide responses aligned with nudge theory. Attempts were made to fine-tune different existing models using a custom dataset containing examples of conversations based on nudge theory. However, this approach required significant computational resources which limited the models’ capabilities to offer snus cessation support.

After evaluating the initial strategies, OpenAI’s Generative Pre-trained Transformer (GPT) based conversational model was selected for integration. It was chosen due to its ability to provide personalized and contextually relevant responses. Through prompt engineering, the model can incorporate nudging strategies in its conversations, making it a suitable choice for offering snus cessation support. The fine-tuned GPT model GPT-4o mini was used, primarily due to its compatibility with communicating to OpenAI from React Native through an API, but also due to it being fast and cheap.

3.3.3 Application Design

Insights gathered from the literature review, state-of-the-art and thematic analysis directly informed the design of the mobile cessation application. The app was tailored to the social contexts, cessation strategies, and motivational factors of young

women using snus. The app design aimed to incorporate digital nudging principles, such as loss aversion, messenger effects, and simplification to encourage behavioural change.

Based on the digital nudges identified in the literature review and the insights gathered from the thematic analysis, a number of potential application features was defined. Each feature was selected with the intention of supporting behaviour change. For instance, the concept of loss aversion shaped the development of a health timeline to visualize health damages associated with snus use, while achievement tracking and progress visualization was grounded in nudges such as priming and anchoring. These components were continuously refined through an iterative design process to ensure alignment with the needs of the target user group.

Throughout the development process, general user interface (UI) and user experience (UX) design principles was followed to ensure the application was both intuitive and engaging for users. The general UI and UX design principles that was focused on include consistency, simplicity, feedback and responsiveness, visual hierarchy, and user-centric design, aiming to reduce cognitive load for the user, enhance visual appeal, and guide the overall user journey [50]. These principles were important given the behavioural focus of the application, where usability and user satisfaction play a crucial role in long-term engagement.

3.4 Usability Testing

Usability testing was performed in order to assess the application and its components' ability to encourage behavioural change in young women aged 16-29. Participants of the usability testing were the same five women that participated in the interviews and presented in Table 3.2. The testing was conducted in person, audio-recorded and analyzed with both qualitative and quantitative evaluation methods.

In the first stage of testing, participants were asked to fill out an initial questionnaire to gather basic demographic information and to assess participants' familiarity with technology and attitudes toward chatbots. The complete questionnaire is presented in Section A.4.2 in Appendix.

Secondly, the participants tested the mobile application using a smartphone. A form consisting of six cases of tasks was given to the participants, including tasks such as creating a profile, setting goals, engaging in a conversation with the chatbot, and logging a snus pouch. The tasks can be seen in Section A.4.3 in Appendix. The tasks were chosen to cover all main functionalities of the application. They were intentionally phrased in an open-ended way so that the participants could explore and complete the tasks without step-by-step guidance. This approach made it possible to observe whether users understood the app's flow and found the user interface intuitive. During the tasks, participants followed a think-aloud protocol where they were asked to verbalize their actions and thoughts while interacting with the app.

After completing the tasks, participants took part in a semi-structured interview with questions where they reflected on the application and its functions. The follow-up questions focused on if the integrated features and conversational chatbot guided by nudge theory could encourage behavioural change. The follow-up questions are introduced in Section A.4.3 in Appendix.

As the final step, participants were asked to fill out the System Usability Scale (SUS) designed to measure the perceived usability of systems [51]. The questionnaire consists of ten questions where an answer is given on a scale from 1 (strongly disagree) to 5 (strongly agree), presented in Section A.4.5 in Appendix. A SUS score was then calculated given in the range of 0–100, with 0 being the lowest perceived usability of a system and 100 being the highest.

4

Results

This chapter presents the findings of the study, structured around three key components: a review of how nudge theory and chatbots are applied in existing health and cessation applications, insights gained from interviews with young female snus users, and the development and evaluation of the mobile cessation application. The results include thematic patterns identified through qualitative interviews, the app’s design and functionality shaped by these insights, and the outcomes from usability testing. Together, these findings inform how digital nudges and a conversational AI can be integrated into a user-centered mobile health intervention for snus cessation.

4.1 Application of Nudge Theory in Health Promoting Mobile Applications

Existing health promoting mobile applications frequently incorporate nudge theory to promote healthier behaviours by subtly guiding users toward better choices without restricting their freedom [27]. These digital nudges take various forms, including reminders, goal-setting, real-time feedback, social comparisons, and progress tracking.

One prominent example is fitness applications paired with wearable devices, which utilize behavioural nudges to promote physical activity and health monitoring [27]. For instance, Apple’s *Apple Watch* and its connecting app *Health* provide context-triggered prompts, such as reminders to stand up, goal achievement notifications, and personalized encouragement messages (e.g., “You can still close your Exercise ring today with a brisk 4-minute walk.”) [27], [52]. The device also uses social comparisons (e.g., “Boom! You won the week!”) to engage users and sustain motivation [27]. Other fitness trackers, including *Fitbit*, *Samsung Galaxy Fit*, and *Garmin* smartwatches, implement similar strategies to encourage movement, improve sleep quality, and promote overall well-being [53]–[55]. These findings demonstrate that digital nudges are used to increase motivation through real-time feedback and social reinforcement.

In the context of addiction cessation, mobile applications designed to help users quit smoking, drinking, gambling, and snus use also integrate nudge-based strategies [24]. Mobile smoking cessation apps such as *Sluta röka*, *Days Since: Sluta Snusa*, *Röka*, *Kwit*, *QuitBot*, *Smoke Free* and *Clean Day* employ features like milestone celebrations, financial savings calculators, and health improvement visualizations to

sustain motivation [56]–[61]. Many of these apps leverage loss aversion, highlighting the financial and health-related costs of continued smoking, while others utilize positive reinforcement to strengthen behaviour change. For alcohol reduction, applications such as *Reframe: Drink less & Thrive* and *Rehubs* provide goal-setting nudges and weekly progress reports, along with community features where users share their experiences and receive peer support [62], [63]. Specifically for snus cessation, applications like *Quit Snus*, *Quitty*, and *I Am Sober* integrate features such as urge management strategies and gamification elements to maintain user engagement [64]–[66]. These apps utilize countdown timers that visualize time since the last snus use, reinforcing progress and strengthening commitment. Additionally, *I Am Sober* offers a community support network, allowing users to share milestones and experiences, further reinforcing social norms as a motivational factor.

The types of digital nudges identified in existing health promoting mobile applications is listed below. See Table 4.1.

Table 4.1: Digital nudges applied in health promoting mobile applications.

Type of digital nudge	Applied through
Messenger effects	Wearable device notifications, Milestone celebrations
Social norms	Social comparisons, Community support networks
Priming	Health improvement visualizations, Countdown timers
Loss aversion	Countdown timers, Financial calculators, Health effect visualizations
Anchoring	Progress tracking, Gamification (badges, achievements)
Hyperbolic discounting	Gamification (badges, achievements)

Overall, the results show that nudge-based strategies are widely implemented across various health promotion applications. Real-time feedback, progress visualization, and social engagement are among the most commonly used techniques to support behaviour change.

4.2 Function of Chatbots in Existing Tobacco and Snus Cessation Applications

Chatbots are increasingly integrated into smoking cessation applications, offering personalized support, real-time assistance, and motivation to users attempting to quit. While chatbots are commonly used in smoking cessation apps such as *Kwit*, *QuitBot*, *Clean Day*, and *Smoke Free*, they are notably absent from available snus cessation applications [58]–[61].

Within these smoking cessation apps, chatbots take on several supportive roles that

assist users during their quitting journey [33]. A key function of chatbots in cessation apps is providing users with educational content about the health risks of tobacco, the benefits of quitting, and strategies for managing withdrawal symptoms. This information is typically delivered in small, digestible messages tailored to the user’s progress. For example, the chatbot in *Smoke Free* offers daily quit tips and reminders, helping users stay informed and engaged throughout their cessation journey [60].

Another key function of chatbots is helping users manage cravings by offering instant, on-demand strategies. Cravings are often unpredictable, and chatbots like *QuitBot* provide immediate interventions, including breathing exercises, distraction techniques, and motivational messages to help users resist relapse [59]. This ability to offer real-time coping mechanisms is particularly valuable, as research suggests that short-term interventions during cravings can significantly increase quit success rates [67].

Chatbots also play an important role in tracking progress and reinforcing motivation. By regularly reminding users of their achievements – such as the number of smoke-free days, the money saved, or improvements in health – chatbots help build a sense of pride and reinforce the benefits of quitting [68]. The apps *Clean Day* and *Kwit*, for instance, celebrates milestones and encouraging users to reach new levels, which can make the quitting process feel more like an engaging challenge rather than a burden [58], [61].

Beyond practical assistance, chatbots provide emotional support, which is often overlooked in digital health tools [33]. Quitting addictive substances can be an emotional and isolating process, but chatbots help by checking in with users, asking how they are feeling, and offering empathetic, encouraging responses. Across applications like *Kwit*, *QuitBot*, *Clean Day*, and *Smoke Free*, chatbots maintain regular conversations with the user, acknowledging difficult days, celebrating victories, and reminding them why they started the journey in the first place [58]–[61]. This consistent presence can make users feel supported and less alone in their quitting process.

Overall, chatbots in tobacco cessation applications are designed to act as both a guide and a companion [33]. They deliver relevant information, offer practical tools to handle cravings, track progress, and provide emotional reinforcement within an accessible and judgement-free environment. Their ability to adapt to the user’s needs, respond in real time, and maintain ongoing communication make chatbots a valuable resource in helping people successfully change their behaviour and maintain long-term cessation. However, no currently available snus cessation apps includes a chatbot feature.

