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Exploring learning abstinence theory

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Exploring
Learning **A**bstinence **T**heory

A new theoretical perspective on continued
abstinence in smoking cessation

Karin Menninga

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RIJKSUNIVERSITEIT GRONINGEN

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A new theoretical perspective on continued abstinence in smoking cessation

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Chapter 1

General introduction

The problem of smoking tobacco

When I look at pictures of my parents when they were young - they are from the 'baby boom' generation, born in the forties right after world war II- I noticed that when they were socializing with family and friends, one thing is always prominently in view: Cigarettes. I estimate that more than 70% of the people on the photographs had a cigarette in their mouth or hands. When I confronted my parents with this observation, my mother said that in the seventies 'almost everyone did it'. To check whether this was really the case, I looked into the literature concerning smoking behavior in the twentieth century. It appeared that, in the late sixties and early seventies, almost 80% of the males in the Netherlands smoked, and about 40% of the females. I think that it is safe to conclude that it was indeed quite normal to smoke. Fortunately, most people in my family threw their cigarettes away when pregnancies happened and children came. It was also in the seventies that the harmful effects of cigarettes became well known to the public, and as a result, the percentage of smokers descended (Gadourek, 1975).

Smoking in the 21th century

Now we are forty years later, the twenty first century is a fact. Many things have changed with regard to smoking and smoking behavior in North America and the European regions. The most important change is that the percentage of smokers has dramatically declined. To illustrate, in 1958 on average 60% of the Dutch adult population smoked, compared to 27% of the Dutch adults in 2010 (Stivoro, 2010). This decline in smokers has resulted in some tremendous health gains: Fewer smokers mean fewer deaths from lung cancer and several other cancers, fewer lung diseases, such as chronic obstructive pulmonary disease, and less life years lost from heart related diseases like atherosclerosis and myocardial infarction (Stivoro, 2010).

Despite decreasing numbers of smokers in the western societies, the World Health Organization states that in 2011 tobacco is still the leading risk factor for premature

mortality worldwide: It still kills nearly six million people and causes hundreds of billions of dollars of economic damage worldwide each year. Most of these deaths seem to occur in low- and middle-income countries. According to the WHO, in 2030 tobacco will kill more than eight million people worldwide if current trends continue (WHO report, 2011). In the European Region, smoking causes about 1.6 million deaths a year (WHO report 2007). When taking a closer look at smoking in the Netherlands, it is estimated that almost 20.000 people die each year as a direct result of smoking tobacco (Stivoro, 2010). It is therefore no surprise that many smokers try to quit smoking.

Quitting behavior in the Netherlands

In the Netherlands, 27% of people older than 15 years smoked in 2010. Approximately 34% of the smokers tried to quit smoking in the same year (Stivoro, 2010). In absolute numbers, this means that each year roughly one million smokers undertake a quit attempt. Although many people try to quit smoking, the relapse rates are also considerably high (McCaul et al., 2006). Only about between 7% and 14% of the smokers who undertake a quit attempt without any support, are still abstinent after one year (McCaul, et al., 2006, Bailie, Mattick & Hall, 1995). With regard to quitting with support, such as individual or group counseling, or pharmacotherapy, abstinence rates are somewhat higher: Counseling around 20% abstinence, and pharmacotherapy around 30% abstinence (Clinical practice guideline, 2008). Thus, most smokers who try to quit relapse to their previous smoking behavior. These figures illustrate that relapse is a serious problem and a major cause of the large and relatively stable smoker population (Willemsen, Hoogenveen, & Van Der Lucht, 2002). Therefore, scientific research on the prevention of relapse is highly relevant.

The state of the art concerning relapse prevention

Relapse prevention can be described as a (behavioral) strategy with the aim to prevent an initial lapse (smoking the first cigarette after a period of abstinence),

maintain abstinence, and engage in lapse management when a lapse has occurred to prevent further relapse (Marlatt & Donovan, 2005). There are several therapies, medications, and interventions available that all provide one or more angles and strategies to help to prevent relapse. Below the various perspectives on relapse will be reviewed briefly.

The biological perspective

One way to understand smoking and relapse is through the biological perspective. This perspective explains the need to smoke in terms of tolerance to nicotine and adapted neurobiological systems and relapse in terms of withdrawal (e.g., Fagerström, 1993; Kalivas & Volkow, 2005; Koob & Le Moal, 1997; Robinson & Berridge, 2003). On the basis of this, pharmacological interventions are applied to support smoking cessation and prevent relapse. The major type of pharmacological intervention is the nicotine replacement therapy (NRT). The aim of NRT is to (temporarily) replace much of the nicotine from cigarettes to reduce the motivation to smoke and nicotine withdrawal symptoms, thus easing the transition from cigarette smoking to complete abstinence (Stead, Perea, Bullen, Mant & Lancaster, 2008). Another type of pharmacological intervention specifically targets the neurobiological systems that are involved in smoking and withdrawal. The most used compounds are bupropion, nortriptyline and varenicline. These medicines probably influence levels of specific neurotransmitters involved in smoking, with the effect that craving and withdrawal are lowered and abstinence becomes easier (Killen et al., 2006, West & Shiffman, 2001).

Many studies have shown that NRT can be effective (Shiffman, Sweeney, Ferguson, Sembower, & Gitchell, 2008). However, combining NRT with other treatments, such as behavioral treatments, is more effective than NRT alone (Silagy, Lancaster, Stead, Mant, & Fowler, 2004). The pharmacological treatments with bupropion, nortriptyline and varenicline also have been shown to successfully support quitting (Wing & Shoaib, 2007).

The automatic/unconscious processes perspective

Smoking and relapse can also be understood by automatic/unconscious psychological processes. The oldest perspective is that of classical conditioning: Originally neutral cues become predictors of smoking and, therefore, they elicit the urge to smoke. For example, cigarettes, ashtrays, but also a conversation or negative emotions, may have been paired repeatedly with smoking. This repeated pairing leads to the relation becoming cognitively firmly established. When smokers try to refrain from smoking these relations are still present and they increase the risk for relapse. Cue-exposure is the strategy to refrain from smoking based on this rationale. In cue-exposure quitters are exposed to these cues repeatedly, but they are not allowed to smoke (as they did in the past). In this way the cues may lose their predictive ability and no longer induce craving. However, the few studies on the effectiveness of cue-exposure treatment in smoking cessation show disappointing results (Niaura, et al., 1999; Havermans & Jansen, 2003). The effects of cue exposure therapy are limited, because renewal after extinction is an important cause of relapse (Thewissen, Snijders, Havermans, van den Hout, Jansen, 2006). This means that the cues regain their predictive ability after finishing the treatment. Furthermore, the optimal approaches for manipulating smoking cues (for example duration of exposure, and number of trials) are still unclear (Sayette, et al., 2000, Tiffany, Carter, & Singleton, 2000).

Another perspective in which automatic/unconscious psychological processes are important is that of implicit cognition and automated impulses (e.g. Wiers et al., 2010, Wiers & Stacy, 2006). This perspective assumes that behavior is often not a result of a reflective decision making that takes into account the pros and cons known by the individual, but that behavior is largely governed by automatic processes that often exert their influence outside conscious control. This does not imply that explicit conscious processes in decision making are unimportant, but that implicit (unconscious) processes play their role simultaneously (Wiers & Stacy, 2006). A relapse prevention intervention on the basis of this rationale is ‘attentional retraining’ (using

computer tasks) that in short comes down to training the attention away from the drug related stimulus (such as a cigarette). In this way, the person learns to automatically turn the attention away from smoking cues, thereby lowering temptations to smoke (Wiers and Stacy, 2006). In reducing alcohol consumption retraining has proven to be effective (Schoenmakers, Wiers, Jones, Bruce, & Jansen, 2007), and in smoking cessation and relapse this approach is promising (Attwood, O'Sullivan, Leonards, Mackintosh, & Munafo, 2008).

A relatively new perspective using automatic/unconscious psychological processes to understand smoking and relapse is the so called Plans Responses Impulses Motives Evaluations (P.R.I.M.E) theory of West (2006, 2007). West's theory integrates ideas on judgment and decision making, emotions, drive, habits, and reflexes. The model distinguishes between five interacting subsystems, in which the higher level subsystems (such as motives, evaluations and plans) engage with lower levels (such as impulses and responses). In the light of this theory, relapse prevention interventions will be effective if they induce a feeling of desire to avoid a certain behavior (such as smoking), translate that desire into an impulse to initiate a change plan before it dissipates, and create a lasting commitment to the plan and trigger supporting activities that preserve or restore balance to the motivational system (West, 2006, 2007). Some strategies based on this complex perspective have been applied with positive results (West, Walia, Hyder, Shahab, & Michie, 2010).

The cognitive/behavioral perspective

The broad (social) cognitive/behavioral perspective focuses on the role of cognitions and behavioral patterns in smoking. Behavior and emotions are governed by underlying cognitions and self-control but also conditioning processes play a role. On the basis of this rationale cognitive/behavioral therapy (CBT) is an empirically supported treatment that focuses on patterns of thinking that are maladaptive and the beliefs that underlie such thinking (British Association for Behavioral and Cognitive

Psychotherapies, 2008). CBT is frequently used in relapse prevention, and mainly focuses on factors that are potential causes of relapse, like negative emotions, physical dependence, social situations, and low self-efficacy (Baer & Lichtenstein, 1988; Borland, 1990; Kenford et al., 2002; Swan, Ward & Jack, 1996; Killen et al., 1996; Marlatt & Gordon, 1985; Shiffman, 1982). One model within this perspective is the cognitive model of addiction from Beck, Wright, Newman, and Liese (1993). From this cognitive perspective, addicted people construe their own reality based on dysfunctional beliefs in which the value of the drug is at the center. Furthermore, they may have certain characteristics, such as poor impulse control, that make them more susceptible to substance abuse. The goal of cognitive therapy in relapse prevention is to modify the faulty or erroneous thinking and maladaptive beliefs that underlie the addiction. In addition, specific cognitive strategies are used to reduce urges, and to establish a stronger system of internal control.

This (social) cognitive/behavioral perspective has also been used to understand the dynamic process of relapse as it unfolds over time (e.g. Shiffman & Rathbun, 2011; Gwaltney, Shiffman, Balabanis, Paty, 2005; Gwaltney, et al., 2002; Borland, 1990, Borland & Balmford, 2005). Although most relapse models agree about which factors are relevant for relapse, such as self-efficacy and outcome expectancies, and that these factors can change over time, according to Gwaltney, Shiffman, Balabanis and Paty (2005) these more ‘traditional’ models have not addressed the variability that can occur in these factors during a quit attempt. Therefore, this line of research often makes use of ecological momentary assessments (EMA). EMA involves repeated sampling of subjects’ current individual behaviors and experiences in real time, in subjects’ natural environments. EMA studies assess particular events in subjects’ lives or assess subjects at periodic intervals, often by random time sampling, using technologies ranging from written diaries and telephones to electronic diaries and physiological sensors. In this way, sudden drops in for example self-efficacy or positive affect (which can result in a

lapse) can be accurately assessed. A (re)lapse prevention strategy that can be used here are timed telephone ‘booster’ sessions to help managing critical situations (such as declines in self-efficacy), and to prevent relapse.

One of the best known models in (social) cognitive/behavioral relapse prevention research is the Relapse Prevention model (RP-model) of Marlatt & Gordon (1985). The RP model suggests that both immediate determinants (e.g., high-risk situations, coping skills, outcome expectancies, and the abstinence violation effect) and covert antecedents (e.g., lifestyle factors, and urges and cravings) can contribute to relapse (Larimer, Palmer, & Marlatt, 1999). Relapse is described as a transitional process, in which a lapse can be followed by either renewed abstinence or a downturn to the original behavior. From the perspective of Marlatt and Gordon (1985), ‘relapse can be viewed as a single act of falling back: a single mistake, an error, a slip’ (p. 32). It depends on the cognitive and affective reactions to this slip whether a total relapse occurs or not. A key mechanism in the model of relapse is the Abstinence Violation Effect (AVE; Marlatt & Nathan, 1978, Marlatt & Gordon, 1985). This effect, comprised of a decrease in self-efficacy and an increase in feelings of guilt and conflict, is thought to arise when an initial lapse has occurred in a high risk situation. As a result, the probability of a total relapse becomes even higher as in most smokers negative emotions are basically related to smoking. Many smoking cessation interventions contain elements based on the Relapse Prevention model (RP-model) and have been found to be effective (e.g., O’Connell, Hosein, Schwartz, & Leibowitz, 2007; Witkiewitz, & Marlatt, 2007).

The state of relapse research

To conclude, many theories and perspectives regarding smoking, relapse, and relapse prevention have been developed in the past three decades. However, the fact remains that despite all those valuable theoretical and research contributions, relapse in ex-smokers is still a major problem. During the past twenty years hardly any progress

has been made with regard to the development of new strategies for the prevention of relapse (Hajek, Stead, West, Jarvis & Lancaster, 2009; Shiffman, 1993; Niaura, Abrams, Shadel, Rohsenow, Monti & Sirota, 1999). Reviews have shown that interventions are often not very effective, meaning that the percentages of abstinence are still low after treatment (reviews concerning Relapse prevention: Irvin, Bower, Dunn and Cheek, 1999: Cue exposure; Niaura et al., 1999; Havermans & Jansen, 2003: Self-help interventions: Lancaster & Stead, 2009). These results make clear that new insights concerning relapse prevention are still highly needed.

One new angle might arise from focusing on abstinence instead of on relapse. That is, a general clinical observation is that over time abstinence becomes easier to maintain: As the weeks and months pass, ex-smokers feel less tempted to smoke (Prochaska, Velicer, Guadagnoli, Rossi & DiClemente, 1991). This observation has led to the idea that simply longer abstinence from smoking will result in further abstinence. Therefore, the main strategy applied in interventions is just to keep ex-smokers from smoking again, for example, teaching smokers cognitive skills (such as anticipating risk situations, self-talk, or increasing one's self-efficacy) and behavioral skills (such as replacing smoking for another behavior to fulfill the same functions or distract oneself). Thus, the rationale is that as long as ex-smokers stay abstinent, refraining from smoking will become easier. In the perspective taken in this thesis 'becoming easier' is caused by changes in specific psychological factors. The psychological processes that are involved in this psychological change (not smoking becomes easier), and the conditions in which these changes do or do not take place is still largely unknown, and have not been formally described yet. That is why in this thesis a new theoretical perspective is introduced, taking notice of the existing descriptions of relapse and relapse prevention, but with the new angle of 'learning about abstinence'. This is called the Learning Abstinence Theory (LAT). In this theory, effortless and continuous abstinence is viewed as resulting from learning: A person has

to unlearn smoking and to learn not to smoke in this process. The next paragraph will further outline the theory.

A new perspective on relapse prevention: Learning Abstinence Theory

The starting point is the observation that, over time, abstinent ex-smokers move from a state in which they have a strong inclination to smoke to a state in which they are no more inclined to smoke; from a psychological point of view their perception of smoking and not smoking changes from one specific state into another. How is this happening? In the LAT it is proposed that this transfer occurs when ex-smokers *learn* about smoking and not smoking. By construing abstinence as a result of learning, new perspectives on relapse prevention emerge.

The concept of learning in LAT is partly inspired by other perspectives on abstinence in addictions. Firstly, in cue-exposure, ex-smokers unlearn the association between unconditioned cues (e.g., negative emotions) and the occurrence of smoking (Brandon, Piasecki, Quin, & Baker, 1995). However, in cue-exposure the learning process has little cognitive substance; it is mainly explained in the abstract terms of conditioning. This means that it is not integrated in the social cognitive account of smoking and relapse in which well-established mechanisms and psychological constructs, such as, outcome expectations and self-efficacy, play a central role. Secondly, in the cognitive behavioral perspective of Beck, Wright, Newman, and Liese (1993), ex-smokers can correct (=learn) inadequate beliefs about smoking, and their ability to abstain from it in so-called ‘experiments’ in cognitive therapy. Although this learning can be understood in terms of social cognitive processes, it is not embedded in learning about progress towards reaching the overarching final goal of abstinence. LAT is a social cognitive account (Bandura, 1986) of learning in the context of the overarching final goal of abstinence. It aims to fill a gap in our understanding of the process of abstinence.

From the LAT perspective, relapse prevention should be based on learning specific things about smoking and not smoking, and not so much on maintaining abstinence itself. Of course abstinence is important because continued abstinence is the final goal of quitting but during learning, abstinence must be regarded as one (albeit central) learning condition. Thus, in LAT the focus is on the process by which fresh ex-smokers' perceptions of smoking and not smoking change. This perspective brings up several questions.

A first question is: 'What can ex-smokers learn?' According to the Social Cognitive perspective on psychological functioning, ex-smokers will have to learn about outcomes and about control. The desired psychological end-state that guarantees continued abstinence is 1) one of perceiving few or no positive outcomes of smoking; 2) experiencing sufficient self-efficacy, and; 3) perceiving relevant positive outcomes of abstinence. Thus, ex-smokers will have to learn that smoking no longer has valued functions for them and therefore are able to do without smoking. In addition, they have to learn that they benefit from refraining from smoking. Both lessons can be learned in learning situations in which they may find proof for it through experience; through enactive learning (Bandura, 1986).

Another question is: 'When does this learning take place?' Learning is thought to take place in learning situations. A learning situation is a situation in which an ex-smoker used to smoke or might have smoked in the past. In Marlatt and Gordon's (1985) Relapse Prevention Model, these situations are called risk situations. For ex-smokers there is something new that can be learned in these situations. Thus, learning may take place over time but is not a simple function of time; it is concentrated in learning situations and, therefore, is a function of the number and quality of learning situations. From this it follows that it is possible that an ex-smoker only needs one learning situation to transit from the fresh ex-smoker's perceptive (for example, still having strong positive outcome expectations about smoking despite having quit

smoking) to the perspective of an ex-smoker who is no longer inclined to smoke (and no longer has positive outcome expectations about smoking). It is also possible that the transition takes many learning situations and, thus, a long time. One consequence of this reasoning is that when all learning situations are avoided, learning is attenuated and the change in the fresh ex-smoker's perceptive will be inhibited and the risk for relapse is not lowered.

This raises a next question: 'What determines what ex-smokers learn in learning situations?' In learning situations ex-smokers are tempted to smoke which leads to cognitive reactions (e.g., thoughts, attention allocation), affective reactions (e.g., fear, craving), and behavioral reactions (e.g., avoiding, asking support). All these reactions are given meaning by the ex-smoker. For example, the affective experience of craving may be interpreted as a sign that smoking is still important, but it may also be interpreted as an expected state in the process of withdrawal. Also, the ex-smoker may dwell on the occurrence of craving or may focus on the rapid decline of craving. Thus, what ex-smokers learn in learning situations depends on what they focus on and on how they interpret the incoming information. This is thought to be determined by the state of mind that is active in learning situations (Erdley & D'Agostino, 1988; Kunda, 1999; Markus, 1977): The specific state of mind determines how information is received and, thus, how the information contributes to learning in a positive (continued abstinence) or a negative (relapse) direction. For example, an ex-smoker may encounter a piece of information that only three to five percent of all quitting attempts succeed. This information is likely to be interpreted as smoking cessation being very difficult and, in turn, this may lower the ex-smoker's self-efficacy to remain abstinent. In a learning situation this state of mind is expected to influence subsequent learning: It may cause the ex-smoker in a learning situation to be focused on signals of impending relapse, for example, by focusing on negative emotions instead of on accomplishments. The ex-smoker learns from the state of mind-induced experience.

The above learning takes place in specified situations and can be viewed as concrete learning, in that it is easy to point out the concrete sources of learning. Learning experiences are formed through interpretations of experiences, emotions, cognitions and behaviors that occur in situations in which they smoked in the past. On the one hand learning is about what exactly ex-smokers learn (concretely). On the other hand it is about *what it means* in the framework of their quit attempt. This is the more abstract learning. For example, when a learning experience signals progress, this is expected to motivate abstinence. Thus, in contrast to the concrete learning, in LAT ex-smokers also learn on a more abstract level; at the level of the final goal they have with refraining from smoking: effortless and continued abstinence with all its desired outcomes.

Continued abstinence as a goal

On the basis of the motivating outcomes they expect, ex-smokers set themselves the goal to stay abstinent. This goal is represented mentally as a desirable and feasible future state for the self (Boldero & Francis, 2002). Because of the positive outcomes they expect to gain by reaching the goal, they are motivated to invest time and effort to reach the goal. As long as they feel that they are approaching that desired goal, they will be motivated, but only as long as they know that it pays-off: When they become uncertain whether their investments will pay-off, their motivation will decline (Kluger and DeNisi, 1996). In other words, when ex-smokers start doubting that the positive outcomes will come available, these imagined positive outcomes will lose their motivating power. Thus, ex-smokers need to learn about whether they approach the goal of continued abstinence. Therefore, from a goal perspective, quitters need feedback about their progress.

Progress feedback refers to feedback on the relevant changes one has undergone and the interpretation of these changes. Ex-smokers observe whether they smoke or not and they monitor how they feel, what they think and what they do. The

observation that one is not smoking is not particularly informative when it comes to the risk of relapse: All ex-smokers are not smoking before they relapse. Thus, we assume that quitters use other sources of information to learn whether they are on the right track. In abstinence, relevant changes concern psychological factors that are related to quitting success, such as perceptions of the positive outcomes of smoking, self-efficacy, and the related craving. For example, the frequency or the changing intensity of craving for smoking, or an increased confidence to stay abstinent might be informative about progress towards their goal. On the basis of this information, ex-smokers are thought to create their own ideas about their progress: They make estimations of whether they approach their final goal of continued abstinence. When quitters interpret this information as signaling good progress, their motivation will be strengthened.

One spontaneous way ex-smokers are dealing with their need for progress feedback is to compare their present to a past point in time. This process and its product are called temporal comparisons (Albert, 1977): Ex-smokers construe their own progress feedback in temporal comparisons on the basis of what they learn about their own present state and the past changes towards that state.

In sum, in the LAT ex-smokers learn at two levels. Firstly, they learn about smoking and not smoking in concrete situations: About the outcomes and about their abilities. Secondly, they learn from these experiences at a higher more abstract level about the progress towards their final goal of continued abstinence.

Objectives

In this dissertation, some aspects of the LAT were tested. For that purpose, data were gathered in the field as well as in the laboratory. Each of the studies addressed one or more predictions derived from the LAT. In this way the LAT may contribute to a further understanding of continuous abstinence and relapse in smoking cessation.

