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# Hi, I'm Cecil(y) the Smoking Cessation Chatbot: The Effectiveness of Motivational Interviewing and Confrontational Counseling Chatbots and the Moderating Role of the Need for Autonomy and Self-Efficacy

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**Abstract.** This study aimed to investigate if and how chatbots can increase smokers' intention to quit, specifically looking into the effectiveness of two communication styles (i.e., motivational interviewing (MI) and confrontational counseling (CC)) and the moderating role of individual differences (i.e., need for autonomy and perceived self-efficacy) that may affect smokers' experience with the chatbot. In an online between-subjects experiment ($N$ = 233), smoking participants were assigned to interact with either a MI chatbot ($n$ = 121) or a CC chatbot ($n$ = 112) for one 8-minute session. Their need for autonomy and perceived self-efficacy were measured, as well as their satisfaction with the conversation and pre- and post-test intention to quit smoking. No significant effects of different communication styles were found regarding the outcomes, nor did the need for autonomy moderate these results. However, the effect of MI on user satisfaction was more profound among smokers with higher self-efficacy, and a positive effect of self-efficacy on user satisfaction appeared. Additionally, interacting with the chatbots about one's smoking behavior significantly increased participants' intention to quit, regardless of its communication style. As such, this study sheds light on the potential of conversational chatbots for smoking cessation interventions, as well as pathways for future research.

**Keywords:** conversational agents, smoking cessation, motivational interviewing, need for autonomy, self-efficacy

## 1. Introduction

For a long time, governments and organizations across the world have tried to increase smoking cessation rates using various interventions [1]. Many of these interventions focus on highlighting the risks associated with smoking, often by using fear and/or emotional appeals [2]. While such heavy messages can be effective for some smokers,

others may cope with the messages more defensively, leading to rejection and dismissal of the message [3]. As a result of such individual differences in emotional and behavioral responses toward anti-smoking messages, tobacco use remains a public health problem of a high caliber [4]. Therefore, developing vehicles for individualized smoking cessation communication has been a recent research priority. For that purpose, conversational agents such as chatbots may be well-suited, as they decrease pressure on health care providers by allowing 24/7, low-cost access to individualized counseling for a large portion of the population that wants to quit smoking [5, 6].

Chatbots can be defined as "artificial intelligence programs designed to simulate human conversation" [6] and have seen a rapid increase in their ability to assist in health counseling over the years [5]. The initial effectiveness and acceptability of chatbots for health counseling has been demonstrated in various settings, such as mental health and physical activity [6].

Within the field of individualized smoking cessation counseling, modern chatbots can use various communication styles, such as confrontational counseling (CC) and motivational interviewing (MI). CC focuses on confronting smokers with the consequences of their behavior to counter self-exempting beliefs and increase risk perceptions through direct advice and health-related information [7]. In contrast, MI aims to enhance the client's motivation and belief that behavior change is necessary through self-persuasion [8]. Despite their differences, both MI and CC are client-centered, directive, and effective in facilitating behavior change [7, 9].

The potential of chatbots and their one-to-one nature allows for individualized conversations, and it is important to gain insight into which communication style fits which individual's needs and preferences. Tailoring to such preferences is likely to lead to higher user satisfaction with the chatbots and, by extension, a higher success rate regarding the target behavior [10]. In this context, two factors may be particularly applicable: the need for autonomy as outlined in Self-Determination Theory (SDT) [11] and perceived self-efficacy as outlined in Social Cognitive Theory (SCT) [12]. Specifically, a higher need for autonomy may ask for autonomy-supportive interventions (i.e., MI), whereas a lower need for autonomy may signal a need for explicit directions from an expert (i.e., CC). Thus, meeting a client's need for autonomy may require the chatbot to use different communication styles. Similarly, it is possible that smokers with a higher perceived self-efficacy in their behavior change abilities could be able to cope with the confrontation of CC, whereas those with a lower self-efficacy need the motivational enhancement found in MI to feel capable of behavior change [3, 7].

Although there is a rich amount of research in personalization techniques for health interventions, little research has compared MI and CC directly while taking into consideration the moderating role of individual differences, especially in chatbot-delivered health interventions. Therefore, to fill this gap in the literature and shed light on the use of chatbots in smoking cessation interventions, this study aims to explore the optimal communication style (MI vs. CC) for a chatbot in terms of user satisfaction and quit intention and the role of the need for autonomy and self-efficacy.