4.3 Interview Results

A thematic analysis of the interview data revealed six main themes that involved participants' experiences and attitudes toward snus use and cessation. The themes are supported by illustrative quotes from the participants.

4.3.1 Snus as Emotional Regulation and Routine

Many participants described snus as a way to manage emotions such as stress, restlessness, and to increase focus. A majority of participants used snus as a way to pass time when bored. Using snus has also become a part of their daily routine as many experience habitual use during everyday activities.

“I use snus more when I’m studying. It helps me concentrate.” (Participant 5)

“At home it gets more of a habit, like when I’m watching TV or after eating.” (Participant 2)

The use of snus becomes automatic, serving as both a psychological comfort and an integrated element in their everyday life.

4.3.2 Social Beginnings and Personal Continuation

All participants' snus use was initiated by either peer exposure or peer pressure, particularly at social settings such as parties, but later became a personally driven habit.

“When I started to use snus, it was definitely because my friends were doing it. Especially when we were partying. You didn’t want to be the one who didn’t try. ” (Participant 3)

The current snus use of all participants was described as a personal habit and not driven by any social factors.

4.3.3 Perceived Rewards and Positive Effects

The benefits of snus experienced by the participants include calmness, increase of focus, and enjoyment.

“I think it’s nice to sit and drink coffee and take a snus. It gives me a small kick in everyday life.” (Participant 1)

One participant (Participant 2) mentioned that snus feels like small rewards during the day, while another (Participant 5) highlighted that snus creates a form of structure in their life.

4.3.4 Dependency and Withdrawal Experiences

Many participants reported symptoms when not using snus for a period, including physical and emotional reactions such as restlessness, feeling of something missing,

and irritability. Cravings were experienced from 45 minutes to 2 hours after the last snus among participants.

“I get restless and a bit annoyed actually. Like you are missing something.” (Participant 4)

Several had tried quitting, primarily because of the costs and the feeling of being dependent on something. The participants describe their attempts unsuccessful due to a lack of motivation and it being easy to fall back on during stress or emotional discomfort.

“I don’t think I was motivated enough. I said that I wanted to quit but deep down I think that I wasn’t ready.” (Participant 5)

As for those who hadn’t tried quitting snus, their motivational factors for quitting snus included costs and if they experience health problems.

4.3.5 Uncertain but Acknowledged Health Awareness

All participants recorded using tobacco-free snus and were aware of the oral health damage associated with their snus use. However, the knowledge beyond oral effects were limited, as all knew their snus use was harmful but were unsure how.

“So, I know it can increase the risk for damages on the gums...” (Participant 2)

“...And I’ve read that tobacco-free snus can contain other stuff that might not be very good for you. But I don’t know exactly what.” (Participant 3)

A majority of participants perceive the use of tobacco-free snus as less harmful than other tobacco products.

4.3.6 Ideal Support Tool for Snus Cessation

Participants expressed what they imagine would suit them in a mobile snus cessation application. Features included progress visualization, showcasing money saved, notifications, goal setting and challenges, and health indicators.

“Some kind of diagram or something that shows how my snus use has gone down. So that you can see it as a competition with yourself to make the graph go down. But that’s what I think, but I’ve never tried it so I don’t know.” (Participant 1)

“Maybe a reminder function that gives some motivation or shows how much I’ve saved, both economically and regarding health. More than that I don’t know.” (Participant 4)

Unwanted features identified by the participants were generic advice on snus cessation and information overload through too much text or notifications. However, most participants found it hard to identify unwanted components.

4.4 Application Development

The final application was shaped by both the insights gathered from thematic analysis and the digital nudges. Features such as the health timeline, progress tracking, and achievements were included based on participants' responses identified during the interviews. These features were selected to nudge users toward healthier decisions through visual feedback, positive reinforcement, and small behavioural prompts.

4.4.1 Development Environment

The mobile application was developed in React Native using TypeScript, a type of programming language for application scale JavaScript development. This approach enabled clearer code structure and early error detection. Here is a simplified example of how a component is defined in React Native:

Listing 4.1: Example of how to build components in React Native using TypeScript.

```
import React, { useState } from 'react';
import { Text, Button, View } from 'react-native';

type Props = {
  name: string;
};

export default function Greeting({ name }: Props) {
  const [count, setCount] = useState(0);

  return (
    <View>
      <Text>Hello, {name}!</Text>
      <Text>You've pressed the button {count} times.</Text>
      <Button title="Press me" onPress={() => setCount(count + 1)}
        />
    </View>
  );
}
```

This type of structure was used throughout the application to build its numerous components. A representative example of the application's structure and implementation is presented in Listing A.1 in Appendix, which contains the code for the first onboarding screen shown in Figure 4.1a. To visualize the app while building, the mobile application Expo Go was used. Through scanning a QR code in VSCode, the mobile app is deployed in Expo Go and changes to the app can be seen in real time.

4.4.2 Integration of the Chatbot

The integration of a conversational AI chatbot was a key component in the mobile application by offering motivational and supportive interactions. In order to inte-

grate OpenAI’s conversational model into the application, an API was used to make React Native and OpenAI communicate with each other. The application’s backend handled API requests and responses.

To align the chatbot’s behaviour with nudge theory, a crafted system prompt was implemented. This prompt instructed the conversational model to take on an empathetic, non-judgemental tone and to subtly encourage small, achievable behaviour changes using nudge theory, such as reducing snus intake, celebrating progress, and suggesting alternatives during cravings. The prompt was also informed by the interviewees’ unwanted features in a mobile snus cessation application. Participants emphasized information overload as a drawback in an application, and as a result, the prompt was designed to guide the model toward concise, clear answers by keeping the replies around 1-3 sentences. The full code block assigning the model to a specific role, including the system prompt, can be seen in Listing 4.2.

Listing 4.2: System prompt.

```
const conversation = [
  {
    role: 'system',
    content: '
You are an expert specializing in snus cessation for
young women aged 16-29.
Use friendly, non-judgmental, and supportive language.
Apply behavioral science, especially nudge theory, to
subtly encourage positive changes, like reducing
snus usage, setting goals, celebrating small wins,
and offering helpful tips or alternatives.
Always be empathetic, motivational, and suggest small
actions that feel achievable.
Keep your replies short, focused, and
encouraging, usually 1-3 sentences.
',
  },
  ...convertedMessages,
];
```

4.4.3 Use of AI for Image Generation

To enhance the visual elements of the mobile application, OpenAI’s ChatGPT was used to generate illustrative images, including an application logo and a representation of the chatbot persona, Nova, seen in Figure 4.1. ChatGPT was prompted with descriptive text inputs to produce images that aligned with the intended visual style and tone of the application. This method allowed for rapid generation of graphical elements that reflected the app’s supportive and user-friendly character.

4.5 Application Design

The final application was designed to support young women in reducing or quitting snus through an engaging and supportive mobile application. The design was shaped

by insights from the thematic analysis, the principles of nudge theory, and established UI/UX design principles. This section presents the screens of the application named “PackOff” and explains the reason behind their layout and functionality. The applied digital nudges in respective feature of the application is listed in Table 4.2.

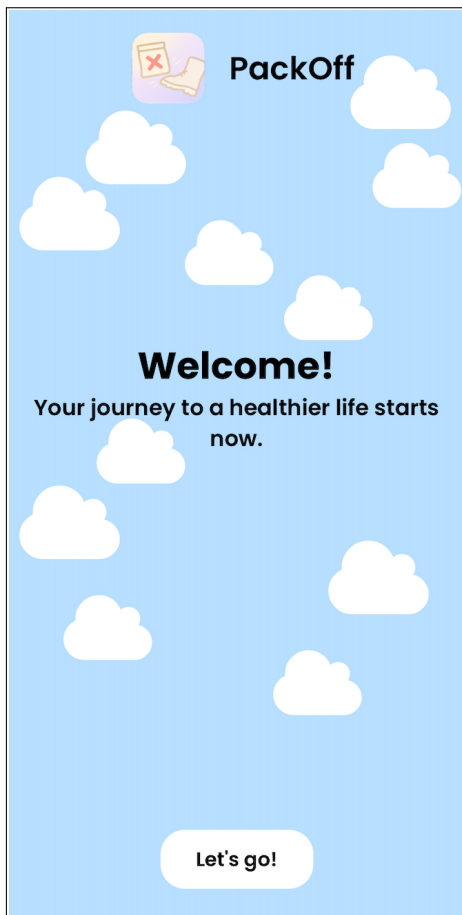
Table 4.2: Applied digital nudges in the PackOff app.

