

Communication Strategies in a Smoking Cessation Chatbot

The Effects of Message Framing and Personalization on Users' Intention to Quit Smoking and
Engagement

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Abstract

Governments and health organizations have been campaigning for decades about the negative consequences of smoking. However, the number of people who smoke remains high to date. For this reason, increased research is being conducted into smoking cessation interventions, with a recent focus on online interventions such as chatbots. This study looked at which communication strategies can be applied in a smoking cessation chatbot. It was investigated whether message framing (i.e., gain versus loss) and personalization (i.e., personalization versus no personalization) in a chatbot led to a higher intention to quit smoking and user engagement. A 2x2 between-subjects experiment was conducted, in which smokers interacted with one of the four designed smoking cessation chatbots. The results showed that message framing and personalization had no significant effect on the intention to quit smoking. In terms of user engagement, message framing was not a significant predictor, but personalizing chatbot messages can be effective to foster user engagement. Furthermore, the results showed that interacting with a smoking cessation chatbot led to an increase in smokers' intention to quit smoking, regardless of the condition. Thus, chatbots can be used effectively as a smoking cessation intervention, and personalizing chatbots is important to increase user engagement. These insights can be used as guidance for future research into communication strategies in smoking cessation chatbots.

Keywords: smoking cessation, chatbots, message framing, personalization, intention to quit smoking, user engagement

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Communication Strategies in a Smoking Cessation Chatbot: The Effects of Message Framing and Personalization on Users' Intention to Quit Smoking and Engagement

Smoking tobacco has been one of the largest health problems worldwide for many decades (Jha & Peto, 2014). Although the number of adult smokers has decreased in many countries (Ritchie & Roser, 2013), almost one in four adults in the world still smoke (World Health Organization, 2021). This is a major health problem, as there are many health risks associated with smoking. It can lead to an increased risk of cancer, metabolic diseases, and cardiovascular diseases (U.S. Department of Health and Human Services, 2014), and is responsible for eight million deaths per year (World Health Organization, 2019). Even though the number of smokers is decreasing, there are still many people who have to deal with the negative consequences of their smoking behavior.

To reduce the number of smokers, governments have implemented various interventions in the past two decades, such as spreading anti-smoking campaigns through mass media (Zhu et al., 2012). In these campaigns, fear appeal (i.e., encouraging people to change their behavior by arousing fear) is one of the most popular strategies, with an emphasis on the negative consequences of smoking on people's health. However, mass media campaigns with fear appeal often do not lead to quit attempts among smokers as the majority of them are aware of the negative consequences of smoking, and knowledge is not the main barrier to smoking cessation (Babb et al., 2017; World Health Organization, 2020). In addition, fear appeal in mass media campaigns can lead to defensive reactions from smokers that prevent them from accepting the message and changing their behaviors (Williams, 2012). Instead of spreading general messages aimed at inducing fear, it is more effective to convey messages that address smokers' individual motivation to quit, as this results in a higher number of smokers who quit smoking compared to generic campaigns (Lancaster & Stead, 2017; Seifert et al., 2012).

Having individual conversations with smokers is an effective approach to help them quit smoking (Van den Putte et al., 2011; Velicer et al., 2006). Research by Lancaster and Stead (2017) showed that individually delivered smoking cessation counseling from a healthcare specialist can help smokers make successful attempts to quit compared to generic anti-smoking interventions. Talking with smokers about their smoking behavior, why they should quit smoking with personally relevant reasons, and what motivates them to quit smoking, increases the likelihood of successfully quitting (Centers for Disease Control and Prevention, 2020). However, counseling sessions are time-consuming for both healthcare professionals and patients. Moreover, there are major shortages of healthcare professionals in many countries (Michel & Ecartot, 2020), making individualized interventions less feasible.

Fortunately, the rapid growth of digital technologies within healthcare contributes as a useful addition to healthcare workers (Laurenza et al., 2018). Chatbots, i.e., “artificial intelligence programs designed to simulate human conversation” (Palanica et al., 2019, p. 2), are increasingly being used in healthcare to assist with health counseling. Chatbots as an interlocutor have proven effective in various healthcare domains such as sexual health (Brixey et al., 2017; Maeda et al., 2020) and mental health (Cameron et al., 2019; Kamita et al., 2019). Several studies have demonstrated initial promise to use chatbots as an interlocutor for smoking cessation counseling (Almusharraf et al., 2020; Calvaresi et al., 2019; Dubosson et al., 2017). However, there are many challenges for a chatbot to effectively contribute to behavioral change and the absolute effectiveness cannot be concluded yet. Chatbots do not have a high influence on increasing smokers’ intention to quit smoking (Fadhil, 2018) and the user engagement (i.e., how actively users interact with a chatbot) is not optimal (Kelder et al., 2012). A high user engagement with a smoking cessation chatbot is important as this is associated with successful quit attempts (Buller et al., 2014). The intention to quit smoking and engagement with chatbots can be increased by incorporating communication strategies

into the messages of chatbots (Duke et al., 2014; Kull et al., 2021). Hence, it is a research priority to identify which communication strategies in a smoking cessation chatbot can increase the intention to quit smoking and engagement with the chatbot.

A strategy that can make a smoking cessation chatbot more effective is by framing the chatbot messages in such a way that it motivates users to quit smoking. A commonly used frame for smoking cessation purposes is goal framing where the benefits of quitting smoking are conveyed using a gain-frame or the risks of smoking using a loss-frame (Toll et al., 2008). Research by Ma and Nan (2018) showed that this type of message framing affects smokers' attitudes and self-confidence toward quitting smoking and ultimately has an impact on the intention to quit (Ajzen, 1991). In addition, several studies showed that message framing affects users' engagement with a chatbot (Gifford & Comeau, 2011; Harden & Heyman, 2018). In summary, message framing in the messages of a smoking cessation chatbot may affect users' intention to quit smoking and engagement.

Another strategy to make smoking cessation chatbots more effective is by personalizing the messages. Compared to mass media campaigns, chatbots can be used to realize a one-to-one approach in which the output is made personally relevant. Personalization increases the personal relevance to the individual users, which is a key factor in successful smoking cessation interventions (Fan & Poole, 2006). Messages from a chatbot can be personalized by addressing the users by their name (Dijkstra & Ballast, 2011), tailoring the messages to the input of the users (Laban & Araujo, 2020), and tailoring the information and advice to the demographic characteristics, current behavior, and motivation state of the users (Haim et al., 2018). Research has shown that personalizing anti-smoking messages has a positive effect on the intention to quit smoking (Dijkstra & Ballast, 2011) and increases the number of people that quit (Dijkstra, 2004). In addition, personalizing a chatbot can ensure higher user engagement by increasing the perceived personal relevance (Bleier et al., 2018),

which is important for a chatbot to be able to contribute to behavioral change (Alkhaldi et al., 2017). Personalization may affect smokers' intention to quit smoking and engagement with the chatbot.

Previous studies showed that message framing and personalization may influence smokers' intention to quit smoking and their engagement with anti-smoking interventions. However, little research has proven the effects in digital settings such as chatbots. Considering the accessible and scalable potential of chatbots as well as their unique one-to-one communication, it is essential to identify effective communication strategies that help realize chatbots' potential. This research adds to the existing literature by examining whether message framing and personalization in the messages of a smoking cessation chatbot affect users' intention to quit smoking and their engagement with the chatbot. It is also being explored whether the use of message framing and personalization can positively reinforce each other. The following research question has been drawn up: *To what extent do message framing (gain versus loss) and personalization (personalized versus non-personalized) in a smoking cessation chatbot's messages affect smokers' intention to quit smoking and their engagement with the chatbot?* By answering this question, this research provides insight into which communication strategies health organizations and chatbot developers should include in the design of the messages of a smoking cessation chatbot so that the chatbot supports smokers in quitting smoking.

Theoretical framework

Traditional smoking cessation interventions

In recent decades, governments and health organizations have been using mass media campaigns as the main approach to smoking cessation interventions (Brinn et al., 2012; Thompson, 1978). These campaigns aim to distribute threatening health messages to a large group of smokers and focus on naming the disadvantages of smoking using a fear appeal. Textual and graphic warnings (e.g., naming or showing the negative effects of smoking on people's lungs or teeth) are typical examples of fear-inducing communications (Mannocci et al., 2014). Although fear-inducing campaigns are widely used, the empirical evidence of researchers on the effectiveness of these campaigns to get smokers to quit is mixed. Whereas some practitioners have evidence that fear-inducing campaigns are effective for behavior change (Morales et al., 2012; Xu et al., 2015), other practitioners have evidence that such campaigns are counterproductive (Ruiter et al., 2014; So, 2021).

Studies by Babb et al. (2017) and Williams (2012) showed that there are three reasons why the use of fear appeal does not contribute to behavioral change. The majority of smokers are familiar with the general disadvantages communicated through the campaigns, knowledge alone does not contribute to behavioral change, and the use of fear appeal in mass media campaigns can lead to defensive reactions that prevent smokers from accepting the message. In addition, research by Niederdeppe et al. (2008) showed that mass media campaigns are not the most effective medium to approach smokers. Anti-smoking campaigns are not as effective for people of low socioeconomic status (SES) compared to those who have a higher education, while smoking prevalence is higher among people with a low SES (Hiscock et al., 2011). Thus, a fear appeal can be counterproductive and mass media campaigns are not effective for certain groups. Designing interventions that are focused on the individual has been a research priority since.

Another smoking cessation intervention that has been used in recent decades is individual behavioral counseling (Richter et al., 2015; Zhu et al., 1996). In individual behavioral counseling, a smoker engages with a healthcare professional in a one-to-one conversation. Compared to mass media campaigns, no general threatening message with fear appeal is spread, but the conversation focuses on the individual smoking behavior and the personal motivation of smokers to quit. The conversation is more in line with the individual, making them more open to the information and advice that is given, which can lead to an increase in the smoker's intention to quit smoking (Klemp et al., 2016). However, individual counseling often takes place face-to-face, making it time-consuming. With the current shortages of healthcare professionals, individual counseling puts more pressure on healthcare (Michel & Ecartot, 2020). It also requires a fair amount of time and effort from the smokers which can create a barrier for them to be present. Because of these disadvantages of individual counseling, increased research is being conducted into digital smoking cessation interventions.

