# The working alliance in automated therapy

## Development of an alliance-supporting eHealth program and two grounded theory studies of relating and change

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*“To conceive of humanity and technology as polar opposites is, in effect,*
*to wish away humanity: we are socio-technical animals,*
*and each human interaction is sociotechnical.”*
*Latour, 1999, p. 214*

*Always judging yourself*
*through the eyes of*
*The Other.*
*Now there is*
*No “Other”.*
*Looking glass self*
*but nobody’s watching.*
*Now you’re in charge*
*of what you see*
*in your reflection.*
*Marianne T. S. Holter, 2018*

# Foreword and acknowledgements

This PhD-project is part of a larger project headed by my principal supervisor, Håvar Brendryen, which is funded by a grant from the Research Council of Norway's public health program (NFR 228158/1-110). The research was conducted at the Norwegian Centre for Addiction Research (SERAF), Institute of Clinical Medicine, University of Oslo.

The story of this dissertation can be said to have started with my position at the Norwegian Quit Smoking Line ("Røyketelefonen"), where I worked part-time as a counsellor while studying psychology. My training there in Motivational Interviewing and the hundreds of conversations I had with people struggling to quit smoking laid an important foundation for the first part of this PhD, which consisted of developing an eHealth program for quitting smoking. From the very beginning, I became fascinated with the idea of whether it was possible to experience a working alliance to an automated eHealth program. This fascination shaped the path forward and, in the end, became the main pursuit of this dissertation.

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Marianne T. S. Holter

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# Executive summary

Health interventions delivered through the Internet as stand-alone treatments – eHealth programs – show great promise for improving people's health [1–5]. However, little is known of *how* these programs facilitate change – that is, their working mechanisms. The overall purpose of this dissertation was to explore one potential eHealth working mechanism: a person-to-program working alliance. A working alliance – a collaborative relationship between client and therapist – is considered to be an important element of effective psychotherapy [6–10] and has for some time intrigued researchers as a possible working mechanism also in eHealth [7,11–20]. However, there are only a few studies that have investigated a potential person-to-program alliance empirically, and although there is preliminary support for the existence of such an alliance [11,15,20], the evidence is still limited. Furthermore, the alliance is usually presumed to include an emotional bond to the therapist [8,21], but the status of the emotional bond in a potential person-to-program alliance is yet unclear [11]. Moreover, for an alliance to be considered an eHealth working mechanism, it must be possible to document that it influences change, but so far, most studies have not found any such association [11,15], and the one study that found an association used a measure that did not include an emotional bond [20]. Thus, current knowledge seems to point towards three unanswered questions: specifically, (1) how people relate to automated eHealth programs and (2) whether ways of relating to a program influences change, and more broadly, (3) whether a fully automated program can support a working alliance. Thus, this dissertation's guiding research question was *can a fully automated program support a working alliance?*

I have explored this question from three different perspectives: a theoretical perspective, a methodological perspective, and an empirical perspective. First, I co-developed an eHealth program for quitting smoking that is specifically designed to support a working alliance (Paper 1). Next, I developed an interview methodology for generating rich data on how the program users related to the program (Paper 2). Finally, I conducted a grounded theory interview study [22] of how the participants related to the program (Paper 3) and how they used it to help them change (Paper 4). Because papers 1 and 2 both provide perspectives for answering the dissertation's guiding research question (a theoretical perspective and a methodological perspective), they are presented as findings in this dissertation.

The main finding of Paper 1 is that from a theoretical perspective, a fully automated eHealth program can support a working alliance through using a text-based relational agent [15] that communicates with computerized Motivational Interviewing [23] and integrates "alliance-factors" in

program elements [12]. I arrived at these program elements by using Intervention Mapping [24] to systematically integrate alliance-support into the program.

The main finding of Paper 2 (which is a viewpoint article) is that from a methodological perspective, understanding how program users relate to an eHealth program through qualitative interviews may require tools for clarifying and exhausting the interview topic, keeping contextual answers short, aiding recall, arranging and analysing the interview as a social situation, and structuring the dual-aim interview. In this paper, I suggest that difficulties may arise when using qualitative interview studies for exploring potential eHealth working mechanisms such as the alliance, because computer programs are usually thought of as inanimate objects and not inter-actional partners, rendering parts of a program's working mechanisms less apparent to the program user ("the invisible interaction"). Being less apparent to the participant, it can be difficult to get rich data on these aspects through standard semi-structured interviews based on descriptive questions. However, by cultivating a methodological awareness of these issues and using available tools from the qualitative field, it is possible to facilitate interview conversations on potential eHealth working mechanisms, generating rich data on for example a potential person-to-program alliance.

The main finding of Paper 3 is that participants related to the program through two relational processes: *making come-alive* and *keeping un-alive*. The paper presents a model of relating in automated therapy, in which different combinations of making come-alive and keeping un-alive results in three broad, partly overlapping ways of relating to a program: a *non-social interaction*, a *semi-social interaction*, and a *semi-social relationship.* When making come-alive is combined with a positive evaluation of the program interaction, the program user experiences a *supportive social presence,* which shares features with the emotional bond of an alliance [21,25]. Thus, Paper 3 answers the dissertation's alliance-question from an empirical perspective, finding support for a working alliance to an automated program by identifying a person-to-program emotional bond and explaining it with a theoretical model.

The main finding of Paper 4 is that participants needed *change-space* for subsequent change-work, and that they got change-space through a semi-social relationship to the program. These findings are presented in a model of change-space, in which having change-space means feeling free and supported to work constructively on changing on one's own terms. In human relationships, change-space can be restricted by *social forcing;* that is, feeling forced to change by the other. The findings presented in Paper 4 suggested that in automated therapy, program users can get change-space through a semi-social relationship to the eHealth program: through making come-alive, the user feels supported and encouraged to work constructively on changing; while through keeping un-alive, the

threat of social forcing is removed. These findings resemble findings from psychotherapy research, in which it has been found that a therapist may support change through providing a supportive presence as well as including an element of clinically useful estrangement [26,27]. The empirical perspective on the alliance-question provided in this dissertation is therefore completed in Paper 4: by finding that relational processes influenced a change process, the evidence supporting a working alliance in automated therapy is strengthened.

In sum, this dissertation study found evidence supporting a working alliance in automated therapy. Such a person-to-program alliance may include an emotional bond to the program, enabled by making come-alive; but may also include keeping un-alive as another important relational process. A person-to-program alliance may facilitate change, specifically by giving program users change-space. This suggests that a working alliance may be a useful concept for understanding eHealth's working mechanisms.

## List of papers in the dissertation:

**Paper 1:** "How a fully automated program simulates three therapeutic processes: A case study".
*Authors:* Marianne T. S. Holter, Ayna B. Johansen, and Håvar Brendryen.
*Status:* Published in Journal of Medical Internet Research (J Med Internet Res 2016;18(6):e176).

**Paper 2:** "Theorizing eHealth working mechanisms through qualitative interviews: Tools to enhance study quality" (Viewpoint article).
*Authors*: Marianne T. S. Holter, Ayna B. Johansen, Ottar Ness, Svend Brinkmann, Mette T. Høybye, and Håvar Brendryen
*Status*: Submitted to the Journal of Medical Internet Research.

**Paper 3:** "The emotional bond and the person-to-program alliance: A grounded theory study of how people relate to an automated eHealth program".
*Authors*: Marianne T. S. Holter, Ottar Ness, Ayna B. Johansen, and Håvar Brendryen.
*Status*: Submitted to the journal of Qualitative Health Research.

**Paper 4:** "The working alliance to a computer program can facilitate constructive change-work: A grounded theory study of relational processes in automated eHealth therapy".
*Authors*: Marianne T. S. Holter, Ottar Ness, Ayna B. Johansen, and Håvar Brendryen.
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# 1. Introduction

## 1.1. Supporting health-promoting behaviour

Finding ways of improving physical, mental, and societal well-being is a prominent task for researchers who want to contribute to human prosperity. When the World Health Organization (WHO) was constituted in 1946, the member states asserted that "health of all peoples is fundamental to the attainment of peace and security". "Health" was defined as "complete physical, mental and societal well-being and not merely the absence of disease or infirmity" [28(p1)]. Likewise, the Norwegian Directorate of Health calls health "a goal in and of itself, as well as a means for achieving good lives" [29(p5)] (*my translation*).

Sometimes, improving health means preventing disease. One major cause of disease worldwide is that of non-communicable diseases – diseases that are not caused by infection, such as cardiovascular disease, cancer, chronic respiratory disease, and diabetes. In 2016, non-communicable diseases were responsible for 71 % of the total number of deaths worldwide [30]. According to WHO "the rise of NCDs [non-communicable diseases] has been driven primarily by four major risk factors: tobacco use, physical inactivity, the harmful use of alcohol, and unhealthy diets" [31]. In other words, unhealthy behaviour account for a large part of premature deaths and disease burden, and helping people change their unhealthy behaviour can significantly improve the health of the world's population.

However, the individual often needs help in becoming and staying healthy. Controlling the risk-factors of non-communicable diseases (e.g. quitting smoking or becoming more physically active) requires changing thoughts, emotions, and impulses [32]. This can be challenging, and people sometimes need help in acquiring and maintaining a healthier lifestyle [23]; help which traditionally has been sought with health professionals. Visiting health professionals has also been a necessary part of disease treatment and disease management [33]. However, technological advances and the spread of the Internet have provided a supplement to person-to-person consultations: eHealth.

## 1.2. The promise of eHealth and web-based interventions

The use of the Internet for health purposes – eHealth – will presumably play an increasingly important role in the years to come, and will possibly be crucial for reaching the World Health Organization's goal of affordable health services to everyone [15,34,35]. Some of eHealth's advantages is that it can reach across borders, to remote places, providing health support to anyone with access to a smart phone or computer with Internet access. Often entirely or partly automated, eHealth can be delivered at a relatively low cost to thousands of people and can provide more or less individualized

guidance to anyone with access to a computer (or a mobile phone) and the Internet. Therefore, there lies great promise in eHealth programs' potential for providing health support to the masses. Using technology to provide health support also means that resources in the health care system can be better utilized, and people can become more engaged in their own health management, moving the practice of healthcare into where people live [35]. The possibilities involved in eHealth has caused many countries to acquire an eHealth strategy [34,35], and Norway even has a directorate for eHealth [36]. However, involving all use of communication technology for health purposes, "eHealth" is a concept covering many types of interventions and tools for a large range of purposes; hence, I will in the following clarify the focus for this dissertation.

"Telemedicine" is the "grandfather term". Originating in the 1970's, telemedicine emerged as a way to reach patients in remote places with the care they needed, using available electronic communications. The term "eHealth" is an expansion of the telemedicine-term, including more than just treatment of patients [35]. In the World Health Organization's (WHO) global eHealth survey, "eHealth" includes as varied health elements as electronic health records, the use of big data or social media for health purposes, and mHealth [34]. While eHealth is an expansion of the original telemedicine-concept, mHealth (mobile health) can be considered a "subset" of eHealth [35]. WHO defines mHealth as "the use of mobile devices - such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and wireless devices - for medical and public health practice" [34(p27)]. As such, mHealth is also a broad term, including different health services such as health call centres, reminders to attend appointments, digital consultations, and health surveys [34]. One special form of eHealth or mHealth is Internet-supported therapeutic interventions [37]. In some regards, Internet-supported therapeutic interventions bear similarities to the original telemedicine in emphasizing (health) interventions – but with new technology and perhaps a broader understanding of what lies within the concept "health". The interventions show great variations concerning format and modality, including online counselling, software using Artificial Intelligence, therapeutic games, blogging, online support groups, and web-based interventions [37]. According to Barak, Kelin, and Proudfoot [37], a web-based intervention is:

> *"a primarily self-guided intervention program that is executed by means of a prescriptive online program operated through a website and used by consumers seeking health- and mental-health related assistance. The intervention program itself attempts to create positive change and or improve/enhance knowledge, awareness, and understanding via the provision of sound health-related material and use of interactive web-based components"* [37(p5)].

Barak and colleagues [37] further distinguish between different types of web-based interventions: web-based education interventions, human-supported therapeutic web-based interventions, and self-guided web-based therapeutic interventions [37]. In this landscape of Internet-facilitated health support, this dissertation concerns self-guided web-based therapeutic interventions with no human support (Figure 1). However, I will for brevity use the label "eHealth programs", sometimes adding "automated" to stress that no human contact is involved.

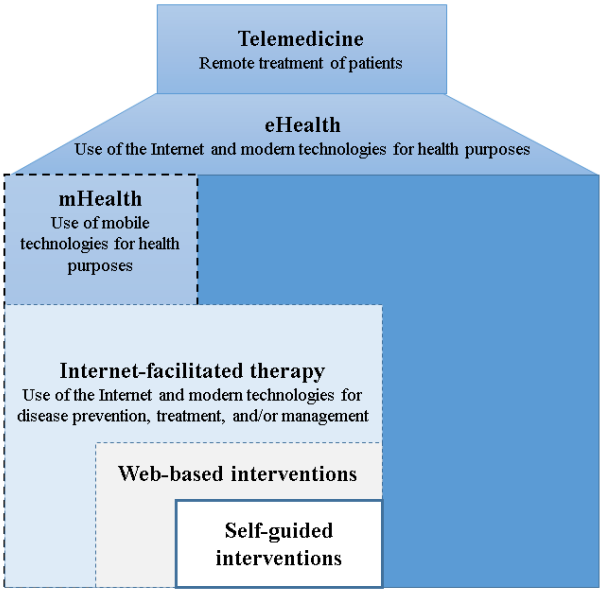


**Figure 1. "eHealth" is an encompassing term with multiple possible meanings. This dissertation concerns self-guided web-based interventions, delivered via the Internet and/or mobile phones. For brevity, these types of interventions will be referred to as "(automated) eHealth programs".**

Automated eHealth programs show promise in many areas; meta studies conclude that they on average show small to moderately positive effects [1–5]. However, interventions vary on many characteristics – such as in their theoretical underpinning, the extent of theory used, program length, program features, and degree of tailoring – presumably contributing to a substantial variation in treatment effects [2,3,38]. Adding to this confusion, it has been a problem that many of the tested interventions were not sufficiently described, leading to an accusation of these interventions being undefinable "black boxes" and a call for more thorough descriptions of intervention content [19,24,38–42]. Indeed, since this criticism was first raised, more researchers have published papers describing their interventions [e.g. 40,43–52], which has added to the transparency of the field.

However, program description only may not be enough; presumably one reason for the great variations in the content and architecture of eHealth programs is that surprisingly little is known of *what* works and *how* [19,39]. Not knowing how eHealth programs achieve their effects makes it difficult

to consistently build effective programs and to advance the field, suggesting a need for research that can identify the effective elements [19,38,53–56]. A handful of potentially important program elements have been identified: There is evidence suggesting that interventions improve when they use automated dialogue, peer-to-peer mediated communication, information about real users, tailoring based on combinations of variables [38], additional theory-based intervention contacts such as text messages [3,38], more behaviour change techniques, and more extensive use of theory [3].

While these efforts are valuable for identifying effective program elements, they lack the unifying, abstract knowledge that is provided by theories. Moreover, although these findings suggest that programs improve with more extensive use of theory, there remains the question of *what* theories interventions should build on. Program developers rely on traditional behaviour change theories or theories and models from psychotherapy [40,43,46,54,56–58]. However, automated eHealth programs are necessarily without human support, and they have the potential of being more flexible and interactive than what is generally assumed in traditional behaviour change theories [54,56]. As such, currently used theories may fail to take into account eHealth programs' unique characteristics, and we may therefore not be utilizing their full potential. This suggests a need for research that can inform our theoretical understanding of eHealth's working mechanisms and serve to build eHealth-specific theories [54,56].

One possible eHealth working mechanism that has received considerable interest is that there might be a "working alliance" (or "therapeutic alliance") between person and program [12,13,15,18,19,59,60]. This idea is derived from the importance of a "working alliance" – a collaborative relationship – between the client and the therapist in psychotherapy [9,61]. Before reviewing the evidence for a person-to-program alliance, I will briefly account for the role of the working alliance in psychotherapy.

## 1.3. The working alliance in psychotherapy

The working alliance is believed to be one of the common factors of psychotherapy – that is, clinically important factors that are the same across different schools of therapy. The term "common factors" has its roots in a paper from 1936, in which Rosenzweig famously declared what has been known as "the dodo-bird verdict" over psychotherapy: that no form of therapy is better than the others, and that therefore "everybody has won and all must have prizes" [62(p412)]. In order to explain this observation, Rosenzweig suggested that all psychotherapy approaches share some common features in the interactions between client and therapist that may be partly responsible for the therapeutic effects. Since then, common factors in psychotherapy have received a lot of research attention, and of all common factors, the working alliance is the most researched [6]; in fact, the alliance is one of the most researched topics within psychotherapy research as a whole [8].

Discussions of the importance of an alliance between client and therapist actually go even further back than Rosenzweig, to the writings of Freud [8,25]. Freud originally thought of the alliance as the client's positive transference [25]; that is, that the client "displaced" qualities from other relationships onto the therapist. The alliance was later re-conceptualization, one of the notable contributions being that of Greenson in 1965, who separated between three elements: transference, the "real" relationship between client and therapist, and what he called the "working alliance" [8,25]. As this short historic review suggests, the alliance-term originates from the psychoanalytic tradition. However, the current understanding of an alliance also has influences from the humanistic tradition and Rogers' emphasis on the therapist's unconditional positive regard and empathy as necessary and sufficient conditions of therapy [8,25].

Building on these former influences, in 1979, Bordin was the first to conceptualize the working alliance so-called pan-theoretically [8,21,25]; that is, a definition that could be applied to all schools of psychotherapy. Bordin's definition of the working alliance is still the most widely used definition of an alliance today [8]. He suggested that the alliance consists of three elements: first, there needs to be an agreement of the goals of therapy; for example, overcoming fear of flying is one goal, disentangling negative emotional patterns another. Second, the client must perceive the tasks that are performed in therapy as meaningful endeavours towards that goal; that is, free association is one type of therapeutic task, behaviour modification another. The third element, as defined by Bordin, is an emotional bond, defined as "the nature of the human relationship between therapist and patient" [21(p254)].

As alluded to previously, the terms "working alliance" and "therapeutic alliance" have sometimes referred to slightly different aspects of the client-therapist interaction, but have other times been used interchangeably [25]. In this dissertation, I will use the term "working alliance", or sometimes just "alliance", as a broad concept meaning the collaborative relationship between a client (or program user) and a therapist (or eHealth program) that is assumed to contribute positively towards change, and that can be defined with Bordin's [21] three elements.

It should be noted that the working alliance is a debated concept, and that it has been criticized on both theoretical and empirical grounds [7–10]. One of the recurring debates is whether the alliance and other common factors are more important for therapeutic outcome than the techniques employed by the psychotherapist; another is how the correlation between alliance and outcome should be explained and whether the documented associations are due to issues in study design. Nevertheless, although there are ongoing debates, most scholars agree that a working alliance between client and

therapist is of importance for therapy outcome [6–10] – which is why researchers in eHealth have taken an interest in the concept.

## 1.4. A potential person-to-program alliance

In automated eHealth, it is the program that provides information, asks questions, gives advice, and sometimes follows the person over time – meaning that the program assumes a similar role in automated therapy as that of the therapist in psychotherapy. This functional similarity makes it pertinent to ask whether there might be a "working alliance" between the person and the program; a person-to-program alliance.

Many researchers have been interested in a possible person-to-program alliance [7,11–20], and this interest is reflected in a newly proposed eHealth program evaluation tool by Baumel and colleagues [59,63,64], which has as one of its quality criteria the assumed degree of alliance-support embedded in the program in question.

Empirical investigation of the content of three eHealth programs has shown that eHealth programs can indeed contain potentially alliance-supporting features. In a qualitative analysis of three established computerized cognitive behavioural therapy (cCBT) programs ("Beating the Blues", "MoodGYM", and "Living Life to the Full"), Barazzone, Cavanagh, and Richards [12] found evidence for many alliance-supporting elements. The analysis was based on a conceptual map of the therapeutic relationship [65] and the adaptation of this model to self-help literature [66]. In this conceptual map, the working alliance is suggested to move through stages of establishing the relationship, developing the relationship, and maintaining the relationship, each stage involving different sub-processes. Across the three interventions, Barazzone and colleagues [12] found substantial evidence for program elements supporting these processes: They found most program elements supporting the establishment of a relationship (being accessible; generating belief in the helpfulness of the program; generating belief in recovery; communicating empathy, warmth, genuineness, and unconditional acceptance; negotiating goals; communicating a collaborative framework; empowering the user; and providing guidance) – there were fewer program elements that supported the development of a relationship (developing a secure base and providing feedback) and maintaining the relationship (being responsive and flexible, and preventing and repairing ruptures in the alliance).

This suggests that eHealth programs *may* support an alliance, but not whether program users experience such an alliance. Consequently, other researchers have tried to measure program users' alliance to eHealth programs. In one pilot study, Ormrod, Kennedy, Scott, and Cavanagh [60] measured participants' alliance to a program for depression ("Beating the Blues"). Alliance was measured

through an adaptation of the Agnew Relationship Measure (ARM) [67]. Participants on average rated their alliance to the program significantly above the neutral midpoint of the scale, which Ormrod and colleagues interprets as an indication of an alliance. In another study, Clarke and colleagues [18] measured participants' alliance to a different program for depression ("myCompass"), also using an adaptation of the ARM [67]. Similar to Ormrod and colleagues, Clarke and colleagues found that participants on average scored slightly above the neutral midpoint of the scale and interpret this as an indication of an alliance. A third study by Kiluk and colleagues [11] measured participants' alliance to a program for substance use ("CBT4CBT") with an adapted version of the WAI ("WAI-Tech") and compared it to participants' alliance to their clinician as measured with WAI. They found that the WAI-Tech (alliance with the program) showed similar psychometric characteristics as the WAI (alliance with the clinician), with similar internal consistency, mean scores, and stability over time, supporting the existence of a person-to-program alliance. However, the bond-subscale of the WAI-Tech was "consistently lower than the other subscales and decreased over time" (p. 143). A decrease over time was also found with WAI bond-subscale, but the mean scores were generally higher than with the WAI-Tech (although only statistically significantly so as measured on session 8). None of these three studies found an association between alliance and outcome [11,18,60].

Perhaps more compelling evidence for a person-to-program alliance is provided by Bickmore, Gruber, and Picard [15], who were able to experimentally manipulate participants' alliance to a program for promoting exercise. The program included an embodied relational agent ("Laura") which was programmed to perform a range of verbal and non-verbal relational behaviours. Participants were randomly allocated to three conditions: one in which Laura performed these relational behaviours (relational group), one in which the interaction was purely instrumental towards promoting exercise behaviour without Laura performing these relational behaviours (non-relational group), and one program version which did not feature an embodied agent at all (control). Alliance was measured with an adapted version of the Working Alliance Inventory (WAI) [68]. Bickmore and colleagues found that participants in the relational group on average scored significantly higher than the non-relational group on the bond-subscale of the WAI, indicating that the relational behaviours of Laura influenced the emotional bond participants experienced to the program. However, the researchers did not find any association between alliance and outcome.

An association between alliance and outcome was, however, found in a study by Meyer and colleagues [20]. The study was on a program for depression ("Deprexis") that consists of a series of "simulated dialogues" in which program content is continuously tailored to user input, and that uses a variety of theoretical methods, including cognitive behavioural therapy as well as acceptance and mindfulness. The program is primarily web-based but also makes use of optional daily text messages.

Forty-nine participants measured depression symptoms twice; upon the first day of using the program and on average 25 days later. Alliance was measured with an adapted version of the Helping Alliance Questionnaire (HAQ-11) approximately three weeks into the program. When controlling for early symptom reduction, the researchers still found a correlation between measured alliance to the program and symptom reduction when the program ended (partial $r = .34$, $p < .02$). As far as I know, this is the first study to document an association between an alliance to an eHealth program and change. However, the adopted measure targeted "the extent to which patients feel that the treatment is helpful, seem to view problems in the same way and seem to share their goals" (p. 51), suggesting that it does not measure a potential emotional bond – one of the elements in Bordin's [21] definition.

Indeed, an emotional bond is arguably the most controversial element of a potential person-to-program alliance. The two other elements defined by Bordin [21], agreement on therapeutic goals and tasks, seem theoretically unproblematic to apply to automatic therapy: Firstly, a person is likely to only sign up for a program with which s/he agrees with its professed goals. Secondly, an intervention can be programmed to negotiate both goals and tasks with the user; the number and complexity of these negotiations is only a question of technological sophistication. In contrast, an emotional bond is usually understood as something fundamentally human, involving complex emotions such as feeling understood, cared for, appreciated, and comfortable with, as well as respect, honesty, liking, trust, and attachment [21,68]. It seems questionable that this kind of complex and strong emotions should arise in the use of an inanimate eHealth program; as such, the viability of the alliance-concept in automated therapy seems to hinge on how people relate to eHealth programs. Therefore, another relevant line of research explores the relationships people form to web-based interventions.

On a fundamental level there is evidence supporting that people treat computers as social actors. In the book called "The media equation" [69], Nass and Reeves present a series of experiments where they have investigated the interactions people have with computers (and other forms of technology). They found that participants acted and reacted socially towards computers – for example, by being polite to computers (when asked to rate a computer's performance, they rated it more favorably when asked by the computer who performed the task than when asked by a different computer) and they treated different computers as different social actors (they disliked computers that criticized other computers). Moreover, after the experiments, participants would usually deny having treated the computers like people, although their behavior indicated that they did. Nass and Reeves call this the "media equation" – media equals real life – and explain it by observing that "people are not evolved to twentieth-century technology", and therefore automatically behave socially towards anything that acts socially towards them (heading: "Why do people respond naturally and socially to

media?", 3rd paragraph). They found these social tendencies for simple technology as well as more advanced technology; just small indications of a social actor (such as text, or simple line-drawings with eyes and a mouth) would cause people to respond socially. This work has important implications for the potential person-to-program alliance: people can respond socially to programs, even though they might think otherwise. However, Nass and Reeves' work does not tell us whether these social responses also occur on a cognitive and emotional level, as would be necessary for it to qualify as a working alliance. This suggests a need for qualitative studies that can explore this experiential level.

There are a few studies reporting qualitative evidence of positive social emotions in the use of eHealth programs [15,17,18,70,71], two of which are particularly relevant for the present discussion: one by Brandt, Dalum, and Thomsen [71], the other by Kaplan, Farzanfar, and Friedman [70]. Brandt and colleagues interviewed participants who had used an automated web-based intervention for quitting smoking. The program was primarily web-based, but also used e-mails and text messages, incorporated an array of theories, was moderately tailored, and included 1 year of follow-up. The researchers interviewed nine participants (a convenience sample consisting of those who responded to their invitation), both men and women, 23-60 years old. Each interview lasted for 45-60 minutes and included using program material as visual stimuli. The themes that were identified were "adding human qualities to the program", "establishing a relation", "intensive support and care", "withdrawal and craving" (for the program), and "communication becomes craving cues". This study demonstrates that it is possible to experience positive social emotions in the use of an eHealth program, vividly illustrated in some of the provided data excerpts – such as "You grow a relationship to the program and I would be ashamed if I lapsed" and "I miss the care even though I know it's just a machine". However, although the analysis "focused on describing the nature of the relationship between the individual informant and DDSP [the program]" (p. 237), the analysis does not seem to capture the essence of the provided data excerpts, and some of the categories appear to be about other parts of the participants' program experience than the relationship to the program – for example, the theme "intensive support and care" seems to be just as much about a program providing the necessary help without that having to involve a relationship, and the theme "communication becomes craving cues" does not seem to be about a relationship at all. Furthermore, it is unclear which of the nine participants made statements that indicated a relationship; thus, we do not know whether the most vivid statements come from one, two, or all nine participants. Moreover, the researchers do not discuss their findings as possible manifestations of a person-to-program alliance, limiting the study's theoretical implications.

In another qualitative study, Kaplan, Farzanfar, and Friedman [70] identified three ways of relating to an automated eHealth intervention. The intervention was a "computer-based system" which

provided education, advice, and support for a variety of health conditions. The program was based on interaction via the telephone, and the intervention used recorded human speech, while the user answered by pressing the keys on their telephone keypad. It seems to have been highly tailored, with the length and content of the "conversations" depending on what the user answered. The participants of the study had used the intervention for about six months. The findings are based on 14 interviews (nine participants were randomly selected, six strategically selected), each interview lasted 45-60 minutes, and the researchers report to have reached saturation. They analysed the interviews through diverse analytical techniques, including the identification of themes "using a grounded theory approach". Their analysis suggests that participants formed three different kinds of relationship to the program: "feelings of love", "feelings of guilt", and "ambiguity and ambivalence". Three participants were categorized as expressing "feelings of love", which involved talking about the program as a person (e.g. a "friend", "helper", or "family member"), expressing that they missed the program after program completion, and talking in ways that made them seem infatuated by the voice of the program. Nine participants were categorized as expressing "feelings of guilt", meaning that they felt judged or lectured by the program. The final category, "ambiguity and ambivalence", included six participants who talked about the program as a machine, one participant who talked about it as a person (i.e. referring to it as "he" instead of "it"), and four participants who expressed ambiguity as to whether they were interacting with a person or a program. The conceptualization of relation types makes this a highly relevant study; however, it does not satisfactorily answer the question of whether it is meaningful to talk about a person-to-program emotional bond. One limitation is that the category "feelings of love" seems to be an overstatement; love is a strong, highly complex, and long-lasting feeling that the authors do not provide sufficient evidence for was found with the said three participants. Another limitation from the present endeavour is that the authors do not discuss their findings in light of the alliance-concept. Therefore, it is also unclear how the two other ways of relating to the program ("feelings of guilt" and "ambiguity and ambivalence") should be understood in terms of a possible person-to-program alliance.

In sum, automated eHealth programs are promising for supporting a range of health-promoting behaviours; however, there is a need to open up the black box of eHealth interventions in order to understand what makes them work [19,39,72]. This calls for transparency and thoroughness in the reporting of individual programs' content and rationale [19,24,38–40], as well as research that can inform eHealth-specific theories and uncover eHealth's working mechanisms [54,56]. One potential working mechanism is a person-to-program working alliance, and there is evidence supporting that such an alliance may exist [11,15] and may influence change [20] – although the evidence is still limited and other studies do not find such an alliance-outcome association [11,15,18,60]. A pressing issue concerns the

potential emotional bond, which a working alliance is usually presumed to include [8,21,25]; however, the status of the person-to-program emotional bond is uncertain [11] as well as theoretically problematic, as it supposes that complex social emotions are part of how users relate to inanimate computer programs. There is qualitative evidence suggesting that people *can* develop positive social emotions towards automated eHealth programs [15,17,18,70,71], but the evidence is anecdotal and the provided examples may be special or extreme. The difficulties in assessing the normality of these examples can partly be assigned to the fact that there is currently no theoretical framework for explaining how people in general relate to automated eHealth programs. Because we do not know whether these positive social emotions are the experiences of a few extreme examples or represent a more normal way of relating to eHealth programs, we do not know if the emotional bond is a meaningful concept in automated therapy; nor do we know if ways of relating to a program has any influence on change. In other words, despite of the research interest in a possible person-to-program alliance, we know little about the nature of such an alliance, including whether it includes an emotional bond and whether it is a useful concept for understanding eHealth-supported change. Furthermore, because we know little of such a potential alliance, we do not know what conditions need to be met for an alliance to develop. As far as I know, few eHealth programs have been developed specifically to support an alliance, and only one project – the work by Bickmore and colleagues [14,16,17,73] – has made alliance-support a prime purpose of the intervention. Moreover, a person-to-program alliance may turn out to be different from the alliance found in psychotherapy [11,18,20,59,70] and there are no methodological guidelines for how a potential, undefined person-to-program alliance can be studied qualitatively. Thus, the purpose of this dissertation was to further explore a possible working alliance in automated therapy, and to specifically pursue the potential role of a person-to-program emotional bond. In pursuing this purpose, this dissertation's overall research question is: *Can a fully automated eHealth program support a working alliance?*

The dissertation's four papers aim to answer this research question through different perspectives:

**Paper 1:** *Theoretical perspective*, specifying how an eHealth program can be designed to support a working alliance.

**Paper 2:** *Methodological perspective*, specifying necessary methodological refinement for exploring potential alliance-processes empirically.

**Paper 3:** *Empirical perspective 1*, exploring qualitatively whether a person-to-program emotional bond is a meaningful concept.

**Paper 4:** *Empirical perspective 2*, exploring qualitatively whether there is an association between ways of relating to an automated eHealth and processes of change.

# 2. Materials and methods

Before starting the qualitative study, I developed the program together with my principal supervisor. This was an advantageous starting point for this dissertation's research question: Before starting the study, I believed that a person-to-program alliance was theoretically possible, but I also considered it possible that the examples of positive social emotions reported in the literature [15,17,18,70,71] were extreme cases only found under some kind of special circumstances. Because I did not know whether I would find any similar indications of relational processes in my study, I wanted the program to be maximally supportive of an alliance, to give a possible alliance the best opportunities for growth. Thus, I decided to develop the program to support an alliance, so that the qualitative study could answer what is *possible* in terms of a person-to-program alliance, under the best conditions I was able to produce. In this section, I will first account for the development of the program, before describing the materials and methods of the two qualitative sub-studies.

## 2.1. Program development

The eHealth program that I co-developed as part of this dissertation was intended for several research purposes, including my dissertation study. In the following I will first account for the project context and team roles, followed by how I planned the program content with Intervention Mapping [24]. Next, I will account for how the program was made, which involved using a private IT-company to develop the technological platform as well as a formative study with early program users. I will end this section with a short description of the final program.

### 2.1.1. Project context and team roles

I entered the project in an early phase of program development. Certain decisions regarding content and structure had by this point been made: the intervention was to target people who wanted to quit smoking, to consist of several sessions covering different themes related to quitting, to have a preparation phase and a follow-up phase, and to include a lapse management component (described below). Furthermore, the program was to be primarily web-based, but also use e-mails and text messages to contact users. The remaining decisions regarding program structure and content were made by me in collaboration with my principal supervisor, Håvar Brendryen. Brendryen was project leader and made the final decisions regarding program content and design, while I did most of the content planning. My co-supervisor, Ayna Johansen, had a consulting role concerning the content of a "mini-motivation intervention" in the program for reengaging program users if they stopped logging on. Brian Danaher from Oregon Research Institute also had a consulting role concerning the content and design of the lapse management component.

### 2.1.2. Planning program content with Intervention Mapping

Intervention Mapping [24] was used for planning the program content. Intervention Mapping is a process for developing theory- and evidence-based interventions, and it specifies a series of six steps, through which the needs of the target group are specified (step 1); and an intervention is planned (steps 2 and 3), designed (step 4), implemented (step 5), and evaluated (step 6). Each step builds on the product of the previous step, but the process is often iterative [24]. For this project, steps 1 (needs assessment), 5 (adoption and implementation), and 6 (evaluation plan) were not conducted – because both the intervention goal and evaluation format were already decided, and because the intervention was primarily designed for research purposes, not real-life implementation. The following will therefore only provide a brief overview of how Intervention Mapping's steps 2, 3, and 4 were used for designing the program.

The product of step 2 of Intervention Mapping is a *change matrix*, in which the desired change is described in detail. It involves deciding performance objectives, selecting determinants, and writing out change objectives [24]. The *performance objectives* are the sequential, lower-order goals (objectives) describing the actions an individual has to take (the "performances" s/he has to do) in order to achieve the overall behavioural goal (Figure 2). For this intervention it was concluded that the overall goal of quitting smoking logically entails deciding to quit smoking and planning how to do it (performance objective 1), initiating the quit attempt and staying smoke-free for the first few days (performance objective 2), establishing a smoke-free lifestyle (performance objective 3), and maintaining the behaviour by managing lapses constructively (performance objective 4).


**Figure 2: Performance objectives of quitting smoking.**

After specifying performance objectives, the next task of Intervention Mapping's step 2 is to decide *determinants* [24]. The determinants are the psychological processes that are thought to influence (determine) the processes involved in the behaviour change. The following determinants were chosen: (a) having the necessary skills to quit; (b) believing you can quit (self-efficacy); (c) having social support (relatedness to social network); (d) feeling autonomous; and (e) having a working alliance to the program (relatedness to the program; Figure 3).

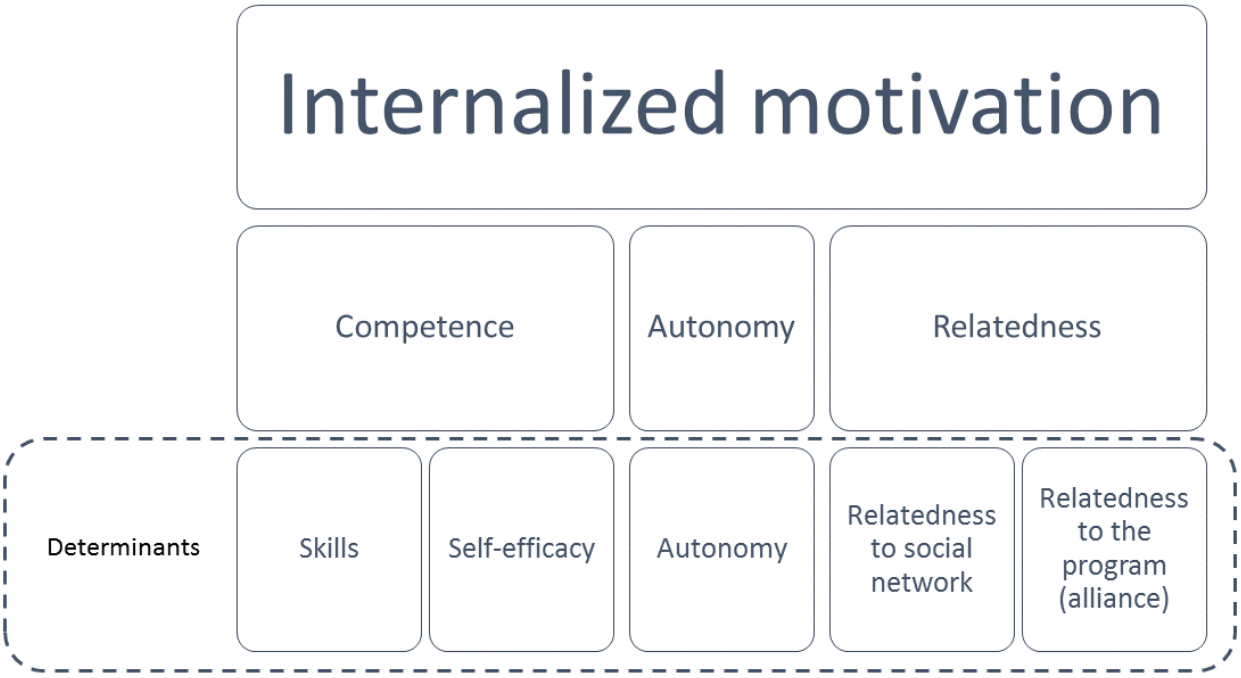


**Figure 3: Psychological determinants of quitting smoking.**

Following the steps of Intervention Mapping [24], the performance objectives and determinants were then combined in a matrix (Figure 4). Each cell in the matrix specifies the intervention's *change objectives* – the goals (objectives) for what needs to change within the specific determinant (column) in order to achieve the specific performance objective (row). The resulting list of change objectives was used to guide program development. The change model can be viewed in Appendix 1, and Figure 4 shows some example change objectives.