Feature / Design Element	Digital Nudge Type	Explanation
Graph showing snus use over time	Priming, Anchoring	Encourages reflection on behaviour and sets visual benchmarks
Money saved and snus avoided cards	Loss aversion, Hyperbolic discounting	Highlights short-term gains and possible losses
Goal suggestions and user-created goals	Simplification, Anchoring	Reduces complexity in setting goals and motivates with achievable targets
Achievements and progress bar	Framing, Anchoring	Visualizes milestones to frame behaviour positively and guide next steps
“Did you know?” health facts	Priming	Influences health perception and motivation
Confirmation prompt when logging snus use	Messenger effects, Loss aversion	Encourages reconsideration before consumption
Chatbot’s greetings and supportive dialogue	Messenger effects	Shapes user behaviour through emotionally aware interactions
Health timeline	Priming, Loss aversion	Visualizes both gains (recovery) and risks (continued use) to influence commitment

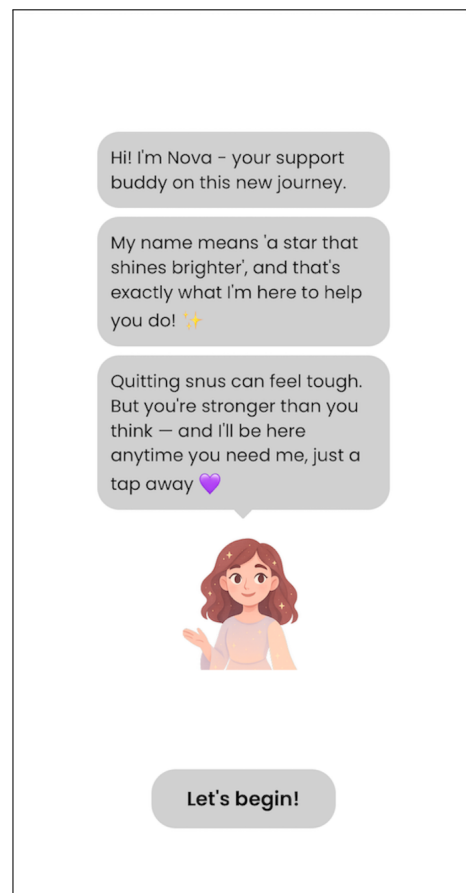
4.5.1 Onboarding

The onboarding process was designed to guide new users into the application in an encouraging and informative way. All screens that are part of the onboarding process are shown in order, from left to right, seen in Figures 4.1 and 4.2. The first screen, shown in Figure 4.1a, welcomes the user when first opening the app with a message to set a motivational tone for the user experience. The clouds on the screen fade in when opening the app, creating a dynamic user experience. From there, the user begins by pressing “Let’s go”, and the clouds fade out. The second screen introduces the chatbot, named Nova, explaining her role in supporting the user throughout their cessation journey, seen in Figure 4.1b. The message bubbles containing the information are appearing one-by-one with a small delay between each other, creating a more human-like, dynamic interaction. By introducing Nova early, the onboarding process establishes a personalized tone and prepares the user

for a tailored and engaging snus cessation journey.



(a) Initial welcome page.



(b) Introduction page of Nova.

Figure 4.1: The initial two onboarding screens.

Next, the user is asked to enter their name shown in Figure 4.2a. This information is used throughout the app to personalize interactions. In the final step of onboarding, the user is asked to write information about their snus use habits: how many snus pouches they typically use in a day, and how much a snus tin costs, seen in Figure 4.2b. This information is stored and used to tailor feedback within the home page of the app.

Figure 4.2 consists of two side-by-side screenshots of a mobile application's onboarding flow.
Screenshot (a) shows a screen with a female avatar icon on the left. To its right, a grey speech bubble contains the text "Let's start with some information about you!". Below this, another grey speech bubble asks "What should we call you?". At the bottom, there is a white text input field with the placeholder "Enter your name" and a grey "Next" button below it.
Screenshot (b) shows a screen with the same female avatar icon. A grey speech bubble says "Let's log your snus use!". Below this, the text "How many snus pouches do you use in a day?" is displayed, followed by a smaller line of text: "One tin contains approximately 20 snus pouches". There is a white text input field with the placeholder "e.g. 14". Below that, the text "What is the price of one snus tin (SEK)?" is shown, followed by another white text input field with the placeholder "e.g. 53". At the bottom, there is a grey "Finish" button.

(a) Screen for the user to insert their name.

(b) Screen to log the user's snus habits.

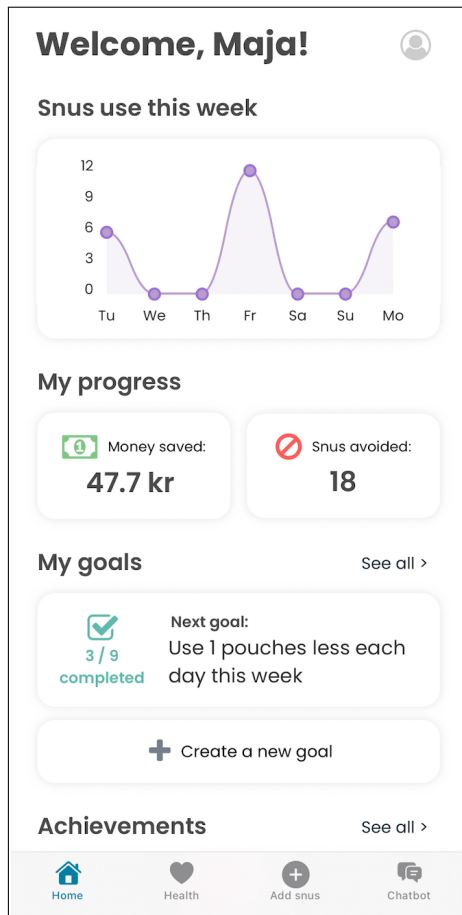
Figure 4.2: The third and fourth onboarding screens.

The onboarding flow was intentionally designed to be consistent and simple for a user-friendly interface, using the same features across all screens.

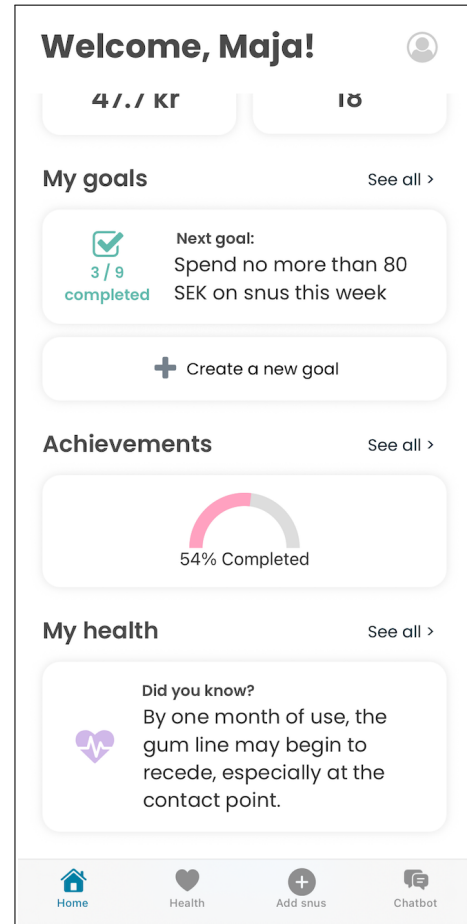
4.5.2 Home Screen

The home screen, illustrated in Figure 4.3, serves as the central dashboard for the user and brings together key motivational and informational elements. From the top, the screen features a personalized greeting using the user's name to create a more customized experience. Immediately below the greeting, a snus usage graph visualizes the user's weekly consumption. This chart offers immediate feedback on progress and patterns, helping users monitor their behaviour over time. It serves as a visual prompt by preparing users to reflect on their habits and consider healthier alternatives. Further down, the screen presents two card-like components: one showing money saved and the other showing the number of snus pouches avoided. These values are updated dynamically whenever the user's snus use is lower than the previous day. The data used for these calculations comes from information provided during onboarding. These cards incorporate loss aversion and hyperbolic discounting nudges by emphasizing immediate, reachable rewards to motivate continued

reduction in their snus use.



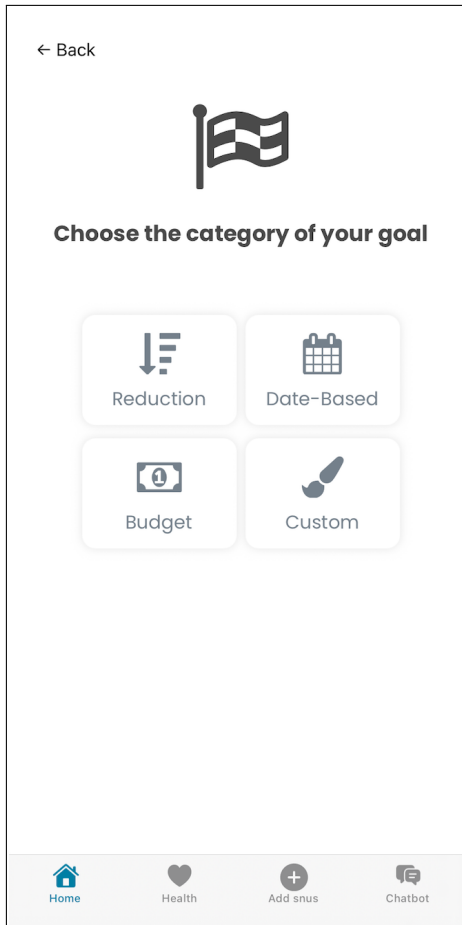
(a) Initial home screen.



(b) Scrolling down on the home screen.

Figure 4.3: Home screen.

The next section in the home screen focuses on goal setting. When launching the app, users are presented with a randomized goal suggestion from the total goal list seen when pressing the “See all >” button, along with an overview of how many goals have been completed. Below this, users can add a new personalized goal by pressing the “Create a new goal”, choosing from four categories: reduction-based, date-based, budget-based, or custom, see Figure 4.4a. The goal of the interaction is to promote motivation by goal completion through simplification of options while also allowing flexible, user-driven choices. A full process of how to create a goal can be seen in Figure A.1 in Appendix. The “See all >” screen containing all goals can be seen in Figure 4.4b.



(a) Initial creating goal screen.



(b) Goal screen.

Figure 4.4: Goal screens.

An achievement overview follows the goals section and displays a progress bar indicating the percentage of total achievements the user has unlocked. Tapping “See all >” leads to a more detailed view, shown in Figure 4.5. This feature is designed to trigger positive reinforcement, leveraging anchoring by visually setting benchmarks, and framing by showing progress in an encouraging format.



Figure 4.5: Achievements page.