Digital smoking cessation interventions

The advent of the internet has led to a huge growth in digital technologies that can offer opportunities for healthcare. This digital form of healthcare is called E-health, which can be defined as “the application of digital information and communication to support and improve health and healthcare” (Van Lettow et al., 2019, p. 6). Digital health interventions are already being used for smoking cessation in various forms. For example, websites are already being used to inform smokers about the disadvantages of smoking, smokers can receive text messages that can support them in quitting smoking, and there are mobile applications that monitor how long a smoker has not lit a cigarette (Troelstra et al., 2021).

The use of digital interventions for smoking cessation has several advantages. Research by Murray et al. (2016) showed that digital tools can increase the effectiveness,

efficiency, accessibility, safety, and personalization of smoking cessation interventions. In addition, digital technology makes it possible for interactive elements to be applied in the interventions, allowing the content to be tailored to the individual (Taylor et al., 2017). As a result, digital interventions such as apps, text messages, and websites can have a positive influence on changing smokers' unhealthy behavior (Ponciano-Rodríguez et al., 2018; Tran et al., 2018). Besides the existing digital health interventions, new modern technologies (e.g., chatbots) offer additional possibilities within healthcare. Researchers are increasingly looking at whether these new modern technologies can also be effectively applied for smoking cessation (Kocaballi et al., 2019).

Chatbots

Chatbots can be defined as “computer systems that use artificial intelligence and natural language processing to mimic human conversation” (Ranoliya et al., 2017, p. 1525). Chatbots within healthcare are used for various purposes such as providing medical information, scheduling appointments, and providing mental healthcare (Hajjar, 2022). There is also increased research into the use of chatbots to stimulate behavioral change, such as quitting smoking (Laranjo et al., 2018; Taylor et al., 2017). Perski et al. (2019) looked at the added value of a supportive chatbot in a smoking cessation application and showed that the addition of a chatbot to a smoking cessation application more than doubled user engagement. Also, participants had a greater chance of success in quitting smoking when they used the chatbot and application compared to only the application. This research showed that chatbots can offer added value as an intervention to stimulate smoking cessation.

The use of chatbots as a smoking cessation intervention has two major advantages (Pereira & Diaz, 2019). First, chatbots monitor the smoking behavior of smokers and raise awareness of this behavior to encourage smokers to develop better habits. Second, chatbots have a high degree of anonymity, which makes it more acceptable for smokers to share

information compared to a human interlocutor. However, the current generation of chatbots is not fully deployed to their potential and there are still many areas for improvement. Current chatbots are more engaging compared to other digital interventions (Perski et al., 2019), however, the engagement of users with chatbots is not yet optimal (Kelders et al., 2012). This might be problematic in smoking cessation as it requires sustained effort. Also, conversing with chatbots does not always have a high influence on users' intention to quit smoking (Fadhil, 2018). Studies by Duke et al. (2014) and Kull et al. (2021) showed that the likelihood of a smoker quitting smoking and engagement with smoking cessation interventions can be increased by applying communication strategies (i.e., techniques in communication toward recipients). The addition of communication strategies in the messages of a smoking cessation chatbot could potentially increase users' intention to quit smoking and engagement with the chatbot.

Communication strategies

Message framing

A communication technique that can be applied in a smoking cessation chatbot is message framing. This technique can be defined as “the content and approach that is used to construct information and communications” (Spacey, 2016, para. 1). Messages can be conveyed with different frames so that receivers are presented with the same message in diverse ways. The most commonly used form of message framing is goal framing, in which the goal of behavior is framed (Levin et al., 1998). In this form of framing, messages are framed positively by focusing on the gains of certain behavior (gain-frame) or negatively by focusing on the losses of certain behavior (loss-frame; Chen et al., 2018). Anti-smoking messages can also be gain-framed (e.g., “you will save money if you quit smoking”) or loss-framed (e.g., “you will lose money if you continue smoking”; Toll et al., 2008, p. 195).

The prospect theory of Kahneman and Tversky (1979) explains the possible mechanism of how gain-frames and loss-frames are perceived differently. This theory suggests that people prefer messages with a loss-frame when the outcomes of behaviors are risky (e.g., detection behavior) and a gain-frame when the outcomes are less risky (e.g., prevention behavior). Rothman et al. (2006) also suggest that messages with a loss-frame have a higher influence on detection behavior (e.g., HIV testing) and messages with a gain-frame have a higher influence on prevention behavior (e.g., exercising to prevent overweight). Smoking cessation messages help smokers to quit smoking so that they experience fewer health problems and can prevent complaints of cancer. Thus, smoking cessation is seen as prevention behavior instead of detection behavior, and the theory suggests that for smoking cessation gain-framed messages are more effective than loss-framed messages.

The theoretical effectiveness of gain-framed and loss-framed messages has also been investigated in several empirical studies. Research by Schneider et al. (2001) and Toll et al. (2007) showed that a gain-frame in anti-smoking messages appears to be more effective than a loss-frame to change smokers' behavior. Message framing also affects smokers' attitudes and self-confidence toward quitting smoking (Ma & Nan, 2018) and ultimately has an impact on the intention to quit smoking, according to the theory of planned behavior (Ajzen, 1991). This is supported by a study by Arendt et al. (2018) which showed that gain-framing messages, compared to loss-framing, led to an increase in smokers' intention to quit smoking. However, no research has been done on the influence of message framing in a chatbot's messages on the intention to quit smoking. Since studies showed that the use of gain-frame in anti-smoking messages is more effective than a loss-frame, the following hypothesis has been established.

H₁: The use of gain-framed messages in a smoking cessation chatbot leads to a higher intention to quit smoking among its users compared to loss-framed messages.

In addition, message framing can also influence other factors. Several studies showed that the use of a gain-frame or loss-frame in anti-smoking messages may affect how engaged smokers are with a smoking cessation intervention (Cornacchione & Smith, 2012; Strekalova & Damiani, 2016). A study by Mavandadi et al. (2017) looked at the effect of message framing in patient reminder letters on their engagement rates and showed that a gain-frame led to higher user engagement with the intervention. Furthermore, the positive effect of the gain-frame on engagement can be explained by the aforementioned prospect theory by Kahneman and Tversky (1979). According to this theory, people are less likely to resist and disengage from interventions for prevention behaviors (e.g., smoking cessation) when a gain-frame is used. By gain-framing the information, the recipients of the message are not deterred compared to a loss-frame, making the recipients more open to the message of the intervention and spending more time on the intervention. Therefore, the following hypothesis has been drawn up.

H₂: The use of gain-framed messages in a smoking cessation chatbot leads to higher user engagement compared to loss-framed messages.

Personalization

In addition to message framing, another important communication strategy for anti-smoking messages is to make the messages more personal for smokers. Personalization in digital communications can be defined as “a process that changes the functionality, interface, information access and content, or distinctiveness of a system to increase its personal relevance to an individual or a category of individuals” (Fan & Poole, 2006, p. 183). Messages can be personalized by tailoring the messages to individuals based on their characteristics (e.g., first name, gender, age), behaviors, and needs, and aims to enhance the relevance of the information in the messages (Kreuter & Wray, 2003).

How personalization enhances health communication messages can be explained by two mechanisms (Hawkins et al., 2008). First, personalization enhances the acceptance and processing of messages. This can be explained by the fact that personalizing information increases the attention, effortful processing, and self-references of the recipients. Thus, personalizing anti-smoking messages can make smokers more open to processing and accepting this information, and their resistance to anti-smoking messages is reduced. Second, personalization based on the behavior of the recipients can affect self-efficacy, behavioral intent, decision-making, outcome expectations, and normative perceptions of the recipients. Personalizing anti-smoking messages based on the behavior of smokers can lead to changes in the behavior of smokers.

In addition to the theoretical explanation, empirical research has also shown that personalizing messages can have an added value for smoking cessation interventions. Research by Dijkstra (2004) together with Ballast (2011) showed that personalizing messages, by addressing smokers by their first name and giving individual feedback to smokers, increased persuasion and led to a higher number of people who quit smoking, compared to non-personalized messages. Following the theoretical expectation and the empirical evidence, the following hypothesis has been established.

H₃: The use of personalized messages in a smoking cessation chatbot leads to a higher intention to quit smoking among its users compared to non-personalized messages.

Besides the effect on the intention to quit, personalization may also affect the relationship of the users with a chatbot. Personalizing messages ensures that users feel more personally addressed, making them experience the relationship as more engaging and enjoyable (Holland & Baker, 2001). This has been confirmed in a few studies (Dijkstra & Ballast, 2011; Bleier et al., 2018), which showed that the use of personalization can foster user engagement with chatbots. Since the use of personalized messages can lead to a higher

user engagement with a chatbot compared to non-personalized messages, the following hypothesis has been drawn up.

H4: The use of personalized messages in a smoking cessation chatbot leads to higher user engagement compared to non-personalized messages.

Interaction effects: combining message framing and personalization

No research to date has studied the interaction effects of combining message framing and personalization in smoking cessation interventions. However, various message strategies in health messages are often combined. These strategies likely have individual and interaction effects (Kaskutas & Graves, 1994). A study by Heisig et al. (2015) looked at the use of message framing and personalization in informed consent procedures and showed that personalization and message framing together led to more positive outcomes. This finding suggests that combining message strategies might increase the effectiveness of persuasive messages. Based on these results and the results of previous studies in favor of the gain-frame and the use of personalization, the following two hypotheses have been established.

H5: The gain-framing and personalization of a smoking cessation chatbot's messages reinforce each other's positive effect on the intention to quit smoking.

H6: The gain-framing and personalization of a smoking cessation chatbot's messages reinforce each other's positive effect on user engagement.

Method

Research design

To investigate the effect of message framing and personalization in a smoking cessation chatbot on the intention to quit smoking and user engagement, a 2 (message framing: gain-frame vs. loss-frame) x 2 (personalization: personalized messages vs. non-personalized messages) between-subject online experiment was conducted. Participants were assigned to one of the four conditions, in which they had a conversation with a smoking cessation chatbot. Moreover, participants were asked to complete an online questionnaire, which measured demographic, control, manipulation check, and dependent variables.

Participants

To participate in the study, there were two criteria checks that the participants had to meet. Since the chatbot aimed to support smoking cessation, the target group consisted of smokers who smoke at least one tobacco product per week. In addition, the participants had to be 18 years or older because this is the minimum age to legally buy cigarettes in the Netherlands from which this study was conducted. The participants of this study were collected via convenience sampling on the Prolific platform. An a-priori statistical power analysis for two-way ANOVA using G*Power (*G*Power*, 2019) suggested that a minimum sample size of 125 participants was needed to discover medium-sized effects (effect size $f = 0.25$, power = .80), which was in accordance with previous meta-analyses on the effects of message framing and personalization on eHealth and smoking cessation interventions (Gallagher & Updegraff, 2011; Lau et al., 2020).

