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Craving in Nicotine-Dependent Smokers: the Effect of Smoking Cessation

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meinen Eltern

Es irrt der Mensch solang er strebt.

Wer ewig strebend sich bemüht, den können wir erlösen.

(Faust, Goethe)

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INTRODUCTION

A thesis about craving, smoking status and nicotine dependence: Is there a need for that? Nicotine dependence is a mental disorder recognized in the American Psychiatric Association's (APA) Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV-TR). The World Health Organization's (WHO) International Classification of Diseases and Related Health Problems, 10th edition (ICD-10) nomenclature lists this disorder under the designation of tobacco dependence. This thesis will apply to the most frequently used terms of »nicotine dependence« and »tobacco use«. Throughout the terms »dependence« and »addiction« are used interchangeably.

Nicotine dependence is the most prevalent and most deadly of the disorders listed in the DSM-IV-TR and ICD-10, with a lifetime prevalence of 20% (Anthony, Warner & Kessler, 1994; Peto, Lopez, Boreham, Thun & Heath, 1992). Tobacco is used more widely than illicit drugs and researchers have rated it as even more addictive than heroin, cocaine, marijuana, or alcohol (Office of Applied Studies, 2006; Centers for Disease Control and Prevention, 2007).

Tobacco use results in a loss of life expectancy (Doll, Peto, Boreham & Sutherland, 2004) and severe health consequences that even lead to death (Neubauer, Welte, Beiche, König, Büsch & Leidl, 2006). Tobacco products are known or probable causes of over two dozen diseases or groups of diseases, e.g., cancers, chronic lung diseases and coronary heart and cardiovascular diseases, and this list is expanding (U.S. Department of Health and Human Services, 2006).

In addition, researchers reported that mental health problems and smoking are co-occurent and that there is, in fact, an increased risk for the development of depression, anxiety and parasuicide for nicotine dependent smokers (Pedersen & von Soest, 2009).
The economic burden due to health care expenditures and productivity losses are high (Centers for Disease Control and Prevention, 2008) and a large amount of effort and money is put in the tobacco control field and the implementation of effective interventions.

Furthermore, tobacco smoking is a chronic relapsing disorder that often requires repeated interventions. Without assistance, most smokers will relapse, mainly within the first eight days (Hughes, Keely & Naud, 2004). In 2002, as many as 70% of cigarette smokers reported a desire to quit (Centers for Disease Control and Prevention, 2002), more than 40% try to quit each year, but only 3-5% of self-quitters achieve prolonged abstinence for more than three months (Centers for Disease Control and Prevention, 2002, 2006; Fiore, Bailey, Cohen, Dorfman, Goldstein, Gritz, et al., 2000; Hughes et al., 2004).

One trigger of smoking relapse is exposure to cues previously associated with cigarette smoking (e.g., sight of a cigarette, an ashtray or other smokers). Confronted with smoking-related cues most smokers report intense craving for cigarettes (Carter & Tiffany, 1999). Moreover, exposure to smoking cues has been shown to provoke relapse (Ferguson & Shiffman, 2009; Shiffman, Paty, Gnys, Kassel & Hickcox, 1996).

Thus, drug craving is a substantial concern among individuals addicted to drugs, clinicians and researchers. In the last two decades literature on substance dependence and abuse has included a growing interest in craving from both, a biological and psychological perspective (e.g., Editor of the special issue, 2000). There is a wide range of models and paradigms that have been used to conceptualize craving (for an overview, see Drummond, 2001; Singleton & Gorelick, 1998). In addition, there is no consensus regarding the role of self-reported craving in the processes underlying addiction or relapse. While some of these theories assign a central role for craving, others question the potential of subjective craving to predict relapse (Lowman, Hunt, Litten, & Drummond, 2000).

According to Tiffany (1991), smoking is considered a »prototypical addiction« and therefore »understanding smoking addiction should lead to advances in our understanding of all other addictions. Indeed, researchers interested in psychological processes basic to addictive disorders might wish to consider the advantages of studying smoking behavior« (p. 617).

Shiffman, Engberg, Paty, Perz, Gnys, Kassel, and Hickcox (1997) reported that the degree of craving differs among smokers depending on their smoking status (smoking vs.

smoking cessation) with higher craving ratings before quitting. With respect to this findings, Wertz and Sayette (2001a) suggest that it would be revealing to compare urge ratings of individuals addicted to drugs before and after quitting to »require greater sensitivity to the meaning of craving at each period, which may help interpret the apparently counterintuitive findings« (p. 10) of Shiffman et al. (1997). Therefore, the aim of the study is to evaluate the effects of smoking status (smoking vs. smoking cessation) on self-reported urge under controlled laboratory conditions with a potent craving manipulation.

THEORETICAL BACKGROUND

The attitude towards smoking has changed dramatically over the years. From *habituating* (U.S. Department of Health and Human Services, 1964) to *the prototypical substance-abuse dependency* (U.S. Department of Health and Human Services, 1979) it was defined a *powerfully addicting drug* in 1988 (U.S. Department of Health and Human Services, 1988). Furthermore, there was underlying scientific evidence that cigarettes and other forms of tobacco are addictive and that nicotine is the drug in tobacco that causes this addiction (U.S. Department of Health and Human Services, 1988).

Nicotine dependence

Nicotine dependence is now defined a mental disorder. It is recognized in both the American Psychiatric Associations (APA) DSM-IV-TR and the Word Heals Organizations (WHO) ICD-10 nomenclature (see Table 1).

Tobacco is used more widely than illicit drugs. Although most people are aware of the adverse consequences of tobacco use, approximately one third of the German population smokes on average 15 cigarettes on a daily basis (see Table 2). The prevalence of smoking and nicotine dependence, respectively, is higher among men than women (see Table 2), varying substantially across age, with the greatest extent at the age of 40 to 44 years (see Table 3).

Table 1

Diagnostic criteria for nicotine dependence

ICD 10	Mental and behavioral disorders due to use of tobacco/dependence syndrome (F17.2)
A cluster of behavioral, cognitive, and physiological phenomena - that develop after repeated substance use and - that typically include a strong desire to take the drug, - difficulties in controlling its use, - persisting in its use despite harmful consequences, - a higher priority given to drug use than to other activities and obligations, - increased tolerance, and sometimes a physical withdrawal state.	
DSM IV	Nicotine-related disorders /dependence (305.10)
Maladaptive pattern of drug use, leading to clinically significant impairment or distress, as manifested by three or more of the following seven criteria, occurring at any time in the same 12-month period: - tolerance - withdrawal - drug is often taken in larger amounts or over a longer period than was intended. - There is a persistent desire or there are unsuccessful efforts to cut down or control the drug use. - a great deal of time is spent in activities necessary to obtain the drug, use the drug or recover from its effects. - important social, occupational, or recreational activities are given up or reduced because of drug use. - drug use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the drug	

Note. ICD 10 = International Classification of Diseases and Related Health Problems, 10th edition; DSM = Diagnostic and Statistical Manual of Mental Disorders, 4th edition.

Table 2

Prevalence rates for tobacco use and nicotine dependence

	men (%)	women (%)	total (%)	N	N (95%-confidence interval)
smokers[a]	35,8	27,8	31,9	16.600.000	(16.000.000-17.200.000)
DSM-IV addiction[b]	8,3	6,3	7,3	3.800.000	(3.500.000-4.200.000)

Note. Source: Epidemiologischer Suchtsurvey 2006; basic age: 18-64 years; basic population: 52.010.517 people; date: 31.12.2005, Statistisches Bundesamt; [a]30-day-prevalence; [b]12-month-prevalence.

Table 3

Prevalence of smoking across age

age	men[a] total population	smokers[a] (men)	women[a] total population	smokers[a] (women)
15-19	2.551	540	2.370	425
20-24	2.525	936	2.390	713
25-29	2.444	885	2.364	637
30-34	2.591	874	2.500	595
35-39	3.395	1.135	3.270	830
40-44	3.668	1.242	3.544	985
45-49	3.063	1.025	3.075	826
50-54	2.751	808	2.841	637
55-59	2.392	615	2.410	428
60-64	2.450	492	2.537	328
65-69	2.612	390	2.848	242
70-74	1.722	206	2.053	125
75+	2.286	187	4.334	144
	34.449	9.334	36.535	6.915

Note. Source: Statistisches Bundesamt, 2006, [a]in 1000.

Besides these facts researchers have rated nicotine as even more addictive than heroin, cocaine, marijuana or alcohol, harming »nearly every organ of the body, causing many diseases and reducing the health of smokers in general« (U.S. Department of Health and Human Services, 2006; Centers for Disease Control and Prevention, 2007). Smoking increases the risk for cancer and coronary heart disease (Doll, Peto & Boreham, 2004). According to the Morbidity and Mortality Weekly Reports (MMWR, Centers for Disease Control and Prevention, 2008) on average, during 2000-2004, approximately 443.000 people died in the United States prematurely from illnesses related to cigarette smoking or exposure to secondhand smoke. In this regard, lung cancer, ischemic heart disease, and chronic obstructive pulmonary disease (COPD) are the leading specific causes of smoking-attributable death. These are more deaths than caused by alcohol, car accidents, suicide, AIDS, homicide, and illegal drugs combined. As reported by the Federal Statistical Office (Destatis), 42.348 individuals (30.249 men, 12.099 women) died in Germany in 2006 exclusively from cancer diseases (e.g., lung, laryngeal, and trachea cancer) associated with the consumption of tobacco products, which is 5.1% of all deaths. Taken all smoking-related deaths together, it adds up to approximately 115.000 deaths in Germany in 2003 (Neubauer et al., 2006). On the contrary, quitting by the age of 30 evolves in a gain of life expectancy of about 10 years (Doll, Peto, Boreham & Sutherland, 2004).

In 2004 the list of diseases caused by smoking (bladder, esophageal, laryngeal, lung, oral, and throat cancers, chronic lung diseases, coronary heart, and cardiovascular diseases, and reproductive effects and sudden infant death syndrome, respectively) has been expanded to include abdominal aortic aneurysm, acute myeloid leukemia, cataract, cervical cancer, kidney cancer, pancreatic cancer, pneumonia, periodontitis, and stomach cancer (U.S. Department of Health and Human Services, 2006).

Furthermore, a number of epidemiological studies have shown that there is a linkage between cigarette smoking and mental health problems (e.g., Kalman, Morissette & George, 2005; Morissette, Tull, Gulliver, Kamholz & Zimering, 2007), especially depression (e.g., Wu & Anthony, 1999), anxiety (e.g. Cuijpers, Smit, Have, Graaf, 2007; Mykletun, Overland, Aarø, Liabø & Stewart, 2008) and suicidal behavior (e.g., Boden, Fergusson & Horwood, 2008). The association between cigarette smoking and the three

aforementioned mental health problems is much stronger for nicotine dependent than for non-dependent smokers. In fact, there is an increased risk for the development of depression, anxiety and suicidal behavior for nicotine dependent smokers (Pedersen & von Soest, 2009).

In Addition, the estimates of the economic burden of smoking between 2000 and 2004 were approximately $193 billion per year, with health care expenditures and productivity losses having equal shares (Centers for Disease Control and Prevention, 2008).

A large amount of effort and money is put in the tobacco control field and implementations of effective interventions. The 2008 WHO Global Tobacco Epidemic report recommends six strategies to counter the tobacco epidemic (the MPOWER package): (1) monitoring tobacco use and prevention polices, (2) protecting people from tobacco smoke, (3) offering help with quitting, (4) warning about the dangers of tobacco, (5) enforcing bans on advertising and promotion, and (6) raising tobacco taxes. The WHO Framework Convention on Tobacco Control (FCTC) recognizes the addictive nature of tobacco use. It suggests to develop evidence-based treatment guidelines and to take effective measures to promote adequate treatment for nicotine dependence (WHO Framework Convention on Tobacco Control; 2003, updated reprint 2004, 2005). Bloomberg and Gates committed a combined investment of $500 million for interventions (Bloomberg Initiative, Press Release, 2008). Nevertheless, the results of the survey of national nicotine dependence treatment services (Raw, Regan, Rigotti & McNeill, 2009) reveal that only a small number of countries have well-developed nicotine dependence treatment services and that treatment is not yet a main concern in most countries.

Nicotine dependence is a chronic relapsing disorder that often requires repeated interventions. Relapse into smoking is very common among self-quitters. Only three to five percent of attempts to quit do not end in relapse six to 12 months after a given quit attempt (Hughes et al., 2004). Actually after brief or more extensive cognitive and/or behavioral treatment relapse rates are very high, up to 90% within one year after treatment (Niaura, Abrams, Shadel, Rohsenow, Monti & Sirota, 1999; for a review of smoking relapse research, see Shiffman, 2006).

In the reconceptualization of the cognitive behavioral model of relapse (Marlatt & Gordon, 1985) Witkiewitz and Marlatt (2004) propose that lapses occur within a system of interacting and compounding risk factors. In their dynamic model of relapse tonic and phasic processes operate within high-risk situations, creating a complex system of risk factors and behavioral responses (see Figure 1).

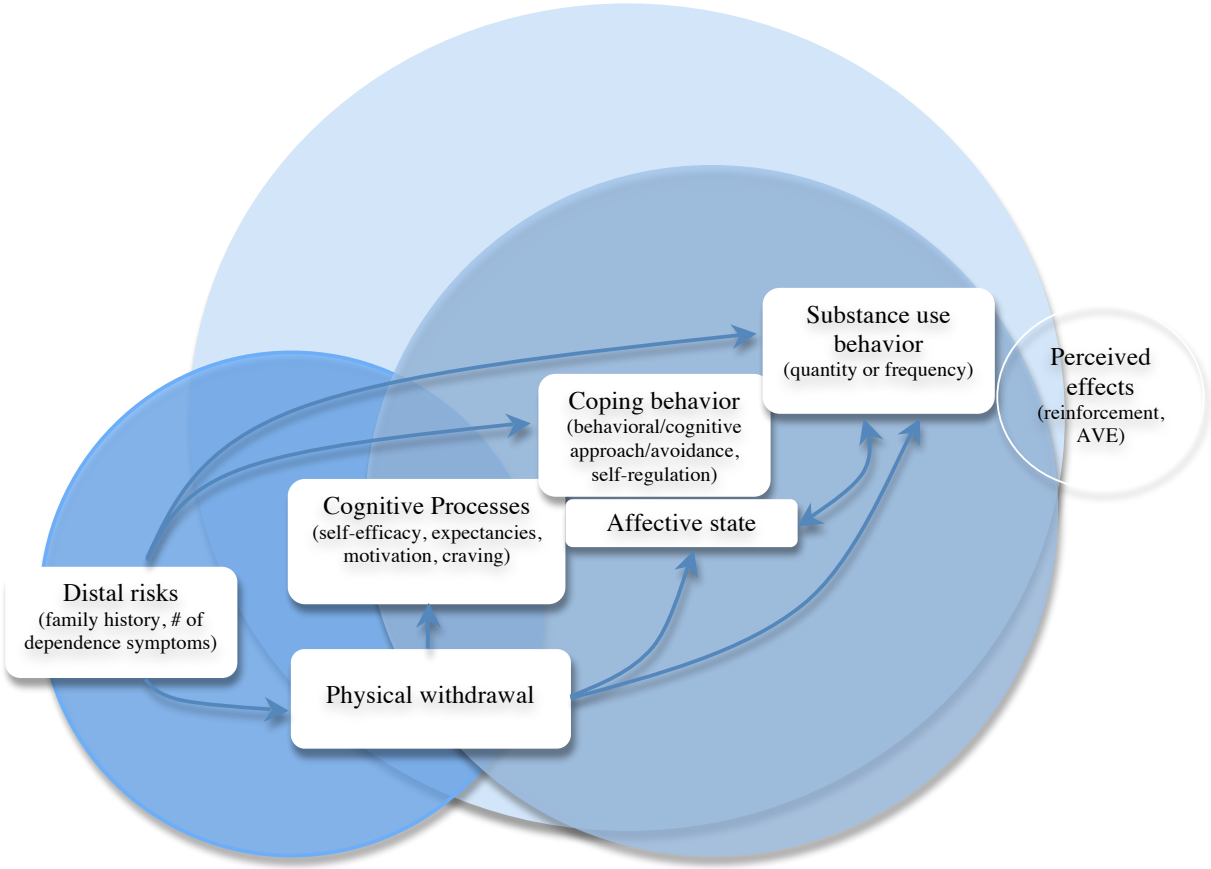

Figure 1. Dynamic model of relapse (Witkiewitz & Marlatt, 2004).

Within this model, phasic processes include coping skills, affective states, motivation, perceived effects of drug use, and craving. Although craving has been the subject of extensive research (e.g., see special issue of Addiction, 2000, devoted to craving) the relationship between craving and the risk for relapse and addiction has not been definitively elucidated (Lowman et al., 2000).

Craving

Craving for cigarettes is one of the most commonly reported symptoms experienced by individuals trying to quit smoking (e.g., West & Schneider, 1987). Recent research has proven that craving ratings predict drug relapse (e.g., Bagot, Heishman, & Moolchan, 2007) and that the strength and duration of craving play a predominantly role for the difficulties to remain abstinent during quit attempts (Georgiades & West, 2009). In the last decades the interest and therefore the research in the construct of craving have been increased, however it did not result in a universal agreed upon definition of this phenomenon (Anton, 1999).

Definition of craving

Craving has been described as a »core feature of addiction« (Sayette, Martin, Wertz, Shiffman & Perrott, 2001) and has been associated with drug use, drug dependence, cessations and relapse (Bagot, Heishman & Moolchan, 2007). The WHO panel (Jellinek, Isbell, Lundquist, Tiebout, Duchene Mardones & Macleod, 1955) considered craving as the fundamental basis of the onset of addiction. Moreover, the ICD-10 (WHO, 1992) includes craving as an optional diagnostic criterion for nicotine dependence, defining the phenomenon as a *strong desire* or sense of compulsion to use the drug (e.g. nicotine/tobacco, see Table 1). In contrast, the DSM-IV (APA, 1994) neglects craving from the diagnostic criteria (see Table 1).