At the bottom of the home screen in Figure 4.3b, a “Did you know?” health fact is displayed. Each time the user opens the app, a new health-related fact appears, aimed at raising awareness and keeping health risks or benefits as a reminder. This feature functions as a priming mechanism and draws upon framing to present health facts in a motivational, rather than punitive, tone. Since the feature is at the bottom of the screen and requires scrolling to reach it, users can choose not to see it if they feel intimidated or scared about the health information. Pressing the “See all >” button pushes the user to the health tab presented in section 4.5.3.

To update the weekly snus usage graph, users can log their snus consumption by pressing the “Add snus” button located in the bottom tab bar. When the button is tapped, a confirmation prompt appears, asking “Are you sure you want to add a snus pouch?”, seen in Figure 4.6. This additional step helps prevent accidental inputs and encourages a moment of reflection before confirming the action. If the user confirms by selecting “Yes”, their daily snus count increases by one, and the data is reflected in the “Snus use this week” visualization on the home screen. If the user chooses “Cancel”, a positive reinforcement message appears (“Great job!”),

aiming to subtly reward the decision not to consume a pouch. The prompts in the application can be seen in Figure A.2 in Appendix.

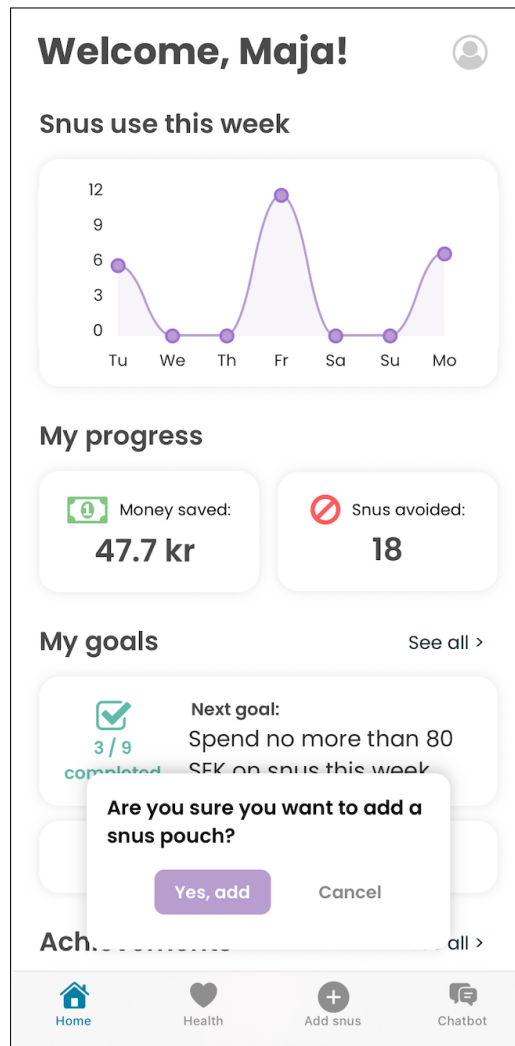


Figure 4.6: Prompt when pressing the “Add snus” button.

This interaction reflects principles of loss aversion by prompting reflection before confirming consumption, and positive reinforcement through supportive messaging when the user declines.

From a UI and UX design perspective, the home screen was designed to maintain a clear visual hierarchy and consistent layout. Components are grouped and presented in a scrollable format, allowing users to intuitively access the most relevant features without cognitive overload. The use of cards, large headings, and clean spacing help reinforce simplicity and supports fast, repeated interactions.

4.5.3 Health tab

The interface of the health tab, shown in Figure 4.7, was developed to provide users with insights into the health effects of using snus and their body’s recovery progress

after reducing or quitting their snus intake. The feature presents information in a scrollable time format, highlighting different stages in a snus user's use and cessation. Users can navigate between three different educational categories within the tab: *How your body heals after quitting snus*, *The health impact of using snus*, and *Nicotine withdrawal symptoms after quitting*. Each category uses a horizontal scrolling interface to highlight the gradual aspect of health changes.



Figure 4.7: Health page showing the different educational categories.

The health feature was developed in response to interview findings which revealed that many participants were unaware of the physiological effects of their snus use. Participants expressed that they lacked both short- and long-term information about the impact of snus on their health. As a result, the health tab was not only designed to educate but to make this information easy to understand.

The health timelines reflect principles from nudge theory in two key ways. First, they leverage priming by framing health improvements in a positive and progressive way by encouraging users to visualize possible future outcomes. Secondly, they utilize loss aversion through both seeing the health effects of using snus and also

what the body regains after quitting, which highlights what is at stake if the user continues to use snus. This could motivate the user to commitment of a cessation journey.

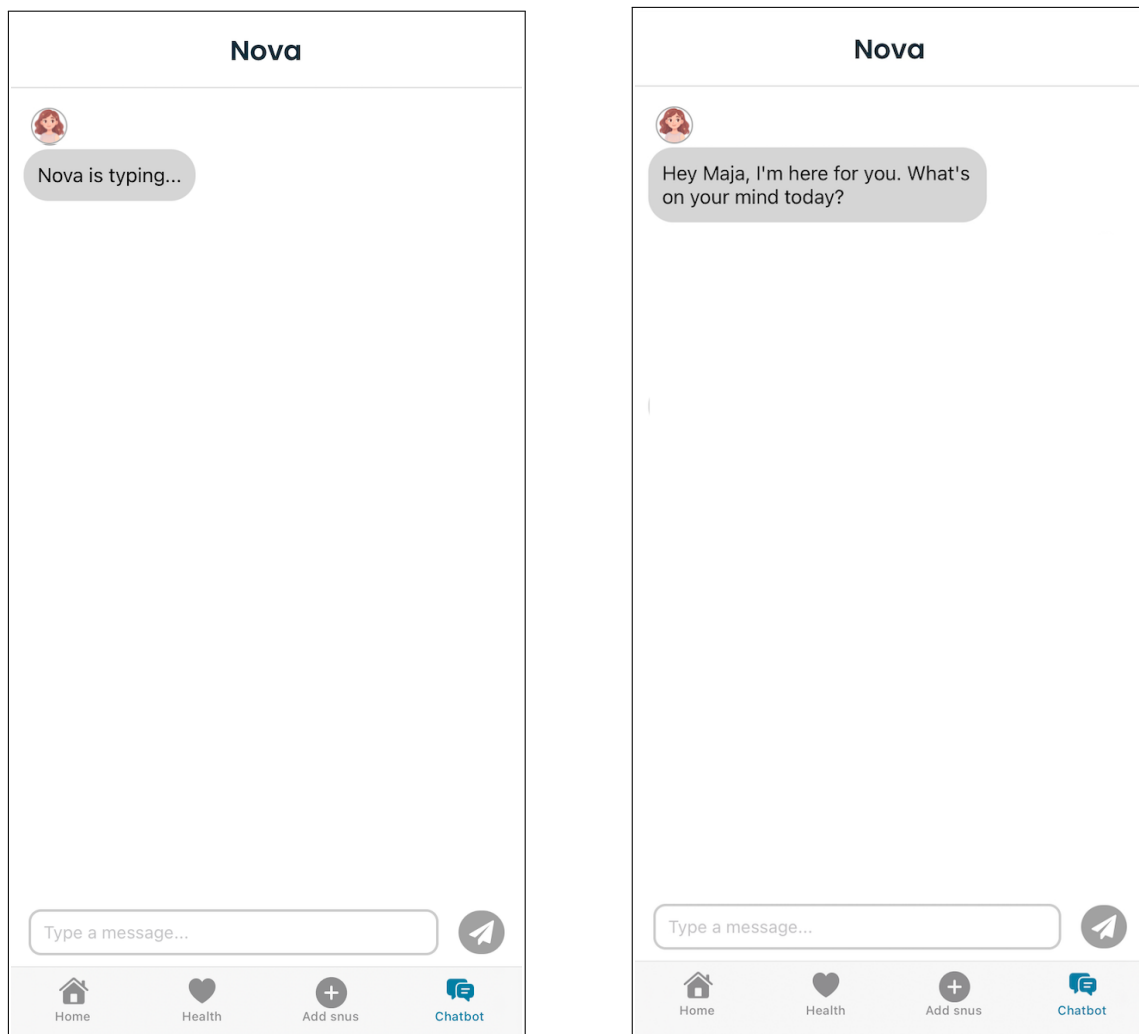
From a UI and UX perspective, the health tab was designed to be clean and minimal, with a clear visual hierarchy to avoid cognitive load. The use of horizontal scrolling encourages user exploration while maintaining a simple layout. The health information is presented in small card-like segments to increase readability and keep users engaged without overwhelming them with information.

4.5.4 Chatbot

The chatbot interface, seen in Figure 4.8, was designed to be minimal and familiar, taking inspiration from standard messaging applications. The aim of a simple interface was to reduce information overload and keep the user's focus on the chatbot's responses. No additional elements were added into the chatbot design in order to avoid distractions, thereby aligning with UI and UX principles such as simplicity and visual hierarchy.

The chatbot, named Nova, was developed as a supportive female persona. This design choice was driven by findings from both the literature review and the interviews which indicated that young women often feel influenced by their peers when it comes to snus use. By making Nova as a friend-like, empathic character, the goal was to enhance trust, relatability, and engagement. The name Nova was chosen not only because it is a female name, but also due to its meaning in astronomy, where a nova represent the sudden appearance of a bright new star. This symbolism align with the chatbot's role in supporting users through positive changes in their snus cessation journey.