Chapter 2 presents an empirical study in which two basic concepts of the LAT are assessed: Temporal comparisons and learning experiences. In a cohort study 323 ex-smokers filled in three questionnaires; at baseline, after one month, and after six months. It was tested whether temporal comparisons and learning evaluations were predictors of relapse. Two types of temporal comparisons were tested: Those relating the present to ‘when you just had quit smoking’, and those relating the present to ‘when you still smoked’. Temporal comparisons were expected to be related to learning evaluations. In addition, it was tested whether the relation between temporal comparisons and relapse was mediated by learning evaluations. When temporal comparisons are considered to be a state of mind, for example, signaling good progress, they might positively affect how information in the learning situation is interpreted. Because self-efficacy is by far the most used psychological construct to understand relapse (Bandura, 1986; Marlatt & Gordon 1985; Mudde, Kok & Strecher, 1995; Kavanagh, Pierce, Lo & Shelley, 1993), we were also interested in the role of self-efficacy as a possible moderator in the relation between temporal comparisons and relapse.

Chapter 3 presents an empirical study on ambivalence in the same cohort of ex-smokers reported in Chapter 2. We assume that ambivalence is normal in smoking cessation, but should have dissolved after the decision has been made and, in the case of smoking cessation, when the smoker has already initiated the quit attempt. When ambivalence is still present after the decision has been made, this is expected to undermine abstinence and increase the risk for relapse to smoking. We propose that this can happen in two ways. Firstly, ambivalence is viewed as a state of mind that can influence smoking cessation, by guiding the interpretation of the incoming information. Secondly, ambivalence might be understood in a dual-process perspective. Ambivalence may be caused by a renewed impulse to smoke that can be held under control by a reflective mechanism; in this study operationalized as the

anticipated negative self-evaluative emotions. Ambivalence pulls towards relapse and self-evaluative emotions avert relapse.

Chapter 4 presents two laboratory studies in which we focus on states of mind in the confrontation with smoking cues. The dependent variable is craving for smoking, as craving is an important risk factor for relapse (Baer & Lichtenstein, 1988; Brandon, Tiffany, & Baker, 1987; Dijkstra & Borland, 2003). For these two studies, temporary abstinent smokers (in Study 1, $N = 140$, and in Study 2, $N = 120$) were asked to remain abstinent at least four hours before the start of the experiment. It was expected that the level of craving when exposed to smoking cues depends on the state of mind a person has at that moment. Therefore, we manipulated states of mind, and studied how much craving these states of mind elicited by using a strong smoking cue (the own cigarettes). In the first study, two smoking-specific states of mind were induced: Before the abstinent smokers were exposed to the smoking cue they were led to believe that smoking has few or many positive outcome expectations, or that they had a high or a low self-efficacy to refrain from smoking. In the second study, it was assumed that exposure to the smoking cue would induce a negative state of mind that influences how the smoking cue is perceived. This state of mind is prevented by boosting the smoker's self-feelings before the exposure using a self-affirmation procedure. The states of mind in both studies are thought to influence the level of craving which, in turn, is one of the pieces of information that will contribute to the learning about smoking, one's ability to refrain from smoking and the outcomes of not smoking.

Chapter 5 presents an experimental field study. The goal of this study was to test a newly developed tailored Internet-delivered intervention. Therefore, recently quit smokers, and smokers who wanted to quit smoking in the near future were recruited to join this study ($N = 393$). In this study, two methods to influence quitters' estimates of their progress were applied: Progress feedback and temporal comparison formation.

Progress feedback refers to feedback on the relevant changes ex-smokers have undergone and the interpretation of these changes. Temporal comparison formation refers to a writing task in which ex-smokers construct perceptions of progress towards continued abstinence. The essence is that quitters explicitly contrast positive aspects of the present state of abstinence with negative aspects of past smoking. Participants were randomly assigned to a control condition or an experimental condition. In both conditions participants had access to a basic tailored quitting system developed to support quitting. Only participants in the experimental condition were offered five times the newly developed intervention (the progress feedback system including the two methods progress feedback and temporal comparison formation) during a six months period. The research question was whether the progress feedback system, based on the LAT, was able to lower relapse rates beyond the effects of the basic tailored quitting smoking system.

Finally, Chapter 6 summarizes the results of the four studies and attempts to integrate the findings in the framework of the LAT. Furthermore, recommendations are formulated concerning research and the practice of relapse prevention.

Chapter 2

'I'm better off now': The role of temporal comparisons and exposure evaluations in smoking cessation

This chapter is based on Menninga, K. M., Dijkstra, A., Gebhardt, W. A., & Siero, F (2011). 'I'm better off now': The role of temporal comparisons and exposure evaluations in smoking cessation. *Journal of Health Psychology, 16*, 1082-1090.

Many smokers plan to quit some day but most quit attempts fail (McCaul, et al., 2006). Only between 7% and 14% of the smokers who undertake a quit attempt without any support, are still abstinent after one year (Baillie, Mattick & Hall, 1995). In the current study we view abstinence as a goal which motivates perseverance when ex-smokers experience progress towards reaching this goal.

In general, people act because they expect their behavior to have positive outcomes. Self-efficacy is a core construct to understand the perception of the chances that the expected positive outcomes will be achieved. In smoking cessation, self-efficacy is by far the most used psychological construct to understand relapse (Bandura, 1986; Marlatt & Gordon 1985; Mudde, Kok & Strecher, 1995; Kavanagh, Pierce, Lo & Shelley, 1993). Self-efficacy refers to the ability to refrain from smoking in different situations, and it is a precondition for the expected positive outcomes to motivate the sustainment of behavior change.

Besides studies on self-efficacy, only a few studies on the motivation of ex-smokers to persevere are available in the literature. These studies show that the motivational construct of the pros of quitting does not predict perseverance in ex-smokers (De Vries & Mudde, 1997; Dijkstra, Tromp & Conijn, 2003; Prochaska, DiClemente, Velicer, Ginpil & Norcross, 1985). Thus, the motivation to persevere in ex-smokers is still not fully understood.

Comparing the present with the past: Temporal comparisons

To understand ex-smokers' motivation, we can consider continuous abstinence to be a goal. Ex-smokers have a need to assess the progress towards their goal (Carver & Scheier, 1990). When they receive feedback that indicates that they are making good progress, they remain more motivated. When they receive feedback that signals that they are not making progress or that they are even regressing, they are likely to become less motivated (Kluger & DeNisi, 1996). As ex-smokers mostly do not receive objective feedback on their progress, they construct their own progress feedback.

People in general, including ex-smokers, construct progress feedback by making temporal comparisons (Albert, 1977).

To evaluate their progress, people look back in time and compare their present state to a relevant state in the past. They evaluate whether, at present, they feel better or worse off. For an ex-smoker, at least two comparisons may be informative. First, ex-smokers may compare their present to the time they still smoked. Second, ex-smokers may compare their present to the time when they had just started their quit attempt. These temporal comparisons motivate ex-smokers to try to maintain their quitting attempt. They inform ex-smokers whether or not they are approaching their desired end-state.

The role of exposure evaluations to assess progress

Temporal comparisons are not static constructs; they can change over time. The experience of the present may change due to experience and learning. In ex-smokers, relevant experiences and learning may especially occur when they are exposed to situations in which they used to smoke. We assume that ex-smokers form exposure evaluations through interpretations of experiences, emotions, cognitions and behavior that occur in the context of situations in which they smoked in the past. When an exposure evaluation signals progress, this is expected to motivate abstinence. Exposure evaluations may contribute to the construction of temporal comparisons, because exposure evaluations provide information about the present, which is compared to the past. A present negative exposure evaluation may make the past relatively more positive. In turn, such a negative temporal comparison may lower the motivation to persevere.

On the other hand, temporal comparisons may also contribute to the formation of exposure evaluations. That is, temporal comparisons as a state of mind may determine what information ex-smokers attend to and how they interpret the information in risk-situations they are exposed to. The basic idea is that the available information in a risk

situation is interpreted against the background of the cognitive (memory) schemas that are activated at that moment (Kunda, 1999; Markus, 1977). For example, when temporal comparisons are negative, the information in a situation in which someone used to smoke will be interpreted negatively and the exposure evaluation will be negative, thereby undermining the motivation to persevere.

Overview of the study

In the present study, we will try to replicate earlier findings on temporal comparisons with regard to the time ex-smokers still smoked (Dijkstra & Borland, 2003; Dijkstra & Borland & Buunk, 2007), and expand our study by: (1) including temporal comparisons with regard to the time ex-smokers just had quit, and (2) by relating temporal comparisons to exposure evaluations. It will be tested whether the association between temporal comparisons and relapse is mediated by exposure evaluations and moderated by self-efficacy.

In a cohort of ex-smokers, a baseline measurement (T1) and a follow-up at one month (T2) and a follow-up at seven months (T3) were used to test the expected relationships, especially, to predict relapse.

Method

Participants and recruitment

Ex-smokers, no longer than six months abstinent, were recruited by advertisements in local newspapers and via the Internet in the Netherlands. Three assessments were conducted; at baseline (T1) and after one (T2) and seven months (T3) follow-up. Participants could choose how to fill out the questionnaires; with a paper and pencil procedure or via Internet.

Questionnaire

At T1, quitting and smoking history were assessed by the questions: ‘Are you refraining from smoking at this moment?’ (Yes/No) and ‘How many days/months have you been refraining from smoking?’ Smoking behavior at T1 was assessed in

terms of the number of months/years smoked in the past and the number of cigarettes smoked per day.

Temporal comparisons at T1 were assessed by asking participants whether, at present, they felt better or worse off compared to when they still smoked (TCsmoke) and whether, at present, they felt better or worse off compared to when they just had quit smoking (TCquit). In TCsmoke, the past comparison episode was the time they smoked before they engaged in the present quit attempt and in TCquit, the past comparison episode was the time they just started the present quit attempt. Relevant comparison dimensions were identified from an earlier study (Dijkstra & Borland, 2003). The general format of the 10 two-sided seven-point items was: 'Compared to when you still smoked/just had quit smoking, do you think you are doing better or worse?' The global format of the anchors was 'much more' (1) to 'much fewer' (7). The other items were: '...is your life more or less meaningful?'; '...do you have more or less positive moments in your life?'; '...are you more or less happy?' and '...is your life better or worse organized?' The higher the scale score, the more negative the participant's evaluation of the present situation compared to his or her situation as a smoker was (TCsmoke, $\alpha = .86$; TCquit, $\alpha = .84$).

Self-efficacy at T1 was assessed with a 12 item scale, validated in earlier studies (Dijkstra & de Vries, 2000; Mudde, Kok & Stretcher, 1995). The scale assessed the confidence level of being able to refrain from smoking in emotional, social, conditioned and motivational situations. The introduction sentence was: 'In some situations it is easy, in other situations it is difficult not to smoke. At this moment you are engaging in a quit attempt. Are you able to refrain from smoking when you...?'. An example of an (emotional) item is: '...are feeling stressed'. All items were measured on a seven-point scale and could be scored from endpoints -3 [*not sure I am able to*] and 3 [*very sure I am able to*]. (Cronbach's $\alpha = .97$).

Positive and negative exposure evaluations at T1 were measured with a newly developed seven-point scale containing eight items. The introduction sentence was: ‘How did you feel the last time that you experienced a strong taste to smoke, but didn’t smoke?’ The items were in the following format: ‘Right after this situation I felt...’. An example of a positive exposure evaluation is: ‘..satisfied with myself’ (endpoints 1 [*not at all satisfied*] and 7 [*very satisfied*]). The higher the scale score, the more positive the evaluations were (Cronbach’s $\alpha = .79$). An example of a negative exposure evaluation is: ‘Right after this situation I felt...’; ‘..disappointed of the fact that I still experienced a strong taste to smoke’ (endpoints 1 [*not at all disappointed*] and 7 [*very disappointed*]). The lower the scale score the more negative the exposure evaluations were (Cronbach’s $\alpha = .75$).

At T2 and T3, relapse was assessed using the question: ‘Have you been smoking at all (even one cigarette or puff) since you’ve quit smoking?’ (Yes/No). Participants who answered the first question in the affirmative were considered to have relapsed.

Demographics measured were sex, age, and education level, which was categorized as low (vocational training), medium (advanced vocational training), or high (college/university training).

Results

Sample Characteristics

Of the 446 ex-smokers who registered at baseline, 395 participants filled in the T1 questionnaire (89%). At T2, 38 participants dropped out (9.6%) leaving 357 participants in the sample. At T3, 23 ex-smokers dropped out (6.4%), leaving 334 ex-smokers in the sample. In addition, eleven other participants were excluded for different reasons (e.g. missing questionnaires).

At T2, 61 (19%) participants reported to have relapsed. At T3, 106 participants (33%) reported to have relapsed.

Correlations of Temporal Comparisons with other cessation-related measures

We computed correlations to assess if temporal comparisons and exposure evaluations were related to each other and to other cessation-related measures (Table 1). TCsmoke correlated significantly with TCquit ($r = .64$). TCsmoke as well as TCquit were related significantly to both measures of exposure evaluations in expected directions. The magnitude of these four correlations was around .26. Lastly, TCsmoke and TCquit were not significantly related to self-efficacy, indicating that they are independent constructs. All these correlations are interpretable and in the expected direction.

Table 1. *Correlations of temporal comparison measures (TCsmoke, TCquit) with other cessation related variables at T1.*

Variable	1	2	3	4
1. TCsmoke				
2. TCquit	.64**			
3. Self-efficacy	-.11	-.05		
4. Negative exposure evaluations	.28**	.22**	-.32**	
5. Positive exposure evaluations	-.28**	-.28**	.17**	-.20**

$N = 323$, * $p < .05$, ** $p < .01$.

TCsmoke and self-efficacy predict relapse

We conducted logistic regression analyses to assess whether TCsmoke at baseline was a predictor of relapse at one (T2) and at seven months (T3). In all logistic regression analyses the number of days quit and amount of cigarettes smoked were included as covariates.

TCsmoke (Table 2) was a significant predictor of relapse at T2: $\text{Exp}(B) = 1.57$; CI 1.15-2.15; $p < .01$. The more negative temporal comparisons participants made at T1, the more often they reported after one month having smoked. When self-efficacy was entered in the model, self-efficacy also significantly predicted relapse after one month: $\text{Exp}(B) = .71$; CI .59-.86; $p < .001$. This finding showed that the less self-efficacy participants reported at T1, the more often they reported having smoked at T2.

TCsmoke stayed significant in this model with self-efficacy: $\text{Exp}(B) = 1.50$; CI 1.09-2.08; $p < .05$. The interaction between TCsmoke and self-efficacy was also significant: $\text{Exp}(B) = .78$; CI .61-1.0; $p < .05$. In predicting relapse at T3, the findings were very similar.

To better understand the interactions, we assessed the predictive power of temporal comparisons when self-efficacy was high and when self-efficacy was low. For this purpose, the complete data set was used to model participants as scoring low or high on self-efficacy, by adding one standard deviation to the standardized means and subtracting one standard deviation from the standardized means, respectively (Cohen, Cohen, West & Aiken, 2003). In the low self-efficacy group, TCsmoke significantly predicted relapse at T2: $\text{Exp}(B) = 2.05$; CI 1.26-3.32; $p < .01$. In the high self-efficacy group, TCsmoke was no significant predictor of relapse at T2: $\text{Exp}(B) = .98$; CI .60-1.61; $p = .94$. In predicting relapse at T3, TCsmoke was also a significant predictor in the low self-efficacy group, but not in the high self-efficacy group.

The same procedure was used to test whether self-efficacy predicted relapse when temporal comparisons were positive versus negative. In the negative temporal comparisons group, self-efficacy significantly predicted relapse at T2: $\text{Exp}(B) = .57$; CI .42-.76; $p < .001$, while in the positive temporal comparisons group, self-efficacy was no significant predictor of relapse at T2: $\text{Exp}(B) = .93$; CI .66-1.33; $p = .71$. In predicting relapse at T3, self-efficacy was also a significant predictor in the negative temporal comparison group, but not in the positive temporal comparison group.

Table 2. *Predicting relapse after one month and seven months from TCsmoke and self-efficacy.*

Relapse		Exp(B)	95% CI		<i>p</i> -value
			Lower	Upper	
T2	TCsmoke	1.57	1.15	2.15	< .01
	Self efficacy	.71	.59	.86	< .001
	TCsmoke x Self efficacy	.78	.61	1.0	< .05
T3	TCsmoke	1.35	1.05	1.75	< .05
	Self efficacy	.83	.70	.98	< .05
	TCsmoke x Self efficacy	.82	.67	1.01	.063

N = 320

To gain insight into the effect sizes, we computed the percentages of relapse in ex-smokers in four groups, based on the 2x2 combination of the median split on self-efficacy (SE) and the median split on temporal comparisons (group 1: low TC and low SE; group 2: high TC and low SE; group 3: low TC and high SE; group 4: high TC and high SE). Figure 1 depicts the raw percentages of relapse after one month (T2) in strata of low and high self-efficacy and positive (low score) and negative (high score) TCsmoke. The pattern of relapse at T2 and T3 was very similar. The highest relapse rate was among ex-smokers with low self-efficacy and negative temporal comparisons (relapse T2 50.8%; T3 46.2%). When ex-smokers had negative temporal comparisons, high self-efficacy seemed to protect against relapse (relapse T2 14.7%; T3 13.2%). In the case of positive temporal comparisons, self-efficacy did not make a significant difference anymore. When self-efficacy was low, relapse at T2 was 23% (T3 20.8%) and when self-efficacy was high, relapse at T2 occurred in 11.5% (T3 19.8%).

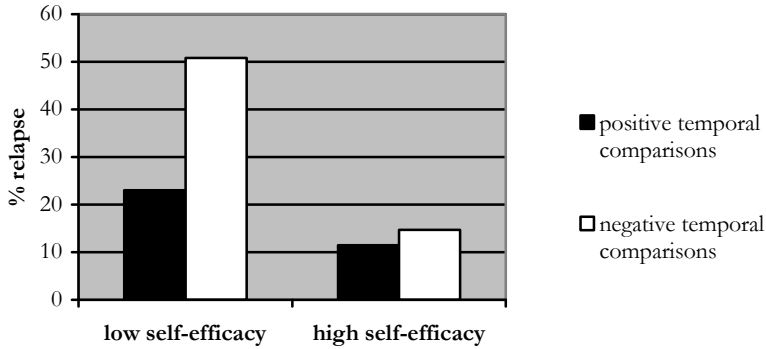


Figure 1. Percentages of relapse at T2 related to temporal comparisons and self-efficacy at T1.

TCquit and self-efficacy predict relapse

We conducted the same logistic regression analyses with TCquit to predict relapse at T2 and T3. We found a main effect of TCquit in predicting relapse at T2: $\text{Exp}(B) = 1.45$; CI 1.05-1.99; $p < .05$; but not at T3: $\text{Exp}(B) = 1.21$ CI .94-1.56; $p = .14$. When self-efficacy was added to the model, self-efficacy predicted relapse significantly at T2: $\text{Exp}(B) = .70$; CI .58-.84, $p < .001$), and at T3: $\text{Exp}(B) = .82$; CI .70-.97, $p < .05$. TCquit stayed significant at T2: $\text{Exp}(B) = 1.43$; CI 1.03-1.99; $p < .05$, but was not significant at T3: $\text{Exp}(B) = 1.20$; CI .93-1.55; $p = .16$. The interaction between self-efficacy and TCquit was not significant at T2 and T3.

Learning experiences predict relapse

Negative exposure evaluations predicted relapse at T2: $\text{Exp}(B) = 1.51$; CI 1.24-1.85; $p < .001$, and T3: $\text{Exp}(B) = 1.36$; CI 1.14-1.61, $p = .001$. We found the same but opposite pattern for positive exposure evaluations, although it was less pronounced. Positive exposure evaluations predicted relapse at T2: $\text{Exp}(B) = .79$; CI .64-.99, $p < .05$, but not at T3: $\text{Exp}(B) = .99$; CI .81-1.21, $p = .94$.

Mediation analyses

Mediation analyses were conducted to test how TCsmoke and exposure evaluations were related in predicting relapse. All variables met the basic criteria of possible mediation (Baron & Kenny, 1986): TCsmoke and TCquit were related significantly to negative exposure evaluations and TCsmoke, TCquit, and negative exposure evaluations were significant predictors of relapse.

Predicting T2 relapse (TCsmoke).

When negative exposure evaluations and TCsmoke were combined in one model, TCsmoke was no longer a significant predictor of relapse at T2: $\text{Exp}(B) = 1.36$; CI .97-1.89; $p = .072$, while negative exposure evaluations still predicted relapse significantly: $\text{Exp}(B) = 1.43$; CI 1.17-1.77; $p < .01$. The Sobel test indicated that negative exposure evaluations significantly mediated the relation between TCsmoke and relapse at T2: Sobel's $Z = 2.59$, $p < 0.01$, two-tailed (for positive exposure evaluations the Sobel's $Z = 1.90$, $p = .06$) (see Figure 2).

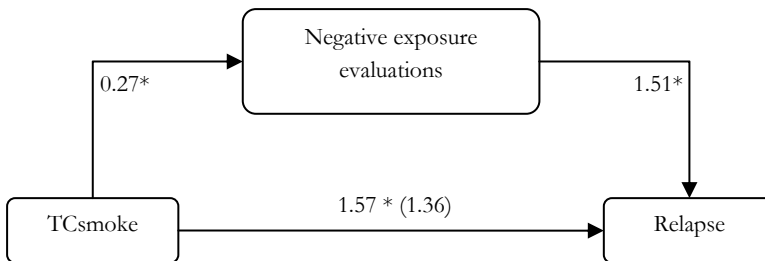


Figure 2. Mediation model with negative exposure evaluations as a mediator in predicting relapse at T2

Note. For the relation between TCsmoke and relapse, and the relation between negative exposure evaluations and relapse, (Exp)B's are reported. For the relation between TCsmoke and negative exposure evaluations, the Beta is reported.

* $p < .01$

Predicting T3 relapse (TCsmoke).

When negative exposure evaluations and TCsmoke were combined in one model, TCsmoke no longer was a significant predictor of relapse at T3: $\text{Exp(B)} = 1.22$; CI .93–1.59; $p = .15$, while negative exposure evaluations were a significant predictor: $\text{Exp(B)} = 1.31$; CI 1.10–1.56; $p < .01$. The Sobel test indicated that negative exposure evaluations significantly mediated the relation between TCsmoke and relapse at T3 (Sobel's $Z = 2.54$, $p = .01$, two-tailed).

Predicting T2 relapse (TCquit).

When negative exposure evaluations and TCquit were combined in one model, TCquit no longer was a significant predictor of relapse at T2: $\text{Exp(B)} = 1.30$; CI .93–1.83, $p = .13$, while negative exposure evaluations were a significant predictor: $\text{Exp(B)} = 1.47$; CI 1.20–1.80, $p < .001$. The Sobel test, again, indicated that negative exposure evaluations significantly mediated the relation between TCquit and relapse at T2: Sobel's $Z = 2.60$, $p < .01$, two-tailed (positive exposure evaluations: Sobel's $Z = 1.89$, $p = .06$).

On the basis of the combined models above, in which TCsmoke and TCquit were no longer significant predictors of relapse when negative exposure evaluations were included in the model, we decided not to test if TCsmoke mediated the relation between negative exposure evaluations and relapse.