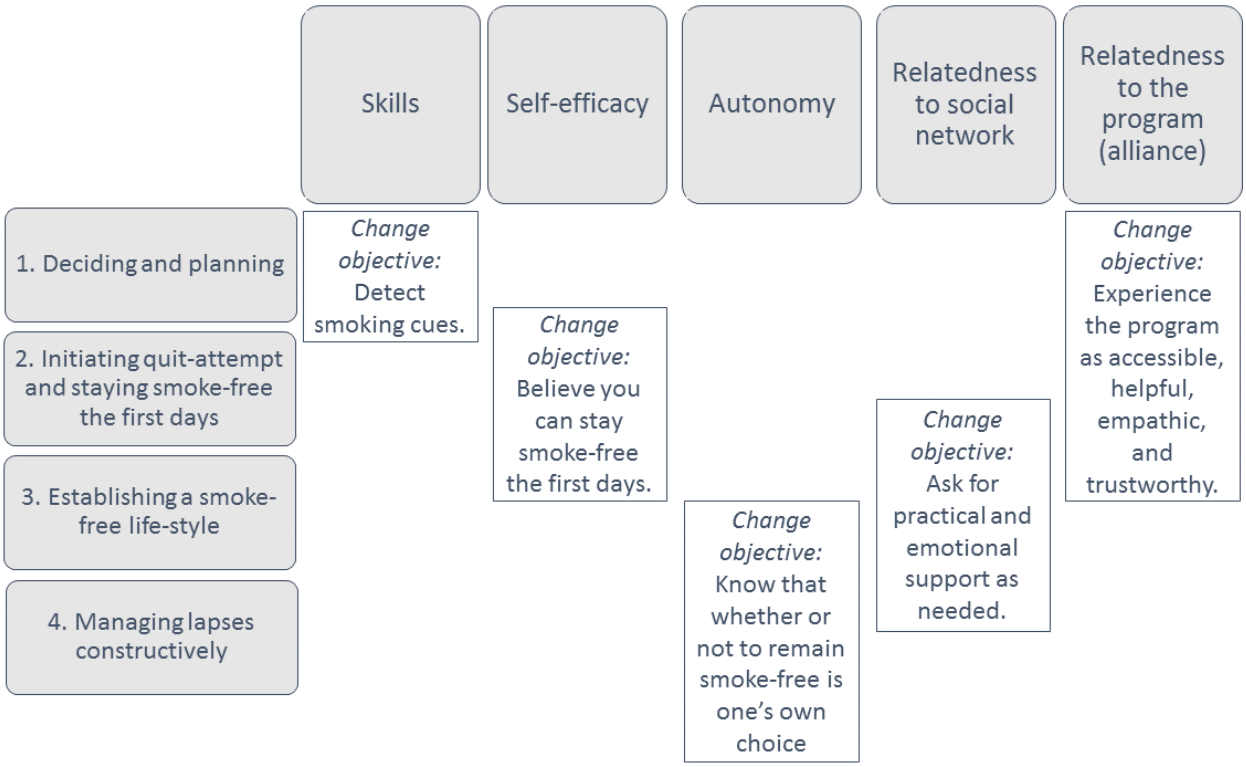


**Figure 4: Example change objectives.**

In step 3 of Intervention Mapping, the change objectives are reviewed for considering which theoretical methods are most apt to produce the desired changes [24]. The main methods that were chosen were a relational agent [17], Motivational Interviewing [23], and relapse prevention [74]. The combination of these methods resulted in the central feature of the intervention: the (text based) relational agent "Andy" which communicates with the user in a written dialogue based on computerized Motivational Interviewing. In addition, we chose a variety of methods suitable for obtaining each specific change objective; an overview of all methods can be found in Appendix 2.

### 2.1.3. Making intervention material

Step 4 of Intervention Mapping consists of producing intervention material [24]. The program was built on a Python-based technological platform ("Serafin") which was developed by a private IT-company (InOnIt AS). My principal supervisor Håvar Brendryen did some of the programming and tailoring of the program. A design company (Miksmaster) made the visual design of the web site, the logo, and some illustrations that were used to visualize a few central points. I wrote all the program text and entered it into the platform, along with each session's logic; made applications of Motivational Interviewing; and conducted a formative study of early program users.

### *2.1.3.1. Writing texts and entering logic*

The list of change objectives was translated into a set of themes that the intervention should cover – some of which were revisited throughout the course of the program. An overview of the sessions can be viewed in Appendix 3. For each session, I had a specific working method for writing the text and logic. Each theme started with a brief introduction and a suitable question for "Andy" (the program) to ask (e.g. "do you have someone who can support you in your quit attempt?"). The user was usually required to answer this first question with an alternative chosen from a multiple choice list provided by the program. My clinical experience from the Norwegian Quit Smoking Line was useful in making the alternatives; I used my experience to imagine possible answers, making a reasonable number of alternatives that represented the range of variation I had encountered clinically. That process would typically result in 2-5 alternatives that differed substantially from each other.

The rest of the session was dynamically tailored to the user's input. Starting from the opening question of the session, each multiple choice alternative became a separate path in a path-diagram in the back-office platform (Figure 5).

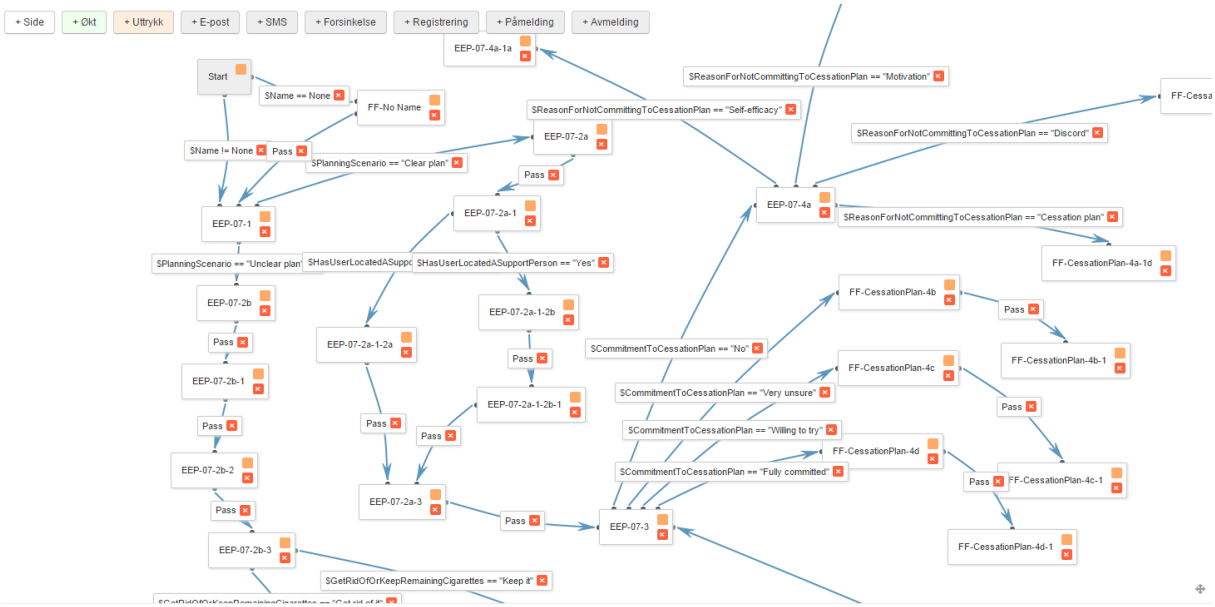


**Figure 5: Example of tailoring: snapshot from one of the sessions in the program platform.**

I worked with each path sequentially, and alternated between generating Andy's (the program's) response (by thinking as a counsellor who was using Motivational Interviewing) and generating responses to choose from for the user (by using my clinical experience and imagination). A simplified illustration of the program tailoring can be viewed in Figure 6.

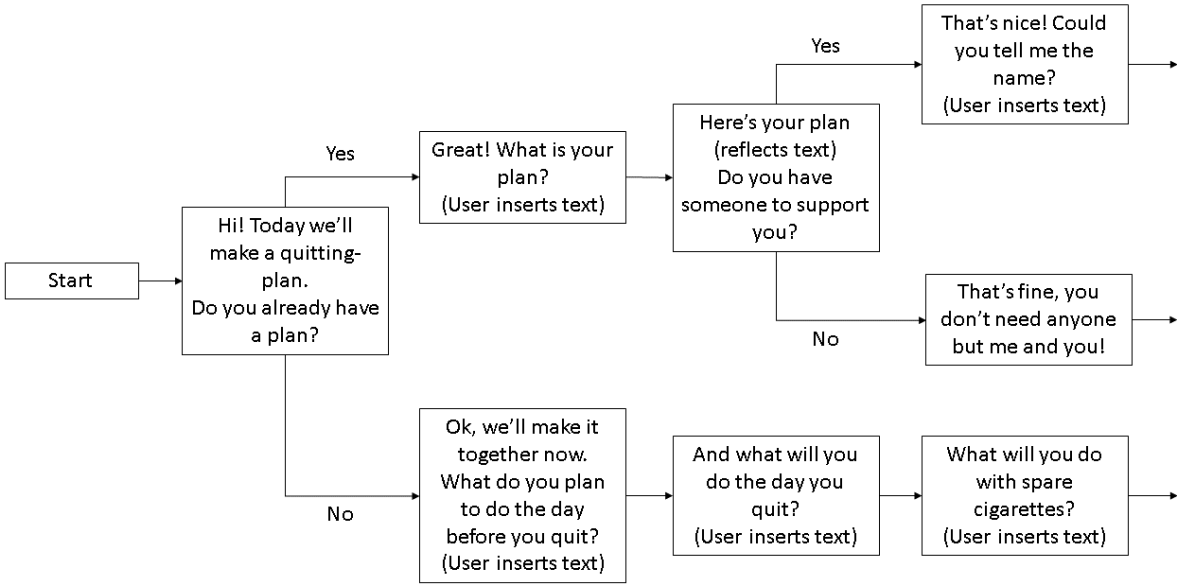


**Figure 6: Example of tailoring: simplified.**

There were few pre-defined rules for the sessions – only that Andy should say hello, introduce the topic with a question, respond to the user's input, summarize, and say good-bye. I tried to strike a balance in the complexity of the sessions: On one hand, to give each path adequate attention considering the imagined user's response; while on the other hand, making the logic manageable to enter into the program. Entering the text into the back-office platform required using logical rules that would route the users along the right pathways of the session according to what they had answered, treating user input as programming variables. In some sessions, one path would give rise to several other paths, resulting in a complex path diagram; other sessions consisted of only one or two paths. The number of paths was based on the complexity of the session theme. All the different pathways of a session ended on the same final page, where Andy would summarize the session (using the user's input as variables so that the summary would be correct for each user) and say goodbye.

Andy's responses were based on Motivational Interviewing (MI) [23]. I used the third edition of Miller and Rollnick's seminal book on MI [23] to develop computerized adaptations of all MI-elements that they describe: the "spirit" of MI; open questions, reflections, and summaries; eliciting and reflecting change-talk; handling sustain-talk or discord; asking for permission before giving advice or information; exploring values and goals; exploring ambivalence; and developing a change plan. The computerized applications of MI also built on the insightful work of Friederichs and colleagues [46,75] and that of Moreau, Gagnon, and Boudreau [49]. A description of how each MI-element is adapted in the intervention can be viewed in Appendix 4. An advantage of having the technological platform

developed in parallel with the intervention was that it made it possible to request features that could support MI-functionalities as these needs emerged – for example, developing an expand/collapse-function [19] that could serve as a computerized application of asking for permission before giving advice [23].

#### *2.1.3.2. Formative study with early users*

The first version of the program included a preparation phase of 10 sessions over 10 days, quit-day on the 11th day, and 14 follow-up sessions over four weeks. This was a fixed trajectory, and a session was only available on the day it was scheduled. A small formative interview study (N = 8) was conducted with the purpose of improving this first program version. These interviews were also part of the qualitative study, and recruitment and sample characteristics are described below (Section 2.7). The feedback from the formative study allowed the allocation of the remaining resources for the project to the most pressing issues.

The formative study resulted in several minor adjustments (such as the discovery and mending of technical problems), but also brought about some more substantial changes. For example, a recurring feedback from the participants was that some felt the program progressed too quickly to quitting-day. These participants experienced that the program initiated internal change-processes which they needed more time to process before they felt ready to quit. We had not considered this option; contrarily, we had assumed that it was wise to commit the users to one quitting day and not allow any procrastination. However, the participants' feedback did not seem like procrastination; they talked about becoming aware of habits and smoking-patterns, and how these processes made it easier for them to understand what they needed to do in order to become smoke-free. In order to respond to this need, we made it possible for users to postpone (or advance) quitting day (described below).

Another useful feedback came from participants who had not quit on the prescribed quitting day, and who were frustrated because the intervention acted as if they had quit when they had not. Some had not quit because there had been a mix-up concerning the quitting date, and some because of technical problems which caused them to miss that specific session. Therefore, in the next version of the program, a quitting phase was included between the preparation phase and the maintenance phase (described below). The quitting phase might extend over several days, and ensured that the user has actually tried quitting before s/he was moved on to the maintenance phase.

### 2.1.4. Program description

The final program is called "Endre" – which in Norwegian means "to change" but is also a masculine name. In this dissertation and in Papers 3 and 4 I use the English name "Andy", in order to give the

non-Norwegian reader a better sense of the relational agent represented by the name. A summary of the key features is presented in the eHealth classification tool in Figure 7 [76]. As shown in the classification tool, Andy is a medium duration intervention, with a preparation phase (10 sessions/10 days), a quitting phase, and a maintenance phase (14 sessions/4 weeks). Andy is currently available in Norwegian on the web for research purposes, free of charge (http://tilendre.no). An overview of the program's sessions can be found in Appendix 3.

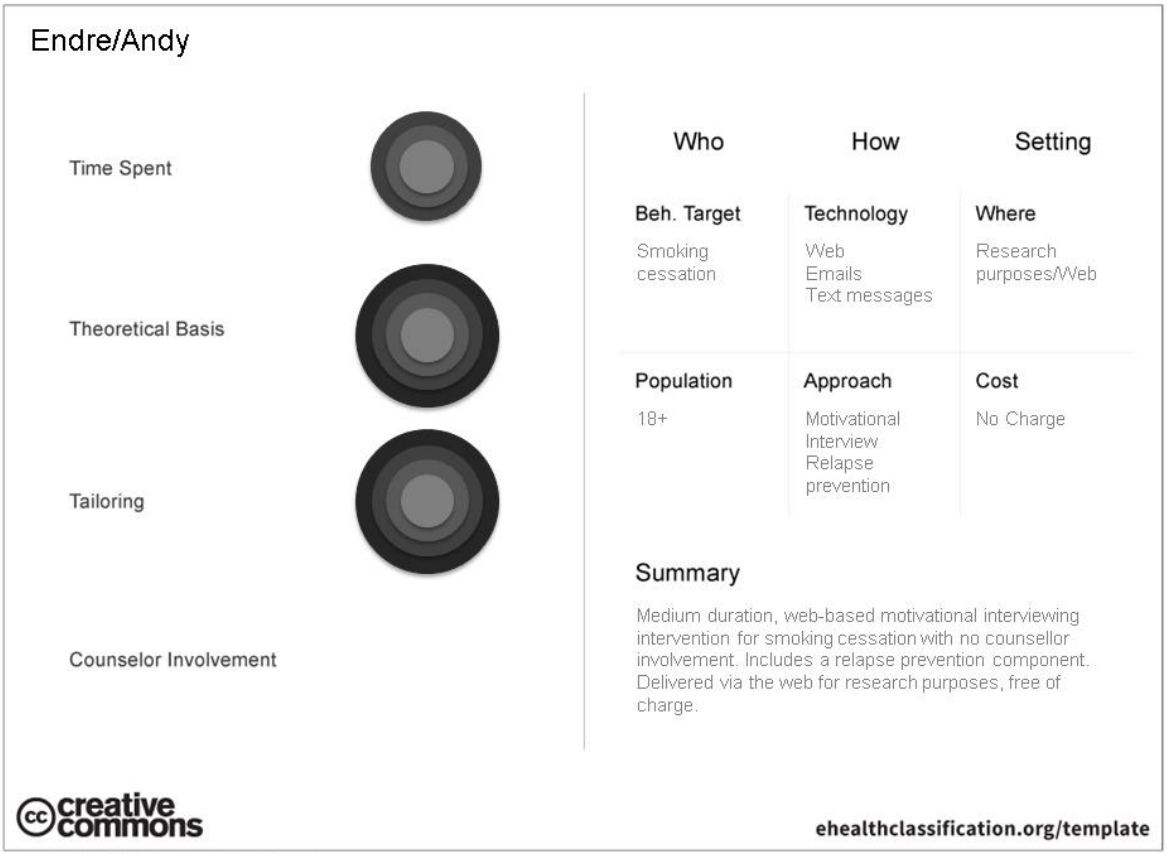


**Figure 7. Andy as described with the eHealth classification tool [76].**

The final program involves a considerable amount of tailoring to individual preferences and use, causing the duration of the program to vary with each individual user; this was one of the changes that were made between the first and the final program version. The user may on two different time points in the preparation phase choose to advance or postpone the quitting day, resulting in a preparation phase that can last from 4 to 24 days. The quitting phase is initiated by the scheduled quitting-day, on which Andy asks the participant if s/he has quit. If the user answers yes, s/he is transferred to the maintenance phase of the intervention. If the user answers that s/he has not quit, Andy will ask why, offer different kinds of support, and ask for a new quit-day. This loop continues until the user has confirmed a quit-attempt, resulting in a quitting phase that can last from 1 to an

infinite number of days. The length of the maintenance phase is set in the present version of the intervention (for research purposes), but the number of sessions in this phase depends on user patterns and may vary from 0 to 14 sessions.

The maintenance phase also includes a lapse management component, consisting of text messages and a special relapse prevention session. After the user has confirmed a quit attempt, s/he starts receiving text messages from Andy in the evening, asking if s/he has been smoke-free that day. If the user answers yes, s/he gets an encouraging text message back from Andy. If the user answers no, s/he gets a supportive text message with a link to a special relapse prevention session. The user can access the session by clicking the link, or s/he will receive it the next time s/he logs on to the web page. The relapse prevention session is dynamically tailored, and leads the user through a process of reattribution, managing negative emotions [74], exploring ambivalence [23], making a choice (to smoke or to quit), and making a new plan for staying smoke-free in similar situations in the future. An overview of the lapse management component can be found in Appendix 5.

Both the technological platform "Serafin", upon which the program is built, and the program itself is "open source" (i.e. the program code is publicly available) and can be accessed at the following web pages: https://github.com/inonit/serafin (for the technological platform Serafin) and https://github.com/inonit/serafin-endre (for Andy - Norwegian language).

The program's content and rationale are the themes for Paper 1 of this dissertation, which describes how Andy simulates a therapist's support of a working alliance, as well as two other therapeutic processes (supporting internal motivation to quit and supporting constructive management of lapses). This paper therefore specifies the conditions that were present for the qualitative study of a potential person-to-program alliance; it also answers the plea for opening up the "black boxes" of eHealth with more thorough descriptions of eHealth programs' content [19,24,38–42]. Furthermore, Paper 1 provides a theoretical answer to this dissertation's guiding research question of whether a fully automated eHealth program can support a working alliance – by specifying how alliance-support can be designed into a program with Intervention Mapping [24].

## 2.2. Qualitative approach and sub-study research questions

This dissertation includes the following qualitative sub-studies:

(1) A formative study
(2) The sub-study presented in Paper 3
(3) The sub-study presented in Paper 4

The formative study differs somewhat from the others, in that it is based on just a subset of the data (the first eight interviews) and employed a different analytic procedure (a simple thematic analysis) [77]. Other than what has already been presented (in Section 2.1.3.2.), I will not go further into the formative study in this dissertation.

The other two sub-studies are sometimes in this dissertation jointly referred to as "the qualitative study", because both are based on the same sample, data sources, and analysis. However, I sometimes refer to them as sub-studies, because they answer different research questions related to the alliance-question which are presented in two separate papers. It might be noted that the analysis I undertook also answered other related research questions with models that are not presented as part of this dissertation, but which will be published separately.

The research questions of the two qualitative sub-study in this dissertation are as following:

**Paper 3 sub-study research question:** *How do the users relate to the program?*

**Paper 4 sub-study research question:** *Do ways of relating to an eHealth program influence change, and if so – how?*

In order to answer these research questions, a grounded theory study [22] was chosen. Grounded theory is a qualitative method in which the researcher works inductively and iteratively, moving between data collection and analysis to answer analytical questions, until s/he has developed a model or theory that explains key processes in the data. The final model/theory is grounded in the data and consists of abstract categories and the relationship between these categories [22].

I wanted to study relating and change as processes, making grounded theory a suitable approach [22,78]. Because I was to study a relationship which consists of only one person (i.e. the program user), I reasoned that any experience of a relationship must at least in part be a created by the program user him- or herself. Therefore, instead of studying relating as a product (i.e. studying the experienced relationship), I thought it would be most informative to study relating in terms of the act of creating; that is, as a process. Furthermore, because I was interested in what relating *did* – if and how relating

influenced change – it seemed useful to study relating and changing as processes, and to explore the interaction between these processes.

Another aspect of grounded theory that made it suitable for this study is that it is a predominantly inductive approach – the aim is to describe key processes in the data through gradual model-building and the method of constant comparison [22,78]. Staying close to the data seemed important given that little research has been done on possible alliance-processes in automated therapy.

Charmaz' [22] version of grounded theory was chosen because I wanted to allow the analysis to be driven by the data. In contrast, the original grounded theory approach launched by Glaser and Strauss prescribes a series of analytic steps that should be undertaken in the analysis. However, insisting to follow these steps runs the risk of forcing the data into a mould and overlooking important and relevant aspects in the data that do not fit into these steps [22]. Charmaz therefore advocates a more flexible grounded theory approach of initial coding, sorting and organizing, category-development, focused coding, theoretical sampling and theoretical saturation. She further recommends that these steps should be done iteratively and be continuously adapted to the data and research questions of each study. As such, Charmaz' approach allows for a dynamic and emerging approach that seemed fitting for the purposes of this study.

## 2.3. Ontological and epistemological position

The epistemological and ontological viewpoint of this dissertation is critical realism [79,80]. The philosophy of science concerns questions of what can be said to exist (ontology) and how knowledge can be required (epistemology). Quantitative research most often assumes a realist ontology and positivist epistemology; within qualitative research, there is more variation in these underlying assumptions. With qualitative research resting on the analysis of meaning, qualitative researchers face the question of whether they should consider the derived meanings as representations of an objective reality – or whether the meanings have created the reality that is experienced. Considering such underlying assumptions of a study is important, because it has implications for how a study's findings can be interpreted and how its quality may be evaluated.

In line with Maxwell [81] and Hacking [82] I see epistemological and ontological positions as tools rather than universally true or false paradigms, and believe that different research questions call for different positions. In this dissertation, I take a stance of critical realism – that is, ontological realism and epistemological constructivism [79]. Critical realism is also sometimes called "subtle realism" [83], and a similar perspective is forfeited by Latour in his book "Pandora's hope: Essays on the reality of science studies" [84].

Critical realism was promoted by Bhaskar as a reaction to the social constructionism that had started to dominate much of qualitative research [80]. In the critical realism stance, reality is seen as something that exists independent of our interpretations of this reality. However, when interacting with reality, it is always interpreted – and potentially transformed. The researcher is also an interacting and interpreting individual, and is therefore also bound by his/her understanding and subjective viewpoint [79,80]. Another aspect of critical realism is that causality is regarded as "open systems", where several forces influence events at once [80]. Therefore, although it considered possible to describe, understand, and explain reality, any attempts to do so will necessarily be partial and just one of several possible explanations [79,80].

Charmaz' [22] description of her "constructivist" version of grounded theory fits well with the critical realist stance. Although Charmaz uses the term "constructivist", she also urges researchers to consider which theoretical lens fits their perspective best (p. 279). Furthermore, one reason for calling her approach "constructivist" was to juxtaposition it with the positivist/objectivist grounded theory approach by Glaser and Strauss which did not acknowledge the researcher's role in knowledge production. In contrast, Charmaz describes constructivist grounded theory as a method for attending to:

> (…) the production, quality, and use of data, research relationships, the research situation, and the subjectivity and social locations of the researcher. Constructivist grounded theorists aim for abstract understanding of studied life and view their analyses as located in time, place, and the situation of inquiry (p. 342).

This is in line with critical realism's emphasis on researcher subjectivity and causality as open systems [79,80], and this dissertation's view of knowledge as subjectively produced and located within its cultural context.

Assuming a critical realist stance for the qualitative study entails that I believe there is a reality to how people relate to automated eHealth programs and how these programs are used for change. Although the experiences of individual participants naturally will differ, I find it reasonable that these experiences will share common features in a way that makes them meaningful to compare, and that can be transferable to other people in similar situations. Because I assume such an objective reality, it follows that any description or explanation of this reality can be judged according to its truth-value – the description/explanation is more or less right and more or less wrong compared to the objective reality. However, I also assume that this reality can only ever be accessed through subjective experience, and that the researcher influences all stages of the research. This means that the

descriptions and explanations I provide in this dissertation are just one interpretation out of several possible – nevertheless, they can still be truthful, and useful.

The critical realist stance also has implications for what I previously called an "inductive approach": Although I have chosen an inductive, grounded theory [22] study design, my critical realist stance entails that the resulting model is a product both of the data *and* of my subjectivity – my influence on the analysis can never be completely removed. However, I have tried to make the research process transparent, and to ensure its' validity through employing different validity measures; I will discuss these measures and the model's validity in Section 5.1.

## 2.4. Pre-understanding and the researcher's position

I conducted all the interviews, transcribed them, and performed the analysis – with a lot of feedback, advice, and suggestions from my three supervisors. Having taken a critical realist stance [79,80], I acknowledge that my pre-understandings have influenced what I have seen as meaningful patterns in the data. In order to use these pre-understandings productively, I have strived to remain reflexive of them throughout the study by regularly confronting them in memos [22,85,86]. In the following, I will clarify some of my preconceptions and values, in order to let the reader judge whether these aspects may have negatively influenced the course of the study [85,86].

I have changed my personal views on a potential person-to-program alliance several times throughout this project, at times seeing it as possible, other times unlikely, and even undesirable. As mentioned in this dissertation's foreword, as I started the PhD, I found it plausible that it was possible to experience an alliance to a helpful program – although I had little idea of how normal such an experience might be or how likely I would find something resembling it. Having a vivid imagination, which easily gets carried away by films, plays, and books, I had no difficulties with imagining the possibility of experiencing alliance-like feelings to a program. In retrospect, I believe this openness to alliance-processes was an asset to the study, because I probably communicated this openness in the interviews in a way that made it easier for participants to share a similar view than if my personal starting point had been different. However, being trained to take a participant-centred perspective, I was careful not to be the one to introduce alliance-like experiences of the program in the interviews – apart from in a calculated way to hear the participant's perspective after first having explored his/her experiences more narratively (the interview methodology is described in Section 2.8.1. and Section 4.4.).

One of the reasons why I found the idea of a person-to-program alliance plausible was that from the outset, I was inclined to think about a relationship in terms of each individual's experience of that relationship. This means that I found it natural to think about "relating" in terms of the individuals'

internal processes – which also is descriptive of how the final relating-model is conceptualized (Paper 3). However, I had few ideas about what *kind* of internal processes relating to an automated eHealth program would consist of, besides from what had been identified in prior work as adding human qualities to programs and experiencing positive social emotions [15,18,70,71]. Thus, although I had an initial idea about relating as internal processes, the specification and understanding of these processes as they appear in the relating-model in Paper 3 was a result of close reading of the data and the method of constant comparison [22]. It can also be argued that my initial thoughts of relating as internal processes was an asset to the study, because it enabled an interpretation of the data (as internal processes) that revealed interesting nuances, providing a perspective that would not have been possible without this preconception.

I spent the first year of this PhD-project on developing the program. As the PhD progressed and participants started using the program, I found myself taking pride in it and being eager to hear the participants' experiences in the qualitative study. In a way, I had programmed myself into a program, and the program was me, doing counselling with prospective users whom I did not know. As I was writing the text and following a path of imagined "conversation" between the program and a user, I found myself caring emotionally for the prospective users who would choose that particular answer, and I crafted the program's responses according to my emotional response. I *wanted* the users to succeed, and I felt compassion for their struggles. So, when the program was finished, I hoped that users would find it helpful – because I cared. Additionally, I realized that I hoped the users would experience the program as a person – having read the studies by Kaplan and colleagues [70] and Brandt and colleagues [71], I found myself thinking that if the users experienced "my" program as a person, it would be an individual intellectual achievement for me. Thus, the first time a participant said that the program had been "a friend and a therapist" to her, I felt very proud. However, this pride also alerted me to the possibility of expecting more of these responses, or undervaluing other types of experience, and I therefore explored these thoughts through writing memos after the interviews [86]. Through memo-writing I also became aware of a disappointment upon interviewing participants who did *not* think about Andy as a person, and that I was thinking I might not be able to use these interviews in the study. However, as the analysis progressed, and I kept reflectively examining my own emotional responses, I realized that the usefulness of the program did not depend on seeing it as a friend or a therapist. Furthermore, I realized that my model had to be able to explain *all* experiences, including those that diverted from my initial preconceptions. Thus, I continuously strived towards finding a way to describe the data that would be true to all the participants' experiences. I believe this reflective process kept me alert throughout the study and that the relating-model presented in Paper 3 can explain how all participants related to the program.

Moreover, as time passed from program development, I noticed that I became less emotionally invested in how the participants experienced the program, and more driven by a wish to understand the change processes involved. This also contributed to a momentum towards a truthful description of the data rather than a favourable "evaluation" of the program.

Ironically, I sometimes was unsure whether I thought a person-to-program alliance would be desirable; I found it ethically problematic that programs should replace people, and I found it even more problematic to potentially be contributing to this trend (some of these ethical considerations are discussed in Section 7). This scepticism presumably made me more attentive to the nuances and functions of ways of relating, and possibly facilitated my sensitivity for other ways of relating as well.

While these pre-understandings concern how participants related to the program, I also entered the study with an alertness to certain change-processes. Through my previous position as a counsellor at the Norwegian Quit Smoking Line I talked to hundreds of people in the process of quitting smoking, and I was intrigued and puzzled by some of the commonalities and differences I saw. I brought these observations into the qualitative study – not so much as a pre-understanding, but more an alertness that had been cultivated through many conversations. This alertness was useful in the interviews, supporting a rapport with the participant as I started from the perspective of an almost-insider; not an insider that had gone through the same experiences, but someone who had witnessed similar experiences many times. The same alertness served as seeds for the emerging analysis, and it is possible to trace elements of the final model of Paper 4 back to my initial thoughts at the Quit Line. Of course, it can be argued that this early alertness may have clouded my vision for other equally important processes in the data. However, to this I would reply – as assumed in the critical realist stance [80] – that I believe that *any* explanation of how people use an eHealth program to quit smoking would be partial, and that this does not invalidate the explanation suggested in this dissertation.

In sum, as a person with relevant experience and interests, I entered this study with several pre-understandings which may have influenced the models I present. Arguably, many of these pre-understandings were crucial for producing the suggested models, contributing to a rapport, alertness, and analytical turns that I would not have taken otherwise. As to the potentially problematic influence of these pre-understandings, I committed myself to remaining reflexive of this possibility throughout the study and to staying close to the participants' experiences. The possible influence of these pre-understandings on the study's validity is discussed in Section 5.1.

## 2.5. The Norwegian setting

In order to judge the transferability of the study (discussed in Section 5.2) it is necessary to provide some information of the study context. This study was conducted in Norway, a country with a high

access to computers, smart phones, and the Internet. Technology is an integrated part of everyday life; a person may have to go online to conduct bank services, receive mail from governmental or municipal services, stay in touch with their children's kindergarten or school, order groceries or other products, read the news, and so on. However, whereas internet-supported interventions are becoming increasingly common for the English-speaking consumer [37], web-based health interventions are less common in the Norwegian setting.

When it comes to smoking (the target behaviour of the web-based intervention), Norway has over several years implemented a range of tobacco control measures. For example, The Tobacco Act bans advertising tobacco and bans smoking on public transportation and in public indoor environments. The act also specifies that all tobacco packages must have pictorial health warnings. Furthermore, there have been two periods of intensive mass media campaigns warning against the dangers of smoking; from 2003 to 2007, and from 2012 to 2017 [87]. These and other measures (e.g. a national Quit Smoking Line, which was closed in 2017) may have contributed to the considerable decline in the number of people smoking in Norway in the recent years, from 43 % in 1973 to 11 % in 2017 [88,89]. Furthermore: most (if not all) Norwegians know that smoking can be extremely damaging to your health. This is of course positive, because it may motivate people to quit and deter people from starting with tobacco. However, it may also entail a stigmatization of those who still smoke. On the daily news 21st October 2017 at the Norwegian Broadcasting Corporation ("Lørdagsrevyen" at "NRK"), they had a news item illustrating this [90]. The headline of the story was that of those who smoke in Norway, 6 out of 10 want to quit. In the segment, the reporter interviewed a few random people in the street for comments. However, only their shadows were portrayed on camera, and the reporter commented that "not many smokers would let us film them". Although other interpretations may be possible, it is tempting to see this as an illustration of how being a "smoker" in Norway is associated with negativity and shame, and that these people therefore did not want to appear on national TV as "smokers".

## 2.6. Theoretical framework

Theoretically, I identify with a humanistic perspective. That is, I believe that people have a natural tendency towards psychological and emotional growth, which is only arrested by external obstacles and limitations. The humanistic perspective is nicely phrased in Ryan and Deci's presentation of Self Determination Theory [91]: "all individuals have natural, innate, and constructive tendencies to develop an ever more elaborated and unified sense of self " (p.5).

Furthermore, and perhaps counterintuitively, I place myself both within a humanistic relationship-focused tradition and an individual constructivist tradition. What I mean by this is that I see the

individual person as both constituted within and continuously created through the relationships in which s/he enacts [92]. However, I also believe that meaning is constructed within the subjective mind – "there can be no understanding without interpretation" [83(p385)]. In other words, I believe that although the experience of being a person is created within relationships, the relationship itself – the process of creating the relationship and the continuous result – is always subjectively experienced and interpreted by the individual.

Finally, pragmatism represents well how I view models, theories, and scientific discourse. Pragmatism is a perspective with roots from Chicago, which "assumes that the value of theories or beliefs rests on effective practical application" [22(p263)]. Just as critical realism, pragmatism assumes that reality can be interpreted in different ways, and scientific value lies in "what works" in real life. As such, my stance is that if a model or theory can provide an explanation or perspective that is useful, it is a good model or theory – if it does good, it is good.

## 2.7. Recruitment and sample

Ethical approval was sought from the Regional Ethical Committee on health research (REK), who concluded that the project did not fall under their mandate (the Health Research Act). Subsequently, approval was sought and granted by the Norwegian Centre for Research Data (NSD). The study consists of two data sources from two different samples: some participants were interviewed, others participated with written material ("reflection notes"). Ethical approval for the interviews was granted by NSD as project number 39934. The reflection note sample was recruited through my principal supervisor's research project, and approval for using what these participants wrote within the program was sought and granted separately by NSD (project number 52874).

All participants in the reflection note sample provided written consent. For the interview sample, participants were given written information about the study along with a request to return a signed consent form should they agree to participate. As will be accounted for shortly, some participants were interviewed over the telephone, and not all of these returned a written consent. However, oral informed consent was ensured from all participants at the beginning of the interview.

For both samples, I recruited participants who wanted to try to quit smoking using an automated, web-based program. Therefore, only people who were motivated to quit and motivated to try an automated eHealth program were included in the study. The characteristics of the samples will be presented separately in the following.

The interview sample (N = 16) consisted of participants recruited through posts in social media (Facebook and a Norwegian platform called "Underskog"), posts at a local General Practitioner's

office, and word-of-mouth via acquaintances. The 16 participants were diverse, including both men (N = 5) and women (N = 11), aged 32-70 years, from a variety of occupations (including nurses, construction workers, teachers, and other people with higher university degree, as well as people on long-term sick-leave. Some had used the program for only a short while, some for its entirety; some had quit smoking, some had quit and (re)lapsed, and some had not managed to quit. Three of the participants were acquaintances of mine. Only one participant withdrew from the study. She withdrew before the interview took place, because she on second thought did not feel comfortable with the prospect of being interviewed.

The formative study (Section 2.1.3.2) was based on data from the first eight interviews. As such, these first eight participants used an early version of the program. There were no pronounced differences as related to the research questions between the participants who used the first program version and those who used the final program version, and any differences were taken into account during analysis. Therefore, they are in the following considered to be one sample (N = 16).

In addition to these 16 participants, 112 participants had agreed to participate through what they had written in the program. Only parts of the total written material were used in analysis, these parts are referred to here as "reflection notes" and described in detail in Section 2.8.2. From these 112 participants I made two theoretical samples [22] to inform the two qualitative sub-studies (the process of theoretical sampling is described below in Section 2.9.2.): for the sub-study in Paper 3, the reflection note sample consisted of 55 participants, aged 25-66; for the sub-study in Paper 4, the reflection note sample consisted of 16 participants, aged 25-63. Both of these samples included men and women with different levels of education (the lowest level being primary school and the highest level being four years or more at a university).

## 2.8. Data collection

### 2.8.1. Qualitative interviews

The analysis is mostly based on individual interviews with the 16 participants in the interview sample. The choice of individual interviews for exploring processes of relating and change in automated therapy is not obvious; some might argue that other methods would have allowed more direct observation of the person-to-program interaction, such as an observational study or the think-aloud procedure [93]. However, there were three reasons for opting for individual interviews: Firstly, I considered the participants' introspection to be highly relevant – how they made sense of their program experiences, and how they constructed both the program and their interactions with it. This interest in introspection ruled out purely observational studies. Secondly, I wanted to explore relating and change as holistic experiences, and not fragmentize the participants' experiences

through drawing their attention to specific aspects of the program. This ruled out the think-aloud procedure [93], which would turn the participants' attention to specific program sessions. Thirdly, directly observing a working alliance may be challenging. In a study investigating the effect of preparing clients for psychotherapy, the researchers found that clients who viewed a video demonstrating alliance-processes scored significantly *lower* on measures of alliance on the first session than participants who did not view this video [94] – possibly indicating that bringing the alliance to the client's attention can be counterproductive for the alliance. Therefore, taking the possible person-to-program alliance seriously, bringing the person-to-program interaction into the interview situation might not be a naturalistic observation of alliance processes, because my presence as an interviewer might disturb any relational processes that normally would occur. For these reasons, individual interviews were considered to be the best option.

In my original research plan, I had planned to combine individual interviews with focus group interviews. However, I decided to change this for two reasons: Firstly, because of the unanticipated amount of time and effort that was spent on arriving at an interview guide that gave rich data (described in the next section). Secondly, as I became increasingly familiar with the processes under study, I realized that they were subtle, difficult to verbalize, and possibly socially potent. These aspects led me to conclude that it would be difficult to explore these processes in a group.

The individual interviews were semi-structured [95]; that is, the interview guide consisted of a list of questions covering all assumingly relevant aspects; some questions were very open, others were more focused. There was no strict ordering of the questions; the participants answered, and I followed up on what I saw as interesting aspects in their answers, returning to the interview guide when a subject was exhausted, until all aspects in the interview guide had been covered.

Of the 16 interviewed participants, three were interviewed twice to clarify and validate the analysis of the first interview. After these 19 interviews, together with the theoretically sampled reflection notes, I judged the models to have reached "theoretical saturation" – that is, new data did not spark new theoretical insights, substantially change categories, or otherwise inform the models [22], and I thought they communicated something useful related to the research questions.

All interviews except two were sound recorded; in the remaining two, a sound recorder for different reasons was not available and notes were taken instead. In the notes, I was careful to separate between direct quotes and my own summaries of what had been said. Most interviews lasted between 45 and 80 minutes, while one interview lasted 35 minutes.

A consequence of recruiting online was that participants came from different parts of the country. Therefore, eight of the 16 participants were interviewed over the telephone, whereas the remaining eight were conducted face-to-face in a variety of locations (at the participant's home, at my office, and at cafés). Other than occasional disturbances on the telephone line, there was no pronounced quality difference between the interviews conducted face-to-face and the interviews conducted over the telephone.