To encourage user engagement, an initial message was integrated to appear as soon as the user enters the chatbot tab, shown in Figure 4.8b, with the goal of the user starting a conversation. Multiple greeting variations were implemented to ensure a more natural and less scripted and repetitive interaction. These greetings are selected at random from a predefined list. Additionally, time-based greetings were included to make the chatbot experience feel more personalized. For example, users who open the chatbot before 10:00 can receive a "Good morning" message, while those engaging in the evening may receive a "Good afternoon" greeting. To further create the impression of a human-like, dynamic interaction, a "Nova is typing..." indicator was added before each message is displayed, seen in Figure 4.8a.



(a) Chatbot screen showing the "Nova is typing..." indicator.

(b) Chatbot screen showing the greeting to a regular user.

Figure 4.8: Screenshots from the chatbot interface.

To support first-time users, an introductory message was implemented. This message appears the first time the user opens the chatbot and briefly explains Nova's role, including how she can support the users snus cessation journey. The introductory message can be seen in Figure A.3 in Appendix. This onboarding prompt ensures that users understand the chatbot's purpose and feel guided from the very start of their journey.

From a behavioural perspective, the chatbot applies several principles from nudge theory. The messenger effect nudge is present throughout the chatbot where messages from Nova influences decision-making. Additionally, due to the flexible nature of the system prompt, the chatbot can use various nudge strategies, all personalized based on user interactions.

An example of an interaction with Nova and a participant obtained during the

usability testing can be seen in Figure 4.9.

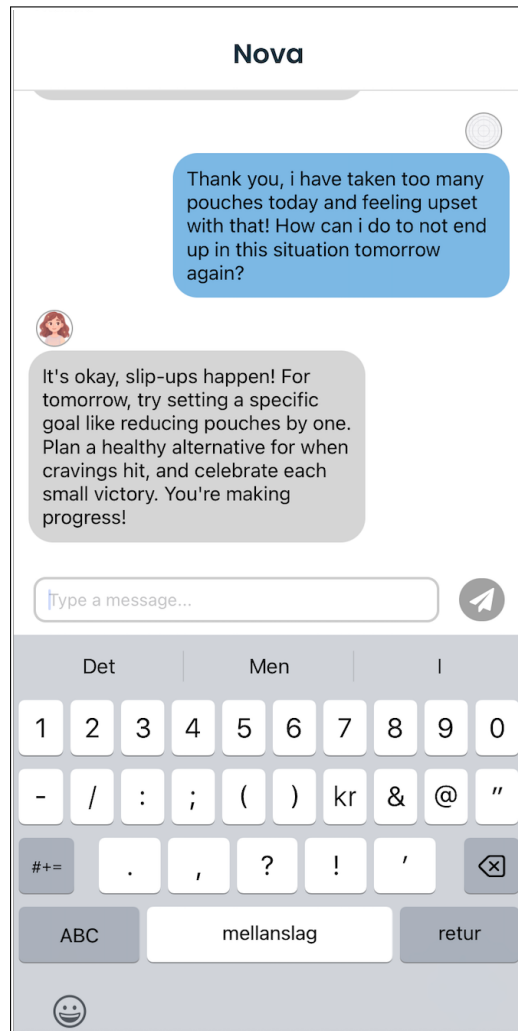


Figure 4.9: Chatbot screen showing a conversation between Nova and a participant.

4.6 Results from Usability Testing

To evaluate the effectiveness, usability, and impact of the mobile snus cessation, a usability test was conducted with five women listed in Table 3.2. Each participant completed an initial questionnaire, performed predefined tasks and answered follow-up questions. Additionally, the participants completed the System Usability Scale (SUS) to quantitatively assess their experience with the application.

4.6.1 Initial Questionnaire

The usability testing began with a short questionnaire aimed at understanding participants' background and digital habits. All participants aged between 18 and 28 used their mobile phone from 2 to 4.5 hours a day (median 3 hours). Everyone used mobile applications designed to support behaviour change, ranging from rarely to the most common answer, occasionally. All participants expressed that they've interacted with chatbots and most use chatbots frequently, but answers varied if they use or have used chatbots on their phone. Opinions on chatbots were consistent across the participants, where everyone found chatbots helpful or sometimes helpful. A majority of participants expressed being very comfortable with using new technology.

4.6.2 Task Completion

Participants were asked to complete multiple predefined tasks within the app with the purpose of mimicking real use scenarios. These tasks included:

- Navigating through the onboarding process (i.e. creating a profile).
- Creating cessation goals.
- Starting a conversation with the chatbot.
- Exploring achievement milestones.
- Logging snus use.
- Exploring health effects associated with snus.

All participants successfully completed the tasks without external assistance. Observations and voice-recordings from the think-aloud process showed that users navigated the interface with relative ease.

4.6.3 Results from the Follow-up Questions

Following the task completion, participants answered follow-up questions regarding their interpretation of the application. The technical knowledge among participants were high as all people felt very confident in using new technology, and everyone used chatbots in their everyday life.

All participants perceived the chatbot feature as very helpful and supporting, with many being surprised at the level of understanding Nova had when users wrote in the chat during the task.

“I am surprised that the chatbot would be this helpful in snus cessation.”
(Participant 1)

Some users commented that Nova gave good tips on how to adapt cessation strategies that didn't seem too difficult for the users to achieve. Also, one user (Participant 3) mentioned that they could imagine using Nova as a snus cessation support tool.

Another feature that were well received by the users was the health tab. All participants were surprised about the physical effects regarding the use of snus.

“I didn’t know that nicotine left the body after multiple days.” (Participant 4)

This made some users reflect on their use of snus and the damages it causes to their health. One participant (Participant 1) mentioned that if she would quit snus, she would have wanted to use the app in order to know what physical reactions she should expect and the health aspects she is improving.

Completing achievements and goals were another feature that was appreciated by the participants. A few mentioned that completing achievements seemed like a game and they would’ve wanted to try completing all achievements if they would use this app. However, creating personalized goals didn’t feel as helpful in their cessation journey.

When logging a snus pouch into the user’s daily usage, most participants expressed that the message prompt probably wouldn’t stop them from using a snus.

“I didn’t even think about the message.” (Participant 5)

One participant (Participant 3) mentioned that the prompt probably would make her irritated in the long term, and she would use the chatbot as a tool instead if she felt unsure about taking a snus or not.

One feature that felt confusing by the users is the card-like sections on the home screen showing the money saved and snus use avoided. Some thought that the snus use avoided would increase when logging a snus pouch and then cancelling. Nonetheless, most users found the visualizing elements like money saved and the snus use graph motivating, with participants expressing their goal in wanting to increase the money saved as much as possible if using the app regularly.

The features that participants expressed would make them continue using the app were the chatbot, achievements, and the health timeline. These features were seen as motivating and fun to engage in.

4.6.4 SUS Score

To assess and quantify overall usability, participants filled out the SUS questionnaire that produces a usability score ranging from 0 to 100. The average mean SUS score among all participants were 90.5. Normalized values per question can be seen in Figure 4.10, where all questions are values between 0-10 representing their contribution to the SUS score. This suggests that the application is generally perceived as consistent easy to use.

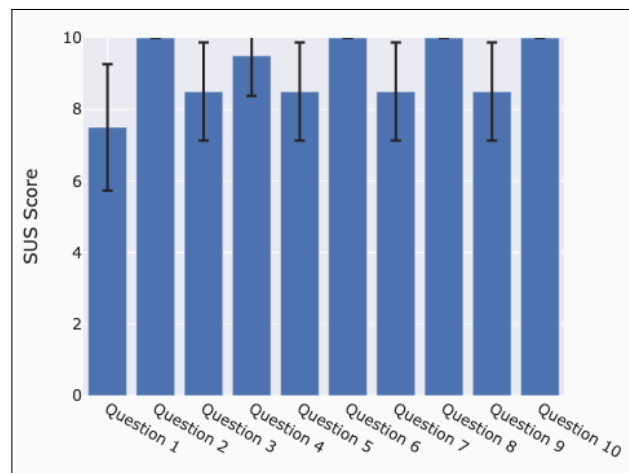


Figure 4.10: Normalized values ranging from 0-10 across the questions 1-10.

5

Discussion

This chapter discusses the key findings of the study in relation to its research objectives and theoretical foundation, and aims to assess the potential and limitations of the developed mobile application as a digital cessation tool. It interprets how digital nudging and conversational AI can be combined to support snus cessation among young Swedish women. The discussion is organized around the four research questions, followed by a reflection on the study's limitations and recommendations for future research.

5.1 Research Questions

This section addresses the research questions that guided the study. Each subsection presents a discussion and interpretation of the findings in relation to a specific research question. The analysis is informed by theoretical insights, state-of-the-art, and the results obtained from interviews, application design, and usability testing. Together, these reflections aim to evaluate the effectiveness and relevance of combining digital nudging and conversational AI in supporting snus cessation among young Swedish women.

5.1.1 How has nudge theory been applied in existing health promoting mobile applications?

Nudge theory has been widely applied in health-promoting mobile applications to subtly influence user decision-making without restricting freedom of choice. These digital nudges take many forms to encourage users toward healthier habits in a non-forced way. Commonly used nudges in existing applications include framing, loss aversion, social norms, messenger effects, and priming, integrated within their interface design. For example, fitness applications like Apple Health and Fitbit apply context-based nudges and milestone notifications to encourage users to stay active. Similarly, in smoking and alcohol cessation apps, strategies such as loss aversion, gamification, and reward visualization are common, helping sustain user motivation over time. These findings align with the theoretical foundation of nudge theory, validating that digital environments are particularly suitable for implementing nudges to encourage healthier behaviours. Despite their strengths, most of these applications adopt a one-size-fits-all nudging approach and lack demographic tailoring. Few explicitly target young women or adapt nudges to the emotional and social context of their nicotine use. This study attempts to address that gap by combining digital

nudges with user-centered design.