Discussion

Two measures of temporal comparisons used two different reference time-points: The time when the ex-smoker still smoked and the time the ex-smoker had just quit. Both measures were related to other constructs in expected and interpretable directions. Both predicted relapse, although only the effect of comparisons with the time one still smoked, was present after seven months. Thus, memories of when the ex-smokers still smoked seemed to be a more important anchor point to construct relevant progress than memories of when they had just quit smoking. This might

indicate that ex-smokers are not so much motivated by progress in their quitting attempt but more by perceived progress in their *lives*. From a goal-hierarchy perspective (Scheier & Carver, 2003), accomplishing abstinence may be a concrete goal in the function of reaching a higher-order goal such as striving to become one's ideal self. The present findings suggest that abstinence is largely motivated by perceived progress towards such a higher-order goal.

Temporal comparisons had an effect both independently and in concert with self-efficacy, meaning that temporal comparisons are not just a different operationalization of a similar control-construct. Furthermore, the data defined a condition under which self-efficacy has no effect on relapse: When temporal comparisons were positive. Strong positive temporal comparisons mean that ex-smokers are no longer bothered and tempted by an 'attractive' smoking past. This may make staying abstinent easier. When we accept this, the above finding, is in line with Bandura's (1986) theoretical assumption that self-efficacy is not a predictor of successful accomplishment when a task is easy.

The concept of exposure evaluations stresses the dynamics of smoking cessation: The progress towards continued abstinence is constructed continuously by the individual on the basis of his or her experience and learning. The data show that exposure evaluations were predictors of relapse after one and after seven months, even in the presence of temporal comparisons.

With regard to the relation between exposure evaluations and temporal comparisons, we found evidence for the mediating role of negative exposure evaluations in the relation between temporal comparisons and relapse. The state of mind of the temporal comparisons may have determined what information people attend to and how they interpret the information. On the basis of our results we have no evidence for the mediating role of temporal comparisons in the relation between negative exposure evaluations and relapse.

Although several questions remain unanswered, by applying the perspective of perceived goal progress towards continuous abstinence, the present study brings us one step further in understanding relapse in smoking cessation.

Our study has some limitations. In particular the recruitment of participants may have biased the sample composition. However, we have no reason to assume that the selection was on relevant variables, as the sample included people with very positive and very negative temporal comparisons and low and high self-efficacy. In addition, the fact that self-efficacy was a predictor of relapse makes our study comparable to all other studies on self-efficacy in smoking cessation. Moreover, the sample contained people of various ages, different educational levels, roughly comparable with the general population of quitters (Stivoro, 2008). Furthermore, in our study, women were overrepresented (63.8%). Posthoc analyses showed, however, that sex did not interact with temporal comparisons in predicting relapse.

Another study characteristic concerns our measure of relapse. We used a conservative self-report measurement of relapse: Participants who reported to have smoked between the measurements (even one puff of a cigarette) were considered to have relapsed. Indeed, even a short, single period of smoking (a lapse) leads almost inevitably to a full relapse (Shiffman et al., 1996). According to Kenford et al., (1994) the relapse rate after a lapse is about 95 percent.

Temporal comparisons and exposure evaluations are not specific to tobacco smoking. They are probably active in all kinds of behavior change that have high percentages of relapse because the old, not-changed situation may still seem attractive. Therefore, in the future it can be tested whether temporal comparisons and exposure evaluations are similarly important as determinants of abstinence in other addictions like alcoholism, drug abuse or eating behaviors.

Chapter 3

Mixed feelings: Ambivalence as a predictor of relapse in ex-smokers

This chapter is based on Menninga, K. M., Dijkstra, A., Gebhardt, W. A. (2011). Mixed feelings: Ambivalence as a predictor of relapse in ex-smokers. *British Journal of Health Psychology, 16*, 580-591.

Being torn between two sides of an attitudinal or a behavioral issue can be conceptualized as ambivalence. In this study ambivalence is defined as the simultaneous existence of strong positive and negative evaluations about the same attitude object (Thompson, Zanna, & Griffin, 1995). Attitudinal ambivalence can be experienced in numerous choices and behaviors, but in addictions, such as smoking tobacco, it is renowned. On the one hand smoking is perceived by smokers as having several strongly desired outcomes (e.g., as a relaxant and a social lubricant; Brandon & Baker, 1991; Marlatt & Gordon, 1985; Shiffman, 1993; Wetter et al., 1994), but on the other hand most smokers know that smoking increases the risk for several potentially lethal diseases.

Ambivalence can be viewed as a normal temporary psychological state in a decision process, for example, on quitting smoking. However, when ambivalence is still present after the decision has been made, it may undermine the motivation to stick to the decision: In smoking cessation, ambivalence can be expected to increase the risk for relapse. Relapse occurs very often in ex-smokers and only between the 7% and the 14% of the smokers who undertake a quit attempt without any support, are still abstinent after one year (Baillie, Mattick & Hall, 1995). We believe that ambivalence might be one cause of relapse.

Ambivalence: Empirical findings

Ambivalence reflects the extent to which one's reactions towards an attitude object are in such a way mixed in that both positive (favorable) and negative (unfavorable) elements are included (Wegener, Downing, Krosnick & Petty, 1995). In the domain of health, ambivalence often resides around the desired outcomes or functions of the behavior on the one hand and the undesired health effects of the behavior on the other hand.

In previous studies, ambivalence has been assessed toward health related behaviors like smoking, food intake and safe sex behaviors. For instance, Lipkus et al. (2005)

examined felt ambivalence towards smoking in relation to the desire to quit among (teen) smokers. With regard to felt ambivalence, people are asked about their mental state, using adjectives such as 'divided' or 'contradictory' in order to assess how ambivalent they feel (e.g., Cacioppo, Gardner & Berntson, 1997). Felt ambivalence was measured using an eight-item scale of which six items corresponded to items used by Lipkus, Green, Feaganes and Sedikides (2001). Their findings suggest that ambivalence with regard to smoking can motivate smokers to make a quitting attempt and that ambivalence interferes with the motivational process of behavior change, presumably because higher ambivalence indicates a weaker attitude towards the behavior. However, the role of ambivalence in abstinence and relapse in tobacco smoking has not been studied. Although attitudinal ambivalence in ex-smokers is clinically relevant (Miller & Rollnick, 1991), there are no empirical reports available on ambivalence in ex-smokers.

Ambivalence and decisional balance

Taking a process-view on decision making, felt ambivalence can be seen as a normal temporary state of mind (Janis & Mann, 1977; Velicer, DiClemente, Prochaska, and Brandenburg, 1985). Janis and Mann (1977) conceptualized decision making as a conflict: To make a sound decision, a careful consideration of all relevant pros and cons is essential. On the basis of this theory, Prochaska and colleagues (1994) integrated the pros of the unhealthy behavior and the cons of the unhealthy behavior in their transtheoretical model (Prochaska & DiClemente, 1983, 1984). In a study on 12 health behaviors, they found that at the start of the change process the pros were higher than the cons, while at the completion of the process this pattern was the reverse. More importantly, in all behaviors there was a moment in the process of change that the pros and cons were equally high - called a crossover - and this moment preceded the actual initiation of the change of the behavior.

The above theoretical accounts of the decision making process as well as the empirical findings suggest that a state of felt ambivalence is normal but should have dissolved after the decision has been made and, in the case of smoking cessation, when the smoker has already initiated a quit attempt. When there are no structural barriers to rewind the decision to quit, felt ambivalence is expected to undermine abstinence and increase the risk for relapse to smoking.

Felt ambivalence in a dual-system perspective

We theorize the relation between felt ambivalence and relapse to be as follows. An adequate motivational structure of low ambivalence in ex-smokers consists of a strong motivation to stay abstinent (pros of quitting) and a weak motivation to smoke again (pros of smoking). We assume, now, that felt ambivalence is not caused by a decrease in the pros of quitting, but specifically by an increase in the motivation to smoke again. Framed within a dual-system perspective (e.g. Epstein, 1990, Strack & Deutsch, 2004), we think that felt ambivalence is caused by an increase in the strength of the impulsive system (the impulse to smoke), relative to the reflective system (the reasoning to stay abstinent). The reflective system may still function - it may contain the motivation to abstain, the related goals and planning - but it has to deal with stronger and reviving impulses to smoke. Therefore, felt ambivalence may be a parameter of the strength of the impulsive system. The stronger the impulses, the more ambivalence is experienced and the higher the risk of relapse.

Felt ambivalence and the anticipation of regret

While ambivalence is a psychological force (the impulse) in the direction of smoking again, the reflective system opposes this tendency. One important candidate for a motivational force that may oppose ambivalence is the anticipation of regret (Van Harreveld, Van Der Pligt & De Liver, 2009). While felt ambivalence is related to an increase in the risk for relapse (as a parameter of the impulse to smoke), the anticipation of regret may protect against relapse by its motivational control.

Regret arises when an individual feels responsible for negative outcomes that he or she experiences (Loomes & Sugden, 1982; Zeelenberg, Van Dijk, Manstead & Van Der Pligt, 1998). In the framework of decision making, regret plays a role as an anticipated emotion. That is, part of weighing the consequences of a decision is the mental operation on what the effects of different choices will be for one's self-regard (Zeelenberg, 1999). In social cognitive theory (Bandura, 1986), regret is part of a broader class of emotions that govern behavior: The self-evaluative emotions (Dijkstra & Buunk, 2008). Ex-smokers may experience self-evaluative emotions when they relapse. The feelings of guilt and self-directed anger they experience in reaction to relapse are referred to as the Abstinence Violation Effect (Marlatt & Gordon, 1985). Ex-smokers might anticipate these negative self-evaluative emotions in the case they smoke again. This will motivate them to stay abstinent.

While felt ambivalence indicates a tendency towards relapse, anticipated negative self-evaluative emotions are a tendency to staying abstinent. This would mean that the lowest chance of relapse would follow from the combination of weak ambivalence, which is a low risk factor, paired with strong anticipated negative self-evaluative emotions, which is a strong protective factor. This interplay of different psychological factors in the decision making process, including ambivalence, will be tested in the current study as an interaction.

Ambivalence, information processing, and learning

Above we argued that ambivalence may be a parameter of the underlying motivational structure to smoke again. We now propose a second way in which felt ambivalence may influence abstinence in ex-smokers: By determining how ex-smokers evaluate the situations in which they used to smoke in the past. Our reasoning is as follows. Ambivalence can be viewed as an affective experience on the basis of an appraisal (Lazarus, 1991). The appraisal concerns the interpretation of a state, a situation, or a happening as being significant for one's well-being, which leads to an

affective reaction. In felt ambivalence, the appraisal concerns the simultaneous presence of the (returned) motivation to smoke and the motivation to stay quit. This appraisal leads to feelings of discomfort (Clark, Wegener, & Fabrigar, 2008), conflict (Sparks et al., 2001), uncertainty (Thompson, Zanna, & Griffin, 1995), and unpleasantness (Van Harreveld, Van Der Pligt & De Liver, 2009). Thus, from the perspective of Lazarus' appraisal theory (1991), activated ambivalence is a state of mind consisting of an affective reaction based on a specific appraisal. We argue, now, that this activated state of mind directs attention and guides the interpretation of incoming information (Erdley & D'Agostino, 1988; Kunda, 1999; Markus, 1977). According to Sedikides and Skowronski (1991), ambiguous stimuli will be encoded as instances of the cognitive structure that is the most highly active in memory. When the cognitive structure (appraisal) and its experience are negative, as in felt ambivalence, the interpretation of ambiguous stimuli will also be negative.

In ex-smokers, situations in which they used to smoke in the past may be particularly meaningful and provide potentially relevant information. They can provide ex-smokers with a relevant learning experience. We expect that learning experiences are related to relapse as they can inform ex-smokers whether it is worth to keep on investing in abstinence (in the case of a positive learning experience) or not (in the case of a negative learning experience). That is, a positive learning experience may signal success, thereby motivating further perseverance. Ambivalence, now, might direct attention to the negative information rather than to the positive information in these situations. That is, the state of ambivalence might selectively support the processing of information that signals that abstinence is at danger. This might lead to a more negative (or less positive) evaluation of the situations in which the ex-smokers used to smoke in the past, thereby, undermining the motivation to stay abstinent. This mediational relation will be tested.

Overview of the study

In this study we assume that ex-smokers, although they have already made the decision to quit smoking, can experience ambivalence with regard to their current non-smoking status.

A cohort of fresh ex-smokers was followed for one month and the main dependent variable was whether they had smoked (relapse) or not during that month. First, we tested whether felt ambivalence at baseline was a predictor of relapse. Second, we tested the interaction between anticipated self-evaluative emotions and ambivalence in predicting relapse after one month. Third, we tested the extent to which the relation between ambivalence and relapse was mediated by learning experiences.

Method

Participants and recruitment

Ex-smokers were recruited by advertisements in local newspapers and via the Internet in the Netherlands. Two assessments were conducted; baseline (T1) and one month follow-up (T2). The interval of one month is chosen because on the basis of earlier studies (Dijkstra & Borland, 2003; Shiffman, 1993) and our clinical experience, we expected one month to be a sufficient period to include relevant learning experiences. Participants could choose how to fill in the questionnaires at home; with a paper and pencil procedure, or via Internet. Smokers were eligible for participation if they had not been abstinent from smoking longer than six months.

Questionnaire

Felt ambivalence was measured using a short version of the Lipkus scale (Lipkus et al., 2001) containing five items: 'You have strong feelings both for and against smoking'; 'You have conflicting thoughts and feelings about smoking; Sometimes you think smoking is good, while at other times you think smoking is bad'; 'Your gut feeling and your thoughts do not seem to agree on whether you should smoke'; 'You find yourself feeling torn between wanting and not wanting to smoke'; 'You have

equally strong reasons for wanting and not wanting to smoke' (endpoints 1 [*not at all*] and 7 [*very much*]), $\alpha = .70$.

Perceived positive outcomes of smoking were assessed using nine items on a five-point scale. The items were validated in earlier studies (Dijkstra et al., 2003). 'Smoking helps to relax'; 'Smoking helps against gloominess'; 'Smoking helps to concentrate'; 'Smoking is companionable'; 'Smoking helps to cope with my anger'; 'Smoking helps to cope with stress'; 'Smoking helps to stay alert'; 'Smoking helps to chase away boredom'; 'Smoking chases away negative thoughts' (endpoints 1 [*totally disagree*] and 5 [*totally agree*]). $\alpha = .89$.

Perceived positive outcomes of quitting were assessed with thirteen items on a five-point scale, divided in long-term and short-term physical outcomes, social outcomes, and self-evaluative outcomes (Dijkstra & Borland, 2003). 'If I succeed in continued abstinence, then...'. The short-term physical outcomes were: '...my stamina will improve'; '... I'm healthier'; '...I feel fit'. The long-term physical outcomes were: '...my risk on heart- and vascular diseases will decline'; '...my risk on lung cancer will decline'; '...my risk on lung diseases will decline'. The social outcomes were: '...others will judge me more positive'; '...others will respect me more'; '...others also benefit from this'. The self-evaluative emotions were: '...I'm very satisfied about myself'; '...I'm proud of myself'; '...I find it wise' (endpoints 1 [*totally disagree*] and 5 [*totally agree*]). $\alpha = .86$.

Anticipated negative self-evaluative emotions were assessed with a five-point scale containing 10 items. 'If I start smoking again, then...'; '...I think negative about myself'; '...I don't respect myself'; '...I'm not satisfied with myself'; '...I'm fed up with myself'; '...I'm mad about myself'; '...I feel guilty'; '...I regret'; '...I'm disappointed in myself'; '...I'm angry about myself'; '...I feel inferior' (endpoints 1 [*totally disagree*] and 5 [*totally agree*]). $\alpha = .94$.

Positive and negative learning experiences assessed at T1 were measured with a newly developed seven-point scale containing seven items. ‘How did you feel the last time that you experienced a strong taste to smoke, but didn’t smoke?’ The items were in the following format: ‘In this situation I felt...’. The items of the positive learning experiences were: ‘...satisfied with myself’ (endpoints 1 [*not at all satisfied*] and 7 [*very satisfied*]); ‘...very happy that I didn’t smoke’ (endpoints 1 [*not at all happy*] and 7 [*very happy*]); ‘...quite sure that I can abstain from smoking’ (endpoints 1 [*not at all sure*] and 7 [*very sure*]); ‘proud of myself because I didn’t smoke’ (endpoints 1 [*not at all proud*] and 7 [*very proud*]). The higher the scale score, the more positive the evaluations were ($\alpha = .79$).

The negative learning experience items were: ‘In this situation I felt...; ‘...disappointed of the fact that I still experienced a strong taste to smoke’ (endpoints 1 [*not at all disappointed*] and 7 [*very disappointed*]); ‘...worried about start smoking again in the future’ (endpoints 1 [*not at all worried*] and 7 [*very worried*]); ‘...afraid that I can’t maintain my quitting attempt’ (endpoints 1 [*not at all afraid*] and 7 [*very afraid*]). The lower the scale score the more negative the evaluations were ($\alpha = .75$).

At T2 abstinence status (relapse at T2) was assessed using the question: ‘Have you been smoking at all (even one cigarette or puff) since you have quit smoking?’ Answer categories were ‘Yes’ or ‘No’. Participants who answered the first question in the affirmative were considered to have relapsed. No biochemical verification of the self-report quitting behavior was conducted, for three reasons. Firstly, the announcement of biochemical verification could be expected to increase non-response and dropout. Secondly, biochemical verification would be a very rough measure of abstinence. Thirdly, the recruitment advertisements and further correspondence explicitly stated that participants did not have to stay quit to join the study and that they were free to withdraw from the study whenever they desired. Therefore, the present study was considered to be

one of low demand and the self-reports on abstinence were considered to be valid (see Velicer, Prochaska, Rossi & Snow, 1992).

Demographics measured were sex, age, and education level, which was categorized as low, medium, or high level of education.

Results

Sample Characteristics

Of the 446 ex-smokers who registered at baseline, 395 participants filled in the T1 questionnaire (89%). At T2, 32 participants had dropped out of 395 (8.1%), leaving 363 participants in the sample. Of the 363 ex-smokers who filled in the two self-report questionnaires, six were excluded because of having smoked only pipe and/or cigars and no cigarettes. Two participants were excluded because they were still smoking at T1, and three participants because they appeared to have quit smoking for more than one year, leaving 352 ex-smokers in the sample.

The sample had quit for an average of 3.35 months ($SD = 69$ days). On average, the ex-smokers had smoked 18.31 cigarettes a day ($SD = 9.62$) and they had smoked for 27.63 years ($SD = 14.13$). Their mean score on felt ambivalence at T1 was 3.46 (scale range 1 to 7; $SD = 1.23$). The mean score on the positive outcomes of smoking at T1 was 3.20 (range 1 to 5; $SD = .97$) and the mean score on the positive outcomes of quitting at T1 was 4.33 (range 1 to 5; $SD = .50$).

Dropout characteristics

Dropouts were compared to those who remained in the study on eight variables: Gender, age, education level, number of days quit, number of cigarettes smoked, number of years smoked, number of serious quitting attempts and duration of their longest quitting attempt. Attrition analyses only showed that dropouts after T1 were significantly younger than respondents and they had smoked for fewer years compared to respondents.

Cross-sectional analyses

We computed correlations to assess the relation between felt ambivalence, learning experiences, and self-evaluative emotions (Table 1). Felt ambivalence correlated significantly with both measures of learning experiences in expected directions (negative learning experiences $r = .43$; $p < .01$, positive learning experiences $r = -.26$; $p < .01$). Felt ambivalence did not correlate significantly with self-evaluative emotions. Furthermore, felt ambivalence correlated significantly with pros of smoking ($r = .28$, $p < .01$) and pros of quitting ($r = -.15$; $p < .01$).

Table 1. *Correlations of felt ambivalence with other relevant variables*

	1	2	3	4	5
1. Felt ambivalence	-				
2. Pros of smoking	.28**	-			
3. Pros of quitting	-.15**	-.04	-		
4. Positive learning experiences	-.26**	-.11*	.35**	-	
5. Negative learning experiences	.43**	.16**	-.06	-.38**	-
6. Anticipated self-evaluative emotions	-.03	-.00	.32**	.19**	.09

$N = 350$

* $p < .05$, ** $p < .01$.

Predicting relapse from felt ambivalence

We conducted logistic regression analyses with felt ambivalence to predict relapse. Felt ambivalence was a significant predictor of relapse (OR= 1.57, 95% CI 1.24, 1.98; $p < .001$): The more participants reported to have conflicting feelings between smoking and not smoking at baseline, the more often they had smoked at follow-up.

Because ambivalence was thought to be a parameter of the underlying motivational structure, we tested whether ambivalence still predicted relapse when the analysis was controlled for two measures of the underlying motivational structure: The pros of smoking and the pros of quitting. However, in a separate model the pros of smoking and the pros of quitting were no significant predictors of relapse. In the controlled

model, the predictive power of felt ambivalence remained the same when the pros of smoking and the pros of quitting were entered in the model.

Felt ambivalence and anticipated negative self-evaluative emotions

The interaction between felt ambivalence and anticipated self-evaluative emotions was significant in predicting relapse (OR= 1.40, 95% CI 1.09, 1.78; $p < .01$). To search for the meaning of this interaction (Table 2), the predictive power of negative anticipated self-evaluative emotions was tested when felt ambivalence was low and when felt ambivalence was high. To do so, the complete data set was used to model participants scoring low or high, by adding one standard deviation to the standardized means (strong ambivalence) and subtracting one standard deviation from the standardized means (weak ambivalence), respectively (Cohen, Cohen, West & Aiken, 2003).

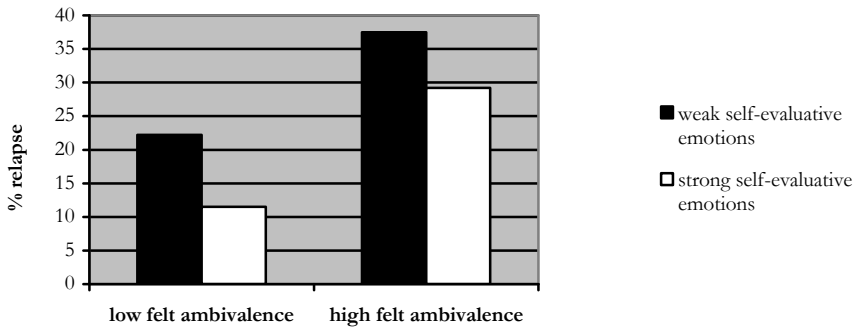
Anticipated self-evaluative emotions were a significant predictor of relapse, only when felt ambivalence was low (OR= .54, 95% CI .36, .81; $p < .01$): The stronger the anticipated self-evaluative emotions, the smaller the risk of relapse. When felt ambivalence was high, anticipated self-evaluative emotions had no significant relation with relapse (OR= 1.23, 95% CI .79, 1.90; $p = .36$). This is in line with earlier findings that show that behavior is more strongly related to its potential psychological determinants when ambivalence is low (Conner et al., 2002; Sparks et al., 2001).