From the phenomenological perspective, craving is the symptom of addiction, in the same way as for instance, a reduced level of interest or pleasure presents a symptom of depressive disorder (Drummond, 2001). Furthermore, several authors emphasize different aspects of craving, for example (a) the dynamic nature of craving (Drummond, Litten, Lowman & Hunt, 2000), with craving being a, for example, linear, curvilinear,

discontinuous or a non-linear phenomenon, existing on the inverted U-curve of the classic Yerkes–Dodson law (Abrams 2000); (b) a continuous, not an all-or-none phenomenon (modified by environmental and/or endogenous factors); (c) a *trait* (i.e., a persistent, general desire, referred to as 'craving-past') vs. *state* phenomenon (i.e., an instant desire triggered by cues, referred to as 'craving-now'; Drummond et al. 2000, Ooteman, Koeter, Verheul, Schippers & van den Brink, 2006). Moreover, craving can be conceptualized (d) as an entity, described and experienced as a concern that can be *intrusive* and *perplexing* and (e) as a process interacting with a diversity of other phenomena to continue drug use behavior or leading to relapse (Drummond et al., 2000; Bagot et al., 2007). As a process, for example, craving may lead to a decrease of self-efficacy in the context of a high-risk situation and therefore increase the likelihood of relapse (Marlatt, 1978).

Verheul, Brink, and Geerlings (1999) advances the opinion that a definition of craving should be limited to »subjectively experienced strong desires or urges« (p. 199) to take the drug and as a predictor for drug abuse and relapse. Herewith conform is the Elaborated Intrusion Theory of Desire (EI, Kavanagh, Andrade & May, 2005) assuming that craving for drugs is equivalent to any other kind of desire and therefore representing a »conscious wish to obtain pleasure, to relieve discomfort or to engage in behavior associated with these outcomes« (Kavanagh et al., 2005). In contrast, some authors have concluded that craving is an epiphenomenon (e.g. Tiffany 1999, Drummond et al. 2000), a cognitive rationalization used by individuals addicted to drugs to explain relapse, neither necessary nor sufficient to cause relapse. According to Tiffany's cognitive processing model, craving can be considered a non-automatic cognitive process arising solitary when efforts to obtain a drug are impeded (Tiffany 1999, see »cognitive models of craving«, p. 16).

Being defined in various ways with different operational definitions, meaning various things including liking, wanting, urges, desires, need, intention or compulsion (Kozlowski & Wilkinson, 1987; Drummond et al., 2000), drug craving has generally been considered a 'desire to use a drug'. It is commonly regarded to be a subjective experience, »in the sense that one must be aware of a desire in order to crave« (Niaura, Rohsenow, Binkoff, Monti, Pedraza & Abrams, 1988; Kassel & Shiffman, 1992).

Sayette et al. (2001) adapted the definition of craving from Baker, Morse, and Shermann (1987) where cravings are described as »emotional states reflecting the activation of motivational […] systems that have particular response patterns involving self-report, behavioral and cognitive correlates« (p. 1419).

As will be revealed, some theories of craving provide more precise predictions about the nature of craving, and the conditions under which it might occur.

Models of craving

To explain the clinical phenomenon and the underlying mechanisms associated with craving, researchers have developed various models of craving (for reviews, see Singleton & Gorelick, 1998; Anton & Drobes, 1998; Anton, 1999; Tiffany, 1999; Tiffany, Conklin, Shiffman, & Clayton, 2004; Lowman et al., 2000; Vukovic, Cvetic, Zebic, Maric, Britvic, Damjanovic & Jasovic-Gasic, 2008). Each model provides a different conceptualization of craving, consistent with its own theoretical framework. Some theories provide more exact predictions about the nature of craving, and the conditions under which it might occur, whereas others lend themselves more to the study of addiction than they do for craving per se.

Singleton and Gorelick (1998) suggest a classification scheme that contains two broad categories of craving models: (1) models based on conditioning mechanisms and (2) models based on cognitive mechanisms (see Table 4). Drummond (2001) adds another category to the main models of drug craving: (3) phenomenological models. In addition, Vukovic et al. (2008) complete this classification with the most recent field of (4) neurobiological and neuropsychological models (Martin-Soelch, 2010; Wilson, Sayette & Fiez, 2004).

Table 4

Classification schemes of craving models

Singleton & Gorelick (1998)	Drummond (2001)
Conditioning models/behavioral theories	
– Conditioned incentive and appetitive models – Conditioned tolerance models – Conditioned withdrawal models – Autoshaping model – Incentive sensitization model	– Conditioned withdrawal model (Wikler, 1948) – Conditioned opponent process model (Siegel, 1989) – Conditioned drug-like model (Stewart, de Wit & Eikelboom, 1984) – Two process theory (Glautier & Remington, 1995) – Incentive sensitization theory (Robinson & Berridge, 2001) – Cue reactivity model (Drummond, Tiffany, Glautier, and Remington, 1995)
Cognitive theories	
– Cognitive-behavioral models – Cognitive model of drug urges and drug use behavior – Neurocognitive models	– Cognitive social learning theory (Marlatt & Gordon, 1985) – Cognitive labeling model – Dual affect model (Baker, Morse & Sherman, 1987) – Dynamic regulatory model (Niaura et al., 1988) – Cognitive processing model (Tiffany, 1990)
Phenomenological models	
	– Phenomenological models

Conditioning models are based on the tenets of classical conditioning. These models conceptualize craving as the essential underlying motive for drug use and have been influential in the development of cue exposure treatments.

Cognitive Theories are based on either cognitive-behavioral, cognitive learning or information-processing approaches. In contrast to the previous, these models assume that cognition plays an important role in the development of craving, considering craving the result of »higher order mental functions« (Tiffany, 1999). These approaches emphasize cognitive processes such as expectancies (e.g., for the pleasant effects of a drug), attributions, imitations, and self-efficacy (e.g., the ability to cope with the desire to use the drug) regarding the control of drug using behavior. They have been influential in the development of cognitive therapies for addiction.

Phenomenological models derive from clinical observation and description (e.g., Li, 2000; Meyer, 2000). These models have a major influence on classification systems of addictive disorders and on the development of pharmacological therapies.

Some of these theoretical models have been developed using exclusively animal models (Grace, 2000; Koob, 2000; Li, 2000; Littleton, 2000; Robinson & Berridge, 2000; Samson, 2000). Given that animals cannot provide access to their thoughts and feelings these theories are based on observations of behavior and are a result of assumptions about the kind of processes underlying these behaviors (Li, 2000). Therefore, models based on animal research might tell us more about the nature of addiction then about the phenomenon of craving itself. Several theories derived from human research (e.g., Drummond, 2000; Niaura, 2000; Tiffany & Conklin, 2000) do not require that (conscious) craving has to be present for relapse to occur. Even though these modern theories of craving do not assign a central role for craving in the process of addiction or relapse (Lowman et al., 2000) it »does not negate the importance or relevance of craving in human addictive behavior, a position that would clearly be contrary to the experience« (Drummond, 2001, p. 35).

Even though, no single model accounts for all aspects of craving, each has elements that may eventually contribute to a more comprehensive model of drug craving. Key characteristics of selected models are described below.

Conditioning models. In the history of drug addicts, certain (unconditioned) stimuli, such as environmental context (Conklin, 2006; Conklin et al., 2008), current mood state and proximal stimuli (smell or sight of a cigarette) associated with drug use and unconditioned effects of the drug become conditioned stimuli (CS). These CS elicit physiological and psychological responses similar to drug use. These responses are also termed cue reactivity (see »cue reactivity«, p. 17). If smokers are presented with smoking-related cues and nicotine consumption does not occur immediately, these cue-induced responses trigger craving.

Conditioning models separate into two main classes: (1) the withdrawal-based theories e.g., Wikler's conditioned-withdrawal model (Wikler, 1948), later expanded by Drummond, Cooper & Glautier (1990) or Siegel's conditioned opponent or compensatory response model (Siegel, 1975; 1989) and (2) the appetitive models, as the conditioned appetitive-motivational model (Stewart et al., 1984). The first lay emphasis on conditioned drug withdrawal, assuming that craving derives from the desire to avoid or alleviate the unpleasant (e.g., aversive) effects (withdrawal symptoms) of not smoking. Siegel (1989) has put forward a similar conditioning model that draws on Solomon and Corbitt's (1974) opponent process theory. Opposing Winkler Siegel suggest that situations associated with drug use, rather than drug withdrawal (Winkler), may possibly trigger conditioned withdrawal reactions and craving. The previous appetitive models focus on the positive-incentive effects of the drug, considering craving as a result from the desire to experience nicotine's pleasant (e.g., reinforcing) effects.

Most recently, based on the same incentive learning principles, Robinson and Berridge developed an incentive sensitization theory (1993, 2000, 2001, 2008) also considered the biopsychological theory of drug addiction. It posits that repeated exposure to drugs can result in increasing and persistent changes in the mesolimbic dopamine system, regulating the attribution of incentive salience to reward-associated stimuli. Repeated or chronic drug use leads to hyper-responsivity of this system that mediates craving for drugs. Therefore drugs and drug-associated cues become hyper-salient, which results in a pathological incentive motivation for drugs.

Up till now, the exact role of classical conditioning in cue reactivity effects is not clear. Based on the available data though, appetitive models are better supported by research literature than withdrawal models (Carter & Tiffany, 1999; Drobes & Tiffany,

1997; Niaura et al., 1988; Rohsenow, Niaura, Childress, Abrams & Monti, 1990). Recent findings (Piper, Federmen, McCarthy, et al., 2008) suggest that withdrawal is an important factor in motivating persistent tobacco use. There is a common consensus that »this paradigm has demonstrated considerably utility in investigations of basic theoretical issues related to our understanding of addictive behaviors« (Carter & Tiffany, 1999).

Cognitive models. The cognitive processing model (Tiffany, 1990; Tiffany & Conklin, 2000) proposes that processes (a) regulating drug use behavior and (b) controlling craving function autonomously from each other. Therefore, drug seeking or drug use behavior can operate independently from the processes controlling craving. According to this model, drug seeking or drug use behavior characterizes automatic processes developed through a long history of drug use. In contrast, craving is hypothesized to represent non-automatic processes. These non-automatic processes are being activated simultaneously with automatic processes to (1) complete interrupted or (2) impede automatic drug use behavior. These two conditions reflect the craving observed (1) in smokers without a quitting attempt and (2) in those attempting abstinence (see »factors modulating craving«, p. 42), respectively. From this perspective, craving is »neither irrelevant nor central« (Tiffany & Conklin, 2000, p. 145) for smoking behavior. Craving displays rather a »cognitive marker« of processes being associated with drug use behavior in certain occasions.

The dual affect model (Baker, Morse & Sherman, 1987) proposes that affects are represented in neural networks. These networks contain information on affect-relevant stimuli, responses, and expectancies. With regard to craving, two types of networks do exist: (1) a »positive-affect« and (2) a »negative-affect« network. The positive-affect network, associated to the motivational incentive system, is activated by appetitive stimuli (e.g., appetitive drug actions). Initiation of this network is characterized by drug's establishing a positive feedback loop which may account in part for essential features of addiction: for example, the attainment of very high blood levels of a drug, the likelihood of relapse once any drug is sampled, and the pursuit of adjunctive appetitive stimuli while using a drug. The negative-affect network, in contrast, is activated by aversive stimuli or consequences and by (signs of) withdrawal. The operating characteristics of this network result in withdrawal symptoms and signs, negative affect, and drug seeking.

Each model provides a different view of craving. Opinions of the importance of this construct remain divided. On the one hand craving is seen as the key substrate or symptom of drug use, dependence, and relapse (e.g., Bagot, Heishman, & Moolchan, 2007), and on the other, as a redundant epiphenomenon, neither necessary nor sufficient to precipitate or predict relapse (Tiffany, Carter, & Singleton, 2000). These inconsistent findings may be due to difficulties concerning the definition of craving (see »definition of craving«, p. 10) and the assortment of appropriate assessment instruments, respectively (for guidelines selecting appropriate measures see Sayette et al., 2000; see »cue reactivity«, p. 17). Another explanation would be that there might be no direct connection between craving and relapse. Drummond et al. (2000) assume that a prediction of relapse may be promising from the correlates and underlying mechanisms of craving. For instance, supported by research literature cue exposure was predictive of nicotine craving, but only for nicotine-deprived smokers (Sayette, Martin, Hull, Wertz & Perrott, 2003). These findings are consistent with previous research. Various studies demonstrated, that, during abstinence, the perceived drug use availability plays a significant role in craving responses (for a review, see Wertz & Sayette, 2001a, see »factors modulating craving«, p. 42).

Cue reactivity

As seen above numerous conditioning models assume that individuals addicted to drugs show significant reactions to cues that are associated with drug use behavior or withdrawal symptoms, which can be symbolic-expressive (e.g., craving, anxiety, pleasure), physiological (e.g. drug-like, withdrawal-like-appetitive), and behavioral (e.g. drug-taking and/or consummatory behavior; Drummond, Tiffany, Glautier & Remington, 1995; Drummond 2000; see Figure 2).

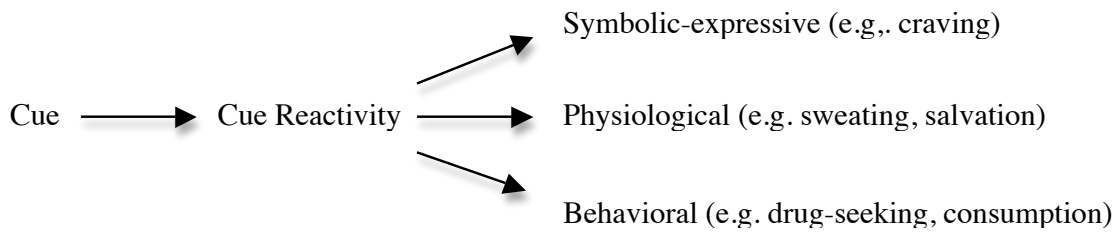

Figure 2. Cue reactivity model (Drummond, 1995, 2000).

These drug-related cues trigger craving to use the drug, motivate ongoing drug use or increase the probability of relapse for those who are abstinent (Ferguson & Shiffman, 2009; Lowman et al., 2000, Waters, Shiffman, Sayette, Paty, Gwaltney, & Balabanis, 2004). Therefore, cue reactivity is considered a conditioned response resembling unconditioned drug withdrawal (Wikler, 1948) and equaling (Stewart et al., 1984) or opposing unconditioned drug effects (Siegel 1975; see »conditioning models«, p. 15). In addition, cue reactivity can also be explained by cognitive theories such as cognitive learning theory and information processing theory (Carter & Tiffany, 1998; Tiffany et al., 2000; see »cognitive models«, p. 16).

Cue reactivity paradigm. The procedure used most commonly to examine the relationship between drug-related cues and the reactions of individuals addicted to drugs is the cue reactivity paradigm (Drummond et al., 1995). Within this paradigm individuals addicted to drugs are exposed to a variety of drug-related (e.g. smoking) cues or neutral stimuli, while their responses are observed and assessed. The salience of conditioned responses (cue reactivity) is measured by comparing the strength of the responses to drug-related cues with the ones to neutral stimuli (Drummond et al., 1995, 2000, Lowman et al., 2000). Table 5 and 6 present an overview of cue reactivity studies on cigarette smokers and the applied cues and stimuli, cue presentation modes and assessment instruments within these studies.

Table 5

Overview of cue reactivity studies with the focus on recruitment and subject variables

Reference	**Recruitment**	**Include/Exclude**	**Subjects**		**Smoking history**					**Last cigarette**
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
Attwood, O'sullivan, Leoranrds, Mackintosh & Munafo (2008)	staff and students at the University of Bristol, and the general population (£10)	include if: ≥5 cigarettes/day, free from medication and illicit substances, normal or corrected-to-normal vision	54 (28/26)	M=22 SD=4	M=11 SD=5	M=16 SD=2	-	-	M=4 SD=2	12h prior to session vs. beginning of study
Bailey, Goedeker & Tiffany (2010)	flyers and newspaper advertisements (30$)	included if: > 18 years, not attempting to quit or cut down smoking, smoking ≥20 cigarettes/day, smoking > one year, CO > 10 ppm	101 (50/51)	M=30	M=25 SD=9,12	-	-	M=31 SD=16.34	-	deprived: 24h prior to session
Bordnick, Traylor, Graap, Copp, Brooks & Ferrer (2005)	local newspaper advertisement	case study of non-treatment-seeking adolescent	1 (0/1)	M=17	M=10	M=1.5	3-4	-	M=6	-
Carter, Bordnick, Traylor, Day & Paris (2008)	college student smokers	included if: non-treatment-seeking, nicotine dependent, 19- 24 years, good physical health, able to wear a VR helmet for 40 min. excluded if: current/past diagnosis of severe mental illness or current diagnosis of dependence (other than nicotine), medication effecting nicotine craving or consumption, mood, or ability to participate, pregnant, engaging in smoking cessation treatment, fearing closed spaces, visual problems that affects viewing VR environments, history of seizure, serious health problems	22	M=20.8 SD=1.4	M=20.8 SD=5.2	-	-	-	-	prior to session
Carter & Tiffany (2001)	radio advertisements ($20)	included if: > 21 years, smoked ≥ one pack of cigarettes/day, were not attempting to quit smoking at the time of the study	60 (30/30)	M=33.4	M=28	-	-	M=33.6	-	30 min prior to cue exposure
Cepeda-Benito & Tiffany (1996)	newspaper advertisement ($30)	-	36 (18/18)	M=33.5 SD=12.1	M=27.9 SD=9.9	M=21.8 SD=12.6	M=4.2 SD=2.4	M=27 SD=11	-	-
		-	40 (20/20)	M=29.1 SD=9.0	M=27 SD=11.5	M=17.5 SD=11	M=3.4 SD=2.2	M=29.8 SD=16	-	-