5.1.2 What are the primary functions of chatbots in existing tobacco and snus cessation applications?

In existing smoking cessation applications, chatbots have multiple roles that offer educational, motivational, and emotional support. They offer users tips on managing cravings, highlight the benefits of quitting, and provide instant interventions such as breathing exercises or distraction techniques. Additionally, they assist in tracking user progress and celebrating achievements, thereby reinforcing positive behaviours. Emotional support is also provided as chatbots simulate empathetic conversations, helping users feel less isolated during their cessation journey. However, while smoking cessation apps like Smoke Free or QuitBot feature chatbot integration, none of the currently available snus cessation applications include such functionality. This absence shows a significant gap in digital cessation tools specifically targeting snus use. Addressing this gap by implementing a conversational AI chatbot within a snus cessation tool, as done in this study, expands the effectiveness of digital support tools for nicotine dependence.

5.1.3 How can a mobile application that encourages behavioural change of young Swedish women aged 16-29 toward snus cessation be designed by leveraging nudge theory and a conversational AI chatbot?

Designing a mobile application to encourage snus cessation among young Swedish women requires aligning nudges with insights gathered from the target user group. This study shows that combining digital nudging with conversational AI can create a personalized, supportive, and engaging digital cessation tool that aligns with the needs and habits of this specific demographic.

The application integrates several types of digital nudges identified in the theoretical framework. For instance, loss aversion is applied through a health timeline that highlights the health effects associated with snus use, as well as a money-saving tracker that emphasizes financial benefits. The achievement system draws upon anchoring, using progress bars and milestone visualization to show user behaviour in terms of success and growth. Simplification was another key strategy, implemented through the app's intuitive goal-setting process and visual dashboards. This ensured that behaviour change tasks felt achievable and not cognitively overwhelming.

Central to the design was the integration of the conversational AI chatbot, Nova, which served as both a motivational coach and an empathetic companion. Nova was developed using prompt engineering to deliver nudge-aligned dialogue, encouraging users to reflect on their habits, set goals, and stay motivated. The chatbot's tone and structure were intentionally concise and supportive, avoiding overwhelming information. This conversational format allowed users to explore sensitive topics such

as dependency, cravings, and failed quit attempts in a judgement-free environment.

Importantly, the app’s development was guided not only by theory but also by qualitative insights from user interviews. Participants mentioned ideas such as motivational tracking, goal-setting, and progress visualization. These informed both the feature set and the UI/UX design choices, ensuring that the application remained user-centered of young female snus users.

The findings from this study suggest that the integration of nudge theory – combined with a responsive and empathetic chatbot – can create the foundation of an effective digital cessation tool by targeting both the emotional and behavioural aspects of snus use.

5.1.4 How is this application perceived by potential users?

The application was positively received by the participants involved in the usability testing. Users reported that the app was intuitive, visually engaging, and emotionally supportive. All participants successfully completed the assigned tasks – such as logging snus use, setting goals, and interacting with the chatbot – without external guidance. This indicated a high degree of usability and effective interface design. The SUS score of 90.5 confirmed the app’s strong user experience.

Participants particularly appreciated the integration of the conversational AI chatbot, Nova, describing it as supportive, empathetic, and motivating. Unlike generic information, Nova offered tailored responses that reflected the emotional and behavioural context of quitting. Users highlighted that they appreciated the short, manageable messages based by the nudges messenger effects and simplification principles. Visual elements on the home screen, such as the weekly snus usage chart, savings tracker, and achievement badges, were also well received. These features incorporated loss aversion (by showing money saved), anchoring (goal benchmarks), and priming (snus habit visualization), helping users visualize their progress and stay engaged. While feedback was overwhelmingly positive, some participants felt confused or unaffected regarding the visual snus pouch avoided feature, and the message when logging a snus pouch.

Overall, the user feedback suggests that the combination of a conversational AI and digital nudges – when taking on nudge theory and a user-centered approach – has strong potential to support snus cessation in a way that feels supportive, engaging, and encouraging.

5.2 Limitations

While this study presents promising findings and contributes to the understanding of digital solutions for snus cessation, several limitations must be acknowledged.

The sample size of participants was small and demographically narrow, consist-

ing of only five participants aged 18–28. While this age group aligns with the target demographic, the findings may not be representative of the broader population of young women who use snus in Sweden. The use of purposive sampling through personal networks also introduces the potential for selection bias, as participants may share similar backgrounds or attitudes toward health technologies. This limits the generalizability of the findings and underscores the need for future research with a more diverse and representative population of young Swedish women who use snus.

Secondly, the evaluation period was short-term and focused primarily on usability and user perception, rather than long-term behavioural outcomes. Although participants responded positively to the application’s design, chatbot, and nudging features, the actual impact on snus cessation could not be measured within the scope of this study. Longer usability studies are required to assess whether the application can produce behavioural change over time.

Also, while the integration of a conversational AI chatbot was well received, its responses were based on a system prompt. As a result, the chatbot may not always provide qualified advice or deeply contextualized responses in all cases. Although efforts were made to ensure the chatbot maintained a supportive tone and avoided misinformation, it remains as a general purpose AI tool and may not always deliver consistent or appropriate support. This limitation raises questions about safety, accuracy, and ethical responsibility in using generative AI within health applications.

Despite these limitations, the study successfully demonstrates a proof of concept for integrating nudge theory and conversational AI in a user-centered mobile cessation application. These limitations serve as a foundation for identifying future development and research directions.

5.3 Future Work

Based on the insights and limitations identified in this study, several approaches for future work are recommended to further advance the development and evaluation of digital snus cessation applications.

First, expanding the scope and scale of user testing could further evaluate the results of the study. Future studies should involve a larger and more diverse group of participants across different geographical regions and socioeconomic backgrounds to enhance the generalizability of the findings. In particular, including individuals with lower digital experience could provide a broader understanding of the application’s usability in regards to behaviour change among a larger population of users.

Also, it would be valuable to evaluate the long-term impact of the intervention on snus cessation. While participants in this study responded positively to the app’s features, its effect on reducing or quitting snus use over time remains unknown. Studies that track user engagement, relapse events, and motivational levels over several weeks or months would provide deeper insight into the app’s effectiveness

and areas of improvement.

Future work should also explore the potential for adaptive personalization. While this version of the app uses very simple, fixed nudging strategies and a general system prompt, more advanced personalization could be implemented by using behavioural data (e.g., usage patterns, time of day, and relapse risk indicators) to dynamically adjust feedback, reminders, or chatbot tone. Machine learning models could enhance the user experience and support tailored interventions based on individual progress and preferences.

Also, ethical considerations and safety mechanisms surrounding conversational AI must continue to be prioritized. While this study used a system prompt to guide the tone and behaviour of an existing general-purpose model, the chatbot was not specifically trained on snus-related cessation with applied principles of nudge theory. As a result, while it provided motivational and supportive responses, it may lack the precision or depth required for more detailed and personalized guidance. Future implementations could explore the development or fine-tuning of task-specific models for snus cessation to enhance safety, relevance, and reliability of the chatbot.

Lastly, the framework developed in this study, combining nudge theory with a conversation AI, could be adapted for other health behaviour change domains such as alcohol reduction, smoking cessation, or mental health. Extending this approach could contribute to a broader market of digital health tools.

In summary, future research should focus on scaling up, validating and refining the app through larger studies, personalized features, and ethical AI practices to maximize its potential as a practical and impactful tool for snus cessation.

6

Conclusion

This thesis explored how a mobile application could support snus cessation among young women aged 16-29 in Sweden by combining principles from nudge theory with a conversational AI. The aim was to develop and evaluate a user-centered intervention that addresses the behavioural, emotional, and social aspects of snus use, offering a more personalized and empathetic approach to snus cessation.

The study demonstrated that digital nudges – such as progress tracking, health timelines, and achievement milestones – can enhance motivation and user engagement without imposing restrictions. These features were positively received by participants, who noted that visualizing their progress and being rewarded for small wins made the process of quitting snus feel more manageable and encouraging. The integration of a generative AI-powered chatbot further strengthened the intervention. Participants described the chatbot, Nova, as supportive, non-judgemental, and emotionally aware.

The user-centered design process, informed by thematic analysis of interviews with current snus users, ensured that the app was built on real-world experiences and tailored to the needs of its intended audience. This approach allowed the application to reflect the motivations and social contexts that influence snus use among young women in Sweden.

While the study was limited by a small sample size, short evaluation period, and reliance on a general-purpose AI model, it successfully provided a proof of concept for integrating behavioural science and conversational AI in a digital health intervention. These limitations also highlight opportunities for future work, including broader user testing, long-term behavioural impact studies, and the development of more specialized AI models for snus cessation.

Overall, this thesis contributes to the growing field of digital health by presenting an innovative, user-centered approach to nicotine cessation. It demonstrates the potential of combining nudge theory and conversational AI in designing supportive, accessible, and engaging tools that encourage individuals to make healthier choices.

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A

Appendix

A.1 User Interviews

1. How do you think your snus use is related to your moods or activities? In which ways?
2. To what degree has social pressure affected your snus use? In which situations?
3. What do you think are the main benefits of snus for you?
4. Do you use tobacco-based or tobacco-free snus?
 - a) If tobacco-based,
 - i. What health consequences are you aware of when it comes to using tobacco-based snus?
 - b) If tobacco-free,
 - i. What health consequences are you aware of when it comes to using tobacco-free snus?
5. How do you feel when you haven't used snus for a while? How long is 'a while' for you?
6. Have you ever tried quitting snus?
 - a) If yes,
 - i. What motivated you to quit?
 - ii. What were your methods and strategies?
 - iii. Why do you think you failed to quit snus?
 - b) If no,
 - i. What would motivate you to quit?
 - ii. What would your methods and strategies be?
7. If a mobile app could help you quit snus, what features would be most useful to you?
8. If a mobile app could help you quit snus, what features would not be useful to you?