## 2. Conceptual Framework

### 2.1. Communication Styles for Smoking Cessation Chatbots

Within the substance abuse counseling literature, confrontation is a frequently mentioned practice [13]. Traditionally, CC aims to break through defense mechanisms such as denial and minimization of the problem, by directly confronting the client's resistance to change [13]. Within the smoking cessation field, CC counselors use techniques such as direct education, challenging clients' perceptions of the issue, and providing a treatment plan [14]. Contrary to the common idea that CC leads to a clash between the counselor and the client, research showed that this style positively predicts client involvement, and that CC may even be perceived as genuine and authentic if delivered in an empathetic manner [15]. However, if the client feels threatened by the counselor's pursuit of behavior change, resistance may escalate, leading to less satisfaction among the client and, in turn, a lower intention to change their behavior [8].

In response to the observed potential for client resistance in CC, Miller and Rollnick [8] developed MI: A counseling style for behavioral change by eliciting motivation *within* the client as opposed to imposing motivation *onto* the client [8, 13]. The MI counselor subtly guides the client through this journey by expressing empathy, accepting resistance, encouraging self-reflection, and acknowledging and supporting the client's self-efficacy [8]. Thus, whereas CC relies on directive advice and expert opinions from a professional, in MI, the client is regarded as the expert and the main driving force behind motivating oneself for behavior change [9].

Over the past decades, research on the effects of MI and CC on smoking cessation and other health behavior has yielded mixed and inconclusive results [16]. Some researchers argue that most smokers do not suffer from lack of knowledge about the negative consequences of smoking and do not need to receive information-based expert advice (i.e., CC), but instead a more motivation-based intervention (i.e., MI). However, there is also evidence suggesting that some individuals found MI too paternalistic and thus preferred a CC-resonant approach [17]. Therefore, CC can be effective for smokers who expect the counselor to be the expert rather than themselves [18]. A similar inconclusiveness pertains within the field of MI in smoking cessation interventions. For example, a meta-analysis showed that MI is efficacious for a wide range of problem behaviors (e.g., alcoholism and physical exercise), but not for smoking cessation. Other, more recent meta-analyses did find greater abstinence amongst smokers who received an MI intervention, although the effects were small [9].

Overall, these results illustrate that both CC and MI seem to have the potential to motivate behavior change. However, despite methodological disparities in this line of research, most literature seems to support the notion that MI yields less resistance and is therefore more likely to effectively change behavior, which is especially relevant for addiction where high resistance is common [16]. Secondly, meta-analyses showed that CC may work for a small portion of the population, but that MI works better for a larger group of individuals, making it a more efficacious approach [19]. Lastly, in the context of chatbot-delivered interventions, CC is most likely to be successful when the sender is deemed a legitimate knowledgeable expert and chatbots may not be particularly

suited for this communication style as chatbots are usually not considered as medical authorities [5]. On a broader note, it is suggested that people prefer chatbots that offer emotional support (i.e., MI) more than informational chatbots (i.e., CC) [20]. Given that this is likely to lead to increased user satisfaction and a higher intention to adhere to the intervention, it is hypothesized that:

*A chatbot employing MI leads to a higher intention to quit (H1) and higher user satisfaction (H2) amongst smokers in comparison to a chatbot employing CC.*

### 2.2. Moderating Role of Need for Autonomy

Whilst there is mounting evidence supporting the effectiveness of MI, most of the studies in this field were conducted in face-to-face clinical settings. Hence, the efficacy of automated MI delivered by chatbots remains inconclusive. In an earlier study [21], we compared an MI-style chatbot with a neutral-style chatbot and found no significant impact of MI. Similarly, recent reviews also acknowledged the inconclusiveness regarding the efficacy of automated MI and, therefore, called for research to further examine human factors that could impact chatbot interventions [22].