Figure 1 shows that most relapse occurred in participants with weak anticipated negative self-evaluative emotions and high felt ambivalence (37.5%). This confirms the hypothesis that when the risk factor is high (ambivalence) and the protective factor is low (anticipated negative self-evaluative emotions) the most relapse occurs. The least relapse (11.5%) occurred when anticipated negative self-evaluative emotions were strong (high protective factor) and ambivalence is low (low risk factor).

Table 2. Predicting relapse from anticipated negative self-evaluative emotions using logistic regression analyses in strata of low and high felt ambivalence

Relapse at T2	OR	95% CI		<i>p</i> -value
		Lower	Upper	
Low felt ambivalence				
Anticipated self-evaluative emotions	.54	.36	.81	< .01
High felt ambivalence				
Anticipated self-evaluative emotions	1.23	.79	1.90	.36

N = 342

**Figure 1.** Predicting relapse from felt ambivalence and anticipated negative self-evaluative emotions

Ambivalence and learning experiences: Mediation analyses.

To conduct mediation analyses, Baron and Kenny (1986) have set specific criteria. For the present study this would mean that, firstly, ambivalence should be a significant predictor of relapse. The above results show that this criterion was met. Secondly, ambivalence should be significantly related to positive and to negative learning experiences. The above results show that this criterion also was met. Thirdly, positive and negative learning experiences should be significant predictors of relapse. The results showed that both positive learning experiences (OR= .71, 95% CI .56, .90; $p < .01$) as well as negative learning experiences predicted relapse significantly (OR= 1.45, 95% CI 1.20, 1.75; $p < .001$). Thus, all three criteria for mediation were met (Baron & Kenny, 1986; but see for example MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002, for critical notes on their mediation procedure).

Two mediation analyses were conducted; one for positive learning experiences and one for negative learning experiences. Because the results were virtually the same (only in opposite directions), we only report the analyses on negative learning experiences. When negative learning experiences were included in the model with felt ambivalence, felt ambivalence remained significant (OR= 1.38, 95% CI 1.07, 1.79; $p = .01$) and negative learning experiences were also significant (OR= 1.30, 95 % CI 1.06, 1.59; $p = .01$). The Sobel test statistic indicated significant mediation (Sobel's $Z = 3.54, p < .001$, one-tailed). Thus, the relationship of ambivalence and relapse was partly but significantly mediated by learning experiences.

Discussion

Not only smokers deal with feelings of ambivalence before they decide to actually quit smoking; ex-smokers experience ambivalence too. It was expected that felt ambivalence would be related to relapse. This was indeed the case. We proposed two ways in which this relation can be understood. Firstly, within a dual-system perspective, felt ambivalence was assumed to be a parameter of the motivation to smoke again. The interaction between felt ambivalence and anticipated self-evaluative emotions supported this notion: The risk for relapse was the highest when ambivalence was strong (strong impulses) and anticipated self-evaluative emotions were weak (weak reflective system), and the risk was the lowest when ambivalence was low (weak impulses) and anticipated self-evaluative emotions were strong (strong reflective system). The second way to understand the relation between felt ambivalence and relapse was by conceptualizing felt ambivalence as an activated state of mind that guides the interpretation of incoming information. In ex-smokers, situations in which they smoked in the past were expected to provide them with relevant information on their quit attempt. As expected, stronger felt ambivalence was related to more negative learning experiences. In addition, these experiences predicted relapse. Lastly, the learning experiences mediated the relation between felt ambivalence and relapse. These

results do support the notion that felt ambivalence guides information processing, which influences evaluations of abstinence, and the subsequent risk for relapse.

Our study has some limitations. First, the method of recruitment of participants may have biased the sample composition. However, we have no reason to assume that the selection was on relevant variables, as the sample included people with high and low ambivalence and high and low anticipated self-evaluative emotions. Moreover, the sample contained people of various ages, different educational levels, roughly comparable with the general population of quitters (Stivoro, 2008). Furthermore, in our study, women were overrepresented (64 %). Posthoc analyses showed, however, that sex did not interact with felt ambivalence in predicting relapse so there's no reason to assume that this variable biased our sample.

Another study characteristic is our measure of relapse. We used a conservative self-report measurement of relapse: Participants who appeared to have smoked between the measurements (even one puff of a cigarette) were considered to have relapsed. We chose to use this measurement, because even a short, single period of smoking (a lapse) leads almost inevitably to a full relapse (Shiffman et al., 1996). According to Kenford et al., (1994) the relapse rate after a lapse is about 95 %.

The present findings could be relevant for the development of smoking cessation interventions. Ambivalence should be monitored and action should be undertaken to lower ambivalence or its negative effects. Firstly, ambivalence should be resolved by trying to lower the pros of smoking and increasing the pros of quitting. Secondly, in the broader context of decision making, it is important to increase the anticipation of negative self-evaluative emotions, especially when ambivalence is low. Thirdly, it should be prevented that ex-smokers' interpretations and learning in risk situations is negatively biased by their ambivalence. Management of active psychological schemas when encountering risk situations might support interpretations that support abstinence.

To conclude, the present findings may contribute to theory and practice of relapse in smoking cessation: Ambivalence is a relevant state in the process of behavior change. In most studies, ambivalence is studied within the motivational process; before the actual decision is made (e.g. Lipkus, et al., 2005). Because our T1-sample consisted of ex-smokers, this was the first study showing that ambivalence is present and influential after the decision to change already has been made.

The present findings may be relevant for all behaviors that: 1) have valued functions (i.e., the pros of the behavior), which are lost when the behavior is changed and that; 2) have important negative consequences when the behavior is maintained (cons of the behavior, or its complement, the pros of changing). Future studies could test the relevance of ambivalence in relapse, for example, with regard to drug and alcohol use, and dieting.

Chapter 4

States of mind determine the level of craving
elicited by smoking cues

This chapter is based on Menninga, K. M., Dijkstra (2012). The active state of mind determines the level of craving smoking cues elicit. Manuscript submitted for publication.

Craving for the substance plays an important role in the maintenance of drug use, such as cigarette smoking. Several studies show that craving levels during the early phases of quitting are predictive of later relapse (Baer & Lichtenstein, 1988; Brandon, Tiffany, & Baker, 1987; Dijkstra & Borland, 2003; Killen & Fortmann, 1997; Shiffman, et al., 1997). In addition, cue-induced craving has been shown to be related to smoking and relapse (Carpenter et al., 2009; Ferguson & Shiffman, 2009; Waters et al., 2004). Craving is defined as a motivational state (Marlatt & Gordon, 1985; Baker, Morse & Sherman, 1986) that can be a cause of relapse. Therefore, understanding the determinants of craving is important step in controlling relapse in smoking cessation. The present study aims to contribute to the knowledge on determinants of craving from a psychological perspective.

Cue-reactivity

An important research paradigm for studying craving is that of cue-reactivity. In this paradigm, smokers or ex-smokers are exposed to smoking cues to assess their reactions. Smoking cues have been shown to induce changes in physiological parameters (Carter & Tiffany, 1999; Carpenter et al., 2009; Niaura et al. 1998), in craving (Carpenter et al., 2009; Dols, van den Hout, Kindt & Willems, 2002; Sayette, Martin, Wertz, Shiffman & Perrott, 2001), in affect (Carter & Tiffany, 2001; Sayette et al., 2001), in response times (Waters et al., 2004; Sayette et al., 2001), and in changes in self-efficacy (Shadel & Cervone, 2006; Niaura et al., 1998). Furthermore, different smoking cues have been shown to differ in the magnitude of the induced effects. For example, Niaura et al. (1998) compared a standardized cognitive stressor (a non-smoking cue) with ideographical smoking cues (subjects were instructed to listen to and imagine themselves in a high risk situation presented on audiotape), and four standardized scripts (subjects were instructed to listen to and imagine themselves in four situations presented on audiotape). All situations were designed to elicit smoking urges (Abrams, Monti, Carey, Pinto, & Jacobus, 1987). They concluded that the

ideographical smoking cues induced the largest changes in outcome measures. Indeed, the exposure to smoking paraphernalia has been shown to be a robust procedure for inducing drug related reactivity (Carter & Tiffany, 1999). In addition, several studies have investigated moderators of cue-reactivity, such as heaviness of smoking (Carpenter et al., 2009; Sayette et al., 2001), nicotine replacement therapy (Waters et al, 2004), and gender (Niaura et al., 1998). However, only a few cue-reactivity studies take a psychological perspective. The psychological perspective on cue-reactivity concerns the meaning that (ex-)smokers give to smoking cues: Smoking cues can be perceived in different ways in different perceived contexts, thereby influencing the level of craving. To illustrate, some studies manipulated the expectancies of smokers on whether they would actually smoke during cue-exposure (Dols, Willems, van den Hout & Bittoun, 2000; Dols, van den Hout, Kindt & Willems, 2002; Field & Duka, 2001). For example, a blue or yellow color computer-screen indicated whether participants were allowed to smoke or not after exposure to a smoking cue. The expectation of smoking or not significantly influenced levels of craving during the exposure. Shadel and Cervone (2006) cognitively primed different self-schemas. For example, they asked smokers: 'Think about yourself as you smoke. Write down the words that describe you when you smoke'. This smoker self-schema prime influenced cue-reactivity. These studies show that the state of mind at the moment of exposure influenced cue effects independently of individual differences in baseline smoking behavior.

States of mind

The effects of smoking cues depend on how (ex-)smokers perceive them. This perception is partly based on the individual's smoking and quitting history and experiences. However, we assume that there are certain states of mind that have predictable additional effects on interpretations of the smoking cues. These states of mind determine, more or less, the meaning of the cue. We argue that the activated state of mind directs attention and guides the interpretation of incoming information

(Erdley & D'Agostino, 1988; Kunda, 1999; Markus, 1977). According to Sedikides and Skowronski (1991), stimuli can be encoded as instances of the cognitive structure that is the most highly active in memory. This mechanism may also exert its influence on the reactions towards smoking cues. In the present context of smoking and craving for smoking, we propose that the effects of smoking cues on craving depend on the state of mind through which they are perceived. In this study, the effects of three induced states of mind will be studied, two based on the social cognitive learning theory (Bandura, 1986) and one on the self-affirmation theory (Steele, 1988).

The present studies

In two laboratory experiments, the general idea was tested that when smokers are exposed to a smoking cue, the smokers' state of mind at that moment influences the level of craving. In Study 1, two smoking-specific states of mind were induced: Before smokers were exposed to the smoking cue (while not being allowed to smoke yet), they were led to belief that smoking had either few or many positive outcome expectations or that they had a high or a low self-efficacy to refrain from smoking. In Study 2, we assume that exposure to the smoking cue (while not being allowed to smoke yet) will induce a negative state of mind that influences how the smoking cue is perceived. This state of mind is prevented by boosting the smoker's self-feelings by using a self-affirmation procedure as manipulation before the exposure.

In both studies, abstinent smokers were confronted with smoking cues to trigger craving after they had been exposed to the above experimental manipulations. The self-reported craving after exposure to the smoking cue is the dependent measure.

Study 1

The social cognitive perspective of smoking and relapse may help define relevant states of mind that might determine how smoking cues are perceived. In this perspective, two constructs are central: Positive outcome expectations and self-efficacy expectations (Marlatt & Gordon, 1985; Niaura, 2000). Positive outcome expectations

of smoking refer to smokers' anticipated positive effects of smoking. These expectations are the primary reasons for smoking. Different reasons to smoke have been distinguished, such as smoking for stimulation, for pleasure, and for reducing negative affect (Ikard, Green & Horn, 1969; Niaura, Goldstein, Ward & Abrams, 1989; Tate & Stanton, 1990). Furthermore, several clusters of smoking outcome expectations have been distinguished: Expectations on positive reinforcement, on negative reinforcement, and on appetite-weight control (Doran, Schweizer & Myers, 2011; Urban & Demetrovics, 2010; Wetter et al., 1994). According to Marlatt and Gordon (1985), positive outcome expectations are at the basis of craving: '...craving is a motivational state associated with a strong desire for an expected positive outcome' (pp.138). Therefore, it is safe to predict that when smokers anticipate strong positive outcome expectations at the moment that they are exposed to smoking cues, they will experience stronger craving.

Besides positive outcome expectations, self-efficacy expectations play a role in smoking and relapse. In the framework of craving for smoking, self-efficacy expectations concern the perceived personal ability to be able to not give in to the craving. Self-efficacy has been shown to be related to relapse in many studies (Gwaltney, Metrik, Shiffman & Kahler, 2009). In addition, self-efficacy can be expected to determine craving. That is, a strong self-efficacy may lead to the expectation that one will not smoke in a specific situation. Indeed, experimental studies show that in a situation in which a smoker expects not to smoke, smoking cues lead to lower levels of craving (Dols, Willems, van den Hout & Bittoun, 2000; Dols, van den Hout, Kindt & Willems, 2002; Field & Duka, 2001). Because the person does not imagine him or herself smoking in that particular situation, in the case of strong self-efficacy, no positive outcomes of smoking will be anticipated. Therefore, the craving for smoking will be low. In further support of this notion, empirical studies show a negative relation between self-efficacy and craving (Dijkstra & Borland, 2003; Shadel &

Cervone, 2006). Thus, when smokers have a high self-efficacy at the moment that they are exposed to smoking cues, they are expected to experience less craving. In addition, both states of mind may interact.

Method

Participants and Design

140 smoking students participated in this study for a payment of 15 euros each. All participants were temporary abstinent smokers, because ex-smokers could not be included: Since it is unethical to seduce ex-smokers to smoke in an experimental procedure. Participants were instructed to stay abstinent for at least four hours before the start of the experiment.

Participants were randomly assigned to one of four conditions in a 2 (weak versus strong positive outcomes) x 2 (low versus high self-efficacy)-design. Thus, in total four different states of mind were induced. A state-of-mind was induced by providing the participants with bogus feedback that was said to be based on the pretest measurements.

The mean age of participants was 22.34 years ($SD = 2.37$), with a minimum of 18 and a maximum of 28 years. 65.7% were women. Participants smoked 14.65 cigarettes a day on average ($SD = 4.81$). The mean intention to quit smoking ('Are you planning to quit smoking in the coming six months?') was 4.25 ($SD = 2.09$) on a seven-point scale (the higher the scale score, the higher the intention to quit smoking).

Procedure

Participants were invited to take part in a study about smoking and smoking behavior. When participants entered the lab-room, they were asked to hand in their cigarettes. After this, participants were seated behind a computer (separate cabins). Before the participants were exposed to any manipulation, some pretest measurements were conducted. After completing the pretest, participants received condition specific bogus feedback regarding their self-efficacy (high or low) to quit smoking and regarding their positive outcome expectations (strong or weak). After the

manipulation, participants were exposed to the smoking cue, during which they answered the posttest questions that comprised the dependent measures.

Materials and Measures

Pretest measures. Participants started with questions about gender, age, education level, smoking status, and smoking history.

Following this, participants answered twenty-eight filler questions about health and health behavior (on five-point 'I do not agree' (1) – 'I do agree' -scale) with two aims. Firstly, the items were meant to disguise the assessment of self-efficacy and positive outcome expectations; the items of these measures were mixed with the filler items. Secondly, participants were told that the feedback they received was based on the pretest scores. By designing the filler questions as ambiguous (it was not immediately clear what they assessed), it was thought to support the perceived reliability of the feedback participants would receive. Two examples of ambiguous questions are: 'Smokers choose to smoke' and 'Smokers are no junks'. The actual measure of self-efficacy contained the following six items: 'It is hard to refrain from smoking when someone offers you a cigarette'; 'It is hard to refrain from smoking when you've just finished your meal'; 'It is hard to refrain from smoking when you're feeling down'; 'It is hard to refrain from smoking when you are going out or having a party'; 'It is hard to refrain from smoking when you're taking a break'; 'It is hard to refrain from smoking when you're feeling stressed' ($\alpha = .70$). The measure of positive outcome expectations consisted of the following five items: 'Smoking helps me to cope with anger'; 'Smoking helps me to cope with stress'; 'Smoking helps me to concentrate'; 'Smoking helps me to relax'; 'Smoking helps me to stay alert' ($\alpha = .77$).

Manipulations.

After completing the pretest measurements, participants received the condition-specific bogus feedback that comprised the main manipulation. Participants were instructed to carefully read the feedback text.

Self-efficacy manipulation. In the low self-efficacy condition participants were led to believe that they had a low self-efficacy to quit smoking: The chance to successfully quit smoking was said to be quite low for them, and if they would undertake a quitting attempt, they would give up easy (61 words). In the high self-efficacy condition, participants were led to believe that they had a high self-efficacy to quit smoking: Their chance to successfully quit smoking was high, and if they would undertake a quit attempt, they would not give up (60 words).

Positive outcome expectations manipulation. In the weak positive outcome expectations condition, participants were led to believe that they saw few benefits of smoking and that smoking was more of a habit and had no important function for them. In addition, it was stressed that, indeed, smoking has no beneficial effects whatsoever (63 words). In the strong positive outcome expectations condition, participants were led to believe that they saw strong benefits of smoking and that smoking had important functions for them. In addition, it was stressed that, indeed, smoking has strong beneficial effects (60 words).

Smoking cue manipulation. After reading the bogus feedback, participants were instructed on the computer screen to ask the experimenter for their cigarettes. Participants who didn't bring their cigarettes (38 participants), borrowed their favorite brand (or a brand that resembled their own brand) from the instructor. Participants were told that this was done because they 'needed' the cigarettes later in the experiment. At this moment with their cigarettes lying in front of them and not being allowed to smoke, their craving was measured.

Posttest measures.

The craving measure was composed of three items on nine-point scales. The items were: 'Do you feel like smoking right now?'; 'At this moment, do you look forward to lighting and smoking a cigarette?'; 'How strongly do you desire to smoke right now?' (endpoints 1 [*not at all*] to 9 [*very much*]). The measure of craving was composed of the

mean score on these three items ($\alpha = .96$). To check the manipulations, self-efficacy and positive outcome expectations were assessed with short measures, using the following two items on a 7-point scale: 'Are you able to quit smoking?' (endpoints 1 [*not at all able to*] and 7 [*definitely able to*]) and 'Does smoking have positive outcomes for you?' (endpoints 1 [*no positive outcomes at all*] and 7 [*many positive outcomes*]).

Results and discussion

Manipulation check

A one-way analysis of variance (ANOVA) was conducted to test whether the manipulations of self-efficacy and the positive outcome expectations were effective. Participants in the high self-efficacy condition reported higher self-efficacy ($M = 5.29$, $SD = 1.27$) than participants in the low self-efficacy condition ($M = 4.91$, $SD = 1.31$), $F(1, 138) = 3.07$, $p < .05$, one-sided. Participants in the low positive outcome expectations condition reported less positive outcomes ($M = 3.73$, $SD = 1.35$) than participants in the high positive outcome expectations condition ($M = 4.24$, $SD = 1.37$), $F(1, 138) = 4.97$, $p = .01$, one-sided. It is concluded that the manipulations were successful.

Self-efficacy and positive outcome expectations: Interaction effects

A 2 (low/high self-efficacy) x 2 (weak/strong positive outcome expectations) ANCOVA with craving as dependent measure and number of cigarettes smoking and number of quitting attempts as covariates showed no significant main effects of the self-efficacy manipulation and of the positive outcome expectations manipulation. However, the interaction between the self-efficacy and the positive outcome expectations manipulations on craving was significant, $F(1, 132) = 10.12$, $p < .01$, $\eta_p^2 = .07$. To test whether this effect existed beyond participants' level of self-efficacy and positive outcome expectation at pretest, the pretest measures of self-efficacy and positive outcome expectations were included in the model as covariates. The model parameters hardly changed, indicating that the effects of the manipulations on craving

were beyond the individual difference before the manipulation. Figure 1 shows the mean scores on craving in the four conditions.

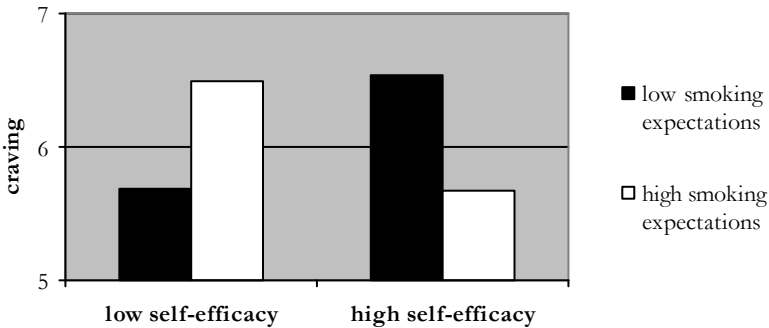


Figure 1. The effects of self-efficacy and smoking expectancies on craving

It was expected that higher self-efficacy would be related to lower craving and stronger positive outcome expectations would be related to stronger craving. However, both effects were only present under conditions: Contrast analyses showed that only when self-efficacy was low, stronger positive outcome expectations led to significantly stronger craving ($p < .05$). In addition, only when positive expectancies were strong, higher self-efficacy led to lower craving, although this effect only approached significance ($p = .076$). Unexpectedly, when smokers saw weak positive outcome expectations, higher self-efficacy was related to stronger craving, although this effect was not completely significant ($p = .055$). Thus, only in the case of strong positive outcome expectations, self-efficacy seemed to do its craving-lowering work. It appears that self-efficacy became only relevant or was only mobilized when the temptation to smoke (on the basis of strong positive outcome expectations) was high. Only then self-efficacy was activated to lower the craving. It seems that when positive outcome expectations were weak, self-efficacy was not ‘alarmed’. Future studies should further disentangle these interactive effects of these states of mind on craving. Although not all effects could be explained, these data do show that we were able to induce a state-of-mind that influenced the level of craving upon exposure to a smoking cue. This

effect existed beyond the individual differences on self-efficacy and positive outcome expectations and the number of cigarettes smoked a day and the number of past quit attempts.

Study 2

In Study 1, a state of mind was induced through information from an external source that was independent of the smoking cue. The state of mind influenced the perception of the smoking cue. However, the smoking cue itself may also induce a certain state of mind that, in turn, influences how the smoking cue is perceived. In an ex-smoker, a smoking cue may not only lead to the temptation to smoke but also remind the ex-smoker of the self-inflicted risk for serious negative consequences of smoking. Against the background of the widely held value of good health, according to the self-affirmation theory (Steele, 1988; Steele & Liu, 1983), it is inadequate and non-adaptive to threaten the own existence. The awareness of doing so will lead to the experience of a self-threat which is experienced as feeling ashamed, dissatisfied and angry with oneself (Dijkstra & Buunk, 2008). The core of the self-affirmation theory is that people try to undo the self-threat. That is why they may change their perspective of the situation that causes the self-threat: They take a defensive perspective towards the smoking cue. By doing so they will not only lower the self-threat but, importantly, also the craving the smoking cue would induce.