Reference	Recruitment	Include/Exclude	Subjects		Smoking history					Last cigarette
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
Conklin, Perkins, Robin, McClernon & Salkeld (2010)	newspaper advertisements and flyers	included if: between 20 - 65 yeas; > 15 cigarettes/day; smoking for ≥ one year, CO > 8ppm	72 (36/36)	M=28.9 SD=12.2	M=20.7 SD=5.3	M=15.5 SD=12.1	-	M=24.4 SD=12.3	M=5.7 SD=1.8	6h prior to session
Conklin, Robin, Perkins, Salkeld & McClernon (2008)	local flyers and newspaper advertisements ($40)	included if: healthy male and female smokers between the ages of 20 - 65, CO air sample <13ppm prior to study	62 (31/31)	M=34.4	M=20.8	M=19.5	-	M=8.7	-	6h prior to session
Conklin & Tiffany (2001)	newspaper and bulletin board advertisement ($50)	-	60 (30/30)	M=35	M=28.9 SD=10.4	M=22.5	M=5	M=34.6 SD= 18.2	-	-
Doran, Spring & McChargue (2007)	recruited via flyers posted on campus and in the surrounding community (paid)	included if: regular smokers (i.e., ≥15 cigarettes/day for the past year), no Axis I disorder (SKID; other than nicotine dependence)	60 (30/30)	M=30.8 SD=10.8	M=19.1 SD=5.2	M=18.1 SD=9.9	-	-	M=5.36 SD=1.88	smoke as usual
Doran, McChargue & Spring (2008)	-	included if: regular smokers (i.e., ≥15 cigarettes/day for the past year) not currently using nicotine replacement therapy or meeting criteria for other axis I disorders.	75 (46/29)	M=41.3 SD=10.6	2 M=0.3 SD=6.7	-	-	-	M=5.9 SD=2.2	prior to cue exposures
Drobes (2002)	local treatment programs and community ads	-	87	-	-	-	-	-	-	-
Drobes & Tiffany (1997)	newspaper and poster advertisement ($18 or 24$)	included if: ≥18 years old, smoke ≥ one pack/day	100 (50/50)	M=29.4	M=25.7	M=5.5	M=3.7	M=25.7	-	no explicit instructions
Droungas, Ehrman, Childress & O´Brien (1995)	posting notices around the University of Pennsylvania ($50 for participation)	included if: not intending to quit smoking excluded, if: used drugs and alcohol on regular basis, were on psychoactive medications, had thought disorder, were pregnant	26 (15/11)	M=20.7	M=15.8	M=4.1	96% 0-3 times	-	-	in the last 30 min (for 62%)
Elash, Tiffany & Vrana Scott (1995)	newspaper advertisements and bulletin board notices ($20 for participation)	-	36 (18/18)	M=20.4	M=26.3 SD = 6.3	M=4.4	M=3.5	M=26.3 SD = 13.5	-	-
Fregni ,Liguori, Fecteau, Nitsche, Pascual-Leone & Boggio (2008)	local advertising on web sites, flyers, notice distributed through out local university	included if: between 18-55 years, currently smoking >15 cigarettes/day for ≥ a year excluded if: neuropsychiatric disorders, history of alcohol/other drugs, not quitting smoking, taking psychiatric medication, pregnancy	24 (13/11)	M=24.8 SD=7.6	M=18.5 SD=4.5	M=9.3 SD=8.5	-	-	M=5.0 SD=1.8	1.5h prior to session

Reference	Recruitment	Include/Exclude	Subjects		Smoking history					Last cigarette
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
Griffin & Sayette, 2008	advertisement	included if: an average of ≥21 cigarettes/day for ≥24 continuous months excluded if: medical conditions that ethically contraindicated nicotine, and illiteracy	34 (19/15)	M=25.21 SD=4.4	M=24.4 SD=5.3	M=9.5 SD=5	M=6.5 SD=3.1	M=9.38 SD=3.58	-	7h prior to session
Hutchison, Monti, Rohsenow, et al. (1999)	providence Veteran Affairs Medical Center and community; advertisement and flyers ($40 grocery store gift certificates)	included if: smoking ≥20 cigarettes/day, contemplating quitting in the next 6 month excluded if: (history of) opiate dependence, positive urine opiate screen, medication with opiates, liver function test > 3 times normal, chronic and acute medical problem	20 (10/10)	M=39.7 SD=10.3	-	M=23.2 SD= 10.3	M=4.4 SD =3	-	-	9h of smoking deprivation; after waking up (had a nicotine replacement patch)
Juliano & Brandon (1998)	classified advertisement/ local community ($15/Std.)	-	132 (86/46)	M=33.1 SD = 11.6	M=27.3 SD = 8.9	M=16.8 SD=11.4		M=16.1 SD = 8.7	-	3h prior to the appointment
Lee, Lim, Wiederhold & Graham (2005)	program of smoking cessation in a high school ($70)	included if: right-handed men; smoke ≥10 cigarettes/day, no lifetime history of medical, psychiatric, or other substance abuse, or medication usage thought to affect brain structure or function at the time of scanning	8 (8/0)	M=17.1 SD = 0.8	M=15.3 SD=5	-	-	-	-	7h prior to scanning
Maude-Griffin & Tiffany (1996)	newspaper advertisement ($15 -$25)	included if: ≥18, smoke ≥one package of cigarettes/day	100 (51/49)	M=22.6	M=24.3	M=6.3	M=1.7	M=18,1	-	smoking condition: between the 2 sessions
McBride, Barrett, Kelly, Aw & Dagher (2006)	McGill University classified ads and by word of mouth (monetarily compensation upon completion of the study)	included if: healthy regular smokers, smoking ≥15 cigarettes/day; FTND ≥ 5 excluded if: any history of psychiatric or neurological illness, previous head trauma, or history of drug abuse (other than nicotine)	20 (10/10)	M=27 SD=8	M=22 SD=6	-	-	abstinent: M=6.33 SD=3.16 Non-abstinent: M=10.39, SD=5.69	-	abstinent state session: > 12h prior to the fMRI vs. non-abstinent state session: 30min prior to the fMRI

Reference	Recruitment	Include/Exclude	Subjects		Smoking history					Last cigarette
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
McClernon, Kozink, Lutz & Rose (2009)	community	included if: smoking ≥10 cigarettes /day for ≥2 years, ppm > 10 ppm, right-handed, free of serious health problems, not currently undergoing treatment for a psychiatric illness, free of medications altering CNS functioning, test negative for illicit drug use, no conditions making MRI research unsafe, not pregnant	18 (7/11)	M=28.6 SD=7.5	M=17.8 SD=2.8	M=11.6 SD=6.7	-	-	4.4 SD=1.4	smoking as usual vs. 24h prior to scanning
McClernon, Kozink & Rose (2008)	pooled from two separate studies	included if: smoking ≥15 cigarettes/day for ≥2 years, afternoon breath CO level >15 ppm., right-handed, no serious health problems, not taking medications altering CNS functioning, testing negative for illicit drug use, no condition making MRI research unsafe	30 (7/23)	M=35.7 SD=9.7	M=23.6 SD=7.4	M=17.9 SD=8.5	-	M=22.3 SD=9.9	6.37 SD=1.61	prior to entering the hospital 2h prior to scanning
McDermut & Haaga (1998)	newspaper advertisement, flyers around American University campus, word of mouth ($10)	included if: smokers	90 (29/61)	M=24.7 SD = 8.6	M=16.2 SD =8.5	M=8 SD =8	M=2.7 SD =2.8	-	-	-
		included if: never smoked	27 (7/22)	M=19.8 SD = 4.1	-	-	-	-	-	-
McDonough & Warren (2001)	posters, University of Illinois ($12/h)	excluded if: psychotropic medications, drug/alcohol abuse, mental health/medical conditions	-	M=16.5	-	-	-	M=7.66	-	-
Miranda, Rohsenow, Monti, Tidey & Ray (2008)	recruited from the community	included if: moderate to heavy smokers	20 (17/3)	M=50.4 SD = 12.9	M=24 SD=7.9	M=23 SD=13.5	-	< 10	5.2 SD=1.5	10h prior to session (overnight nicotine deprivation period)
Niaura, Shadel, Abrams, et al. (1998)	newspaper advertisement, community announcements, physician referrals	included if: CO smaller than/or 8ppm	128 (63/65)	M=43.5 SD = 11,1	M=27.8 SD 12.0	-	-	-	M=6.2 SD=2	12h prior to session
Niaura, Sayette, Shiftman, Glover, Nides, et al. (2005)	($150.00)	included if: smoked 10–24 cigarettes/day for the last 3 years; not trying to quit smoking	319	M=37.8 SD=13.13	M=17.3 SD=3.94	M=20.6 SD=12.3	M=3.5 SD=11.5	-	M=4.96 SD=1.96	-
Payne, Smith, Sturges & Holleran (1996)	veterans, spouses of veterans, medical center employees of the Jackson Veterans Affairs Medical Center Smoking Cessation Clinic	included if: 18 – 65 years; >15 cigarettes/day for ≥3 years, adequate reading/writing skills excluded if: current regular use of medication, current drug/alcohol abuse, unstable medical or major psychiatric conditions	117	-	-	-	-	-	-	30min. prior to session

Reference	Recruitment	Include/Exclude	Subjects		Smoking history					Last cigarette
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
Rickard-Figueroa & Zeichner (1985)	undergraduate psychology courses (course credit)	included: participants who rated items from the Smoking Confidence Questionnaire: able to refrain from smoking 45% or less (when they see someone smoking, a cigarette or an ashtray)	48 (24/24)	-	M=19	-	-	-	-	2h prior to session
Rohsenow, Monti, Hutchison, Swift, MacKinnon, Sirota et al. (2007)	community advertisements	included if: smoke > 15 cigarettes a day (> 6 months), interest in quitting smoking, not in a quit attempt/using nicotine replacement. excluded if: history of opioid abuse or dependence; use of medications that contraindicated opiate antagonists; liver function tests > than three times normal; allergy to adhesives/acetaminophen; use of medications that interfere with reactivity assessment; pregnancy	134 (72/62)	men: M=49.3 SD=12.4 women: M=44.5 SD=11.7	men: M=28.8 SD=11.3 women: M=25.5 SD=8.7	-	men: M=2.7 SD=2.3 women: M=2.8 SD=2.1	men: M=28.4 SD=10.2 women: M=25.7 SD=12.2	men: M=6.5 SD=1.7 women: M=6.4 SD=1.9	10h prior to session
Sayette & Hufford (1994)	introductory psychology course (course credits)	included if: smoked > 18 month	40 (12/28)	M=21.1 SD = 5.3	M=15.8 SD = 4.5	M=4.7 SD = 3.8	-	-	-	12h prior to session vs. non-deprived
Sayette & Hufford (1995)	introductory psychology course (course credits)	included if: smoked > 18 month	40 (12/28)	M=21.1 SD = 5.3	M=15.8 SD = 4.5	M=4.7 SD = 3.8	-	-	-	12h prior to session vs. non-deprived
Sayette, Loewenstein, Kirchner & Travis (2005)	newspaper advertisements and local flyer ($45)	included if: not currently interested in quitting, willing to refrain from smoking for part of a day; literacy and good health conditions, smoke ≥15 and 30 cigarettes/day for the past 12 months.	80 (46/34)	M=23 SD=5.0	M=21.4 SD=5.2	-	-	-	-	12h prior to session vs. as usual
	newspaper advertisements and local flyer ($45)		38 (exp. 1) 32 (16/16)	M=24.9 SD=5.2	M=20.7 SD=5.4	-	-	-	-	12h prior to session
Sayette, Martin, Hull, Wertz & Perrott (2003)	advertisements in newspapers and radio programs	included if: smokers not currently interested in trying to quit smoking; HS: ≥21 cigarettes a day; TC: average of 1-5 cigarettes on ≥2 days a week medical condition that did not contraindicated nicotine ethically, literate	127 (60/67)	M=24.7 SD=4.2	TC: M=3.7 SD=1.4 HS: M=24.8 SD=5.3	TC M=6.7 SD=4.3 HS M=9.2 SD=5.1	-	-	-	7h prior to session vs. non-deprived
Sayette, Martin, Wertz, Shiffman & Perrott (2001)	advertisements in newspapers and radio programs ($40, and $5 for the behavioral choice task)	included if: smokers not currently interested in trying to quit smoking; HS: ≥21 cigarettes a day; TC: average of 1-5 cigarettes on ≥2 days a week medical condition that did not contraindicated nicotine ethically, literate	127 (60/67)	21-35	-	-	-	HS <16 TC<10	-	deprived: 7h prior to session vs. minimally deprived

Reference	Recruitment	Include/Exclude	Subjects		Smoking history					Last cigarette
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
Sayette, Martin, Wertz, Perrott & Peters (2005)	newspaper and radio advertisements ($80)	included if: heavy smokers (HS): 20-40 cigarettes/day, medical condition that did not contraindicated nicotine ethically, literate	TC: 68 (35/33) HS: 70 (34/36)	TC: M=23.1 SD=3.3 HS: M=24.0 SD=3.7	TC: M=3.8 SD=1.4 HS: M=23.9 SD=4.9	TC: M=5.1 SD=3.0 HS: M=8.0 SD=4.3	TC: 6.7 SD=2.5 HS: 5.8 SD=2.7	TC: M=5.8 SD=3.4 HS M=13.0 SD=4.8	-	12h prior to session
Sayette, Wertz, Martin, Cohn, Perrott & Hobel (2003)	advertisements in newspapers and radio programs	included if: > 21 cigarettes/day for > 24 months excluded if: medical conditions that contraindicated nicotine, illiteracy	253 (124/129)	M=24.6 SD=4.2	TC<5 HC=21 M=14.5 SD=11	M=7.9 SD=5.1	6.2 SD=2.7	HS < 16 TC<10	-	-
	introductory psychology course	included if: abstinent smokers	57 (28/29)	M=19.9 SD=4.5	M=13.6 SD=4.5	M=4.7 SD=3.8	-	M=10.8 SD=4.1	-	11pm the night before experiment
Shadel, Niaura, Abrams, et al. (1998)	nicotine-dependence research study of smokers who quit in the clinic with provision of written self-help material ($170)	included if: want to quit smoking in 7 days	183	M=42.8 SD=11.7	M=25.8 SD=10.5	M=24.6 SD=11.4	M=3.3 SD=2.4	M=30.2 SD=11.1		12 hrs prior to experiment (3 standardized cigarettes in experiment)
Shadel, Niaura, Abrams (2004)	-	-	40 (17/23)	M=23.2 SD= 10.7	M=16.6 SD= 7.6	-	-	-	M=4.9 SD=2	1 vs. 12 h prior to session
Shadel, Niaura, & Abrams (2001a)	-	-	15 (8/7)	M=41.1 SD=11.4	M=27.7 SD=20	-	-	M=6.1 SD=2.6	M=7.6 SD=1.7	13h prior to session
Thewissen, van der Meijden, Havermans, van den Hout & Jansen (2008)	recruited personally or responded to advertisements posted at Maastricht University	included if: smoked for ≥2 years, ≥5 cigarettes a day	33 (10/23)	M=21.7 SD= 2.6	27%<10 67%=11-20, 4%>21	>2	-	-	M=2.94 SD=1.93	2h prior to testing
Tiffany, Cox & Elash (2000)	-	included if: > 21 years, smoked ≥a pack of cigarettes/day, not attempting to quit smoking Excluded if: pregnant, using medication, CO level less then 10ppm	61 (30/31)	M=31.5	M=29	M=7.2	M=3	M=36.4	-	-
Tiffany & Drobes (1990)	introductory psychology course		60 (37/23)	M=20.5	M=15.9	M=3.5	M=1.4	M=14.1	-	-
Tiffany & Hakenewerth (1991)	bulletin board notices, television, radio and newspaper advertisement	included if: between 18 - 50 years, smoked a minimum of one pack of cigarettes/day for the previous year	66 (36/30)	M=33.5	M=30.8	M=14.9	M=3	M=28.2	-	-

Reference	Recruitment	Include/Exclude	Subjects	Smoking history						Last cigarette
			N (m/f)	Age	Cig/day	Years smoking	Quit attempts	Co-level (ppm)	FTND	
Tong, Bovbjerg & Erblich (2007)	recruited by advertisement in New York City	included if: smoke an average of ≥10 cigarettes/day over the previous 5 years, no previous or current cancer, cardiovascular disease, emphysema, or other smoking-related illnesses, not currently attempting to quit smoking, no history of hospitalization or treatment for other substance abuse	20 (10/10)	M=37.7 SD=13.9	M=17.5 SD=8.3	M=18.5 SD=13.3	M=2 SD=1.5	-	M=4.7 SD=1.6	upon arrival
Waters, Shiffman, Sayette, Paty, Gwaltney & Balabanis (2004)	smokers of a smoking cessation clinic	included if: smoking for ≥5 years and to be smoking ≥15 cigarettes/day, high motivation and efficacy to quit	158 (78/80)	M=38.6 SD=9.5	M=23.7 SD=8.7	M=21.4 SD=9.7	-	-	M=5.85 SD=2	first day of smoking cessation
Warthen & Tiffany (2009)	advertisements	included if: ≥18 years, smoking ≥15 cigarettes/day for the past year, not seeking to quit or restrict smoking, CO level of ≥10ppm	43 (19/24)	M=39.6 SD=10.9	M=23 SD= 8.4	-	-	M=31 SD= 12.57	-	-
Wertz & Sayette (2001b)	introductory psychology class (course credits)	-	92	M=20.1 SD=4.1	M=14.4 SD=5.2	M=4.85 SD=3.7	-	< 20	-	11pm night before
Wilson, Sayette, Delgado & Fiez (2005)	advertisements in local newspapers	excluded if: dependence on any drug other than nicotine or caffeine, illiteracy, or medical conditions that ethically contraindicated nicotine administration	22 (22/0)	M=24.4 SD=4.9	M=21.6, SD=2.7	M=2	-	< 16	-	deprived: 8h prior to session

Note. ≥ = at least, > = more then, ppm = carbon monoxide level (CO), h = hours, N (m/f) = Number of male and female participants/subjects, M=Mean, SD=standard deviation for number of age, of cigarettes smoked per day, of years smoking, of previous quit attempts, carbon monoxide level (CO) and nicotine dependence assessed by Fagerstroem Test für Nikotinabhängigkeit (FTNA), time spent since last cigarette.