Human factors play an important role in the interaction with chatbots, and accounting for individual differences in designing the chatbot can improve user satisfaction and adherence [23]. Specifically in behavior change interventions, need for autonomy is a crucial characteristic that determines users' experience with the intervention. When this need is satisfied, the individual feels that it is intrinsically rewarding to perform the target behavior [24]. On the other hand, when one's need for autonomy is not satisfied, the individual feels pressured to think or behave in a way determined by external others, such as practitioners or interventions (e.g., chatbots) and might engage in defensive responses. Whilst the need for autonomy is universal, the level of this need differs per individual [24]. For instance, 'self-reliers' are individuals with a higher need for autonomy and are less likely to seek external control, whereas 'expert-dependents' are individuals with a lower need for autonomy and tend to depend on external guidance [24]. Therefore, in order to maximize the effectiveness of and user satisfaction with the smoking cessation chatbot, its communication style should be adapted to the client's preference, ranging from autonomy-supportive (i.e., MI) to more directive-confrontational communication (i.e., CC).

Indeed, whereas CC might lead to resistance, recent research [25] contends that this resistance may not be caused by communication style, but by different needs for autonomy among clients. For instance, individuals with a higher need for autonomy feel more satisfied by autonomy-supportive communication (i.e., MI), leading to better health behavior outcomes (i.e., intention to quit smoking). Similarly, clients with a lower need for autonomy were more likely to seek guidance from an expert [24]. It seems plausible that clients with a lower need for autonomy would benefit more from the advice and guidance that CC delivers, whereas those with a higher need for autonomy would benefit more from enhancing intrinsic motivation as done through MI. Coleman et al. [18] provided some evidence for this claim and found that smokers who have a higher need for autonomy prefer a counselor that respects their autonomy (i.e., MI) as opposed to a counselor that gives confrontational advice (i.e., CC). More specifically, smokers with

a higher need for autonomy may prefer to act independently, which is facilitated more by MI, whereas smokers with a lower need for autonomy may prefer to receive specific advice, which is facilitated more by CC. As such, it is hypothesized that:

*The need for autonomy moderates the relationship between chatbot communication style and smokers' intention to quit smoking and user satisfaction, in that the positive effect of MI (vs. CC) on intention to quit (H3) and user satisfaction (H4) is stronger for smokers with a higher need for autonomy than for smokers with a lower need for autonomy.*

### 2.3. The Moderating Role of Perceived Self-Efficacy

In addition to the need for autonomy, self-efficacy is another factor that should be considered when designing a smoking cessation chatbot. Considering smoking cessation is often characterized by hardship and relapse, it is necessary for smokers to have at least some confidence in their ability to quit before they start an attempt. Bandura's SCT [12] states that the higher one's perceived self-efficacy, the more confidence and commitment one feels toward achieving their goal. In smoking cessation research, many studies suggested that self-efficacious smokers often have a higher intention to quit than those with a lower perceived self-efficacy (for a review, see [26]).

There is evidence to suggest that the level of self-efficacy may affect the way clients respond to an intervention. Gaume et al. [27] found that counselors with more CC-styled skills are effective in behavior change for clients who express high levels of confidence in their ability to change. Similarly, Colby et al. [28] found that MI did not lead to increased quitting self-efficacy nor increased smoking abstinence, possibly because participants already had a relatively high level of self-efficacy at baseline. Together, past research suggests the possibility of a ceiling effect, which could mean that smokers with a high level of perceived self-efficacy may not be advantaged by an MI chatbot that specifically aims to raise this level. Additionally, smokers with a high level of self-efficacy may believe that they are able to quit smoking whenever they want and that they are not vulnerable to smoking risks, hereby reducing pressure to quit, and reducing the effectiveness of MI [7]. To counter these self-exempting beliefs, Kotz et al. [7] found that CC is useful in increasing risk perceptions, making cessation more likely. Hence, CC would be more beneficial for smokers with a high level of self-efficacy, whereas MI might be more beneficial for smokers with a lower level of self-efficacy. As such, it is hypothesized that:

*Perceived self-efficacy moderates the relationship between chatbot communication style and smokers' intention to quit and satisfaction, in that the positive effect of MI (vs. CC) on intention to quit (H5) and user satisfaction (H6) is stronger for smokers with a lower perceived self-efficacy than for those with a higher perceived self-efficacy.*

The conceptual model can be seen in Figure 1.