However, not all ex-smokers will experience a self-threat that is large enough to activate self-regulatory defenses. Especially in ex-smokers who highly value their health, the smoking cue (and its associated risk for negative physical outcomes) will elicit a strong self-threat. Therefore, these ex-smokers will display a self-regulatory defensive reaction to avert the threat. To test whether a self-threat is involved in the psychological reaction towards the smoking cue, a self-affirmation procedure can be applied.

A self-affirmation procedure is applied before people are confronted with stimuli (Critcher, Dunning & Armore, 2011), in the present case, with their own smoking paraphernalia. In a self-affirmation procedure, important individual characteristics of participants are affirmed (McQueen & Klein, 2006). The effect is that participants feel good about themselves; the procedure makes participants realize that their self-worth does not hinge on temporary or situational evaluations of their self-image. Therefore, a self-affirmation procedure induces a psychological state of ‘open-mindedness’. The effect is that people dare to face the potential threat and they accept the threat without denial (Harris & Napper, 2005; Sherman & Cohen, 2002). Thus, when ex-smokers are affirmed before they are exposed to smoking paraphernalia, they will no longer have the inclination to reduce the self-threat: They accept the feelings caused by the confrontation, including the craving.

In sum, ex-smokers who strongly value their health will experience a self-threat when they are exposed to the own smoking paraphernalia, that activates self-regulatory defenses to hold off the threat. By adopting this defensive perspective the threat will diminish but also the craving that is induced by the same smoking cue. A self-affirmation procedure will induce ‘open-mindedness’ towards the threatening cue, which will lead to an increase in craving.

Method

Participants, Procedure and Design

120 smoking students were recruited to join this study. The same procedure was used as in Study 1 (for example they had to be abstinent for four hours). They were randomly assigned to a self-affirmation or a no-self-affirmation condition. The mean age was 21.71 years ($SD = 3.49$), with a minimum of 18 and a maximum of 40 years (1 participant). 52.6% were women. Smokers smoked on average 12.37 cigarettes a day ($SD = 5.03$). The mean intention to quit smoking was 3.68 ($SD = 2.03$) on a seven-

point scale (the higher the scale score, the higher the intention to quit smoking within six months).

Materials and Measures

Pretest measures. Participants started with questions about gender, age, education level and smoking status and history.

Health value was measured with two questions: ‘How important is quitting smoking to you?’ and ‘How important is your health to you?’ (endpoints [*not at all important*] and 7 [*very important*]).

Manipulations

Self-affirmation manipulation. In the self-affirmation condition, participants were presented with six domains (theory, economics, aesthetics, social aspects of life, politics, and religion) and were asked to choose the domain they valued the most (e.g., Sherman, Nelson, & Steele, 2000). After participants made their choice, they received questions about this most valued domain. In the no self-affirmative condition, participants were asked to choose the domain they valued the most but they received questions about a less valued domain.

Smoking cue manipulation. After the manipulation, participants were instructed to ask the experimenter for their cigarettes. Participants who didn’t bring their cigarettes (26 participants), borrowed their favorite brand (or a brand that resembled their own brand) from the instructor.

Posttest measures.

The same measure of craving as in Study 1 was used. To check the manipulation, participants were asked how many positive thoughts they had during the experiment. ‘How many positive thoughts did you have during this whole experiment?’ (endpoints 1 [*very few positive thoughts*] and 7 [*very many positive thoughts*]).

Results and discussion

Manipulation check. A one-way analysis of variance (ANOVA) was conducted to test whether the self-affirmation manipulation was effective. Participants in the self-affirmation condition reported significantly more positive thoughts ($M = 4.70$, $SD = 1.27$) than participants in the no self-affirmation condition ($M = 4.08$, $SD = 1.18$), $F(1, 118) = 7.68$, $p < .01$.

The interaction between self-affirmation and health value. The interaction between self-affirmation and health value was tested using ANCOVA with craving as dependent variable and number of cigarettes smoked a day and the number of quit attempts as covariates. This two-way interaction was significant, ($F(1,114) = 13.46$, $p < .001$, $\eta_p^2 = .106$). To examine how to interpret this interaction, the main effect of self-affirmation was tested when health value was moderate and when health value was high. To this purpose, the complete dataset was used to model a group scoring moderately on health value and a group scoring high on health value, by adding and subtracting one standard deviation from the mean-centered mean of health value scores, respectively (Cohen, Cohen, West & Aiken, 2003).

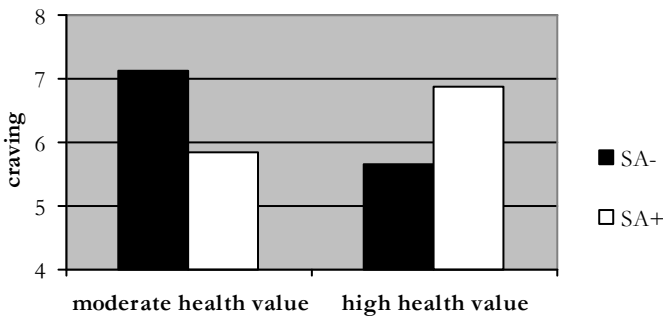


Figure 2. The effects of health value and self-affirmation on craving

As expected, among abstinent smokers with high health value, self-affirmation significantly increased the reported craving ($p < .05$; Figure 2). This is in line with our reasoning that when abstinent smokers highly valued health, the smoking cue induced

a self-threat which activated a defensive perspective on the smoking cue. This defensive perspective psychologically ‘blurred’ the smoking cue, lowering the impact on the individual as suggested by the relatively low level of craving. The notion that especially those who highly valued health reacted with defenses is also supported by the significant relation ($p < .01$) between health value and craving when participants were not affirmed: When health value was moderate, reported craving was higher than when health value was high. Thus, especially in participants who highly valued health the smoking cue activated self-regulatory defenses that could be prevented by self-affirmation. When these high value participants were affirmed, they were able to face the self-threat and craving as shown by their higher level of craving.

Unexpectedly, among participants with moderate health value, the self-affirmation procedure led to a significant drop in craving ($p < .01$), meaning that inducing open-mindedness led participants to report lower craving. When the participants who moderately valued health were not affirmed their level of craving was relatively high, suggesting that they did not need a defensive perspective to cope with the possible self-threat induced by the smoking cue. They seem to have been somewhat open-minded towards the smoking cue, accepting the self-threat and the craving. However, when these participants were enticed to process the information on the smoking cue even more open-minded, the self-threat may have become too strong to face. Such a reaction to an ‘overload’ of threat is well documented in the field of persuasion (Block & Williams, 2002; Burnkrant & Unnava, 1995; Meyers-Levy & Peracchio, 1996; Na, 1999). To be able to accept this reasoning we need to assume that when they were not affirmed, their open-mindedness was not complete. It is very well possible that they were able to face the self-threat because they were still actively regulating the information from the smoking cue. Taking away this last resort with a self-affirmation procedure may have been too much. Reed and Aspinwall (1998) showed similar differential effects of self-affirmation. Although this reasoning has its basis in theories

and studies on persuasion, the two core elements of our theorizing – a self-threat and a defensive reaction to lower a cause of the threat – play a central role.

Lastly, when participants were affirmed, health value was significantly related to craving ($p < .05$); the lower the health value the lower the craving. Because all analyses were corrected for smoking and quitting behavior, we assume that the lower craving in participants with moderate health value is not caused by less physiological reactivity. As argued above, it is probably low because of a defensive reaction to lower the self-threat, which also made the smoking cue lead to less craving.

General discussion

Although several questions remain unanswered, the results of both studies showed that craving is more than just a physiological reaction to a smoking stimulus. We discovered that different states of mind elicit different levels of craving. These effects were found independent of participants' quitting and smoking behavior and holding the smoking cues constant (one's own cigarettes).

Both studies showed that we could change the level of craving when confronted with one's own cigarettes by changing smokers' states of mind. In Study 1, the states of mind were related to smoking: Expecting strong or weak positive effects of smoking or experiencing control or not over smoking. At the moment of exposure to their cigarettes, these states of mind determined how smokers perceived the smoking cue. In our theorizing they determined whether the smoking cue was associated with strong or weak positive effects, and whether the attraction of the smoking cue was perceived to be under one's control or not, respectively. We assume that these states of mind were smoking-specific: We would not expect these states of mind to influence perceptions of other, not smoking-related stimuli. In contrast, in Study 2 a general, not smoking-related state of mind was induced. Self-affirmation was thought to induce open-mindedness (Harris & Napper, 2005; Sherman & Cohen, 2002). This open-mindedness seemed to determine the level of craving during the exposure to the smoking cue. We

assume that this happened because the open-mindedness changed the perception of the smoking cue. The general state of being self-affirmed can be expected to also influence perception of other stimuli (Correl, Spencer & Zanna, 2004; Wakslak & Trope, 2009). Thus, craving was influenced by smoking-related as well as by general states of mind.

The states of mind influenced craving beyond the number of cigarettes smokers smoked a day: All analysis were controlled for the influence of this most important potential confounder. This strongly suggests that craving, as assessed in the present study, is not only determined by biological factors but also has more flexible or volatile psychological causes. As a result, when ex-smokers move through their environments encountering smoking cues, their craving reactions towards these stimuli may strongly differ from moment to moment: While talking to another ex-smoker may temporary make salient one's accomplishments (e.g., 'I am already refraining from smoking for ten days') and bring about a state of mind of high self-efficacy, and the confrontation with a tobacco advertisement may bring about a state of mind of expecting strong positive outcomes of smoking, a self-affirming conversation may make the ex-smoker open-minded. All these states of mind influence ex-smokers reactions towards smoking cues. From a meta-cognitive point of view this may have subsequent effects on smokers' motivation to invest in their quitting attempt. That is, ex-smokers are thought to use the craving they experience as feedback to assess whether they are on the right track (Kluger & DeNisi, 1996); whether they are approaching the desired outcome of continued abstinence. Therefore, fluctuating levels of craving may lead to uncertainty on how well their quit attempt is going, thereby undermining their motivation to invest and persevere (Menninga, Dijkstra, Gebhardt, & Siero, 2011).

When it comes to designing relapse prevention interventions, this phenomenon should be taken into account: Risk situations not only are defined by the confrontation with a smoking cue, or the (smoking) history of the situation, but also by more short-

lived states of mind, even those not related to smoking. Future research could try to develop and test a taxonomy of relevant states of mind. For example, states may be smoking-related or general (as in our studies) but also affective or non-affective. A taxonomy might be used as a basis to map individual ex-smokers' risks to incur certain states of mind.

The results of the present studies should be interpreted against the background of the methodology, of which the measure of craving is an important aspect. We assessed craving with a three-item self-report measure on the desire and inclination to smoke. This measure does not assess physiological aspects of craving, nor does it explicitly comprise the anticipation of positive outcomes of smoking. It is meant to be a parameter of the psychological experience (the desire) of being pulled towards smoking. The use of brief self-report measures of craving, even one-item measures, is state-of-the-art in cue-exposure research (Baumann & Sayette, 2006; Carpenter et al., 2009; Dols et al., 2002; Sayette et al., 2001; Waters et al., 2004).

A limitation of both studies is related to the samples of participants. We were interested in craving in recently quitted ex-smokers, but because of ethical reasons we could not include this group: Seducing ex-smokers with smoking cues may lead to relapse. Therefore, we used temporary abstinent smokers, who were instructed not to smoke at least four hours before the experiment. The fact that 'real' ex-smokers couldn't be used may have biased the results at some point. Especially with regard to the expectation of our participants that they were allowed to smoke again after the experiment, they differ from 'real' ex-smokers. On the other hand, our experiment was designed to show differences between manipulations on craving; it is not immediately clear how the manipulation would work qualitatively different in 'real' ex-smokers. In an alternative design to study similar research questions, ex-smokers' momentary states of mind might be assessed (not manipulated) and related to momentary measurements of craving (Shiffman et al., 1997).

The present studies provide experimental evidence that craving is not only determined by automated physiological reactions but also by the psychological interpretations of smoking cues. The meaning of a smoking cue does not lie in the cue itself, but is given to the cue by psychological interpretations. These interpretations can change and they can be manipulated. We hope these results may inspire research as well as the practice of smoking cessation.

Chapter 5

Effects of a tailored intervention that provides progress feedback and stimulates positive temporal comparison formation to prevent relapse: A randomized trial

Nowadays, the Internet has become an inextricable part of our daily lives. In 2007, the majority of people in the world had access to the Internet: In Europe and North-America this is even more than 80%. In addition, in 2010, 70% of the Dutch population perceived the Internet as a basic need in life (Synovate, de online barometer, 2010). Besides as a source of amusement and information, internet can be used for therapeutic interventions. A quick search on the Internet brings out multiple Internet therapies for a range of problems, for example, psychotherapy, online life coaching, and depression counseling. With regard to the effectiveness of these online interventions, for example of brief therapist-delivered interventions, there is some evidence that they might work (Stead, Bergson, & Lancaster, 2008). Internet-based interventions are attractive because they are relatively cheap (Swartz, Noell, Schroeder, & Ary, 2006). Furthermore, access to the content of the online programs is flexible for the user, and anonymity is better guaranteed compared to in-person or phone-based counseling. In addition, internet may also be a good source to reach people who otherwise would not seek help in the regular health care system (Civljak, Sheikh, Stead, & Car, 2010).

Internet-based interventions for smoking cessation

Although the internet seems to be a promising messenger for delivering smoking cessation treatment (Swartz, Noell, Schroeder, & Ary, 2006), the effects of these interventions are small (see Civljak, Sheikh, Stead, & Car, 2010 for a review). Moreover, not all Internet smoking cessation programs provide a direct intervention, or offer good quality (Bock, et al., 2004; Etter, 2006). One contemporary way to develop Internet-delivered interventions to be more effective is to tailor them to individual characteristics. That is, standardized health education interventions are in many cases not applicable to an individual's psychological state or situation (Dijkstra, De Vries, Roijackers & Van Breukelen, 1998; Lancaster & Stead, 2005) and tailored interventions take into account individual differences using different tailoring strategies

(Dijkstra, 2005; Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008). Thus, tailored persuasive information refers to any combination of information or change strategies that is used to influence one specific person, based on an assessment of characteristics, and interests that are unique to that person (Kreuter, Farrell, Olevitch, & Brennan, 1999; Grant Harrington & Noar, 2012).

With regard to the effectiveness, tailored Internet interventions in general have been found to be more effective than their non-tailored counterparts (Noar, Benac & Harris, 2007). With regard to smoking cessation, tailored interventions can also be more effective (e.g. Etter, 2005; Strecher, Shiffman, & West, 2005). For example, Strecher et al., (2005) showed that a tailored web-based program had significant more positive effects (i.e. higher abstinence rates after six and twelve weeks, and higher satisfaction with the program) than a web-based, non-tailored cessation program. To conclude, although the absolute effects of Internet based interventions are relatively small, tailoring them can increase their effectiveness.

Relapse prevention

With regard to smoking cessation, a great deal of research has been done on relapse prevention and some prominent theories and models to understand relapse have been developed. One influential model is the Relapse Prevention Model of Marlatt and Gordon (1985). This model is an integrative framework for understanding the cognitive/behavioral processes involved in relapse, and it has a prominent position in the clinical practice (Kirchner, Shiffman, & Wileyto, 2012). Furthermore, pharmacological compounds have been developed which are quite effective in supporting behavioral/psychological smoking cessation interventions. Other prominent models of addiction and relapse focus more on psychophysiological determinants, such as the role of neurobiology and the working of certain hormones in addiction (e.g., Kalivas & Volkow, 2005; Koob & Le Moal, 1997; Robinson & Berridge, 2003), or the more unconscious processes (such as reflexes and impulses)

that govern behavior and behavior change (e.g. Wiers et al., 2010, Wiers & Stacy, 2006; West, 2006, 2007).

However, despite all the knowledge on relapse that is gathered in the past decades, relapse rates among quitters are still very high. Based on several studies, on average only 7.3% of the smokers who undertake an unsupported quit attempt succeed (10 months follow-up; Baillie, Mattick & Hall, 1995). Moreover, the lowest relapse rates in the best smoking cessation treatments available are still about 70% (about six months follow-up; Clinical Practice Guideline, 2008). Indeed, researchers have concluded that little progress has been made with regard to relapse prevention (Niaura, et al., 1999; Shiffman, 1993). Moreover, in the review of Hajek, Stead, West, Jarvis and Lancaster (2009), it was tentatively concluded that relapse prevention interventions hardly work. New perspectives on relapse prevention are thus highly needed (Piasecki, Fiore, McCarthy & Baker, 2002). The Internet-delivered relapse prevention intervention that was developed and tested here was based on the conceptualization of continued abstinence as a behavioral goal (Carver & Scheier, 1990).

Continued abstinence as goal

On the basis of the motivating outcomes quitters expect, they set themselves the goal to stay abstinent. This goal is represented mentally as a desirable and feasible future state (Boldero & Francis, 2002). Because of the positive outcomes they expect to gain by reaching the goal, they are motivated to invest time and effort to reach the goal. As long as they feel that they are approaching that desired goal, they will be motivated. However, when they become uncertain whether their investments will pay-off, their motivation will decline (Kluger & DeNisi, 1996). In other words, when quitters start doubting that the positive outcomes will come available, these imagined positive outcomes will lose their motivating power. Therefore, it is essential for quitters to have the idea that they are on the right track. Therefore, from a goal perspective, quitters need feedback about their progress: Positive progress feedback

will reinforce their idea that they are approaching their ultimate goal of continued abstinence and will support their motivation.

Quitters receive feedback about their progress by introspection and by observation. They observe whether they smoke or not and they monitor how they feel, what they think and what they do. The observation that one is not smoking is not particularly informative when it comes to the risk of relapse: All ex-smokers are not smoking before they relapse. Thus, we assume that quitters use other sources of information to conclude whether they are on the right track. For example, the frequency or the changing intensity of craving for smoking, or an increased confidence to stay abstinent might be informative about progress towards their goal. When quitters interpret this information as signaling good progress, their motivation will be strengthened. When it comes to intervention development, based on this conceptualization we should help quitters to attend to relevant information, or to interpret the relevant information they encounter.

In this study, two methods to influence quitters' estimates of their progress were applied: Progress feedback and temporal comparison formation. Progress feedback refers to feedback on the relevant changes the ex-smoker has undergone and the interpretation of these changes. In abstinence, relevant changes concern psychological factors that are related to quitting success, such as craving and self-efficacy. Temporal comparison formation is another way to construe perceptions of progress (Albert, 1977) towards continued abstinence. People look back in time and compare their present state to a relevant state in the past. They evaluate whether, at present, they feel better or worse off. Positive temporal comparisons - presently feeling better off compared to the past - motivate ex-smokers to try to maintain their quitting attempt. Temporal comparison formation is an intervention method based on this theorizing. The essence of this method is that quitters explicitly contrast positive aspects of the present state of abstinence to negative aspects of past smoking.

In sum, the basis of the presently developed tailored intervention is the notion that continued abstinence is a goal and that quitters need to know whether they approach the goal. We will try to achieve the latter by exposing them to progress feedback and temporal comparison formation.

The present study

The goal of the present study was to test a newly developed tailored Internet-delivered intervention to prevent relapse that provides quitters with progress feedback and encourages temporal comparison formation. Ex-smokers and smokers who were motivated to quit were randomly assigned to a control condition or an experimental condition. In the experimental condition they were exposed to this intervention five times during a six months period. This tailored intervention system was called the progress feedback system (FBS). In addition, in both conditions participants had access to a basic tailored quitting smoking system (BQS) that provided tailored feedback and individually adapted smoking cessation information, but no information on goal progress. This system was based on an earlier version (Oenema, et al. 2008). Thus, the research question is whether the FBS was able to lower relapse rates beyond the effects of the BQS.

Method

Recruitment and Design

Recent ex-smokers and smokers who were planning to quit smoking (in the advertisement not further specified) were recruited by advertisements in local newspapers and via the Internet in the Netherlands. Participants were assigned to the experimental or control group in order of registration by the project assistant. Participants were not informed about the existence of two research conditions. Three self-report assessments through the Internet were conducted; baseline (T1), after three months (T2), and after six months (T3). We only report the outcomes of T3 because the intervention was spread over six months. When an assessment was not completed

within one week, participants received a reminder by e-mail. After participants had filled in the first questionnaire, they all received an invitation to visit the Basic tailored Smoking cessation System (BQS; see below). Participants in both conditions were told that they were free to use the BQS as often as they wanted during the coming six months. Only participants in the experimental condition were invited to log in to the Progress Feedback System (FBS) five times over the period of six months.

To compute the number of participants to be included, an estimation must be made regarding the effects that can be expected; the number of participants should be sufficient to show such an effect. However, relapse percentages strongly depend on the selection of participants (e.g. smoking status or the duration of abstinence at inclusion, the recruitment channel), in this case, the selection among smokers who want to quit and ex-smokers. For example, if we wanted to demonstrate a difference in relapse rates of 20% (70% relapse in the control group, and 50% relapse in the experimental group, p set on .05, power .90), then 73 participants per condition would be needed (DSS Research). However, if we wanted to demonstrate a difference in relapse rates of 10% (70% relapse in the control condition, and 60% relapse in the experimental condition), 280 participants per condition would be needed. Dijkstra, Conijn and De Vries (2006) were able to induce a difference of 23% in relapse rates after two months using a single tailored letter, in a sample of ex-smokers who had quit for an average period of three months. On the one hand, it might be argued that the present intervention will be more powerful than the Dijkstra et al., (2006) single tailored letter, as ex-smokers will be exposed five subsequent times. Therefore, the difference in relapse rate might be even larger. On the other hand, in the present study we included smokers who were motivated to quit. Because they are earlier in the process of smoking cessation than ex-smokers, the effects of the intervention on relapse might be smaller. In addition, the follow-up duration in the present study was longer. All in all, the expected difference

between the conditions was tentatively put on 20%, thereby needing at least 73 participants to be included in each condition at the T3 relapse outcome measurement.

The Basic Quitting System

The Basic Quitting System (BQS) consisted of two main modules, a motivation module aiming to motivate smokers or ex-smokers and a support module aiming to increase self-efficacy in smokers or to support quitting in ex-smokers. Participants in both conditions could log in to the system every day if they wanted. The BQS provided smokers and ex-smokers with individually tailored information: The texts were composed on the basis of an individual assessment and the information was personalized (e.g., ‘dear John’), adapted to smoking status and several psychological variables, and state feedback about the individual was presented.