Table 6

Overview of cue reactivity studies with the focus on cue presentation mode and assessment instruments

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Attwood, O'Sullivan, Leoranrds, Mackintosh & Munafo (2008)	-	- smoking cues: smoking-related pictures - neutral stimuli: neutral pictures	- Fagerstroem Test of Nicotine Dependence (FTND) - Eysenck Personality Questionnaire, Revised (EPQ-R) - Spielberger State-Trait Anxiety Inventory (STAI-State and STAI-Trait) - Brief Questionnaire of Smoking Urges (BQSU)	- smoking topography device - visual probe task - visual analogue scales (VAS)
Bailey, Goedeker & Tiffany (2010)	- cue–availability paradigm (0, 50, or 100%) - deprivation (deprived/abstained from smoking for 24 h vs. non-deprived/continued smoking the regular amount)	- smoking cue: puff of a cigarette - neutral stimulus: sip of water	- Vitolograph CO monitor - Mood Form - Smoking History Form - Clinical Research Support System (CReSS) - Withdrawal Symptoms Checklist (WSC)	- Vitolograph CO monitor - Questionnaire on Smoking Urges (QSU) - Withdrawal Symptoms Checklist (WSC) - Mood Form - heart rate - skin conductance - puff topography - latency to access door to sample the cue were measured
Bordnick, Traylor, Graap, Copp, Brooks & Ferrer (2005)	- case study - virtual reality nicotine cue reactivity assessment system (VR-NCRAS):	- 2 neutral cue rooms (art gallery) with e.g. aquarium and bubble sound - 2 smoking stimuli rooms: (1) teen specific items and smoking related materials (2) party scene with an offer of a cigarette to the subject	- Fagerstroem Test of Nicotine Dependence (FTND)	- 100-point VAS
Carter, Bordnick, Traylor, Day & Paris (2008)	- virtual reality nicotine cue reactivity assessment system (VR-NCRAS)	- neutral scenario: a nature scene (with neutral cues) - smoking stimuli scenario: a party scene (with cigarette cues, e.g. cigarettes and lighters while interacting with other smokers)	- Smoking History Form - Fagerstroem Test of Nicotine Dependence (FTND) - Cigarette Craving Visual Analog Scale	- multidimensional scaling (0-10) - Questionnaire of smoking urges (four item subscale)
Carter & Tiffany (2001)	- cue–availability paradigm (0, 50, or 100%)	- in vivo smoking cue: lit cigarette (of the participant's brand) in an ashtray - in vivo neutral stimulus: glass of water		- Questionnaire of smoking urges (four item subscale) - two-item mood assessment (positive vs. negative) - latency to smoke - heart rate - skin conductance

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Cepeda-Benito & Tiffany (1996)	- study 1	- imagery smoking cue: 6 imagery sentences describing smoking craving - imagery neutral stimulus: 6 imagery sentences that did not describe smoking craving	- series of questionnaires	- Vividness of the image (0-100) - Level of positive (0-100) and negative mood experienced (0-100) - Brief Questionnaire of Smoking Urges (BQSU) - EKG - SCL
	- study 2	- descriptions of smoking and desire to smoke in the urge sentence were replaced by a description of non-smoking activities in the no-urge sentences		
Conklin, Perkins, Robin, McClernon & Salkeld (2010)	-	- proximal smoking cues: pictures of standard smoking related environments and individual pictures of the environments in which participants smoke - proximal neutral stimuli: pictures of standard neutral environments and individual pictures of the environments in which participants do not smoke	- Smoking History Form - Fagerstroem Test of Nicotine Dependence (FTND) - Balanced Inventory of Desired Responding, Impression Management section (BIDR-IM)	- 4-item Questionnaire of Smoking Urges (QSU) - Diener and Emmons Mood Form - heart rate pulse plethysmograp - vividness (0-100) - craving 0-100) - negative and positive affect (0-100) - arousal (0-100) - relevance (0-100)
Conklin, Robin, Perkins, Salkeld & McClernon (2008)	-	- pictorial cues of salient smoking and nonsmoking environments and proximal cues: - smoking cues: three smoking contexts that generated the strongest craving (i.e., bar, restaurant, and bus stop) and - neutral stimuli: three nonsmoking contexts that generated the least craving (i.e., church, shower, and gym)	- Smoking History Form - Fagerstroem Test of Nicotine Dependence (FTND) - Balanced Inventory of Desired Responding, Impression Management section (BIDR-IM) - Diener and Emmons Mood Form - visual analog scale of nicotine withdrawal	- 4-item Questionnaire of Smoking Urges (QSU) - craving measure - four-item relevance measure - single item measures of vividness, positive and negative mood, and excitement and calmness. - heart rate - skin conductance
Conklin & Tiffany (2001)	-	- 4 personalized, 4 standardized and 4 personalized of another smoker imagery scripts: - positive mood/urge - positive mood/no urge - neutral mood/urge - neutral mood/no urge	- Interview session - Balanced Inventory of Desired Responding, Impression Management section (BIDR-IM) - Questionnaire Upon Mental Imagery-Brief - Questionnaire of Smoking Urges (QSU) - Mood Form - smoking history form	- post-imagery rating form (including 10-item craving measure) - Brief Questionnaire of Smoking Urges (BQSU) - 4-item questionnaire regarding personal relevance of script scenario - script vividness, overall positive and negative affect and arousal (100-piont scale) - skin conductance - heart rate
Doran, Spring & McChargue (2007)	-	- smoking cues: lit cigarette, own preferred brand, lighter & ashtray - control stimulus: electrical tape	- Barratt Impulsiveness Scale - Fagerstroem Test of Nicotine Dependence (FTND) - Brief Questionnaire of Smoking Urges (BQSU) - screening of cigarette consumption	- hypothetical cigarette choice task (CCT), followed by the actual CCT component

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Doran, McChargue & Spring (2008)	-	- smoking cues: lit cigarette, own preferred brand, lighter & ashtray - control stimulus: electrical tape	- Fagerstroem Test of Nicotine Dependence (FTND) - Barratt Impulsiveness Scale, version 11	- Questionnaire of Smoking Urges - heart rate (HR) - mean arterial pressure (MAP)
Drobes (2002)	- picture cue presentation paradigm healthy controls vs. alcoholic non-smokers vs. non-alcoholic smokers vs. alcoholic smokers	- alcohol-related cues - smoking-related cues - affective cues	- Fagerstroem Test of Nicotine Dependence (FTND)	- several relevant psychophysiological indices (e.g., heart rate, skin conductance, startle reflex) - craving to drink alcohol rating scale - craving to smoke rating scale - pleasure rating scale - arousal rating scale - control rating scale - interest rating scale
Drobes & Tiffany (1997)	- abstinent condition - smoking condition - during intersession interval	- imagery: 3 urge scripts, containing smoking content, 3 neutral ones without smoking content - in vivo urge cue: experimenter smoking participants cigarette - in vivo neutral stimulus: experimenter drinking water	- Questionnaire of Smoking Urges (QSU) - Mood Form - Withdrawal Symptoms Checklist (WSC) - smoking history form - Automatic Smoking Questionnaire (ASQ) - Reason for Smoking Questionnaire	- 11-item urge measure - scene vividness (imagery trials) - how careful they observed & thought about the scene (in vivo trials) - positive and negative affect during the trial (0-100) - heart rate - skin conductance - finger temperature - facial electromyography (fEMG)
Droungas, Ehrman, Childress & O´Brien (1995)	-	- smoking video/task - neutral video/task - unpleasant video/task	- Revised Michigan Alcohol Screening Test (MAST-R) - Smoking Profile Questionnaire - Craving & Reason for Using Questionnaire (CRU Q) - Ikard, Green & Horn questionnaire	- Mood Questionnaire (MQ) - Drug Related States Questionnaire (DRSQ)
Elash, Tiffany & Vrana Scott (1995)	-	- 12 imagery sentences with smoking cues - 12 imagery sentences without smoking cues - each containing 4 negative, 4 pleasant/relaxing, 4 neutral affect content/material/descriptors	- Diener and Emmons Mood Form - Questionnaire of Smoking Urges (QSU) - Smoking history form - Reason for Smoking Questionnaire (RFS)	- Brief Questionnaire of Smoking Urges (BQSU) - electrocardiogram (4mm Electrodes) - skin conductance - facial electromyography (fEMG)
Fregni ,Liguori, Fecteau, Nitsche, Pascual-Leone & Boggio (2008)	- three different types of brain stimulation with transcranial direct current stimulation	- smoking cue: participants own lit cigarette, lighter, ashtray and smoking video	- demographic profile data - smoking-habits profile data	- visual analog scale for mood (0-100) - visual analog scale for craving (0-100)

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Griffin & Sayette, 2008	-	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- demographic information - smoking history and patterns - several measures putatively associated with smoking ambivalence - difficulty refraining from smoking assessed using past severity of withdrawal and difficulty abstaining - withdrawal symptoms - interest in quitting smoking	- self-reported urge to smoke (1-10) - facial coding: FACS
Hutchison, Monti, Rohsenow, et al. (1999)	- placebo group - naltrexone group	- smoking cues: participants own cigarette, ashtray, lighter	- Fagerstroem Tolerance Questionnaire (FTQ) - Smoking history questionnaire	- urge to smoke (single item scale 0-100) - Positive affect/negative affect Scale (PANAS) - Minnesota Withdrawal Scale
Juliano & Brandon (1998)	- „availability of smoking“ (within 20min vs. not smoking for up to 3 hr.) - environmental stimuli	- smoking related cues: participants own lit cigarette, lighter, ashtray - neutral stimuli: stapler, pen, pencil	-	- self-reported urge to smoke (at the moment): single-item urge measure - scale from 0 – 10 - reaction time task - Positive affect/negative affect Scale (PANAS)
Lee, Lim, Wiederhold & Graham (2005)	- virtual environment	- background environment: bar, alcoholic drink, a pack of cigarettes, a lighter, an ashtray, a glass of beer, advertising posters, avatar smoking a cigarette - six types of stimulus were employed: 2D and 3D smoking-related images, neutral 2D and 3D images, and 2D and 3D nonsmoking-related images.	- handedness was determined with a standard rating scale - demographic data - medical history survey of smoking behavior - modified Fagerstrom Tolerance Questionnaire - Presence Questionnaire Simulator Sickness Questionnaire	- a self-rating on a 10-point scale of current smoking craving before and after scanning
Maude-Griffin & Tiffany (1996)	- 2 studies: 6 to 24 h between sessions	- smoking condition: continue smoking between sessions - abstinent condition: stay abstinent between sessions - audiotapes imagery scripts: - positive affect, positive affect-urge, negative affect, negative affect-urge	- smoking history form - Questionnaire of Smoking Urges (QSU) - Reasons of Smoking Questionnaire - Withdrawal Symptoms Checklist (WSC) - Affect Intensity Measure (AIM) - Mood form	- heartrate (HR) - finger temperature(FT) - skin conductance (SC) - vividness of the imagined scene (100-point scale) - intensity of positive/negative affect (100-point scale) - intensity of urges to smoke (100-point scale) - intensity of craving (100-point scale)
McBride, Barrett, Kelly, Aw & Dagher (2006)	- 2 experimental sessions with a 4 weeks intersession interval - abstinent vs. non-abstinent condition - expectant group: allowed to smoke a cigarette immediately after the scan vs. non-expectant group: had to abstain from smoking for 4 h after the scan	- 6 2min videos alternating between smoking (s) and control (c) content in the following order: C-S-S-C-C-S	- Fagerstroem Test of Nicotine Dependence (FTND) - Profile of Mood States (POMS) - carbon monoxide (CO) monitor	- functional magnetic resonance imaging (fMRI) - seven item craving questionnaire

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
McClernon, Kozink, Lutz & Rose (2009)	- satiated condition: smoke before session vs. abstinent condition: abstinent for 24h	- photographic smoking cues: people smoking - photographic control stimuli: people in normal activities	- questionnaires regarding smoking history and suitability for functional magnetic resonance imaging (fMRI) research - Fagerstroem Test of Nicotine Dependence (FTND)	- functional magnetic resonance imaging (fMRI) - 32-item version of the Shiffman–Jarvik Withdrawal Questionnaire - craving rating on one-item, four-point scale
McClernon, Kozink, & Rose (2008)	- 2 studies	- 60 full-color pictures of smoking cues: objects/people - 60 full-color pictures of control stimuli: everyday objects/activities - 15 full-color pictures of target cues: animals	- self-report withdrawal symptoms - Fagerstroem Test of Nicotine Dependence (FTND)	- self-report craving measured prior to scanning - functional magnetic resonance imaging (fMRI) – brain responses to smoking cues in brain regions including vSTR, right MOG, and GP. The vSTR
McDermut, & Haaga (1998)	- smokers: contemplators (want to quit) vs. Precontemplators (don't want to quit) - control group (non-smokers)	- smoking-related cue: video of actress talks on the phone, lights a cigarette - neutral stimulus: video of actress talks on the phone	- Self-Assessment Maniken (SAM) - CIDI - Fagerstorm Test of Nicotine Dependence (FTND) - Fagerstrom Tolerance Questionnaire (FTQ) - Contemplation of smoking: asking them; Contemplation Ladder (CL)	- craving (0-100) - Positive affect/negative affect Scale (PANAS) - heart rate - akin temperature - manipulation check: how similar was the video to situation in which they smoke
McDonough & Warren (2001)	- smokers vs. non-deprivation vs. smoking deprivation vs. non-smokers - 40 trials of a cognitive stressor task	- smoking cues: 20 different color pictorial stimuli with smoking related scenes (people lighting, holding, smoking cigarette) - neutral stimuli: 20 neutral (nonsmoking-related) stimuli	- Fagerstorm Test of Nicotine Dependence (FTND)	- electroencephalogram (EEG) - electroocculogram (EOG) - ERPs - Stressor task - Mood adjective check list (mMACL) - rate stimulus (un)pleasant on Likert scale - urge to smoke (11-point Likert scale) - Questionnaire of Smoking Urge (QSU)
Miranda, Rohsenow, Monti, Tidey & Ray (2008)	-	- smoking cue: pack of the participant's preferred brand of cigarettes with one cigarette out of the pack, a lighter, and an ashtray - relaxation instead of a neutral stimulus	- Fagerstorm Test of Nicotine Dependence (FTND)	- smoking urge (0-11) - Minnesota Nicotine Withdrawal Scale - mean arterial pressure - heart rate
Niaura, Shadel, Abrams, et al. (1998)	- mental arithmetic task	- in vivo exposure - standardized script from recent relapse - personal high-risk situation - standardized script	-	- DINAMAP 1846 SX automatic blood pressure monitor (blood pressure and heart rate) - smoking urge (1-11) - self-efficacy (1-11) - artificiality of the manipulations (1-11)

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Niaura, Sayette, Shiftman, Glover, Nides, Shelanski, Shadel, Koslo, Robbins & Sorrentino (2005)	- new rapid-release nicotine gum (RRNG) vs. current nicotine polacrilex gum (NPG)	- smoking cues: favored brand of cigarette, a lighter and an ashtray	- medical history form - physical examination - laboratory assessments electrocardiogram - assessment of smoking history and nicotine dependence - Fagerstroem Test of Nicotine Dependence (FTND) - test for carbon monoxide	- craving scale consisting of five items
Payne, Smith, Sturges & Holleran (1996)	- 15 min. vs. 90 min. vs. 180 min. smoking deprivation	- smoking cue: smoked a cigarette - neutral stimulus: female research assistant browsing through a magazine	- smoking history and demographics form	- heart rate (HR) - systolic/diastolic blood pressure (SBP/DBP) - finger temperature (FT) - topographical components of smoking behavior - FTQ - Likert scale ratings (1-5) for desire to smoke - Likert scale ratings (1-5) for positive affect - Likert scale ratings (1-5) for negative affect - Likert scale ratings (1-5) for physical withdrawal symptoms - Likert scale ratings (1-5) for desire and confidence to quit smoking - Likert scale ratings (1-5) for the valence of smoke exposure and anticipated taste qualities of cigarette smoked by the research assistant, the enjoyment and taste qualities of a cigarette smoked by the subject post-eue-exposure
Rickard-Figueroa & Zeichner (1985)	-	- smoking cue: individual smokes a cigarette	- smoking Confidence Questionnaire - Smoking history questionnaire	- smoking urge ratings (5 point Likert scale) - heartrate - systolic and diastolic blood pressure - cognitve coping style: 6 item questionnaire - smoking duration
Rohsenow, Monti, Hutchison, Swift, MacKinnon, Sirota et al. (2007)	- 50mg naltrexone vs. placebo - nicotine replacement (42-mg, v.21-mg) vs. placebo	- smoking cue: participants own lit cigarette, lighter, ashtray - control stimuli: pencil, eraser, small pack of paper	- demographics and smoking history. - Fagerstroem Test for Nicotine Dependence (FTND)	- Minnesota Nicotine Withdrawal Scale (MNWS) - Brief Questionnaire of Smoking Urges (BQSU) - Cigarette Enjoyment Rating Scale, - urge to smoke (0-10) - Cigarette Enjoyment Rating Scale - heartrate - mean aterial pressure - medication side effects checklist

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Sayette & Hufford (1994)	-	- smoking cue: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- Ad Lib Characteristics of Smoking Form - Smoking Consequences Questionnaire	- reaction time - self-reported urge to smoke (1-10)
Sayette & Hufford (1995)	- deprived vs. non-deprived	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- Demographic questionnaire - Smoking history form	- self-reported urge to smoke (1-10) - facial coding: FACS - Self-Assessment Maniken (SAM) - Brief Mood Introspection Scale (BMIS) - Marlowe-Crowne Social Desirability Scale (MCSD) - Video taped for facial expression
Sayette, Loewenstein, Kirchner & Travis (2005)	- experiment 1 - high craving session: 12h deprivation vs. low craving session: smoke as usual (low crave)	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- demographic form - a standard form for assessing smoking history, patterns, and current interest in quitting - BIDR	- Self-reported urge to smoke (rating scale 0-100) - Smoking Consequences Questionnaire—Twelve (SCQ-12) - retrospective timing and prospective timing
	- experiment 2 - anticipate group: high craving condition part experiment 1 vs. experience group	- smoking cues: participants own lit cigarette, lighter, ashtray	-	- anticipate group: estimate (using the 0 –100 scale) future urges—if they were not permitted to smoke - Experience group: urge-to-smoke ratings
Sayette, Martin, Hull, Wertz & Perrott (2003)	- heavy smokers [HS] vs. tobacco chippers [TC]) - deprived for 7hrs. vs. minimally deprived	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- data on age, gender, ethnicity, marital status, education and income - smoking history - smoking patterns - current interest in quitting	- reported urge to smoke (0 – 100) - magnitude estimations - rating of affective valence (1 – 10) - response time / measure of cognitive resource allocation - Ad libitum characteristics of smoking (AD LIB: Sayette & Hufford, 1997) - Smoking Consequences Questionnaire/Brief (SCQ-B) - behavioral choice task
Sayette et al. (2001)	- heavy smokers [HS] vs. tobacco chippers [TC]) - deprived for 7hrs. vs. minimally deprived	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- data on age, gender, ethnicity, marital status, education and income - smoking history - smoking patterns - current interest in quitting	- reported urge to smoke (0 – 100) - magnitude estimations - rating of affective valence (1 – 10) - response time/measure of cognitive resource allocation - Ad libitum characteristics of smoking (AD LIB: Sayette & Hufford, 1997) - Smoking Consequences Questionnaire/Brief (SCQ-B) - behavioral choice task