A total of 135 participants took part in this experiment. Of these, 10 participants did not complete the questionnaire or chatbot conversation, leaving 125 participants in this study. The average duration of participants' participation was 11 minutes. Participants who took

longer than 40 minutes to participate were automatically rejected by Prolific. Participants who completed their participation in an extremely short time, less than 4 minutes, were removed as their data might have been less valid. Among the eligible participants, 88 were male (70.4%), 34 were female (27.2%), and 3 were non-binary or had a third gender (2.4%). The average age was 33, the youngest participant was 18 and the oldest participant was 70. The majority of the participants had a bachelor's degree ($n = 52$, 41.6%). This was followed by undergraduate ($n = 29$, 23.2%), high school graduate or less than high school ($n = 27$, 21.6%), and master's degree and PhD or higher ($n = 17$, 13.6%).

Materials

The two independent variables used to manipulate the chatbots were message framing and personalization. In message framing, a distinction was made between the use of a gain-frame where the focus was on the benefit of quitting smoking and a loss-frame where the focus was on the disadvantage of smoking. In personalization, a difference was made between a personalized chatbot in which messages were adapted to the individual user and a non-personalized chatbot in which messages were generic to all users. An overview of the four experimental conditions can be seen in Table 1 and the chatbot scripts per condition can be found in Appendix A.

Table 1

Experimental conditions

Conditions	Message framing	Personalization
Condition 1	Gain-frame	Personalized messages
Condition 2	Gain-frame	Non-personalized messages
Condition 3	Loss-frame	Personalized messages
Condition 4	Loss-frame	Non-personalized messages

Chatbot

The chatbots for this experiment were built in the online chatbot design program Flow.ai. The chatbot type chosen for this research was a rule-based chatbot because it gives accurate outcomes compared to AI-powered chatbots, which is important for medical information (Malik, 2019). There was a limited capability for this chatbot to understand natural language, and using constrained input allowed the content to be tailored to the users' wants and needs. To ensure that the chatbots contributed to helping the users quit smoking, the conversation needed to be based on effective intervention guidelines. The structure of the conversation was built using the 5A model suggested by the World Health Organization (2014). This model is designed as a guideline for smoking cessation interventions, based on the systematic approach of "Ask, Advice, Assess, Assist, Arrange". Several studies have shown that using this model for the structure of smoking cessation interventions can be effective (Alomari et al., 2013; Simmons et al., 2012). An overview of the conversation structure can be seen in Table 2.

Table 2

Structure of the chatbot conversation following the 5A model

Stages	Task
1. Ask	Asking the user to describe their smoking behavior
2. Advice	Advising the user to quit smoking
3. Assess	Assessing the willingness to quit smoking of the user
4. Assist	Assisting in quitting smoking by giving concrete advice
5. Arrange	Arranging a follow-up conversation with the user

Message framing

The use of either a gain-frame or a loss-frame was applied to the context of the smoking cessation chatbots. The messages of the chatbots with the gain-frame focused on the desired behavior (i.e., quitting smoking) in a positive way. The chatbots asked questions that focused on good things about quitting smoking (e.g., “please tell me one good thing about quitting smoking”), indicated that quitting smoking has advantages and mentioned some advantages (e.g., “people who quit smoking reduce the risk of lung cancer by 30 to 50% compared to people that continue smoking”), and the exercises given by the chatbot focused on the benefits of smoking cessation (e.g., “list three benefits of quitting smoking and repeat these benefits three times”). The gain-frame was also applied by talking about the benefits of quitting smoking in the response to the answers of the chatbot users (e.g., “you are well aware of the benefits of quitting smoking”). The messages of the chatbots with a loss-frame focused on the current undesirable behavior (i.e., smoking) in a negative way. The chatbots asked questions that focused on the disadvantages of smoking (e.g., “please tell me one bad thing about smoking”), indicated that smoking has many disadvantages and mentioned some disadvantages (e.g., “people who continue smoking are 15 to 30 times more likely to get lung cancer compared to non-smokers”), and the exercises given by the chatbot focused on the cons of smoking (e.g., “list three disadvantages of continuing smoking and repeat these disadvantages three times”). The loss-frame was also applied by talking about the disadvantages of smoking in the response to the answers of the chatbot users (e.g., “you are well aware of the disadvantages of smoking”).

In each stage of the 5A model, message framing was applied to the messages of the chatbots in the form of a gain-frame or loss-frame. The stimuli were based on stimuli from other studies on the use of a gain-frame and loss-frame for smoking cessation. An overview of all stimuli used in this study for message framing can be seen in Table 3.

Table 3*The stimuli for message framing*

Stage	Topic	Gain-frame	Loss-frame	Source
1. Ask	Benefits and costs	“Please tell me one <i>good</i> thing about <i>quitting smoking</i> .”	“Please tell me one <i>bad</i> thing about <i>smoking</i> ?”	Toll et al., 2010
2. Advice	Money	“ <i>Quitting smoking</i> also has other benefits besides health benefits. <i>It might also save you a lot of money</i> .”	“ <i>Smoking</i> also has other disadvantages besides health risks. <i>Smoking costs a lot of money</i> .”	Toll et al., 2008
	Friends and family	“ <i>Quitting smoking</i> can <i>protect your family and friends</i> from diseases related to second-hand smoke.”	“ <i>Smoking</i> can also <i>cause diseases</i> related to second-hand smoke in your close family and friends.”	Toll et al., 2008
	Health	“People who quit smoking <i>reduce the risk of lung cancer by 30 to 50%</i> compared to people that continue smoking.”	“People who continue smoking are <i>15 to 30 times more likely to get lung cancer</i> compared to non-smokers.”	Centers for Disease Control and Prevention, 2021; National Cancer Institute (US), 2022; Steward et al., 2006
3. Assess	Process	“ <i>With the right motivation</i> , many others have also <i>succeeded in quitting smoking</i> .”	“ <i>Without the right motivation</i> , others have <i>failed in quitting smoking</i> .”	Toll et al., 2010

4. Assist	List of benefits/costs	<p>“List <i>three benefits of quitting smoking</i> and repeat these <i>benefits</i> three times. This way you will be reminded of what the <i>benefits of quitting smoking</i> are for you.”</p>	<p>“List <i>three disadvantages of continuing smoking</i> and repeat these <i>disadvantages</i> three times. This way you will be reminded of what the <i>disadvantages of smoking</i> are for you.”</p>	Toll et al., 2007
	Nicotine patches	<p>“Your attempts to quit smoking are more <i>likely to succeed</i> if you use nicotine replacements, like gum or patches.”</p>	<p>“Your attempts to quit smoking are more <i>likely to fail</i> if you <i>don't use</i> nicotine replacements, like gum or patches.”</p>	Steward et al., 2006
5. Arrange	Support	<p>“<i>Talking to others</i> about your decision to quit <i>makes quitting smoking easier.</i>”</p>	<p>“<i>Keeping your decision a secret and not sharing with people</i> that you want to quit <i>will likely decrease your motivation.</i>”</p>	Toll et al., 2008
	End of conversation	<p>“And remember... <i>If you hold on to your reasons for quitting</i>, you will have a <i>better chance of success in quitting smoking.</i>”</p>	<p>“And remember... <i>If you do not hold on to your reasons for quitting</i>, you will have a <i>greater chance of failure to quit smoking.</i>”</p>	Toll et al., 2007

Personalization

The personalized chatbots sent messages that were tailored to the individual users. The chatbots without personalization sent messages that were the same for all users. Studies by Li (2016) and Li and Liu (2017) showed that one simple personalization cue might not be sufficient to generate favorable effects and suggested combining multiple personalization strategies to maximize the effect. Therefore, three forms of personalization were applied to ensure that there is a clear difference between personalized and non-personalized messages. The first strategy was identification, in which a distinction was made in how the users were addressed. According to Dijkstra and Ballast (2011) and Hawkins et al. (2008), a chatbot can be personalized by naming the user's first name in the conversation (e.g., "Linda, I hope you now have a better idea of what the benefits of quitting smoking are"). The chatbot without personalization responded in a general way (e.g., "I hope you now have a better idea of what the benefits of quitting smoking are"). The second strategy that was used to personalize the chatbot is through personalized response (Hawkins et al., 2008; Laban & Araujo, 2020). The chatbot responded to the answers of the individual users by giving a summary of their attitudes, beliefs, or behaviors disclosed (e.g., "Linda, I understand that you are not yet very motivated to quit smoking"). The non-personalized chatbot gave a general response or continued the conversation (e.g., "Ok, thanks"). The third strategy that was used to personalize the chatbot was by adapting the information and advice to the demographic characteristics, smoking behavior, preferences, and living situation of the individual smokers (Hawkins et al., 2008; Kocielnik et al., 2018; Sillice et al., 2018). The demographic characteristics to which the messages were tailored are gender and age (e.g., "Linda, young adult women like you live healthier lives when they quit smoking. The risk of lung cancer is reduced by 30 to 50 % compared to young adult women who continue smoking"). The non-personalized chatbots gave the information and advice in a general way which was the same

for all users (e.g., “people who quit smoking reduce the risk of lung cancer by 30 to 50% compared to people that continue smoking”).

For the first strategy, the name of the participant was asked at the beginning of the conversation. The name given by the participants was applied in multiple messages in all stages of the 5A model. In the second strategy, a personalized response was given by the chatbot based on answers from the participants (typed answers and answers that were registered via buttons). The personalized response was applied during the *Ask*, *Advice*, and *Assist* stage. For the third strategy, questions were asked by the chatbot in the conversation to find out the individual characteristics of the participants, so that the information and advice could be tailored to them. This strategy was applied in the *Advice* and *Assist* stage. An overview of the three strategies can be found in Table 4.