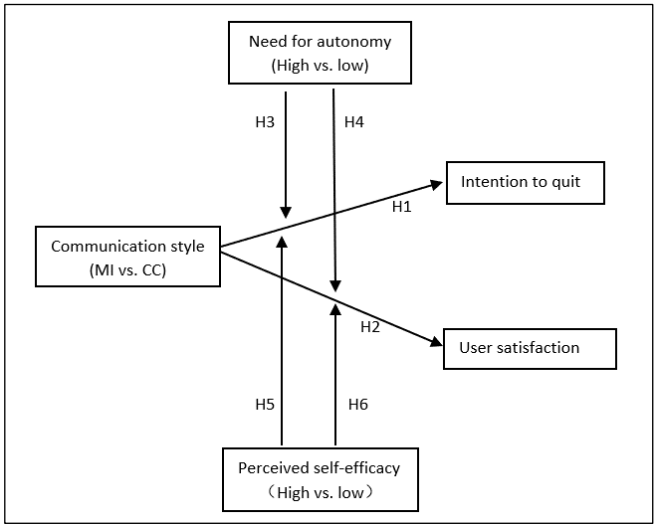


**Figure 1.** Conceptual model of the hypotheses

# 3. Methods

## 3.1. Participants

An a-priori statistical power analysis using G*Power revealed that a sample size of 158 participants is necessary to uncover small to medium effects (effect size $f = 0.25$, power = 0.8), in accordance with previous meta-analyses on the effects of MI on smoking cessation [9]. To be able to partake in the experiment, participants had to be at least 18 years old, proficient in English, and have smoked at least one cigarette in the week prior to participation. As such, from November 23rd, 2021, to December 3rd, 2021, a total of 270 participants were recruited who met the requirements, agreed to the terms of the study, and completed the survey.

Participants who did not finish the chatbot conversation ($n = 37$) were removed from further analysis, leaving a final sample of 233 participants. Among these participants, 147 identified as female (63.1%), 83 as male (35.6%), and three as non-binary or preferred not to say (1.3%). Most participants reported to be between 18 and 25 years old (81.5%, $n = 190$) or 26 to 30 years old (11.2%, $n = 26$), the remaining participants indicated to be over 31 years old (7.3%, $n = 17$).

## 3.2. Experimental Design and Procedure

The online between-subjects experiment was conducted using Qualtrics for the survey-based part of the experiment and Flow.ai, a chatbot-building platform frequently used by companies and researchers, for the chatbot-part of the experiment. Prior to the commencement of data collection, ethical approval was obtained from Tilburg School of

Humanities and Digital Sciences. Additionally, a pre-test was conducted to see whether the two conditions differed significantly using the Client Evaluation of Motivational Interviewing (CEMI) scale [29]. This proved to be the case in the pre-tested materials ($M_{MI}$ = 5.1, $SD_{MI}$ = 0.7, $M_{CC}$ = 3.9, $SD_{CC}$ = 0.8, $t(22) = 4.00$, $p < .001$) as well as the materials used in the official experiment, finding that participants in the MI condition perceived the chatbot as more MI-like ($M = 5.1$, $SD = 0.9$), whereas participants in the CC condition perceived the chatbot as more CC-like ($M = 3.6$, $SD = 0.8$, $t(231) = 3.20$, $p = < .001$). Therefore, the manipulation was deemed successful.

Upon starting the experiment, participants first provided demographic data and information about their smoking status, after which they were randomly assigned to either the MI condition ($n = 121$) or the CC condition ($n = 112$). Participants' need for autonomy and perceived self-efficacy was measured, as well as their intention to quit at baseline. Then, participants were redirected to the Flow.ai environment, where they were asked to engage in one 8-minute conversation with either Cecily the MI chatbot or Cecil the CC chatbot. After the conversation, participants' intention to quit and their satisfaction with the conversation were measured. Finally, the participants were debriefed and thanked for their participation.

### 3.3. Operationalization

**MI Chatbot Condition**. MI works through a relational component and a technical component, in which the former focuses on acceptance, collaboration, evocation, and compassion – in other words, the 'MI-spirit' [8]. Within chatbots, the use of natural, person-like discourse and the use of emoticons can enhance this MI spirit, which were incorporated into the MI chatbot's dialogue. The technical component was operationalized by asking open-ended questions, providing reflections and affirmations [8]. During the conversation, the chatbot emphasized that that the participants were the experts rather than the chatbot, engaged the participants in shared agenda-setting to devise a goal for the conversation, encouraged the participant to express their thoughts and feelings about behavior change, helped the participant with identifying goals and barriers to change and setting a quitting plan if the participant wished to do so.