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Sayette, Martin, Wertz, Perrott & Peters (2005)	- heavy smokers [HS] vs. tobacco chippers [TC]) - alcohol vs. non-alcohol group	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- data on age, gender, ethnicity, marital status, and income - Smoking history and patterns - Drinking patterns (quantity/frequency/variability index) - 20-item positive and negative subscales of the Positive and Negative Affect Schedule	- urge rating/analog scale 0-100 - magnitude estimation - facial coding: FACS certified coder - level subjective intoxication (0-100)
Sayette, Wertz, Martin, Cohn, Perrott & Hobel (2003)	- heavy smokers [HS] vs. tobacco chippers [TC]) - deprived for 7hrs. vs. minimally deprived - smoking opportunity	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- demographic information - smoking history and patterns - current interest in quitting	- self-reported urge ratings (0-100) - Facial coding: facial expressions associated with positive and negative affect - Facial coding: facial expressions posited to be associated with appetitive motivation or suppressed affect
	- latency interval of 15s, 30s and 60s	- smoking cue: participants own lit cigarette, lighter, ashtray - control cue: electrical tape	- demographic information - smoking history and patterns - current interest in quitting	- self-reported urge ratings (0-100) - Facial coding: facial expressions associated with positive and negative affect - Facial coding: facial expressions posited to be associated with appetitive motivation or suppressed affect
Shadel, Niaura, Abrams, et al. (1998)	- cue exposure 7 days before quitting - follow ups: 7, 14 30 days after quitting	- 3 audiotaped scripts that depicted neutral, positive and negative valenced situations - 2 scripts contained smoking cues	-	- smoking urge (1-11) - Positive affect/negative affect Scale (PANAS) - Physiological measures: - heart rate - mean arterial pressure
Shadel, Niaura, Abrams (2004)	- 12h deprivation vs. 1h deprivation	- active in vivo smoking cue: participants own lit cigarette, lighter, ashtray - control stimulus: pencil	- Fagerstroem Test of Nicotine Dependence (FTND)	- think aloud in an unstructured way - visual analog scale (1-10) on craving
Shadel, Niaura & Abrams (2001a)	- 12h deprivation vs. 1h deprivation	- active in vivo cue: participants own lit cigarette, lighter, ashtray - active video cue: tape of lit cigarette, lighter, ashtray - neutral video stimulus: a pencil beeing sharpend	- Fagerstroem Test of Nicotine Dependence (FTND)	- visual analog scale (1-10)
Thewissen, van der Meijden, Havermans, van den Hout & Jansen (2008)	- low vs. high smoking relevant room - being able to smoke vs. not being able to smoke	- low smoking-relevant room (office, scent of perfume) - high smoking-relevant room (bar, scent of alcohol and fresh smoke) - smoking cues: participants own cigarettes, lighter and ashtray	- Fagerstroem Test of Nicotine Dependence (FTND)	- visual analog scale (0-100) for - valence of the room - subjective arousal - urge to smoke - reference to a smoking context - perceived control of smoking - 5. expectation of availability to smoke

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Tiffany, Cox & Elash (2000)	- placebo condition vs. nicotine patch condition	- imagery – cigarette - imagery - neutral - in vivo – cigarette - in vivo – neutral	- Questionnaire of Smoking Urges (QSU) - Mood Form - Smoking History Form - Reasons for Smoking Questionnaire - Withdrawal Symptoms Checklist	- 11-item craving measure - Brief Questionnaire of Smoking Urges (BQSU) - scene vividness (imagery trials) (0-100) - how careful they observed & thought about the scene (in vivo trials) (0-100) - overall positive and negative affect during the trial (0-100) - heart rate - skin conductance
Tiffany & Drobes (1990)		- smoking cues: 4 smoking urge scripts (2 negative, 2 positive emotional content) - neutral stimuli: 4 scripts without smoking urge (2 negative, 2 positive emotional content) - 2 neutral affect scripts	- smoking history form - Reasons for Smoking Questionnaire (RFS) - Affect Intensity Measure (AIM) - Questionnaire Upon Mental Imagery (QMI) - Mood Form	- intensity of maximum urge and craving (0-100) - vividness of their image (0-100)
Tiffany & Hakenewerth (1991)		- smoking cues: 2 audiotaped imagery with explicit descriptions of smoking urge situation (urge scripts) - neutral stimuli: 2 audiotaped imagery with devoid of explicit urge content (neutral scripts)	- smoking history form - Reasons for Smoking Questionnaire (RFS) - Affect Intensity Measure (AIM) - Questionnaire Upon Mental Imagery (QMI)	- self reported urge (0-100) - vividness of their image (0-100) - heart rate - skin conductance - finger temperature
Tong, Bovbjerg & Erblich (2007)		- 24 high-resolution videos compatible for MRI environment, - smoking cues: 12 videos containing cigarette smoking scenes (e.g., lighting up) - neutral stimuli: 12 videos containing neutral scenes (e.g., reading a book)	- demographic questionnaire - smoking history questionnaire - Fagerstroem Test of Nicotine Dependence (FTND) - Minnesota Nicotine Withdrawal Questionnaire	- heart rate - blood pressure - skin conductance - skin temperature - self-reported craving (0–100)
Warthen & Tiffany (2009)	- cue reactivity ecological momentary assessment procedure (CREMA) for laboratory and naturalistic settings	- smoking photographic cues: 20 smoking photographs of smoking-related stimuli (e.g. burning cigarettes) - neutral photographic stimuli: 20 non-smoking photographs of everyday activities and objects (e.g. persons talking) - smoking imagery cues: sets of 20 sentences describing smoking relevant scenarios - neutral imagery stimuli: sets of 20 neutral scenarios	- Questionnaire of Smoking Urges (QSU) - Mood Form - Smoking History Form (SHF) - Fagerstroem Test for Nicotine Dependence - Nicotine Addiction Taxon Scale	- real time assessment through personal digital assessments (PDA) - four-item subscale of the Questionnaire of Smoking Urges - Single-item measures (1-5) to assess - positive mood - negative mood and - validity checks

References	Additional information	Cues/presentation mode	Pre-questionnaires	Assessment instruments
Waters, Shiffman, Sayette, Paty, Gwaltney & Balabanis (2004)	- high-dose nicotine (35 mg) vs. placebo patch	- smoking cues: participants own lit cigarette, lighter, ashtray - control stimulus: electrical tape	- Fagerstroem Test of Nicotine Dependence (FTND) - Nicotine Dependence Syndrome Scale - real time assessment through personal digital assessments (PDA) - monitor urges and smoking using	- cue reacitivity task (CR) - reaction time task (RT) - self reported urge (0-100)
Wertz & Sayette (2001b)	- smoking conditions: yes vs. no vs. maybe - emotional stroop task *(144 stimuli)*	- 9 smoking words - 9 matching words - 18 distracter words - each word in 4 colors (red, yellow, green and blue	- smoking information form	- self-reported urge (0-100) - Positive affect/negative affect Scale (PANAS) - Emotional Stroop task
Wilson, Sayette, Delgado & Fiez (2005)	- smoking expectancy: being able to smoke during a break vs. not being able to smoke for 2h	- neutral related cues: e.g., roll of tape, golfball - smoking-related stimuli: a cigarette	-	- self reported urge (0-100) - functional magnetic resonance imaging (fMRI)

Assessment instruments

Within the cue reactivity paradigm, responses to drug-related cues can be indexed by both (1) self-report and (2) non-verbal measures (for a review of theoretical and methodological issues in the measurement of drug craving, see Sayette, Shiffman, Tiffany, Niaura, Martin, & Shadel, 2000). Self-report measures concern craving (e.g., Tiffany, Cox, & Elash, 2000), mood and feelings of cue-induced high (e.g., Droungas, Ehrman, Childress, & O'Brien, 1995). Non-verbal measures typically involve (a) reinforcement "proxies", (b) drug self-administration, (c) psychophysiological responding, (d) neurobiological responding, (e) cognitive processing and (f) expressive behavior (Sayette et al., 2000). These non-verbal measures are not specific to craving but, under certain conditions, associated with craving behavior. For an overview of cue reactivity assessment instruments see Table 7.

Table 7

Cue reactivity and assessment instruments

Cue reactivity	Cue reactivity assessment instruments (examples)
Self-reported	
Urge to smoke/craving	Single item rating scales (e.g. VAS)
	Multidimensional assessment (e.g. QSU)
	Drug Related States Questionnaire (DRSQ)
	Magnitude Estimation (ME)
Mood/state of affect	Multidimensional mood scale (MDBF)
	Positive affect/negative affect Scale (PANAS)
	Mood Questionnaire (MQ)
	Mood adjective check list (MACL)
	Self-Assessment Manikin (SAM)
	Brief Mood Introspection Scale (BMIS)

Table 7 – *conduction* -

Cue reactivity and assessment instruments

Cue reactivity	Cue reactivity assessment instruments
Physiological reactions	
Systolic/diastolic blood pressure	Radial artery tonometry pressure sensor
Heart rate	Electroencephalogram (ECG)
Skin conductance	Fingertip skin conductance sensor Pulsed
Skin temperature	Photo-thermal radiometry (PPTR)
Salivation	Recording of swallowing events using electromyography
Behavioral/emotional reactions	
Facial expressions	Facial Action Coding System (FACS)
	Facial Electromyography (fEMG)
Startle reflex	Reflexive eyeblink (representing positive and negative emotional responding)
Drug self administration	Drug use behavior: amount of cigarettes consumed, latency to smoke/first puff, smoking puff frequency, puff duration, strength volume and interpuff interval
Cognitive processing	
Cognitive resource allocation	Divided attention task such as reaction time (RT) paradigm; explicit memory task such as cued recall
Drug reinforcement proxies/	
Motivation to engage in drug	Behavioral choice task
	Emotional Stroop task
Neurobiological responding	
Brain structures	Magnetic resonance imaging (MRI)
Brain processes	Positron emission tomography (PET)

There is no »gold standard« measure of drug craving (Sayette et al., 2000). Therefore it is important to determine the optimal measure(s) for specific research or a given aim of a study. Sayette et al. (2000) provide recommendations or guidelines for selecting appropriate measures.

Non-verbal measures. Non-verbal measures are generally less vulnerable to the response biases or reactivity created by self-report measures, but they also have limitations. Physiological responding, for example, such as heart rate and skin conductance are less influenced by cue manipulation with effects sizes that can be considered small (Carter & Tiffany, 1999). This may be due to the fact that physiological indices of cue reactivity are unspecific and ambiguous and derive from general measures of physiological responses. Only a small percentage of these responses may be reflective of cue manipulations. In this sense, physiological measures of cue reactivity contain »a great deal of noise, as these physiological processes are most probably engaged in many functions unrelated to manipulations of drug cues« (Carter & Tiffany, 1999, p. 334). This concern with specificity is also problematic in other non-verbal measures, in which changes in these measures often are due to factors other than craving. Most importantly, how these non-verbal measures relate to self-report measures of craving depends entirely on one's theory of craving (Sayette et al., 2000).

Self-report measures. Self report measures can be classified into three main types (Lowman et al., 2000): (1) single-item measures (e.g., visual analog scales [VAS]), (2) questionnaires involving multidimensional assessment (e.g., the Questionnaire of Smoking Urges [QSU], Tiffany & Drobes, 1991) and (3) questionnaires representing medical or psychiatric symptomatology, assumed to be associated with craving. Self-report measures, which exhibit strong cue-specificity with large effect sizes (Cohen, 1988) »may have a natural advantage over physiological responses in the evaluation of cue manipulations« (Carter & Tiffany, 1999, p. 333). They provide »the richest information and [remain] the most popular measure of urge responding« (Wertz & Sayette, 2001a, p. 3). They are practically useful, have external validity in experimental settings and a high degree of face validity.

Limitations of self-reports are that one must be aware that it is not a one-to-one description of the individuals' craving state, but an interaction of different psychological influences.

Single-item measures have a low reliability and a lack of content validity in comparison to multi-item rating scales (Sayette et al., 2000; Tiffany, Carter & Singleton, 2000, Tiffany & Drobes, 1991). By using multi-item rating scales, the reliability and validity can be increased. Multi-item measures, however, may affect craving (Sayette et al., 2000). To assess immediate responses to craving manipulation without interfering with changes of craving it is important to reduce the time that is needed completing a questionnaire. A compromise will need to be made between practicability, less interference with the assessed construct and a maximum of reliability and validity of the measures.

Cue reactivity studies consider changes in urge ratings from baseline to cue and stimulus exposure a »key measure of craving« (Sayette et al., 2001, p. 1420). This may lead to another challenge. A nicotine-deprived state at the beginning of the laboratory session can lead to high baseline levels (Sayette et al., 2000). This may lead to an inadequate range on the scale to accurately quantify potential increases in urges elicited by cue exposure.

One approach to overcome ceiling effects is to use magnitude estimation (ME). Within this approach, smokers rate their current urges relative to baseline levels. At baseline, participants imagine their urge and assign it with a number (e.g., 20). This number will then serve as a comparison for all subsequent ratings. Throughout the study, participants rate their perceived magnitude of craving in relation to this initial value. Critical features of ME are, that (1) a baseline rating of zero is not possible and that (2) ME does not have a maximum end point. As a final point, (3) smokers may enter a study with varying levels of craving. In consequence, subsequent values are based on comparison to different initial levels. This may cause problems for assessing individual differences (Green, Shaffer & Gilmore, 1993).

To account for initial craving levels and increases in craving during cue exposure Sayette et al. (2001) proposed an even more improved method, the composite score. In this analysis »initial pre-cue exposure baseline urge rating scale scores are multiplied by a subsequent cue exposure magnitude score« (p. 1420).

Despite the limitations of self-reports, they provide important information about an individuals craving state and should therefore continue to play a major role in the measurement of craving (Tiffany, Carter & Singleton, 2000; Sayette et al., 2000).

Classification of cues and cue presentation mode

Classification of cues. A wide variety of drug-related cues or neutral stimuli have been used to elicit cue reactivity (see Table 6). Drummond (2000) appoints four main categories for a preliminary classification of types of cues: (1) exteroceptive; (2) interoceptive; (3) temporal, and (4) cue relationships. In addition, to amend this classification, (5) standard vs. idiographic cues should be taken into account.

Exteroceptive cues refer to visual or olfactory cues, i.e., sight, smell, and taste, whereas interoceptive cues include, for example, moods, cognitions, and priming doses of the drug (Davidson, Tiffany, Johnston, Flury, & Li, 2003).

Regarding temporal relationships it is expected that cues occurring more proximally to drug use (e.g., cigarette smoking) will be more salient, and produce greater reactivity, than more distal cues. Therefore, cues most proximal to drug administration (e.g., viewing or handling a lit cigarette, ashtray, or lighter) are most often chosen. Moreover, they are »presumably ubiquitous across the smoking experience« (Conklin et al., 2008) and more readily observable. Distal cues, however, involve stimuli that have been repeatedly been present throughout drug use but not directly linked to drug use behavior (e.g., environments associated with smoking or/and other people smoking; Conklin 2006). Nevertheless, Conklin et al. (2008) could demonstrate, that distal cues alone are capable, similar to proximal cues, to evoke strong subjective responses.

It is likely that there exist complex (inter-)relationships between cues (Drummond, 2000). One cue, for example, could have salience for an individual only in the present of other cues. This co-occurrence of cues is described as a *cue cluster*, in which each cue is necessary but not sufficient for drug use. The relationship between cues can also be characterized as a *cue chain* or a cue cascade. In a cue chain cues occur sequentially, with

each cue increasing the salience of the subsequent cue. In a cascade process each cue increases the likelihood of encountering, and the salience of, the next cue.

Idiographic cues are related to high-risk or relapse situations drawn from an ideographically defined situation. Opponent to this are standardized cues (e.g. affectively valenced standardized scripts depicting situations generally associated with relapse; Niaura et al., 1998).

Cue presentation mode. Studies aimed at eliciting cue responses in people addicted to drugs have been using various modes of cue presentations (e.g., Cater & Tiffany, 1999; Sayette et al., 2001). These cue presentation modes range from (a) in vivo (e.g., watching other people smoke), (b) imaginal/in sensu (e.g., imagining oneself or other people smoke or smoking scenes), (c) audio (e.g., hearing a description of smoking), (d) scripts (e.g., of smoking relapse situations) and less commonly (e) video (e.g., seeing a film of other people smoking), and/or (f) pictorial (e.g., viewing pictures of other people smoking) to, recently, (g) computer based/virtual reality modes. For an overview of presentation modes of smoking cues see Table 6.

Various laboratory-based cue reactivity studies have revealed that, regardless of presentation mode, individuals addicted to drugs show robust subjective responding and moderate physiological reactivity to drug-related cues (for an overview, see Carter & Tiffany, 1999). Besides, in vivo cues are being most effective in producing cue reactivity (Niaura et al., 1998). One conclusion of a meta-analysis of over 40 cue reactivity studies by Carter and Tiffany (1999) is that there is »no further need to conduct basic research to determine if addicts react to drug-relevant stimuli [...] research investigating factors that may modulate these effects is needed [...]« (p. 336).

Factors modulating craving

Research has shown that a variety of factors influence cue reactivity and craving, respectively. These factors can be clustered into three categories (Drummond, 2000): (1) cue characteristics, (2) individual, and (3) contextual factors (see Figure 3).

Cue characteristics. Cue characteristics determine both the intensity and the valence of cue reactivity (Lowman et al., 2000). In vivo cues have been found to be more salient than in sensu or imaginal cues, whereas interoceptive cues tend to have a greater salience then imaginal or visual cues (Drummond, 2000; see »classification of cues and cue presentation mode«, p. 40).

Individual factors. Personality traits, such as introversion, neuroticism, and impulsivity are associated with increased cue reactivity and craving, respectively. Dependence and cue reactivity tend to be positively correlated (e.g., Glautier & Drummond, 1994; Thomas, Drobes & Deas, 2005; McClernon, Kozink, & Rose, 2008). Responses to smoking cues are more pronounced in females (Field & Duka, 2004).

According to Verheul et al. (1999), personality is the most important factor affecting the intensity and frequency of craving, respectively. This is in accordance with the findings that specific personality dimensions, e.g., reward sensitivity (Glautier, Bankart, & Williams, 2000; Kambouropoulos, & Staiger, 2009) Behavioral Activation System (BAS) sensitivity (Zisserson & Palfai, 2007), display significant predictors of cue reactivity. In respect to trait reward sensitivity, Kambouropoulos, and Staiger (2009) focus on reinforcement expectancies also described as cue reward salience.

Urgency, a personality trait closely related to impulsive behavior, has been found to predict craving for cigarettes (Billieux, Van der Linden, & Ceschi, 2007). Recent findings suggest that impulsivity accounts for an increased reactivity to environmental smoking cues (Doran, Spring & McChargue, 2007). Impulsivity predicts greater cue reactivity in smokers in terms of mean arterial pressure, however, not concerning heart rate and self-reported craving (Doran, McChargue, & Spring, 2008). These findings may be explained by a lack of conscious awareness of internal states of impulsive smokers and therefore craving might not be reflected in self-report measures.