However, early interviews revealed that it was surprisingly challenging to get sufficiently rich data to answer the research questions for papers 3 and 4, and after the first six interviews considerable changes were made to the interview guide. In these first six interviews, I was struggling to get participants to talk about the part of their experiences that would inform my research questions. Therefore, I underwent a process of methodological refinement: Firstly, I tried to understand the underlying causes of why I was not getting sufficiently rich data – through closely analysing the interviews, consulting my supervisors, contacting other researchers on the field, and reading others' work. Secondly, I searched for appropriate methodological tools to counteract these presumed underlying causes. The result was a substantial revision of the interview guide, which included structuring the interview in topical blocks [96], employing epistemic interviewing [97], and using interview vignettes [98–100]. Epistemic interviewing involves that the interviewer engages the participant in a reciprocal dialogue in which both use their expertise to seek knowledge about the research topic together [97] – similar to what is known as "co-producing interviews" or involving the participants as "co-researchers" [101]. The interview vignettes [98–100] were short stories that exemplified different ways of relating to Andy, and were used together with epistemic interviewing to guide the interview conversation onto how the participant related to Andy. The vignettes exemplified ways of relating that I had identified in the analysis so far and were crafted with an aim of displaying maximum variation and "opening up" the topic.

Using vignettes along with theoretical sampling [22] seemed a good match, as the vignettes were based on the emerging analysis of how participants related to Andy (the program). In this interview section I also practiced theoretical sampling in other ways, asking other questions corresponding to my gradually evolving understanding of the processes under study. Charmaz [22] writes that in grounded theory, a researcher can practice theoretical sampling through the questions s/he chooses to ask in the interviews. By specifically asking for experiential aspects that can inform the developing model, the researcher is practicing theoretical sampling of experiences. Following this, each new interview was based on the analysis of previous interviews, and when needed I included new questions to saturate the emerging model. The dialogue was flexible, and the interview guide changed as new questions about the model emerged.

In addition to leading to a revised interview guide, the methodological refinement process resulted in a viewpoint article on exploring potential eHealth working mechanisms through qualitative interview studies – this dissertation's Paper 2. To make the paper relevant to as many as possible, Paper 2 more generally discusses potential challenges in conducting such studies and tools to counteract the challenges. These challenges and tools are the "findings" of Paper 2 and will be presented in the "Main findings" section of the dissertation (Section 3). The methodological refinement process is described in more detail in Section 4.4, along with the importance for this process for the findings reported in Paper 3 and Paper 4. As such, Paper 2 provides a methodological answer to this dissertation's guiding question of whether a fully automated eHealth program can support a working alliance: That answering this question through qualitative interviews may require cultivating a methodological awareness and making use of certain methodological tools.

As a final remark on interviewing, it might be noted that the course of the study did not only involve changes to the interview guide; it also involved changes to me as an interviewer. In retrospect, I realize I started out with a very simple view on interviewing; I thought it was more or less just a matter of talking, and that "everyone" could do it. I even thought I might have a small advantage to other novices, because I had experience with Motivational Interviewing [23] through my job as a counsellor at the Norwegian Quit Smoking Line, and because I had conducted interviews for my Master's thesis. However, upon reading the third edition of Brinkmann and Kvale's seminal book InterViews [102], I developed a much greater respect for the art and craft of interviewing. I realized that conducting high-quality interviews (with interesting data) is a skill that must be acquired – and I realized that I had not acquired it yet. Furthermore, I realized that my skills with "therapeutic" interviewing (i.e., Motivational Interviewing) might *hamper* my research interviews, because therapeutic interviews have a different aim than does research interviews [95]. I realized that my much-developed, almost intuitive ability to reflect change-talk [23] might lead my research interviews into a wrong path – because reflecting change-talk produces change in the participant, while research interviews are supposed to produce knowledge. I felt dismayed and humbled. Although my previous training had given me listening skills, I realized I was insecure, not used to (or comfortable with) taking a power position and leading the conversation as the situation required me to. As I transcribed my early interviews, I realized that this reluctance to lead was not only causing me to get less rich data than I should, but also the participant was put in an awkward situation because s/he expected me to lead. However, through reading the literature [96,97,102] and learning from my early interviews, I improved my interviewer skills and was able to conduct interviews of higher quality. As part of these improved skills, I cultivated an abduction technique in which I treated the words of the participant in the interview as signs and tried to use what I knew to imagine the inner experience that those signs

signified. I would then summarize what the participant had said, along with my interpretation of it, testing my understanding with the participant. Listening to the participant's answer, I did not simply take agreement for agreement but made a judgement of to what degree it represented a kind of superficial acceptance or a more whole-hearted identification of my interpretation – for example, if a participant followed up on my interpretation with more details, repeated my words, or added a comment such as "that's right, that's exactly how it was", I would take this to be a more whole-hearted agreement on which I would place greater emphasis than simple "mhm's". These improved interviewer skills, together with the revised interview guide, resulted in increasingly interesting and effective interviews.

### 2.8.2. Reflection notes

Written answers to certain program questions – "reflection notes" – were included as a triangulation method for counteracting specific methodological validity threats associated with the interviews [79]. These validity threats are discussed in Section 5.1. The reflection notes were written answers from the participants, collected within the program sessions, with Andy (the program) as a "co-interviewer". At the end of a program session, Andy would ask the participants to describe their experiences of using the program ("How would you describe working with me?"). There were two versions of this question: Some participants got a version where Andy introduced the question with four example ways of relating, similar to the analysis-based examples provided in the interview vignettes. In this version, the text on the screen would be "some describe working with me as…", upon which the four examples were given, and then the participant was asked for his/her perspective. Other participants received a version where the question stood alone without any examples. There seemed to be no systematic differences in how the participants answered as to whether the question was introduced with examples or not; therefore, I did not separate the participants in the analysis but treated the sample as one. In addition, some participants were asked to give general feedback on the intervention at the end of the program; the participants' answers to this question was also included in analysis. For all these program questions, gathered at 3-4 different time points during the course of the intervention, the participants were asked to provide their answer in a text box, and they typically answered with 1-3 sentences. These answers are what is here referred to as "reflection notes".

## 2.9. Data analysis and model development

### 2.9.1. Transcribing interviews and translating excerpts

I transcribed all the interviews myself. Although many treat transcription as a mechanical procedure of writing down what has been said, transcription is in reality the first stage of analysis [103,104]. Transcribing involves analytic decisions because the transcription of an interview is not the same as

the interview encounter, and there will always be information that is lost in the transcription [103,104] – for example the tone of voice, the speed or volume of an utterance, the turn-taking of the interviewer and participant, the physical encounter – all of which can potentially add or alter the meaning of what was said [105]. It is up to the person transcribing to decide what information is necessary to retain in the transcription, and that decision will depend on the research question. For example, when the study focus is the discourse and social exchanges between the interviewer and participant, a very specific and detailed mode of transcribing is recommended [104], while this may not be necessary when the research interest is in *what* the participant says.

I decided to use two different modes in transcribing the interviews. For the most part, understanding processes of change relied on the *content* of the participants' uttered meaning. Therefore, the interviews were mostly transcribed without retaining hesitations, sounds that were not words, or repetitions; this is what I called a "crude transcription mode". However, most interviews also had segments with reflections on how participants related to the program. During these segments, participants would often communicate nonverbally that they were struggling to grasp or explain their experiences (and sometimes also explicitly commented that this was difficult to verbalize). These sections were transcribed more verbatim; what I called a "detailed transcription mode". The detailed transcription mode included pauses, tone of voice, laughter, hesitations, self-corrections, and so on – because I saw these non-verbal markers as potentially meaningful regarding the research questions. Retaining non-verbal markers in these sections proved fruitful on several occasions, allowing the analysis to go beyond what the participants reported verbally. The transition between crude transcription and detailed transcription was indicated in the manuscript.

An additional challenge for researchers working with non-English material is the process of translating data excerpts to English [103] and otherwise preparing them for publication. Translating excerpts also involves acts of interpretation. The interviews of this study were conducted in Norwegian; hence, the provided data excerpts have been translated from Norwegian to English. However, the process of translating is not straight-forward, and there is not always a direct relationship between Norwegian and English – especially when the participant uses idioms, or other language- or cultural-specific bearers of meaning. Therefore, in the translation process, it was sometimes necessary to change the words *uttered* by the participants to retain what I considered to be the *meaning* they uttered [103]. This, of course, is an act of interpretation [103] – but it is an interpretation that is in line with the analysis that the data excerpt already were a part of.

In the translation process I also "cleaned up" some of the quotes. Some participants talked more clearly and coherent than others, and in order to represent all participants in a way that was

respectful to them and easily accessible to the reader, I removed hesitations, un-finished sentences and other disruptions that were not consider to bear meaning, or that might confuse what I saw as the main message of the excerpt as pertained to the research questions. However, I do acknowledge that this too is an act of interpretation – other researchers with other agendas would have displayed the data excerpts differently. This is therefore another example of how a written interview (or an excerpt from this interview) is not the same as the verbal and physical encounter [103,105], and that interpretation and analysis starts already in the act of transcribing.

### 2.9.2. Analysing transcripts and reflection notes

The data was analysed according to grounded theory [22], starting inductively and gradually moving on to deduction as the model became more complete. Analysis was an iterative process, moving back and forth between interviewing, transcribing, coding, memo-writing, and category development. The transcripts were coded using HyperResearch; the rest of the analysis was conducted with other software (Word, PowerPoint) and pen and paper.

In the inductive phase, the interview transcripts were coded inductively, using codes to summarize the meaning of each interview segment and staying close to the data [22,106]. However, with relatively little experience in qualitative methodology, I started out by coding with almost exclusively *in vivo* codes. Consequently, almost every code was unique – I was afraid to start generalizing too much and not to stay close enough to the data. After having read Miles, Huberman & Saldana [106], I realized that (a) not all codes have to be *in vivo*, they can be researcher-generated (p.74); (b) coding *is* analysis (p.72); and (c) codebooks should be structured, not "a catalogue of disjointed descriptors but rather a conceptual web" (p.84). Thus, I had to go through many processes of sorting and organizing [22] to generate more abstract codes that could be used on several segments. I used different methods for sorting, organizing, and comparing codes and data to further my understanding, including mind-maps, tables [106], and memo-writing [22].

In addition to this type of initial, inductive cross-case analysis, the inductive phase included case analyses [106] of the participants that were interviewed. To answer the research questions, it seemed important to not only fragmentize and reassemble across cases, but also to understand individual trajectories. Thus, for each case, I summarized the participants' main story, noted things that struck me from the interaction, and answered the research questions for each case. Writing these case analyses was an efficient way of developing my understanding in the initial phase of the study.

This inductive phase gradually moved on to a deductive phase. I found this transition difficult, especially moving from initial coding to focused coding [22] – raising the initial codes to the necessary level of abstraction while at the same time staying true to the data. I also found it difficult to leave

any codes behind – I had a feeling that they were all relevant to what I wanted to explain and understand. Therefore, I went straight from inductive coding to placing the codes in a model, to see if this analytical step could make it easier to focus the analysis. From this early model I made a list of focused codes, as well as new questions for the interview guide for theoretical sampling of where my model was incomplete. The deductive phase included coding data material (transcripts and reflection notes) with focused codes derived from the model, theoretical sampling, and model refinement in an iterative process.

At one point, I had a model consisting of two main categories; one describing processes of relating, the other describing processes of change. For a long time, I was stuck with these two categories, finding it difficult to see any relation between them and wondering which to pursue in my grounded theory. Further analysis made me pursue the category that explained change. However, suddenly the program was no longer represented in the model, nor how participants made sense of their relationship to the program. This problem caused me to focus more on how the participants' relational processes influenced change. Doing so reintroduced the program and the participants' relationship to it into the model and was an early version of the final model presented in Paper 4. The model was revised until it was judged to be theoretically saturated.

However, "theoretical saturation" is a debated term that some researchers criticize for being used somewhat uncritically in qualitative research [22,107]. One might argue that when (or if) you reach "saturation" depends on the questions you ask. An analysis can always delve deeper or reach wider to explain more [107]. Therefore, perhaps "theoretical sufficiency" [Dey, in 22] is a more appropriate term, denoting when a theory or model is sufficiently saturated to account for all existing and new data on a level that is theoretically or practically useful. I judged the models presented in Papers 3 and 4 to be theoretically sufficient because I could use them to explain all existing and new participants according to (a) how they related to the program, and (b) how they had used to program to quit smoking. However, despite this initial "theoretical saturation", the final stages of analysis and writing up generated new insights and questions. Nevertheless, the time constraints of the dissertation work prohibited me from starting another round of interviews. Indeed, according to O'Reilly and Parker [107] "in reality, researchers often stop recruitment when resources become limited and are driven by time and money, rather than sample adequacy" (p. 193). In sum, the models presented in Papers 3 and 4 are, as of my judgement, theoretically sufficient; grounded in the data, and of theoretical and practical value.

# 3. Main findings

This section presents the main findings of this dissertation. Papers 1 and 2 are also presented here, although they strictly speaking are theoretical and methodological papers (and Paper 2 is a Viewpoint article). However, since both papers provide relevant perspectives for illuminating the dissertation research question, their main conclusions will be presented as findings here; the findings of Paper 1 consist of how Andy supports three therapeutic processes, including the support of a working alliance, while the findings of Paper 2 consist of what methodological tools can be used for exploring possible eHealth working mechanisms such as the alliance through qualitative interview studies.

In the empirical papers (papers 3 and 4), all expressions and words indicated with quotation marks are data excerpts. For longer quotes, a participant number is indicated to facilitate the reader's judgement of how well the analysis represents the data. For the sake of this synopsis, participants who appear in both Paper 3 and Paper 4 are given the same number. In addition, the participant's gender is indicated, and whether s/he was interviewed or participated with reflection notes. This synopsis provides an overview of the findings; they are presented in more detail and with more data excerpts in the papers.

## 3.1. Paper 1

***How a fully automated program simulates three therapeutic processes: A case study.***

The first paper of this dissertation describes the content and treatment rationale of the smoking cessation program Andy. This is done by providing a focused description of how Andy simulates three therapeutic processes:

- Supporting internalization of motivation [91]
- Supporting a working alliance
- Supporting constructive management of lapses [74]

These processes were chosen because all were considered to be important for the program to be helpful for quitting smoking: Internalized motivation means performing a behaviour because the individual accepts it as an important step towards a valued goal [108], and has been found to improve self-regulation, performance, and persistence [91,109,110]. As reviewed previously in this dissertation, a working alliance to the program may also support change [7,12,15,59], although the mechanisms are yet unspecified. Finally, when trying to change, lapses must be expected – and if they occur, they must be handled constructively to avoid a complete relapse to the old behaviour [74].

The integration of these therapeutic processes into the program involved using selected steps from the Intervention Mapping protocol [24] to go from abstract concepts to operationalisations, and from operationalisations to specific program elements.

### 3.1.1. From concepts to operationalisations

Going from abstract concepts to operationalisations involved the change matrix of Intervention Mapping's step 2 [24]. As described earlier in this dissertation, the change matrix specifies what needs to change within the selected psychological determinants for the intervention to achieve the selected performance objectives (i.e. sub-goals). In operationalising these three therapeutic processes, the first task was to consider how these processes should be represented in the change matrix: as psychological determinants of behaviour or as performance objectives.

#### *Psychological determinants*

Internalized motivation and a working alliance to the program were considered to be psychological determinants of quitting smoking – meaning that program users were expected to need both for the program to help him/her towards the final goal of becoming smoke-free. Internalized motivation was further partitioned into five psychological determinants: (1) skills, (2) self-efficacy, (3) autonomy, (4) relatedness to social network, and (5) relatedness to the program (i.e. working alliance). These determinants were selected because internalization of motivation is believed to be supported through the need for competence, autonomy, and relatedness [91]. I considered both skills and self-efficacy important for the program user's competence in quitting smoking, suggesting that both should be considered as determinants. I kept autonomy as a separate determinant, while relatedness was partitioned into relatedness to the program user's social network and relatedness to the program – thus including alliance-support as a way of also supporting internalized motivation.

#### *Performance objectives*

While internalized motivation and a working alliance to the program were considered to be psychological determinants, constructive management of lapses was considered to be a performance objective. That is, to achieve the final goal of becoming smoke-free, program users would have to manage lapses that might occur and return to the task of becoming smoke-free.

#### *Overview: Change matrix*

Once the therapeutic processes were located in the change matrix as either psychological determinants or performance objectives, operationalization of these concepts was completed through filling out the matrix cells with change objectives, as each cell specifies what needs to change within a specific determinant for the user to achieve a specific performance objective [24] (Table 1). For example, supporting a working alliance to the program was operationalized as making Andy behave as a social actor; making it empathic, unconditionally accepting, and knowledgeable;

and letting the user choose a topic that the program would cover. An overview of the operationalisations of the three therapeutic processes can be viewed in the simplified change matrix in Table 1: the operationalization of alliance-support is found in column one, lapse management support in row four, and the operationalization of supporting internalization of motivation encompasses the entire matrix. The table does not include references to make it easier to read; however, the operationalisation of alliance draws on the work of Bickmore and colleagues [14] and Barazzone and colleagues [12], the operationalisation of internalization of motivation draws on Self Determination Theory [91,110] and Motivational Interviewing [23], and the operationalisation of lapse management draws on relapse prevention theory [74]. A detailed change matrix can be found in the original paper or in Appendix 1.

**Table 1. A simplified version of the change matrix in Paper 1.**

<table>
<tr><td rowspan="4">Perform-ance objectives</td><td colspan="5">Psychological determinants</td></tr>
<tr><td colspan="5">Internalization of motivation</td></tr>
<tr><td colspan="2">Relatedness</td><td colspan="2">Competence</td><td>Autonomy</td></tr>
<tr><td>Relatedness to the program</td><td>Relatedness to social network</td><td>Skills</td><td>Self-efficacy</td><td>Autonomy</td></tr>
<tr><td>1. Decide & plan</td><td rowspan="4">Make Andy behave as a social actor.<br><br>Make Andy accessible, helpful, empathic, unconditionally accepting, knowledgeable, trustworthy, responsive, easy to use.<br><br>Let the user choose a topic which Andy will cover.</td><td>Encourage making a public commitment to quitting and getting support from a selected person in the network.</td><td>Facilitate identifying smoking cues, preparing to handle cravings, making a plan, preparing for high-risk situations.</td><td>Facilitate belief in becoming and staying smoke-free, and confidence in the plan.</td><td rowspan="5">Facilitate commitment to the quit attempt.<br><br>Facilitate autonomous decisions, also when it goes against standard advice.<br><br>Facilitate internal attribution of success.</td></tr>
<tr><td>2. Initiate & stay smoke-free the first 3 days.</td><td rowspan="3">Encourage requesting support from selected person when needed.</td><td>Facilitate implementing the plan, getting rid of remaining cigarettes, withstanding cravings, coping with withdrawal.</td><td>Facilitate confidence in staying smoke-free the first days.</td></tr>
<tr><td>3. Establish a smoke-free life-style.</td><td>Facilitate identifying and handling high-risk situations.</td><td>Facilitate confidence in staying smoke-free, also in high-risk situations.</td></tr>
<tr><td>4. Manage lapses construct-ively.</td><td>Facilitate support and understanding from social network.</td><td>Encourage getting rid of cigarettes. Facilitate resisting new urges to smoke.</td><td>Facilitate confidence in continuing the quit-attempt.</td></tr>
</table>

### 3.1.2. From operationalisations to program elements

After operationalisation, the next phase of the integration process was going from operationalisations to specific program elements. This phase involved using steps 3 and 4 of Intervention Mapping [24]. In Intervention Mapping's step 3, each change objective (i.e. cell in the change matrix) is combined with the best suited method for inducing that change. For the endeavour of integrating therapeutic processes in an eHealth program, this meant moving systematically through the operationalisation of each therapeutic process, combining each element of the operationalisation with the best suited change-inducing method. Once the methods are chosen, step 4 of Intervention Mapping involves producing intervention material, using the selected methods to achieve the specified change objectives. The result of this process can be viewed in Table 2, which displays the three therapeutic processes (left column), the main methods used to facilitate them (step 3 of Intervention Mapping, middle column) and the most important program elements for simulating each process (step 4 of Intervention Mapping, right column). A complete list over the methods chosen for the program and example program elements for each change objective can be found in Appendix 2.

Table 2. Methods used to simulate the three therapeutic processes and example program elements, simplified.

| Therapeutic process | Methods applied | Program elements |
|---|---|---|
| Supporting a working alliance | Relational agent<br><br>Motivational Interviewing (MI)<br><br>Dynamic tailoring | The unembodied relational agent "Andy"<br><br>Computerized Motivational Interviewing (cMI)<br><br>A "flexible session manager" that adapts the program sessions to individual user patterns by:<br>- adjusting the number of sessions<br>- choosing which sessions for the user to access (prioritized list)<br><br>A "mini motivation intervention" that is implemented if the user disengages with the program, using text messages to encourage continued program use and continued quit attempt |
| Supporting internalization of motivation | MI<br><br>Dynamic tailoring<br><br>Modelling | cMI (e.g. eliciting change talk through questions, bolstering self-efficacy through confidence rulers, accepting and handling sustain talk and discord, asking for permission before giving advice)<br><br>Four fictional "quitters" that provide model stories |
| Supporting constructive lapse management | MI<br><br>Relapse prevention<br><br>Dynamic tailoring | A lapse management component that uses cMI and consists of:<br>- Daily text messages after quit attempt asking for smoking status<br>- A special, highly interactive relapse prevention session that is offered if users report a lapse |

In sum, Andy is developed to simulate support of a working alliance, internalization of motivation, and lapse management; this was achieved by using Intervention Mapping [24] to go from abstract concepts, to operationalisations, to specific program elements. The final program supports a working alliance and internalized motivation through the unembodied relational agent "Andy" who uses computerized Motivational Interviewing (Appendix 4) in a written "conversation" with the program user about quitting-related themes. An alliance is also supported by adjusting the number of sessions according to individual use, and by encouraging re-engagement with the program after discontinuation through text messages; while internalized motivation is also supported through

model stories of four fictional “quitters”. Finally, constructive lapse management is supported through a special lapse management component that monitors smoking status through text messages and offers just-in-time therapy in a special relapse prevention session if the user reports a lapse (Appendix 5).

## 3.2. Paper 2

***Theorizing eHealth's working mechanisms through qualitative interviews: tools to enhance study quality***

The second paper of this dissertation is a viewpoint article concerning the use of qualitative interviews for exploring potential eHealth working mechanisms. In the paper, I propose that certain aspects of an eHealth program's working mechanisms may not be readily available for the participant to describe in an interview as part of their program experience. The purpose of the paper is to provide some guidelines for other researchers who would wish to use qualitative interviews to explore potential eHealth working mechanisms. Based on the experiences with this dissertation work and some of the co-authors' experiences with other studies, I discuss five potential challenges in conducting such interviews and present tools for counteracting these challenges from the field of qualitative methodology.

### 3.2.1. The invisible interaction

Interviewing participants about possible eHealth working mechanisms may be challenging because participants lack awareness of how the program influences their internal change processes through the person-program interaction. This proposition is based on two elements: a theoretical conceptualization of the working mechanisms of a behaviour change intervention and an observation concerning how we usually conceive "things" [84].

First, I suggest that the working mechanisms of a behaviour change intervention can be conceptualized as how the interaction between the help-seeker and the intervention influences the help-seeker's internal change-processes. The interaction between the help-seeker and the intervention, in turn, can be partitioned into the interactional content (the "what" of the interaction) and the interactional processes (the "how" of the interaction) (Figure 8). For example, the working mechanisms of psychotherapy can be conceptualized as how the content and interactional processes of the therapy sessions influence the client's internal change processes.

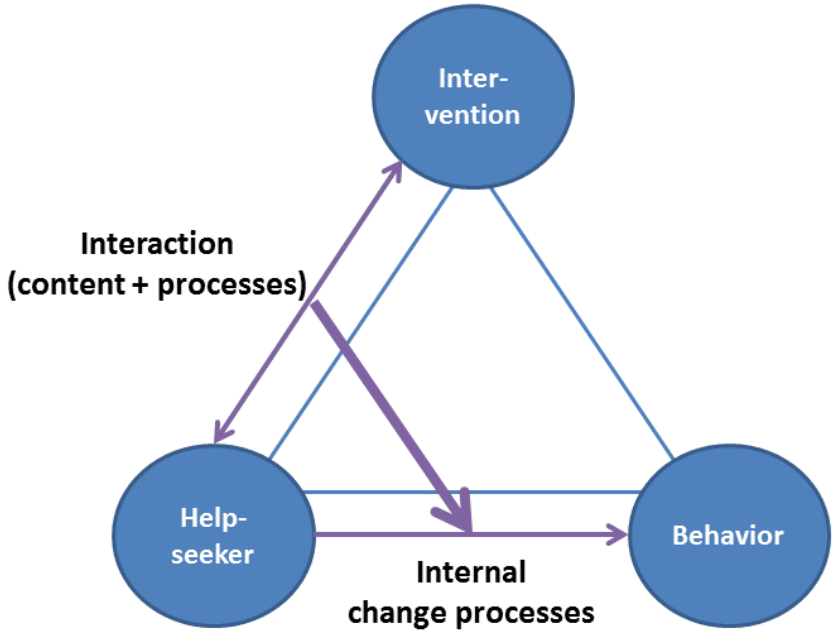


Figure 8. Hypothesized working mechanisms of a behaviour change intervention.

Furthermore, I suggest that it is possible to differentiate between interventions according to the extent to which they influence the interaction's content and processes: while both the client and the therapist will have some influence on the interactional content (what is said) and some influence on the interactional processes (how the session proceeds), a self-help book will have absolute influence over interactional content (what is written) and no influence on the interactional processes (e.g. in what sequence the content is read and when).

Regarding automated eHealth programs, their most prominent feature is their content [37,111]. Programs are things, and people often mistakenly believe that they do not interact with things. However, we do inter-act with things, in the sense that their properties influence a course of action [84]. Furthermore, many eHealth programs may substantially influence how the interaction with the user unfolds [37,111]; for example by initiating interaction through emails or text messages, or tailoring the program sessions according to user input [19]. Thus, participants may not think about the program as an inter-acting agent, although it may substantially influence the interaction; in other words, the interactional processes may be invisible (Figure 9).

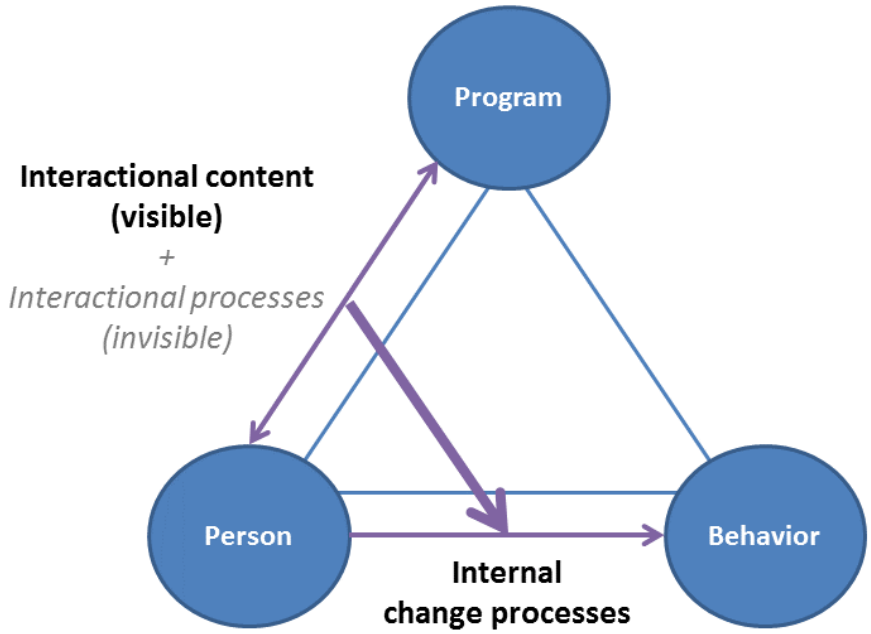


**Figure 9. Hypothesized working mechanisms of automated eHealth programs, as experienced by the user.**

The invisible interaction with the program may contribute to certain challenges in conducting interview studies that seek to explore elements in this interaction. Five such challenges, and tools to counteract them, will be accounted for in the following.

### 3.2.2. Challenges and tools

#### *3.2.2.1. Achieving a joint understanding of the interview topic*

It is often recommended that interviews should mostly consist of asking the participant to describe his/her experience as detailed as possible (i.e. "descriptive questions" [95]). However, it may be difficult to get the participant to describe his/her interaction with the program through descriptive questions alone; to the participant, the interaction with the program may not be the most pronounced aspect of their experience. This may cause the participant to describe other aspects of his/her experience and leaving the researcher with little data on the person-program interaction. In other words, by relying on descriptive questions, the participant and the interviewer may fail to achieve a joint understanding of what the interview is about. However, there are tools that the interviewer may use to clarify and exhaust the interview topic. One such tool is using interview vignettes [98–100]; that is, vivid prose stories that provide the participant with one or several examples that s/he can relate to. Another tool is involving participants as co-researchers [101], which is similar to what Brinkmann [97] calls "epistemic interviewing". When using a co-researcher approach, the interviewer becomes a type of participant and the participant becomes a type of researcher; both sharing their understanding of the topic under study up until this point and pursuing knowledge together using their different

expertise. A final tool for clarifying and exhausting the interview topic is to ensure the possibility of conducting follow-up interviews, which gives the interviewer the chance to pursue questions that were left unanswered in the first interview and gives the participant time to reflect on the interview topic.

#### *3.2.2.2. Keeping contextual answers short*

Even though the interview topic may be clarified, a second challenge that may arise is that participants nevertheless spend too much time talking about aspects that are peripheral to the research question. For example, the participants may spend too much time talking about the problem behaviour (e.g. excessive drinking or smoking). The participants may be motivated to talk about these aspects or believe that they are important for the interviewer. Indeed, these aspects may be useful as context for the analysis, but they should not take up too much interview time. One way of keeping such contextual answers short is through using in-interview questionnaires that the interviewer fills out together with the participant, containing questions that allows the participant to talk about these issues, but at the same time signals a wish for brevity by having to write down the answers.

#### *3.2.2.3. Recalling specific program aspects*

A third challenge is that participants may have difficulties in recalling specific program aspects in the interview (e.g. specific sessions or program components). This may not be a problem if the researcher is interested in the overall experience of using the program. However, if specific program sessions or components are important for the research question, memory can be helped by letting the participant go through specific program sessions in the interview and interview with the think-aloud technique [93]. Alternatively, if the researcher does not want to use the program directly in the interview, s/he can ask memory-facilitating questions to help the participant recall as detailed and correctly as possible [112].

#### *3.2.2.4. Seeing through the social interview situation*

A fourth challenge is that social processes in the interview situation may make it difficult to get interesting and/or valid data – a potential problem in all interviews if it is not acknowledged by the interviewer [105]. For example, gender issues may influence the interaction; as may the participant's perception of the interviewer as a clinician or a program developer. The interviewer may counteract negative influences by considering possible social influences on the interview situation on beforehand (given the interviewer and participant characteristics) and change any anticipated negatively influencing circumstances before the interview (e.g. how the interviewer presents him/herself, interview location, etc.). Furthermore, the interviewer may monitor the social situation during the interview and make corrections or clarify misunderstandings at its beginning or along the

way. Additionally, the interviewer should make reflective notes of social processes that may be of importance to the analysis during as well as immediately after the interview. Finally, the researcher should take into account any relevant social aspects of the interview during analysis [85,86].

#### *3.2.2.5. Mixing applied and basic research*

A final possible challenge is related to the mixing of applied and basic eHealth research. If interviews are already being conducted for applied purposes (e.g. program improvement), it can be tempting to use the same interviews to pursue a more basic research question concerning potential eHealth working mechanisms – as was done in the early phase of this dissertation study. However, while the applied interview purpose presumably will require the participant to answer specifically and perhaps superficially about the program, the basic research interview purpose may require reflecting on the interaction with the program. If the transition between the two purposes of the interview is not made explicit to the participant, s/he may continue to answer interview questions specifically and superficially. A tool for counteracting this challenge is to structure the dual-aim interview into topical blocks, and introducing each block with a short introduction about its purpose [96]. This will make it clearer for the participant when to answer superficially about the program and when to engage in deeper reflections concerning the program interaction.

## 3.3. Paper 3

***The emotional bond and the person-to-program alliance: A grounded theory study of how people relate to an automated eHealth program.***

The purpose of this qualitative sub-study was to explore the viability of the person-to-program emotional bond. As reviewed previously in this dissertation, the emotional bond of a working alliance concerns the relationship between the client and therapist; therefore, the potential person-to-program emotional bond was explored by pursuing the following research question: *How do the users relate to the program?* This sub-study is based on the entire interview sample (N = 16) and a theoretical sample of reflection note participants (N = 55).

### 3.3.1. Relational processes: Making come-alive and keeping un-alive

I found that the best way of describing the participants' ways of relating to Andy was with two relational processes: *making come-alive* and *keeping un-alive*. When *keeping un-alive*, participants interacted with and thought about Andy as an inanimate thing – a "questionnaire", "tool", "machine", or "computer" – incapable of thinking, feeling, or acting on its own accord. When keeping un-alive, the participants experienced no other social agent other than themselves – if they talked about other social agents, they referred to the program designers or the researchers of the study, as did this participant: "I keep thinking about how you've sat down and made this program! There's quite a lot of work put into this!" (participant 1, interviewed, female).

In contrast, when *making come-alive*, participants interacted with and thought about Andy as a person; a social agent capable of thinking, feeling, and acting independently. Participants almost exclusively judged the program interaction positively; as a result, making come-alive led to Andy being experienced as a *supportive social presence*. This supportive social presence was described as "someone" (not something) who "understood", "supported" or "looked after" the participants; a "conversational partner", "friend", or "therapist". When making come-alive, Andy was described as "caring", "positive", "very nice", and non-judgemental. In reflection notes, making come-alive was often expressed by addressing the program as "you", as exemplified by the following excerpt: "The funny thing is that I like talking to you, you give me pictures and metaphors I haven't thought about myself" (participant 2, reflection notes, female).

### 3.3.2. Non-social interaction, semi-social interaction, and semi-social relationship

In order to unpack these processes further, two sensitizing concepts [22] were used: Shotter's [113] concepts of thinking from "within" an activity versus thinking "about" that activity from the outside. These sensitizing concepts caused me to distinguish between two different relational situations: thinking about Andy when actively engaging with the program ("within") versus thinking about Andy

when not actively engaging with the program between program sessions ("about"). Directing both mine and the participants' attention to the differences between these relational situations revealed important nuances in ways of relating, which led to the conceptualization of three broad, partly overlapping relation types: a *non-social interaction*, a *semi-social interaction*, and a *semi-social relationship*.

I found that some participants kept un-alive both when they thought about Andy and within the program sessions; I call this a *non-social interaction.* Even when answering Andy's personal question "How would you describe working with me" within the program activity, some participants kept un-alive, as exemplified in the following excerpt:

> Like a hidden part of my personality. Nothing is new, all the thoughts about smoking and quitting smoking have been thought before, just in a different way and sequence. I get to structure my thoughts and approach free from stress. My subconsciousness is working when I'm not working with the program. (Participant 3, reflection note, female)

Other participants kept un-alive when they thought about Andy but could make come-alive within the program activity; I call this a *semi-social interaction.* For example, one participant had talked about Andy only as a program (i.e. keeping un-alive) in her first interview. However, in her second interview, we discussed the difference between thinking from within and thinking about, upon which she said the following:

> But yes, when you put it like that, I'm thinking – and you're talking about in that moment – yes, there and then in that moment when I was sitting and working with the program, of course it was a person that sort of spoke to me. (…) Sort of… it's that illusion that it isn't just a program, it's someone you're sitting and talking to. (Participant 4, interviewed, female)

Finally, some participants could also make come-alive when they were thinking about Andy between program sessions, in what I call a *semi-social relationship*. To them, Andy became a social presence that lingered also after the program interaction; an "understanding" or "secret" "friend", a "tutor", "psychologist" or "therapist"; someone who could "be there" and "look after" them. Perhaps this was most forcefully expressed by a participant who wrote the following in a reflection note: "I completely forget that you're a program" (participant 5, reflection note, female).

Apart from those who were categorized as experiencing a non-social interaction, most participants alternated between making come-alive and keeping un-alive, which meant that Andy was experienced both as a social agent and as an inanimate thing. This ambiguity was sometimes expressed through descriptors with double meaning (i.e. "robot psychologist" and "digital friend"),

sometimes through verbal modifiers (i.e. "*kind of* like a person", "*almost* like a friend"), sometimes through the use of quotation marks in the reflection notes (i.e. a "here I can talk to a 'person'", "nice to 'talk to'"), and sometimes through laughter that suggested embarrassment over making an inanimate object come alive. This ambiguity was explained by one participant in the following way: "It's funny, because it becomes kind of a relationship in quotation marks (…). What can I say… something in-between a program and a person, if you get what I'm saying? That it's… almost neither nor" (participant 6, interviewed, female).

### 3.3.3. Relational model

In sum, participants related to Andy with two relational processes (making come-alive and keeping un-alive) combined differently in two relational situations (thinking from within the program activity versus thinking about the program). Although there were individual differences, participants could be categorized as expressing one of three relational types: a non-social interaction, a semi-social interaction, or a semi-social relationship. These findings are displayed in a theoretical model of relating in automated therapy in Figure 10.

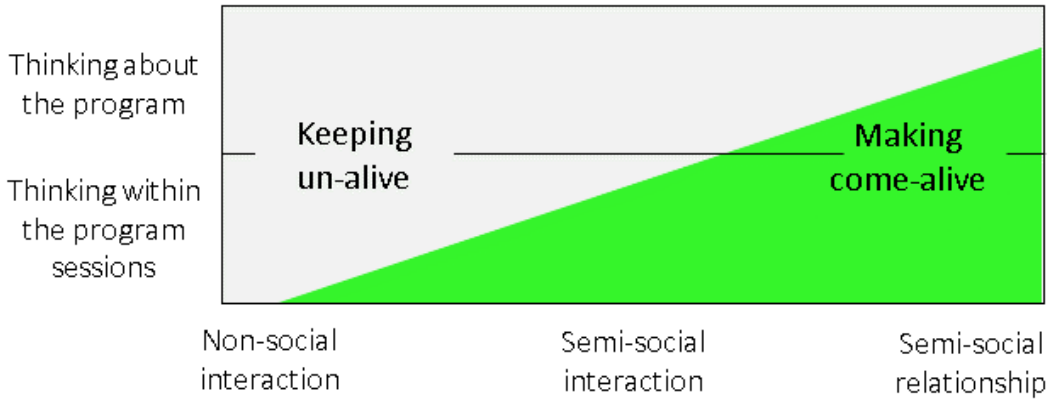


**Figure 10. A model of relating in automated therapy. Two relational processes (keeping un-alive and making come-alive) are combined with two relational situations (thinking about the program and thinking within the program sessions) to make out three broad, partly overlapping relational categories: a non-social interaction, a semi-social interaction, and a semi-social relationship.**

I used this theoretical model to locate all participants in terms of the three relation types, considering the interview sample and the reflection note sample together (N = 71). Two participants could not be classified: One because it was the first interview, and I did not have the theoretical understanding to ask for these aspects when they were not volunteered. The other was also an early interview; in addition, this interview was not sound recorded, and my interview notes did not provide sufficient information for classification. Of the remaining 69 participants, 12 expressed a non-social interaction, 34 expressed a semi-social interaction, and 23 expressed a semi-social

relationship. The judgements were done conservatively, meaning that it is likely that the numbers underestimate the degree of making come-alive in the sample. Of course, these numbers should be interpreted with caution: because they combine two highly different data sources, because the boundary between a semi-social interaction and a semi-social relationship is not absolute, and because the study was not designed to estimate how these relational types are represented in the study population. Nevertheless, the numbers suggest that for this sample, both making come-alive and keeping un-alive were normal relational processes, and that neither relational type was unique to just one or two individuals but were found with many.

## 3.4. Paper 4

***The working alliance to a computer program can facilitate constructive change-work: A grounded theory study of relational processes in automated eHealth therapy.***

The purpose of this paper was to explore the interplay between processes of relating and processes of change in the use of an automated eHealth program. This exploration was guided by the following research question: *Do ways of relating to an eHealth program influence change, and if so – how?* This sub-study is based on the entire interview sample (N = 16) and a theoretical sample of reflection note participants (N = 16).

I identified several and complex change-processes and chose to focus the analysis on the change-process that most clearly seemed to be associated with how the participants related to the program; what I call *getting change-space*, which was restricted by the experience of *social forcing*. In the following, I will first account for social forcing, then the process of getting change-space.