Table 4

The stimuli for personalization

Strategy	Personalized messages	Non-personalized messages	Source
1. Identification	The users are addressed personally.	The users are generally addressed.	Dijkstra & Ballast, 2011; Hawkins et al., 2008
2. Personalized response	The responses of the chatbot are adapted to the information that the individual user discloses.	The chatbot gives a general answer which is the same for all users.	Hawkins et al., 2008; Laban & Araujo, 2020
3. Tailored information and advice	The messages are tailored to the demographic characteristics and smoking behavior of the individual users.	The messages are the same for all users. Individual characteristics are not considered.	Hawkins et al., 2008; Kocielnik et al., 2018

Pre-test

Prior to the experiment, a pre-test was conducted with 20 participants. The pre-test aimed to investigate to what extent the differences between the manipulations were clear and to obtain feedback on the chatbot and questionnaire. Two independent samples t-tests were performed to check whether the manipulations were clear to the participants and showed that the manipulations for message framing and personalization were in the right direction. There was a clear distinction in the perception of emphasized gain versus loss among the participants assigned to different conditions. There was also a distinction in the perception of personalized and non-personalized chatbots, however, this difference was less clear. Therefore, the messages from the personalized chatbot were made more personal. For example, the response “Okay!” was changed to “Thanks for your honest answer! 😊”.

Furthermore, emojis have been removed from the messages of the non-personalized chatbots because they could contribute to the perception of personalization (Manganari, 2021). The questionnaire used for the pre-test, which was also used for the main experiment, can be seen in Appendix B and the questions in the questionnaire that only applied to the pre-test can be seen in Appendix C.

Procedure

The participants were first given an explanation about the online experiment and had to fill in an informed consent form. After this, they had to complete a pre-test questionnaire in which two criteria check questions were asked (e.g., “are you 18 years of age or older?”) and the baseline intention to quit smoking (hereinafter referred to as the pre-test intention to quit smoking) was measured. After the pre-test questionnaire, the participants were redirected to the page of the chatbot conversation. The participants received instructions about the chatbot conversation and a link to one of the four chatbots. After the conversation, the participants returned to the questionnaire where they were asked for a unique code that they received at

the end of the conversation to check if they had completed the entire conversation and which chatbot they had talked to. The participants received a post-test questionnaire that measured the manipulation check questions, dependent variables, control variables, and demographic questions. Finally, the participants were thanked for their participation and debriefed. The questionnaire can be seen in Appendix B.

Measures

Dependent variables

Intention to quit smoking. Participants' intention to quit smoking was measured after the chatbot conversation using a scale by Gagnon et al. (2012). This scale measured the intention to stop drinking alcohol and consisted of three items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree; $M = 3.05$, $SD = 1.12$, Cronbach's $\alpha = .87$). The items of this scale have been adapted to the subject of this current study examining the intention to quit smoking. One example item is "I intend to not smoke in the coming month".

User engagement. Participants' engagement with the chatbot was measured using the user engagement scale (UES) by O'Brien et al. (2018). The total scale consists of twelve items of which three items that measure aesthetic appeal are not used for this study because they are not relevant. The remaining nine items have been adjusted to the subject of this study and were measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree; $M = 3.59$, $SD = 0.65$, Cronbach's $\alpha = .80$). One example item is "using this chatbot was difficult".

Control variables

To examine whether other variables affect the effects of the hypotheses, four control variables were measured. A study by Aryanpur et al. (2016) showed that gender and nicotine dependence can affect smokers' intention to quit. Gender was measured via a single item. Nicotine dependence was measured by the Fagerström Test for Nicotine Dependence (FTND)

scale by Heatherton et al. (1991). This scale consisted of six items (Cronbach's $\alpha = .68$). The items were formulated as questions where the answers were linked to scores from 0 to 10. A higher total score indicated a stronger nicotine dependency ($M = 3.46$, $SD = 2.28$). One example item is "how many cigarettes per day do you smoke?".

Another control variable that may influence the intention to quit smoking is participants' baseline intention to quit smoking prior to the experiment (i.e., pre-test intention to quit smoking). To measure this potential control variable, the same scale was used which measured the dependent variable intention to quit smoking (Gagnon et al., 2012). This scale consisted of three items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree; $M = 2.33$, $SD = 0.95$, Cronbach's $\alpha = .75$).

Prior chatbot experience may influence users' engagement with chatbots and was therefore included as a potential control variable (Feine et al., 2020). To measure this potential covariate a scale by Ashktorab et al. (2019) was used that consisted of two items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree; $M = 3.09$, $SD = 0.85$). The result of a Spearman's rho correlation showed that the two items of this scale had a medium correlation, indicating acceptable reliability of the measurement ($r = .29$, $p < .001$; Cohen, 1988). One example item is "I use chatbots frequently".

Manipulation check questions

To measure whether the manipulations consisting of message framing and personalization in the chatbots worked properly, manipulation checks were conducted. Message framing was measured with a scale by Cho and Boster (2008) with four items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), where a higher score indicated a higher perception of a gain-frame ($M = 2.86$, $SD = 0.93$, Cronbach's $\alpha = .77$). The original scale was used for a manipulation check of message framing consisting of a gain-frame and loss-frame in advertisements for drugs. The scale has been adjusted to fit the

current research. An example item used for this study is “this chatbot focused on the advantages of quitting smoking”.

Perceived personalization was measured with two items, based on a scale by Kalyanaraman and Sundar (2006), on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicated a higher perception of personalization ($M = 3.24$, $SD = 1.21$). The results of a Spearman’s rho correlation showed that the two items of this scale had a strong correlation, indicating high reliability of the measurement ($r = .79$, $p < .001$; Cohen, 1988). The original scale was used to measure the personalization of an advertisement. The scale has been adjusted to measure the personalization of a chatbot. An example item used for this study is “in the conversation I was approached as a unique individual”.

Statistical analyses

First, manipulation checks were conducted to examine how strong the manipulations (message framing and personalization) were through two independent samples t-tests. Hereafter, randomization checks were performed to examine whether there are significant differences in the control variables between the four different conditions. To check whether gender should be seen as a covariate, a chi-square test of association was performed. To check whether nicotine dependence, prior chatbot experience, and the pre-test intention to quit smoking were covariates, three one-way ANOVAs were performed. Two two-way ANOVAs were conducted to investigate the effects of message framing and personalization in a smoking cessation chatbot on users’ intention to quit smoking and user engagement. The control variables gender, nicotine dependence, and pre-test intention to quit smoking may influence the intention to quit smoking, and users’ prior chatbot experience may influence user engagement. These variables were included as covariates if they were not equally distributed across conditions.

Results

Manipulation checks

To analyze whether the manipulations of message framing and personalization were strong enough, two independent samples t-tests were performed. The first t-test showed that messages with a gain-frame scored significantly higher on the perceived strength of a gain-frame ($M = 3.48$, $SD = 0.67$) compared to messages with a loss-frame ($M = 2.26$, $SD = 0.74$; $Mdif = 1.21$, $t(123) = 9.62$, $p < .001$, $d = 1.74$). The second t-test showed that perceived personalization was higher for messages with personalization ($M = 3.64$, $SD = 0.97$) compared to messages without personalization ($M = 2.87$, $SD = 1.29$). The assumption of normality was not met, so the conclusion about significance was based on the bootstrapped confidence interval. The results showed that the difference was significant ($Mdif = 0.77$, $t(123) = 3.78$, 95% CI [0.39, 1.17], $p = .002$, $d = .68$). Thus, both manipulations were deemed successful.

Randomization checks

To check whether gender, nicotine dependence, and pre-test intention to quit smoking should be seen as covariates in the analyses for the intention to quit smoking and whether prior chatbot experience should be seen as a covariate in the analysis for user engagement, four randomization checks were performed. A chi-square test showed that there was no association between gender and the four conditions ($\chi^2(6) = 4.83$, $p = .693$). Two one-way ANOVAs showed that there was also no significant difference between both nicotine dependence ($F(3, 124) = 1.17$, $p = .326$, $\eta^2 = .03$) and pre-test intention to quit smoking ($F(3, 124) = 0.26$, $p = .853$, $\eta^2 = .00$) and the four conditions. However, another one-way ANOVA showed that there was a significant difference between prior chatbot experience and the four conditions ($F(3, 124) = 3.52$, $p = .017$, $\eta^2 = .08$). Therefore, users' prior chatbot experience

was included as a covariate in the analyses for the hypotheses about user engagement. The results of the three one-way ANOVAs can be found in Table 5.

Table 5

Means, standard deviations, and p-values of the one-way ANOVAs

Control variable	Gain-frame/ personalization (<i>n</i> = 30) Mean (<i>SD</i>)	Gain-frame/ no personalization (<i>n</i> = 32) Mean (<i>SD</i>)	Loss-frame/ personalization (<i>n</i> = 31) Mean (<i>SD</i>)	Loss-frame/ no personalization (<i>n</i> = 32) Mean (<i>SD</i>)	P-value
Nicotine dependence	2.87 (2.00)	3.88 (2.49)	3.35 (2.51)	3.69 (2.04)	.326
Prior chatbot experience	3.30 (0.82)	3.27 (0.76)	3.10 (0.90)	2.70 (0.80)	.017
Pre-test intention to quit smoking	2.39 (1.07)	2.40 (0.97)	2.32 (0.86)	2.21 (0.95)	.853