Contextual factors. Finally, contextual factors play a major role in modulating cue-elicited craving. It appears plausible to assume that this category refers to environmental factors (e.g., surrounding that allows smoking). My reading of contextual factors, however, is a much broader definition including cognitive factors, e.g. context-specific expectancies (e.g. Thewissen et al., 2008) and availability or expectancies regarding the opportunity to use a drug (Wilson et al., 2005), self-efficacy (e.g., Gwaltney, Shiffman, Sayette, 2005; Niaura, 2000) or cognitive vigilance and resistance to a drug (e.g., Lowman et al., 2000). Craving may also lead to attentional biases (e.g. subtle cues for drug use become more salient; Gross, Jarvik, & Rosenblatt, 1993), which predicts smoking relapse (Waters et al., 2003). Information processing (e.g. smoking becomes more attractive when craving) may partly mediate the relation between urge and substance use (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Sayette, 2004).

Overlaps between factors. The question arises whether individual factors only represent traits, or, moreover states. Deprivation, for example, affects cue reactivity in a way that increasing deprivation results in greater cue reactivity (e.g., Payne et al, 1996; Sayette & Hufford, 1994). If individual factors would subsume states and, deprivation would be categorized as a state of an individual (being deprived of tobacco or nicotine) then deprivation would be classified as an individual factor. In contrast, deprivation could be labeled as contextual, reflecting a time span where e.g. cigarettes have not been available. This example shows that there are overlaps between categories that should be taken into account (see Figure 3).

Furthermore, smoking status affects an individual's self-reported craving. Being confronted with a smoking cue, nicotine dependent smokers with no recent intention to quit reported craving ratings about twice as strong compared to abstinence seeking smokers (Sayette et al., 2001; Wertz & Sayette, 2001b). At first sight, smoking status (whether an individual smokes or not) obviously seems to be an individual factor. But, in a broader sense, it can also be defined as a contextual factor, representing a specific form of availability (see Figure 3).

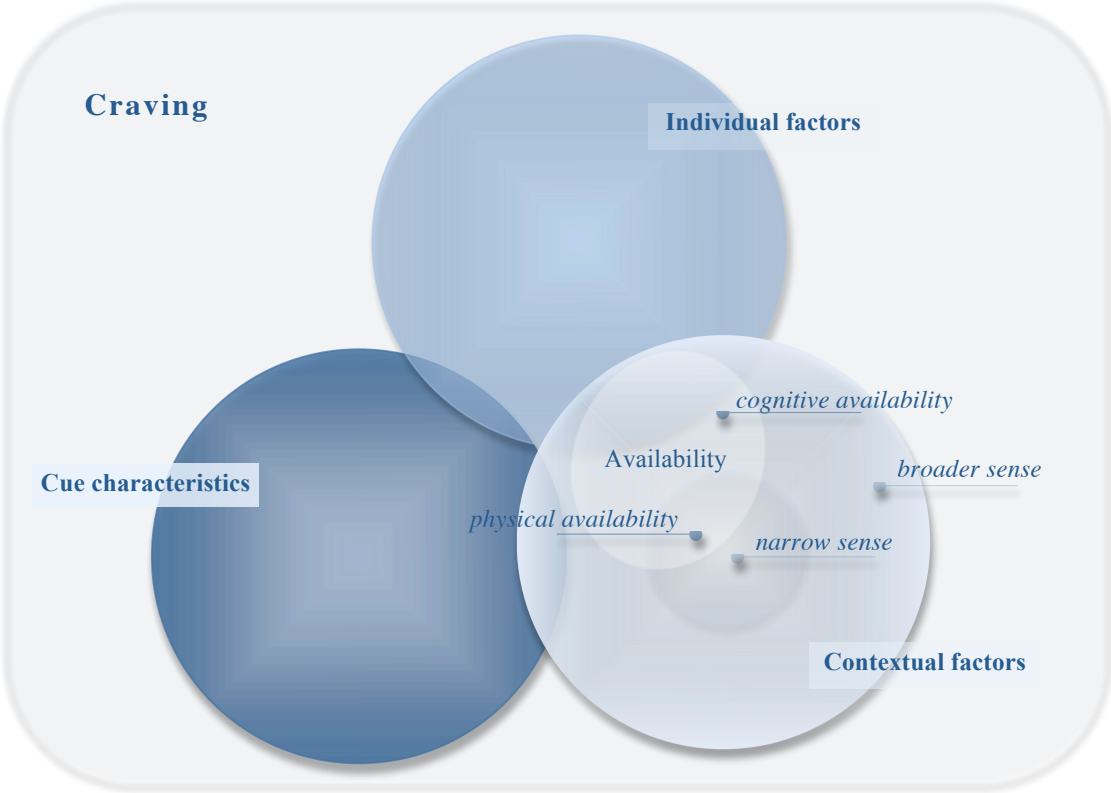

Figure 3. Factors modulating craving: position of availability.

Availability

Various terms have been used to characterize availability, described as the »belief that the drug is available for use« (Juliano & Brandon, 1998, p. 46) or »whether or not a drug is available for use (Wertz & Sayette, 2001a, p. 3). Juliano and Brandon (1998) use the terms *drug availability*, *perceived availability* and *opportunity to use the drug* equivalently. Wertz and Sayette (2001a), however, propose a clear definition with *perceived drug use opportunity* reflecting (1) drug availability, (2) intention to use the drug, and (3) the anticipation of drug effects. The definition of Wertz and Sayette recognizes conditions, in which a drug is physical available without a perceived opportunity to use it. In a situation like this (e.g., smoking cessation) the drug itself may not signal imminent use.

Physical and cognitive availability. Therefore, it seems reasonable, that availability itself can be seen in the narrow sense of »physical availability« (e.g., a cigarette is physically there, in a surrounding that allows smoking) and in the broader sense of »cognitive availability« (e.g., restrain from smoking during smoking cessation).

Within the cognitive processing model, Tiffany (1990; Tiffany & Conklin, 2000; see »models of craving«, p. 12) describes two types of situations in which craving might occur. These two situations are in line with the two forms of availability mentioned above. (1) *Abstinence-seeking* situations, in which the drug is technically available, but individuals do not intend to use it because they are trying to quit (»lack of cognitive availability«); (2) *abstinence-avoidance situations,* in which the drug is physically not available, but individuals try to get and use it (»lack of physical availability«).

Theories of learning have been utilized to explain availability and predict the influence of this phenomenon on cue reactivity (Juliano & Brandon, 1998). Within these theories (1) the belief itself becomes a conditioned stimuli that elicits drug craving and other conditioned responses even in the absence of other cues, (2) availability moderates conditioned responses to a drug cue, e.g., an environmental stimulus (in this view availability serves as a discriminative stimuli or »occasion setter«), (3) availability moderates conditioned responses in terms of suppressing the conditioned response until unconditioned stimulus presentation (inhibition of delay; Pavlov, 1927), (4) the belief that the drug is not available (lack of perceived drug availability) becomes a conditioned stimulus that elicits drug withdrawal (see Wikler, 1973), (5) restrictions, e.g., the unavailability of a drug, lead to motivation to regain freedom, to an increased motivation to smoke (psychological reaction theory, Brehm & Brehm, 1981).

The first three theories predict that perceived drug use availability elicits greater cue reactivity (e.g., craving). In contrast, the last two theories support the assumption that a lack of perceived drug use availability enhances cue reactivity.

Findings of Juliano and Brandon (1998) support the prediction of the first three theories. Only participants who expected to be able to smoke after the cue exposure session reported slightly higher cravings being exposed to smoking cues compared to control stimulus. Recent studies sustain this prediction (e.g. Thewissen et al., 2008).

Wertz and Sayette (2001a) reviewed several studies concerning the importance of perceived drug use opportunity. Even though most of these studies have not addressed this factor explicitly, it is varied in these studies in different ways. These different groups of studies show different facets or manipulations of perceived drug use opportunity: (1) non-clinical samples of drug users intending to continue drug use following the experimental session (perceived drug use opportunity is considered high), (2) clinical samples of individuals in abstinence seeking programs (perceived drug use opportunity is considered absent), (3) samples including both individuals addicted to drugs and healthy controls, e.g., social drinkers believing that they could use the drug following cue exposure, (4) and addicted and social drinkers being prohibited to use the drug during experimental procedure and (5) studies including the within-session manipulation of perceived drug use opportunity.

The main conclusion of this review (Wertz & Sayette, 2001a) is that individuals addicted to drugs report stronger craving when they perceive their drug as being available for use.

Classification of availability

Local and distal availability. The classification proposed by Wertz and Sayette (2001a) distinguishes between *local* and *distal* availability (Carter & Tiffany, 2000, 2001; Wertz & Sayette, 2001a). Local availability refers to drug use opportunity and access to the drug during the experimental session (see »cue availability paradigm«, p. 46). In contrast, distal availably refers to drug use opportunity and access to the drug following the experiment session (see Figure 4).

Cue availability paradigm. To evaluate the impact of local drug availability on a wide range of cue reactivity measures, Carter and Tiffany (2001) enhanced and expanded the classical procedure of cue reactivity (see »cue reactivity«, p. 17). This cue availability paradigm equals the cue reactivity paradigm with the addition that, on a trial-by-trial basis,

drug availability is manipulated. At the beginning of each trial, participants are informed about the probability of drug use (e.g., 0%, 50% or 100% probability). With this new procedure, Carter and Tiffany (2001) verified their assumption that smokers' cue-elicited cigarette craving increased with increased availability of cigarettes. These effects were apparent in all three reactions to cues (see »cue reactivity«, p. 17): (1) self-report, (2) autonomic responding and (3) drug seeking behavior. Furthermore, smokers reported stronger negative affect during presentations of smoking cues relative to neutral stimuli when the probability of drug use was zero.

As demonstrated, availability can be manipulated (1) experimentally, either (a) within a session (local availability, see »cue availability paradigm«, p. 46) or (b) with the prospect of being able to smoke at the end of the experiment (distal availability, for an overview, see Wertz & Sayette, 2001a). Besides, availability can be varied (2) through smoking status (smoking vs. smoking cessation). The combination of physical and cognitive availability with the aforementioned facets results in a variety of potential manipulations of availability (see Figure 4).

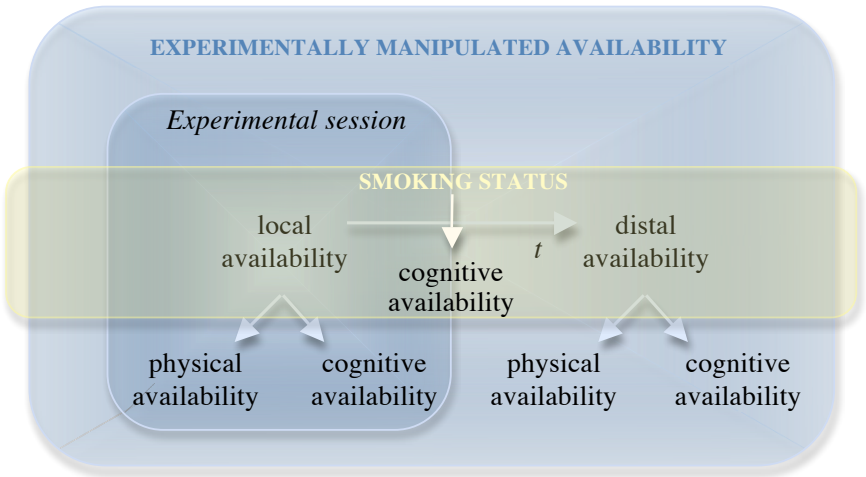

Figure 4. Manipulation of availability.

Study rational

Numerous studies (Juliano & Brandon, 1998; Cater & Tiffany, 2001; Wertz & Sayette, 2001a) provide evidence that cigarette availability has an announced impact on craving, with availability enhancing craving (see »factors modulating craving«, p. 42). Therefore, availability or perceived drug use opportunity is a targeting field of research, on which the present study will focus on.

Juliano and Brandon (1998) proposed that perceived availability is influenced by internal demands, such as attempts to quit smoking. For that reason »future studies should address the impact of perceived availability on individuals attempting to quit smoking« (p. 51).

Taking the findings of cue reactivity and cue availability studies into account (see »cue reactivity«, p. 17; »factors modulating craving«, p. 42) it is predicted that (1) a high expectation of perceived drug use opportunity will enhance the magnitude of craving whereas (2) a low or the absence of perceived drug use opportunity will reduce the magnitude of craving (see Figure 5).

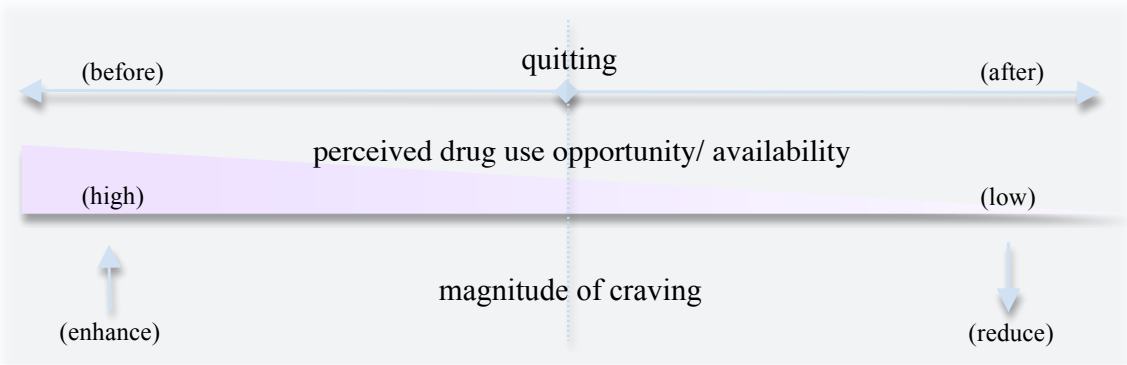

Figure 5. Assumed link between smoking status, availability and craving.

These conclusions will explain the apparently counterintuitive observations of Shiffman et al. (1997) that cravings prior to quitting tended to be higher than those experienced after quitting.

To »require greater sensitivity to the meaning of craving at each period« (Wertz & Sayette, 2001a) our chief aim is to examine changes of craving ratings before and after smoking cessation under controlled laboratory conditions.

In order to evaluate these changes we needed to induce a robust craving state. A common craving manipulation has been drug cue exposure. As mentioned above (see »cue reactivity«, p. 17), cue reactivity paradigms are used to explore the relationship between drug-related cues and the reactions of individuals addicted to drugs. Therefore, this paradigm will be implemented to test the study hypotheses.

For a better understanding, the definition of craving and cue reactivity are presented later on, once the procedure and detailed timeline of the current study are displayed (see »definition of craving, cue reactivity«, p. 75).

Hypotheses

Various cue reactivity studies have proven that individuals addicted to drugs show significant and robust reactions (cue reactivity) to cues that are associated with drugs (for an overview, see Carter & Tiffany, 1999).

Therefore we predict that nicotine dependent smokers will report the strongest cravings during smoking cue exposure at both times, pre (t_1) and subsequent (t_2) smoking cessation (hypothesis 1a) and

that the exposure to smoking cues elicits craving in nicotine dependent smokers pre (t_1) and subsequent (t_2) smoking cessation (hypothesis 1b, see Figure 6).

Moreover, we predict that nicotine dependent smokers report stronger craving ratings to smoking cues as compared to neutral stimuli pre (t_1) and subsequent (t_2) smoking cessation (hypothesis 1c, see Figure 6)

As the main hypothesis, it is assumed that nicotine dependent smokers report higher cue specific craving during a cue reactivity session preceding smoking cessation (t_1) compared to subsequent (t_2) smoking cessation (hypothesis 2: cue-specific craving, see Figure 6).

Furthermore, we assume that nicotine dependent smokers report higher overall craving ratings preceding smoking cessation (t_1) compared to subsequent (t_2) smoking cessation (hypothesis 3: overall craving, see Figure 6)

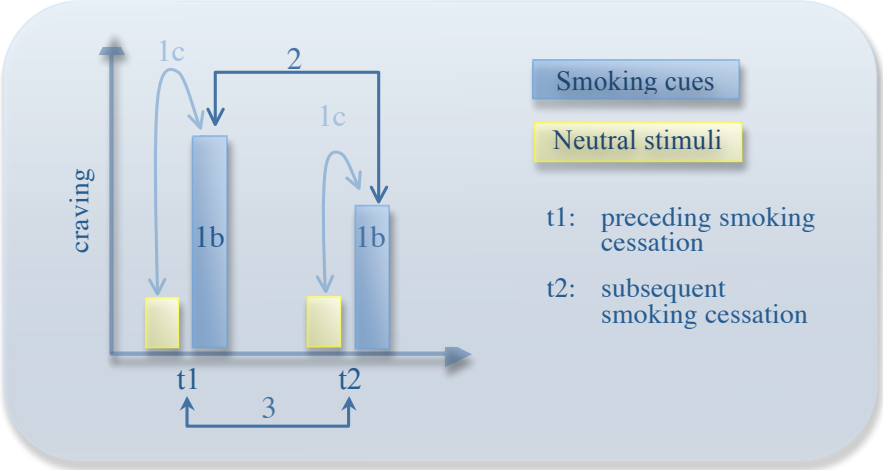

Figure 6. Hypotheses of the current study.

Besides craving ratings, mood ratings will be assessed, as a control variable, to compare the patterns of craving and mood ratings throughout the study (see »assessment instruments«, p. 60).

METHOD

Participants

With smoking being considered a »prototypical addiction«, the selected sample of the study have been nicotine dependent smokers with the intention to quit smoking and a quit attempt between two experimental sessions (session one [t_1] and session two [t_2]).

At the beginning of the year 2003 (as a new year's resolution) 71 smokers were recruited through newspaper advertisements and radio announcements to participate in two experimental and one follow-up sessions. For their participation participants were placed in a lottery, with a chance to win 250,-, 125,- or 75,- Euro if they participated in all three sessions.

Participants were considered eligible if they met the following criteria: (1) 18 years or older, (2) had been smoking at least 20 cigarettes per day, (3) for at least 18 month, (4) attempting to quit smoking, (5) had no history of drug or alcohol abuse, (6) had no major psychiatric conditions, or (7) current medical problems.