A.2 Application Development

Listing A.1: Code for building the first onboarding screen.

```
import { View, Text, StyleSheet, SafeAreaView, TouchableOpacity,
  Image } from 'react-native';
import { useRouter } from 'expo-router';
import { useEffect, useState } from 'react';
```

A. Appendix

```
import Animated, { useSharedValue, useAnimatedStyle, withTiming }
  from 'react-native-reanimated';
import { FontAwesome } from '@expo/vector-icons';

export default function OnboardingWelcomeScreen() {
  const router = useRouter();
  const [startTransition, setStartTransition] = useState(false);
  const [showButton, setShowButton] = useState(false);

  const handleLetsGo = () => {
    setStartTransition(true);
    cloudOpacities.forEach((opacity, i) => {
      setTimeout(() => {
        opacity.value = withTiming(0, { duration: 1000 });
      }, i * 100);
    });

    setTimeout(() => {
      router.push('/onboarding/nova');
    }, 1500);
  };

  const cloudOffsets = [
    useSharedValue(-150),
    useSharedValue(-150),
    useSharedValue(-150),
    useSharedValue(-150),
    useSharedValue(-150),
    useSharedValue(150),
    useSharedValue(150),
    useSharedValue(150),
    useSharedValue(150),
    useSharedValue(150),
    useSharedValue(150),
  ];

  const cloudHeights = [570, 470, 410, 130, 230, 190, 280, 80, 160,
    520, 620];
  const cloudHorizontalOffsets = [-100, -140, -70, -80, 10, -140,
    100, 160, 180, 140, 90];
  const cloudOpacities = cloudOffsets.map(() => useSharedValue(1));

  useEffect(() => {
    cloudOffsets.forEach((offset, i) => {
      const direction = i < 3 ? -150 : 150;
      offset.value = direction;
      setTimeout(() => {
        offset.value = withTiming(0, { duration: 800 });
      }, i * 200);
    });

    const timer4 = setTimeout(() => {
      setShowButton(true);
    }, 9500);

    return () => {
```

```

        clearTimeout(timer4);
    };
}, []);

const animatedStyles = cloudOffsets.map((offset, i) =>
  useAnimatedStyle(() => ({
    transform: [
      { translateX: offset.value + cloudHorizontalOffsets[i] },
    ],
    opacity: cloudOpacities[i].value,
    position: 'absolute',
    top: cloudHeights[i],
    left: 150,
  })))
);

return (
  <SafeAreaView style={styles.safeArea}>
    <View style={styles.cloudLayer}>
      {animatedStyles.map((style, i) => (
        <Animated.View key={i} style={style}>
          <FontAwesome
            name="cloud"
            size={75 + (i % 2) * 10}
            color="white"
          />
        </Animated.View>
      ))}
    </View>

    <View style={styles.container}>
      <View style={styles.appandappname}>
        <Image source={require('@assets/images/packoff.png')}
          style={styles.logo} />
        <Text style={styles.appname}>PackOff</Text>
      </View>

      <View style={styles.middletext}>
        <Text style={styles.title}>Welcome!</Text>
        <Text style={styles.subtitle}>Your journey to a healthier
          life starts now.</Text>
      </View>

      <TouchableOpacity style={styles.button} onPress={
        handleLetsGo}>
        <Text style={styles.buttonText}>Let's go!</Text>
      </TouchableOpacity>

    </View>
  </SafeAreaView>
);
}

const styles = StyleSheet.create({
  safeArea: {
    flex: 1,

```

```
    backgroundColor: 'rgb(186, 222, 255)',
  },
  container: {
    flex: 1,
    justifyContent: 'space-between',
    alignItems: 'center',
    backgroundColor: 'rgb(186, 222, 255)',
  },
  title: {
    fontSize: 34,
    fontWeight: 'bold',
    marginTop: 44,
    fontFamily: 'Poppins_700Bold',
  },
  appname: {
    fontSize: 29,
    fontFamily: 'Poppins_600SemiBold',
  },
  subtitle: {
    fontSize: 20,
    marginBottom: 200,
    textAlign: 'center',
    fontFamily: 'Poppins_600SemiBold'
  },
  button: {
    backgroundColor: '#fff',
    paddingVertical: 14,
    paddingHorizontal: 32,
    borderRadius: 22,
    marginBottom: 20,
    alignItems: 'baseline',
  },
  buttonText: {
    color: '#kkk',
    fontSize: 18,
    fontFamily: 'Poppins_600SemiBold'
  },
  logo: {
    width: 90,
    height: 80,
    marginRight: 10,
  },
  appandappname: {
    flexDirection: 'row',
    alignItems: 'center',
    justifyContent: 'center',
    marginTop: 10,
    marginBottom: 20,
  },
  middletext: {
    alignItems: 'center',
  },
  cloudLayer: {
    ...StyleSheet.absoluteFillObject,
    zIndex: 1,
    pointerEvents: 'none',
  },

```

```
} ,  
});
```

A.3 Application Design

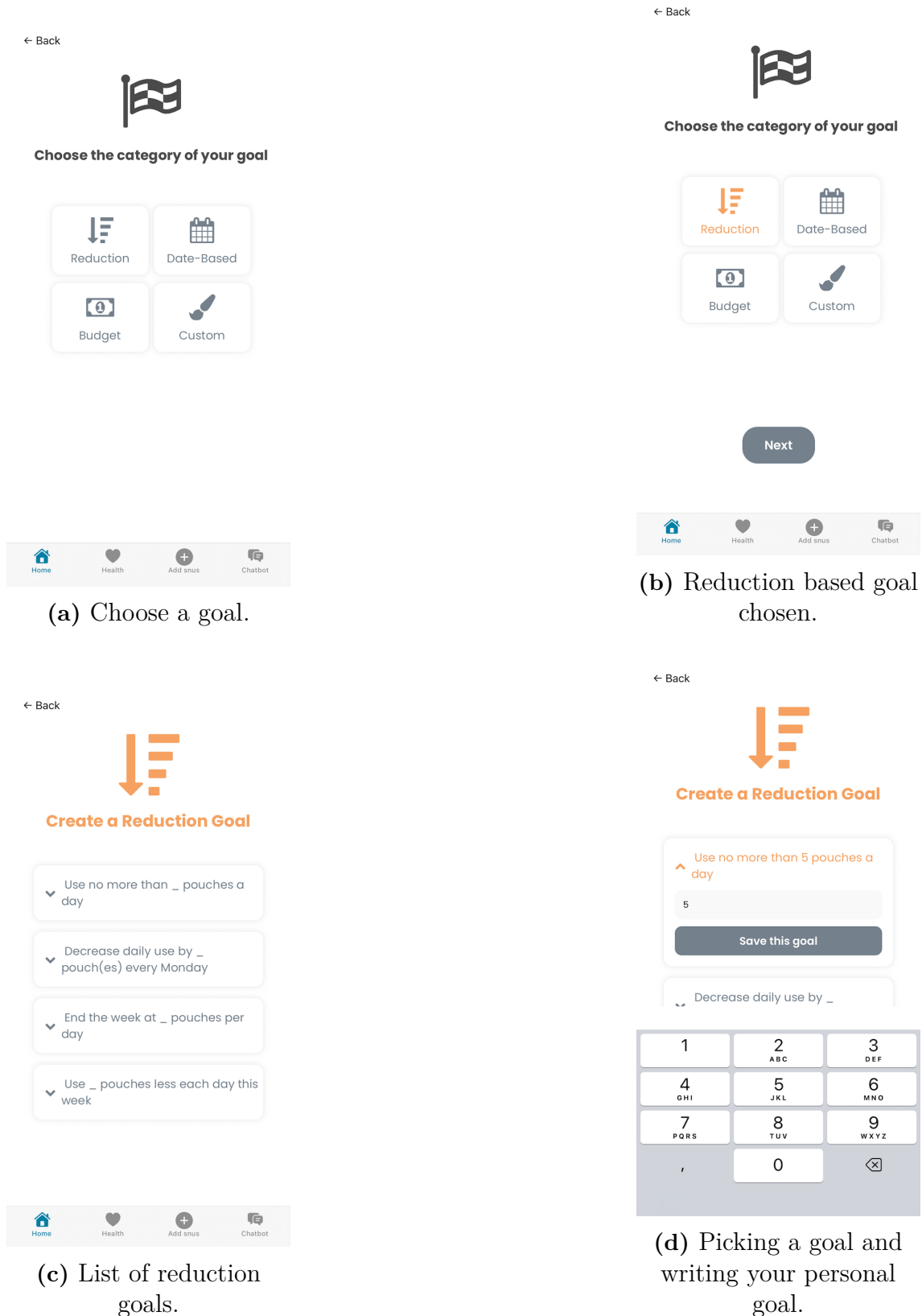
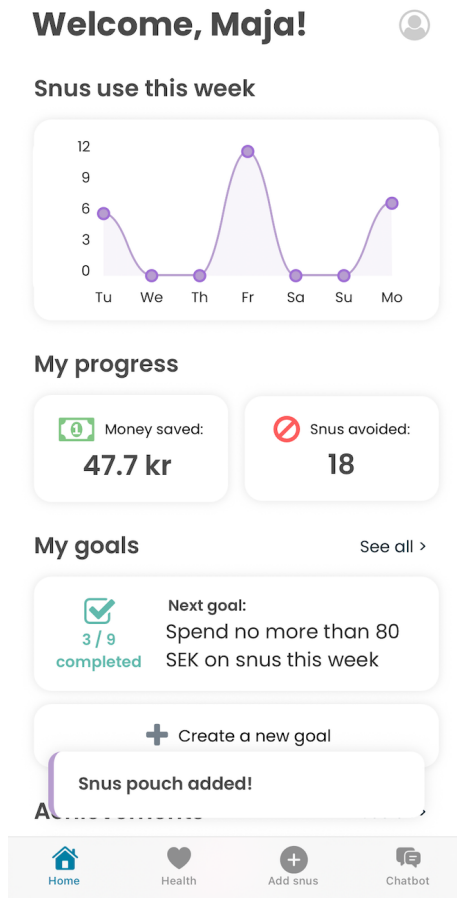
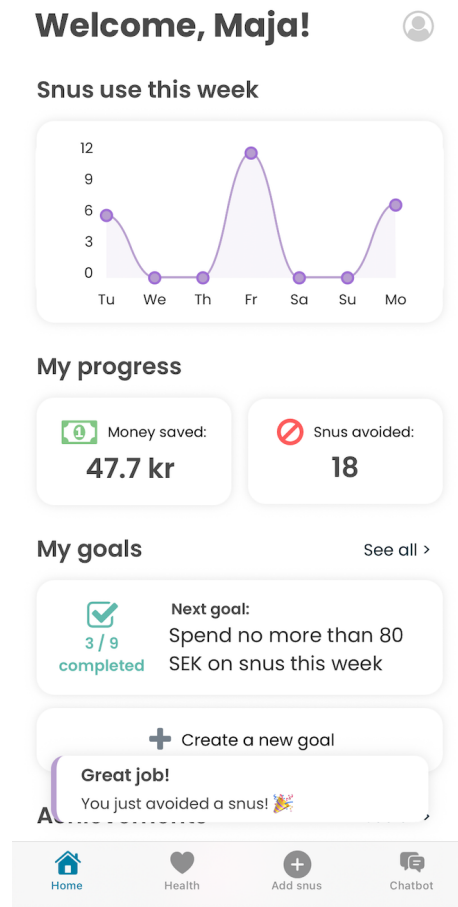