The *motivation module* was designed to enhance the motivation to quit by increasing smokers’ expected positive outcome expectations of quitting. Four clusters of outcomes were addressed: Long term physical outcomes, short term physical outcomes, social outcomes, and self-evaluative outcomes. The paragraphs on each of the four clusters of outcomes were selected from the text library database with several versions of it, adapted to different individual characteristics (e.g., age, expected outcomes). On long term physical outcomes there were 18 messages in the text library from which one was selected, on short term physical outcomes there were 23, on social outcomes 3 messages, and on self-evaluative outcomes there were 4 messages from which 1 was selected. The length of the texts varied depending on individual characteristics. In total, motivation module-users received 6 or 7 paragraphs of text (1 per screen) including a tailored introduction, ranging from 90 to 260 words. The total number of words of the texts together varied from 800 to 1500 words.

An example of a part of a text from the motivation module is: ‘You seem not very convinced that smoking is bad for your physical condition. Nevertheless, in spite of your young age, you perceive some physical complaints through smoking. And that is

as expected: With every cigarette and with each puff, you inhale two wrongdoers: Tar and carbon monoxide are very harmful. One out of two smokers will die from smoking’.

The *support module* was designed to increase self-efficacy to refrain from smoking by offering skills that can support abstinence. Again, on the basis of an assessment the computer system composed a persuasive message consisting of different paragraphs. The library database contained several possible texts to be included in a paragraph on a certain topic. Smokers received individualized advice on nicotine replacement; an individual received one of four texts on nicotine replacement. In addition, 4 paragraphs provided tailored self-efficacy enhancing information about coping with habitual risk situations (1 of 3 texts from the library), emotional risk situations (1 of 5 texts), social risk situations (1 of 6 texts) and relapse (1 of 2 texts). In total, support module-users received 7 or 8 paragraphs of text (1 per screen) including a tailored introduction, ranging from 40 to 120 words. The total number of words of the texts together varied from 400 to 680 words.

An example of a part of a text in the support module is: ‘It seems that you are not very confident that you can refrain from smoking when you are stressed. Therefore, you should prepare yourself for this risk situation. When it is not possible to avoid the situation you may use other means to lower your stress. For example, you can learn the short relaxation exercise shown in Box 2.’

The Feedback System (FBS)

The Feedback System (FBS) was based on the rationale that continued abstinence is a behavioral goal and that the motivation to stay abstinent depends on the extent to which quitters think that they make progress towards this goal: As long as they think that they make progress or that making progress is within their reach, they may stay motivated to invest in refraining from smoking (Kluger & DeNisi, 1996).

Only participants in the experimental condition had access to the FBS. During the six months of the study, they were invited five times with one month intervals to enter the FBS, the first time one month after the start of the study (the T1 assessment), using information from the T1 assessment to compose progress feedback. When they were tracked to not have logged in within one week, they were sent a reminder. The FBS consisted of two parts: The progress feedback part and the temporal comparison formation part.

In the FBS participants received *progress feedback* about changes in relevant variables since the last time they had logged in. When participants were abstinent now and abstinent the last time, they received progress feedback on levels of self-efficacy, temporal comparisons, and craving. When participants had been smoking in the meantime, this was taken into account in the feedback. When participants smoked now and smoked the last time, they received progress feedback on levels of self-efficacy, and motivation to quit. When participants had been quitting in the meantime, this was taken into account in the feedback. When participant were abstinent now and smoked last time, no progress feedback could be generated and they received state feedback on self-efficacy, temporal comparisons, and craving. When participant smoked now and were abstinent last time, no progress feedback could be generated and they received state feedback on self-efficacy, and motivation to quit.

In the feedback, the change in the variable was formulated (e.g., 'It seems you still miss smoking a lot') and the meaning of the specific changes for smoking cessation (e.g., 'That is not a good sign'). In addition, a behavioral recommendation was given (e.g., 'You should be more active now and apply the cessation skills'). When the feedback was positive, the communication goal was to reinforce the behavior but warn the participants to stay alert. When the feedback was negative, the communication goal was to warn that things are not going well but to provide hope and motivation to take action (Kluger & DeNisi, 1996).

An example of a progress feedback text is: ‘Since the last time you were here, you have become more confident that you are able to refrain from smoking. That is great. This makes quitting much easier and it increases your chances to quit for good: You are on track! But don’t underestimate quitting; still prepare yourself well for risk-situations’. Progress feedback was provided on all two or three feedback variables, with the total number of words ranging from 130 to 170.

The second part of the FBS consisted of the *temporal comparison formation* task. Temporal comparisons are the self-generated feedback of ex-smokers in which they compare their present situation with their situation when they still smoked. Positive temporal comparisons have been shown to be robust predictors of continued abstinence (Dijkstra & Borland, 2003, Dijkstra, Borland, & Buunk, 2007, Menninga, Dijkstra, Gebhardt, & Siero, 2011). The writing task was based on the principle of mental contrasting (Oettingen, 2000): Ex-smokers were asked to first elaborate on the negative aspects of their situation when they still smoked and immediately after that on the positive aspects of being quit. ‘For a moment, remember the days or weeks before you had quit smoking’ and ‘Now, think for a moment about how it’s going now. How are you doing now?’ Each of the five times they were invited to finish the writing task they were asked to write about another theme; about social aspects, long term-physical, short-term physical, and self-evaluative aspects, and addictive aspects. For example, the task on the social aspects was introduced as follows (negative aspects of past smoking): ‘Describe how you noticed that people in our society looked more negatively at smokers’; the task on the long term physical aspect was introduced as follows (positive aspects of present abstinence): ‘Describe now how good your body feels at this moment now you are not smoking anymore’. When participants who logged in were not abstinent (anymore), they were asked to write about the negative aspects of smoking now and the positive aspects of not smoking in the future in a similar format as described above. Every month, starting one month after enrollment, participants

were invited (and when necessary after one week reminded) to log into the FBS and read the progress feedback and finish the writing task. Thus, in total, the intervention comprised of five exposures.

Pretest assessment (T1)

Quitting and smoking history were assessed by the questions: ‘Are you refraining from smoking at this moment?’ and ‘How many days/months have you been refraining from smoking?’

Quitting behavior was assessed with two items: The number of months/years smoked, and the number of cigarettes smoked per day.

Temporal comparisons were assessed by asking participants whether they felt better or worse off compared to when they still smoked on four dimensions of general positive outcomes or desired states. Relevant dimensions were identified from an earlier study (Dijkstra & Borland, 2003). The global format of the two-sided seven-point items was: ‘Compared to when you still smoked...’; ‘...do you think you are doing better or worse?’ (endpoints 1 [*much better*] and 7 [*much worse*]); ‘...is your life more or less meaningful?’ (endpoints 1 [*much more meaningful*] and 7 [*much less meaningful*]); ‘...do you have more or fewer good moments in your life?’ (endpoints 1 [*much more good moments*] and 7 [*much fewer good moments*]); ‘...are you more or less happy?’ (endpoints 1 [*much more happy*] and 7 [*much less happy*]) and ‘...is your life better or worse organized?’ (endpoints 1 [*much better organized*] and 7 [*much worse organized*]). The higher the scale score, the more negative the participant’s evaluation of the present situation compared to his or her situation as a smoker (Cronbach’s alpha = .86).

Self-efficacy was assessed with a 12 item scale, validated in earlier studies (Dijkstra & de Vries, 2000; Mudde, Kok & Stretcher, 1995). Twelve items assessed the confidence level of being able to refrain from smoking in emotional, social, conditioned and motivational situations. All items were measured on a seven-point scale and could be scored from endpoints -3 [*not sure I am able to*] to 3 [*very sure I am able to*]. Alpha = .97.

The introduction sentence was: ‘In some situations it is easy, in other situations it is difficult not to smoke. At this moment you are engaging in a quit attempt. Are you able to refrain from smoking when you...?’. An example of an (emotional) item is: ‘...are feeling stressed?’.

Perceived positive outcomes of smoking were assessed using nine items on a five-point scale. The items were validated in earlier studies (Dijkstra & Borland, 2003). Examples of items of this scale are: ‘Smoking...?’, ‘... helps to relax’, ‘...helps to cope with my anger’, ‘...is companionable’, ‘...helps to stay alert’. The items could be scored from endpoints 1 [*totally disagree*] to 5 [*totally agree*]. (Cronbach’s alpha = .89).

Perceive positive outcomes of quitting were assessed through the use of thirteen items on a five-point scale, divided in long term and short term physical outcomes, social outcomes and self-evaluative outcomes. ‘If I succeed in continued abstinence, then...?’. The short term physical outcomes were: ‘...my condition will improve’; ‘... I’m healthier’; ‘...I feel fit’. The long term physical outcomes were: ‘...my risk on heart- and vascular diseases will decline’; ‘...my risk of lung cancer will decline’; ‘...my risk of lung diseases will decline’. The social outcomes were: ‘...others will judge me more positive’; ‘...others will respect me more’; ‘...others will also benefit’. The self-evaluative emotions were: ‘...I will be very satisfied about myself’; ‘...I will be proud of myself’; ‘...I will find it wise’. The items could be scored from endpoints 1 [*totally disagree*] to 5 [*totally agree*]. (Cronbach’s alpha = .86).

Posttest assessment (T3)

Relapse was assessed using the question ‘Have you been smoking at all (even one cigarette or one puff) since you have filled in the second questionnaire three months ago?’ Participants who answered the first question in the affirmative were considered to have relapsed. In addition, point prevalence quitting was assessed: ‘Did you smoke during the past seven days, even if it was only one cigarette or one puff?’

Results

Sample characteristics

In total, 393 participants registered for the study. At baseline, the sample consisted of participants who had quit smoking ($n = 141$) and participants who were still smoking but planning to quit ($n = 252$). The ex-smokers had smoked on average 19.01 cigarettes a day ($SD = 9.46$), had smoked for 26.37 years ($SD = 13.51$), and had undertaken 3.67 quitting attempts on average ($SD = 4.33$). Smokers smoked on average 18.15 cigarettes a day ($SD = 10.77$), smoked on average for 28.85 years ($SD = 13.15$), and had undertaken 4.55 quitting attempts on average ($SD = 6.31$). Of the 393 participants at baseline, 160 filled in questionnaires 1 and 3 (38.4%). Ex-smokers and smokers did not significantly differ on number of cigarettes smoking/smoked, number of years smoked, and number of past quitting attempts.

Randomization and attrition analyses

We conducted randomization analyses in all 393 participants, as well as in the group participants who completed questionnaires 1 and 3 (160 participants). Univariate analyses of variance for continuous variables and Chi-square analyses for categorical variables revealed that the experimental and the control group in both samples did not significantly differ on age, sex, smoking status at baseline (smoker or ex-smoker), number of cigarettes smoking/smoked, number of past quit attempts, duration of smoking, duration of quitting, temporal comparisons, perceived positive outcomes of quitting, and perceived positive outcomes of smoking. In the whole sample ($N = 393$) as well as in the sub sample ($n = 160$) the groups only differed significantly on self-efficacy ($p = .05$): Participants in the experimental group reported a significant higher self-efficacy ($N = 393, M = 4.62; N = 160, M = 4.82$) than participants in the control group ($N = 393, M = 4.34; N = 160, M = 4.30$). Therefore, in all below statistical analyses, self-efficacy was included as a covariate (see table 1 for the participant characteristics of both groups).

Table 1. *Participant characteristics in the experimental and the control condition*

	Experimental group (n = 191)		Control group (n = 202)	
	M	SD	M	SD
Age	46.7	12.4	48.9	12.2
Amount of cigarettes smoking/smoked	17.9	10.1	19.1	10.5
Amount of quitting attempts	4.4	4.6	4.7	5.9
Number of years smoking/smoked	27.2	12.9	28.8	14.1
Temporal comparisons	3.63	.97	3.36	.98
Positive outcomes of smoking	3.10	.63	3.06	.62
Self-efficacy	4.61	1.2	4.27	1.4
% of women	58%		59%	
% ex-smokers	34%		36%	

An attrition analysis was conducted to assess whether dropouts after T1 significantly differed from the participants who remained in the study (of whom T1 and T3 data were available). Testing the same variables as in the randomization check (listed above) and the variable condition, the results showed that dropouts only differed on the variable condition ($F = 4.47, p = .035$): Significantly more participants dropped out of the experimental group (66.4%) compared to the control group (53.5%). At the end of this chapter a flowchart is included with drop-outs per condition at different time points.

Effects of condition on relapse

Logistic regression analyses were conducted with relapse at T3 as dependent variable, condition as independent variable, and self-efficacy as covariate. There was no significant main effect of condition, $\text{Exp}(B) = 1.35, \text{CI } .70\text{-}2.64, p = .37$. Subsequently it was tested whether the conditions differed in relapse rates in subgroups by applying moderation analyses. Several moderators were included in the model to test whether an interaction effect could be uncovered: Three smoking related variables were tested as moderators: number of cigarettes smoking/ smoked, duration of quitting, and number of quitting attempts, and four psychological variables: self-efficacy, perceived smoking

outcomes, perceived quitting outcomes, and craving. None of these seven interactions was significant. In all below regression analyses, these moderators are tested. In conclusion, we were not able to demonstrate that the FBS was effective in preventing relapse beyond the BQS.

Intention to treat analyses

At T3, 233 participants had dropped out despite reminders to fill in the T3 measurement. In the intention to treat analyses, we considered all these 233 participants to be relapsed at T3. Logistic regression analyses were conducted with relapse at T3 as dependent variable and self-efficacy as a covariate. Only a marginal significant main effect of condition was found: $\text{Exp}(B) = 1.69$, CI .96-2.96, $p = .069$. In addition, two marginal significant interaction effects were found: Between condition and self-efficacy: $\text{Exp}(B) = .61$, CI .38-1.00, $p = .052$, and between condition and number of quitting attempts: $\text{Exp}(B) = .81$, CI .65-1.01, $p = .065$.

Analyses in smokers and in ex-smokers

In the above analyses, T1- smokers as well as T1-ex-smokers were included. The same analyses were now conducted for T1-smokers and T1-ex-smokers separately. Of the 160 participants for whom T1 and T3 data were available, 93 reported to smoke at baseline; 39 in the experimental condition and 54 in the control condition. At T3, 22 participants (24%) had quit smoking (14 participants in the control condition, and 8 participants in the experimental condition). Among those T1-smokers, no significant main effect of condition on relapse at T3 was found, $\text{Exp}(B) = 1.45$, CI .53-4.02, $p = .47$, and no significant moderator effects were found.

Sixty-seven participants reported to be ex-smoker at baseline: 40 participants in the control group, and 27 participants in the experimental group. At T3, 42 (64%) of the 67 participants were abstinent (25 participants in the experimental group and 17 participants in the control group). In the subsample of the 67 participants who reported to be ex-smoker at T1, no main effect of condition on relapse at T3 was

found, $\text{Exp}(B) = .98$, $CI .35-2.74$, $p = .96$. Only one significant moderation effect was found: a significant interaction effect between condition and number of quitting attempts, $\text{Exp}(B) = .50$, $CI .28-.90$, $p < .05$. Although the contrasts were not significant, there was a tendency ($p > .05$) for the experimental group, compared to the control group, to lead to less relapse in ex-smokers with fewer past quit attempts but to more relapse in smokers with a higher numbers of past quit attempts.

In conclusion, with regard to our measure of continuous abstinence, no reliable significant effects could be found of the FBS applied in the experimental condition. To further study the effects of the tailoring systems, exposure analyses were conducted.

Exposure analyses

In the following analyses the exposure to the tailored interventions, and the relation between exposure to the FBS and relapse were studied. Due to technological fallacy, the exposure to the BQS and the FBS could not be distinguished in the log-in data. On average, participants logged in 3.42 times ($SD = 3.59$) and, as expected, participants in the experimental condition logged in (BQS plus FBS) significantly more often into one of the systems than participants in the control group (BQS only; $F(1,157) = 37.11$, $p < .001$: control group $M = 2.10$, $SD = .26$; experimental group $M = 5.27$, $SD = .50$).

Next, it was studied how many participants were exposed to the FBS. Participants in the experimental group received five times an invitation to access the FBS. This time not simply having logged in but having completed a writing task (temporal comparison formation) was considered as a full exposure to the FBS. On average, participants in the experimental group ($n = 66$, one missing value) filled in 2.59 writing tasks (range 0 to 5, $SD = 1.18$): fifteen participants did not fill in any writing task, six participants filled in only one writing task, seven participants filled in two writing tasks, twelve participants filled in three writing tasks, fifteen participants filled in four writing tasks, and eleven people filled in all five writing tasks. Thus, 77% of the participants completed at least one writing task but only 17% completed all five writing tasks.

It can be concluded that the exposure in the experimental condition to the FBS was far from complete. Therefore, in the subsequent analyses we selected only participants of whom we were certain that they had been exposed to the FBS (as indicated by having finished a writing task) and compared their relapse rates at T3 with those of participants in the control condition. To increase comparability of the control condition and the selected participants in the experimental condition, the control condition participants were matched on relevant variables.

First, those participants in the experimental condition were selected who filled in one task or more ($n = 51$) and they were compared to control condition participants ($n = 93$). A MANOVA was conducted to assess whether the groups were comparable with regard to self-efficacy, perceived smoking outcomes, perceived quitting outcomes, age, sex, duration of quitting, number of cigarettes smoking/smoked, number of quitting attempts. A Chi-square analysis was used to test whether groups were comparable on sex. These tests revealed that perceived quitting outcomes significantly differed between the conditions, $F(1,143) = 4.44, p = .037$ (control condition $M = 1.97, SD = .055$, experimental condition $M = 2.11, SD = .057$). It was decided to exclude the 25% lowest scoring participants on perceived quitting outcomes from the control group (23 participants). After this exclusion, the groups did not significantly differ anymore and thus were considered to be comparable. A logistic regression analysis was conducted with relapse at T3 as dependent variable and condition as independent variable. There was no significant main effect of condition on relapse ($\text{Exp}(B) = .98, \text{CI } .47\text{-}2.07, p = .96$), and no significant moderator effects were found.

The next step was to select the participants in the experimental group who filled in two writing tasks or more and compare them to the participants in the control condition (control condition $n = 93$, experimental condition $n = 45$). The conditions did not differ significantly on the same variables as tested above, suggesting that they

were comparable. Again, there was no significant main effect of condition on relapse ($\text{Exp}(B) = .25$, $\text{CI } .60\text{-}2.62$, $p = .55$), and there were no significant moderator effects.

Next, participants in the experimental condition were selected who had filled in three tasks or more, and they were compared to the participants in the control condition (control condition $n = 93$, experimental condition $n = 38$). Both groups only differed significantly on the variable perceived quitting outcomes: $F(1,130) = 8.38$, $p < .05$ (experimental condition $M = 2.25$, $SD = .06$, control condition, $M = 1.97$, $SD = .05$). It was decided to exclude the lowest 25% scoring participants on perceived quitting outcomes in the control condition (23 participants). After this exclusion, the groups did not significantly differ anymore and were considered comparable. Again, there was no significant main effect of condition on relapse and no significant moderator effects were found.

Next, only participants in the experimental group were selected who had filled in four or more tasks and they were compared to the participants in the control condition (control condition $n = 93$, experimental condition $n = 25$). Both groups significantly differed on age ($F(1,118) = 4.95$, $p < .05$, age control condition $M = 50.48$, $SD = 1.36$, age experimental condition $M = 44.48$, $SD = 2.24$) and on perceived quitting outcomes, $F(1,118) = 5.71$, $p = .05$ (control condition $M = 1.97$, $SD = .061$, experimental condition $M = 2.25$, $SD = .081$). It was decided to exclude the oldest 25% participants from the control group (24 participants) and the participants 25% lowest scores on perceived quitting outcomes (23 participants). After these exclusions, the groups did not significantly differ anymore and were considered comparable. In total, 47 participants were excluded from the control condition, leaving 46 participants in the control condition, and 25 participants in the experimental condition. There was no significant main effect of condition on relapse, $\text{Exp}(B) = .57$, $\text{CI } .20\text{-}1.58$. $p = .28$, and there were no significant moderator effects found.

Finally, only participants in the experimental condition were selected who filled in all five tasks (11 participants). Only perceived quitting outcomes significantly differed between the control and the experimental condition: $F(1,103) = 3.97$ ($p = .05$, control condition $M = 1.97$, $SD = .05$, experimental condition $M = 2.35$, $SD = .14$). It was decided to exclude those participants from the control group with the lowest 25% of scores on perceived quitting outcomes (23 participants). After this exclusion, the groups did not significantly differ anymore and were considered to be comparable. Because the group sizes differed strongly (experimental condition 11 participants, control condition 70 participants), a Levene's test for equal variances was conducted. This test revealed that the group variances did not differ significantly ($p = .88$).

There was no significant main effect of condition on relapse ($\text{Exp}(B) = .49$, CI .13-1.77, $p = .28$). There was one significant interaction effect between condition and craving: $\text{Exp}(B) = .25$, CI .06-.96, $p = .043$). Because this was an isolated significant effect with the p -value just below .05 it was not further studied.

In conclusion, these exposure analyses show that exposure to the FBS - as indicated by having finished a writing task - was low, and that relapse rates in participants who had been exposed did not differ significantly from comparable participants in the control condition. Thus, no reliable significant effects of the FBS on relapse at T3 could be detected.

Point prevalence analyses

In the above analyses, relapse at T3 was the dependent variable: 'Have you been smoking at all (even one cigarette or puff) since you filled in the second questionnaire three months ago?' This is a fairly conservative measurement of relapse or abstinence. A less stringent measure of abstinence is the seven days point prevalence abstinence measure: 'Have you been smoking during the past seven days (even one cigarette or puff)?'. Of the 98 participants who had smoked since they had filled in the second questionnaire, 12 reported to not have smoked during the past seven days. These 12

participants were considered to be abstinent. Together with the participants who had not smoked at all since they had filled in the second questionnaire, the number of point prevalence abstainers was 76, compared to 76 participants who had smoked during the last 7 days ($n = 152$; from eight participants no data on point prevalence abstinence were available). A logistic regression analysis was conducted with point prevalence as dependent variable and condition as independent variable. There was no significant main effect of condition on point prevalence quitting ($\text{Exp}(B) = .76$, $\text{CI } .40\text{--}1.46$, $p = .41$), and no significant moderator effects were found.

Intention to treat analyses

Intention to treat analyses showed no significant main effect of condition ($\text{Exp}(B) = 1.51$, $\text{CI } .90\text{--}1.54$, $p = .12$). A marginal significant interaction effect was found between condition and self-efficacy ($\text{Exp}(B) = .65$, $\text{CI } .41\text{--}1.03$, $p = .069$).

Analyses in smokers and in ex-smokers

In the above point prevalence analyses, T1- smokers as well as T1-ex-smokers were included. The analyses were now conducted for T1-smokers and T1-ex-smokers separately. Of the 152 participants from whom point prevalence data at T3 were available, 66 were ex-smokers at baseline, and 86 were smokers at baseline. There were no significant effects of condition on point prevalence quitting in ex-smokers, nor in smokers, and there were no significant moderator effects.