### 3.4.1. Change-space is restricted by social forcing

Some participants found it difficult to quit smoking because of *social forcing*; that is, because of other people's wishes, feelings, and opinions regarding their quit-attempts. Social forcing could take on many different forms, but all had similar effect on the participants' quit attempts: making them focus on the other – or their relationship to the other – and drawing their attention away from what *they* thought, felt, or needed in order to successfully quit smoking on their own terms, thereby obstructing constructive change-processes.

Social forcing could come from partners or family, who worried about the participant's health, or from more distant relations. Whether through ridicule, judgement, pushing the participant to quit, or emotional sanctioning of failure, social forcing made the participant think about the relationship to the other instead of what s/he needed to quit smoking. Positive expectations could have the same effect: sensing that others hoped and believed that they would succeed in quitting would sometimes cause participants to fling themselves into "unsustainable quit attempts" or self-handicapping, driven by the other's wishes and not their own. Doubt and shifting focus could also be created if others asked questions about the quit attempt or offered their advice, which participants experienced as a form of uninvited interference with negative effects, as exemplified with the following story:

> A friend asked me 'are you motivated'. And I was very provoked by that question, because I had been up until then. But when she asked me that question, she doubted my motivation. And that sort of annoyed me. I think she should have taken it for granted that I was motivated! So, she contributed to creating some thoughts in me, or a doubt. So sometimes

> when you involve other people you can become affected, and you may be affected in the wrong direction. (Participant 4, interviewed, female)

Importantly, the central aspect of social forcing was not the other's actions, but the participant's interpretations and projections; the participant's assumptions about the other's thoughts concerning him/her and his/her quit attempt. The participant's assumptions could sometimes go counter to what the other actually said or did, but the assumptions would nevertheless be taken to be more real. Some participants felt social forcing just by discussing quitting with another person and said that they would therefore never see a therapist to get help in quitting.

The interpretive essence of social forcing was vividly illustrated in the story of one participant, who spoke affectionately of her husband and described his support in her many attempts to quit smoking. I was therefore surprised when she told me that she had lapsed, and that she had not told him. When I asked her why, she talked about their history as a couple: how they had led a healthy and sporty life-style together, and how he had continued this track while she had started smoking more and more. Although he *said* he supported her, she was reluctant to use him for support in her smoking and struggling to quit, because "that's not the image I want him to have in his head of me". Although his support seemed to be genuine, she was convinced that she "knew" what he was "really thinking", as exemplified in a quote from her interview:

> So, we're at a café, and I'm smoking, and I'm noticing the cigarette smoke reaching him, so he moves a little, I know that he's not that keen, but he never complains, he says 'no, it's fine'. But deep inside I know that he wants me to be healthy! That he wants me to be happy, and he knows I'm not happy smoking. Because I do complain about it. (Participant 1, interviewed, female)

In sum, social forcing could take on many forms, but the experience of social forcing resided in the participant's attentional shift to the other, thinking about and caring about the other's thoughts, feelings, and opinions more than their own. Social forcing thus restricted their ability to work constructively on quitting smoking; that is, social forcing limited their *change-space* (Figure 11).

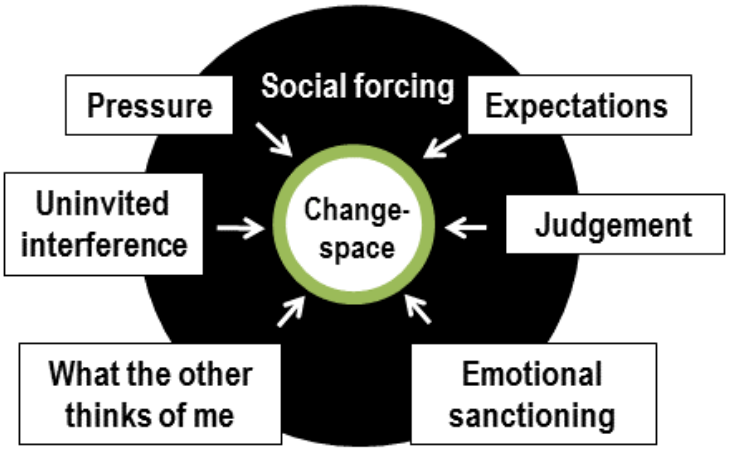


**Figure 11. Social forcing can take on various forms which all restrict the individual's change-space, making it difficult to focus on one's own change-processes and work constructively on changing on one's own terms.**

### 3.4.2. Getting change-space through making come-alive and keeping un-alive

Participants who experienced a lot of social forcing and therefore had little change-space got change-space through Andy. They experienced that Andy did not force them, but focused on what they thought, felt, and wanted, and this gave them more change-space. However, they also got change-space through how they related to Andy, by making come-alive and keeping un-alive.

Through making Andy come-alive into an experienced social presence, participants felt "understood" and "supported", "looked after", and "believed in". They described that Andy "cared" and was "someone" who could "be there" for them. Some described Andy as a "psychologist", "therapist", "friend", or "conversational partner". The experienced supportive social presence of Andy seemed to make the participants feel accepted, and that it was safe to acknowledge the difficult aspects of quitting as well. Making come-alive thus created a feeling of not being alone, of someone witnessing their journey, giving participants confidence and freedom to work constructively with changing. The relief of feeling understood was expressed by one participant like this:

> It was a little bit like having a – well, an *understanding friend* who understood what I was going through. Of course, you may have friends, or boyfriends, who of course support you if you have to quit, but who don't really understand how hard it can be. (…) I got a feeling there was a *person* there (small laugh) who understood that this was tough as hell. (Participant 7, interviewed, female)

However, it was not only making come-alive that facilitated constructive change-work; keeping un-alive was also instrumental in giving participants change-space. Through keeping un-alive,

participants removed the possibility of social forcing from the relationship to Andy – because keeping un-alive reminded them that Andy was not a person. Therefore, Andy could not think negatively about them, feel disappointment, or sanction – there was no "other" through whose eyes they could disappointedly see themselves, and there could be no social forcing. The benefits of thinking of Andy as something other than a person was expressed as following in a reflection note:

> Here I can relate to a 'person'. Answer what I want to answer, receive encouragements and okay questions that I answer as much as I feel like. I see my quitting process as something personal and I don't feel like talking too much with others or discussing it with them. The program therefore suits me fine. (Participant 8, reflection note, female)

In sum, both making come-alive and keeping un-alive gave participants change-space, but through different processes. Not surprisingly therefore, participants who got change-space through Andy seemed to do so in a semi-social relationship, alternating between making come-alive and keeping un-alive. This combination seemed to be especially beneficial: in some ways, participants related to Andy as a social presence that supported and understood, while in other ways they related to an inanimate program that did not think or feel anything and therefore could not be socially forcing. The advantage of this duality was expressed by one participant as following: "[Andy is like] a secret friend… or someone who…can give you advice without pushing you, a friend who doesn't love you or hate you, someone who doesn't know you, who can give you good advice." (Participant 9, interviewed, female).

### 3.4.3. Change-space model

The findings are summarized in a theoretical model (Figure 12) which proposes that social forcing restricts change-space, and that in eHealth therapy, a person can get change-space through how s/he relates to the program.

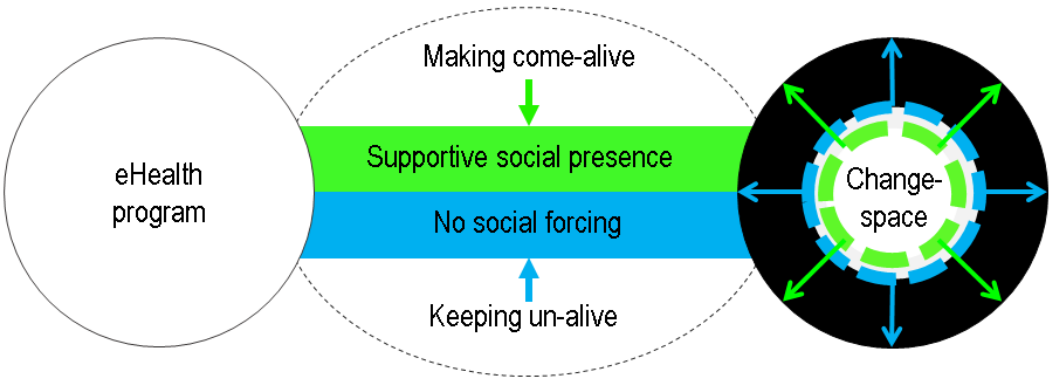


**Figure 12. A model of getting change-space in automated eHealth therapy, which proposes that a person can get change-space through how s/he relates to the eHealth program.**

# 4. Discussion

The purpose of this dissertation was to further explore a possible working alliance in automated therapy, and to specifically pursue the potential role of a person-to-program emotional bond. My work has been guided by the following overall research question: *Can a fully automated eHealth program support a working alliance?* I have sought answers to this question from a theoretical, a methodological, and an empirical perspective. From a theoretical perspective (Paper 1), I suggest that an automated eHealth program can support a working alliance by using a relational agent [73] that incorporates alliance factors [12] and employs dynamic tailoring to communicate with computerized Motivational Interviewing [23,114]. By systematically combining these methods with alliance factors I integrated the simulation of alliance-support in "Andy", the fully automated eHealth program for quitting smoking that I co-developed and that has been the case for the qualitative study. From a methodological perspective (Paper 2), I suggest that to get rich interview data on a potential person-to-program alliance it may be necessary to employ certain methodological tools for clarifying and exhausting the topic (e.g. vignettes [98–100] or considering the participant as a co-researcher [97,101]), keeping contextual answers short (e.g. through an in-interview questionnaire), aiding recall (e.g. through memory-facilitating interview questions [112]), arranging and analysing the interview situation (e.g. with reflective memos), and structuring the dual-aim interview [96]. By using these methodological tools to refine my interview guide I was able to get rich data that could answer the research questions of the qualitative study. These interviews informed two grounded theory studies [22] of how the users related to Andy and how relating influenced change, which led to two theoretical models: a model of relating in automated therapy (Paper 3) and a model of a change process (Paper 4). The relating-model (Paper 3) suggests that program users relate to automated eHealth programs through two relational processes – *making come-alive* and *keeping un-alive* – and that when the user also judges the interaction positively, making come-alive leads to the experience of the program as a *supportive social presence*. This supportive social presence was described as "caring", "understanding", "supportive", "positive", "interested", "very nice", and non-judgmental, and was sometimes referred to as a "conversational partner", "friend", or "therapist". Although some participants only kept un-alive (in what I call a *non-social interaction*), most participants alternated between making come-alive and keeping un-alive (in a *semi-social interaction* or a *semi-social relationship*). Finally, the change-model (Paper 4) suggests that people need *change-space* to be able to work constructively on changing; to be able to focus on their own thoughts, feelings, and preferred courses of action and be confident in their own processes. However, change-space can be restricted by *social forcing*; being preoccupied with the other's imagined judgements and the potential consequences of these judgements for the relationship to that other. The change-model

suggests that program users can get change-space through how they relate to an eHealth program: Through making come-alive, the program is experienced as a supportive social presence that makes the user feel safe to express all aspects of changing, acknowledged, and supported; while through keeping un-alive, the user is reminded that s/he is interacting with an inanimate thing that cannot judge them, to whom they have no relationship, thereby removing the threat of social forcing. Thus, by relating to the program through making come-alive and keeping un-alive, the person can feel both free and supported to work on changing on his/her own terms; that is, s/he has change-space. Later in this discussion I will use these two models to explore the alliance-question from an empirical perspective; however, I will first compare this research with prior work.

## 4.1. Comparisons to prior work

Andy is specifically developed to support a working alliance (Paper 1). Although there are other programs that contain potentially alliance-supporting elements [12], to the best of my knowledge there is only one other project which comprehensively and transparently accounts for *how* the program is intended to support an alliance [14,16,17,73]. This dissertation builds on this work in the incorporation of alliance-factors [12] and a relational agent [73] in the program. However, it also adds to this work by demonstrating how a purely text-based relational agent (i.e. "non-embodied") can be developed to support a working alliance – in contrast to the work of Bickmore and colleagues [14,16,17,73], which relies an embodied relational agent that can emulate both verbal and non-verbal "socio-emotional" behaviours.

This dissertation also contributes to the field in that Andy is designed to simulate the support of two other therapeutic processes as well (internalization of motivation and lapse management), and it is possible that combining these three therapeutic processes in one program leads to synergy effects (Figure 13). One such potential synergy effect indicated in the figure is that supporting an alliance may also increase internalization of motivation: because one of the three basic needs that supports internalization of motivation is the need for relatedness [91], supporting a person-to-program alliance (i.e. a sense of relatedness to the program) may increase internalization of motivation. Another potential synergy effect is that supporting a working alliance may increase the likelihood of the program user benefiting from a lapse management component: supporting a person-to-program alliance is likely to lead to increased commitment, satisfaction, and trust [65], which may make the user continue with the program long enough to experience a lapse while using it (and benefiting from the lapse component). Similarly, supporting internalization of motivation may also support constructive lapse management: more internalized motivation leads to increased self-regulation, performance, and persistence [91,109,110], which may make the user less inclined to lapse in the first place and may keep him/her engaged with the program long enough for a lapse management component to be

helpful. Another possible synergy effect indicated in the figure is that supporting constructive lapse management may also support an alliance: providing timely and adequate help if the user experiences a lapse will presumably make the program appear more sensitive to his/her needs, and need sensitivity is believed to support an alliance [12]. Finally, supporting constructive lapse management may also support internalization of motivation: if the program is successful in helping the user recover from a lapse, it will likely increase his/her sense of competence, which is another of the basic needs that supports internalization of motivation [91].

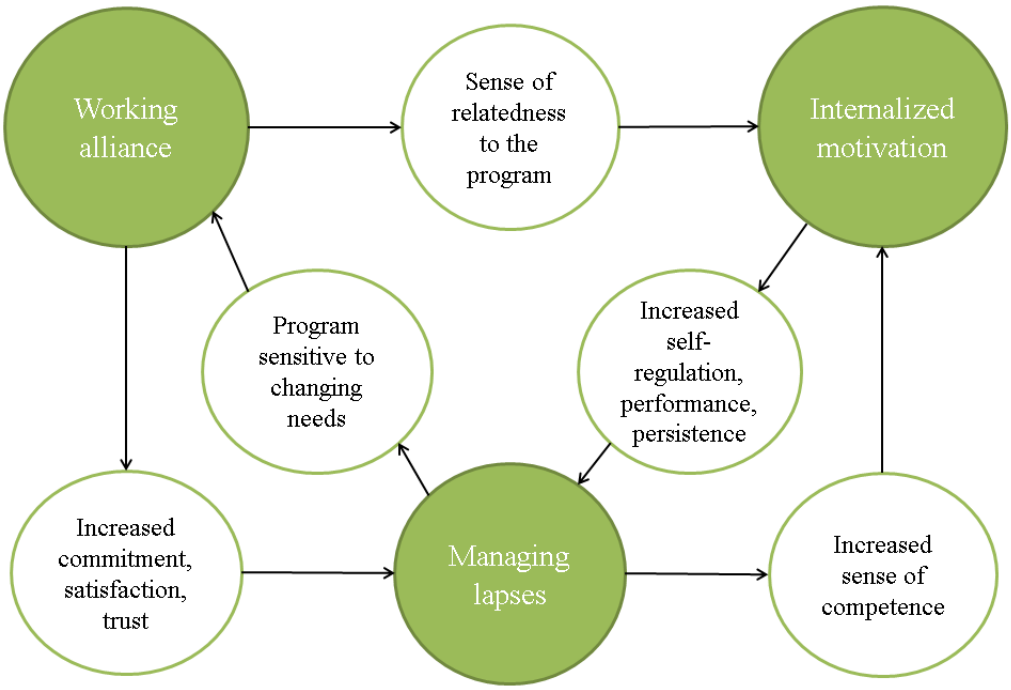


**Figure 13. Integrating the support of alliance, internalized motivation, and constructive lapse management in one program may lead to synergy effects.**

The empirical part of this PhD study is based on qualitative interviews. Although the field of eHealth has an overweight of quantitative studies, there are qualitative studies as well, and these often rely on interviews [70,71,115,116], providing important insights into how eHealth programs are received and used. This dissertation adds to this growing body of qualitative eHealth studies. However, this dissertation also extends on this work by suggesting how qualitative eHealth interviews can be conducted to provide richer data on more narrow aspects of the program experience (Paper 2). Although the aforementioned studies are interesting, the interviews seem to have covered a broad range of program experiences; for example, the purpose of the interviews in the study by Brandt and colleagues [71] was to gather positive and negative experiences to inform program development, and the purpose of the interviews in the study by Darvell and colleagues [115] was to explore participants'

"perceived impact of the program, their engagement with and use of the program, and their overall perception of treatment" (p. 176). Although such broadly defined purposes are certainly valid, it may also be interesting to narrow the focus of the interviews in order to produce richer data on a few aspects of the program experience. Richer data on a few aspects ("thick descriptions") can in turn give grounds for more thorough analyses of these aspects, which may make such studies more apt to shed light onto questions of general working mechanisms and increase the validity and transferability of the results [117].

In the qualitative sub-study in Paper 3, I found that participants could relate to the program as if it were a person and respond to it with positive social emotions. This supports similar findings from other studies within the field of eHealth [15,17,18,70,71], and is similar to what is referred to as "anthropomorphism" within the field of Artificial Intelligence and robotics [118–120]. This dissertation also extends on this prior work by suggesting that this way of relating to inanimate things can be conceptualized as the relational process "making come-alive", which was found to be a normal process for this study's sample.

Furthermore, I found that some participants experienced ambiguity and ambivalence in whether they were interacting with a person or a machine (Paper 3), as has been reported previously [15,70]. This dissertation extends on these observations by suggesting that ambiguity is the result of simultaneously making come-alive and keeping un-alive, thereby providing a theoretical explanation for this experience.

While ambiguity has been reported previously, I have not found any studies in which explicitly thinking about eHealth programs as inanimate objects (i.e. keeping un-alive) is conceptualized as a way of relating; thus, another way this dissertation extends on prior work is by conceptualizing keeping un-alive as a relational process (Paper 3). Although Kaplan and colleagues [70] report that some participants talked about the program as a machine, they treat this as an instance of their "ambiguity and ambivalence"-category and not as a separate form of relating. Perhaps thinking about eHealth programs as inanimate objects has not been thought of as a way of relating because it is the expected state of affairs. However, although it might be the expected state of affairs, I believe that keeping un-alive nevertheless is of analytic interest; attending to keeping un-alive makes it possible to explain a larger range of relating through different combinations of making come-alive and keeping un-alive. Another reason for attending to keeping un-alive is that I found that it was instrumental in facilitating change (Paper 4); I will discuss this finding further shortly.

I found that in facilitating change, it was important that Andy had a non-judgemental tone and that it did not force the participant into quitting (Paper 4); this confirms similar observations in previous

studies [15,18,71]. However, I also extend on these observations by providing a theoretical explanation: that the benefit comes from a program that does not engage in social forcing (such as judgement and being pushed towards change), thereby creating more change-space (i.e. feeling free to work constructively on changing). This dissertation also extends on prior work by suggesting that when using an automated eHealth program, the experience of being free from social forcing is amplified by keeping un-alive, by which program users remind themselves that the program cannot judge or force them.

Finally, I found that change was also facilitated by making come-alive, turning the program into an experienced supportive social presence (Paper 4). Although other qualitative studies have found that people may add human qualities to a program or respond to it with positive social emotions [15,17,18,70,71], none of these have systematically analysed whether this has any influence on change. This dissertation therefore extends on this work by providing evidence that relating to a program through making come-alive can give the program user change-space, which may be a prerequisite for further constructive change-work.

## 4.2. Empirical support for a person-to-program alliance

The findings in Paper 3 and Paper 4 support the existence – and usefulness – of a person-to-program alliance, and the relevant processes are explained with two theoretical models. First, the findings of Paper 3 support the existence of a person-to-program emotional bond. As accounted for previously, the main finding of this sub-study was that participants related to Andy through making come-alive and keeping un-alive, and that making come-alive together with a positive judgement of the program interaction led to an experienced supportive social presence. This experienced supportive social presence can perhaps be understood as what is known as a "transitional experience" [121]. "Transitional" phenomena and experiences are terms launched by Winnicott, who originally used them to refer to how a child relates to a favourite teddy bear or doll: "In establishing a unique relationship with such an inanimate object, the child bestows special meaning on it (…). In a sense, it [the toy] comes alive for the child" [122(p95)]. Although originally considered part of a child's normal psychological development, both Winnicott and others have later used the terms to explain adult experiences, such as how we understand and use the world around us (i.e. "objects") [121] and as a process that can be utilized in psychotherapy [122]. The person who experiences transitional phenomena is also the creator of that same experience. As such, transitional experiences can be understood as:

> a type of 'playing' in the sense that the boundaries between what is real and what is not real are temporarily blurred. It is also a form of playing in that it is a creative act through which one's internal experience is brought out into the world and in some sense made real" [122(p95)].

This description of transitional experiences seems to fit well with what participants in this dissertation study experienced when making come-alive and adds plausibility to considering making come-alive a normal psychological process. One puzzling aspect of making come-alive was that the experienced supportive presence of Andy appeared to take on a real quality, at the same time as participants never seemed to doubt that they were in fact "talking" to a computer program. This seemingly paradox can be explained by thinking of making come-alive as a transitional experience; a type of "playing" which temporarily blurs out the boundaries of what is real and what is not real, the act of creating and the experience of that which is created. Considering making come-alive as a transitional experience can change the interpretation of previous reports of relating to inanimate computer programs with positive social emotions [15,17,18,70,71]: from considering these as possibly reflecting the experiences of a few, exceptional cases, to seeing them as manifestations of what might be a normal psychological process. That is, if transitional phenomena are part of human beings' normal psychological make-up, then making come-alive may be a normal way of relating to automated eHealth programs. This is supported by the findings in the sub-study of Paper 3, in which making come-alive was something the majority of the participants sometimes engaged in.

The supportive social presence that was experienced through making come-alive bear certain resemblances to the emotional bond of the working alliance. The social presence of Andy was experienced as "caring", "understanding", "supportive", "positive", "interested", "very nice", and non-judgmental; the emotional bond of the alliance was previously defined as feeling understood, cared for, appreciated, and comfortable with, as well as involving respect, honesty, liking, trust, and attachment [21,68]. Although the conceptual overlap is not complete, it is nevertheless substantial, and complete overlap is perhaps not to be expected from two such "fuzzy" constructs. Furthermore, several participants described Andy as a "therapist", "psychologist", "friend", or "conversational partner", terms that suggest a constellation of positive social emotions. The complex social emotions indicated in these labels, together with the conceptual overlap, suggests that it is reasonable to describe the experienced supportive social presence enabled by making come-alive as a person-to-program emotional bond. Considering making come-alive as a normal way of relating to an eHealth program implies that it also may be normal to experience a person-to-program emotional bond.

Finding support for a person-to-program emotional bond addresses a knowledge gap in the literature. As previously argued for, the emotional bond is theoretically the most controversial

element of a person-to-program alliance. Apart from the study of Bickmore and colleagues [15], quantitative studies have not addressed the question of the emotional bond specifically, and one found lower scores on the bond-subscale than on the others [11]. While quantitative research have not addressed the question of an emotional bond, prior qualitative studies have identified instances of positive social emotions but not provided any possibility to assess the normality of experiencing such emotions [18,70,71]. This dissertation addresses this gap by providing evidence for a person-to-program emotional bond and adding plausibility to that experiencing such a bond may be a normal way of relating to an eHealth program. This suggests the existence of an emotional bond in automated therapy and supports the person-to-program alliance as a meaningful concept.

While the findings in Paper 3 support the person-to-program alliance as a meaningful concept, the findings of Paper 4 suggest that it is also a useful concept. As previously accounted for, the main finding of Paper 4 was that relational processes (making come-alive and keeping un-alive) was instrumental in facilitating a specific change-process (getting change-space). By defining change-space an analytic category – involving an experience of feeling free to work creatively and uninterruptedly on changing – it was possible to consider the influence of the previously defined relational processes on this specific change-process. Considering the interplay between these analytic categories, I found that the experienced supportive presence enabled by making come-alive gave participants a feeling of safety and encouragement that gave them more change-space – through feeling cared for and understood, and that someone was witnessing their journey, encouraging them to go on and functioning as a buffer for negative self-feelings if they experienced failures or setbacks. Thus, Paper 4 shows how the previously defined emotional bond influences a change-process, providing additional support for considering it part of a person-to-program alliance.

However, I also found that participants got change-space through the other relational process, keeping un-alive. As previously accounted for, the usefulness of keeping un-alive for getting change-space seemed to be explained by how social forcing restricted participants' change-space in the interaction with other people. In order to understand these processes it can be helpful to consider Cooley's [123] concept "the looking glass self". Cooley argued that people's self-images are results of how they imagine others' judgements, and that we use others as psychological "looking glasses" (i.e. mirrors): "Each to each a looking glass/Reflects the other that doth pass" (p. 2). However, because we never actually *know* the other's thoughts, the judgements that we feel is always imagined. Cooley writes:

> As we see our face, figure, and dress in the glass, and are interested in them because they are ours, and pleased or otherwise with them according as they do or do not answer to what

> we should like them to be; so in imagination we perceive in another's mind some thought of our appearance, manners, aims, deeds, character, friends, and so on, and are variously affected by it. A self-idea of this sort seems to have three principal elements: the imagination of our appearance to the other person; the imagination of his judgment of that appearance, and some sort of self-feeling, such as pride or mortification. The comparison with a looking-glass hardly suggests the second element, the imagined judgment, which is quite essential. The thing that moves us to pride or shame is not the mere mechanical reflection of ourselves, but an imputed sentiment, the imagined effect of this reflection upon another's mind. (…) We always imagine, and in imagining share, the judgments of the other mind. (p. 2)

Several aspects of how social forcing restricts change-space can be understood by considering the operations of the looking glass self; especially the sometimes subtleness and apparent ubiquity of social forcing. For example, some participants seemed to experience social forcing whenever they talked with another person about quitting smoking (and were for this reason reluctant to seeing a therapist to get help in quitting). This may seem more understandable if we consider their experiences in terms of the looking glass self: for these participants, there was no easy escape from imagining the other's potentially negative judgement, because "we always imagine, and in imagining share, the judgments of the other mind". Because these imagined judgements were negative, the resulting "self-feeling" was negative. Furthermore, because the other's judgements are so important – both in terms of the relationship to the other and in terms of one's self-feelings – discussing quitting with another person meant shifting focus towards the other's imagined judgements and away from one's own constructive change-processes.

This theoretical lens can also help explain why some participants felt socially forced even though the other behaved in an apparently neutral or even supportive manner – such as the participant who was asked by a friend whether she was motivated, or the participant who did not share a lapse with her supportive partner because "that's not the image I want him to have in his head of me". According to Cooley, it is not necessarily the other's behaviour that causes negative self-judgement, because the judgement is imagined: "the thing that moves us to pride or shame is not the mere mechanical reflection of ourselves, but (…) the imagined effect of this reflection upon another's mind" [123(p2)]. Imagination can overlook – or misinterpret – neutral or supportive behaviour and create a conviction of negative judgement, even in the absence of objective "proof". Imagining the other's judgements, then, is basically a *self*-judgement. And if the participant imagines the other's judgement of his/her quitting efforts to be negative, then s/he will experience being socially forced, focusing on the threat social forcing poses to one's self-image and the relationship to the other instead of focusing on constructive change-work. Thus, by understanding social forcing as a manifestation of the looking

glass self, it becomes evident that human interaction does not necessarily provide an escape for social forcing – or a place for change-space.

While there may be no easy escape from social forcing in human interaction, there is an escape in the semi-social relationship to an automated eHealth program, and that is keeping un-alive. When keeping un-alive, participants could remind themselves that with Andy, there was no other mind to which they could attribute their negative self-judgements. In other words, keeping un-alive could function as a form of self-protection in the interaction with Andy: if a participant was making Andy come-alive and thought that "he" might be passing a negative judgement, the participant could counteract this through keeping un-alive, reminding him/herself that Andy cannot possibly judge because Andy is a computer. Whether conscious or unconscious, reverting to keeping un-alive in situations like this would serve as a way of avoiding the threat of negative self-judgement, making it possible to refocus quitting smoking on one's own terms. Thus, by removing the threat of social forcing and providing a temporarily escape from the looking glass self, keeping un-alive gave participants change-space. This suggests that keeping un-alive was also instrumental in facilitating change-space, albeit working through other mechanisms than making come-alive. Because both making come-alive and keeping un-alive were important in giving participants change-space, both of these relational processes should be considered as possible elements of a person-to-program alliance.

The constructive combination of these two relational processes is perhaps somewhat surprisingly mirrored in qualitative research on psychotherapy: one study by Carey and colleagues [27] who investigated psychological change "from the inside" with clients (N = 27) in psychotherapy; the other by Lilliengren and Werbart [26], who explored curative and hindering factors in psychotherapy from the clients' perspective (N = 22). These psychotherapy clients considered it important that the therapist was supportive, sharing their journey [27], and cultivating an atmosphere of acceptance and respectfulness [26]. This seems to bear similarities to what is known as an emotional bond [21] and resembles the supportive social presence that participants in this dissertation study experienced when making come-alive. However, the participants of these psychotherapy studies also talked about difficulties in sharing their problems with their close relations, and found psychotherapy as a place where they could escape judgement [27]. Furthermore, they appreciated that the therapist was an "outside person" that was not part of their everyday lives [26], with no personal knowledge, preconceptions, or connections with the participant [27]. As such, therapy became a "breathing place" and a "neutral zone" [26]. It seems that these psychotherapy clients found it useful to keep the therapist at an emotional distance, and that in addition to the supportive presence of the therapist there was a degree of clinically useful estrangement. This clinically useful estrangement seems to

resemble the process of keeping un-alive; keeping the helper at a distance, making it possible to interact without damaging the relationship, talking about change with someone who does not pass negative judgements of you. The usefulness of this clinical estrangement for supporting change in psychotherapy supports the notion of considering keeping un-alive as part of a person-to-program alliance. Moreover, this element of clinically useful estrangement seems to make the semi-social relationship to Andy resemble more the relationship to a therapist than that to a friend.

Paper 4 thus addresses another knowledge gap, which concerns whether a person-to-program alliance influences change. As previously reviewed, prior qualitative work has not analysed for what relating *does* [18,70,71], and with one exception, quantitative studies have not found any association between alliance and outcome [11,15,18,60]. The study that did find such an association used an alliance-measure directed at perceived helpfulness and that does not assess a potential emotional bond [20]. The role of the person-to-program alliance in inducing change has therefore been uncertain, especially with regards to a potential emotional bond. This dissertation addresses this knowledge gap in the evidence provided for an association between how participants related to the program and the facilitation of change-space.

In sum, papers 3 and 4 provide an answer to the alliance-question from an empirical perspective, suggesting that a fully automated program can indeed support a working alliance. The support for this is provided through empirical evidence for the most controversial element of a person-to-program alliance, namely the emotional bond, along with a theoretical model for explaining that bond as the relational process making come-alive (Figure 10) together with a positive judgement of the interaction. Further support for a person-to-program alliance is provided through evidence suggesting that the relational processes making come-alive and keeping un-alive influenced a specific change-process – getting change-space. The influence of these processes is explained with another theoretical model (Figure 12). This dissertation therefore supports the working alliance as both a meaningful and a useful concept in automated therapy; that making come-alive is an important process facilitating the emotional bond of such an alliance; and that keeping un-alive is another relational process with significance for change.

## 4.3. Alliance: Theoretical versus empirical perspectives

As described earlier, I started this thesis work with a theoretical perspective on how to support the users' relationship to an automated eHealth program (Paper 1) and ended with an empirical perspective on how the participants related to Andy (papers 3 and 4). In the following, I will compare these two perspectives, looking back at the theoretically assumed alliance-supporting program elements in Paper 1 from the empirical vantage point of papers 3 and 4. First, I will account for which

of the theoretical assumptions that were confirmed empirically; next, I will account for which theoretical assumptions that were not confirmed; and finally, whether the empirical perspective revealed alliance-supporting elements that had not been anticipated theoretically.

Some of the theoretical assumptions about what might support an alliance (Paper 1) were supported in the empirical study (papers 3 and 4): It was initially thought to be important that Andy behaved like a social actor [73], and this was indeed one of the aspects contributing to making come-alive, which in turn facilitated the experienced supportive social presence of Andy. Furthermore, it was thought necessary that Andy communicated with empathy and unconditional acceptance [12,23], which was also part of the supportive social presence that participants experienced. The program was made to be responsive by dynamically adapting to the participants' answers through multiple-choice, and it was made sensitive to new needs by offering support in the case of a lapse [12,74]. The dialogue-quality of the program supported making come-alive, and the lapse component contributed to the experience of Andy as a supportive social presence. Computerized Motivational Interviewing (MI) [23,46,49] was another method chosen to support an alliance. MI is concerned with eliciting the client's own reasons, strategies, and commitment for changing, as well as accepting resistance towards change and "rolling" with it [23]. From the empirical perspective, these MI-elements seemed to culminate in a sense of Andy focusing on the participant's change-space and refraining from social forcing. Finally, it was anticipated that supporting constructive lapse management might enhance a working alliance to the program through the synergy effects of incorporating all three therapeutic processes (alliance-support, lapse-support, and support of internal motivation), an anticipation that was confirmed in the qualitative study.

There were other aspects that were thought to support a working alliance from a theoretical perspective that were not found to be important from an empirical perspective. Being helpful, knowledgeable, trustworthy, and easy to use [12] did not surface as important alliance-aspects for the participants. Furthermore, Andy was designed to negotiate program goals by allowing participants to influence the program content slightly: they were asked to choose one of four "special topics" that would be covered during the course of the program. Additionally, alliance ruptures were sought prevented and repaired by including a mini-motivation intervention (based on text messages) that encouraged the user to re-engage with the program if s/he stopped logging on [12]. The participants did not talk about these program elements. This might imply that these alliance-elements were not important, or that the program's incorporation of these alliance-elements were not satisfactory. Alternatively, because I did not conduct a deductive analysis, these aspects were not specifically investigated, and thus it cannot be claimed that they were *not* important aspects of relating; only that they did not surface as important elements in the analyses in papers 3 and 4.

Finally, there were certain program elements that were found to be alliance-supporting from the empirical perspective that had not been anticipated to be so. One such unanticipated alliance-supporting element was the significance of the program as an inanimate object, which facilitated keeping un-alive. Andy was not designed to emphasize its' un-aliveness; on the contrary, Andy was developed to approximate a human social agent as far as the available technology, time, and resources would allow us. In fact, the only reference to Andy being a program is in the first session, in which Andy presents "himself" and "reveals his identity" through the following statement:

> *"I'm a program developed by researchers and quitting smoking experts at the University of Oslo. I'm writing "I", but I'm not a real person, and I don't want to trick you into believing otherwise. Still, I'll be talking about me as "me" in our conversations. I may not be a person, but I do the best I can!"*

The reason for adding this text was to communicate to the program user Andy's belief in his/her unconditional worth (believing that s/he should not be "tricked"), as well as the result of an ethical consideration that it should be made explicit to the program user that s/he is not interacting with a person. However, the positive influence of keeping un-alive for the working alliance was not anticipated.

Another unanticipated alliance-supporting element was Andy's support of autonomy. Autonomy-support was included as part of supporting internalization of motivation; however, the empirical perspective suggests that Andy's autonomy-support was alliance-supporting as well. Andy was designed to support autonomy in that the user's choices and perspectives should always be respected; this turned out to be the opposite of social forcing. Social forcing (when purposeful) means trying to make the other person do what you believe is right – as exemplified with participants' family members who tried to conjure the participant into quitting through emotional sanctioning, or participants who experienced being ridiculed for wanting to quit again. When Andy instead engaged in autonomy-support, this gave participants change-space, and seemingly supported their alliance to the program. This indicates that there may have been a reciprocity between getting change-space and experiencing an alliance to Andy: that when Andy provided change-space, this strengthened the participants' alliance to Andy – however, this reciprocity would need to be investigated further empirically, as it was not analysed for specifically.

In conclusion, the empirical perspective on alliance (papers 3 and 4) confirmed certain aspects of the theoretical perspective (Paper 1), found no support for others, and uncovered some unanticipated alliance-supportive elements. Both perspectives suggested that alliance would be supported by making the program behave like a social actor, communicating with empathy and unconditional

acceptance, using Motivational Interviewing, and including a lapse management component. Unexpectedly, it was also found that alliance was supported through the *un*-aliveness of the program and through autonomy-support. Furthermore, as described previously in this dissertation, before embarking on this study I was not sure how specific conditions a potential person-to-program alliance would need to manifest, and I therefore designed the program to provide the best theoretical support for a working alliance. Although this section points to other possible elements of a person-to-program alliance, the alliance-processes I conceptualized in Paper 3 and pursued further in Paper 4 were making come-alive and keeping un-alive, which may not require special circumstances at all: while keeping un-alive is, as previously accounted for, the expected state of affairs; similar processes to making come-alive is identified in studies using highly different programs [15,17,18,70,71]. As such, there is reason to believe that the alliance-processes identified in Paper 3 are not contingent on the alliance-supporting elements described in Paper 1, but rather, represent a more general way of relating to automated eHealth programs. The issue of the models' transferability will be discussed more extensively in Section 5.2.

## 4.4. The methodological perspective's importance for the empirical findings

In this section, I will review the importance of the methodological perspective in Paper 2 for the empirical perspective in papers 3 and 4. The challenges and tools described in Paper 2 are purposefully described more generally to be relevant for as many qualitative eHealth studies as possible. Therefore, in the following I will review exactly which of the challenges described in Paper 2 arose in the data collection for this study, which of the methodological tools that were employed, and how it mattered for the findings presented in papers 3 and 4.

As accounted for previously, the first eight interviews of this dissertation's qualitative study had two purposes: getting feedback for program improvement (the formative study, Section 2.1.3.2.) and starting data collection for the qualitative sub-studies. The original interview guide was crafted to covering both purposes; however, moving the conversation beyond a superficial level of likes and dislikes was surprisingly difficult. Consequently, the interviews generated sparse data to inform the research questions of the qualitative sub-studies, especially how the participants related to Andy. Although some participants unsolicited referred to Andy as a "psychologist" or a "secret friend", the interviews' turn towards this way of talking about Andy was on their initiative and in that sense coincidental. Because it was the participants, not me, who brought the conversation on this level, I did not have data to either support or refute whether these other participants also thought about Andy as some kind of "therapist", leaving me no safe grounds on which to conclude how participants related to Andy. I did not want to give up on the research questions, and I did not want to settle for insufficient data based only on the accounts of a few participants. This spurred me to search for

other ways of conducting the interviews that could generate richer data; a process which led to several realizations of what had went "wrong" in the earlier interviews and what could be done to improve the next ones.

A fundamental problem with these early interviews was that most participants talked about the program in superficial terms – likes and dislikes, problems and ideas for improvement – and I could not seem to raise the conversation to a level where I would understand how they related to Andy. The methodological refinement process led me to identify this as emanating from two fundamental challenges: (1) mixing applied and basic research, and (2) achieving a joint understanding of the interview topic. The first problem was that I *was* asking questions about likes and dislikes – questions that would inform the formative study and help us improve the program. It seemed that starting with these questions set the tone for the interview, and subsequent questions – that were intended to tap into ways of relating – were answered in the same manner as the first ones. This is the challenge that I in Paper 2 call "mixing applied and basic research": gathering data to inform the development of a specific program while also gathering data to understand a fundamental question relevant to eHealth programs more generally, the transition between the two not being apparent to the participants. The mix generated lots of useful data for the applied research question, but not for the basic research questions.