Hypothesis testing

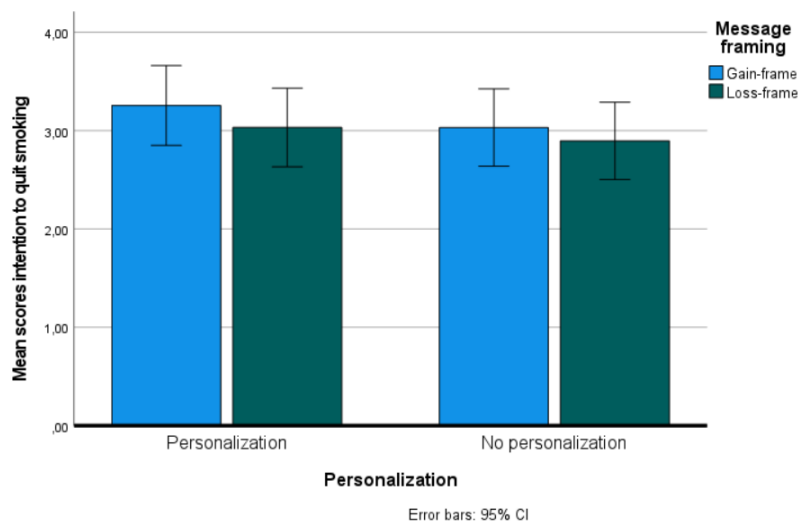
Effects on intention to quit smoking

To test whether the use of a gain-frame, personalization, and the interaction of a gain-frame and personalization in a smoking cessation chatbot leads to a higher intention to quit smoking, a two-way ANOVA was conducted. In this analysis, no control variables had to be included as covariates and the assumptions of normality and homogeneity of variance were met. H1 stated that gain-framing chatbot messages lead to a higher intention to quit smoking compared to loss-framing. The results showed that there was no significant main effect of message framing, $F(1, 121) = 0.80, p = .374, \text{partial } \eta^2 = .01$. Chatbots with gain-framed messages did not lead to a higher intention to quit smoking ($M = 3.14, SD = 1.16$) compared to chatbots with loss-framed messages ($M = 2.96, SD = 1.07$). H3 stated that personalizing the

chatbot messages to the individual users leads to a higher intention to quit smoking compared to non-personalized messages. There was also no significant main effect of personalization, $F(1, 121) = 0.80, p = .372, \text{partial } \eta^2 = .01$. Chatbots with personalized messages did not lead to a higher intention to quit smoking ($M = 3.14, SD = 1.14$) compared to chatbots with no personalized messages ($M = 2.96, SD = 1.10$). H5 predicted that the use of a gain-frame and the personalization of messages reinforce each other in the effect on the intention to quit smoking. However, no significant interaction effect was found between message framing and personalization, $F(1, 121) = 0.05, p = .827, \text{partial } \eta^2 = .00$. Thus, all hypotheses for the intention to quit smoking were not accepted. A visualization of the results can be seen in Figure 1.

Figure 1

Mean scores of message framing and personalization on the intention to quit smoking



Effects on user engagement

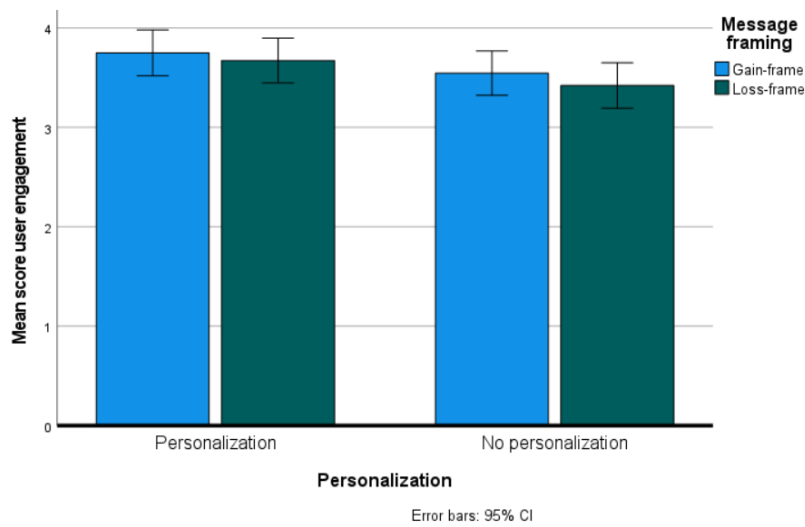
To test whether the use of a gain-frame, personalization, and the interaction of a gain-frame and personalization in a smoking cessation chatbot leads to a higher user engagement, a two-way ANOVA was conducted with the covariate prior chatbot experience. The data was not normally distributed ($z\text{-scores}_{\text{skewness}} = -2.20, -2.84$), and the assumption of homogeneity

of variance was also not met ($VR = 2.24$). The ANOVA is quite robust against the violation of the assumption of normality. However, this does not apply to a violation of the assumption of variance, and it should be noted that the p-value might be somewhat biased (Field, 2018).

The results showed that the covariate prior chatbot experience was not significantly associated with user engagement, so prior chatbot experience does not influence the effect of message framing and personalization on user engagement, $F(1, 120) = 3.50, p = .064$, partial $\eta^2 = .03$. H2 stated that gain-framing the messages of a smoking cessation chatbot leads to a higher user engagement. However, no significant main effect of message framing was found, $F(1, 120) = 0.74, p = .391$, partial $\eta^2 = .01$. Chatbots with gain-framed messages did not lead to a higher user engagement ($M = 3.67, SD = 0.57$) compared to chatbots with loss-framed messages ($M = 3.52, SD = 0.72$). H4 predicted that personalizing chatbot messages leads to higher user engagement. The results showed that there was a small to medium significant main effect for personalization, $F(1, 120) = 3.93, p = .050$, partial $\eta^2 = .03$. So, personalizing the messages of a chatbot led to higher user engagement ($M = 3.72, SD = 0.58$) compared to not personalizing the chatbot messages ($M = 3.47, SD = 0.70$). H6 predicted that the use of a gain-frame and the personalization of messages reinforce each other in the effect on user engagement. There was also no significant interaction effect between message framing and personalization, $F(1, 120) = 0.04, p = .839$, partial $\eta^2 = .00$. Based on these results, there was only support for hypothesis 4 which predicted that personalization leads to a higher user engagement. A visualization of the results can be seen in Figure 2.

Figure 2

Mean scores of message framing and personalization on user engagement



Exploratory analysis

A mixed ANOVA was performed to test whether there was a significant difference in the pre-test intention to quit smoking and the intention to stop smoking which was measured after the chatbot conversation. The Kolmogorov-Smirnov test, which was used to test normality, showed that there were potential violations of normality, so the outcomes should be interpreted with caution. There was a significant difference between the pre-test and post-test intention to quit smoking, $F(1, 121) = 87.44, p < .001, \eta_{\text{partial}2} = .42$. This indicated that the intention to quit smoking is higher after the chatbot conversation ($M = 3.05, SD = 1.12$) compared to the intention to quit smoking before the chatbot conversation ($M = 2.33, SD = 0.95$). Furthermore, there was no significant interaction effect between the level of message framing and the intention to quit smoking (i.e., pre-test versus post-test; $F(1, 121) = 0.11, p = .736, \eta_{\text{partial}2} = .00$). There was also no interaction effect between the level of personalization and the intention to quit smoking (i.e., pre-test versus post-test; $F(1, 121) = 0.67, p = .415, \eta_{\text{partial}2} = .01$). To conclude, people's intention to quit smoking increased after they engaged in

a conversation with a smoking cessation chatbot, regardless of what communication strategies had been applied. A visualization of the results can be seen in Figures 3 and 4.

Figure 3

Mean scores of message framing on the pre-test and post-test intention to quit smoking

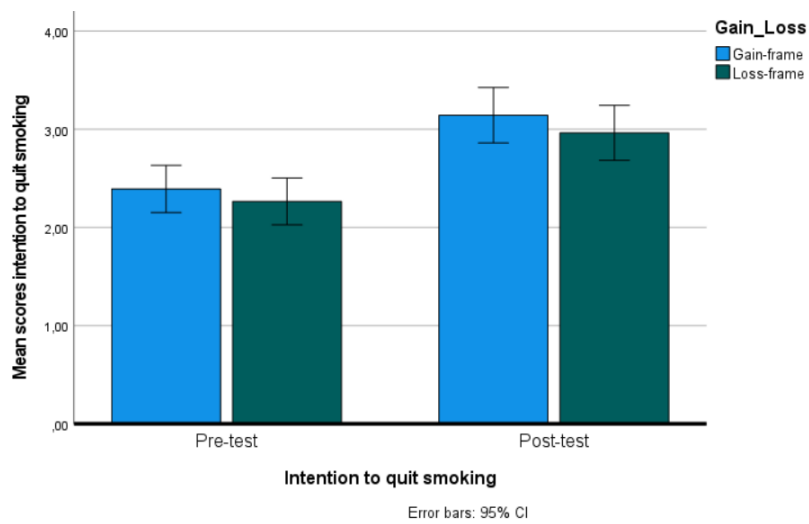
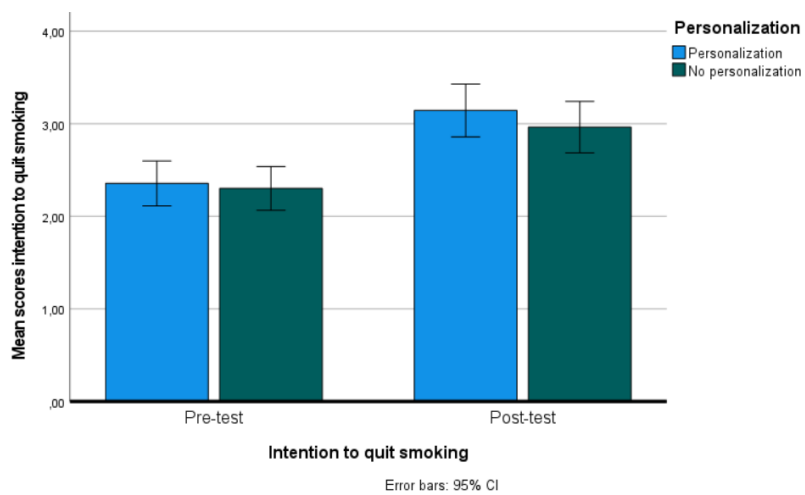


Figure 4

Mean scores of personalization on the pre-test and post-test intention to quit smoking



Discussion

This research aimed to investigate which communication strategies can be applied in a smoking cessation chatbot to increase smokers' intention to quit smoking and user engagement with the chatbot. Based on existing literature, it was expected that the use of a gain-frame, compared to a loss-frame, and personalization, compared to no personalization, would lead to a higher intention to quit smoking and user engagement. It was also expected that the simultaneous use of a gain-frame and personalization would reinforce each other. Overall, the results showed that message framing had no significant effect on the intention to quit smoking and user engagement. Also, personalizing messages did not affect the intention to quit smoking, however, there was a significant positive effect of personalization on user engagement. The simultaneous use of a gain-frame and personalization did not reinforce each other in the effect on the intention to quit smoking and user engagement. Furthermore, an exploratory analysis showed that smokers' intention to quit smoking, which was measured after the chatbot conversation, was higher compared to the pre-test intention to quit smoking.