Exposure analyses

Next, the effects of exposure to the FBS on point prevalence quitting were studied. The same procedure was followed as with the above exposure analyses, but now with point prevalence as dependent variable. No significant main or interaction effects were found.

Discussion

In the present study, a tailored Internet intervention for smoking cessation was developed and tested. Participants were randomly assigned to one of two groups: A

control group which received the BQS, and an experimental group which received the BQS plus FBS. We were interested whether the FBS was effective in lowering the relapse rates. Our results indicated that we were not able to lower relapse rates in the experimental group. This was the case for both smoking cessation measures; relapse at T3 and seven days point prevalence abstinence at T3. There may be a number of reasons for these null-findings.

The first and probably the most important reason for our findings is that participants in the experimental condition were not sufficiently exposed to the FBS. Participants in both conditions were encouraged to use the BQS as often as they wanted. Participants in the experimental group were also encouraged to use the FBS: Five times during the six months interval they were invited by e-mail to log in to the FBS and on the basis of the log-in data they were send a reminder when necessary. As expected, participants in the experimental group logged in more often (5.2 times compared to 2.1 times in the control group), but this is still low given the time span of the study of six months. This difference in exposure seemed not enough to induce lower relapse rates in the experimental condition compared to the control condition. This problem of lack of exposure in (internet-delivered) interventions is also well known in the literature, especially when they are implemented in real life (see Crutzen, et al., 2011, for a review; Bennett & Glasgow, 2009; Evers, Cummins, Prochaska, & Prochaska, 2005, Segan & Borland, 2011). The first challenge is to stimulate people to make an initial visit to the website. This is about raising curiosity and the expectation of some reward (e.g., important information), not yet about the contents and presentation of the website itself. Secondly, we should make people stay and explore the website. Here attractiveness, user friendliness and a promise of reward may be important. Thirdly, people should be stimulated to return to the website. Expectations of reward on the basis of the first visit may be central. Brouwer et al. (2011) showed in their systematic review that the time spent on a website was related to peer support,

for example, the possibility to communicate to others on a forum, and the number of log ins was related to e-mail and phone contact and to updates of the intervention website. In a review of Crutzen et al., (2011) some suggestions are made to improve exposure for internet delivered interventions, such as providing content in an interactive way (for example in discussion boards) combined with monitoring health behavior and behavior change. Furthermore, it is recommended to track and report multiple exposure measures, such as duration of visit, and number of pages visited (Crutzen, De Nooijer, Candel, & De Vries, 2008). However, Willemsen, Wiebing, Van Emst and Zeeman (2006) suggested that the actual usage of interventions might be less important than that people know that there are interventions available. Thus the promotion of the existence of smoking cessation methods might be enough to stimulate people to quit smoking on their own. In addition, a financial compensation for participants using an intervention might also work (Kaper, Wagena, Willemsen, & Van Schayck, 2006). Nevertheless, still a lot has to be learned about how to get people exposed to our web-based interventions. Probably one of the lessons of our study is that being motivated to quit smoking is something completely different from being motivated to adhere to our smoking cessation intervention.

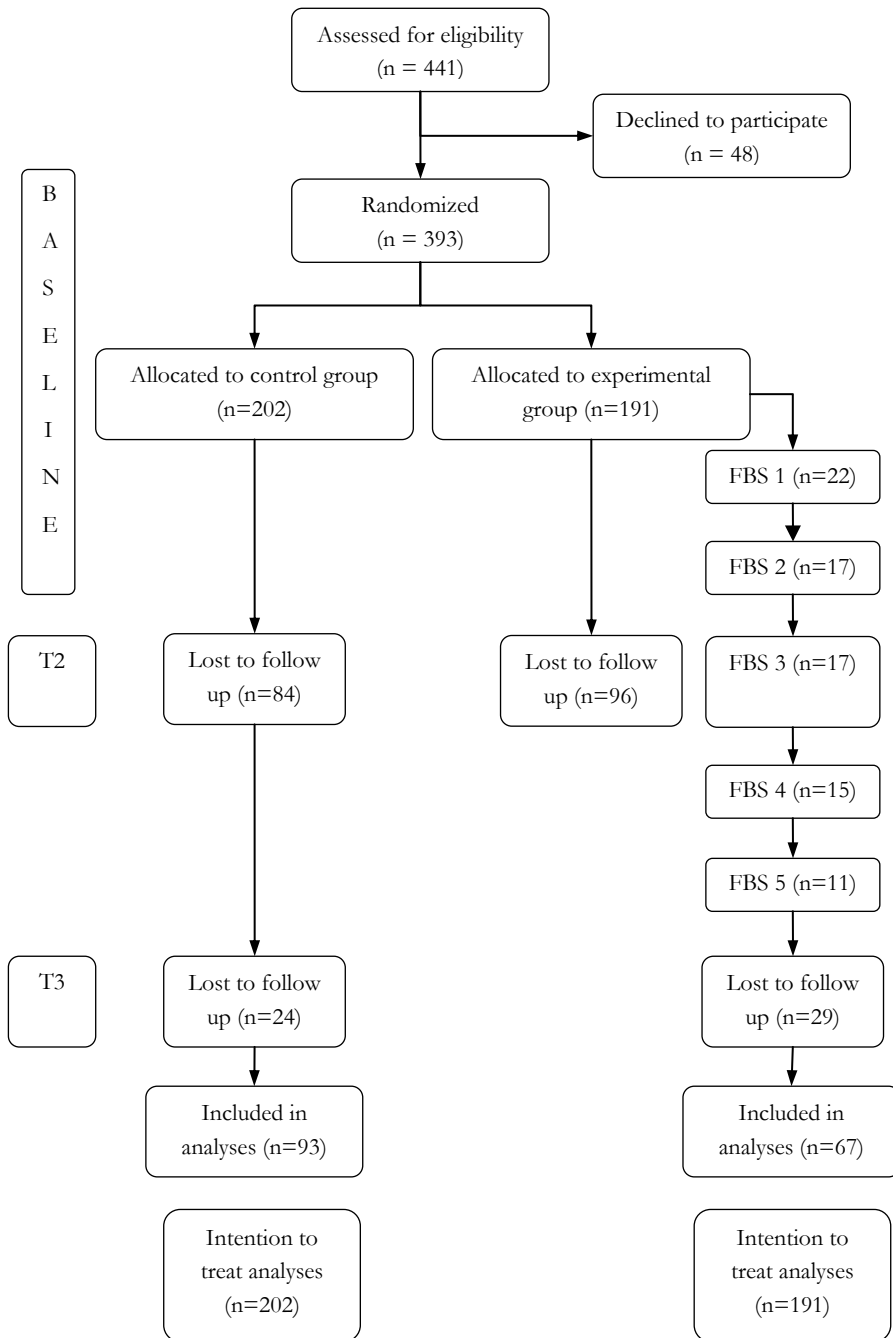
Another reason for the null-findings may be that the absolute effects of smoking cessation treatments delivered through the Internet are quite small (see Civljak, Sheikh, Stead, & Car, 2006, for a review). Face to face contact is still more effective. Killen, Fortmann, Davis, & Varady (1997) stated that this might be the case because self-regulatory skills required to withstand the urge to smoke may be better learned, rehearsed and retained under direct supervision from a therapist than through the simple modeling offered by self-help materials (for example delivered via the Internet). In addition to these small effects, most smokers and ex-smokers already have access to the widely available information on smoking cessation through the Internet (Lancaster

& Stead, 2005). Thus, it may not be easy to induce effects with self-help interventions above the default effects of wide-spread information.

This study also suffered from a high percentage of drop outs. One reason for this high loss might be that participants may have started enthusiastic, but that their motivation to participate and to fill in the T3 measurement declined when they relapsed. Another reason for the high loss of participants may be that we raised certain expectations in the recruitment of participants. The advertisement stated that participants would receive a personal advice on their smoking behavior. Although this advice was highly tailored to the participant and its situation, we heard from some participants who contacted us for study-related questions that the information was not always experienced as such. It could be that on the basis of the advertisement participants expected a personal advice from a coach, for example through email or telephone. Thus, disappointment may have caused dropout.

In conclusion, the present study made clear that developing Internet-based interventions for smoking cessation is not only about smoking cessation, but also about Internet use. Not only should the intervention contain evidence-based methods to stimulate and support abstinence, but the shape and formulation of these methods and the context should also motivate people to adhere to the Internet-based intervention. Maybe the involvement of living others (i.e., peers, coach) is essential or maybe gaming elements may be part of the solution. In the end, the effectiveness of Internet-delivered interventions in a population may primarily depend on the extent to which we succeed to get people exposed to it.

Flowchart of number of participants allocated per condition, and drop-outs at different time points



Chapter 6

General discussion

Tobacco smoking kills millions of smokers each year. Smoking cessation is one solution for this problem. Although many smokers try to quit smoking, most quitters relapse back to smoking. In the past 25 years little progress has been made with regard to the practice of relapse prevention, although some new theoretical perspectives were developed and applied. Therefore, new directions are needed to inspire research on relapse and the practice of relapse prevention. In this thesis, the Learning Abstinence Theory (LAT) is formulated to that purpose, and empirical data are gathered to test some basic assumptions of this theory.

In the LAT, learning about abstinence is central. Firstly, quitters learn in learning situations, about smoking, about their ability to quit, and about not smoking. What they learn in these situations depends on the information they attend to and how they interpret the information; this depends on their situational *state of mind*. Secondly, quitters learn about their progress towards the desired end-goal of continued abstinence. They need and generate *progress feedback* to find out whether they are on the right track, that is, whether spending effort will pay off. In addition, quitters construct their own progress feedback in the form of temporal comparisons. These two main aspects of the LAT - states of mind and progress feedback - are the focus of this thesis. In the empirical Chapters 2, 3 and 4, the notion that the state of mind influences interpretations and learning is addressed. In empirical Chapters 2 and 5, feedback about progress, partly as self-constructed temporal comparisons, is studied.

Summary of main findings

Chapter 2: Temporal comparisons and learning experiences predict relapse.

This first empirical chapter reports on a cohort of 323 ex-smokers who were quit for less than six months and were followed for seven months. At T1, several individual differences were assessed to predict self-reported abstinence at T2 (one month follow-up) and at T3 (seven months follow-up). At T1 they were asked: a) how their present situation was compared to their situation when they still smoked and to when they just

had quit, on several dimensions (temporal comparisons), and b) how they evaluated the last time they were tempted to smoke but did not smoke (learning evaluations). Firstly, temporal comparisons predicted relapse at T2 and at T3. Thus, self-constructed progress feedback may have a motivational influence on abstinence. Secondly, temporal comparisons predicted relapse in interaction with self-efficacy at T2 and at T3. This replicates earlier findings and shows that temporal comparisons are a unique predictor of relapse. Thirdly, learning evaluations predicted relapse at T2, suggesting that retrospective interpretations of learning situations have a motivational influence on abstinence. Lastly, the relation of temporal comparisons with relapse at T2 was significantly mediated by learning evaluations. This finding is in line with the notion of temporal comparisons as a state of mind that governs information processing in learning situations. In addition, it shows that self-constructed progress feedback (temporal comparisons) is related to relapse.

Chapter 3: Ambivalence, anticipated emotions, and learning experiences predict relapse.

This chapter reports on the same cohort of ex-smokers as in the former chapter, but now the role of ambivalence in relapse is addressed. Although ambivalence is a normal phase in decision making and behavior change, after the decision to quit has been made it should no longer be present. However, the data show that there still was relevant variance in ambivalence among ex-smokers. Firstly, the data showed that ambivalence predicted relapse at T2: Stronger feelings of being torn apart between smoking and not smoking seemed to undermine abstinence. Secondly, the relation of ambivalence with the anticipation of negative self-evaluative emotions in the case of relapse was addressed. This relation was interpreted within a dual-system framework with ambivalence pulling towards relapse and self-evaluative emotions averting relapse. The results showed that self-evaluative emotions only predicted relapse when ambivalence was low. Thirdly, the relation of ambivalence with relapse was partly

mediated by learning evaluations. This finding is in line with the notion of ambivalence as a state of mind that governs information processing in learning situations.

Chapter 4: The active state of mind determines the level of craving smoking cues elicit.

This chapter reports on two laboratory studies (N=140 and N=120) on craving for tobacco. Participants were temporary abstinent smokers for ethical reasons. It was tested whether the perception of a smoking cue (the participants' cigarettes) was influenced by the state of mind of the abstinent smoker. Abstinent smokers were exposed to the smoking cue after induction of specific states of mind, after which craving was assessed. Differences in the level of craving during the exposure to the smoking cue were interpreted as resulting from the different states of mind. Study 1 showed that when participants were made to believe that smoking has strong positive outcomes for them they reported stronger craving, but only when their self-efficacy was low. In addition, when participants were made to believe that they could easily quit smoking they reported lower craving, but only when they saw strong positive outcomes of smoking. Study 2 showed that when open-mindedness was induced using a self-affirmation procedure, the level of craving significantly changed, the direction depending on the extent to which the abstinent smoker valued health. The data from both studies showed that the state of mind during the exposure to the smoking cue affected the level of craving that was triggered. This conclusion is in line with the notion that what is encountered and, thus, can be learned in learning situations, (partly) depends on the ex-smoker's state of mind.

Chapter 5: Supporting quitting with progress feedback and temporal comparison formation.

This chapter reports on the effects of a newly developed tailored Internet-delivered intervention to prevent relapse in recently quit smokers or smokers who wanted to quit smoking (N=393). After a pretest, participants were randomly assigned to the experimental condition or the control condition. Three months (T2) and six months (T3) after that, follow-up measurements were conducted. The intervention presented

in the experimental condition was designed to present quitters five times (with one-month intervals) with a computer module that provided them with progress feedback and that stimulated temporal comparison formation (called the Feedback System; FBS). In addition, quitters in both the experimental and the control condition had access to a tailored smoking cessation website (called the Basic tailored Quitting smoking System; BQS). Thus, the study was designed to test whether the newly developed FBS could further lower relapse rates, beyond the effects of the BQS. However, due to high participant dropout and few participants actually being exposed to the FBS, the study lacked sufficient statistical power and no effects on relapse could be detected: 59% of the T1 participants did not provide T3 data, and the mean exposure to the FBS was 2.6 times, while only 11 participants had been exposed to the FBS properly, despite e-mail invitations and e-mail reminders.

The Learning Abstinence Theory

For ex-smokers, continuous and effortless abstinence is the final goal to be reached. LAT acknowledges this but focuses on the process *before* this goal is reached; on the learning that takes place which results in the desired continuous abstinence. Learning in smoking cessation is generally defined as gaining and accumulating knowledge that is relevant to abstinence.

In the LAT, learning can take place on a concrete and on an abstract level. On the concrete level, learning takes place in learning situations - situations in which an ex-smoker used to smoke in the past. In these situations, quitters learn about outcomes of smoking, their control over smoking, and the outcomes of quitting. What they learn depends on what they see: To what information they attend to and how they interpret the information in the learning situation. On the abstract level, ex-smokers can learn about the progress towards their final goal. They gather available information to find out whether they make good progress towards their final goal (Carver & Scheier, 1990). As long as they feel that they are approaching their desired goal, they will be

motivated. But only as long as they know that it pays-off: When they become uncertain whether their investments will pay-off, their motivation will decline (Kluger & DeNisi, 1996). Therefore, ex-smokers look for progress feedback and construct their own ideas about their progress (temporal comparisons).

The concept of learning in LAT is partly inspired by other perspectives on abstinence in addictions. Firstly, in cue-exposure, ex-smokers unlearn the association between unconditioned cues (e.g., negative emotions) and the occurrence of smoking (Marlatt, 1990; Drummond, Cooper & Glautier, 1990). Secondly, in the cognitive behavioral perspective of Beck, Wright, Newman, and Liese, (1993), ex-smokers can correct (=learn) inadequate beliefs about smoking, and their ability to abstain from it in so-called ‘experiments’ in cognitive therapy. Cue-exposure as well as the ‘experiments’ in cognitive therapy takes place in learning situations. However, in cue-exposure the learning process has little cognitive substance; it is mainly explained in the abstract terms of conditioning. In cognitive therapy, the learning is concrete but not embedded in the overarching final goal of abstinence in which progress feedback plays an important role. Thus, LAT is an attempt to further develop the concept of learning in abstinence, and it might fill a gap in our understanding of the process of abstinence.

In this dissertation, two main aspects of LAT were tested: The influence of states of mind on lower level learning, and the role of progress feedback in abstract learning. The concept of states of mind was tested correlational in the context of learning experiences and relapse in Chapters 2 (temporal comparisons), and 3 (ambivalence), and experimentally in relation to craving in chapter 4 (outcome expectations, self-efficacy, self-affirmation). The concept of progress feedback was tested in the Chapters 2 (temporal comparisons) and 5 (progress feedback and temporal comparison formation).

The findings in Chapter 2 and 3 were in line with the notion of states of mind influencing learning and subsequent risk for relapse. The states of mind of ‘perceiving

the progress towards abstinence as negative (temporal comparisons)’ and ‘feeling torn apart by smoking and not smoking (ambivalence)’ might be regarded as states of mind that determine what ex-smokers learn in learning situations. These states of mind were thought to lead to a negative learning evaluation which, in turn, increased the risk for relapse. In Chapter 4, states of mind were manipulated, which resulted in different levels of craving, which is an important predictor of relapse (Baer & Lichtenstein, 1988; Brandon, Tiffany, & Baker, 1987; Dijkstra & Borland, 2003; Killen & Fortmann, 1997; Shiffman, et al., 1997). Thus, looking at the smoking cues from different perspectives (i.e., perceiving weak or strong positive outcomes of smoking, perceiving low or high self-efficacy, feeling self-affirmed or not) partly determined the meaning of the smoking cues. Craving might be conceptualized here as an effect of the state of mind but also as a cause of subsequent learning: The level of craving and its underlying beliefs on smoking and control over smoking are informative to the quitter and add to the learning about abstinence. These data in combination with results of earlier studies in other domains (Erdley & D’Agostino, 1988; Kunda, 1999; Markus, 1977) make a good case that in smoking abstinence, learning is at least partly determined by the state of mind of the ex-smoker.

Progress feedback was addressed in Chapter 2 in the concept of temporal comparisons: The self-constructed progress feedback of ex-smokers. Temporal comparisons were a significant predictor of relapse, in relation with self-efficacy. The data also showed that using the anchor ‘compared to when you were still smoking’ was a stronger predictor than ‘compared to when you just had quit’. The latter might be argued to refer to the ex-smoker’s estimation of the *progress towards abstinence*. In this format the comparison is within the period of abstinence. The former (‘compared to when you still smoked’) might refer to the ex-smoker’s estimation of *progress in life*. In this format the change from smoking to abstinence is central. Thus, here ex-smokers seem to weight the past and present on an abstract level; it may not so much be about

abstinence but about what abstinence brings to their life. The global content of the items that comprise the temporal comparisons (e.g., ‘are you doing better or worse’ and ‘do you have more or less positive moments in your life’) is consistent with this reasoning. In Chapter 5, the intervention contained two elements with regard to progress feedback: Actual progress feedback on several relevant psychological states and a temporal comparison formation task. Unfortunately, dropout was too high and exposure too low to draw meaningful conclusions about the effects. Thus, with regard to progress feedback, only evidence on ex-smokers’ own construction of progress was gathered.

Strengths and limitations

The data presented in this thesis were generated from three samples of participants: From ‘fresh’ ex-smokers from the general population (Chapters 2 and 3), from abstinent smokers from a student population (Chapter 4), and from ‘fresh’ ex-smokers and smokers who wanted to quit from the general population (Chapter 5). The first and third samples are a self-selection from the general population although they still contain a high variance in variables such as level of education, age and smoking history. This adds to the generalizability of the results. Moreover, there are no indications that the selection was related to the variables or relations between variables under study. The abstinent smokers from the student population were younger (22 and 21 years of age in Study 1 and 2, respectively), but the average number of cigarettes smoked a day (14.7 and 12.4 in Study 1 and 2, respectively) was close to the average number smoked in the general population (14 a day; Stivoro, 2010), and in a similar age group in the general population (10 to 13 a day; Stivoro, 2010). However, it cannot be ruled out that, for example, smoking history (e.g., number of years smoked, number of past quit attempts, smoking-related physical complaints) influenced quitters’ reactions towards smoking cues.

In Chapters 2, 3 and 5, relapse was assessed through self-report: ‘Have you been smoking since [time x], even one cigarette?’ It could be argued that a biochemical validation should have been conducted; a cotinine or CO measurement (e.g. Benowitz, Pomerleau, Pomerleau, & Jacob, 2003). However, literature has shown that under certain conditions, biochemical validation is not necessary (Glasgow et al., 1993; Patrick et al., 1994; Velicer et al., 1992). The SRNT (Society of Nicotine Research and Tobacco) subcommittee on Biochemical Verification (2002) also reviewed a number of reviews and stated that: ‘The results of these four studies are consistent and suggest that biochemical validation is not always necessary in smoking cessation studies. The levels of misinterpretation are generally low.’ (p.156). More specifically, biochemical validation has little surplus value when smokers have little reason to consciously misreport their smoking behavior: When they are in a study of low demand with little social pressure to abstain (Glasgow et al., 1993; Velicer et al., 1992). Indeed, the studies in this thesis are of low demand in that there was no personal contact between the researcher and the participants: In the cohort reported in Chapter 2 and 3 no intervention was applied as spontaneous activity was assessed, and in Chapter 5 the intervention concerned a self-help intervention. Thus, we can assume that the self-reported relapse data are valid.

Another issue concerns the causality in the relations between predictors, mediators and the dependent variable in the studies reported in Chapter 2 and 3: The relations of temporal comparisons and ambivalence with relapse are mediated by learning evaluations. Firstly, on the basis of our theorizing, we assume that negative temporal comparisons and high ambivalence cause relapse. Secondly, we assume that negative learning evaluations cause relapse. Thirdly, we assume that temporal comparisons and ambivalence cause more negative learning evaluations. However, in the cohort design these data are only correlational, although they are prospective when it comes to predicting relapse. With such data, conclusions about causality must be made in the

context of considerations on the theoretical plausibility and on possible alternative explanations. Alternative explanations could be related here to the influence of not measured variables on relapse (e.g. Shiffman & Waters, 2004). For example, it might be that temporal comparisons or ambivalence are related to underlying psychological factors, such as ‘smoker identity’ or ‘uncertainty’, that on the one hand contribute to negative temporal comparisons and higher ambivalence, and on the other hand are the actual cause of relapse. To become certain about causality an experimental design is warranted in which the causal factors (temporal comparisons and ambivalence here) are manipulated. In Chapter 5 we designed a task meant to lead to the formation of positive temporal comparisons: It was expected that this task would cause a lower risk of relapse. Thus, to check causality additional experimental work is needed.