Another challenge was that I was not really asking questions about how participants related to Andy; I was asking them to describe their subjective program experiences. I had been trained in conducting "participant-centred interviews" which centres around the participants' subjective experiences in a way that can be traced back to the Rogerian tradition of patient-centred interviews [97]. As such, I thought that the only way to get valid interview data was by asking descriptive questions about the participant's subjective experience [95], and that if I asked too direct questions about how participants related to the program (e.g. "do you think about Andy first and foremost as a therapist, a friend, or a program?"), it would automatically invalidate their responses as "speculative". Therefore, the interview guide was carefully crafted with various descriptive questions concerning program experiences that *might* lead the conversation onto aspects of relating, upon which I hoped to follow up with new questions that would lead me to an understanding of how the participant related to Andy. The problem was that most participants did not answer these descriptive questions in a way that provided such a "window" into how they related to the program. Presumably, the participants expected a standard "user interview" about their superficial experiences with using the program – such interviews permeate Western society, and many of us are often asked to evaluate a product we have been using. Furthermore, as I suggest in Paper 2, the interactional qualities of using an eHealth program may be largely invisible to the user, as we usually consider programs to be things (that do

not interact) and not actors (that interact). Therefore, the way of relating to Andy was not the most apparent aspect of most participants' program experiences and was therefore not the aspect they volunteered in response to my descriptive questions. This is the challenge that I in Paper 2 call "achieving a joint understanding of the interview topic".

One of the tools I used in the revised interview guide to counteract these challenges was structuring it into two topical blocks [96]: one for program improvement, the other for the qualitative sub-studies. At the beginning of the interview, I provided a general introduction of the interview's structure, and each topical block was introduced with a short explanation of its underlying intention. After the formative study was ended, subsequent interviews were structured with two other topical blocks: first one topical block concerning the participant's subjective experience, then a topical block based on the principles of epistemic interviewing [97]; that is, that I as an interviewer joined the participant in pursuing knowledge to inform the research questions. The reason for including both these topical blocks was that because relatively little is known about how people relate to eHealth programs, I wanted to both explore the participants' subjective experience in a participant-centred way, and to discuss my emerging understanding with them through joint knowledge production.

As previously accounted for, the epistemic interview section was introduced with interview vignettes [98–100] that illustrated different ways of relating to Andy based on the evolving analysis. In this section I also pursued any small indications of relating from the first interview section, such as signs of making come-alive (e.g. talking about Andy as "him") or keeping un-alive (e.g. consistently talking about Andy as "the program") together with the participant and asked for his/her views on different ways of relating and different needs regarding quitting smoking. Together, these tools were used for two of the purposes discussed in Paper 2: "structuring the dual-aim interview" and "clarifying and exhausting the interview topic".

In addition to the two aforementioned challenges, the final challenge that was keeping the initial interviews from generating sufficiently rich data was that participants would sometimes spend much time talking about things that were peripheral to the research topic – such as previous quit attempts, other quitting aids, or their motivation for quitting. Even when I succeeded in moving past these themes, participants would often return to them – perhaps because these were aspects that they wanted to share, or because these were easy topics to talk about. As an interviewer, I found it difficult to limit the time spent on these issues – I wanted the participant to feel that s/he was welcome to speak freely, but this meant that too little time was left for exploring the main purpose of the interviews. This is the challenge that in Paper 2 I call "not straying off the interview topic". The tool I used for counteracting this challenge was using an in-interview questionnaire, which was

included in the first topical block of the interviews (the participant-centred block). The questionnaire asked for demographic information and included more peripheral interview questions that from experience the participants would want to bring up anyway, or that might be of contextual value for the analysis but that I did not want to spend too much time on. I filled out this in-interview questionnaire together with the participants, and the questionnaire format communicated that I wanted short answers (because I would write them down). Among the questions in the questionnaire were whether the participant had tried quitting smoking before and the participant's reason for quitting. This tool dramatically changed how participants responded to a question such as "why did you want to quit smoking?" – from being interpreted as an invitation to start a narrative of many years of struggling to quit, to eliciting concise answers such as "to be a better role model for my children". Thus, including an in-interview questionnaire allowed for these themes to be covered while also setting aside more time for the next, more important interview section – what I in Paper 2 refer to as "keeping contextual answers short".

Paper 2 also discusses two challenges that are not mentioned here ("recalling program experiences" and "seeing through the social interview situation") along with suggestions for methodological refinement to meet these challenges ("aiding recall" and "arranging and analysing the interview situation"). In the early phases of analysis, before the main categories were conceptualized, I thought that these might be contributing factors to the insufficiently rich data. On several occasions, I experienced that participants had difficulties in recalling any specific program session. Furthermore, my early conceptualizations of making come-alive led me to wonder whether it may be a process associated with norm-breaching behaviour and that my presence as an interviewer inhibited participants from talking about it (this was also one of the main reasons for including reflection notes as an additional data source). However, later analysis made me consider making come-alive as a more global process of relating, not necessarily tied to a specific session, making it unnecessary to keep the interview conversation on any specific session. Moreover, although I did find indications of some participants experiencing embarrassment when making come-alive (e.g. giggling, laughing), the epistemic interviewing I later employed created an atmosphere of acceptance and made it possible to address such issues directly. I nevertheless included these challenges along with appropriate tools because I believed they might still be important for other qualitative interview studies of potential eHealth working mechanisms, although my specific research question and emerging analysis rendered them less important.

This process of identifying underlying challenges and employing appropriate tools was crucial for the data that informed the qualitative sub-studies: Structuring the dual-aim interview and keeping contextual answers short allowed for more interview time to be spent on the research questions of

the qualitative sub-studies, while interview vignettes and epistemic interviewing facilitated interview conversations that generated rich data on how the participants related to Andy and how they used Andy to quit smoking. This rich data – together with reflection notes – saturated the evolving models and answered the research questions of the qualitative sub-studies (papers 3 and 4). In particular, these tools led me to realize that some participants made come-alive within the program interaction although they only kept un-alive when they were talking about the program. This realization, in turn, was central for discovering that far from being a marginal experience, making come-alive was something most participants engaged in; as well as leading to the conceptual differentiation between a semi-social relationship (making come-alive and keeping un-alive when thinking about the program) and a semi-social interaction (making come-alive only within program sessions) (Paper 3). Another important finding made possible with the revised interview guide was the influence of keeping un-alive on getting change-space (Paper 4), which was a theme pursued with epistemic interviewing. Finally, this methodological refinement increases the validity of the qualitative sub-studies, an issue which I will turn to shortly. In sum, the methodological answer to this dissertation's guiding alliance-question offered in Paper 2 – that exploring a potential alliance with qualitative interviews might require methodological awareness and refinement – was essential for the empirical answer offered in papers 3 and 4 – that an automated eHealth program can indeed support a working alliance; an alliance which includes making come-alive and keeping un-alive as relational processes that both are instrumental in giving the program user change-space.

# 5. Validity and transferability of the proposed models

This section concerns the quality and usefulness of the qualitative sub-studies in papers 3 and 4; their validity and transferability. In this section, I will first clarify my views on validity in qualitative research before accounting for how validity has been sought ensured in the qualitative sub-studies. Thereafter, I will discuss the transferability (i.e. "generalizability") of the proposed models.

## 5.1. Validity

The question of how to assess the quality of qualitative studies has been extensively discussed [79,83,85,101,124–128], and there is no consensus on this issue [124]. Some researchers find the term "validity" too closely associated with the positivist ontology and epistemology of quantitative research, and instead use quality terms such as "authenticity", "credibility", "trustworthiness", and "goodness" [124]. However, I agree with researchers [79,102,124] who contend that "validity" is a useful concept, because it is an overarching concept that is immediately recognizable as a quality assessment that indicate that a study should be "sound", "just", "well-founded", and "not erroneous" or "reflective only of researcher bias" [124]. Furthermore, that although immediately recognizable, the validity-term does not have to be directly imported from its quantitative roots, but can be filled with meaning appropriate to the qualitative context, which will vary between studies [79,102,124]. Therefore, the validity of a specific qualitative study must be seen in relation to "the purposes and circumstances of the research" [124(p528)], and cannot simply rely on the correct application of specified methodological procedures [79,124]. This entails that the validity of a specific study must be discussed in relation to how the researcher has considered possible alternative explanations to the study's findings [79].

It follows from the quality-debate that the validity of a study's findings must be seen in relation to its ontological and epistemological background, or what is seen as constituting "reality" and "knowledge". As discussed previously (Section 2.3.), in this dissertation I take a stance of critical realism [79,80]. From a critical realist perspective, a valid model would be a model that portrays *one* true account of reality. This is because critical realism assumes an objective, "true" reality, meaning that an account of that reality can be more or less true. However, because it is also assumed that reality is always seen through a subjective lens, it follows that no account of reality can claim to be the only account. Therefore, the best I can strive for is that the account offered in this dissertation reflects reality in a sufficiently truthful way to be one of many possible true accounts.

Assessing a study's validity means judging the plausibility of competing explanations of its findings; that is, judging possible threats to the study's validity. Some validity threats can be anticipated when planning the study, and should be sought met through appropriate measures in the study design [79]. Before commencing on the study, I identified three potential threats to validity. The first was that I

might inadvertently impose a theoretical understanding of the alliance-concept onto the data, and subsequently find what I set out looking for – or, being bound by this alliance-definition, concluding that I found no alliance-processes. In order to avoid this, I "bracketed out" the alliance-concept from my understanding and exchanged it with the words "relating" and "change", on which I based the research questions. Thus, the interviews and the analysis did not involve searching for a potential alliance; they involved conceptualizing ways of relating and ways of using the program for supporting change. Another way of avoiding imposing a theoretical understanding of "alliance" onto the data was that I postponed the literature search on alliance until after the analysis was completed – in accordance with principles of grounded theory [22]. Consequently, the models in Papers 3 and 4 are grounded in the data, not derived from a theoretical understanding of an "alliance".

Another validity threat that worried me early in the study was the possible distorting effect of the social interview encounter. After the first six interviews, I had reason to believe that "relating" to a fully automated program might be associated with breaching social norms – norms of to whom (or what) it is acceptable to have a "relationship", and norms regarding use and attitudes towards technology. I was therefore concerned that by gathering data in a social situation – the interview – processes of relating might be obscured. This was the main reason for adding "reflection notes" as a data source: to gather data on relating through the program itself, without an interviewer present. This was therefore a form of methodological triangulation in which the innate validity threats of one method is sought overcome by adding another method [79] (as accounted for previously, an unanticipated advantage of including reflection note was that it provided a perspective of relating from "within" the program activity [113]; however, this was not the reason for including them in the study design). The analysis of the reflection notes confirmed the analysis of the interviews, suggesting that the social interview encounter did not pose a threat to the study's validity.

Another potential validity threat that I was aware of before commencing the study was the possible negative influences of my subjectivity; that the findings or analysis should be substantially distorted through my preconceptions, motivations, and so on, so that the final models would be a very selective view of the actual processes of relating and change. As accounted for previously, I have tried to avoid such negative effects through writing reflexive memos throughout the study [22,85,86], regularly confronting and questioning my subjectivity. Rereading my memos upon writing up the study confirmed to me that my understanding of the processes has transformed several times, as a response to being confronted with the data. This has strengthened my belief that through my subjectivity, I have remained true to the data, and that the model I present is one partial, potentially useful, explanation of relating and change through automated web-based interventions.

In addition to these validity threats, which have been sought contained through various measures, there may be validity threats – competing explanations for the findings – of which I am not aware. To minimize these potential and unknown threats, I have tried to retain transparency, and have in Paper 3, Paper 4, and throughout this dissertation sought to report all information that is thought to be important to report in qualitative methodology [129]. I have also strived for cultivating methodological rigor; being attentive, sensitive, respectful, reflective, conscientious, engaged, aware, and open (Davies & Dodd, 2002).

Another argument for this study's validity is associated with the use of epistemic interviewing [97] in the revised interview guide. In line with the principles of epistemic interviewing, I continuously tested my interpretation with the participants, and the participants verified (as well as nuanced and corrected) my interpretations *in situ* [97]. Therefore, by the end of an interview the participant and I had a shared understanding of how s/he had related to the program and how s/he had used it to quit smoking (this of course pertains to the last interviews when the models approached saturation and validation). This characteristic of epistemic interviewing can be seen as a form of "member checking" [79,126] in that my interpretations were "tested" with the participants [117], making it more likely that they were "not curtailed by the researcher's own agenda and knowledge" [126(p356)].

However, it should be kept in mind that the models are higher-order interpretations than the interpretations that were done in the interviews. Therefore, it cannot be said that the participants verified *the models* as the most correct representations of reality. Rather, the models are my final representations of the reality I witnessed; the results of a series of steps that I undertook, starting from the actual interview encounter and including transcribing, coding, sorting, organizing, and abstracting. For each step, information that I considered to be less relevant to the research questions was removed, while information that I considered to be relevant was condensed and abstracted, in a process similar to what Latour [84] describes as "circulating reference". Thus, the use of epistemic interviewing in this study does not provide an unequivocal validation of the final models. However, because the interpretations I offered in the interviews were done in light of these models, the use of epistemic interviewing ensured that the first steps of interpretation were shared by the participants, and that in this first step, my interpretation of reality coincided with theirs. This also means that the applications of the proposed models to real people and their quit attempts were clinically meaningful to the participants, which suggests that they may be *useful* – perhaps just as important as being valid.

## 5.2. Transferability

While I choose to use the term "validity" as a judgement of study quality, I find the term "generalizability" less suitable for qualitative research, because it seems to imply an indiscriminative application of a study's findings to the larger population from which the study sample was drawn. Instead, with qualitative research, I prefer the term "transferability". According to Guba [117], the qualitative researcher "does not attempt to form generalizations that will hold in all times and all places, but to form working hypotheses that may be transferred from one context to another depending on the degree of 'fit' between contexts" (p. 81) – what he calls the "transferring context" and the "receiving context". A similar process is referred to by Brinkmann and Kvale as "analytic generalization" [102(p297)]. Having taken a critical realist standpoint [79,80], I believe that it is possible for a study's findings to be transferrable to other people and contexts, because a valid study – although always influenced by the researcher's subjectivity – can nevertheless be one of several possible true accounts of reality. The question of a study's transferability is thus whether it is plausible that the findings rest on some idiosyncratic aspect of the study, which would limit their transferability.

The question, then, is how to assess whether the findings of a study are transferrable from the transferring context to a given receiving context. Guba [117] suggests to describe both the transferring context and the receiving context with a "thick description" (i.e. detailed descriptions of contextual elements ) – "to demonstrate an essential similarity between the two contexts" (p. 81). However, demonstrating essential similarity through thick descriptions becomes problematic if one does not know what these "essential similarities" are. The problem is that a "context" can be described with endless complexity and the question is which of these elements are important [105]. For example, two contexts (e.g. Norway and USA) can be similar in some respects (e.g. familiarity with technology) and dissimilar in other respects (e.g. healthcare system). Providing a "thick description" of both contexts can thus be a daunting task if one does not know which aspects to describe in detail. Another challenge with the approach suggested by Guba [117] is that it seems to require a defined "receiving context"; presumably, it would also be interesting to be able to say something about the general transferability of a study's findings to a variety of potential "receiving contexts".

Therefore, a different approach might be to tentatively delineate the assumed analytic boundaries of a study's findings. By analytic boundaries, I mean which contextual aspects are likely to have had a significant impact on the findings, in that if they were changed, it would be expected (or quite possible) that the findings would have been different. I will discuss two sets of boundaries in this qualitative study: (1) boundaries related to the eHealth program, and (2) boundaries related to the participants and their cultural context.

The first set of analytic boundaries concerns whether the findings are transferrable to other eHealth programs than Andy; this question is most pertinent for the relating-model (Paper 3). As reviewed previously, other studies report similar processes as making come-alive and keeping un-alive for other interventions [15,17,18,70,71]. Although the number of studies is not great, the interventions are highly disparate, with two programs including an embodied relational agent that performs verbal and non-verbal "socio-emotional" behaviour [15,17], one intervention that answered with a recorded human voice and let the users respond with the telephone keypad used [70], as well as two programs that did not use any relational agent at all [18,71] – one of which was a tailored and interactive web-page that the user could navigate at leisure [71]. Including Andy in this list – an eHealth program based on a text-based, unembodied relational agent – it seems that making come-alive and keeping un-alive are not tied to very specific program elements. However, whether some programs allow more program users to engage in making come-alive more often is yet unknown and is a question which would require empirical investigation. Nevertheless, the diversity of programs shows that making come-alive is possible as a response to many types of programs.

The second set of analytic boundaries concerns the participants and the cultural context; whether the findings are transferable to other program users than the ones who participated in the study. The dissertation's study sample was quite heterogeneous, suggesting that the findings are not tied to any specific gender, age, or socioeconomic status. Furthermore, the other studies that report examples that resemble making come-alive were conducted in different countries, including the United Stated of America [15,17,70], Denmark [71], and Australia [18], suggesting that the relating-model of Paper 3 is transferrable beyond the Norwegian context, at least to other Western societies.

Regarding the change-space model suggested in Paper 4 there is need to reconsider the second set of analytic boundaries, concerning the participants, the cultural context, and the target behaviour – because the model describes how an eHealth program can facilitate change-space, the behaviour change in question is of interest. Andy helps people to quit smoking – as reviewed previously in this dissertation (Section 2.5), smoking has been on a decrease in Norway over the last decades [88] and can be considered a stigmatizing behaviour. This suggests that the participants in this dissertation study might have experienced much social forcing for them to quit smoking; perhaps more so than if they were trying to change a different kind of behaviour. Thus, their need for change-space may have been greater, and their venues for finding change-space may have been fewer. In short, it may be that the change-space model is especially suited for explaining the first phase of eHealth-facilitated behaviour change when the target behaviour is stigmatized – if the behaviour is less stigmatized, there may be less need for change-space and the model may not be transferrable. However, it should be noted that stigma may be associated with most types of behaviour change – including

psychological change – because in many cases, there will be a common agreement that it would be better for the individual to change the target behaviour (e.g. reduce drinking, change an inactive lifestyle, or manage depression). Nevertheless, stigmatized behaviour is one potential analytic boundary for the change-space model, and special considerations should be taken before transferring it to explain the facilitation of behaviour change that is not – or less – stigmatized.

In sum, there is reason to believe that the relating-model and the change-space model proposed in this dissertation study may be transferrable to other eHealth programs and contexts. However, the transferability of the change-space model to behaviour change that is less stigmatized is a question in need of empirical investigation; as is whether the relating-model is transferable outside Western countries. Naturally, empirical investigation is necessary to ascertain any transferability of the models; however, the present discussion suggests that they are at least promising working hypotheses [117] for how other automated eHealth programs support stigmatized behaviour change in Western countries.

# 6. Strengths and limitations of the study

One limitation of this dissertation study is related to Paper 1 and concerns the application of the three therapeutic processes to the program. How these processes were applied could have been made even more transparent; for example, by including all program material in an appendix, marked with which change objective it was supposed to achieve and the theoretical methods that were used. Furthermore, more time could have spent searching the literature for best practice to inform program development, and more care could have been taken into crafting and re-working the text for each webpage in each session. Instead, the text was written in a race against the clock, because time restraints made it necessary to let the first participants start using the program before all sessions were completed. This need for high speed in the text production caused certain segments to be less well written than others. However, time constraints did not allow for a more thorough process, as the program had to be finished and the data collection for the study had to start. In sum, there are improvements that could have been made both to the program and to the reporting of the program. However, improvements can potentially always be made, and the program sufficed for its purpose, which was intended for further research.

A strength of the study in Paper 1 is that it focuses program description on three key processes. This focused description has the advantage of making the most important program facets more apparent to the reader, enabling critical examination of these facets and showcasing one way of applying them an eHealth program. I believe that another strength is the non-linear and idiosyncratic way each session was made (described in Section 2.1.3.1.): By basing the sessions on clinical experience and turn-shifting between the counsellor's role and the user's role, every individual session-path was treated according to what I judged to be its unique needs. This may have added a more "naturalistic" feeling to Andy than if all sessions had been pre-planned and cast in the same mould. Finally, the amount of tailoring on different levels is a strength of the program, making Andy flexible, moderately sensitive, and personalized.

Regarding Paper 2, it might have benefited from being designed as a study systematically testing different interview guides and comparing the resulting data in respect to their richness. However, this was beyond the scope of this paper, which is more a viewpoint article discussing the experiences made in this dissertation's qualitative study. I chose to include my co-authors' experiences from four other studies as well because I wanted the article to be as useful as possible to as many as possible. However, I acknowledge that this is not enough for the suggested challenges and tools to be considered universal to all similar studies, and that the explanation I present of the invisible eHealth interaction is a hypothesis that has yet to be empirically tested. Nevertheless, I believe that Paper 2

can be useful to other qualitative eHealth researchers embarking on an interview study. Moreover, the paper is arguably a strength to this dissertation study in how it provides insight to the methodological decisions inherent in the qualitative sub-studies, thus adding to their transparency.

Concerning the qualitative studies in papers 3 and 4, it might be argued that the relatively few participants is a limitation – the analyses in both studies were predominantly based on the 16 participants who were interviewed, with reflection notes only serving to saturate and refine the models. However, I agree with other qualitative researchers who contend that the quality of qualitative studies lies not within the number of participants, but in the quality of the data and the analysis [102,107,130]. These, I believe, lie within these studies' strengths. Moreover, it was possible to include more participants in the study, but I stopped interviewing because I judged the models to have reached theoretical saturation [22].

However, it should be noted that the concept "theoretical saturation" can be a problematic concept when used uncritically to justify the size of the study sample [22,107]. Although I judged the models to be theoretically sufficient when I stopped data collection, new questions emerged in the final phases of analysis and writing up: for example, what decided when a participant made come-alive and when s/he kept un-alive? Why did some participants not make come-alive at all – were they unwilling, or unable? Is the process of making come-alive driven by some change-related need, such as the need for change-space? However, pursuing all unanswered questions would have led to a daunting task and a presumably never-finished study (or dissertation). In truth, it is difficult to say when an analysis is ever "saturated" in the sense that no new questions emerge, and it is possible to argue that inductive studies such as the ones in this dissertation can always generate new questions [107]. That is, more data would presumably have answered some questions, but also generated new ones. As such, perhaps instead of calling a model theoretically "saturated" it would be more appropriate to say that it is theoretically "sufficient" [Dey, in 22]. In sum, despite of unanswered questions, I regard the models of papers 3 and 4 as theoretically saturated because they were able to answer all existing and incoming data in relation to the research questions in a way I believe to be useful.

Another limitation of the qualitative sub-studies is that the transferability of the models is uncertain. Although transferability is discussed theoretically in Section 5.2., the discussion could only allow me to conclude that the models are promising working hypotheses [117] for other programs and contexts; to ascertain transferability it would be necessary with empirical investigation of such other programs and contexts. A different study design might have added to the expected transferability of the models; for example, if the study had included participants using different programs for different target behaviours. However, this was beyond the scope of this study.

On a more conceptual level, there are limitations to what this study can tell us about a person-to-program alliance. These conceptual limitations will be discussed as suggestions for further research in Section 8.

A final limitation of the qualitative study is that it can be criticized for lacking focus and being too comprehensive. With the analysis being so comprehensive, it may have compromised the detail of the analyses, and more nuances and sub-processes might have become apparent if I had focused on one of these aspects. However, I saw it as important to describe both processes of relating and of change (because without change, relating to an eHealth program would be of little value), and I may not have realized how comprehensive my models of change were before writing up. Despite of the comprehensiveness of the study, I believe I have remained rigorous throughout the analysis. Moreover, although the models might have been more detailed had I focused on fewer aspects, I believe that they are potentially useful in their current form.

The qualitative sub-studies of papers 3 and 4 also have several strengths. Some of these strengths were alluded to earlier and lie within the data collection and analytic procedure: Firstly, the initial difficulties in getting sufficiently rich data to answer the research questions did not cause me to change analytic focus, but instead led me into a process of methodological refinement. This process resulted in an improved interview guide, which together with the additional data material from the reflection notes increased the quality and richness of the data so that they were able to answer the research questions. Importantly, this made it possible to pursue the purpose of exploring possible alliance-processes in automated therapy that has guided this dissertation work. Secondly, I believe I have undertaken a rigorous analysis, driven by the data but also leading to two full-fledged, abstract grounded theory models. My dual commitment to, on one hand, staying close to the data, while on the other, raising the analysis to their currently abstract level, made it possible to use these models to pursue the purpose of discussing the potential person-to-program alliance in light of the users' experiences. A third strength is that I have strived to remain reflexive and transparent throughout the study and in the process of writing up. Another strength lies within my multiple roles: from my position at the Norwegian Quit Smoking Line, to co-designing the program, to conducting the interviews, transcribing, and analysing, immersing me in the data and the topics under study. Moreover, as discussed previously, validity has been a concern from study design to writing up, and efforts have been made to increase the validity of the findings.

Finally, one of the strengths of this dissertation study is that it allows for tracing a potential person-to-program alliance from the design of the program (Paper 1), through the methodological aspects of the data collection (Paper 2), to an analysis of users' experiences (papers 3 and 4). This contributes to

the dissertation study's transparency and makes it possible for the different sub-studies to inform each other.

# 7. Ethical aspects

No significant ethical issues arose during the study. The interview topic was not especially sensitive; even though smoking is somewhat stigmatized in Norway, all the participants seemed to be comfortable in the interview and talked freely about smoking, quitting, and using the intervention. However, even though there were no serious ethical issues, research is wrought with small ethical dilemmas that must be dealt with as they arise, and this dissertation study is no exemption to this general observation. In this section, I will first reflect on a few such ethical dilemmas; then I will discuss some broader ethical issues that are relevant to this dissertation.

One such small ethical dilemma occurred when I called a participant to reschedule the interview. Because I was not planning to interview, I had no recording device available. However, as we started talking, I heard that she thought I had called to interview her and had started telling her story – in which smoking as well as quitting were entwined with shame, guilt, and identity issues. I decided to go through with the interview, because I did not want to reject this participant who already had started sharing her story with me – even though this meant not being able to record the interview and thus risking less "dense" data. The result of this decision was that the interview offered less rich data to answer the research questions; however, it was still useful, and the participant was heard and respected.

In another interview, an ethical dilemma arose out of the use of epistemic interviewing. According to Brinkmann [97], epistemic interviewing can bring about specific ethical issues because of the method's ideal of knowledge acquisition through the interviewer and participant testing each other's beliefs. As such, the interviewer can pose confrontational questions, because s/he tries to understand the topic under hand, not simply document the participant's feelings and experiences. The interview section in which this dilemma arose featured in the summary of Paper 4, in which a participant had felt socially forced when her friend asked her if she was motivated to quit smoking. This interview was conducted before I had conceptualized change-space and social forcing, and I did not understand the participants' reaction – from what she told, her friend's comment had sounded caring and quite innocent. Had this been a participant-centred interview, I would have disregarded my own reaction and asked her more about how the comment had made her feel. Instead, trying to understand, I shared my reactions with her, and said: "It was probably well intended – maybe it isn't that easy to support you?". The moment I had said it I felt the breaching of a norm – I had confronted her and challenged her, instead of following her lead (and possibly indicated something negative about her personality). In contrast to the previous ethical dilemma, in this dilemma I chose to follow the methodology in order to produce relevant data, at the potential cost of the participant's immediate welfare. However, although epistemic interviewing can lead to situations like these in

which the participant feels confronted, Brinkmann [97] argues that epistemic interviewing also means taking *what* the participant says seriously and meeting it with respect, and that in that sense it avoids the ethical issues concerned with participant-centred interviewing: "that human feelings are instrumentalized to achieve a successful outcome, namely a 'full disclosure' of the respondent's private world" [97(p1122)]. In the end, the participant's discomfort was presumably not too deep or long-lasting – although she immediately seemed to react to my question, she answered it factually, and we continued the interview in a pleasant and what seemed a mutually rewarding manner.

Another ethical dilemma consisted of handling differences in social status and differences with verbalizing psychological experiences. One participant seemed to find it difficult to engage in introspection and verbalizing psychological experiences in the way that I was asking for. His answers about how he had experienced using Andy seemed surprisingly superficial, and he had difficulties going beyond phrases such as that the program had "helped me psychologically". I assumed we must be misunderstanding each other and tried to rephrase my questions to make them clearer, with no luck. Finally, he said: "I understand that you want me to answer something else or something more, but I cannot put it any other way". This remark made me realize that I was making him feel inadequate or inferior. He probably had little experience in talking about feelings and psychological experiences – without doubt less so than me. I was ashamed that I might be making him feel inadequate just because he had less experience in this field than me (and impressed by his ability to meta-communicate on this issue). Trying to repair, I started adapting to his vocabulary and manner of speaking, in an effort to communicate equality. However, I soon realized that this was not working, nor was it particularly ethical – by trying to use a façade that was not mine and a manner of speaking that I could not adapt whole-heartedly, there was a chance I appeared to be mocking or patronizing him. Thus, the ethical and relational dilemma I tried to solve (while also conducting the interview on a factual level) was how to ask my questions in a way that he could understand and answer meaningfully, without on the one hand maximizing the distance between us and on the other hand appearing false or patronizing. I finally resolved this by retaining my own manner of speaking, but adopting terms and words that he introduced, trying to communicate between the lines that in this interview, we were both experts, but on different topics. This turned out to be the right strategy – at the end of the interview he thanked me, expressed that it had been a pleasant conversation, and said that he hoped I would call again for another interview. For my part, the interview had generated interesting data and I was able to place his experiences within my evolving models. Furthermore, the interview had given me an unanticipated and important lesson on the challenges of interviewing someone with different background than myself, and on navigating both the factual and emotional level of an interview simultaneously.

Taking a step away from these moment-to-moment ethical dilemmas, this study also bears relevance to broader ethical matters. One concern I had in the beginning of the study is what role technology and computers should have in human interaction. As described in Paper 1, Andy is designed to resemble a written conversation with a human and simulates therapist-supported interaction and therapeutic processes. In this sense, the research in this dissertation could be accused of contributing to the threat that new technology poses to job security [131,132]: We may increasingly find that sophisticated eHealth programs may take the jobs of counsellors, therapists, and other professionals who guide people towards change or decisions. Replacing human labour can be ethically problematic. However, as indicated earlier in this dissertation, there is still a need for facilitating behaviour change to counteract non-communicable diseases, which is a growing problem in developing countries [30]. Therefore, instead of taking people's jobs, interventions like Andy may meet a need that today is unmet. Furthermore, new technology may be able to reach people that are not reached with traditional therapy [37]. Additionally, automatic services can spend more time on individual emotional needs, "listening" empathically, and negotiating treatment plans than what is possible for busy health care personnel [15]. Hence, automated eHealth programs may offer opportunities for filling human voids; reaching people that are currently not reached and allowing for more thorough individual care than what is possible with current human resources.

Furthermore, even if new technology like Andy may entail changes to the labour market, these changes are not necessarily negative. New jobs may be created, and human labour may become increasingly about performing tasks together with advanced technology [133]. As such, new technology can also lead to a reorganization of society. Latour [84] argues that humans have always exchanged functions with technology: From the beginning of mankind, we have invented ways of using "things" (or what he calls "nonhumans") to perform previously human tasks, or to improve human performance. In the next shift, after the new technology has been established, we learn from the new situation and reorganize ourselves. Thus, although the new technology might seem threatening now, it may generate new jobs, new approaches to therapy and treatment, and new ways of organizing human society in a way that ultimately serves human welfare.

Another ethical consideration I had in the early phases of this dissertation study concerned whether supporting a person-to-program alliance was ethical. I had a vague sense that there was something wrong with relating emotionally to a program, and that I should not be contributing to it, neither through program design nor research. I had difficulties with getting a hold of these thoughts – they seemed to slip away when I tried to hold them. Also, I was intellectually fascinated by the thought of supporting a person-to-program alliance. Therefore, although the feeling sometimes crept up in the background, I did not allow it to change my path. Now I am glad, because in retrospect I think that

research such as the one featured in this dissertation contributes to the good. We are sociotechnical animals [84], and there is nothing wrong – or new – in weaving our life fabric with technological threads as well. If the next societal step includes humans developing working alliances to automated programs, this is just another step, nothing radically new – and not unethical. On the contrary, my research suggests that developing such alliances can be helpful (Paper 4), by helping people make changes they need to make in their lives.

Maybe the discomfort I felt was an expression of society's norms concerning relationships and technology – the same norms that caused the study participants to sometimes express embarrassment when making come-alive (Paper 3). If so, then it is possible to think that the research in this dissertation can help change these norms: By conceptualizing making come-alive as a potentially normal way of relating to an automated eHealth program, I am not only describing something but also creating something – "when worlds of meaning intersect, creative outcomes may occur. New forms of relating, new realities, and new possibilities may all emerge" [134]. The research in this dissertation may contribute to such a "new form of relating" – relating emotionally to automated programs as something normal. However, I suggest that this "new way of relating" consist of *both* making come-alive *and* keeping un-alive (Paper 3). In other words, the emotional relationships we may form to eHealth programs might never be *just like* an emotional relationship to another human being. Although we might experience positive (and negative) emotions and emotional attachment to automated programs through making come-alive, we will also be keeping un-alive; knowing, reminding ourselves, and interacting with technology as technology. This indeed is another way of relating than we do to other humans.

# 8. Practical implications and future research

This dissertation provides evidence for the person-to-program alliance, suggesting that it includes an emotional bond facilitated by making come-alive, as well as the relational process keeping un-alive. Furthermore, I propose getting change-space as a prerequisite for subsequent change-work, and that an automated eHealth program can facilitate change-space through how it is related to by the program users. These findings have potential practical implications.

Regarding program design, this dissertation's findings suggests that an eHealth program may benefit from supporting a person-to-program alliance, especially if the target behaviour is stigmatized (Paper 4). An alliance may be supported through a person-to-program emotional bond and through keeping un-alive. The emotional bond, in turn, is a result of the program user making come-alive combined with a positive judgement of the program interaction (Paper 3). Making come-alive can be facilitated by including a relational agent – which does not need to be embodied – while the interaction may be judged more positively if the program communicates empathy and supports autonomy, both of which can be achieved with computerized Motivational Interviewing (Paper 1).

Based on the findings in Paper 4, I also suggest that a person-to-program alliance is supported by keeping un-alive, suggesting that there are possible gains by also emphasizing the program as an inanimate object. This means that programs might benefit from including elements that emphasize their program qualities as well as their human-like qualities – for example in their visual design, in the administration of input and output, or by communicating to the user the program's incapability of actually understanding the user's input (in the case of programs that do not use natural language processing) or its' inability to become disappointed. Finally, an alliance can possibly also be supported by making the program sensitive to emerging needs, for example through components for supporting constructive lapse management (Paper 1).

Another practical implication of this dissertation is that it suggests methodological tools for conducting qualitative interview studies on more basic eHealth research questions. As argued for previously, there are a number of eHealth qualitative interview studies that seem to seek the answer to more basic research questions, but where the interviews have covered a broad range of purposes [71,115,116]. Paper 2 provides a methodological perspective and suggestions for methodological tools that other researchers may find helpful if they are interested in narrowing the focus of the interviews, especially if their interest lies with possible eHealth working mechanisms.

The dissertation's findings may also have implications for how the working alliance to eHealth programs are measured. So far, the status of the person-to-program emotional bond has been

unclear; therefore, researchers have either used measures that do not include an emotional bond [20], adapted the Working Alliance Inventory (WAI) in a way that deemphasizes the role of a potential emotional bond [11], or only superficially altered the wording of the WAI in a way that presupposes an emotional bond as a part of the person-to-program alliance [15,18,60]. According to this dissertation study, a person-to-program bond is potentially a normal way of relating to an eHealth program and should therefore not be disregarded in alliance-measures, as this may underestimate the alliance. On the other hand, people do not make come-alive all the time. Therefore, if a person is asked to rate the emotional bond to a program when s/he is keeping un-alive, the person will presumably rate the bond as low – because the questions will not make sense, as the person at that moment is thinking about the program as an unalive object and not a social actor. This may therefore also underestimate the alliance, especially for people who mostly experience a semi-social interaction (i.e. keeping un-alive when thinking about the program but making come-alive within program sessions). Further research into the role of making come-alive and keeping un-alive is needed to inform more appropriate measures of a person-to-program alliance.

This dissertation also suggests other directions for future research. Firstly, as discussed previously, the transferability and usefulness of the proposed models of relating and change-space should be investigated empirically. Furthermore, the change-space model would benefit from being expanded to include what happens once a person *has* change-space; this is something I will be pursuing in future publications (Holter, Ness, and Brendryen, *manuscript under preparation*).

As previously remarked upon, this study also has certain conceptual limitations regarding what it is can tell us about the person-to-program alliance; these are possible venues for future research. Regarding the person-to-program emotional bond, it is unclear whether making come-alive in a semi-social *interaction* is enough for the program user to experience an emotional bond, or whether the emotional bond also requires thinking *about* the program as a social actor in a semi-social *relationship*. Furthermore, it might be useful to achieve a better understanding of when program users engage in making come-alive and when they engage in keeping un-alive (and why). Although I suggest that keeping un-alive may serve a self-protecting function if the person feels threatened by social forcing from the program, this is yet an unverified hypothesis. A related question has been breached upon earlier, and concerns whether there are program features – for example a relational agent – that makes more program users engage in making come-alive more of the time. Whether making come-alive and keeping un-alive emanates from specific needs, personality features, specific program elements, or other processes is a possible area of investigation that would reveal more about the person-to-program emotional bond and how it might be harnessed to maximize the helpfulness of such programs.

Another possible direction for future research concerns the person-to-program alliance more broadly. Although this dissertation provides evidence for a person-to-program emotional bond and that it is useful for giving program users change-space, this does not amount to evidence that an emotional bond is a *necessary* part of an alliance in automated therapy. I found that the supportive social presence enabled by making come-alive gave participants change-space by making them feel supported and encouraged (Paper 4); however, it is theoretically possible that similar processes can be facilitated by keeping un-alive. As also found in this dissertation study, there were quite a few participants who did *not* make come-alive in a non-social interaction with Andy; the current analysis does not account for whether these and similar program users benefited less from the program, or whether they benefited, but in a different way. This leads to a more general question of how a person-to-program alliance should be defined, the answer to which will require more research effort. There is also a need to explore how a person-to-program alliance influences other change-processes than the one identified in this study, and the role of making come-alive and keeping un-alive for facilitating these.

In conclusion, this dissertation study has explored the question of a working alliance in automated therapy from different perspectives, starting with a program developed specifically to support a working alliance, continuing with developing a specific methodology for exploring a potential alliance through qualitative interviews, and finding empirical support for a person-to-program emotional bond, as well as that eHealth programs may facilitate constructive change-work through how program users relate to them. As such, this dissertation suggests that the working alliance may indeed be an eHealth working mechanism, and that supporting an alliance by facilitating making come-alive and keeping un-alive may make eHealth programs more effective. Furthermore, this dissertation work has led to the conceptualization of two theoretical, eHealth-specific models: a model for relating and a model of change-space. While the relating-model can be used to locate program users within a landscape of relating, from a non-social interaction, to a semi-social interaction, to a semi-social relationship; the change-space model explains how an eHealth program can facilitate one specific change-process, including specific elements of eHealth programs such as the absence of another human and the possibility for interactivity. As such, both models represent eHealth-specific theories taking into account the uniqueness of this medium, and contributing to our understanding of what works so that eHealth programs can be made more effective [54,56]. By becoming increasingly effective, eHealth programs may continue to fill the voids where humans fall short and be used together with human professionals to provide better help for people in need. Through such efforts, eHealth programs may become part of a solution for improving the health of

the world's peoples, preventing and managing disease and thus improving the conditions of mankind.