**CC Chatbot Condition.** The primary aim of the CC chatbot was to make the participant face the issues that their smoking behavior may cause by providing confrontational health information and unsolicited feedback on the participant's behavior [7, 8]. During the conversation, the chatbot directed the participant to talk about their current smoking behavior, after which the participant was told that their behavior is quite worrisome. The chatbot provided advice (without asking for permission) on how to tackle nicotine dependency. Factual data were used to confront minimization of the issue or resistance [7]. Lastly, the chatbot urged for readiness and abstinence by providing advice on how to deal with withdrawal symptoms and encouraging the participant to seek assistance from a medical professional. Examples of both chatbot utterances can be found in Table 1.

The interaction in both conditions took roughly same amount of time. Except for the aforementioned manipulations, the content of the dialogues (e.g., the information provided) was comparable across the two conditions.

**Table 1.** Example chatbot utterances of the two conditions.

| MI chatbot utterances | CC chatbot utterances |
|---|---|
| "In this conversation, you are the expert on your own situation, smoking behavior, and thoughts." (collaboration) | "It may feel good now, but think about your future self for a second." (directive) |
| "Could you reflect on how quitting smoking may hinder your progress toward this goal?" (open-ended question) | "Before you can start your quit attempt, you must feel 100% ready. That way, your chances of a successful attempt are higher." (urge for readiness) |
| "Okay, so if I understand you correctly, your goal is […], but smoking can prevent you from achieving this goal: "[…]"." (reflection) | "That's quite worrisome." (judgement) |
| "You should definitely be proud of that achievement! ☺" (affirmation) | "I advise you to distract yourself by thinking about your reasons for quitting, and what you're doing all this for." (direct advice) |

### 3.4. Measurements

**Nicotine Dependency.** The Fagerström Test for Nicotine Dependence (FTND) [30] was administered prior to experimental exposure. This measurement contained six questions, such as "How many cigarettes do you smoke per day?". The total number of points participants received based on their answers ranged from 2 and 12. A higher sum indicated a stronger nicotine dependency ($M$ = 3.6, $SD$ = 2.1, Cronbach's $\alpha$ = .72).

**Need for Autonomy**. To measure participants' need for autonomy, the Help-Seeking Scale [31] was administered. This scale consisted of fourteen items. An example statement is "Instead of dealing with a problem on my own, I prefer to rely on someone who knows more than I". The questions were presented using a Likert-scale, ranging from 1 (*not at all true of me*) to 7 (*very true of me*). A higher computed mean score indicated a higher need for autonomy ($M$ = 4.5, $SD$ = 0.7, Cronbach's $\alpha$ = .71).

**Perceived Self-Efficacy**. To gain insight in the extent to which participants feel self-efficacious enough to change their behavior, the Smoking Abstinence Self-Efficacy Questionnaire (SASEQ) [32] was administered. This measurement consisted of six 'vignettes', such as "You feel agitated or tense. Are you confident that you will not smoke?". Participants' perceived self-efficacy was then measured using a Likert-scale, ranging from 1 (*certainly not*) to 5 (*certainly*). A higher computed mean score indicated a higher perceived self-efficacy ($M$ = 2.7, $SD$ = 0.8, Cronbach's $\alpha$ = .76).

**Intention to Quit**. Participants' intention to quit was measured using the Contemplation Ladder [33], a one-item instrument on which participants can rank themselves in terms of their readiness to quit on a scale from 0 (*no thought of quitting*) to 10 (*taking*

*action to quit*). This question was administered prior to experimental exposure to establish a baseline value ($M$ = 6.4, $SD$ = 2.9) as well as after exposure ($M$ = 7.2, $SD$ = 2.5) to assess whether the conversation led to an increased intention to quit.

**User Satisfaction with the Conversation**. Lastly, user satisfaction with the conversation was measured using the Client Satisfaction Questionnaire (CSQ-8) [34]. The CSQ-8 contains eight items, such as "To what extent has the consultation with the chatbot met your needs?", which were measured on a scale ranging from 1 to 4. A higher computed mean score indicated a higher user satisfaction with the conversation ($M$ = 2.6, $SD$ = 0.6, Cronbach's $\alpha$ = .93).

**Perception of Motivational Interviewing**. Manipulation checks were carried out using a shortened version of the CEMI scale [29]. The scale included statements such as "The chatbot told you what to do" and "The chatbot showed you that it believed in your ability to change your behavior". Scores were measured using a Likert-scale ranging from 1 (*not at all*) to 7 (*a great deal*). A high total mean score indicated that the participant viewed the chatbot as MI-like; a low total mean score indicated that the participant viewed the chatbot as CC-like ($M$ = 4.3, $SD$ = 1.1, Cronbach's $\alpha$ = .76).