Theoretical implications

It was expected that gain-framing the messages of a smoking cessation chatbot, compared to loss-framing, would lead to a higher intention to quit smoking and user engagement. Albeit non-significant, the use of a gain-frame did result in both a higher score of the intention to quit smoking and user engagement. Several studies showed that a gain-frame in smoking cessation interventions may be effective for increasing the intention to quit smoking (Arendt et al., 2018; Ma & Nan, 2018) and user engagement (Jensen et al., 2017; Mavandadi et al., 2017). However, other studies indicate that the positive effect of gain-framing on smoking cessation depends on variables such as self-efficacy and the need for autonomy (Altendorf et al., 2020; Fucito et al., 2010). This research did not investigate potential moderators, and future studies into the use of message framing in chatbots should

include these moderators. In addition, the insignificant differences can be explained by the fact that message framing has been applied in a chatbot. People generally prefer to interact with people, compared to chatbots, and are more skeptical about the messages a chatbot sends (Araujo, 2018). Thus, chatbot messages, both gain-framed and loss-framed, might be less likely to be accepted and therefore have less impact on the intention to quit smoking and user engagement.

It was also expected that personalized chatbot messages, compared to non-personalized messages, would lead to a higher intention to quit smoking and user engagement. Although personalizing messages did result in a higher intention to quit smoking, this difference was not significant. This might be explained by the fact that it is difficult to increase the intention of people in the short term (Ajzen, 1991), especially with addictive behaviors such as smoking. In this experiment, the intention to quit smoking was measured after one interaction of about 5 minutes with the chatbot. Having multiple conversations could lead to a higher intent to quit smoking compared to one-time interventions (Goldstein et al., 1998). In addition, it was found that personalizing messages led to higher user engagement. Personalizing the chatbot messages can make smokers feel more personally addressed, making them experience the relationship with the chatbot as more engaging. This is in line with previous studies which also showed that personalization can lead to higher user engagement (Bleier et al., 2018; Dijkstra & Ballast, 2011). In addition, studies indicated that only one personalization technique is not enough to see clear effects (Li, 2016; Li & Liu, 2017). In this study, three personalization techniques were used, which may have contributed to the positive effect on user engagement.

Furthermore, it was expected that the control variable prior chatbot experience would influence the user engagement with the chatbot and that message framing and personalization would reinforce each other. The results showed that prior chatbot experience did not affect the

relationships between the two communication strategies and user engagement. This finding is not in line with the research by Feine et al. (2020), which showed that prior chatbot experience influences user engagement. The results also showed that there were no interaction effects between message framing and personalization on the intention to quit smoking and user engagement with the chatbot. Albeit non-significant, the chatbot with gain-framing and personalized messages scored higher on the intention to quit smoking and user engagement compared to the other conditions. Future lines of research on the application of message framing and personalization in smoking cessation interventions may look at the interaction between message framing and personalization.

In addition to hypothesis testing, an exploratory analysis was conducted into the difference between the pre-test and post-test intention to quit smoking to gain more insights into the growth of participants' intention to quit smoking. The post-test intention to quit smoking was significantly higher, compared to the pre-test intention to quit smoking, regardless of the conditions. This result showed that a conversation with a smoking cessation chatbot can increase the intention to quit smoking and is in line with previous studies which showed that chatbots can be effective for smoking cessation (Avila-Tomas et al., 2019; Pereira & Diaz, 2019). Thus, chatbots have great potential as a smoking cessation intervention and more research is needed to explore which communication strategies should be applied to these chatbots to maximize their potential.

Strengths and limitations

All 125 participants of this study met the criterion that they smoked at least once a week. This means that the target group of smoking cessation interventions, i.e., regular smokers, participated in this study. In addition, it turned out that there was much variation in the ages of the participants. The youngest participant was 18 and the oldest participant was 70 ($M = 33$, $SD = 0.97$). According to Simon et al. (2019), chatbots for smoking cessation are

promising for younger smokers such as adolescents. However, both younger and older smokers voluntarily participated in this study in which they interacted with chatbots. This shows that chatbots may be beneficial for people from all age groups.

This study also contains some limitations that must be considered when interpreting the findings. First, this research was distributed on a survey platform where participants could decide for themselves whether they wanted to participate in this study. This may have created a self-selecting bias, which means that only people who already have some interest in the substantive topic participated in the study (Andrade, 2020). Thus, only smokers who are interested or somewhat motivated to quit smoking may have participated in this study. Smokers who are not motivated or interested in quitting smoking may have decided to not participate. This may have led to a self-selection bias in the resulting data from this research and this must be considered when interpreting the findings. It is advisable that future research also includes smokers who may not have a possible self-selecting bias. These smokers can be contacted directly through healthcare institutions or anti-smoking organizations.

Second, the results were collected by self-reported answers from the participants. This may have led to response bias, meaning that inaccurate answers may have been given by the participants (Rosenman et al., 2011). Response bias may have arisen because the participants did not understand the questions, did not read the questions correctly, refused to give honest answers, or gave socially desirable answers (Cole, 2022). The intention to quit smoking, both pre-test and post-test, was measured by self-reported intentions. Self-report smoking behavior is often underreported, because the respondents may feel pressure due to social or medical disapproval (Rebagliato, 2002). Besides, the theory of planned behavior states the intention to exhibit a certain behavior leads to the actual behavior (Ajzen, 1991). However, this is a bit more complicated and the intention to exhibit a certain behavior does not always lead to the actual behavior (Webb & Sheeran, 2006). In particular, addictive behavior, such as smoking,

is very difficult to change even though people have the intention to change their behavior. It is advisable that future research into the use of smoking cessation chatbots measures changes in the actual behavior of smokers over a longer period.

Suggestions for future research

In addition to the suggestions for future research based on the limitations, two more suggestions can be made based on the findings of this study. First, the results provide tentative support that personalization leads to higher user engagement. Future research may look more in-depth at the use of personalization in chatbots to better utilize this strategy. It can be investigated which personalization techniques (e.g., name mentioning, personalized response, tailored information and advice) lead to higher user engagement. Second, the results showed that there was a clear difference between the pre-test and post-test intention to quit smoking. However, this was not caused by the communication strategies in this study. Future research may delve into how conversing with a smoking cessation chatbot increases the intention to quit smoking. It can also be investigated whether other communication strategies in smoking cessation chatbots (e.g., communication style and social characteristics; Chaves & Gerosa, 2020), contribute to increasing the intention to quit smoking.

Conclusion

This research was aimed at investigating the effectiveness of message framing and personalization in a smoking cessation chatbot on smokers' intention to quit smoking and engagement with the chatbot. There was no significant difference between the use of gain-framed or loss-framed messages on the intention to quit smoking and user engagement. There was also no difference between personalized and non-personalized messages on the intention to quit smoking and no interaction effect between message framing and personalization. However, personalizing the messages led to a higher engagement of the chatbot users. Furthermore, smokers' intention to quit smoking was higher after the chatbot conversation than before the conversation, regardless of the manipulated communication strategies. Thus, chatbots have the potential to be used for smoking cessation purposes, and personalizing the messages can make the users feel more engaged in the conversation. Future research is encouraged to continue the line of research in identifying effective communication strategies in chatbots to increase smoking cessation intent and user engagement.

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Appendix A – Chatbot scripts

Message framing in the text is highlighted in blue and personalization is highlighted in green. The non-italic sentences are the messages from the chatbot, and the italic text is the response of the chatbot users.

1. Introduction and ask stage

Personalization / gain-frame

Hi there! I'm Roby
What is your first name?
<i>[First name]</i>
Nice to meet you, [first name]! I'm here to talk to you about your smoking behavior and help you quit smoking.
I want to ask you some questions first. Can you tell how many years or months you've been smoking?
<i>[Response]</i>
Okay! You've been smoking for [response], got it!
And how many cigarettes do you smoke per day?
<i>[Response]</i>
Thanks! [First name], you said that you smoke [response] cigarettes per day. Noted!
People have different opinions about smoking. I'm curious, please tell me one good thing about quitting smoking.
<i>[Response]</i>
Good that you're aware of this benefit of quitting smoking :) Thanks for sharing!

Personalization / loss-frame

Hi there! I'm Roby
What is your first name?
<i>[First name]</i>
Nice to meet you, [first name]! I'm here to talk to you about your smoking behavior and help you quit smoking.
I want to ask you some questions first. Can you tell how many years or months you've been smoking?
<i>[Response]</i>
Okay! You've been smoking for [response], got it!
And how many cigarettes do you smoke per day?
<i>[Response]</i>
Thanks!

[First name], you said that you smoke [response] cigarettes per day. Noted!
People have different opinions about smoking. I'm curious, please tell me one bad thing about smoking.
[Response]
Good that you're aware of this disadvantage of smoking. Thanks for sharing!

No personalization / gain-frame

Hi there! I'm Roby
What is your first name?
[First name]
Nice to meet you I'm here to talk to you about your smoking behavior and help you quit smoking.
I want to ask you some questions first. Can you tell how many years or months you've been smoking?
[Response]
Okay
And how many cigarettes do you smoke per day?
[Response]
Thanks
People have different opinions about smoking. I'm curious, please tell me one good thing about quitting smoking.
[Response]
Okay

No personalization / loss-frame

Hi there! I'm Roby
What is your first name?
[First name]
Nice to meet you I'm here to talk to you about your smoking behavior and help you quit smoking.
I want to ask you some questions first. Can you tell how many years or months you've been smoking?
[Response]
Okay
And how many cigarettes do you smoke per day?
[Response]
Thanks
People have different opinions about smoking. I'm curious, please tell me one bad thing about smoking.
[Response]
Okay

2. Advice stage

Personalization / gain-frame

[First name], quitting smoking does have several benefits. Especially for your health		
That is why it is very important that you stop smoking.		
Do you agree?		
Yes, I do.	I'm not convinced yet.	
Good to hear that you think quitting smoking is important!	You said that you find quitting smoking not very important. I'm here for you to motivate you and help you quit smoking.	
I'd like to tell you a little bit more about the benefits of quitting smoking.		
To find out how smoking affects you personally, please click on your gender. If you don't identify as male or female, please click on your biological gender.		
<i>Male</i>	<i>Female</i>	
And what is your age?		
<u>18 - 29</u>	<u>30 - 64</u>	<u>65 or higher</u>
[First name], young adult men/women like you live healthier lives when they quit smoking. The risk of lung cancer is reduced by 30 to 50 % compared to young adult men/women who continue smoking.	[First name], adult men/women like you live healthier lives when they quit smoking. The risk of lung cancer is reduced by 30 to 50% compared to adult women/men who continue smoking.	[First name], elderly men/women like you live healthier lives when they quit smoking. The risk of lung cancer is reduced by 30 to 50% compared to elderly women/men who continue smoking.
Did you know about this, [first name]?		
Yes	No	
Quitting smoking does not only have benefits for you. It can also protect your close family and friends from diseases.		
Can you say a name of someone you live with? If not, then say a name of someone you often see.		
[Response]		
By quitting smoking, you can protect [response] against diseases related to second-hand smoke.		
[First name], quitting smoking also has other benefits besides health benefits.		
How much do you spend on average per week on smoking?		
[Response]		
Quitting smoking can save you a lot of money. When you spend [response] per week, you save a huge amount of money per year by quitting smoking. With this money, you can do fun things like going on a holiday. 😊		
That sounds good, right?		
Yes, absolutely!	Not really	