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# Original change model of “Endre”

**Health behaviour: Quitting smoking and staying smoke-free through the help of “Endre”**

| PERFORMANCE OBJECTIVES | PERSONAL DETERMINANTS | | | | |
|---|---|---|---|---|---|
| | Internalized motivation | | | | |
| | Relatedness | | Competence | | Autonomy (Aut) |
| | To the program (RelP) | To social network (RelSN) | Skills (Ski) | Self-efficacy (SE) | |
| **PO1: Decide to quit smoking and plan how to do it.** | **RelP.1a:** Experience the program as a social actor.<br><br>**RelP.1:** Experience the program as:<br>b) Accessible.<br>c) Potentially helpful.<br>d) Empathic, warm, genuine, and unconditionally accepting.<br>e) Having general expertise on smoking | **RelSN.1a:** Make a public commitment to the quit attempt.<br><br>**RelSN.1b:** Choose a “support person” from one’s personal network. | **Ski.1a:** Identify personal smoking cues and be able to detect smoking urges and cravings early.<br><br>**Ski.1b:** Prepare to handle cravings.<br><br>**Ski.1c:** Make an action and coping-plan for the quit attempt. | **SE.1a:** Believe it to be possible to quit smoking and stay smoke-free.<br><br>**SE.1b:** Express confidence in one’s ability to execute the cessation plan. | **Aut.1a:** Commit to the quit attempt.<br><br>**Aut.1b:** Decide whether or not to make a public commitment to the quit attempt.<br><br>**Aut.1c:** Decide whether or not to engage a “support person” in the cessation attempt.<br><br>**Aut.1d:** Choose how to make the quitting plan (by oneself or a more guided version). |

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| | cessation that can be combined with the user's expertise on herself.<br>f) Trustworthy.<br>g) Responsive to user input.<br><br>**RelP.2h:** Choose a special theme to influence the program content.<br><br>**RelP.2i:** Understand how to use the program and do the exercises. | | **Ski.1d:** Identify one's high-risk situations, and make an action and coping-plan for handling them. | | **Aut.1e:** Combine the advice of the program with one's own style and preferences. |
| **PO2: Initiate the quit attempt and stay smoke-free for the first three days.** | **RelP.1d-g, i** | **RelSN.2:** Request support from the "support person" as needed. | **Ski.2a:** Implement action- and coping-plan for the quit attempt.<br><br>**Ski.2b:** Get rid of remaining cigarettes and smoking accessories. | **SE.2:** Express confidence in one's ability to stay smoke-free the first three days. | **Aut.2a:** Revise the action- and coping-plan if needed.<br><br>**Aut.2b:** Decide whether or not to get rid of remaining cigarettes, or whether to make the cigarettes less accessible. |

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| | | | **Ski.2c:** Withstand cravings and cope with withdrawal symptoms. | | |
| **PO3: Maintain the quit attempt over time (from day 4 and onwards).** | **RelP.3:** Experience the program as:<br>a) Sensitive and adjustable if new needs emerge.<br>b) Suiting one's own preferences and style.<br><br>**RelP.3c:** Continue with the program for as long as needed, and if necessary return to the program after a period of disengagement. | **RelSN.3:** Ask the "support person" for help and support/reinforcement to the extent that is needed. | **Ski.3a:** Identify and counteract thought-patterns that could lead to a (re)lapse ("lapse signatures").<br><br>**Ski.3b:** Follow plans for high-risk situations.<br><br>**Ski.3c:** Stay smoke-free, also in social situations and at parties.<br><br>**Ski.3d:** Be able to imagine one-self as smoke-free. | **SE.3a:** Express confidence in one's ability to stay smoke-free in high-risk situations.<br><br>**SE.3b:** Express confidence in staying smoke-free in the long run. | **Aut.3a:** Decide to what degree, when and how the "support person" is needed.<br><br>**Aut.3b:** Know that staying smoke-free or not is one's own choice.<br><br>**Aut.3c:** Attribute success in the cessation attempt internally.<br><br>**Aut.3d:** Decide not to think too far ahead if doing so creates counterproductive, negative stress. |

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| **PO4: Resume the quit attempt after a lapse and use the lapse as a learning experience.** | **RelP.1d, f-g, RelP.3a-b** | **RelSN.4:** Be able to explain the difference between a lapse and a relapse to significant others in order to gain their understanding for the lapse and support for the continued quit attempt. | **Ski.4a:** Know the difference between a lapse and a relapse.<br><br>**Ski.4b:** Get rid of any spare cigarettes after a lapse.<br><br>**Ski.4c:** Resist new urges to smoke. | **SE.4:** Express confidence in one's ability to continue with the quit attempt after a lapse. | **Aut.4a:** Know that whether to keep smoking or keep quitting is a matter of one's own choice.<br><br>**Aut.4b:** Know that whether or not to be completely abstinent of cigarettes is one's own choice. |

## Comments

All the change objectives under the determinant "Relatedness to the program", except RelP.1a, are derived from Barazzone and colleagues' paper on working alliance in fully automated computerized Cognitive Behavioural Therapy programs [1]. Change objectives SE.1a and Aut.1e is also based on this study. RelP.1a is derived from the work of Bickmore and colleauges [2].

Change objective RelSN.3 is based on a Cochrane review [3] that suggests two types of partner behaviours as important: Helping behaviour ("such as talking the smoker out of taking a cigarette") and emotional reinforcement of the individual's efforts [3].

Change objective Ski.3a is greatly inspired by a Norwegian book on health behaviour change by Prescott and Børtveit [4], as well as a book on mindfulness [5].

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## Methods- and materials table

The three processes are simulated through combining change objectives with methods into practical applications. Cells in blue influence therapeutic alliance. All cells influence internalized motivation. Cells in bold and with an * influence behaviour maintenance through lapse prevention.

| Change objectives | Methods | Applications |
|---|---|---|
| 1. Experience the program as a social actor [1]. | Relational agent [1]<br>Dynamic tailoring | "Endre" refers to "himself" in the first person tense. Every session starts with a greeting and ends with a farewell, both appropriate to the time of day the user logs on. If the user logs on before 12 AM, "Endre" says "Good morning" and "Have a nice day". If she logs on between 12 AM and 6 PM, "Endre" says "Hello" and "Have a nice day". If she logs on after 6 PM, "Endre" says "Good evening" and "Enjoy your evening". "Endre" also occasionally uses humour, and can refer to previous "conversations" with the user. |
| 2. Experience the program as helpful, empathic, warm, genuine, unconditionally accepting, trustworthy, and responsive [2]. | Relational agent [1]<br>MI: The spirit of MI, asking open questions, using complex reflections [3–5]<br>Dynamic tailoring | "Endre" displays the cMI spirit through the text to communicate helpfulness, empathy, and trustworthiness.<br>"Endre" displays empathy through multiple choice questions paired with tailoring to provide complex reflections.<br>"Endre" is responsive by using tailoring to respond to user input on the subsequent page. |
| 3. Be aware of one's Influence on program content (negotiating goals). | Dynamic tailoring<br>MI: Asking questions, using reflections | In the first session, the user is asked to choose one of five "special themes" (weight, identity, party-smoking, stress, and handling emotions) to be covered during the program. "Endre" underscores the fact that now the user has an opportunity to influence the program content (to maximise the effect of "negotiating"). The user chooses a topic, and on the subsequent page the chosen topic is reflected back to her ("Right, I'll make sure we cover X during our conversations"), again to create awareness of the fact that she has influenced the program content. |

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| | | Later, dynamic between-session tailoring is used to give the user two special sessions on the chosen topic during the program. |
| 4. Understand how to use the program and do the exercises [2]. | Relational agent [1]<br>MI: Offering information [3]<br>Modelling [6] | "Endre" explains program features that might be difficult to understand.<br>Four fictional "quitters" demonstrate how to answer certain questions. Their answers can be revealed by clicking on their images. |
| 5. Make a public commitment to the quit attempt.<br><br>6. Choose a "support person" from one's personal network.<br><br>13. Decide whether or not to (a) make a public commitment, and (b) engage a "support person". | MI: Asking questions, using complex reflections, conveying MI-spirit [3–5], offering information, handling sustain-talk and discord [3].<br>Modelling [6] | Public commitment: "Endre" asks the user if she will tell people that she will quit smoking. The four fictional "quitters" tell model stories on (a) committing publically with no problems, (b) committing publically and overcoming problems, (c) doubting whether to commit publically and overcoming doubts, and (d) deciding not to make a public commitment because of valid personal issues. If the user says she will not make a public commitment, "Endre" asks the user if she wants "his" advice. By clicking on the question, the user reveals the advice (the user is advised to make a public commitment). The user is again if she will tell people about quitting. If the answer again is negative, "Endre" handles this "discord" by reflecting and refocusing onto next topic. If the answer is positive, "Endre" gives a complex reflection and affirmation.<br><br>"Support person": Same procedure, but without the model stories. |
| 7. (a) Identify personal smoking cues and (b) be able to detect smoking urges early. | MI: Asking questions, using reflections [3,4]<br>Dynamic tailoring<br>Prompting self-monitoring of behaviour [6]<br>Modelling [6] | The user is asked to identify personal smoking cues from a list. Through tailoring, her answers are reflected back to her.<br><br>The user is given a "home assignment" to write down when, where and why she smokes. "Endre" explains that it will be easier to quit once the user has a better understanding of the antecedents of smoking. Two of the fictional "quitters" tell stories of having objections with the |

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| | | exercise, but doing it and being rewarded with increased understanding. After two days, the user is asked to report on what she has found out. |
| 8. Make an action and coping-plan for the quit attempt.<br><br>14. Choose how to make the quitting plan (by oneself or a more guided version). | MI: Asking open questions, using direct and complex reflections [3,4], choosing a planning scenario [3].<br>Dynamic tailoring | The user is asked if she already knows what to do when quitting, or if she wants some help. If the user already has a plan, "Endre" asks what the plan is and then the user may write it down in a text box, and on the subsequent page the plan is reflected back to the user. If the user wants help in making the plan, "Endre" asks a series of questions regarding how to quit (open questions and text boxes): (1) tapering or quitting "cold turkey" (2), how to prepare the day before quitting day, (3) what to do with remaining cigarettes, (4) what to do the actual quitting day, (5) planning self-rewards, and (6) how to handle the urge to smoke. The answers are reflected back to the user in a final cessation plan. |
| 9. (a) Identify one's high-risk situations, and (b) make an action- and coping-plan for handling them. | MI: Asking open questions, using direct and complex reflections [3,4], offering information, reminding [3].<br>Dynamic tailoring | The user is asked to identify her high-risk situations from a list. Through tailoring, her answers are reflected back to her. "Endre" proposes three general strategies for handling those situations (avoiding the situation, removing oneself from the situation, using a strategy to handle the urge to smoke). By clicking on the suggestions, the user reveals more detailed information on them. The user is reminded of her "smoking urge strategies" and is then asked to make a plan for staying smoke-free in high-risk situations (free text). The plan is directly reflected back to the user. |
| 10. Believe it to be possible to quit smoking and stay smoke-free.<br><br>11. Be confident in one's ability to execute the action- and coping plan.<br><br>21. Be confident in one's ability to stay smoke-free the first three days.<br><br>28. Be confident in (a) one's ability | MI: Confidence-ruler, reflecting change-talk [3,5]<br>Dynamic tailoring | "Endre" asks the user how certain she is that she will be able to quit/remain smoke-free. The user may choose from five statements representing low to high self-efficacy. "Endre" reflects the user's answer, and asks why she did not choose a statement representing a more pessimistic alternative. The user writes her answer in a text box, and this change-talk is directly reflected |

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| to stay smoke-free in high-risk situations, and (b) one's ability to stay smoke-free in the long run.<br><br>**34*. Be confident in one's ability to continue with the quit attempt after a lapse.** | | back to her.<br><br>If the user answers the lowest degree of self-efficacy, she is asked what she might do to feel more optimistic. This is also considered change-talk and reflected back to the user.<br><br>In some occasions, numbers are used instead of statements. |
| 12. Commit personally to the quit attempt, and know one's personal reasons for doing so. | MI: Confidence-ruler, reflecting change-talk [3,5]<br>Dynamic tailoring. | Same as the above, only now the user is asked to what degree she believes that she will follow through with her cessation plan. |
| 15. Combine the advice of the program with one's own style and preferences. | MI: Conveying the spirit of MI (autonomy), asking questions, reflecting [3,5]<br>Modelling [6] | Upon offering advice, "Endre" stresses that the user knows best what is best for her. When "Endre" gives a general advice, the user must write a personal application of that advice in a text box. The user's text is reflected back to her. The four fictional "quitters" demonstrate different applications of an advice that are compatible with their different personalities. |
| **16*. Experience the program as: (a) Sensitive and adjustable for emerging needs, and (b) suiting one's own preferences and style** [2]**.** | MI: Asking questions [3,4]<br>Dynamic tailoring | During the course of a session the user is asked several questions, which through tailoring take the session in different directions. |
| 17. Ask the "support person" for practical assistance and emotional support as needed.<br><br>24. Decide to what degree, when and how the "support person" is needed. | MI: Reminding, asking questions, direct reflections | In the follow-up phase, "Endre" occasionally reminds the user of her plan to engage a "support person" (e.g. "Maybe (Name) could give you some support now?"). In a special session, the user is asked if she wants advice on what to ask the "support person". By clicking on the question, the user reveals the advice (examples of asking for practical assistance and emotional support). The four fictional "quitters" provides model stories of (a) having no "support person" but managing, (b) asking for and receiving maximum support, (c) receiving support, but also negative behaviour and correcting that negative behaviour, and (d) not needing support. The user is asked to write (free text) what she needs from the "support person". "Endre" gives a direct reflection of the user's answers. |
| 18. Implement action- and coping- | MI: Asking questions, reflecting, | "Endre" reminds the user on her |

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| plan.<br><br>19. Get rid of remaining cigarettes and smoking accessories.<br><br>20. Withstand cravings and cope with withdrawal symptoms.<br><br>22. Revise the action- and coping-plan if needed.<br><br>23. Decide whether or not to get rid of remaining cigarettes, or whether to make the cigarettes less accessible. | conveying the MI-spirit (affirmation), [3–5] offering information, reminding, handling sustain-talk and discord [3].<br>Dynamic tailoring | quitting day of her cessation plan. "He" also recommends to the user to revise the plan if she is no longer satisfied with it. "Endre" then asks if the user has any cigarettes left. If the user answers no, "Endre" reflects and affirms. If the user answers yes, "Endre" asks if "he" may give an advice. By clicking on the question, the user reveals the advice (to get rid of cigarettes). If the user answers that she wants to keep the cigarettes, "Endre" reflects this decision and refocuses onto the next topic. The user is reminded of her smoking cues and recommended to remove as many as possible. Finally, "Endre" reminds the user of her "smoking urge strategies". |
| **25*. Continue with the program for as long as needed, even after a period of program disengagement ("rupture prevention and repair")** [2]**.** | Dynamic tailoring | The program is designed to be flexible, and a user that seldom logs on to the program only receives the most important sessions. Program length is also adjusted according to user behaviour. Dynamic tailoring ensures smooth transitions. |
| 26. Identify and counteract thought-patterns that could lead to a (re)lapse. | Persuasive communication [6] | "Endre" tells the user stories about two of the fictional "quitters", and how small decisions they made led to a lapse. The user is asked to think about how this might apply to her cessation attempt. |
| 27. Follow plans for high-risk situations. | MI: Asking open questions, reflecting, conveying the MI-spirit (affirming) [3–5], reminding [3].<br>Active learning [6] | "Endre" asks the user if she has encountered any high-risk situations so far. If the user has been smoke-free in some of these situations, "Endre" provides affirmation and asks what she did to remain smoke-free (text box). The user's answer is reflected directly back. If the user has not been smoke-free in any high-risk situations, "Endre" provides an empathic reflection and asks the user what she has learned which can make it easier to stay smoke-free next time (text box). The user's answer is reflected directly back. If the user has not encountered any high-risk situations yet, "Endre" reminds her of her plan for high-risk situations. |
| 29. Attribute success in the | MI: Asking open questions, | "Endre" asks the user who can |

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| cessation attempt internally. | reflecting, conveying the MI-spirit (affirming) [3–5]<br>Modelling [6] | take the credit for her successful quitting, and the user may choose from a list of alternatives. If the user chooses herself as the credit for success, “Endre” reflects and affirms this. If the user chooses someone else, “Endre” politely says that this time the user is wrong, because it is the user’s credit. Then, two of the fictional “quitters” provide two different modelling stories of how they used to externalize the reason for smoking, and how they for different reasons suddenly realized that they themselves were in charge of the behaviour. |
| **31*. Know the difference between a lapse and a relapse.**<br><br>**30*. Explain the difference between a lapse and a relapse to significant others to gain their continued support.** | Using imagery [6]<br>Using advance organizers [6]<br>MI: Asking open questions, reflecting, conveying the MI-spirit (affirming) [3–5], offering information [3]. | The user is explained the difference between a lapse and a relapse though comparing lapsing with puncturing a car and changing the tire to get back on the road. “Endre” asks rhetorically what this has to do with quitting smoking, and by clicking on the text, the user reveals the meaning of the analogy to recovering from a lapse. “Endre” also shows the user an image of a circle which illustrates four steps in the self-regulation process to go from a lapse and back to being smoke-free.<br><br>If the user reports a lapse, “Endre” asks if she finds it difficult to explain the lapse to others. If the user answers no, “Endre” reflects this and gives an affirmation. If the user answers yes, “Endre” asks the user if she wants “his” advice. By clicking on the question, the user reveals the advice (to use the image of the car or the circle to explain). |
| **32*. Get rid of any spare cigarettes after a lapse.** | MI : Asking questions, conveying MI-spirit (affirming) [3–5]<br>Persuasive communication [6] | If the user reports a lapse and decides to keep quitting, “Endre” asks if she has any cigarettes left. If the user says no, “Endre” reflects and provides an affirmation. If the user says yes, “Endre” advices the user to get rid of it. |
| **33*. Resist new urges to smoke.** | MI: Reminding [3], asking questions, reflecting [3,4] | “Endre” reminds the user of the two general possibilities of either leaving the difficult situation or using a smoking urge strategy. If |

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| | | the user wants, “Endre” reminds her of her smoking urge strategies. |
| **35*. Know that whether or not to remain smoke-free is a matter of one’s own choice.** | MI: Asking questions, giving complex reflections [3,4], reminding [3].<br>Using imagery [6] | If the user reports a lapse, “Endre” reminds her of the car-analogy, emphasizing that now she has a choice. The choice is illustrated with a car at a crossroad, next to a sign. “Endre” then asks the user what she wants to do: Keep quitting or keep smoking. |

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## Overview of the sessions in Endre

| Session number | Topic | Content |
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| **PREPARATION PHASE** | | |
| **1** | Introduction | Introduction of the program.<br>The user may choose a special theme that will be addressed during the program:<br>1. Managing one's weight as smoke-free<br>2. Handling stress as smoke-free<br>3. Handling strong emotions as smoke-free<br>4. Establishing a smoke-free identity<br>5. Being smoke-free/smoking at parties. |
| **2** | Eliciting change-talk: Reasons and need | • Elicits and reflects the user's reasons for quitting.<br>• Asks the user how important quitting is to her ("need ruler" – see "confidence ruler" in Multimedia Appendix 3). |
| **3** | Handling smoking urges | • Strategies for handling the urge to smoke.<br>• The user gets general advice and is asked to make personalized "smoking urge strategies".<br>• The user also gets a «home-assignment»: To pay attention to and note down her «smoking cues». |
| **4** | Making a quit plan<br>Eliciting change-talk: Commitment | Making a plan for the quit attempt.<br>One of two possibilities:<br>1. If the user has a clear plan, she is asked to write it down.<br>2. If the user wants help in making a plan, she is guided through five questions:<br>a) "Will you reduce your cigarette smoking before quitting, or will you quit «cold turkey»?"<br>b) «What do you need to do the day before you quit?»<br>c) «What will you do with any cigarettes you might have left?»<br>d) «What will you do the day you quit?»<br>e) «How will you make sure to take care of yourself along the way?»<br>f) «What can you do when you get the urge to smoke?»<br>g) "Endre" adds how the user plans to handle smoking urges (user input from the last session).<br>After the plan is made, the user is asked whether or not she intends to follow through with it ("commitment ruler" – see "confidence ruler" in |

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| | | Multimedia Appendix 3). |
| **5** | Social support and public commitment | • Choosing a «support person» from the user's social network.<br>• Telling others about quitting (making a public commitment).<br>• If the user does not have anyone to ask for a "support person", "Endre" says that she is fully capable of quitting on her own, together with "his" support. |
| **6** | «Smoking cues» and withdrawal symptoms | • Following up on the «home-assignment»: What are your «smoking cues»?<br>• What withdrawal symptoms to expect, and how to minimize them. |
| **7** | Values and goals exploration | Identifying the user's life values. Asking the user how smoking and quitting smoking suit these values. |
| **8** | Psycho-education: Lapse management | The difference between a lapse and a relapse.<br>How to go back to quitting if you experience a lapse. |
| **9** | High-risk situations | • Identifying high-risk situations, taking the user's «smoking cues» as a starting point.<br>• Making a plan for handling high-risk situations. The user gets general advice (avoid the situation, leave the situation or use a "smoking urge strategy") and is asked to make a personalized plan.<br>• Confidence ruler: Staying smoke-free in high-risk situations. |
| **10** | Eliciting change-talk: Self-efficacy | Eliciting and strengthening the user's belief, or self-efficacy, in her ability to quit smoking («confidence ruler»). |
| **QUITTING PHASE** | | |
| **11** | Confirm quit-attempt | The user is asked if she has quit smoking.<br>1. If the user answers yes, "Endre" congratulates and asks about her self-efficacy for staying smoke-free the rest of the day. The user then moves on to the follow-up phase.<br>2. If the user answers no, she is reminded of her plan to quit (user input from earlier session). |
| **12** | Confirm quit-attempt | If the user answered no last session, she receives a new session the next day asking if she has quit.<br>1. If the user answers yes, "Endre" congratulates and asks about her self-efficacy for staying smoke-free the rest of the day. The user then moves on to the follow-up phase. |

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| | | 2. If the user answers no, “Endre” asks if she intends to quit tomorrow.<br>a) If the user answers yes, the session is ended.<br>b) If the user answers no, “Endre” asks if this is because tomorrow for some reason is not a good day, or if the user is feeling unsure about quitting.<br>1. If the user answers that tomorrow is not a good day, “Endre” accepts, but says that “he” will still ask her if she has quit tomorrow, just in case.<br>2. If the user answers that she is unsure about quitting, “Endre” offers help (self-efficacy or motivation). |
| **13** | Confirm quit-attempt | If the user answered that she had not quit last session, she receives a new session the next day asking if she has quit.<br>1. If the user answers yes, “Endre” congratulates and asks about her self-efficacy for staying smoke-free the rest of the day. The user then moves on to the follow-up phase.<br>2. If the user answers no, “Endre” asks her if this is because she wants to quit, but does not feel ready yet; or if she is unsure whether or not she wants to quit.<br>a) If the user answers that she does not feel ready, “Endre” offers advice. The advice is to stop postponing, because the time for quitting may never be “right”.<br>b) If the user answers that she is unsure whether or not she wants to quit, “Endre” offers help (self-efficacy or motivation). |
| **14** | Confirm quit-attempt | If the user answered that she had not quit last session, she receives a new session the next day asking if she has quit.<br>1. If the user answers yes, “Endre” congratulates and asks about her self-efficacy for staying smoke-free the rest of the day. The user then moves on to the follow-up phase.<br>2. If the user answers no, “Endre” says that |

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| | | "he" believes in her, and that "he" will ask again tomorrow. The session is repeated until the user confirms having quit (or stops logging on). |
| **FOLLOW-UP PHASE** | | |
| **15** | Eliciting change-talk: Self-efficacy | Confidence ruler: Self-efficacy for staying smoke-free for the rest of the day. |
| **16** | Eliciting change-talk: Self-efficacy | Confidence ruler: Self-efficacy for staying smoke-free for the rest of the day. |
| **17** | Special theme | The user's special theme, chosen in session one.<br>One of the following:<br>• Weight: Making a plan for maintaining one's weight when quitting smoking.<br>• Stress: Learning coping skills for handling stress without smoking.<br>• Strong emotions: Learning coping skills for handling strong emotions without smoking.<br>• Identity: Identity exercise: Who am I as smoke-free?<br>• Smoking at parties: Staying smoke-free (or not) at parties, and how. |
| **18** | High-risk situations | The user is asked if she has been in any high-risk situations. If she has, she is asked if she has been smoke-free in any of them. |
| **19** | Detecting and stopping a lapse | How to stop a lapse before it occurs.<br>Reminder: The user's reasons for quitting. |
| **20** | Social support | How to get the best support from the "support person". The user is asked to specify what she needs (both of practical help and emotional support), and to specify if there is anything she wants the "support person" to *stop* doing. She is encouraged to share these thoughts with her "support person".<br><br>Users who did not find a "support person" get a different session, where "Endre" acts as a support person: Reminding her to use the program for support and inspiration, and telling her how well she has done so far on her quit attempt. |
| **21** | Internal attribution of success | Reminder: Everything the user has achieved is due to her own efforts. |
| **22** | Eliciting change-talk: Self-efficacy | Confidence ruler: Self-efficacy for staying smoke-free. |
| **23** | Special theme | A new session on the user's special theme. |

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| | | The user gets one of the following:<br><br>• Weight: Opportunity to reconsider one's plan for not gaining weight.<br>• Stress: Asks for the user's coping strategies for handling stress.<br>• Strong emotions: Asks for the user's coping strategies for handling strong emotions.<br>• Identity: Asks if there are any situations in which the user feels smoke-free.<br>• Smoking at parties: Follows up on the user's input from the first session (whether or not she planned to stay smoke-free at parties).<br><br>All users are also asked whether parties might be a high-risk situation for lapsing. |
| **24** | Reminder: Reasons | "Endre" reminds the user of her reason for quitting. The user may write a new most important reason if she wants. The user may also write a new text on how quitting smoking relates to her values. |
| **25** | High-risk situations | The user is asked if she has been in any high-risk situations. If necessary, the plan for handling high-risk situations is revised.<br>Confidence ruler: Staying smoke-free in high-risk situations. |
| **26** | Eliciting change-talk: Self-efficacy | Confidence ruler: Self-efficacy for being smoke-free two years from now. |
| **27** | Internal attribution of success | Reminder: Everything the user has achieved is due to her own efforts. |
| **28** | Final session | Sums up the lessons from the program and wishes the user good luck. |

## Computerized Motivational Interviewing (cMI) in "Endre"

| MI-technique | cMI-application |
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| **The "spirit" of MI [1]** | The "spirit" of MI consists of collaboration, acceptance (absolute worth, autonomy, accurate empathy, and affirmation), evocation, and compassion [1].<br>• *Collaboration* and *autonomy* is communicated throughout the program: Whenever "Endre" gives an advice, it is underscored that ultimately the user knows what is best for her and most make her own decisions.<br>• *Absolute worth*: In the very first session, "Endre" reveals that although "he" "pretends to be" a real person, "he" in fact is not, and "he" would not want to deceive the user to believe otherwise. This communicates that the user is of absolute worth and should not be led under false pretence.<br>• *Accurate empathy:*<br>  ○ "Endre" communicates with accurate empathy – within the restriction that "he" can only reflect with accurate empathy when the user is given pre-defined multiple choice alternatives (see below).<br>  ○ Accurate empathy is also communicated through the multiple choice alternatives themselves. For example, when "Endre" asks the user how certain she is of staying smoke-free the first couple of days (see below), the statements representing the five degrees of self-efficacy reflects an empathic understanding of a large range of emotional states (e.g. "It sounds terribly difficult, but I will do my best").<br>• *Affirmations:* "Endre" provides the user with *affirmations* (genuine comments on the user's strengths and accomplishments), e.g. "Congratulations, you've done quite a bit of work today towards your aim of becoming smoke-free!", or "So you've tried quitting before – that means you've got some experience to draw from now". Two sessions are entirely devoted to an affirmation: Underscoring that the user's accomplishments are due to own efforts, and nobody else's.<br>• *Evocation*: The entire program is based on asking the user to give *her* opinions, *her* reasons, and *her* plans.<br>• *Compassion:* Compassion is perhaps communicated best through the fact that the first author has written all the text for the program, drawing upon her experience with MI-based telephone-counselling. The compassion is not mechanically put into different parts of the program, but is conveyed through the actual compassion for the prospective user.<br>• *The spirit of MI* is also sought communicated through the program's visual design and interface. |

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| **Open questions, reflections and summaries [1]** | "Endre" asks questions, and the user may sometimes answer through a text box, sometimes through multiple choice alternatives. Multiple choice questions allow for *complex reflections* of the user's answer, because the answer is "understood" by the program [2] (this includes communicating with accurate empathy, as described above). Freely written text in a text box, on the other hand, gives the user the opportunity to compose a personal answer. These answers, however, can only be *directly reflected* back to the user, without taking into account their actual contents [2]. Friederichs and colleagues recommend combining multiple choice questions and open questions with text boxes for freely written text [2]. In "Endre", questions are sometimes phrased with text box answers, sometimes with multiple-choice, but they are rarely combined. The reason for this is because the mere number of questions in the program would make the "double" questions tedious for the user, and potentially disturb the flow of the "conversation". |
| **Eliciting and reflecting change-talk** | "Endre" elicits and reflects change-talk, or "language that signals movement towards change" [1]. There are different types of change-talk: Desires, ability, reasons, need, commitment, activating language, and taking small steps [1]. Ability, desires/reasons, need, commitment, and taking small steps are all elicited in "Endre" – for details, see below.<br><br>"Endre" reflects the user's change-talk; directly, if the change-talk is in a text box, more complex if the change-talk is expressed through multiple-choice alternatives. |
| **Eliciting change-talk: Ability/self-efficacy ("Confidence ruler"), need, and commitment [1]** | The user is asked to indicate her self-efficacy in achieving a specific goal by choosing a statement representing five degrees of self-efficacy ranging from very low to very high. After having chosen a statement, the user is asked to type in why she did not choose a statement reflecting lower self-efficacy. This reason is subsequently reflected back to her. By asking the user to justify her choice, reasons that speak towards changing are elicited [1]. If the user chooses the lowest degree of confidence, she is either asked what she can do to feel more confident – also eliciting change-talk [1], or she is offered help.<br>At some occasions, the user may choose a number from 1-5 instead of choosing between statements [3]. One benefit of using statements instead of numbers is that "Endre" by that defines what is meant by the lowest degree of self-efficacy, making it less likely that the user will choose that alternative. In most cases, the lowest alternative represents an extreme that most people will not identify with (i.e. "It's absolutely hopeless and I've already given up"). If the user reads this alternative and does not choose it because she finds it too extreme, she is indirectly strengthening her change-talk. This might be seen as a version of "agreeing with a twist", a strategy where the therapist agrees with the client's sustain-talk as a way of making her see it in a different light [1].<br><br>Change-talk concerning need, or how important quitting is to the user, as well as commitment to the quit plan, is elicited through a "ruler" in the same way as change-talk concerning ability. |

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| **Eliciting change talk: Commitment and taking steps [1]** | When a user agrees to follow "Endre's" (general) advice, she is sometimes asked to specify how she will do it. For example, if the user agrees to get rid of any remaining cigarettes when she has quit, "Endre" asks what she will do with them. When the user specifies how she will do an action leading towards quitting, such as getting rid of remaining cigarettes, she is strengthening her commitment to doing it, and this is therefore a form of change-talk. |
| **Eliciting change-talk: Reasons [1]** | The user is asked about her reasons for quitting smoking. "Endre" asks the user to write down her most important reason for quitting, starting the sentence with "I want to stop smoking because…" By completing the sentence with her personal reason, the user is producing change-talk.<br><br>The user is also asked to choose more reasons from a list of alternatives, and "Endre" reflects these reasons back to her, elaborating on them (complex reflection). |
| **Handling sustain-talk or discord [1]** | "Endre" allows the expression of sustain-talk (reasons for upholding the status quo) or discord (dissatisfaction with therapy) as multiple-choice alternatives where sustain-talk or discord could be expected as a likely response to "Endre's" question. If the user chooses a sustain-talk/discord alternative, "Endre" provides a complex, empathically accurate reflection. Depending on the context, "Endre" may normalize, offer help, follow up with more questions, or simply reflect and refocus [1]. For instance, if the user has expressed a low degree of self-efficacy, "Endre" offers to help through reminding the user of her reasons for quitting or how she might handle smoking urges. The user then may choose "Please remind me of my reasons for quitting", "Please remind me of how I can handle the cravings", or "None of these alternatives seem very helpful". The complex, empathic reflection provided by "Endre" is crafted to accurately reflect the response the user has given, but at the same time to communicate an appropriate amount of hope or normalization of the user's feelings [1]. |
| **Asking for permission before giving advice/information [1]** | In MI, a counsellor should ask the client for permission before giving advice or information [1]; it should not be given out uninvited.<br>The cMI-equivalent of asking for permission is to require an action from the user before revealing the advice. This can be done by clicking on a video that gives the advice [3]. In "Endre", asking for permission is done in two different ways:<br><br>1. Multiple-choice alternatives. This is a close parallel to asking for permission in face-to-face conversations, requesting a "yes" or "no" from the client/user before continuing. For example, "Endre" may ask the user for permission before embarking on the topic of the day ("Today's session is going to be about revisiting your reasons for quitting. Is that okay for you?"). "Endre" may add that if the user says no, the session will be short because "he" has nothing else planned for today. The user may answer yes or no, and if she answers no, the session is ended. |

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| | 2. Hiding and showing text upon mouse click. The user is asked whether she wants an advice (or a piece of information). Clicking on the text reveals the advice or information, without leaving the page. If the user does not want to receive the advice or information, she can go to the next page without revealing the text. |
| **Exploring values and goals [1]** | Internalized motivation is characterized by the motivation being assimilated into the person's value- and belief-system [4]. In MI, one may use a "structured value exploration" as an exercise with the client [1]. This can also be done in a fully automated program [3]. In "Endre", a separate session is dedicated to exploring values and goals:<br>1. The user may choose from a list of values which values are important for her.<br>2. On the subsequent page, the user's choices are reflected back to her.<br>3. "Endre" asks the user to specify how (a) smoking and (b) quitting smoking relate to the values she has chosen. The user writes this down in a text box.<br>4. The user's text is reflected back to her. |
| **Exploring ambivalence [1]** | In MI, one should explore ambivalence only if the client is truly uncertain of what she wants [1]. For this reason, "Endre" only suggests exploring ambivalence if the user reports that she might want to start smoking again (expressed through multiple choice). When exploring ambivalence, "Endre":<br>1. Asks the user to describe positive aspects of smoking, or things that she (is going to) miss.<br>2. Asks the user to describe (personally) negative aspects of smoking.<br>3. Asks the user to describe negative aspects of quitting.<br>4. Asks the user to describe short term positive aspects of quitting.<br>5. Asks the user to describe long term positive aspects of quitting.<br>6. Summarizes the ambivalence exploration by showing all the text the user has typed in (direct reflection).<br>7. Asks the user to consider what she has written and decide whether she wants to continue quitting or start smoking again (multiple choice question, one answer possible).<br>8. If the user answers that she wants to keep quitting, "Endre" reacts with empathic gladness.<br>9. If the user indicates that she wants to start smoking again, "Endre" responds empathically and respects this. |
| **Developing a change plan [1]** | When helping the client to develop a change plan, Miller and Rollnick recommend that the therapist first establishes whether the client already has a clear plan, if she has an unclear plan, or if she has no plan at all. These different starting points call for different approaches by the therapist [1]. In "Endre", a separate session is dedicated to making a change plan. In this session, the user is first asked whether she already knows what to do (clear plan) or whether she would like some help in making a change plan (unclear plan / no plan at all). |

| | |
|---|---|
| | If the user indicates that she already has a plan, she is simply asked to write that plan down in a text box.<br><br>If the user indicates that she wants help in making the plan, she is guided through six different questions:<br>1. "Will you reduce your cigarette smoking before quitting, or will you quit «cold turkey»?"<br>2. «What do you need to do the day before you quit?»<br>3. «What will you do with any cigarettes you might have left?»<br>4. «What will you do the day you quit?»<br>5. «How will you make sure to take care of yourself along the way?»<br>6. «What can you do when you get the urge to smoke?»<br><br>Each question is followed by a text box, and the four fictional "quitters" provide "their" answers as examples.<br><br>Finally, "Endre" presents the user's answer to all six questions (direct reflection) as the user's cessation plan. |

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4. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol [Internet] 2000;55(1):68–78. Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/0003-066X.55.1.68

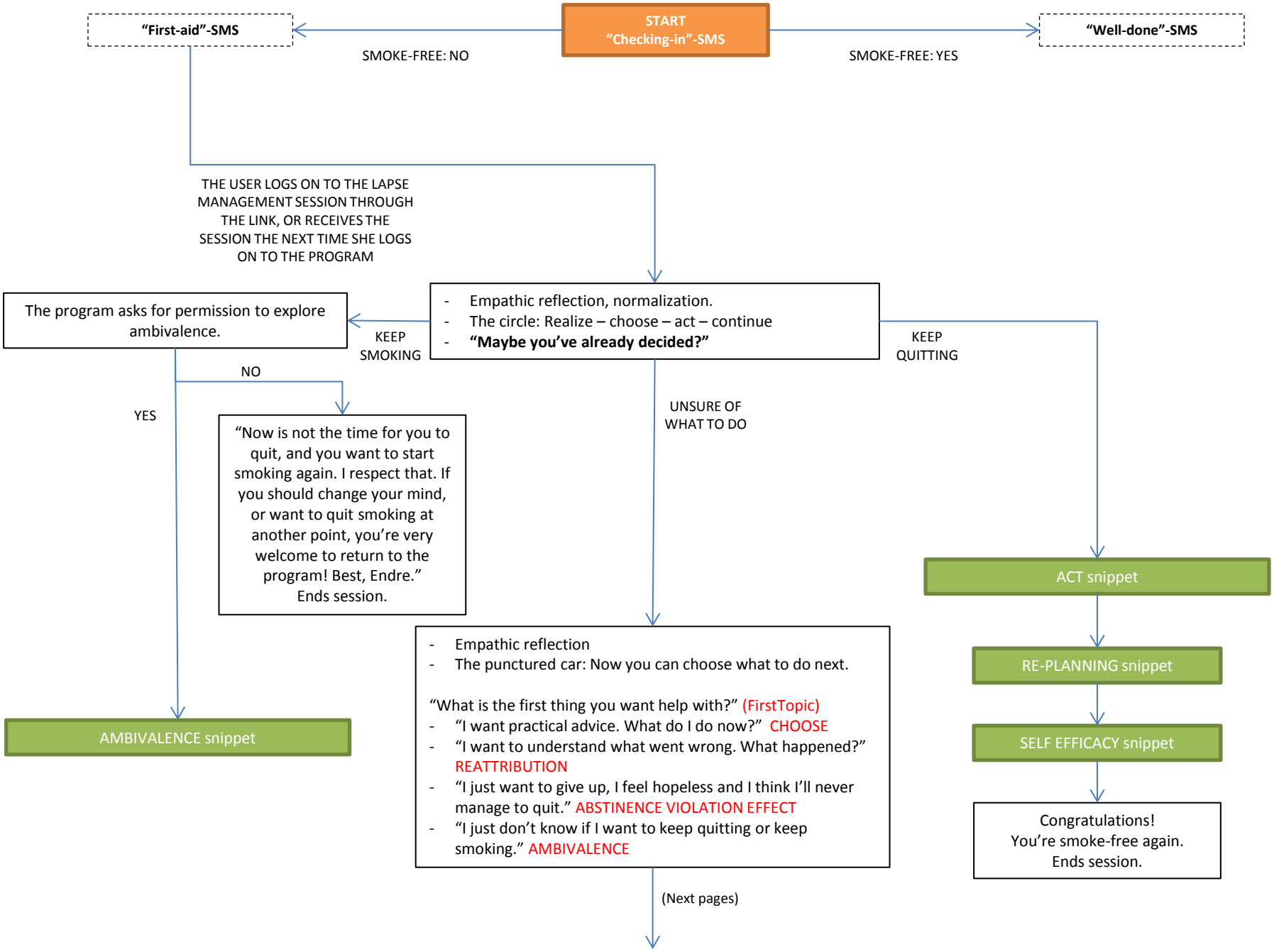
# Lapse management: SMS messages and web-session

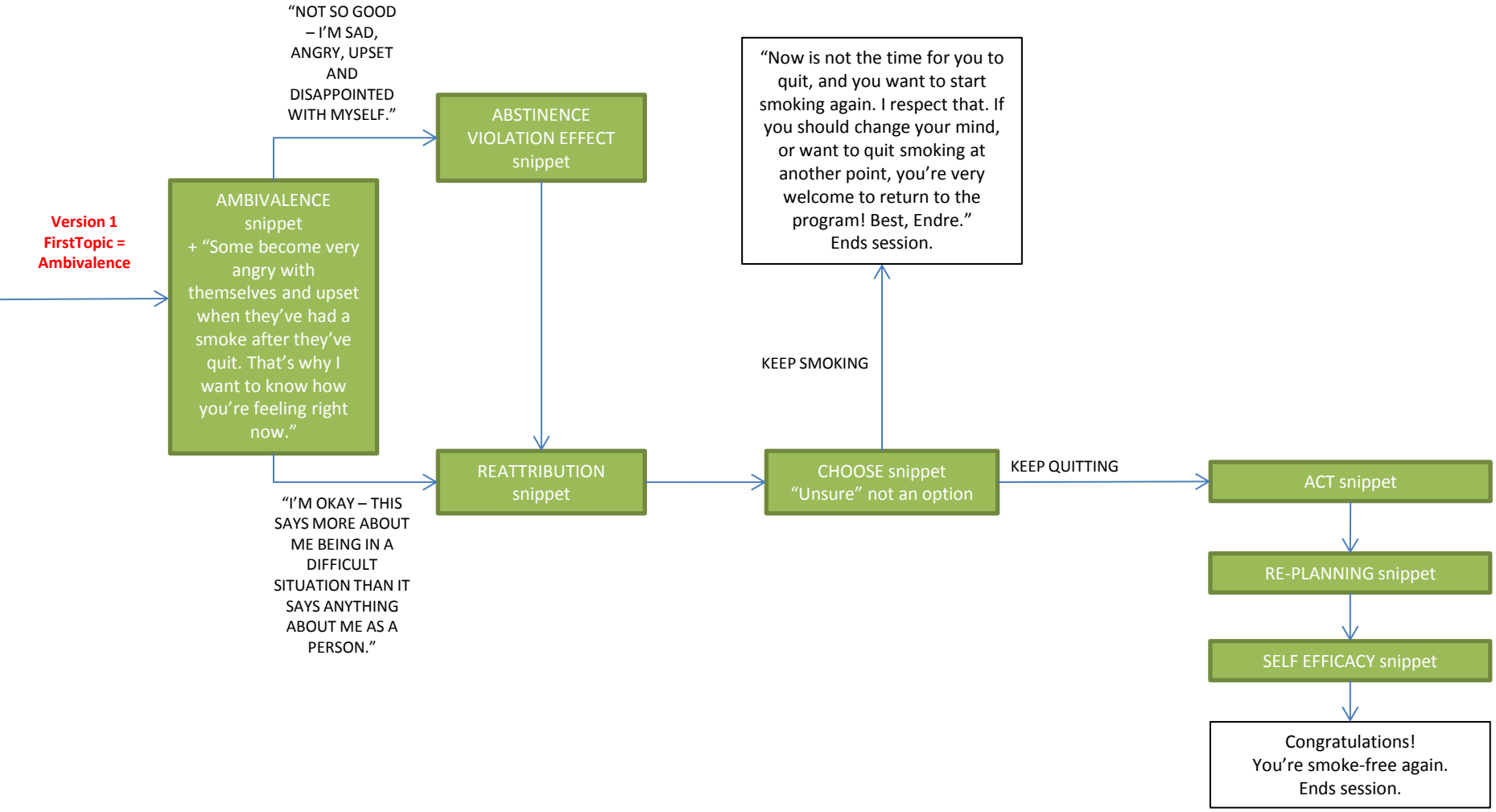
After quitting day, the user's smoking status is monitored by an automatically generated "Checking in"-SMS from "Endre" every evening. The user is requested to answer the "Checking in"-SMS, replying NO if she has had a cigarette and YES if she has been entirely smoke-free. If the user answers YES (no lapse), she immediately receives a "Well done"-SMS with an affirmation. If the user answers NO (reports a lapse) she receives a "First aid"-SMS intended to reduce the negative emotions and catastrophic cognitions of the abstinence violation effect (AVE) [1] through accurate empathy [2] and underscoring the importance of the user's choice. The "First aid"-SMS contains a link to the web-based lapse-management session. If the user for some reason cannot use the link (e.g. she does not have a smartphone), she gets the lapse management session the next time she logs on to the program.