### 3.5. Statistical Analysis

To test the effect of MI (vs. CC) on intention to quit and user satisfaction, taking into consideration of the possible influence of age, gender, and nicotine dependency [35], two one-way ANCOVAs were performed. To test the hypothesized moderating role of need for autonomy and self-efficacy, Hayes' PROCESS model 1 with covariates was used. All analyses were performed with SPSS 27.

## 4. Results

### 4.1. Main Analysis

**Main Effects**. H1 posited that an MI chatbot would lead to a higher intention to quit in comparison to a CC chatbot. A one-way ANCOVA showed that the covariates age ($F$(1, 228) = 1.37, $p$ = .243), gender ($F$(1, 228) = 1.38, $p$ = .241), and nicotine dependency ($F$(1, 228) = 3.52, $p$ = .062) were not significantly associated with the intention to quit, although nicotine dependency was only marginally insignificant. No significant effect of chatbot communication style on one's intention to quit was found, $F$(1, 228) = 0.97, $p$ = .325. Thus, H1 could be rejected.

H2 posited that an MI chatbot would lead to higher user satisfaction with the conversation in comparison to a CC chatbot. Similarly to H1, the covariates age ($F$(1, 228) = 0.26, $p$ = .613), gender ($F$(1, 228) = 0.15, $p$ = .700), and nicotine dependency ($F$(1, 228) = 0.01, $p$ = .253) were not significantly associated with user satisfaction. A significant effect of chatbot communication style on user satisfaction could not be uncovered, $F$(1, 228) = 1.31, $p$ = .253. Therefore, H2 could also be rejected.

**Moderating Role of Need for Autonomy**. Taking the analyses one step further, H3 posited that smokers' need for autonomy would moderate the relationship between chatbot communication style and intention to quit, in that the positive effect of MI (vs. CC) on intention to quit is stronger for smokers with a higher need for autonomy than for smokers with a lower need for autonomy. Results from Hayes' PROCESS model 1 showed that need for autonomy did not moderate the relationship between chatbot communication style and intention to quit ($b$ = -.15, $t$ = -.32, $p$ = .746). The main effect of need for autonomy on intention to quit was also insignificant ($b$ = -.11, $t$ = -.16, $p$ = .876). None of the covariates (i.e., age, gender, nicotine dependency) were significant either. Thus, H3 could be rejected.

Similarly, H4 hypothesized the moderating role of need for autonomy in the relationship between chatbot communication style and user satisfaction with the conversation. Results showed that the interaction was not significant ($b$ = -.03, $t$ = -.25, $p$ = .806), nor was the main effect of need for autonomy on user satisfaction ($b$ = .12, $t$ = .64, $p$ = .520) or any of the covariates. H4 could also be rejected.

**Moderating Role of Perceived Self-Efficacy**. Similar procedures with PROCESS model 1 were carried out to test the proposed moderating effect of perceived self-efficacy. H5 posited that the positive effect of MI (vs. CC) on intention to quit is stronger among people with lower self-efficacy. The moderation was not significant ($b$ = -.09, $t$ = -.23, $p$ = .822), nor was the main effect of perceived self-efficacy on intention to quit ($b$ = .81, $t$ = 1.25, $p$ = .213). None of the covariates (i.e., age, gender, nicotine dependency) were significant either. H5 was therefore rejected.

Lastly, H6 proposed the moderation of self-efficacy in the relationship between chatbot communication style and user satisfaction. Results revealed a significant moderation ($b$ = -.21, $t$ = -2.09, $p$ = .038). However, simple slope analysis showed that the effect of MI is stronger among individuals with higher self-efficacy, which is opposite to what was hypothesized. Additionally, a main effect of self-efficacy appeared ($b$ = .40, $t$ = 2.42, $p$ = .016), such that higher self-efficacy predicts higher user satisfaction with the chatbot. No significant covariates were found (i.e., age, gender,

nicotine dependency). Therefore, H6 was rejected. The results of the hypothesis testing are visualized in Figure 2.