Personalization / loss-frame

[First name], smoking does have several disadvantages. Especially for your health		
That is why it is very important that you stop smoking.		
Do you agree?		
<i>Yes, I do.</i>	<i>I'm not convinced yet.</i>	
Good to hear that! Good to hear that you think quitting smoking is important!	You said that you find quitting smoking not very important. I'm here for you to motivate you and help you quit smoking.	
I'd like to tell you a little bit more about the disadvantages of smoking.		
To find out how smoking affects you personally, please click on your gender. If you don't identify as male or female, please click on your biological gender.		
<i>Male</i>	<i>Female</i>	
And what is your age?		
<u>18 – 29</u>	30 - 64	65 or higher
[First name], young adult men/women like you live very unhealthy lives if they continue to smoke. The risk of getting lung cancer is 15 to 30 times higher compared to young adult men/women who do not smoke.	[First name], adult men/women like you live very unhealthy lives if they continue to smoke. The risk of getting lung cancer is 15 to 30 times higher compared to adult men/women who do not smoke.	[First name], elderly men/women like you live very unhealthy lives if they continue to smoke. The risk of getting lung cancer is 15 to 30 times higher compared to elderly men/women who do not smoke.
Did you know about this, [first name]?		
<i>Yes</i>	<i>No</i>	
Smoking does not only have disadvantages for you. It can also cause diseases in your close family and friends.		
Can you say a name of someone you live with? If not, then say a name of someone you often see.		
<i>[Response]</i>		
By continuing smoking, you can increase the likelihood of diseases related to secondhand smoke for [response].		
[First name], smoking also has other disadvantages besides health risks.		
How much do you spend on average per week on smoking?		
<i>[Response]</i>		
Smoking costs a lot of money. When you spend [response] per week, you waste a huge amount of money per year. You probably missed some fun things because the money spent on cigarettes 😞		
That's a waste of your money, right?		
<i>Yes, it certainly is!</i>	<i>Not really</i>	

No personalization / gain-frame

Quitting smoking does have several benefits	
That is why it is very important that you stop smoking.	
Do you agree?	
Yes, I do.	I'm not convinced yet.
I'd like to tell you a little bit more about the benefits of quitting smoking.	
People who quit smoking reduce the risk of lung cancer by 30 to 50% compared to people that continue smoking.	
Did you know about this?	
Yes	No
Quitting smoking does not only have benefits for you. It can also protect your family and friends from diseases related to second-hand smoke.	
Quitting smoking also has other benefits besides health benefits. It might also save you a lot of money	
That sounds good, right?	
Yes	No

No personalization / loss-frame

Smoking does have several disadvantages	
That is why it is very important that you stop smoking.	
Do you agree?	
Yes, I do.	I'm not convinced yet.
I'd like to tell you a little bit more about the disadvantages of smoking.	
People who continue smoking are 15 to 30 times more likely to get lung cancer compared to non-smokers.	
Did you know about this?	
Yes	No
Smoking does not only have disadvantages for you. It can also cause diseases in your close family and friends.	
Smoking also has other disadvantages besides health risks. Smoking costs a lot of money	
That's a waste of your money, right?	
Yes	No

3. Assess stagePersonalization / gain-frame

[First name], I hope you now have a better idea of what the benefits of quitting smoking are.	
Is this true?	
Yes	No
So, you are well aware of the benefits of quitting smoking. That is a step in the right direction!	So, you are not yet aware of the benefits of quitting smoking. No problem! You don't have to have that completely clear right now.

With the right motivation, many others have also succeeded in quitting smoking. Are you willing to give it a try?			
Yes		Not so much	
Good to hear! 😊		Thanks for your honest answer! 😊	
How motivated you are to quit smoking? With 1 being not motivated at all and 10 being very motivated.			
[Response option 1 to 10]			
1-4	5-6	7-8	9-10
[First name], I understand that you are not yet very motivated to quit smoking. I am happy to help you so that together we can increase your motivation.	[First name], I understand that you are a little bit motivated to quit smoking. That is already a step in the right direction.	[First name], I understand that you are motivated to quit smoking. You're on the right track!	[First name], I understand that you are very motivated to quit smoking. You're on the right track!

Personalization / loss-frame

[First name], I hope you now have a better idea of what the disadvantages of smoking are. Is this true?			
Yes		No	
So, you are well aware of the disadvantages of smoking. That is a step in the right direction!		So, you are not aware of the disadvantages of smoking. You don't have to have that completely clear right now.	
Without the right motivation, others have failed in quitting smoking. Are you willing to give quitting smoking a try?			
Yes		Not so much	
Good to hear! 😊		Thanks for your honest answer! 😊	
How motivated you are to quit smoking? With 1 being not motivated at all and 10 being very motivated.			
[Response]			
1-4	5-6	7-8	9-10
[First name], I understand that you are not yet very motivated to quit smoking. I am happy to help you so that together we can increase your motivation.	[First name], I understand that you are a little bit motivated to quit smoking. That is already a step in the right direction.	[First name], I understand that you are motivated to quit smoking. You're on the right track!	[First name], I understand that you are very motivated to quit smoking. You're on the right track!

No personalization / gain-frame

I hope you now have a better idea of what the benefits of quitting smoking are. Is this true?	
<i>Yes</i>	<i>No</i>
With the right motivation, many others have also succeeded in quitting smoking. Are you willing to give it a try?	
<i>Yes</i>	<i>Not so much</i>
How motivated you are to quit smoking? With 1 being not motivated at all and 10 being very motivated.	
<i>[Response option 1 to 10]</i>	
Ok, thanks	

No personalization / loss-frame

I hope you now have a better idea of what the disadvantages of smoking are. Is this true?	
<i>Yes</i>	<i>No</i>
Without the right motivation, others have failed in quitting smoking. Are you willing to give it a try?	
<i>Yes</i>	<i>Not so much</i>
How motivated you are to quit smoking? With 1 being not motivated at all and 10 being very motivated.	
<i>[Response option 1 to 10]</i>	
Ok, thanks	

4. Assist stagePersonalization / gain-frame

To help you quit smoking, we must plan a stop date together. From how many days from today do you want to plan your stop date? Please write down a number from 0 to 14.	
<i>[Response]</i>	
[First name], you have said that you want to stop in [response] days. Good job! :)	
You may be tempted to light a cigarette when you try to quit. That's why I'd like to share with you an exercise.	
Do you want an exercise that you can do alone or together with a friend or family member?	
<i>Alone</i>	<i>With a friend or family member</i>
Cool! You like to beat challenges on your own. If you're having trouble resisting a cigarette, do the following quick exercise. List three benefits of quitting smoking and repeat these benefits three times. This way you will be reminded of what the benefits of quitting smoking are for you.	Great! You like to share your quitting journey with people. If you're having trouble resisting a cigarette, do the following quick exercise. Call a friend or family member and list together three benefits of quitting smoking. This way you will be reminded of what the benefits of quitting smoking are for you.
Do you find this exercise helpful?	
<i>Yes!</i>	<i>Not so much</i>
Nice!	No problem, [first name]!

<p>Good to hear [first name]! I have a tip for you that can increase your chances of quitting smoking.</p>	<p>I have a tip for you that can increase your chances of quitting smoking and may be more useful to you.</p>
<p>Your attempts to quit smoking are more likely to succeed if you use nicotine replacements, like gum or patches. I advise you to use one of these products when you stop smoking.</p>	

Personalization / loss-frame

<p>To help you quit smoking, we must plan a stop date together. From how many days from today do you want to plan your stop date? Please write down a number from 0 to 14.</p>	
<p>[Response]</p>	
<p>[First name], you have said that you want to stop in [response] days.</p>	
<p>You may be tempted to light a cigarette when you try to quit. That's why I'd like to share with you an exercise.</p>	
<p>Do you want an exercise that you can do alone or together with a friend or family member?</p>	
<p><i>Alone</i></p>	<p><i>With a friend or family member</i></p>
<p>You like to beat challenges on your own. If you're having trouble resisting a cigarette, do the following quick exercise List three disadvantages of continuing smoking and repeat these disadvantages three times. This way you will be reminded of what the disadvantages of smoking are for you.</p>	<p>You like to share your quitting journey with people. If you're having trouble resisting a cigarette, do the following quick exercise. Call a friend or family member and list together three disadvantages of continuing smoking. This way you will be reminded of what the disadvantages of smoking are for you.</p>
<p>Do you find this exercise helpful?</p>	
<p><i>Yes!</i></p>	<p><i>Not so much</i></p>
<p>Good to hear [first name]. I have a tip for you that can lower your chances of continuing smoking.</p>	<p>No problem, [first name]. I have a tip for you that can lower your chances of continuing smoking and may be more useful to you.</p>
<p>Your attempts to quit smoking are more likely to fail if you don't use nicotine replacements, like gum or patches. I advise you to use one of these products when you stop smoking.</p>	

No personalization / gain-frame

<p>To help you quit smoking, we must plan a stop date together. From how many days from today do you want to plan your stop date? Please write down a number from 0 to 14.</p>	
<p>[Response]</p>	
<p>You have now decided that you would like to try to quit smoking.</p>	
<p>You may be tempted to light a cigarette when you try to quit. That's why I'd like to share with you an exercise.</p>	

Are you ready?		
<i>Yes</i>	<i>Sure</i>	<i>Not really</i>
If you're having trouble resisting a cigarette, you can do the following quick exercise.	If you're having trouble resisting a cigarette, you can do the following quick exercise.	You don't have to do this exercise now. You can do the exercise when you're having trouble resisting a cigarette.
List three benefits of quitting smoking and repeat these benefits three times. This way you will be reminded of what the benefits of quitting smoking are for you.		
Do you find this exercise helpful?		
<i>Yes</i>	<i>Not so much</i>	
I have a tip for you that can increase your chances of quitting smoking. Your attempts to quit smoking are more likely to succeed if you use nicotine replacements, like gum or patches. I advise you to use one of these products when you stop smoking.		