In Chapter 5 the concept of progress feedback was tested using two operationalizations: Providing quitters with progress feedback on several relevant variables, and forming positive temporal comparisons using a task modeled by the mental contrasting procedure (Oettingen, 2000). Unfortunately, the experimental field study designed to test this treatment package that started with 393 participants at pretest suffered from a large dropout and low treatment exposure. Thus, the causal test on progress feedback could not be conducted adequately. The high dropout in this study was not anticipated. To compare; the dropout in the longitudinal sample reported in Chapter 2 and 3 were 9.6% at T3 (seven months after T1), whereas the dropout of this study was 59% at T3 (six months after T1). The difference might be caused by the intervention: It may be experienced as an obligation that is easily avoided by deciding to not join the study anymore. But even in the control condition in which quitters were only invited once to visit the basic quitting system, 53% did not fill in the T3 questionnaire. It seems that participants had no strong motivation to visit the website and to fill in the T3 questionnaire. Low adherence is common in multiple internet-delivered interventions (e.g. Danahar, McKay, & Seeley, 2005, Glasgow, et al.,

2007), and from our study it is clear that invitations and reminders are not enough to stimulate participants, not even to only join the measurements. The difference in dropout between our cohort and the field experiment might also be caused by a selection of participants: Only in the field experiment smokers who were motivated to quit were also invited in the recruitment ads. However, post hoc dropout analysis showed that even among the ex-smokers in the Chapter 5 field experiment the dropout rate was 52% at T3. The high dropout and low exposure figures from the field experiment present a novel challenge: How to motivate quitters to expose themselves repeatedly to an Internet-delivered intervention.

Recommendations

The two aspects of the LAT that are addressed in this thesis (states of mind and progress feedback) need further study. When it comes to states of mind, our laboratory experiments provided one piece of the puzzle. However, what is needed now is a taxonomy of states of minds: What are relevant states of mind when it comes to abstinence? Firstly, as in the first experimental study in Chapter 4, states of mind are specific to the behavior, in the present thesis, smoking cessation. These states are related to determinants of the behavior (e.g., perceiving high self-efficacy to remain abstinent, or perceiving negative progress in temporal comparisons). Secondly, as in the second experimental study in Chapter 4, states of mind may be related to general psychological states that influence information processing, such as open-mindedness (e.g. Sherman & Cohen, 2006), ego-depletion (e.g. Baumeister & Heatherton, 1996; Baumeister, 2002), and level of construal (e.g. Trope & Liberman, 2010). Thirdly, another set of states of mind might be emotions and moods as they are renowned to influence preferences for certain information and information processing (e.g. Neumann, 2009; Das, Vonkeman, & Hartmann, 2012). The effects of these three classes of states of mind could be studied systematically in ex-smokers, experimentally, but also using the method of momentary assessments (Shiffman, Stone, & Hufford,

2008). In addition, it should be studied what information in learning situations is particularly relevant and informative when it comes to learning about smoking, control over smoking, and quitting: (physical) sensations, emotions, thoughts, social comparisons, one's own behavior? Unraveling this concrete learning process may be the key to understanding why some ex-smokers become effortless and continuous abstinent and why others give up.

When it comes to progress feedback further experimental work is needed. In our operationalization of progress feedback in the field experiment, quitters were provided with progress feedback on variables that were found in earlier studies to be related to quitting activity and relapse (e.g., craving, self-efficacy, perceived positive outcomes of quitting). Thus, the choice for the information to feedback was based on theoretical principles and empirical findings. However, it may be that quitters need feedback on other variables to support their feeling of being on the right track, for example, explicit feedback on the more global dimensions that were used in the temporal comparison measures. In addition, temporal comparisons might be studied further. As argued above, the causal power of temporal comparisons needs to be demonstrated. Temporal comparisons should be manipulated experimentally and separately from progress feedback to see what the effects are on the motivation to remain abstinent, on craving and on relapse (in our field experiment they were part of the same package). In addition, the construction of temporal comparisons should be studied: 1) What information is used to construct temporal comparisons? Do ex-smokers change their perceptions of the past or do they change perceptions of the present? And how is this related to learning situations? 2) What motivates the construction of temporal comparisons? We assume that ex-smokers want to know whether spending effort will pay off. But it may be that temporal comparisons are also used to generate hope (reflecting optimism) or to legitimize impending relapse. Temporal comparisons may

represent the core of the motivation to stay abstinent and may capture a prominent position in the theorizing on abstinence and relapse, next to self-efficacy.

When it comes to the therapeutic practice of smoking cessation, it may be clear that on the basis of the LAT, states of mind of ex-smokers should be monitored and influenced, and ex-smokers should be provided with progress feedback. Thus, ex-smokers should explicitly be guided in learning the right things. One condition for learning is abstinence: Without abstinence no learning situations can be encountered and therefore skills to remain abstinent should also be applied. However, in the LAT, abstinence is in function of learning and care should be taken that the abstinence skills do not stand in the way of learning. That is, several classical abstinence skills might slow down the learning process or even let ex-smokers learn the wrong things. For example, avoidance of risk-situations is one strategy that is frequently recommended to ex-smokers (e.g. Prochaska & Velicer, DiClemente, & Fava, 1988; Prochaska & DiClemente, 1983). However, avoidance prevents learning. Furthermore, engaging in alternative behaviors to fulfill the need that was originally satisfied by smoking might have a detrimental effect on learning: When the ex-smoker now uses a relaxation exercise instead of smoking to relax, the positive outcome expectancy that smoking helps to relax might even be reinforced. Thus, although these strategies can help to remain abstinent, they may inhibit learning. A reconsideration of the application and operationalization of abstinence skills or strategies in practice is needed.

Another consequence of LAT follows from its primary focus on learning instead of on abstinence. When the focus is on staying abstinent, a violation of abstinence may completely undermine the intention. In the present (Western) culture of smoking cessation, in which most smokers have made multiple quit attempts (Stivoro, 2010), a violation of abstinence means that the quit attempt ‘failed’. After a failure smokers mostly resume their former level of smoking. The lessons for the smoker are clear: ‘Smoking still has desirable outcomes for me and I was not able to resist the

temptation to smoke, despite all the reasons to quit I saw at the start of the quit attempt'. Thus, primarily focusing on abstinence and, therefore, conceptualizing smoking cessation as 'an attempt' to stay abstinent may have detrimental effects and may be partly responsible for why smoking cessation in our culture is perceived as 'difficult' (e.g. Yong, Borland, & Siahpush, 2005) and why relapse rates are high. Instead, according to LAT the focus of smoking cessation should be on learning: Learning is the primary means to reach the final goal of continuous and effortless abstinence. From this perspective, smokers no longer 'engage in a quit attempt' but 'start the process of unlearning smoking', in which abstinence skills and strategies are applied in function of learning.

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Nederlandse samenvatting

(Dutch summary)

Hoewel vele rokers jaarlijks een stoppoging ondernemen, zijn de meeste stoppogingen niet succesvol, de meeste rokers vallen weer terug in hun oude rookgedrag: Slechts 7 tot 14 procent van de ex-rokers die verder geen hulpmiddelen bij het stoppen gebruikt, is na een jaar nog gestopt. Van de ex-rokers die wel hulpmiddelen gebruiken (zoals counseling of farmacotherapie) is dat succespercentage hoger; ongeveer 20% met counseling en 30 % met farmacotherapie. Nog steeds valt dus minstens 70% van de ex-rokers terug.

De afgelopen decennia zijn er verschillende ontwikkelingen geweest op het gebied van terugvalpreventie. Ruwweg zijn er drie lijnen te onderscheiden. Ten eerste zijn er de farmacologische interventies, zoals het gebruik van nicotinevervangers (zoals nicotinepleisters). Het doel van nicotinevervangers is het (tijdelijk) vervangen van de nicotine die anders via sigaretten ingenomen zou worden, om zo de motivatie om te roken te verlagen en ontwenningssverschijnselen te voorkomen. Een ander type van een farmacologische interventie richt zich voornamelijk op de neurologische processen die betrokken zijn bij het roken en de ontwenningssverschijnselen die kunnen plaatsvinden na het stoppen met roken.

De tweede lijn houdt zich meer bezig met de automatische en/of onbewuste processen die optreden bij het stoppen met roken. Een van de oudste voorbeelden hiervan is klassieke conditionering, waarbij van origine neutrale stimuli voorspellers worden van roken en daarom ook de zin in het roken opwekken. Hierbij valt te denken aan sigaretten, asbakken, maar ook een gesprek of negatieve emoties kunnen worden gelinkt aan het roken zelf. Wanneer rokers dan proberen te stoppen zijn de linken tussen deze stimuli en het roken nog steeds aanwezig, wat de kans op terugval verhoogt. Een ander voorbeeld in de tweede lijn is de rol van impliciete cognitie bij het stoppen met roken. Dit perspectief gaat ervan uit dat gedrag, hier het roken van tabak,

vaak niet een gevolg is van rationele keuzes, maar voornamelijk bestuurd wordt door automatische processen die buiten ons bewustzijn om werken.

De derde lijn richt zich op de meer cognitief/gedragmatige aspecten bij gedragsverandering, op de rol van meestal bewuste denk- en gedragspatronen. Cognitieve gedragstherapie richt zich bijvoorbeeld op het veranderen van dysfunctionele overtuigingen die ten grondslag liggen aan gedrag, zoals het geloof dat iemand roken nodig heeft om gelukkig te zijn. De cognitief/gedragmatige aanpak van stoppen met roken wordt veel gebruikt in terugvalpreventie en richt zich voornamelijk op de mogelijke oorzaken van terugval, zoals negatieve emoties. Een van de bekendste modellen in de derde lijn is het Relapse Prevention (RP) model van Marlatt & Gordon (1985). Het RP model stelt de coping responsen van ex-rokers in risicosituaties centraal: wat een ex-roker doet als hij of zij in verleiding wordt gebracht maakt het verschil. Terugval is beschreven als een proces waarin het opsteken van één sigaret kan uitlopen op een volledige terugval of hernieuwde abstinentie. Het hangt af van de cognitieve en affectieve reacties op deze 'kleine' terugval of een volledige terugval optreedt of niet.

Ondanks het vele onderzoek dat is verricht en de nieuwe theorieën die zijn ontwikkeld in de afgelopen 20 jaar, is er weinig voortgang geboekt in de klinische praktijk van stoppen met roken. Nieuwe inzichten op het gebied van terugvalpreventie zijn daarom nog steeds hard nodig.

In dit proefschrift wordt een nieuw theoretisch perspectief gepresenteerd, waarin elementen van reeds eerder gebruikte (cognitief/gedragmatige) theorieën worden gecombineerd met nieuwe elementen. Het nieuwe perspectief heet de Leer Abstinentie Theorie (Learning Abstinence Theory: LAT). Vanuit het perspectief van de LAT heeft het voorkomen van terugval te maken met het leren van de juiste dingen met betrekking tot roken en niet roken. De nadruk ligt in de LAT op het (leer)proces wat leidt tot het einddoel, continuerende en moeiteloze abstinentie, en niet op het proces

dat direct vooraf gaat aan terugval. Het gaat meer om hoe een verse ex-roker transformeert naar een ervaren ex-roker die niet meer naar roken taalt dan om hoe stimuli precies tot terugval leiden.

In de LAT staat het leren centraal. Leren kan op twee niveaus plaatsvinden: op het concrete en op het abstracte niveau. Op het concrete niveau vindt leren plaats in zogenaamde leersituaties – situaties waarin een ex-roker vroeger rookte. In deze leersituaties leren ex-rokers over de positieve uitkomsten van roken (bijvoorbeeld over het vermeende ontspannende effect van roken), over hun controle over het roken (in hoeverre men in staat is zonder roken te kunnen) en de positieve uitkomsten van het stoppen met roken (bijvoorbeeld een positieve zelfwaardering). Wat ex-rokers precies leren in een leersituatie hangt af van in welke specifieke psychologische toestand ze op dat moment verkeren: welke informatie ze aandacht geven en hoe ze deze informatie interpreteren. Zo kan het zijn dat een ex-roker maar één leersituatie nodig heeft om te ‘transformeren’ van een verse ex-roker naar een definitieve ex-roker, maar het kan ook zijn dat een ex-roker meerdere leersituaties nodig heeft om hetzelfde te bereiken. Naast de specifieke psychologische toestand hangt dit onder andere af van de kwaliteit van de leersituaties. De ervaringen in leersituaties worden door de ex-roker herinnerd als leerevaluaties.

Op het abstracte niveau leren ex-rokers over hun voortgang met betrekking tot hun uiteindelijke doel: continue en moeiteloze abstinente. Een ex-roker verzamelt beschikbare informatie om uit te zoeken of hij of zij goede voortgang maakt. Zo lang ex-rokers voelen dat ze het uiteindelijke doel gaan bereiken, zullen ze ook gemotiveerd blijven om vol te houden. Feedback over de voortgang van de stoppoging is dus essentieel om gemotiveerd te blijven. Ex-rokers creëren ook zelf hun voortgangsfeedback, wat resulteert in zogenaamde temporale vergelijkingen; evaluaties van ex-rokers waarin ze hun huidige situatie vergelijken met situaties in een eerder punt

in de tijd. Vindt de ex-roker dat hij of zij nu beter af is dan eerder, dan is dit een positieve temporale vergelijking die de motivatie om door te zetten zal verhogen.

In dit proefschrift worden een aantal elementen uit de LAT getest. Deze worden in vier studies gepresenteerd in vier empirische hoofdstukken. In het eerste empirische hoofdstuk (hoofdstuk 2) richten we ons op twee basisconcepten van de LAT: temporale vergelijkingen en leerevaluaties. 323 ex-rokers, niet langer gestopt dan zes maanden, vulden drie keer een uitgebreide vragenlijst in: bij aanmelding, na drie maanden en na zes maanden. Getest is of temporale vergelijkingen en leerevaluaties voorspellers van terugval waren na één en na zes maanden. Dit bleek inderdaad zo te zijn. Hieruit concludeerden we dat wanneer de voortgang als negatief wordt ervaren (in het geval van negatieve temporale vergelijkingen), dit de kans op terugval vergroot. Daarnaast bleek dat leerevaluaties de relatie tussen temporale vergelijkingen en terugval medieerden. Dit suggereert dat temporale vergelijkingen als specifieke psychologische toestanden werken die kunnen bepalen hoe een leersituatie wordt geëvalueerd: positief of negatief. Deze leerevaluaties beïnvloeden op hun beurt weer de kans op terugval. Tevens hebben we gekeken naar de relatie tussen temporale vergelijkingen en eigen effectiviteit (in hoeverre iemand zichzelf in staat acht succesvol te stoppen met roken), aangezien eigen effectiviteit een sterke voorspeller is van terugval. Het bleek dat gevoelens van lage eigen effectiviteit gecombineerd met negatieve temporale vergelijkingen tot de meeste terugval leidden: 50.8% terugval na een maand in vergelijking met 11.5% terugval bij hoge eigen-effectiviteit en positieve temporale vergelijkingen. Deze studie laat dus zien dat zelf-gegenereerde feedback in temporale vergelijkingen terugval voorspelt en dat temporale vergelijkingen mogelijk als specifieke psychologische toestand leerevaluaties beïnvloeden, en zo indirect van invloed zijn op terugval.

Het tweede empirische hoofdstuk (hoofdstuk 3) is gebaseerd op hetzelfde cohort ex-rokers als in hoofdstuk 2. In dit hoofdstuk staat ambivalentie centraal. Ambivalentie

weerspiegelt de mate waarin iemands reacties ten opzichte van een object of gedrag (zoals roken) gemengd zijn, dus zowel positief als negatief. Een tijdelijke toestand van ambivalentie is normaal in het proces van stoppen met roken, maar zou verdwenen moeten zijn als de ex-roker daadwerkelijk gestopt is. Wanneer er nog steeds sprake is van ambivalentie tijdens de stoppoging, kan dit de stoppoging negatief beïnvloeden en leiden tot terugval. Ten eerste zou ambivalentie met terugval kunnen samenhangen via de invloed op leersituaties; als een specifieke psychologische toestand die dan de aandachtsprocessen en informatieverwerking bepaalt. Ambivalentie zou zo gerelateerd moeten zijn aan leerevaluaties. Uit de resultaten bleek inderdaad dat ambivalentie terugval voorspelde na één maand en dat negatieve leerevaluaties de relatie tussen ambivalentie en terugval medieerden. Ten tweede zou ambivalentie samen kunnen hangen met terugval in een duaal procesmodel perspectief, waarin twee systemen worden onderscheiden: het impulsieve en het reflectieve systeem. In onze conceptualisatie weerspiegelt ambivalentie het impulsieve systeem (de impuls om te roken) dat roken voorstaat. Het reflectieve systeem werd geoperationaliseerd als de verwachte negatieve zelf-evaluatieve emoties (zoals schuldgevoelens) in het geval iemand weer zou gaan roken. Dit systeem staat het niet-roken voor. Uit de resultaten bleek dat sterke gevoelens van ambivalentie (sterk impulsief systeem) gecombineerd met lage verwachtingen van zelf-evaluatieve emoties (zwak reflectief systeem) leidde tot de meeste terugval: 37.5% na één maand tegen 11.5% bij een zwak impulsief maar sterk reflectief systeem.

Hoofdstuk vier behandelt twee experimentele laboratoriumstudies waarin wordt onderzocht wat de effecten zijn van specifieke psychologische toestanden op de interpretatie van rokengerelateerde stimuli (i.c. de eigen rookwaren): kunnen we rokers ‘anders’ laten kijken naar de rookwaar en daarmee beïnvloeden hoe graag ze willen roken? Deelnemers aan beide studies waren rokers ($N = 140$ en $N = 120$), die gevraagd werden voorafgaande aan het experiment tenminste vier uren niet te roken.

Bij aanvang van beide studies werd de deelnemers gevraagd hun rookwaren in te leveren. Na de voormeting en de manipulatie volgde daarna de confrontatie met hun eigen rookwaren (als rookstimulus), waarna de hunkering naar een sigaret werd gemeten. In de eerste studie werden twee roken gerelateerde psychologische toestanden gemanipuleerd: hoge versus lage eigen effectiviteitsverwachtingen en zwakke versus sterke verwachte positieve uitkomsten van roken. Zoals verwacht leidde een specifieke psychologische toestand van hoge eigen effectiviteitsverwachtingen tot minder hunkering, maar alleen als de abstinente roker sterke verwachte positieve uitkomsten had. En zoals verwacht leidde de specifieke psychologische toestand van sterke verwachte positieve uitkomsten tot meer hunkering naar roken, maar alleen als de eigen effectiviteitsverwachtingen laag waren.

In de tweede studie werd als manipulatie een zelfbevestigingsprocedure toegepast. Het uitgangspunt is dat de confrontatie met de eigen rookwaren niet alleen tot hunkering leidt, maar ook tot de associatie met een gezondheidsbedreiging. Deze associatie leidt ertoe dat rokers de saillantie van de bedreigende stimulus proberen af te houden; dat leidt dan tot minder bedreiging, maar ook tot minder hunkering. Een zelfbevestigingsprocedure maakt dat mensen niet defensief maar ‘met een open geest’ zullen reageren op de dreiging (de rookwaren). Ze zien de bedreiging onder ogen en zullen zo ook meer hunkering ervaren. Dit effect werd inderdaad gevonden, maar alleen als de abstinente rokers grote waarde hechtten aan hun gezondheid. Beide experimenten laten zien dat specifieke psychologische toestanden van invloed zijn op de perceptie van rokengerelateerde stimuli. Dit leidt tot verschillen in hunkering wat weer bijdraagt aan de inhoud van leersituaties en dus aan leerevaluaties.

In het laatste empirische hoofdstuk (hoofdstuk 5) werd een nieuwe gepersonaliseerde internetinterventie getest in een gerandomiseerde trial met een follow-up van zes maanden onder rokers die wilden stoppen en ex-rokers (N = 393; controle conditie, n = 202; experimentele conditie, n = 191). De interventie in de

experimentele conditie was ontworpen om terugval tegen te gaan door middel van het ondersteunen van het abstracte leren over de voortgang van de stoppoging. De interventie omvatte 1) voortgangsfeedback op grond van metingen en; 2) het genereren van positieve temporale vergelijkingen door middel van een schrijfpdracht. Dit pakket werd gedurende de zes maanden vijfmaal aangeboden aan de deelnemers in de experimentele conditie. Daarnaast hadden alle deelnemers, dus ook die in de controleconditie, toegang tot een basaal stoppen met roken systeem dat ‘advies op maat’ gaf. Er konden geen significante verschillen in percentages terugval tussen de condities worden aangetoond. Dit had vooral te maken met de lage blootstelling aan de interventie in de experimentele conditie: uiteindelijk zijn slechts 11 deelnemers in de experimentele conditie vijfmaal blootgesteld aan de nieuwe interventie; veel te weinig om een effect aan te kunnen tonen. Ondanks uitnodigingen en herinneringen maakten deelnemers dus nauwelijks gebruik van de interventie. Daarnaast was de uitval in deze studie erg hoog (59% na zes maanden). Het is duidelijk dat als het om internetinterventies gaat, de blootstelling een probleem is dat extra aandacht behoeft.

Samenvattend kan gesteld worden dat de resultaten uit hoofdstuk 2 (temporale vergelijkingen) en hoofdstuk 3 (ambivalentie) suggereren dat specifieke psychologische toestanden inderdaad het leren in leersituaties kunnen beïnvloeden en hieruit voortvloeiend ook het risico op terugval. Ook in hoofdstuk 4 (de waarneming van een rookstimulus en hunkering) zijn er aanwijzingen dat verschillende psychologische toestanden leiden tot verschillen in hoe de rookstimuli (leersituaties) worden waargenomen. De hoofdstukken 2 (temporale vergelijkingen) en 5 (de feedbackinterventie voor rokers en ex-rokers) handelden over de rol van voortgangsfeedback bij ex-rokers. Temporale vergelijkingen voorspelden inderdaad terugval in hoofdstuk 2, maar door de hoge uitval en de lage blootstelling aan de interventie in hoofdstuk 5, konden we geen conclusies trekken over de effecten van voortgangsfeedback.

Concluderend kunnen we stellen dat er nog veel werk te doen is ten aanzien van de verdere toetsing en ontwikkeling van de LAT. Ten eerste is het van belang te onderzoeken welke soorten specifieke psychologische toestanden nu precies een rol spelen bij het stoppen met roken en abstinentie. Daarnaast is er meer experimenteel onderzoek nodig om de rol van voortgangsfeedback en temporale vergelijkingen verder te onderzoeken.

Uiteindelijk zal de LAT de basis moeten leggen voor een nieuwe kijk op stoppen met roken. Vanuit de LAT gezien, 'doen' rokers niet langer een stoppoging, maar beginnen zij aan een proces van het afleren van het roken, waarin vaardigheden om het roken af te leren primair in dienst staan van het leren.

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Karin Menninga, december 2012

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