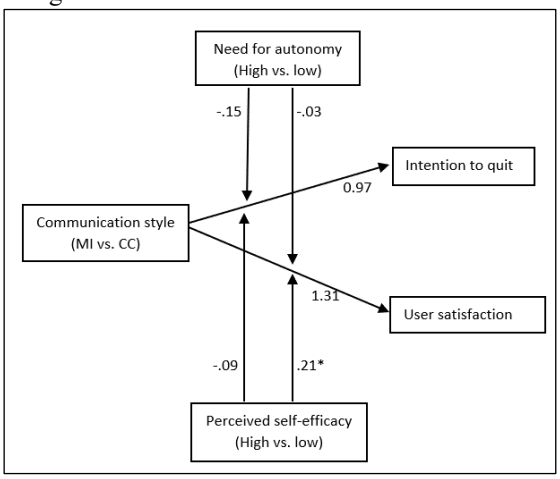


**Figure 2**. Test results as integrated in the conceptual model. *$p < .05$

### 4.2. Secondary Analysis

A repeated measures ANCOVA was carried out to test whether conversing with the chatbots raised participants' intention to quit. The covariates age ($F(1, 229) = 1.45$, $p = .229$), gender ($F(1, 229) = 2.34$, $p = .136$), and nicotine dependency ($F(1, 229) = 2.98$, $p = .086$) were not significantly associated with participants' post-test intention to quit. No significant effects of chatbot communication style on intention to quit were found, $F(1, 228) = 0.78$, $p = .379$. However, a large significant effect was found of chatbot interaction in general on intention to quit, $F(1, 232) = 59.20$, $p = < .001$, $\eta_p^2 = .20$. Smokers' intention to quit after exposure was significantly higher ($M = 7.2$, $SE = 0.2$) than at baseline ($M = 6.4$, $SE = 0.2$, $M_{difference} = 0.8$, $SE = 0.1$, $p < .001$). Thus, conversations with a chatbot about smoking – no matter what communication style is used – seem to be effective in raising smokers' intention to quit.

## 5. Discussion

### 5.1. Main Findings

This study aimed to uncover the potential of conversational chatbots in motivating smoking cessation. Specifically, the study investigated the effectiveness of chatbot-delivered MI and CC in raising one's intention to quit, which communication style led to higher user satisfaction with the conversation, and to what extent these outcomes were moderated by individuals' need for autonomy and perceived self-efficacy. Overall, results show that chatbot interaction about smoking cessation – regardless of the communication style used by the chatbot – does lead to a significant increase in one's intention

to quit smoking. However, intention to quit and user satisfaction with the conversation did not differ between participants in the MI condition and participants in the CC condition, nor were these outcomes moderated by participants' need for autonomy or perceived self-efficacy. Thus, all hypotheses were rejected.

It was hypothesized that MI (vs. CC) as a communication style would lead to a higher intention to quit and higher user satisfaction among smokers. Participants' intention to quit did significantly increase after the chatbot interaction, regardless of their assigned condition. An explanation for the insignificant results may be found in the conceptualization of MI and CC in this study. An analysis of the subscales of the manipulation check revealed that the technical skills of both the MI chatbot ($M$ = 4.8, $SD$ = 1.3) and the CC chatbot ($M$ = 4.3, $SD$ = 1.4) were perceived to be quite MI-like. Thus, participants in the CC condition still found that the chatbot helped them to feel confident about their ability to quit by discussing the need for behavior change, despite its confrontational approach to the conversation. This resemblance was not the case for the relational subscale, on which the MI chatbot ($M$ = 5.3, $SD$ = 1.3) was perceived as more MI-like than the CC chatbot ($M$ = 2.9, $SD$ = 1.1). This echoes previous research demonstrating that people appreciate empathic communication from a chatbot, compared to purely informational chatbots [20]. In addition, Lundahl et al. [16] found that the effect of MI is subject to a dosage effect, meaning that more treatment time using MI may lead to better outcomes. Considering that this study consisted of a single 8-minute session, it could be that the duration of the exposure was too short for the expected effects of MI to occur. Future research should investigate whether multiple sessions and/or longer exposure to an MI chatbot could provide stronger effects on intervention outcomes. Additionally, future research may investigate whether a distinctively CC-based approach – without MI-related elements, as found in this study – can be effective to begin with in chatbot-delivered counseling, since chatbots may never possess the legitimate expertness of a medical professional that usually makes clients more receptive to professional health advice [5].