No personalization / loss-frame

To help you quit smoking, we must plan a stop date together. From how many days from today do you want to plan your stop date? Please write down a number from 0 to 14.		
[Response]		
You have now decided that you would like to try to quit smoking.		
You may be tempted to light a cigarette when you try to quit. That's why I'd like to share with you an exercise.		
Are you ready?		
<i>Yes</i>	<i>Sure</i>	<i>Not really</i>
If you're having trouble resisting a cigarette, you can do the following quick exercise.		
List three disadvantages of continuing smoking and repeat these disadvantages three times. This way you will be reminded of what the disadvantages of smoking are for you.		
Do you find this exercise helpful?		
<i>Yes</i>	<i>Not so much</i>	
I have a tip for you that can lower your chances of continuing smoking. Your attempts to quit smoking are more likely to fail if you don't use nicotine replacements, like gum or patches. I advise you to use one of these products when you stop smoking.		

5. Arrange stage

Personalization / gain-frame

We are almost at the end of our conversation!	
Do you think talking with me is going to help you make a quit attempt?	
<i>Yes definitely!</i>	<i>I don't know yet</i>
Nice to hear, [first name]! Talking to others about your decision to quit makes quitting smoking easier. So, I'm happy that we talked!	No problem, [first name]. But I want to tell you that talking to others about your decision to quit makes it easier to quit smoking.
If you want to talk to me again, don't hesitate to reach out!	
Until next time, [first name].	
And remember ... If you hold on to your reasons for quitting, you will have a better chance of success in quitting smoking.	
You can now return to the survey. Please fill in this code in the next question in the survey: 111	

Personalization / loss-frame

We are almost at the end of our conversation!	
Do you think talking with me is going to help you make a quit attempt?	
<i>Yes definitely!</i>	<i>I don't know yet</i>
Nice to hear, [first name]. Keeping your decision a secret and not sharing with people that you want to quit will likely decrease your motivation. So, I'm happy that we talked.	No problem, [first name]. But I want to tell you that not informing people that you want to quit will keep you from getting motivated to quit smoking.
If you want to talk to me again, don't hesitate to reach out!	
Until next time, [first name].	
And remember ... If you do not hold on to your reasons for quitting, you will have a greater chance of failure to quit smoking.	
You can now return to the survey. Please fill in this code in the next question in the survey: 333	

No personalization / gain-frame

We are almost at the end of our conversation!	
Do you think talking with me is going to help you make a quit attempt?	
<i>Yes</i>	<i>I don't know yet</i>
Talking to others about your decision to quit makes quitting smoking easier.	
If you want to talk to me again, don't hesitate to reach out!	
Until next time	
And remember ... If you hold on to your reasons for quitting, you will have a better chance of success in quitting smoking.	
You can now return to the survey. Please fill in this code in the next question in the survey: 222	

No personalization / loss-frame

We are almost at the end of our conversation!	
Do you think talking with me is going to help you make a quit attempt?	
Yes	<i>I don't know yet</i>
Keeping your decision a secret and not sharing with people that you want to quit will likely decrease your motivation.	
If you want to talk to me again, don't hesitate to reach out!	
Until next time.	
And remember...	
If you do not hold on to your reasons for quitting, you will have a greater chance of failure to quit smoking.	
You can now return to the survey. Please fill in this code in the next question in the survey: 444	

Appendix B – Questionnaire

Introduction and informed consent

Dear participant, welcome!

Thank you for your time to participate in this study. This study aims to find out which communication strategies can be applied in the messages of a chatbot that supports smokers in the process of quitting smoking.

Criteria for participation

- You are a frequent smoker
- You must be 18 years of age or older
- You can read and understand the English language

Explanation of this research

In this research, you will engage in a conversation with a chatbot. After this conversation, you receive some questions about the conversation. Participation takes about 10 to 12 minutes in total. I recommend completing the research on a computer or laptop as this works more easily and you have to switch between the survey and the chatbot conversation.

This research is being conducted for a master's thesis at Tilburg University. If you have any questions, please contact the researcher José Moerkens via j.m.moerkens@tilburguniversity.edu. If you have comments or complaints about this research, please contact the Research Ethics and Data Management Committee of the Tilburg School of Humanities and Digital Sciences via tshd.redc@tilburguniversity.edu.

Informed consent

This section is a request for your informed consent to participate in this study. By agreeing to this consent form, you declare that:

- I am aware that my data is treated confidentially;
 - I am aware that my answers are used anonymously for scientific research and publications resulting from this research;
 - I am aware that participation in this study is voluntary;
 - I am aware that regardless of the reason I can leave the study by closing my window or continue participation at any other time;
 - I am aware that the researcher does not see the information I share with the chatbot and that this information is deleted from the system after 24 hours;
 - I am aware that my data can be stored for a maximum of 10 years according to the guidelines of Tilburg University.
- Yes, I agree to participate in this study.
 - No, I do not agree to participate in this study.
-

Criteria check questions

To participate in this study, you must be 18 years of age or older.
Are you 18 years of age or older?

- Yes
- No

* When participants select no: Unfortunately, you can no longer participate in this research. Your participation in this research stops now.

To participate in this study, you must be a frequent smoker.

Do you smoke? (at least one cigarette per week)

- Yes
- No

* When participants select no: Unfortunately, you can no longer participate in this research. Your participation in this research stops now.

Pre-test intention to quit

Please indicate to what extent you agree with the statements.

1. I intend to not smoke in the coming month

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
0	0	0	0	0

2. In the coming month, the chances that I will not smoke are...

Very low	Low	Moderate	High	Very high
0	0	0	0	0

3. In the coming month, I will not smoke

Very unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely
0	0	0	0	0

Chatbot conversation

In this part of the research, you will enter into a conversation with a chatbot. The chatbot asks you questions about your smoking behavior, gives you information and advice, and helps you make a successful quit attempt. It is important that you take the following into account.

1. Make sure you don't click away from the survey when you go to the chatbot conversation.
2. Complete the entire conversation with the chatbot.
3. The conversation takes about 3 minutes.
4. Activate the chatbot by saying hello or hi.

Click here to start the chatbot conversation: [CLICK HERE](#).

Please note! The button for the next page of this survey will appear after you have completed the conversation with the chatbot.

Criteria check question

Thank you for returning to the survey.

What was your chatbot code?

- 111
- 222
- 333
- 444

Did you finish the entire conversation with the chatbot?

- Yes
- No

* When participants select no: Unfortunately, you can no longer participate in this research. Your participation in this research stops now.

Dependent variables questions

Please indicate for the following statements to what extent you agree with the statements.

1. I intend to not smoke in the coming month

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
0	0	0	0	0

2. In the coming month, the chances that I will not smoke are...

Very low	Low	Moderate	High	Very high
0	0	0	0	0

3. In the coming month, I will not smoke

Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very likely
0	0	0	0	0

Please indicate for the following statements to what extent you agree with the statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I lost myself in the conversation	0	0	0	0	0
The time I spend talking to the chatbot just slipped away	0	0	0	0	0
I was absorbed in the conversation	0	0	0	0	0
I felt frustrated while using the chatbot	0	0	0	0	0
I found this chatbot confusing to use	0	0	0	0	0
Using this chatbot was difficult	0	0	0	0	0
Using the chatbot was worthwhile	0	0	0	0	0
My experience with the chatbot was rewarding	0	0	0	0	0
I felt interested in this experience with the chatbot	0	0	0	0	0

Manipulation check questions

Please indicate for the following two statements to what extent you agree with the statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
This chatbot focused on the advantages of quitting smoking	0	0	0	0	0
This chatbot explained the positive things that can happen if I quit smoking	0	0	0	0	0

The chatbot focused on the disadvantages of smoking	0	0	0	0	0
The chatbot showed the negative things that can happen if someone smokes	0	0	0	0	0
The chatbot conversation was specifically aimed at me	0	0	0	0	0
In the conversation, I was approached as a unique individual	0	0	0	0	0

Demographic and control questions

The following 10 questions are about you, your smoking behavior, and your experience with chatbots.

Please indicate to what extent you agree with the statements

1. I use chatbots frequently

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

2. I am familiar with chatbot technology

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

3. How soon after you wake up do you smoke your first cigarette?

- Within 5 minutes
- 6-30 minutes
- 31-60 minutes
- After 60 minutes

4. Do you find it difficult to refrain from smoking in places where it is forbidden (for example: in the movie theater, in the library)?

- Yes
- No

5. Which cigarette would you hate most to give up?

- The first one in the morning
- Any other

6. How many cigarettes do you smoke on average per day?

- 10 or less
- 11-20
- 21-30
- 31 or more

7. Do you smoke more frequently during the first hours after waking than during the rest of the day?

- Yes
- No

8. Do you smoke when you are so ill that you are in bed most of the day?

- Yes
- No

9. What is your age?

.....

10. What is your gender?

- Female
- Male
- Non-binary / third gender
- Prefer not to say

11. What is your highest level of education?

- Less than high school
- High school graduate
- Some college
- Bachelor's degree
- Master's degree
- PhD or higher
- Prefer not to say

End of survey

Thank you for your participation in this study!

This study investigates which communication strategies can be applied in a smoking cessation chatbot so that it can effectively contribute to the process of quitting smoking.

In this study, the chatbot was manipulated with two communication strategies. The chatbot messages were framed through a gain-frame where the emphasis was on the benefits of quitting smoking or a loss-frame where the emphasis was on the disadvantages of smoking. The chatbot has also been manipulated through personalization. The chatbot sent messages that are personalized or not to the individual user. It could be that your chatbot gave little response to your answers.

Would you like to know more about this study or are you curious about the results, do not hesitate to contact the researcher via j.m.moerkens@tilburguniversity.edu.

Appendix C – Additional questions pre-test

1. Did the conversation with the chatbot go smoothly?

- Yes
- No, please explain
.....

2. Is the instruction on how to access and use the chatbot clear?

- Yes
- No, please explain
.....

3. Were the questions you were asked in the survey understandable?

- Yes
- No, please explain
.....

4. Did you encounter any problems completing the survey?

- Yes, please explain
.....
- No

5. If you have any additional comments about the survey and/or the chatbot conversation, please write them down below.

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