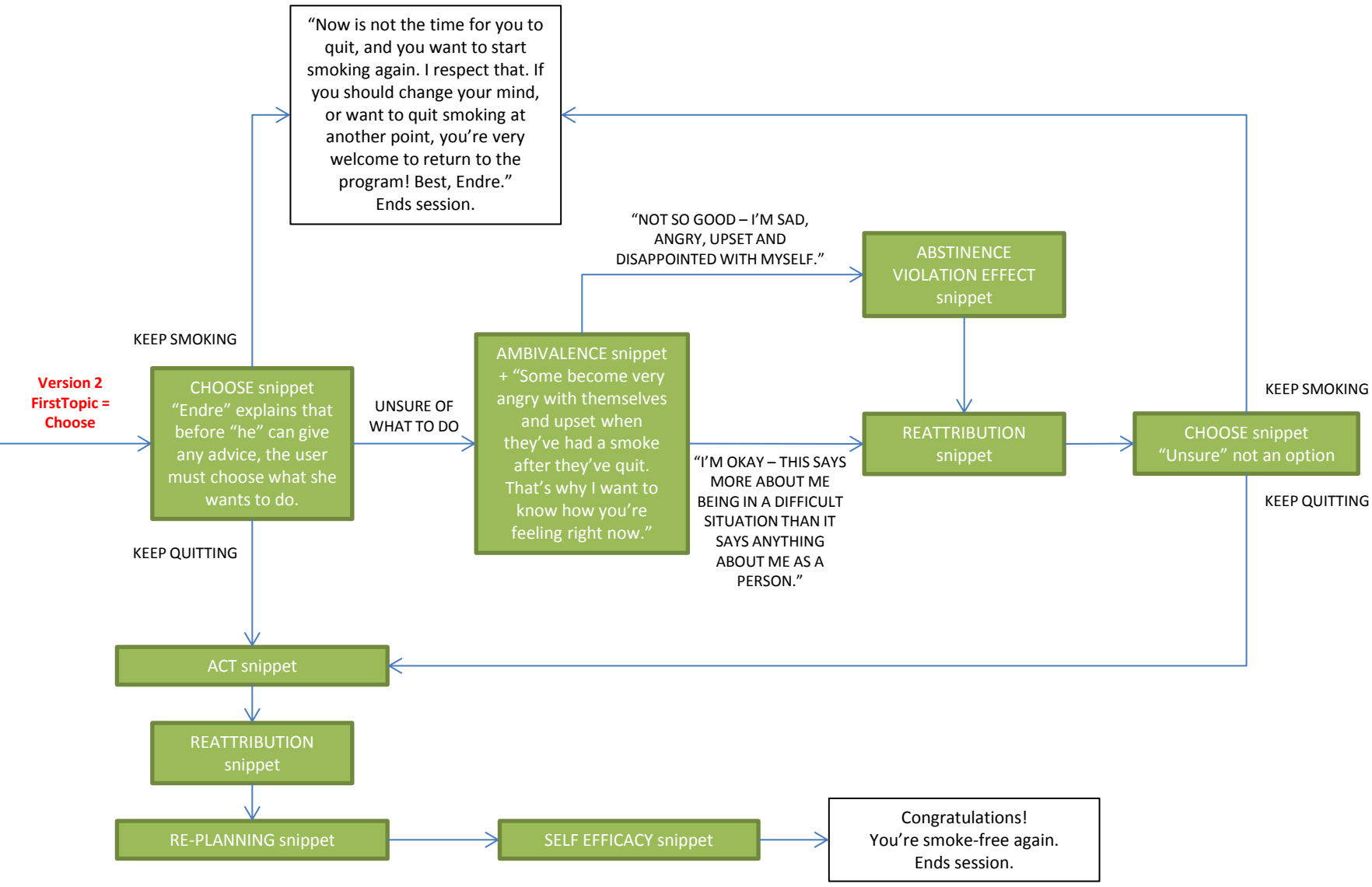
The web-based lapse-management session is tailored to the user's input through small intermediate mini sessions, or snippets. The first snippet is quite short, only meant to clarify whether the user needs further help. If help is needed, the user may choose between four alternatives. The user's choice determines the build-up of the remaining session. An overview of the seven snippets' content can be found in the table to the right. The flow-chart of the session can be viewed beneath.

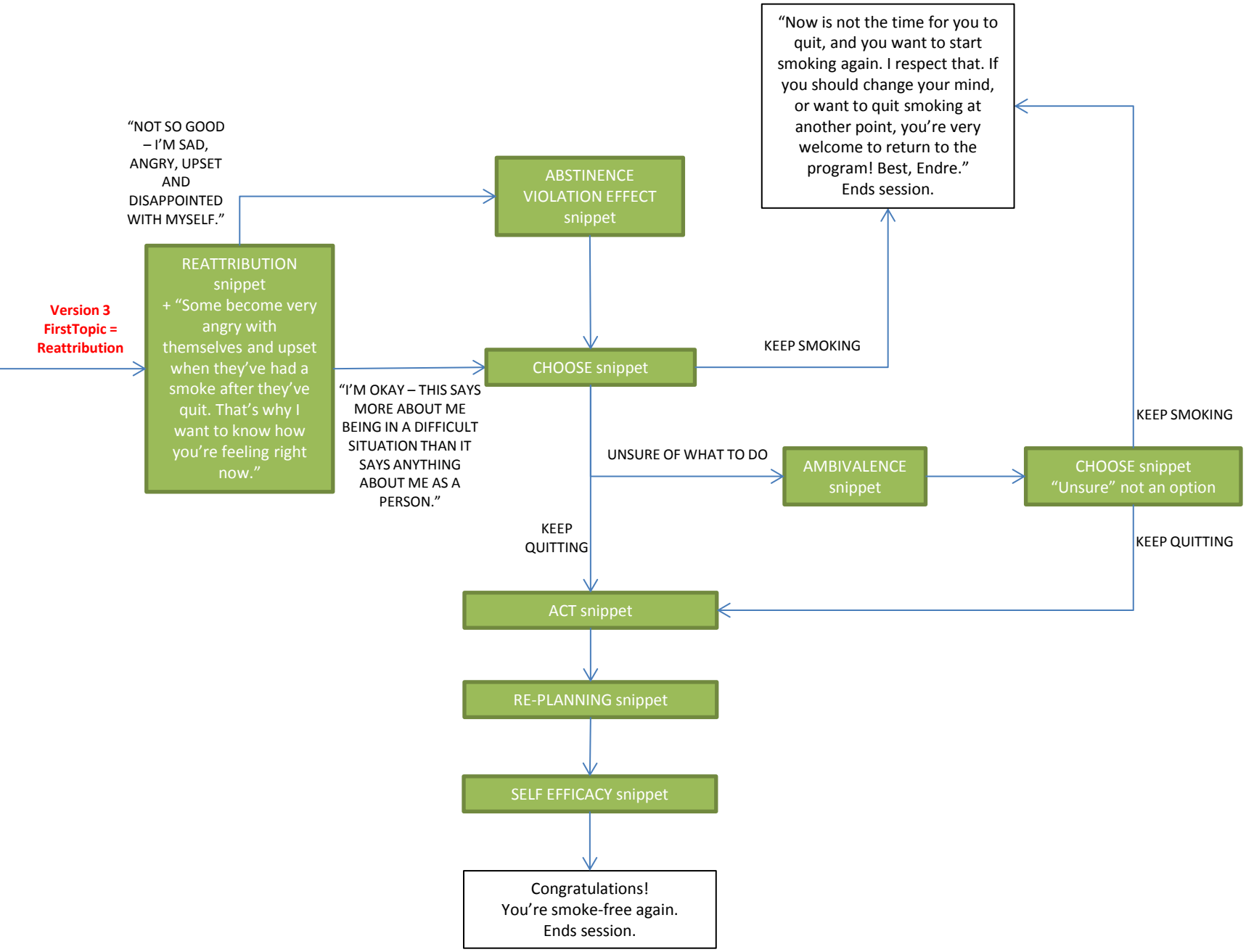
| SMS-type | Example | Number of versions |
|---|---|---|
| "Checking-in" | "Hi, [user's name]! How has your day been? Have you been smoke-free? If yes, please answer YES. If you've had a slip-up, please answer NO. Best, Endre." | 28 |
| "Well-done" | "Wonderful! I hope you're proud of yourself! Best, Endre." | 28 |
| "First-aid" | "Thank you for being honest! A slip-up doesn't have to mean that much. You can still choose to be smoke-free, if that's what you want. Click on the link in this SMS, or log on to the program. It's easier to talk about this on the webpage. (link)" | 10 |

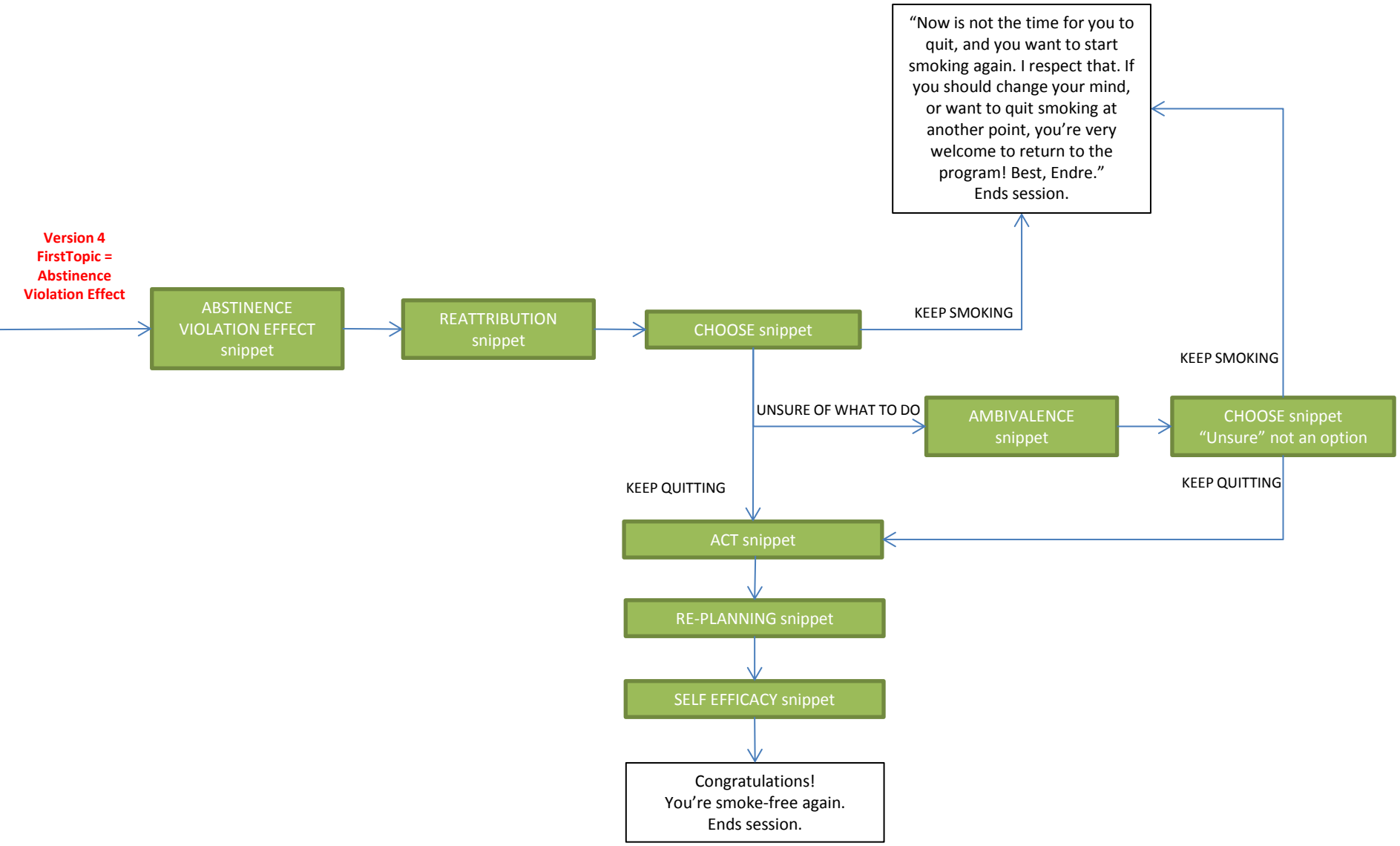
| Snippet | Description |
|---|---|
| **Reattribution [1]** | Mandatory for all users. Involves attributing the lapse to the situation [1] – where the user was, who she was with, what she did, what she felt. |
| **Abstinence Violation Effect [1]** | Only provided if the user identifies with a description of the Abstinence Violation Effect (see flow-chart). Involves:<br>- Empathic reflection [2]<br>- Thinking about past mastery experiences [2]<br>- Normalization<br>- Replacing counter-productive thoughts [3] |
| **Exploring ambivalence [2]** | Only provided if the user indicates that she is unsure whether she wants to keep quitting. Explores negative and positive aspects of quitting [2]. |
| **Choose** | Mandatory. The user is asked, on the basis of what has been "discussed", to decide whether to keep quitting or keep smoking. If the user has not explored ambivalence, "Unsure" is an option. If she already has explored ambivalence, she may only answer "Keep smoking" or "Keep quitting". |
| **Act** | Mandatory (if the user chooses to keep quitting). The user is encouraged to get rid of remaining cigarettes, asked if she is in a high-risk situation, and guided back to a safe situation if necessary. |
| **Re-planning [2] and asking about social support** | Mandatory (if the user chooses to keep quitting). The user is shown her input from the reattribution-snippet (above) and is asked to make a plan [2] on how to avoid a lapse in a similar situation in the future. The user is also asked if she finds it difficult to explain the lapse to significant others, and is offered advice on how to do so if needed. |
| **Self-efficacy [2]** | Mandatory (if the user chooses to keep quitting). Confidence-ruler [2] asking about self-efficacy for staying smoke-free. |


START
"Checking-in"-SMS
"First-aid"-SMS
SMOKE-FREE: NO
"Well-done"-SMS
SMOKE-FREE: YES
THE USER LOGS ON TO THE LAPSE MANAGEMENT SESSION THROUGH THE LINK, OR RECEIVES THE SESSION THE NEXT TIME SHE LOGS ON TO THE PROGRAM
- Empathic reflection, normalization.
- The circle: Realize – choose – act – continue
- "Maybe you've already decided?"
The program asks for permission to explore ambivalence.
KEEP SMOKING
KEEP QUITTING
YES
NO
"Now is not the time for you to quit, and you want to start smoking again. I respect that. If you should change your mind, or want to quit smoking at another point, you're very welcome to return to the program! Best, Endre."
Ends session.
UNSURE OF WHAT TO DO
ACT snippet
RE-PLANNING snippet
SELF EFFICACY snippet
Congratulations!
You're smoke-free again.
Ends session.
AMBIVALENCE snippet
- Empathic reflection
- The punctured car: Now you can choose what to do next.
"What is the first thing you want help with?" (FirstTopic)
- "I want practical advice. What do I do now?" CHOOSE
- "I want to understand what went wrong. What happened?" REATTRIBUTION
- "I just want to give up, I feel hopeless and I think I'll never manage to quit." ABSTINENCE VIOLATION EFFECT
- "I just don't know if I want to keep quitting or keep smoking." AMBIVALENCE
(Next pages)


"NOT SO GOOD – I'M SAD, ANGRY, UPSET AND DISAPPOINTED WITH MYSELF."
ABSTINENCE VIOLATION EFFECT snippet
"Now is not the time for you to quit, and you want to start smoking again. I respect that. If you should change your mind, or want to quit smoking at another point, you're very welcome to return to the program! Best, Endre."
Ends session.
Version 1
FirstTopic = Ambivalence
AMBIVALENCE snippet
+ "Some become very angry with themselves and upset when they've had a smoke after they've quit. That's why I want to know how you're feeling right now."
KEEP SMOKING
REATTRIBUTION snippet
CHOOSE snippet
"Unsure" not an option
KEEP QUITTING
ACT snippet
RE-PLANNING snippet
SELF EFFICACY snippet
"I'M OKAY – THIS SAYS MORE ABOUT ME BEING IN A DIFFICULT SITUATION THAN IT SAYS ANYTHING ABOUT ME AS A PERSON."
Congratulations!
You're smoke-free again.
Ends session.


"Now is not the time for you to quit, and you want to start smoking again. I respect that. If you should change your mind, or want to quit smoking at another point, you're very welcome to return to the program! Best, Endre."
Ends session.
"NOT SO GOOD – I'M SAD, ANGRY, UPSET AND DISAPPOINTED WITH MYSELF."
ABSTINENCE VIOLATION EFFECT snippet
KEEP SMOKING
Version 2 FirstTopic = Choose
CHOOSE snippet "Endre" explains that before "he" can give any advice, the user must choose what she wants to do.
UNSURE OF WHAT TO DO
AMBIVALENCE snippet + "Some become very angry with themselves and upset when they've had a smoke after they've quit. That's why I want to know how you're feeling right now."
"I'M OKAY – THIS SAYS MORE ABOUT ME BEING IN A DIFFICULT SITUATION THAN IT SAYS ANYTHING ABOUT ME AS A PERSON."
REATTRIBUTION snippet
CHOOSE snippet "Unsure" not an option
KEEP SMOKING
KEEP QUITTING
KEEP QUITTING
ACT snippet
REATTRIBUTION snippet
RE-PLANNING snippet
SELF EFFICACY snippet
Congratulations!
You're smoke-free again.
Ends session.


"Now is not the time for you to quit, and you want to start smoking again. I respect that. If you should change your mind, or want to quit smoking at another point, you're very welcome to return to the program! Best, Endre."
Ends session.
"NOT SO GOOD – I'M SAD, ANGRY, UPSET AND DISAPPOINTED WITH MYSELF."
ABSTINENCE VIOLATION EFFECT snippet
REATTRIBUTION snippet + "Some become very angry with themselves and upset when they've had a smoke after they've quit. That's why I want to know how you're feeling right now."
Version 3 FirstTopic = Reattribution
CHOOSE snippet
KEEP SMOKING
"I'M OKAY – THIS SAYS MORE ABOUT ME BEING IN A DIFFICULT SITUATION THAN IT SAYS ANYTHING ABOUT ME AS A PERSON."
UNSURE OF WHAT TO DO
AMBIVALENCE snippet
CHOOSE snippet "Unsure" not an option
KEEP SMOKING
KEEP QUITTING
KEEP QUITTING
ACT snippet
RE-PLANNING snippet
SELF EFFICACY snippet
Congratulations!
You're smoke-free again.
Ends session.


"Now is not the time for you to quit, and you want to start smoking again. I respect that. If you should change your mind, or want to quit smoking at another point, you're very welcome to return to the program! Best, Endre."
Ends session.
Version 4
FirstTopic =
Abstinence
Violation Effect
ABSTINENCE VIOLATION EFFECT snippet
REATTRIBUTION snippet
CHOOSE snippet
KEEP SMOKING
KEEP SMOKING
UNSURE OF WHAT TO DO
AMBIVALENCE snippet
CHOOSE snippet "Unsure" not an option
KEEP QUITTING
KEEP QUITTING
ACT snippet
RE-PLANNING snippet
SELF EFFICACY snippet
Congratulations!
You're smoke-free again.
Ends session.

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Original Paper

# How a Fully Automated eHealth Program Simulates Three Therapeutic Processes: A Case Study

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## Abstract

**Background:** eHealth programs may be better understood by breaking down the components of one particular program and discussing its potential for interactivity and tailoring in regard to concepts from face-to-face counseling. In the search for the efficacious elements within eHealth programs, it is important to understand how a program using lapse management may simultaneously support working alliance, internalization of motivation, and behavior maintenance. These processes have been applied to fully automated eHealth programs individually. However, given their significance in face-to-face counseling, it may be important to simulate the processes simultaneously in interactive, tailored programs.

**Objective:** We propose a theoretical model for how fully automated behavior change eHealth programs may be more effective by simulating a therapist's support of a working alliance, internalization of motivation, and managing lapses.

**Methods:** We show how the model is derived from theory and its application to *Endre*, a fully automated smoking cessation program that engages the user in several "counseling sessions" about quitting. A descriptive case study based on tools from the intervention mapping protocol shows how each therapeutic process is simulated.

**Results:** The program supports the user's working alliance through alliance factors, the nonembodied relational agent *Endre* and computerized motivational interviewing. Computerized motivational interviewing also supports internalized motivation to quit, whereas a lapse management component responds to lapses. The description operationalizes working alliance, internalization of motivation, and managing lapses, in terms of eHealth support of smoking cessation.

**Conclusions:** A program may simulate working alliance, internalization of motivation, and lapse management through interactivity and individual tailoring, potentially making fully automated eHealth behavior change programs more effective.

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**KEYWORDS**

Internet; eHealth; telemedicine; behavior therapy; motivational interviewing; working alliance; intervention mapping; smoking cessation; cell phones; text messaging

## Introduction

"Black boxes," or poorly described programs, have long been a criticism of the eHealth field [1-4], and effective program components across individual interventions are still largely unknown [5]. To address this problem, assumed mechanisms should be adequately described and put in a theoretical context [6]. This would build well-founded hypotheses for active program ingredients. Theoretically founded hypotheses may be especially useful in fully automated programs because automation standardize the therapy that is given. The standardization allows for program elements to be described in

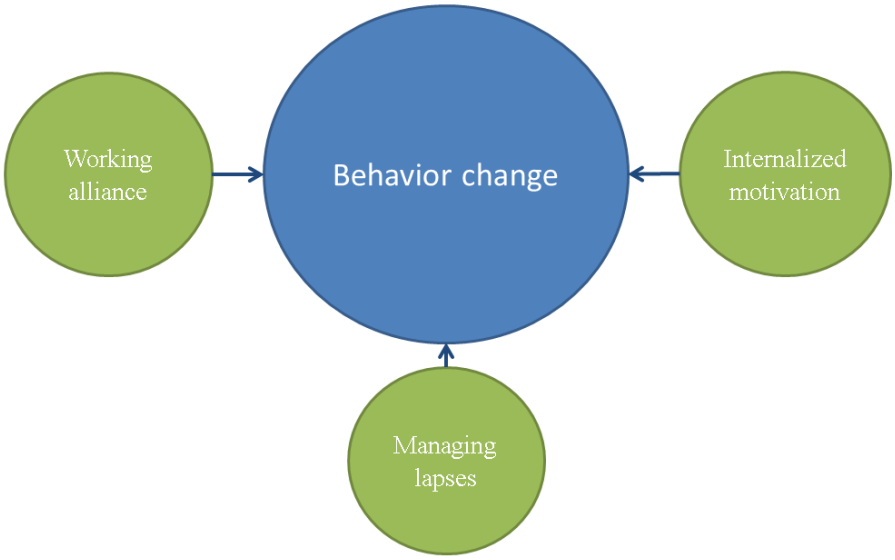
detail and investigated empirically, free from human variations and with a large degree of reliability. Investigating eHealth programs in light of counseling theories may increase our understanding of how such programs work [6]. In this paper, we will break down the components of an eHealth program and discuss its potential for interactivity and tailoring in terms of common concepts from face-to-face counseling. We hypothesize that simulating the therapeutic processes of supporting a working alliance [7,8], internalized motivation [9], and lapse management [10] simultaneously may be important to optimize behavior change.

According to Riley and colleagues, traditional health behavior change theories are static and linear in nature, and therefore, do not take advantage of the potential involved with interactive eHealth interventions [6]. eHealth interventions are not necessarily static or linear, as they can follow individual users and respond with tailored output to their immediate and previous responses. This enables dynamic adjustment of the intervention delivered, and theories from face-to-face counseling may therefore be more suited to understand eHealth interventions' effective ingredients [6]. In this paper, therefore, we examine *Endre*, a fully automated program for smoking cessation that uses a fictional "therapist" to conduct tailored "counseling" sessions with the user.

Within eHealth-assisted behavior change, there is a growing interest in the concept of a working alliance [11-22], which is found essential in face-to-face counseling [7,8]. The alliance is commonly defined as an emotional bond, as well as agreement on task and goal [7]. It can also be described as therapist processes—such as empathy, warmth, and genuineness, establishing a collaborative framework and offering support and guidance [23]. A strong alliance facilitates client processes that are central to therapy-assisted behavior change, such as expectancies, intentions, motivation, hope, openness, trust, commitment, satisfaction, and a changing view of the self [23]. It may be possible to develop a working alliance to a fully automated program [12,21,22], but so far, there are only a few examples of programs designed to support a working alliance [11,12]. Likewise, motivational interviewing (MI) [24] is considered an effective method to motivate client change in counseling [25]. The effectiveness of MI has been linked to its ability to influence 3 basic psychological needs, including competence, relatedness, and autonomy [26,27]. By supporting these needs, external motivation, a weak form of motivation characterized by performing an activity to gain an external reward or avoid an external punishment, can become internalized. This means the activity is performed because the individual accepts it as an important step toward a personally valued goal [26], improving self-regulation, performance, and persistence [9,27,28]. Although MI is often mentioned as one of several methods in eHealth programs [29-33], only 2 report MI as a main method applied extensively [32,33]. Finally, behavior change is difficult, and even when an individual is motivated and the change is going well, he or she still needs to avoid lapses or setbacks in behavior. If a lapse should occur, the individual needs to react constructively to avoid a complete relapse. Teaching people how to prevent a lapse from becoming a relapse (lapse preparation), and helping them manage lapses (lapse management), is thus important when implementing behavior change [10]. Lapse preparation and lapse management have previously been applied to fully automated eHealth programs [31,34-37], but its effect has not been documented. Each therapeutic process has a unique contribution to the user's change process. Supporting internalization of motivation gives the user strength and persistence in upholding the change [9,27,28]. Helping the user manage lapses keeps him or her from resuming the old behavior after a setback. Finally, supporting a working alliance makes a positive therapy outcome more likely [7,8] (Figure 1).

No published description exists, as far as we know, of a program supporting all 3 processes simultaneously, as proposed in the theoretical model in Figure 1. The aim of this paper is therefore to illustrate this model through a case study of *Endre*, a fully automated smoking cessation program, and to forward a hypothesis of these 3 therapeutic processes as important eHealth elements. We use a focused, descriptive analysis to conceptualize the translation from theory to intervention. The analysis is based on a modified intervention mapping protocol [38], which is a framework for designing and planning health promotion interventions through a taxonomy of mapping tools that can be used to code intervention contents. We use the steps that target process theory, methods, and design integration (steps 2-4) to focus on the 3 therapeutic processes that constitute the working hypothesis of *Endre*. This paper therefore also exemplifies the use of intervention mapping as an approach ideally suited to investigate potentially important elements in the "black box" of eHealth programs.

**Figure 1.** Different therapeutic processes affect behavior change differently.




## Methods

### The Case: Endre

*Endre* is a fully automated eHealth program for smoking cessation that has evolved from the third author's experience with the smoking cessation program *Happy Ending* [34]. *Endre* has some of the same basic structures as *Happy Ending*. It uses tunneling [18,39], has both pull (Web page) and push elements (e-mails and short message service [SMS] messages), and delivers program materials through the "voice" of a nonembodied relational agent [11]. Importantly, lapse management (with Marlatt's cognitive behavioral model of relapse prevention [10] as methodological counterpart) is a central component of both *Endre* and *Happy Ending*. However, as opposed to *Happy Ending*, which in addition to lapse management consisted of a large number of theoretical and methodological underpinnings [34], the content of *Endre* is centered on 2 other theoretical concepts: internalized motivation (with MI as the methodological counterpart [26,27]) and working alliance (with *alliance factors* [13] as the methodological counterpart).

*Endre* consists of 26 tunneled [18,39] Web sessions. On registration, users provide their mobile phone number and e-mail address, which prompts receipt of an automatically generated e-mail with a username and password. After the program starts, the user goes through 10 days of preparing to quit with one new session each day, followed by their quit day, which is scheduled on the 11th day. The user must confirm a quit attempt before the program moves on to the follow-up phase. In the follow-up phase, the user gets one new session the first 3 days, then 2 new sessions every week for the first 4 weeks, and finally one new session a week for the last 4 weeks. The program ends 8 weeks after the cessation day. Automatically generated e-mails give the user access to each new session through a link. The links are time based, they lead to today's session for that individual user, and one cannot access earlier sessions by clicking on old links. If a user rarely logs on, he or she will only receive the most important missed sessions. An overview of the themes for each session can be viewed in Multimedia Appendix 1.

*Endre* provides no additional human support. Most sessions involve user interactivity, requesting input from the user (see screenshots below for examples). We anticipate that an adult, typical user with average reading abilities may spend 4-6 minutes on each session. The user receives synchronous and immediate feedback on input. The lapse management component of *Endre* is based on the lapse management component in *Happy Ending* [34] and consists of daily SMS messages that are sent out to users who have quit, asking them if they have been smoke free that day. If the user reports a lapse, he or she gets access to a special, Web-based session intended to help the user recover from the lapse (Multimedia Appendix 2). This special session can be accessed whenever and for as many times as necessary.

### Analytic Procedure

We describe how a counselor's support of a working alliance, internal motivation, and lapse preparation and management are simulated in *Endre* by using selected steps from the intervention mapping protocol (steps 2, 3, and 4) [38]. Intervention mapping is well suited for describing process simulation because it can be applied to understand the program construction. Furthermore, the necessary information for an intervention mapping analysis was readily available, as *Endre* was developed using intervention mapping. Intervention mapping is conventionally used to describe everything in a program [29,30,40-50]. Contrarily, we use it in a focused way to describe only the elements that are relevant to our hypothesis of important program elements. The intervention mapping tools are thus used for an analysis consisting of 2 parts: First going from general therapeutic process to theoretical operationalization suiting the context of this program; and second, going from theoretical operationalization to simulation in specific program elements.

First, we describe how supporting a working alliance, internalized motivation, and lapse preparation and management are operationalized in *Endre* 's theoretical change model (step 2 in intervention mapping [38]). In the change model, the changes necessary to quit smoking by means of *Endre* are

described and displayed in a matrix. In the intersecting cells of the matrix, the operationalization of each therapeutic process is described in a list of change objectives. That is, each change objective shows how one aspect of one of the therapeutic processes is operationalized for the purpose of the intervention (that the user quits smoking and stays smoke free with *Endre*) and its context (a fully automated program). An analytic text accompanies the change model to describe how the 3 processes are represented in the change model. The change model that was used for the development of *Endre* (Multimedia Appendix 3) is simplified to highlight the 3 therapeutic processes, and we use sequential numbering of the change objectives instead of conventional intervention mapping-labeling [38] to improve readability outside of the intervention mapping community. The change model operationalizes the abstract and general therapeutic processes. It is therefore the first part of the analysis toward the processes' simulation.

After showing how supporting a working alliance, internalized motivation, and lapse preparation and lapse management are operationalized through change objectives, we describe how the 3 therapeutic processes are simulated through specific program elements (steps 3 and 4 in intervention mapping [38]). The program elements result from combining change objectives with theoretical methods for inducing change (eg, MI, modeling). This second part of the analysis takes the (theoretical) operationalizations of the 3 therapeutic processes and makes them into (practical) simulations through specific program elements.

## Results

### Operationalization of the Therapeutic Processes in Endre

The operationalization of the therapeutic processes can be viewed in the change model matrix (Table 1). In the matrix, sub-behaviors in quitting, or performance objectives, are crossed with theoretical constructs, or personal determinants , believed to be causing or influencing the behavior. Each therapeutic process is represented within the model either as a personal determinant or a performance objective. The personal determinants and performance objectives intersect in cells containing change objectives , which specify how each personal determinant must change for the individual to be equipped to do each performance objective.

Working alliance and internalized motivation are operationalized as personal determinants, whereas behavior maintenance through lapse preparation and lapse management is operationalized as a performance objective. Having a working alliance to the program is not a necessary psychological process for quitting smoking in general. It might, however, be an important process for quitting smoking with the help of *Endre*, if one assumes that a successful simulation of supporting a working alliance can have the same benefits for therapy outcome in a fully automated program as it has in face-to-face counseling [7,8]. Though a working alliance can be an important psychological process for quitting smoking with *Endre*, internalized motivation is an important psychological process for succeeding in quitting smoking at all. In the model, internalized motivation is separated into the underlying personal determinants relatedness, competence, and autonomy; the 3 "needs" that influence the internalization of motivation [9]. Competence is itself separated into 2 personal determinants: skills and self-efficacy. As with competence, relatedness is also separated into 2 personal determinants: relatedness to social network and working alliance. Working alliance, or relatedness to the program, is included under relatedness because a positive counseling relationship can also support the client's (or user's) need for relatedness [27]. In contrast, behavior maintenance through lapse prevention and lapse management is operationalized in the change model as a performance objective, meaning that managing lapses in a constructive way is considered an important subgoal for succeeding in quitting smoking. The change objectives belonging to each therapeutic process is the operationalization of that process for the purpose of this program.

**Table 1.** Modified change model.[a]

| Performance objectives | Personal determinants | | | | |
|---|---|---|---|---|---|
| | Internalized motivation (therapeutic process 2) | | | | |
| | Relatedness | | Competence | | Autonomy |
| | Working alliance (therapeutic process 1) | To social network | Skills | Self-efficacy | |
| 1. Decide to quit smoking and plan how to do it. | 1. Experience the program as a social actor [11].<br>2. Experience the program as accessible, helpful, empathic, and trustworthy [13].<br>3. Be aware of one's influence on program content [13].<br>4. Understand how to use the program and do the exercises [13]. | 5. Make a public commitment to the quit attempt.<br>6. Choose a "support person" from one's personal network. | 7. (1) Identify personal smoking cues and (2) be able to detect smoking urges early.<br>8. Make an action and coping plan for the quit attempt.<br>9. (1) Identify one's high-risk situations, and (2) make an action and coping plan for handling them [24]. | 10. Believe it to be possible to quit smoking and stay smoke free [13].<br>11. Be confident in one's ability to execute the action and coping plan [24]. | 12. Commit personally to the quit attempt and know one's personal reasons for doing so [24].<br>13. Decide whether or not to (1) make a public commitment and (2) engage a "support person."<br>14. Choose how to make the quitting plan (by oneself or a more guided version) [24].<br>15. Combine the advice of the program with one's own style and preferences [13]. |
| 2. Initiate the quit attempt and stay smoke free for the first 3 days. | 16. Experience the program as: (1) responsive, sensitive, and adjustable for emerging needs and (2) suiting one's own preferences and style [13]. | 17. Ask the "support person" for practical assistance and emotional support as needed [51]. | 18. Implement action and coping plan.<br>19. Get rid of remaining cigarettes and smoking accessories.<br>20. Withstand cravings and cope with withdrawal symptoms. | 21. Be confident in one's ability to stay smoke free the first 3 days [24]. | 22. Revise the action and coping plan if needed.<br>23. Decide whether or not to get rid of remaining cigarettes, or whether to make the cigarettes less accessible.<br>24. Decide to what degree, when and how the "support person" is needed. |
| 3. Establish a smoke-free lifestyle (from day 4 and onward). | 25. Continue with the program for as long as needed, even after a period of program disengagement ("rupture prevention and repair") [13]. | Same as the above (change objective 17). | 26. Identify and counteract thought patterns that could lead to a (re)lapse [52].<br>27. Follow plans for high-risk situations. | 28. Be confident in (1) one's ability to continue being smoke free, and (2) one's ability to stay smoke free in the long run. | 29. Attribute success in the cessation attempt internally. |
| 4. Maintain the behavior by managing lapses constructively (therapeutic process 3). | Same as the above (change objectives 16 and 25). | 30. Explain the difference between a lapse and a relapse to significant others to gain their continued support. | 31. Know the difference between a lapse and a relapse, and how to recover from a lapse.<br>32. Get rid of any spare cigarettes after a lapse.<br>33. Resist new urges to smoke. | 34. Be confident in one's ability to continue with the quit attempt after a lapse. | 35. Know that whether or not to remain smoke free is a matter of one's own choice. |

[a]Every cell specifies the theoretical operationalization of one (or several) therapeutic process(es).

### Simulation of the Therapeutic Processes in Endre

In this section, we describe how the therapeutic processes are simulated in *Endre*. For each therapeutic process, we present program elements that are involved in the simulation and describe the methods that are used. To support working alliance we adapted MI [24] to a computerized "counselor" who delivers all program material through what we refer to as computerized motivational interviewing (cMI). The "counselor" is called *Endre*, which has a double meaning in Norwegian, being a man's name, as well as literally meaning "to change." Internalized motivation is primarily supported through cMI, whereas behavior maintenance is strengthened with a psycho-educative session before the quitting day, as well as a special Web-based session that is made accessible if the user reports a lapse. If the user experiences several lapses, this is recognized by *Endre*, and the content of the session is adjusted accordingly.