We attempted to examine whether the main effect of MI could be explained by considering participants' need for autonomy. No significant results were found with this regard. However, albeit insignificant, results showed that participants with a higher need for autonomy had a lower intention to quit than participants who had a lower need for autonomy, regardless of the communication style of the chatbot. This finding may illustrate that smokers with a higher need for autonomy may benefit less from smoking cessation chatbots *precisely* because of their desire to make decisions without interference from others or persuasive technologies [24]. It is, therefore, essential that the chatbot is presented in a non-intrusive way, allowing people to interact with the chatbot at their own choice and own pace. Research on persuasive chatbots has shown that perceived intrusiveness negatively predicts people's perception of the chatbot and the persuasiveness [36]. In this study, due to the relatively short interaction time, it is likely that the purpose of the conversation (i.e., motivating smoking cessation) was introduced early without enough initial engagement, which resulted in threats to one's autonomy. Since these results illustrate that the opportunity to act autonomously is relatively important to most people, future (qualitative) research could shed light on how people with varying levels of need for autonomy could benefit from health-related chatbots –

if people with a high need for autonomy can benefit from such interventions at all. These results could show how interventions should be designed in order to be need-supportive and effective in facilitating behavior change.

Self-efficacy was proposed as a moderator in the relationship between chatbot communication style and intention to quit and user satisfaction. We found that self-efficacious smokers were more satisfied with the interaction, and that the effect of MI on user satisfaction was more profound among people with higher self-efficacy. Perhaps, smokers with a lower self-efficacy may prefer to receive information about how to sustain a quit attempt (i.e., CC) while MI works better with already self-efficacious smokers by encouraging them to reflect on their own beliefs and facilitate action planning. Addiction researchers have categorized interventions on a continuum, ranging from more self-help approaches (e.g., mobile app, booklet) to more intensive care (e.g., nicotine replacement therapy) [37]. It could be that an MI chatbot falls on the self-help end and is more suitable for people with higher self-efficacy. However, this study investigated self-efficacy as a trait and did not investigate whether an MI chatbot could effectively raise one's perceived self-efficacy during the process. A potential proposition to be considered in future research is whether an increase in perceived self-efficacy after conversing with a conversational chatbot could mediate – rather than moderate – the relationship between chatbot communication style and intervention outcomes.

### 5.2. Limitations and Suggestions for Future Research

The present study sheds some light on the use of chatbots for smoking cessation, however, there are several limitations that warrant consideration in the interpretation of the findings. First, this study did not gather any information regarding participants' race or education, even though past research has found that such factors may influence one's communication preferences and experience with digital interventions such as chatbots [38]. Future research considering these traits could yield some additional insight in the potential and effectiveness of chatbots in health counseling, for example, how chatbots could convey a higher trustworthiness or legitimacy and therefore lead to higher user satisfaction and better intervention outcomes.

Second, we did not measure participants' perception on the quality of the interaction and the chatbot, while such perception might have played a role in user satisfaction and the intention to quit. To have more experimental control and to ensure that the chatbot in both conditions delivered the content in a structured and consistent manner, we created the chatbots with constrained capability. Participant input was limited to mostly predetermined keywords, and the chatbots used little natural language processing and generation. Although constrained chatbots are commonly used in the healthcare domain to ensure controllability and avoid unwanted harm [39], it might limit the variability and quality of the interaction, and hinder user experience. Future research is encouraged to explore the potential with more advanced chatbots and find the balance between controllability and user experience.

## 6. Conclusion

This study set out to explore the effectiveness of conversational chatbots using two different communication styles – MI and CC – on smokers' intention to quit and user satisfaction with the conversation, and the moderating role of smokers' need for autonomy and perceived self-efficacy. No significant effects of MI (vs. CC) on intention to quit and user satisfaction emerged, nor were these effects moderated by need for autonomy or perceived self-efficacy. However, results did show that a higher perceived self-efficacy translates into a higher user satisfaction, as well as modest evidence that chatbot interaction about smoking cessation effectively raises intentions to quit. As such, practical implications of this study include that health professionals may consider developing chatbots in order to keep up with clients' demands regarding cessation help whilst simultaneously decreasing the pressure on health care systems. Still, more research is needed into what exactly smokers desire when it comes to counseling chatbots to elevate the success of such tools. This study aims to provide a steppingstone for further research into this topic, which is currently more important than ever.

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