During a three-month period (January to March 2003) 60 smokers participated in the first experimental session (t_1), 47 in the second (t_2) and 42 in the follow-up session (t_3). Four participants were excluded from data analysis of session one and two as a result of a reduction in the sense of smell through common cold ($n = 3$) and of language difficulties ($n = 1$, native speaker of English). Thirteen participants dropped out after session one. Two participants attended session two but were excluded from data analysis of this session because they had smoked more then one cigarette between sessions. All 15 participants were labeled »relapsed«. An Overview of sample sizes and dropouts is shown in Figure 7.

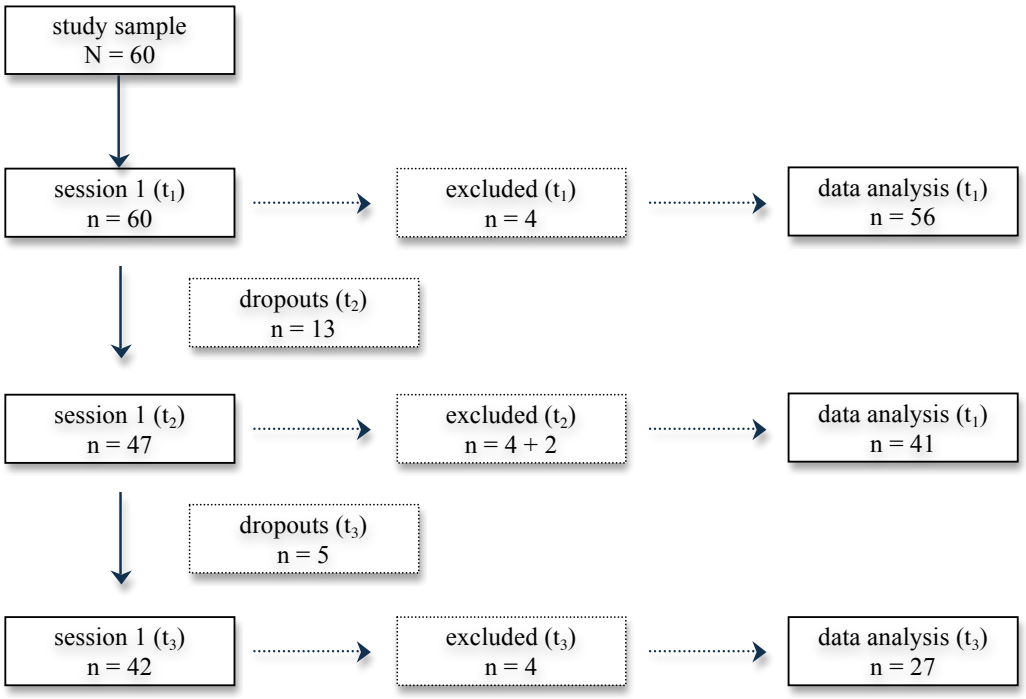

Figure 7. Overview of dropouts and sample size.

Demographic characteristics, tobacco use and nicotine dependence of participants, who participated in both experimental sessions without a relapse (n = 41) were compared with the ones that were considered »relapsed« (n = 15). No significant differences were found except for QSU-Factor 2. Participants who were considered »relapsed« reported a significant higher (M = 3.31; *SD* = 1.55) »urgent and intense desire and intention to smoke anticipating that smoking would relieve dysphoria« then those who stated abstinent (M = 2.17; *SD* = 1.14). The main characteristics of participants are summarized in Table 8.

Table 8

Demographic characteristics of participants

	N = 56						*N = 41*						*N = 15*					
	M	SD	Min	Max	N	%	M	SD	Min	Max	N	%	M	SD	Min	Max	N	%
Age	44.34	8.63	*21*	62	_	_	44.66	8.09	21	62	_	_	43.47	10.24	24	59	_	_
Sex																		
Male	_	_	_	_	*n*=33	58.9%	_	_	_	_	*n*=27	65.85%	_	_	_	_	*n*=06	60.00%
Female	_	_	_	_	*n*=23	41.1%	_	_	_	_	*n*=14	34.15%	_	_	_	_	*n*=09	40.00%
Marital status																		
Single	_	_	_	_	*n*=09	16.1%	_	_	_	_	*n*=05	12.20%	_	_	_	_	*n*=04	26.70%
Married	_	_	_	_	*n*=41	73.2%	_	_	_	_	*n*=32	78.00%	_	_	_	_	*n*=09	60.00%
Divorced/separated	_	_	_	_	*n*=06	10.7%	_	_	_	_	*n*=04	09.80%	_	_	_	_	*n*=02	13.30%
Educational attainment/ Highest degree																		
10 years of school	_	_	_	_	*n*=04	7.1%	_	_	_	_	*n*=01	02.44%	_	_	_	_	*n*=0	0%
Professional training	_	_	_	_	*n*=41	73.2%	_	_	_	_	*n*=31	75.60%	_	_	_	_	*n*=13	86.70%
College degree	_	_	_	_	*n*=11	19.7%	_	_	_	_	*n*=09	21.96%	_	_	_	_	*n*=02	13.30%
Employment status							_	_	_	_			_	_	_	_		
Employee	_	_	_	_	*n*=32	57.0%	_	_	_	_	*n*=25	60.97%	_	_	_	_	*n* = 7	46.70%
Skilled-worker	_	_	_	_	*n*=07	12.0%	_	_	_	_	*n*=05	12.20%	_	_	_	_	*n* = 2	13.30%
Self-employed	_	_	_	_	*n*=06	10.0%	_	_	_	_	*n*=03	07.32%	_	_	_	_	*n* = 3	20.00%
Student	_	_	_	_	*n*=01	1%	_	_	_	_	*n*=01	02.44%	_	_	_	_	*n* = 0	0%
Household/retired	_	_	_	_	*n*=10	17.0%	_	_	_	_	*n*=07	17.07%	_	_	_	_	*n* = 3	20.00%

Note. M=Mean, SD=standard deviation, Min/Max=Minimum and Maximum of age, sex, marital status highest degree of educational attainment and employment status for N = 56 (whole sample), N = 41 (participants who participated in both experimental sessions without a relapse), N = 15 (participants who were considered relapsed).

Readiness to quit smoking was high among all participants. On a 11-point Likert scale (0 = »not at all important/confident« to 10 = »extremely important/confident«) they averaged 9.32 (*SD* = 1.35; Min = 3, Max = 10). Whereas confidence was lower with an average of 6.20 (*SD* = 2.713; min = 0, max = 10). Reasons being most important for quitting smoking include »Ärger wegen Abhängigkeit« (»frustration concerning tobacco dependence«; 69.6%), »Angst vor zukünftigen körperlichen Beschwerden« (»fearing future medical problems«; 62.5%) bzw. »Akute gesundheitliche Gründe« (»current medical problems«; 57.1%).

At the beginning of session one 30.4% (n = 17) participants reported chronic, 10.7% (n = 6) current medical problems and 46.4% (n = 26) medical intake. For detailed information on medical conditions, medications and intentions to quit smoking, see Appendix A.

Assessed by the German-language Version of the Fagerstroem Test for Nicotine Dependence (FTND, Heatherton, Kozlowski, Frecker, & Fagerstroem, 1991; Fagerstroem Tests für Nikotinabhängigkeit, Fagerstroem & Schneider, 1989 [FTNA]) the level of nicotine dependence was rated medium to very high for most participants. Participants were asked to complete a brief questionnaire on alcohol use. A majority (80.36%; *n* = 45) reported consumption of alcohol, 19.64% (*n* = 11) stated abstinence. Detailed information on participants' tobacco and alcohol use and nicotine dependence is listed in Table 9.

Table 9

Tobacco and alcohol use and nicotine dependence

	N = 56						*N = 41*						*N = 15*					
	M	SD	Min	Max	N	%	M	SD	Min	Max	N	%	M	SD	Min	Max	N	%
Years smoking	24.89	9.899	2	42		-	24.20	10.186	2	42		-	26.80	9.12	10	38		-
Cigarettes/day	28.50	11.860	3	60		-	27.12	10.812	3	60		-	32.27	14.06	19	60		-
Smoking days/month	29.84	.708	26	30		-	29.88	.557	27	30		-	29.73	1.03	26	30		-
quit attempts	4.41	5.500	0	35		-	3.90	3.859	0	20		-	5.80	8.57	0	35		-
CO # 1 (ppm)	36.11	13.664	9	65		-						-						-
CO # 2 (ppm)	30.89	11.197	7	54		-						-						-
Type of cigarette																		
(Ultra) Lights	-	-	-	-	17	30.4	-	-	-	-	12	29.30	-	-	-	-	5	33.30
Medium	-	-	-	-	5	8.9	-	-	-	-	4	9.80	-	-	-	-	1	6.70
Normal	-	-	-	-	30	53.6	-	-	-	-	22	53.70	-	-	-	-	8	53.30
Tobacco	-	-	-	-	4	7.1	-	-	-	-	3	7.30	-	-	-	-	1	6.70
Nicotine dependence																		
Very low	-	-	-	-	5	8.9	-	-	-	-	4	9.70	-	-	-	-	1	6.70
Low	-	-	-	-	15	26.8	-	-	-	-	13	31.70	-	-	-	-	2	13.30
Medium	-	-	-	-	11	19.6	-	-	-	-	9	22.00	-	-	-	-	2	13.30
High	-	-	-	-	20	35.7	-	-	-	-	12	29.30	-	-	-	-	8	53.40
Very high					5	9.0					3	7.30					2	13.30
Readiness to change	9.32	1.35	3	10	56		9.17	1.50	3	10	41		9.73	.70	8	10	15	
Confidence	6.20	2.71	0	10	56		6.24	2.71	0	10	41		6.07	2.82	1	10	15	
Alcohol/last month (g)	529.01	704.51	-	-	45	-	527.38	722.21	-	-	33	-	533.50	684.09	-	-	12	-
Alcohol/drink day (g)	61.73	41.00	-	-	45	-	61.58	45.34	-	-	33	-	62.16	38.33	-	-	12	-
QFI (g)	17.63	23.48	-	-	45	-	18.13	24.25	-	-	32	-	17.78	22.80	-	-	12	-

Note. M=Mean, SD=standard deviation, Min/Max=Minimum and Maximum for number of years smoking, of cigarettes smoked per day, of days smoked per month, of previous quit attempts, carbon monoxide level at onset of study (CO #1) and after smoking cue exposure (CO #2); type of cigarette smoked and nicotine dependence assessed by Fagerstoem Test für Nikotinabhängigkeit (FTNA), Importance and Confidence, Mean and SD for gram of pure alcohol drank within the last 30 days prior to first session, gram of alcohol drank on a drinking day and Quantity-Frequency Index (QFI) for alcohol use (Bühringer et al., 2000) N = 56 (whole sample), N = 41 (participants who participated in both experimental sessions without a relapse), N = 15 (participants who were considered relapsed).

Experimental design

The main goal of the study was to examine the influence of smoking status (smoking vs. smoking cessation) on self-reported urge under controlled laboratory conditions. Each participant attended two experimental sessions (t_1 and t_2) two to three days pre and subsequent a scheduled »last day of smoking« [LDS] and a follow-up session (t_3). Figure 8 displays the schematic timeline of the study.

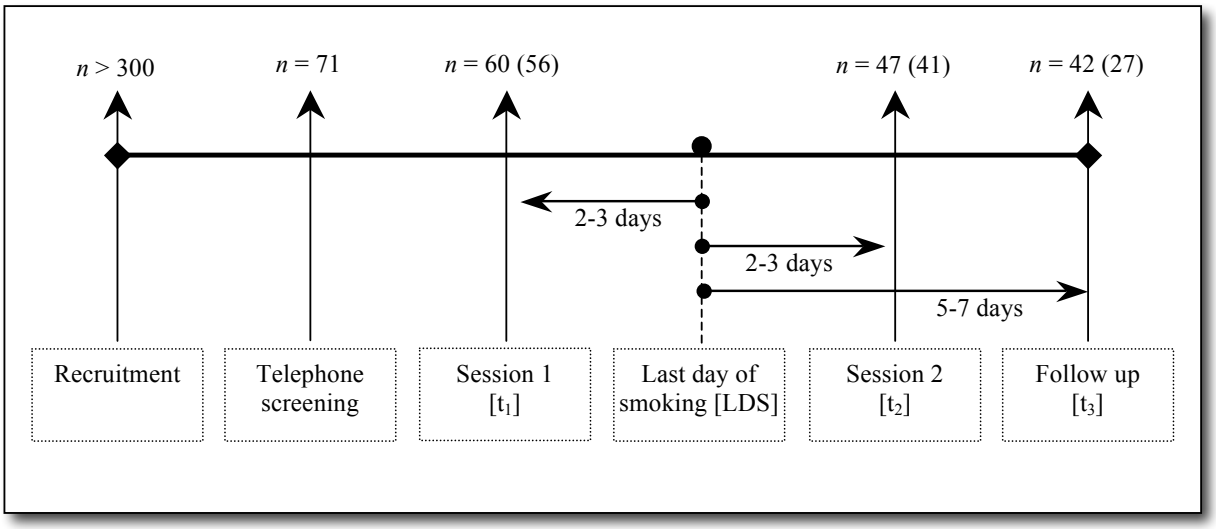

Figure 8. Schematic timeline of study.

Within each laboratory session a potent smoking cue exposure manipulation was used to elicit craving (»cue reactivity paradigm«, p. 18). All participants were exposed to smoking cues and neutral stimuli. Craving strength was varied between the sessions by manipulating cue-availability (»manipulation of availability«, p. 58). Cue reactivity was assessed through craving response measures (»assessment instruments«, p. 60).

Cues, stimulus and presentation mode

Considering the impact of cue characteristics (»factors modulating craving«, p. 42) and their presentation mode (»classification of cues and cue presentation mode«, p. 40) we chose cues being considered the most powerful or representative of relapse (Shadel et al., 1998). The sight, smell, and touch of a burning cigarette, a new unwrapped pack of participants' own cigarettes (or tobacco), their own lighter (or matches), as well as an ashtray served as smoking cues to increase magnitude of reactivity. These cues can be considered idiographic (participants *own* cigarettes/tobacco and lighter/matches), exteroceptive (sight and smell of the burning cigarette) and most proximal (viewing or handling a lit cigarette). Cues were presented in an in vivo presentation mode.

A bottle of water and a bottle opener served as the neutral stimulus, as being unlikely associated with the smoking cue. The smoking cue and the neutral stimulus were presented in a black cardboard box.

Consistent with the majority of cue exposure studies (Carter & Tiffany, 1999, Sayette, Martin, Wertz, Perrott & Peters, 2005) we decided against counterbalancing the order of cues. The main concern was that nicotine-deprived smokers being pre-exposed to smoking cues would still be experiencing significant urges during the following neutral stimulus exposure conditions. This would lead to difficulties in interpreting effects of any subsequent neutral stimuli exposure. Therefore, the order of presentation was fixed, with the neutral stimulus being presented before the smoking cue for all participants. This way, responses to neutral stimuli could not be affected by any carryover effect. We judged that concerns about carryover effects outweighed concerns resulting from not counterbalancing presentation of neutral stimulus and smoking cue.

Manipulation of availability

The perceived availability in the present study was manipulated (1) experimentally and (2) through smoking status. According to Figure 4 availability can be classified as followed:

The manipulation of the *experimental availability* is identical at both sessions due to the experimental design, with a

- local physical availability: participants own cigarettes/tobacco and lighter/matches are physically present within the sessions
- distal physical availability: participants own cigarettes/tobacco and lighter/matches are physically present following the sessions
- local cognitive unavailability: participant gets the instruction not to take a puff during smoking cue exposure within the sessions.

The *availability manipulated through smoking status (smoking vs. smoking cessation)*, on the other hand will certainly vary among session one an two, because of a quit attempt in between sessions.

At session one it can be described as

- local cognitive availability: the participant has the intention to quit smoking but did not quit yet,
- distal cognitive availability: the participant has the intention to quit smoking but did not quit yet, so that smoking after the session would be possible,

whereas within session two it can be displayed as

- local cognitive unavailability: the participant has quit smoking, therefore the cigarette does not signal imminent use
- distal cognitive unavailability: the participant has quit smoking, therefore the cigarette does not signal imminent use.

For an overview of the classification of availability in the present study see Table 10.

Table 10

Classification of availability in the present study

	session one (t_1)		session two (t_2)	
	experimental	smoking status: smoking	experimental	smoking status: smoking cessation
local				
physical	availability	---	availability	---
cognitive	unavailability	availability	unavailability	unavailability
distal				
physical	availability	---	availability	---
cognitive	---	availability	---	unavailability
definition	high expectation of perceived drug use opportunity[1]		lack of perceived drug use opportunity[1] abstinence seeking[2]	

Note. Experimental = experimentally manipulated availability; smoking status = availability manipulated through smoking status (smoking vs. smoking cessation); local/distal = local/distal availability; physical/cognitive = physical/cognitive availability

[1] Wertz and Sayette (2001a)

[2] Tiffany (1990)

In terms of Wertz and Sayette (2001a) participants will have a lack of perceived drug use opportunity within session two. The cigarette is physical available, but does not signal imminent use because of smoking cessation. With regard to Tiffany (1990) participants are »abstinence-seeking« (»availability«, p. 44).

Assessment instruments

Within both sessions cue-specific craving was assessed by using two measures

- a single-item rating scale (VAS) and
- ME.

As a control variable, affective valence was assessed through

- Multidimensional Mood Questionnaire (MDBF)

All three measures were combined into one questionnaire battery termed »craving and mood«, each form marked with a number on the first page ranging from one to six corresponding to the six assessments within one session (see Appendix A).

In reference to Leight and Warren (1988) the maximum number of assessments during one session is determined by the task, but being concerned about fatigue and loss of sensitivity, it should not exceed 20-30. Having six assessments within one session we are way under this critical number.

At the end of the experimental sessions a questionnaire battery (»Allgemeiner Fragebogen«; see Appendix A) was administered including a

- Demographic questionnaire (only at t_1)
- Brief questionnaire on tobacco and alcohol use
- Documentation of somatic conditions
- German-language version of the Questionnaire of Smoking Urges
- FTNA
- Readiness/Confidence Ruler
- Intention to Quit Smoking Questionnaire

During the break between cue/stimulus exposures participants completed the first (t_1) and the second half (t_2) of the

- Freiburger Personality Inventory

A summary and classification of all applied questionnaires and assessment instruments displays Table 11.