### Simulation of Working Alliance Support

Working alliance is supported in program elements using a nonembodied relational agent [12], cMI (Multimedia Appendix 4), and dynamic tailoring [42] to convey alliance factors [13]. For the users to experience the program as a social actor [11] (change objective 1) that is accessible, helpful, empathic, and trustworthy [13] (change objective 2), the relational agent [12] *Endre* is used throughout the program. *Endre* is a nonembodied, text-based relational agent that simulates a "counselor" the user "communicates" with. Some key attributes of *Endre* can be found in Textbox 1, and examples of how "he" is represented in the program can be found in Figures 2-6.

**Textbox 1.** Attributes of the relational agent Endre.

| |
|---|
| Uses first person tense. |
| Introduces a new topic for each session. |
| Asks questions and reflects answers empathically [24]. |
| Uses appropriate greetings and farewells according to time of day [12]. |
| Uses humor [12]. |
| "Remembers" earlier conversations by explicitly referring to them or implicitly adjusting program content. |

To further support a working alliance, users are allowed to influence the program content [13] (change objective 3). This is a way of "negotiating" goals [13] and is done in the first session (Figure 2). After *Endre* has presented the program plan, the user is asked to choose a topic he or she considers important when quitting. On the subsequent page, *Endre* assures the user that "he" will make time for this topic during the course of the program. The user's topic is visited 2 times during the program.

To build a working alliance to the user, it is also necessary for him or her to receive guidance in how to use the program [13] (change objective 4). *Endre* provides guidance to the user, for example by explaining how new sessions are made available and how the user can log onto them. In addition, new program exercises are demonstrated by four fictional "quitters" (Figure 3).

Working alliance is further strengthened if the program is experienced as responsive, sensitive, adjustable for emerging needs, and suiting one's own preferences and style [13] (change objective 16). To address this, *Endre* has a *flexible session manager* (Textbox 2) that adjusts the total number of sessions to user behavior. This means that a user who does not log on to the program every time a new session is available will only receive the most important sessions, limiting the total number of sessions for that particular user.

**Textbox 2.** Flexible session manager.

| |
|---|
| Ensures that a user who has missed several sessions receives the most important session of the ones he or she has missed. |
| A user that seldom logs on will only get the most important sessions of the program. |
| We developed a set of rules that decides what session the user will get next (ie, the most important sessions), based on: |
| the program plan, |
| which sessions the user has already logged on to, |
| rules that categorize the sessions as either high priority (all users must go through these) or low priority (the user only receives these if he or she has done the high-priority sessions thus far). |
| A user who has missed several sessions first receives those that are categorized as high priority. |
| If the user has logged on to all high-priority sessions, he or she receives low-priority sessions that address (in the following order): skills, self-efficacy, relatedness, and autonomy. |

A final program aspect supporting working alliance is a "mini motivation intervention" (Textbox 3), consisting of SMS messages and intended to prevent program disengagement (alliance "rupture" [13]) (change objective 25).

**Textbox 3.** Mini motivation intervention.

Before quitting day:

If the user misses one session, nothing happens.

If the user misses 2 sessions, he or she gets an SMS message from *Endre*, reminding him or her to log on.

If the user misses 3 sessions, he or she gets an SMS message where *Endre* normalizes having second thoughts and recommends logging on to the program.

If the user misses a fourth session, nothing happens.

If the user misses a fifth session, he or she gets a final SMS message where *Endre* appeals to the "healthy part" of the user to log on.

After quitting day:

After quitting day, there is no intervention if the user does not log on to the Web page.

A part of the lapse management system is that the user every evening receives an SMS message, asking if he or she has been smoke free. If the user does not answer the SMS message, he or she will receive up to 3 extra SMS messages encouraging him or her to answer.

**Figure 2.** Choosing a topic ("negotiating" goals).

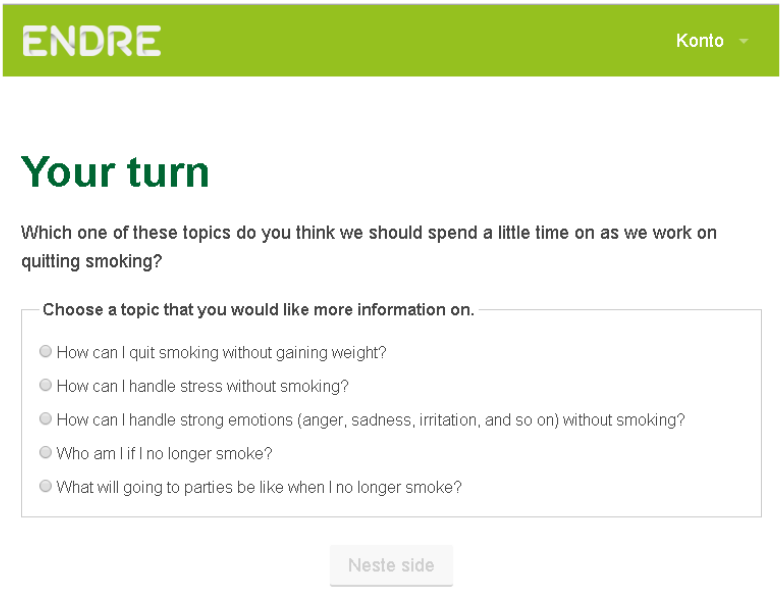



**Figure 3.** The 4 "quitters" demonstrate how to do the program exercises and model how to combine Endre's advice with one's own personal style.

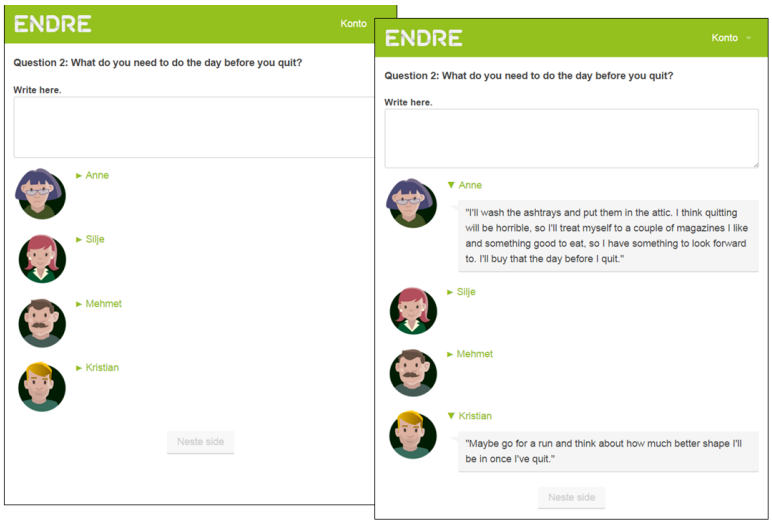


**Figure 4.** Eliciting self-efficacy change talk through a confidence ruler.

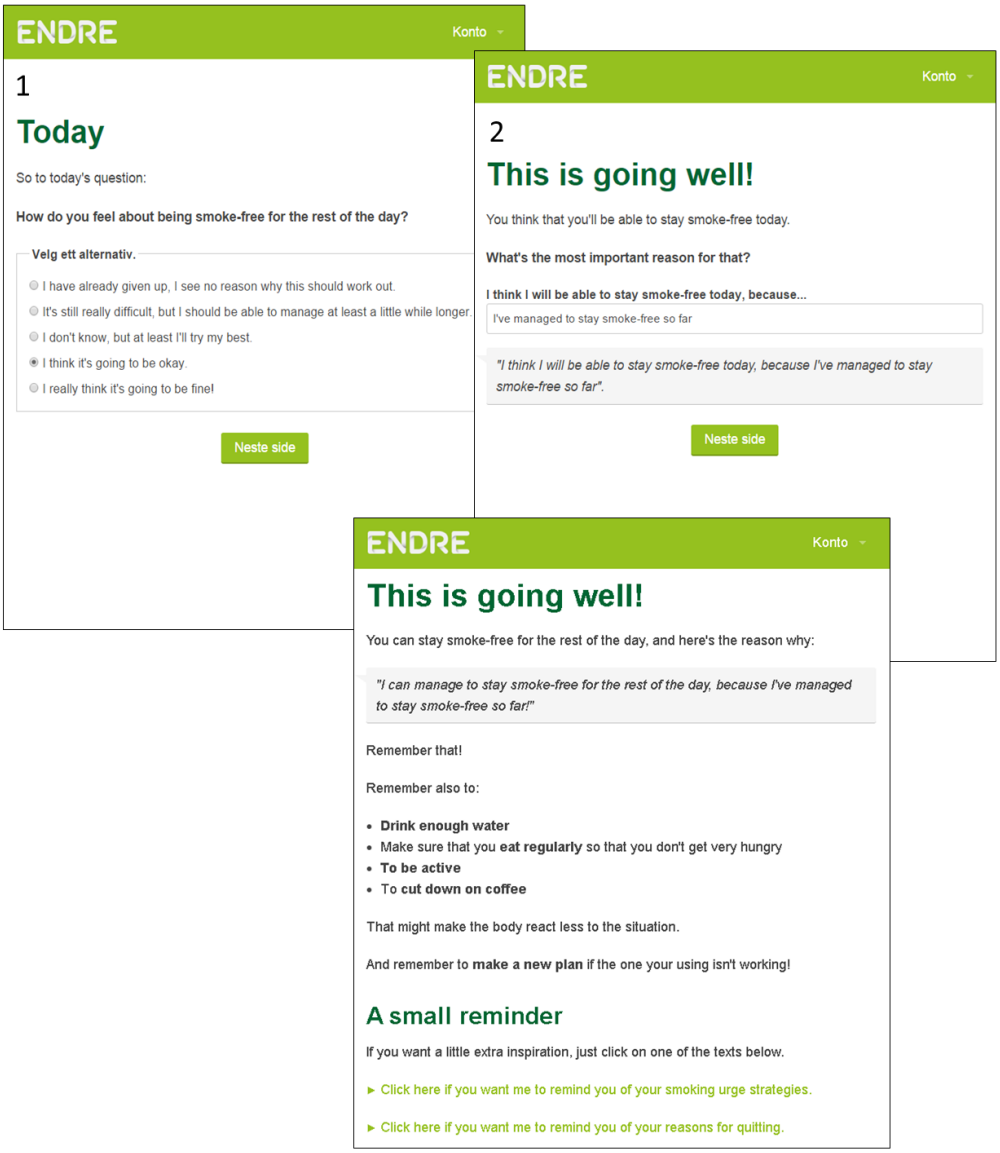



**Figure 5.** Endre has asked the user to choose a "support person" for her quit attempt, and the user has answered that he or she wants to quit without any help.

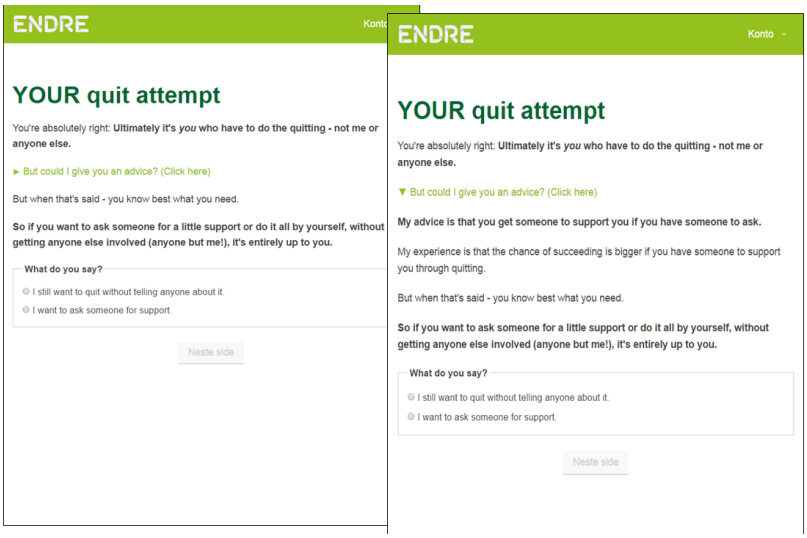
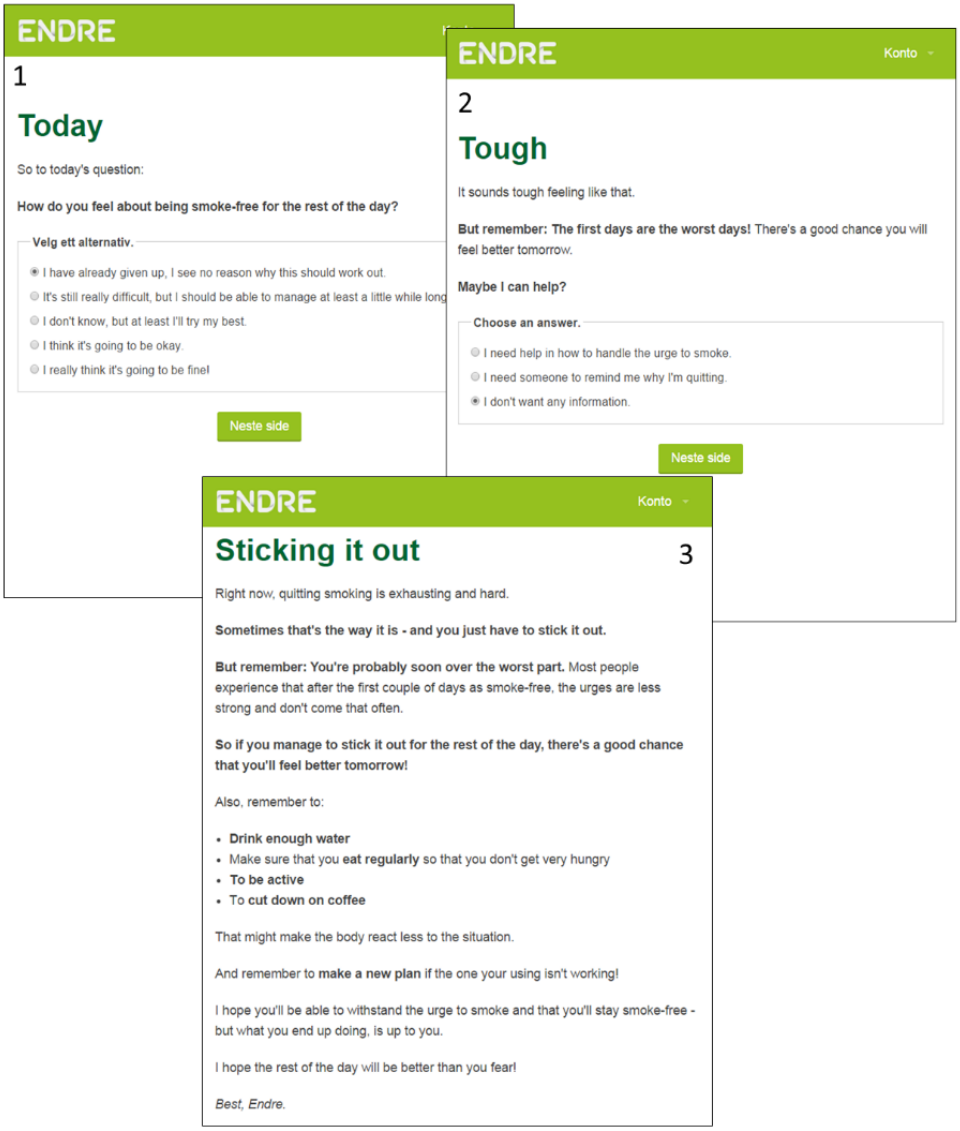


**Figure 6.** Handling sustain talk and discord.




## Simulation of Internalized Motivation Support

Internalized motivation is achieved through *Endre* strengthening the user's autonomy, competence, and relatedness [9]. Relatedness is partly supported through building a working alliance between the user and the program, as described in the previous section. The other part of relatedness, relatedness to social network, is strengthened through helping the user find support in the people surrounding him or her. This is done by advising the user to recruit a "support person" from his or her social network (change objective 6), advising him or her to make the quit attempt public (change objective 5), and guiding the user in how to make their "support person" have the greatest positive impact on his or her quit attempt (change objective 17). Figure 5 is from the session where *Endre* advices the user to choose a "support person," showing what happens when the user does not want to follow *Endre* 's advice. Another way in which *Endre* supports the user's relatedness to his or her social network is effectuated if the user reports a lapse after he or she has quit. *Endre* then asks if this lapse may affect the user's relationship to his or her social network. If the user answers yes, *Endre* offers help to ensure the social network's continued support for the quit attempt (change objective 30). All advice is given using cMI (Multimedia Appendix 4) and dynamic tailoring [42].

Autonomy is supported in program elements using cMI, dynamic tailoring [42], and modeling [38]. One way *Endre* supports autonomy is by asking for permission before giving any information or advice (Textbox 4). This is a way of acknowledging that the user chooses what information to receive. Asking for permission is relevant to change objectives 13, 15, 23, and 24.

**Textbox 4.** Asking for permission.

*Endre* requires one of two actions from the user before giving any information or advice:

Hide/show text: The user can choose whether or not to click on the question (eg, "do you want me to tell you about…") to reveal the information. An example can be viewed in Figure 3.

Question + multiple choice yes/no: The user must answer yes or no when *Endre* asks for permission to give information or advice; if the user answers yes, the information is revealed on the next page. For example, one session starts by *Endre* introducing today's topic, and then asking the user whether he or she thinks this sounds okay. If the user answers yes, the session continues. If the user answers no, the session is ended.

A second way in which autonomy is supported is through handling *sustain talk* (reasons for smoking) and *discord* (dissatisfaction with therapy) [24] respectfully. Sustain talk and discord may be expressed by the user at select places in the program through multiple-choice alternatives. The fact that expressing sustain talk or discord is allowed (even when it goes against the program) communicates respect for the user's autonomy. If sustain talk or discord is expressed, *Endre* repeats the user's feelings empathically, and then, depending on the situation, asks more questions, normalizes, offers help, or changes the topic [24]. Handling sustain talk and discord is relevant to change objectives 13, 15, 23, 24, and 35. An example of how sustain talk or discord may be expressed and how it is handled can be seen in Figure 6. This is from the user's second day as smoke free. On page 1, *Endre* asks the user how he or she feels about staying smoke free for the rest of the day. The example shows the user choosing the statement representing the lowest degree of self-efficacy; so low that it qualifies as sustain talk. On page 2, *Endre* offers help. The user chooses that he or she does not want any help; this can be seen as dissatisfaction with the program, or discord. On page 3, *Endre* reflects empathically and normalizes the user's feelings.

A third way *Endre* supports the user's autonomy is through eliciting and reflecting *change talk*, that is, talk arguing toward change [24] (change objective 12). Change talk is the user's autonomous reasons and capacities for quitting and is requested throughout the program. *Endre* repeats the user's change talk and sometimes elaborates on it. For example, in one session, *Endre* asks the user for his or her most important reason for wanting to become smoke free (eliciting change talk). *Endre* repeats the user's most important reason on the next page (reflecting change talk). Asking for permission, handling sustain talk and discord, and eliciting change talk is achieved through cMI and dynamic tailoring [42], and details of these applications can be viewed in Multimedia Appendix 4.

A fourth and final way in which *Endre* supports autonomy is through modeling [38]. In the program, 4 fictional "quitters" model autonomy by illustrating how to combine the advice of the program with one's own style and preferences (change objective 15). The 4 "quitters" are of different gender, age, socioeconomic status, cultural background, and *smoking profiles* [53]. The "quitters" answer *Endre* 's questions and tasks in ways that suit their situation and personality. An example of this application can be viewed in Figure 3. This screenshot is from the session for making a cessation plan, where *Endre* asks the user what he or she needs to do the day before quitting. By clicking on the names of the 4 fictional "quitters," the user may read "their" answers.

Autonomy is supported through asking for permission before giving advice, handling sustain talk and discord respectfully, eliciting and reflecting change talk, and modeling how to combine the program's advice with one's own preferences and style. Competence is supported through increasing the user's quit-related skills and increasing his or her self-efficacy for quitting. Skills can be acquired through the general information and advice that *Endre* gives, as well as through program exercises. For example, before quitting day, *Endre* asks the user to spend a few days thinking about what precedes his or her smoking—what are his or her *smoking cues*. After a few days, *Endre* asks the user for these smoking cues. This teaches the user to be attentive to what triggers the urge to smoke. The advices and exercises that *Endre* gives are based on self-monitoring of behavior, counter-conditioning, active learning, goal setting, planning coping responses, and implementation intentions [38], always communicated using cMI (Multimedia Appendix 4).

Whereas skills are supported through information, advice, and exercises, self-efficacy is supported through cMI techniques, in combination with dynamic tailoring [42]. The user's self-efficacy is strengthened through "confidence rulers" [24,32]. An example of this application can be found in Figure 4. These screenshots are from the same session as the ones in Figure 6, but showing what happens when the user answers differently. In this example, the user chooses the statement reflecting a quite high degree of self-efficacy. On page 2, *Endre* asks the user to justify why he or she chose that statement over a statement representing a lower degree of self-efficacy. The user types in his or her answer, and on page 3, this statement is reflected back to him or her. The user has argued for change and had the argument reflected back, amplifying the effect [24].

Self-efficacy is also strengthened through affirmations [24], that is, compliments on the user's strengths and accomplishments. For example, in one session, the user is asked if he or she has tried quitting before. If the user answers yes, *Endre* replies that this is a good thing, because the user then has experience that he or she can use to increase the chances of succeeding this time. Turning previous quitting experience into something positive is a way of providing affirmation, supporting self-efficacy, competence, and internal motivation.

### Simulation of Lapse Preparation and Lapse Management Support

Behavior maintenance is supported through a psychoeducative session before the user's quit day and a lapse management component after he or she has quit. First, a psychoeducative session on lapses and relapses prepares the user to respond constructively in case of a lapse (change objectives 31 and 35).

In this session, a car puncturing a tire is used as a visual analogy [38] for lapsing and relapsing. The cars can be seen in Figure 7. Car no.1 illustrates the lapse (puncturing the tire), car no.2 illustrates a relapse (giving up and succumbing to negative emotions), car no.3 shows the process of choosing, car no.4 is acting to resume the quit attempt, and car no. 5 illustrates being smoke free again.

In the preparatory session, the user is also presented with an advance organizer [38] of the process of becoming smoke free again after a lapse. The advance organizer has the shape of a circle (Figure 8) displaying the self-regulation loops [54] that can help the user back to being smoke free. First, realize that you are smoking ("innse"), then choose: Keep smoking or keep quitting ("velge"), then act to become smoke free again ("handle"), and finally continue with being smoke free ("fortsett"). The information is given with cMI (Multimedia Appendix 4).

Following up on the preparatory session on lapses and relapses is a lapse management component which is effectuated after the user has confirmed a quit attempt. Every day, the user receives an SMS message asking if she is still smoke free. If the user answers yes, another SMS message compliments the user's accomplishment. If however the user answers no, he or she receives an SMS message with a link to a Web-based lapse management session. The user may access the session through the SMS message; if he or she does not log on via the SMS message, he or she receives the lapse management session when logging on to the program next time. The lapse management session helps the user make a choice, become smoke free again and learn from the lapse. When logging on to the Web-page, the user is first reintroduced to the car (Figure 7) and the circle (Figure 8). *Endre* then asks if the user has already decided what to do: keep quitting or keep smoking (Figure 9). If the user chooses to keep quitting, *Endre* guides him or her back to being smoke free, helps making a new plan on how to face a similar situation in the future without lapsing, and supports the user's belief in his or her ability to stay smoke free. Figure 9 shows a screenshot from the lapse management session. In this example, *Endre* has asked the user if he or she knows what to do now, and the user has answered that he or she is unsure. On the next page, shown in the screenshot, the user may choose which topic he or she wants *Endre* to start with (the picture does not show the entire page). Asking the user what topic to start with is a way of asking for permission [24], strengthening his or her autonomy and supporting internal motivation. In addition, letting the user influence the program structure influences the working alliance positively [13]. This screenshot shows the main topics that are covered in the lapse management session: reattribution [10], ambivalence [24], the abstinence violation effect [10], and making a choice. Only users who express ambivalence or an abstinence violation effect when asked go through these topics. Multimedia Appendix 2 contains more information on the lapse management component, including a flow chart that shows the different ways in which this session may be built up. Some of the methods that are used are cMI (Multimedia Appendix 4), dynamic tailoring [42], reattribution [55], and cognitive restructuring [56].

**Figure 7.** Visual analogy for lapsing and resuming the quit attempt.

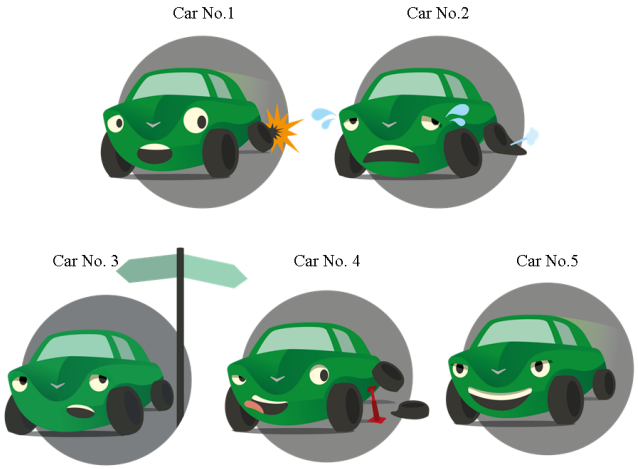


**Figure 8.** Advance organizer of returning to the quit attempt after a lapse (from top left section): realize (“innse”), choose (“velge”), act (“handle”), and continue (“fortsett”).

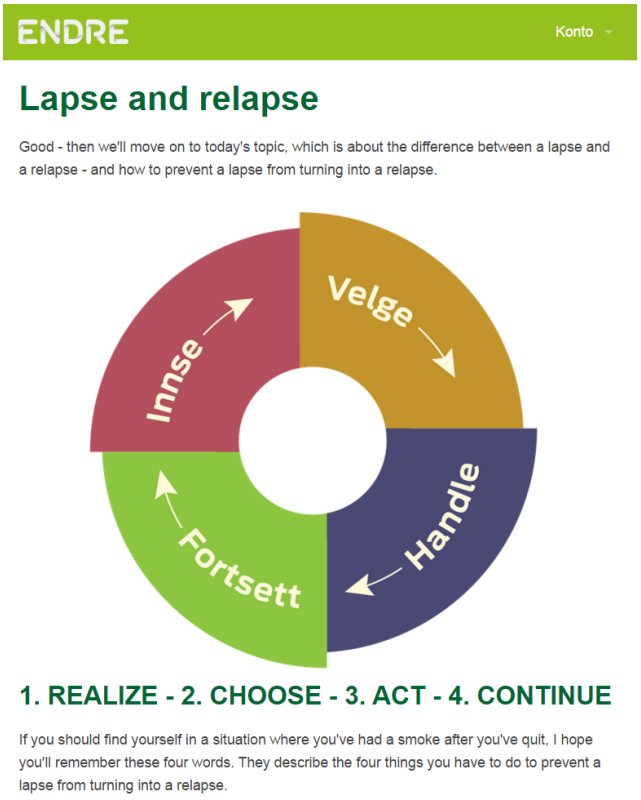
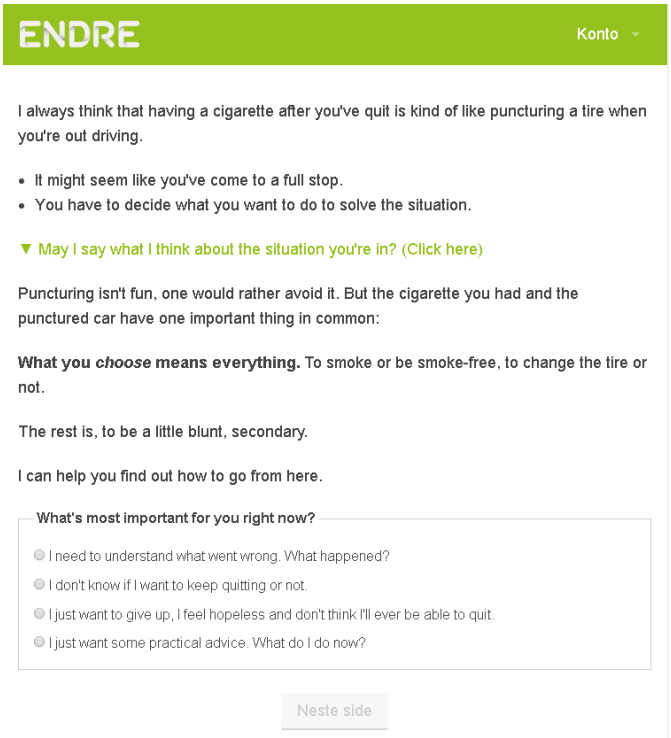



**Figure 9.** From the lapse management session: the user is unsure of what to do and is asked what topic to begin with.




## Discussion

### Summary Analysis

This case study illustrates our proposed theoretical model for eHealth behavior change interventions: simulating a counselor’s support of working alliance, internalization of motivation, lapse preparation, and lapse management simultaneously. The case, *Endre*, is a fully automated smoking cessation program where each session takes the form of a written “counseling session” between the user and the program. The program content and structure were analyzed using intervention mapping [38],

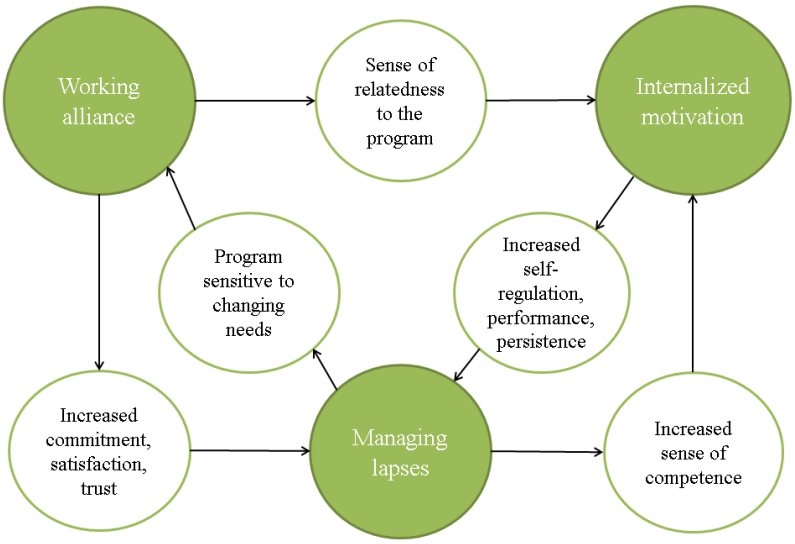
illustrating the translation from theoretical model to intervention. The analysis shows that simulation of the 3 therapeutic processes is accomplished through a range of program elements. Working alliance [7,8] is supported through alliance factors [13], a nonembodied relational agent [12],cMI (Multimedia Appendix 4), and dynamic tailoring [42]. Internal motivation [9] is supported through cMI, dynamic tailoring, and modeling [38]. Finally, relapse is sought prevented through a psychoeducative session on lapses and relapses and a postquit day lapse management component.

By defining the components of a program and discussing its potentials for interactivity and tailoring in terms of concepts from face-to-face counseling, eHealth programs can be better understood [6]. This has implications both for program development and for the theoretical development of eHealth therapeutic process. In addition, by showing how the therapeutic processes of a program can be documented, from abstract concept through operationalization to simulation in specific program elements, we have demonstrated how intervention mapping used in a focused manner provides a compelling, interpretative approach to eHealth case studies. The value of such an inquiry for future empirical investigation is substantial: If the intervention should prove not to be effective, this may be because the identified theoretical processes are not sufficient for supporting behavior change or because the translation from theory to intervention elements was less than optimal.

The analysis of *Endre* suggests that the simultaneous simulation of each therapeutic process may result in a synergy effect. The operationalization in Table 1 reveals some of these potential interaction effects. The table visualizes that a working alliance is also a part of internalized motivation. When a working alliance to *Endre* is supported, this can influence the user's need for relatedness, thus supporting his or her internalized motivation to quit [27]. In addition, Table 1 visualizes that a working alliance and internalized motivation (columns) cross behavior maintenance (row). This means that for *Endre* to succeed in helping the user manage lapses, he or she needs to have both a working alliance to *Endre* and internalized motivation to recover from a lapse, demonstrating that lapse management in a fully automated program can benefit from a strong working alliance and internalized motivation. A strong working alliance may enhance the effect of a lapse management program element through facilitating client processes such as commitment, satisfaction, and trust [23].This may increase the likelihood of the user staying with the program long enough to benefit from the lapse management therapy and trust the therapy that is given. At the same time, internalized motivation increases self-regulation, performance, and persistence [9,27,28] and may function as a buffer for future lapses. Should the user experience a lapse, a program that is supportive through that difficult period is likely to strengthen the working alliance by demonstrating sensitivity to the user's changing needs [23]. Furthermore, if the user should succeed in overcoming the lapse it would also presumably increase his or her feeling of competence, again enhancing internalized motivation [27]. It seems therefore that simultaneous simulation of supporting a working alliance, internalized motivation, and lapse management may result in a mutual enhancement of each process. These hypothesized synergy effects are displayed in Figure 10.

Interaction can be assumed from the operationalization level, but the step to simulation also shows the many methods and program elements that support several therapeutic processes at once. For example, all program material is delivered by the relational agent *Endre* using cMI. A relational agent supports working alliance [12], and cMI supports both working alliance [25] and internalized motivation [26], but in different ways. *Endre* also uses cMI in the lapse management session, influencing all 3 therapeutic processes at once. Another example of a program element that support several therapeutic processes are the 4 "quitters," serving both as guides in how to do the program exercises (supporting a working alliance) and as models in how to exercise autonomy in the quitting process (supporting internalized motivation). The fact that many program elements support several therapeutic processes at once implies that the effort needed to incorporate more than one therapeutic process in a program may diminish for each process included.

**Figure 10.** Hypothesized synergy effects of the 3 therapeutic processes.




## Comparison with Prior Work

All 3 therapeutic processes have been applied to fully automated programs previously. Studies on working alliance have mostly been on relational agents [11,12]. *Endre* builds on this work, although applying a nonembodied, rather than embodied relational agent, allowing the user freedom to "create" aspects of the relational agent. To further support a working alliance, *Endre* also incorporates alliance factors [13]. "Endre" also builds on previous work in the application of MI [32,33] and use of lapse preparation and lapse management [31,34-37]. The most significant contribution of *Endre*, however, is simulating all 3 processes simultaneously, something that to the best of our knowledge has not been done before systematically in a fully automated eHealth program.

Finally, this paper extends earlier work using intervention mapping eHealth tools to present a focused descriptive analysis of chosen program elements. Papers that use intervention mapping usually follow the structure of the intervention mapping steps and reports on most of these [29,30,40-50]. Instead of giving a full account of the breadth of the program, this paper uses intervention mapping for a focused descriptive analysis to make an argument of possible important eHealth elements. The description is intended to be sufficiently deep to allow for further inquiry into the chosen elements. This application of intervention mapping represents a complementary approach to the standard use of the method, that is, instead of using intervention mapping as a purely descriptive tool, we use it as a normative tool to determine what elements *should* be present in the "black box" of eHealth programs.

## Limitations

Although comprehensive, the analysis presented here is a simplification of how the 3 therapeutic processes are simulated in *Endre*. Especially the social behavior of the relational agent, cMI, and dynamic tailoring are elements that are used in the entire program, and a full account was therefore not possible. Another limitation is that to highlight the 3 therapeutic processes, descriptive depth was chosen over descriptive breadth. In addition, *Endre* does not simulate the 3 therapeutic processes perfectly. A fully automated program neither has the flexibility nor the presence of an actual human being. Just as *Endre* is not a human counselor, cMI is not MI. But the program may nevertheless simulate these 3 therapeutic processes convincingly enough to derive some of the benefits they have in face-to-face counseling. It should also be noted that *Endre* only represents one way in which these therapeutic processes may be simulated. Thus, if *Endre* fails to be an efficient program, it may be because the therapeutic processes in a fully automated program are not successful in inducing change or because the simulation of the therapeutic processes in *Endre* was inadequate.

There are, of course, limitations to the type of program that *Endre* represents. First, not everyone who wishes to quit smoking may benefit from such a detailed program. In the first author's clinical experience, some simply quit and do not wish to spend more time elaborating on the process. A participant in an earlier study conducted by the third author [57] actually experienced late night SMS messages asking whether she had been smoke free that day as smoking cues, creating a risk of (re)lapsing. *Endre* does make it possible for "unproblematic" quitters to move through many of the sessions rapidly, and the flexible session manager makes it possible to complete fewer sessions than what is in the full program. Nevertheless, it is a quite extensive intervention, communicating an expectation that quitting smoking is a process instead of a one-time action and requiring answers to daily SMS messages. Second, not everyone may wish to convey their thoughts with a program. Efforts to simulate a therapeutic setting aside, the therapy may still seem too artificial and ultimately unconvincing to the user. Alternately, the simulation may be too convincing, and sharing one's personal thoughts on quitting smoking with a machine that responds empathically to one's input may create an "uncanny" feeling [58] because the program acts like a human without being one. Even though reports from users of *Endre* so far indicate to the contrary that they respond positively to the

"mixture" of Man and machine, this is an area that will require further research.

### Future Directions

*Endre* and the theoretical model presented here will be evaluated in forthcoming studies. Because the application of the model to the program is made explicit, it is possible to test. Empirical investigations may in turn influence or alter the theoretical model or its recommended application to a program.

In one current Randomized Controlled Trial (RCT), the lapse management component will be evaluated by randomly allocating participants to one version of the program with the lapse management component and one version without it. The results of this RCT will tell us whether providing immediate help to users who have had a lapse can significantly improve their success rate. We also plan to collect indicators on working alliance and on internal motivation.

Another ongoing project is a qualitative study on the users' working alliance to *Endre*. The goal of this study is to explore the nature of the working alliance because it is not given that working alliance to a fully automated program is identical to the working alliance to a human therapist. It is only when we can be convinced of the nature of working alliance to a fully automated program that it will be truly meaningful to test its importance for eHealth-assisted behavior change.

Finally, although we have argued that *Endre* simulates support of a working alliance, internalized motivation, and lapse preparation and lapse management, we do not know to what extent this simulation is successful for the user. One might establish simulation success through RCTs as the one described previously and compare the results with comparable findings from the counseling literature.

### Conclusions

We have demonstrated how *Endre*, a fully automated eHealth program, through interactivity and individual tailoring emulate 3 effective mechanisms of face-to-face counseling. By having used intervention mapping to systematically break down *Endre* into smaller components and showed how the program simulates a counselor's support of a working alliance, internalized motivation, and lapse preparation and lapse management, our analysis is an example of how knowledge of what works in eHealth programs may be deepened by interpreting them in light of therapeutic processes. We suggest that the combination of these 3 therapeutic processes may result in a synergistic effect. Based on the analysis, we believe the combined support of a working alliance, internalization of motivation, and lapse preparation and management should be an element in the "black box" of automated eHealth behavior change programs that will make them more effective.

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### Conflicts of Interest

None declared.

### Multimedia Appendix 1

Overview of the themes in Endre.

[PDF File (Adobe PDF File), 366KB - jmir_v18i6e176_app1.pdf ]

### Multimedia Appendix 2

The postquit day lapse management component of Endre.

[PDF File (Adobe PDF File), 345KB - jmir_v18i6e176_app2.pdf ]

### Multimedia Appendix 3

Change model from the development of Endre.

[PDF File (Adobe PDF File), 216KB - jmir_v18i6e176_app3.pdf ]

## Multimedia Appendix 4

Computerized motivational interviewing in Endre.

[PDF File (Adobe PDF File), 476KB - jmir_v18i6e176_app4.pdf ]

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## Abbreviations

**CMI:** computerized motivational interviewing
**MI:** motivational interviewing
**RCT:** randomized controlled trial
**SMS:** short message service


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