Figure A.1: Screens visualizing how to create a goal.



(a) Prompt when adding a snus.



(b) Prompt when cancelling a snus.

Figure A.2: Screens visualizing the “Add snus” prompts.

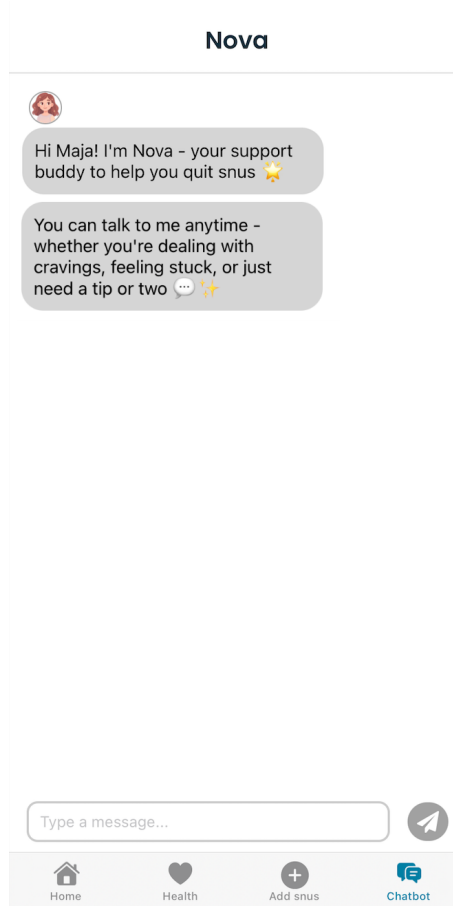


Figure A.3: Chatbot screen showing the interface as a first-time user.

A.4 Usability testing

A.4.1 Consent Form

Consent and information about participation in an Interview and a Usability Testing activity for Chalmers University of Technology

During this study, I agree to participate in both an interview and a usability test related to a mobile application.

Before the usability test, I will take part in a voice-recorded interview. I will be asked questions about my experiences, opinions, and habits related to snus use. I understand that I may choose not to answer any question and can stop the interview at any time.

During the usability test, I agree to participate in testing a mobile application. Throughout the session, only my voice will be recorded. I will be asked to navigate through the app to complete several tasks previously explained, answer questions,

and verbalize my thoughts. Subsequently, I will be interviewed with follow-up questions and be asked to complete a usability questionnaire.

I understand and consent that Maja Vikla will utilize the obtained information in an anonymized way for her master's thesis and will not distribute them further. I acknowledge that my participation in this test is voluntary, and I agree to raise any concerns I may have. Please sign below to confirm that you have read and understood the information provided in this form and that any questions regarding the session have been addressed.

Place:	Signature:
Date:	Name clarification:

A.4.2 Initial Questionnaire

1. How old are you?
2. How many hours per day do you use your phone?
3. How often do you use mobile applications specifically designed to support behaviour change (e.g. improving physical activity, mental well-being, sleep, or nutrition habits)?
 - Frequently
 - Occasionally
 - Rarely
 - Never
4. How often do you interact with artificial intelligence chatbots to assist you with any task or to obtain information on any topic?
 - Frequently
 - Occasionally
 - Rarely
 - Never
5. Do you currently use or have used any chatbots on your mobile phone?
 - Yes
 - No
 - I'm not sure
6. What is your general opinion on chatbots based on your past experiences?
 - I find them helpful
 - I sometimes find them helpful
 - I rarely find them useful
 - I find them confusing or frustrating
 - I have never really used one

7. On a scale of 1 to 5, how comfortable are you with using new technology? (1 = Not comfortable at all, 5 = Very comfortable)

A.4.3 Tasks to Perform

As a participant of this usability test, you will now be asked to complete a series of tasks using the mobile application provided. While doing so, please think and speak out loud – share your thoughts, decisions, and impressions as they arise. It’s also helpful if you describe what you are clicking on, to better understand your focus and navigation through the app.

Case 1: Getting started

You’ve just downloaded the app and want to get started. Before using the app’s features, you need to create your personal profile so the app can tailor your experience.

Tasks:

1. Open the app and begin by following the steps shown on the screen.
2. Read the short introduction from Nova and continue when you’re ready.
3. Answer the questions asked to create your profile.
4. Complete your profile.

Case 2: Setting a goal

You’ve decided that you want to challenge yourself to reduce your snus use this week. You’re motivated by setting personal goals and want to create one that suits your lifestyle.

Tasks:

1. Scroll to the **My goals** section on the home screen.
2. Create a new personal goal.
3. Save your goal and confirm its listed under **My goals**.

Case 3: Managing a Craving

It’s the middle of the day and you feel a strong urge to use snus. You want to use the app to find quick support and reminders to help you manage the cravings and stay on track with your goals.

Tasks:

1. Tap the **Chatbot** tab.
2. Write how you’re feeling to Nova.
3. Follow Nova’s response and explore the advice she’s giving you.

Case 4: Reaching a Milestone

You’ve been actively using the app and realised you’ve hit a milestone – you’ve gone three days without snus! You’re curious to see whether this has triggered a new achievement.

Tasks:

1. Scroll to the **Achievements** section on the home screen.
2. Click to view all available achievements.
3. Check if any achievements have been completed.

Case 5: Logging your Snus Use

You've just used a snus pouch. You want to track this in the app to stay aware of your daily usage and monitor your progress during the week.

Tasks:

1. Tap the **Add snus** tab.
2. Add a snus pouch to your daily usage.
3. Confirm it is listed under your snus use this week.

Now imagine that you were just about to take a snus pouch, but at the last moment, you decided not to.

Tasks:

1. Tap the **Add snus** tab.
2. Cancel the registration of a snus pouch.

Case 6: Exploring the Health Effects of Snus

You're curious about what happens in your body when you stop using snus. You also want to understand how snus affects your health in the long term.

Tasks:

1. Tap the **Health** tab.
2. Read through the timelines of:
 - a. The benefits of quitting snus.
 - b. The health effects of using snus.
 - c. What happens in your body after quitting.

A.4.4 Follow-up Questions

1. How did you perceive Nova?
Did she feel helpful, supportive, annoying, or something else?
2. Did you notice any features in the app that encouraged you toward healthier choices or behaviours?
For example: achievements, tips, chat messages, visual feedback, etc.
3. In what ways (if any) did the app motivate you to reflect on or change your snus habits?
Did you feel more aware of your usage or motivated to reduce it?
4. What part of the app felt most supportive or useful to you – and why?
5. Were there any features that felt confusing, unnecessary or unhelpful?
6. Did the information you received from Nova in Case 3 influence your decision or made you think differently about your snus use?
7.
 - a. In case 5, how did you feel about the confirmation message when logging a snus pouch ("Are you sure you want to add a snus pouch?")?
Did it make you think twice? Did it feel supportive or unnecessary?
 - b. In case 5, when you chose to cancel the snus pouch, how did the "Well done!" message make you feel?
Did it feel genuine, encouraging, or out of place?
8. How helpful do you think earning achievements and/or completing goals are for staying motivated to reduce your snus use?
9. How did the health timelines (e.g. withdrawal symptoms, benefits of quitting) affect your thoughts about quitting or reducing snus?

10. How did seeing your progress in separate areas (e.g. money saved, snus pouches avoided) affect your overall perception of the app's usefulness in helping you quit snus?
11. What would encourage you to continue using this app regularly in your daily life?

A.4.5 System Usability Scale Questionnaire

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

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