Table 11

Classification of questionnaires and measurements

	Label	Included in	Time of presentation
Background variables	Demographic questionnaire	Questionnaire battery	At the end of t_1
	Documentation of somatic conditions		At the end of t_1 and t_2
	Freiburger Personality Inventory		In between stimulus presentations in t_1/t_2
Motivation	Readiness/Confidence Ruler	Questionnaire battery	At the end of t_1 and t_2
	Intention to Quit Smoking Questionnaire		
Craving response measures	Visual analog scale	Craving and mood rating	Within t_1 and t_2
	Magnitude estimation		
Tobacco use and nicotine dependence	Questionnaire of Smoking Urges	Questionnaire battery	At the end of t_1 and t_2
	FTNA		
	Brief questionnaire on tobacco and alcohol use		
Affective valence	Multidimensional Mood Questionnaire	Craving and mood rating	Within t_1 and t_2

Note. t_1/t_2 = session one/two (pre/subsequent LDS).

Background variables

Demographic and somatic questionnaire. To assess background variables two questionnaires were applied, (1) a short demographic questionnaire adapted from standard guidelines for documentation of the German Society for Addiction Research and Therapy (Deutsche Gesellschaft für Suchtforschung und Suchttherapie e.v., 2001; see Appendix A) and a (2) Documentation of somatic conditions, developed for the purpose of the study (see Appendix A).

Freiburger Personality Inventory. The Freiburg Personality Inventory (FPI-R, Freiburger Persönlichkeitsinventar, revidierte Version, Fahrenberg, Hampel & Selg, 1994) contains 138 Items, that assemble to the following scales: (1) Lebenszufriedenheit (Satisfaction with Life), (2) Soziale Orientierung [»Social Orientation«], (3) Leistungsorienterung [»Achievement Motive«], (4) Gehemmtheit [»Self-consciousness«], (5) Erregbarkeit [»Excitability«], (6) Aggressivität [»Aggressiveness«], (7) Beanspruchung [»Encroachment«], (8) Körperliche Beschwerden [»Physical Complaints«], (9) Gesundheitssorgen [»Worries about Health«], (10) Offenheit [»Candidness«], and two secondary scales Extraversion [»Extroversion«] and Emotionalität [»Emotionality«]. Internal consistency (Cronbachs Alpha) for the subscales range from $\alpha = .73$ to $\alpha = .83$. Participants indicate the extent of their agreement with each statement on a dichotomous scale (»stimmt« [»It's right«]; »stimmt nicht« [»It's not right«]).

Motivation

Readiness/Confidence Ruler. Both (1) importance of abstinence and (2) abstinence self-efficacy were assessed using single-item rating scales adapted from Miller and Rollnick (2002; German-language version Demmel, 2008). Ratings of importance of abstinence from tobacco were assessed with »Wie wichtig ist es Ihnen, mit dem Rauchen aufzuhören? Wie denken Sie im Moment darüber?« [»At this moment, how important it is for you to quit smoking?«]. The confidence in the ability to enact those changes, the tobacco abstinence self-efficacy, was assessed by »Wenn Sie sich jetzt vornehmen würden, mit dem Rauchen aufzuhören: Wie zuversichtlich sind Sie, dass Ihnen das gelingen würde?« [»If you decided to quit smoking right now, how confident are you that you would succeed?«]). Participants were asked to indicate their level of importance and confidence on an 11-point rating scale ranging from 0 (labeled as »unwichtig« [»not at all important/ confident]«) to 10 (labeled as »sehr wichtig« [»extremely important/confident«]).

Intentions to Quit Smoking Questionnaire. The intentions to quit smoking questionnaire was developed for the purpose of the study. It consists of nine predetermined (e.g. Ärger wegen Abhängigkeit« [»frustration concerning tobacco dependence]; »Akute gesundheitliche Gründe« [»current medical problems«]) and two participant directed items (see Appendix A). Participants rated the importance of these items on a 5-point Likert scale ranging from 0 (labeled »unwichtig« [»unimportant«]) to 4 (labeled »sehr wichtig« [»very important«]). High scores indicate high importance.

Craving response measures

In terms of assessment instruments of craving we decided on self-reports, being found to be a more "robust and cue-specific measure than psychophysiological responses (»assessment instruments«, p. 36; Carter & Tiffany, 1999). With six assessments within approximately 40 minutes (see Figure 10) it appears to be plausible to reduce the time that is needed to complete a questionnaire. Another advantage of reduction in time is to assess immediate responses to craving manipulation without interfering with changes of craving. Therefore, we decided on one-dimensional, frequently single-item scales throughout one session. In addition to a visual analog scale ME was assessed to counter for ceiling effects.

VAS. Participants reported their urge to smoke using a single-item rating scale (»Würden Sie jetzt gerne eine Zigarette rauchen?« [»At this moment, would you like to smoke a cigarette?«]). They were asked to mark the location on a 10 cm visual analog scale, ranging from 0 (labeled »nein, überhaupt nicht« [»no, not al all«]) to 10 (labeled »ja, sehr gerne« [»yes, indeed«]) corresponding to the smoking urge they experienced. VAS data was recorded as the number of millimeters from the left of the line. High scores indicate a strong desire to smoke.

ME. Participants were asked to rate their urge to smoke (»Wie stark ist Ihr Verlangen, eine Zigarette zu rauchen, jetzt?« [»At this moment, how strong is your urge to smoke?«]) by assigning a number whose magnitude matched their urge. Participants were not allowed to use a negative digit. The number zero should be used to express no craving at all. Besides these two rules no reference or range was given as a basement for that judgment. During the six trials participants reported the magnitude of their current urge in comparison to their first rating (»Wie stark ist Ihr Verlangen jetzt, eine Zigarette zu rauchen im Vergleich zum ersten Wert?« [»At this moment, how strong is your urge to smoke in comparison to your first rating«]). At the final assessment, participants were asked to rate their strongest craving they have ever experienced. Data were normalized by the method proposed by Mittag (1990). For detailed description of this procedure, see Demmel and Schrenk (2003).

Carter and Tiffany (1999, 2001) criticized that self-reports of craving or affect were commonly collected after cue presentation. These ratings might be influenced by memory biases. To eliminate these concerns we decided on ratings in the presence of the cues (sight, smell, and touch of a burning cigarette, a new unwrapped pack of participants' own cigarettes (or tobacco), their own lighter (or matches), as well as an ashtray).

To overcome the limitations of one-dimensional scales we additionally applied a questionnaire involving multidimensional assessment, the Questionnaire of Smoking Urges at the end of both sessions.

Tobacco use and nicotine dependence

Questionnaire of Smoking Urges. Cigarette craving was assessed using a German-language version of the Questionnaire of Smoking Urges (QSU, Tiffany & Drobes, 1991; QSU-G, Mucha & Pauli, 2003; Müller, Mucha, Ackermann & Pauli, 2001). The QSU is a 32-item questionnaire containing eight questions in each of four categories (1) desire to

smoke; (2) anticipation of relief from negative affect and nicotine withdrawal; (3) anticipation of pleasure or immediate positive outcome from smoking, and (4) intention to smoke reflecting »distinct conceptualization of smoking urges« (Tiffany, 1992, p. 125). Thirteen of the 32 items (4, 6, 8, 10, 11, 16, 17, 21, 22, 26, 27, 28 and 32) are reverse keyed in order to reduce variance due to acquiescence. Each item of the QSU is scored on a 7-point scale, ranging from 1 (labeled »stimmt überhaupt nicht« [»strongly disagree«]) to 7 (labeled »stimmt völlig« [» strongly agree«]). The response categories between 1 and 7 are only labeled 2, 3, 4, 5 and 6 without a verbal label. Factor analysis identified a two-factor structure of the QSU, related to the positive (factor 1) and negative (factor 2) reinforcing properties of smoking. Factor 1 items representing »a desire and intention to smoke with smoking anticipated as pleasurable« and Factor 2 items representing »urgent and intense desire and intention to smoke anticipating that smoking would relieve dysphoria« (Willner et al., 1995 p. 32). The QSU can be assessed by its total score and by the score on Factor 1 and Factor 2. Using the following cutoff points, the total scores on the QSU are classified as: minimum (0-64), mild (65-98), moderate (99-139) and intense craving (140 >).

Fagerstroem Test for Nicotine Dependence. Participants' level of nicotine dependence was determined using a German-language version of the Fagerstroem Test for Nicotine Dependence (FTND, Heatherton, Kozlowski, Frecker, & Fagerstroem, 1991; Fagerstroem Tests für Nikotinabhängigkeit, Fagerstroem & Schneider, 1989 [FTNA]). The FTNA is a 6-item self-report measure of nicotine dependence with satisfactory internal consistency (Cronbach's = .64) and high test-retest reliability (r = .88). Findings indicate that the FTNA total score correlates with other measures of nicotine dependence such as carbon monoxide, nicotine and cotinin level. The FTNA has a range of 0-10 points, 0-2 points indicating no or a very low, 3-4 a low, 5 a medium, 6-7 a high and 8-10 points a very high level of nicotine dependence.

Assessment of tobacco and alcohol use. The brief questionnaire on tobacco and alcohol use was developed for the purpose of the study. For detailed information, see Appendix A.

Affective valence

Multidimensional Mood Questionnaire. Current mood state was assessed using a short version of the Multidimensional Mood Questionnaire (MDBF, short version A: Steyer, Schwenkmetger, Notz & Eid, 1994, 1997). Factor analysis of the MDBF established three subscales, reflecting three bipolar dimensions of mood: (1) feeling good vs. feeling bad (GS/GB scale: 4 items contented, sick, good, unwell; $\alpha = 0.83$), (2) being awake vs. being tired (WM/AT scale; 4 items: rested, floppy, tired, lively; $\alpha = 0.79$) and (3) feeling calm vs. feeling tense (RU/CT scale; 4 items: composed, restless, uneasy, relaxed; $\alpha = 0.84$). Participants were asked to rate their current mood state (»Im Moment fühle ich mich …« [»At the moment, I feel …«]) on a 5-point Likert scale ranging from 1 (labeled »überhaupt nicht« [»not at all«]), to 5 (labeled »sehr« [»very much so«]). The response categories between 1 and 5 were only labeled 2, 3, and 4 without a verbal label. Evaluation totaling all scores. Possible scores range between 4 and 20. High scores indicating feeling well (GS/GB scale), being awake (WM/AT scale) and feeling calm (RU/CT scale).

Procedure

Telephone screening

Smokers who responded to newspaper advertisements and radio announcements underwent a telephone screening to exclude those who did not meet selection criteria (for detailed information on telephone screening instructions, see Appendix B). Participants who were deemed ineligible were encouraged to participate in smoking cessation programs. They were given information and telephone numbers of current local programs[1].

Eligible participants were asked to attend two experimental sessions (t_1, t_2) and a follow-up session (t_3). These sessions were scheduled based on participants LDS which each participant selected. The first session (t_1) was assigned approximately two to three days pre LDS, the second session (t_2) approximately two to three days subsequent LDS, a follow-up was scheduled about seven days after LDS (see Figure 8).

After the telephone screening participants received a letter containing information and instructions, a confirmation of their LDS and of all scheduled appointments (t_1, t_2, t_3), a debriefing, a brochure about quitting smoking and directions to the laboratory (see Appendix B). They were told to avoid using alcohol or illegal and over the counter drugs (excluding prescription medication) within 24 hours of experimental sessions (t_1, t_2). They were also asked to refrain from smoking after LDS and from using any nicotine replacement aids throughout the entire study. They were informed that breath measurement instruments would confirm compliance with smoking instructions.

For both sessions (t_1, t_2) participants were told to bring a new, unwrapped pack of their preferred cigarette or tobacco brand and their lighter or matches.

[1] Gesellschaft für Angewandte Psychologie und Verhaltensmedizin mbH (APV); Bundeszentrale für Gesundheitliche Aufklärung (BzGA)

Laboratory set-up

The study took place at the psychophysiological laboratory of the University of Münster, Germany. At arrival, participants were escorted from the main entrance to the laboratory by the experimenter. The laboratory was a two by three meter room with a window and a right angle desk. The desk was placed in the corner of the room, with one angel facing the window.

Participants were seated on a swivel chair behind the desk, facing a keyboard and a computer monitor that was located at eye level, at approximately 50 cm from the participants. On the desk to the left side of the computer screen all craving and mood rating forms were placed (»assessment instruments«, p. 60).

Expired carbon monoxide (CO) level was measured using an expired alveolar carbon monoxide breath analysis (Micro Smokerlyzer®, Bedfont Scientific Limited®).

All questionnaires were paper-and-pencil tests. ME practice (»assessment instruments«, p. 60) and stimulus/cue exposure instructions were presented on a computer monitor using PowerPoint© presentations with white lines and letters facing a dark blue background (see Appendix C for instructions). Changes in instruction were preceded by a computer generated alert tone.

Experimental session 1 (t_1)

The cue exposure procedure and the presentation of the cues were adapted from the procedure described by Sayette et al. (2001). Experimental sessions occurred Mondays through Fridays from 8.30am to 7.30pm and lasted approximately 60 minutes. Three male psychology undergraduates under the supervision of a psychologist were conducting these sessions.

A timeline of session one is seen in Figure 9. A detailed timeline of the entire study is presented in Figure 11.

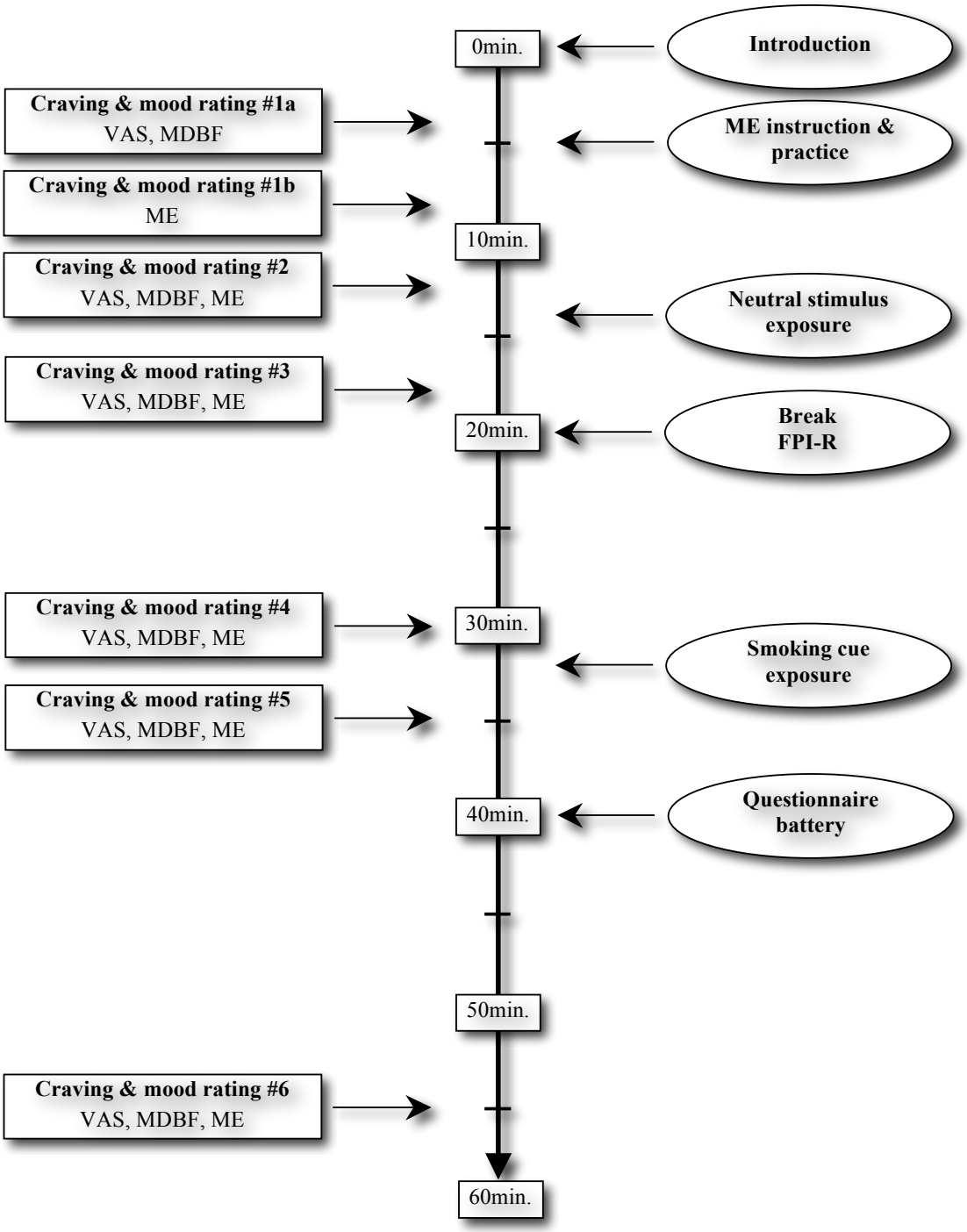

Figure 9. Timeline of the first session.

Introduction. Upon arrival, participants were given a brief verbal description of the session (for detailed instructions, see Appendix B). After written informed consent was obtained (see Appendix B) participants presented their pack of cigarettes (or tobacco) and lighter (or matches) to the experimenter. Craving and mood ratings were completed, containing VAS and MDBF, following ME instruction and practice (»assessment instruments«, p. 60).

ME instructions and practice. Participants were given instructions and practice trials for ME (e.g., van der Klaauw & Smith, 1995), being »essential … prior to craving assessment« (Sayette, 2001, p. 197). Using a PowerPoint© presentation they were asked to perform ME of the length of seven lines varying from one to 24 cm (1 cm, 4 cm, 8 cm, 12 cm, 16 cm, 20 cm and 24 cm). These lines were presented on the monitor for approximately 15 seconds in quasi-random order, which was randomly selected before session one and fixed for all participants). Participants rated the length of the current line in proportion to the first line they have rated (see Appendix C for detailed instructions).

Following ME instructions and practice participants rated their urge to smoke via ME. From then on, whenever reported urge and mood measures occurred they were assessed using first VAS then MDBF and finally ME.

Participants were then asked how long it had been since their last cigarette and the number of cigarettes smoked that day was recorded. Next, participants smoking status was verified by using an expired alveolar carbon monoxide breath analysis (CO reading #1; for detailed information on instructions and report sheet, see Appendix B).

Preceding cue exposure the experimenter informed the participants about the cue exposure procedure. They were told that (1) the following instructions were given by a PowerPoint© presentation, and that the experimenter would leave the room to not disturb them; (2) that they would be exposed to a neutral stimulus followed by a smoking cue and that the same procedure in the same order would be used at session two; (3) that they will be asked to complete the craving and mood ratings.

Presentation of the neutral stimulus. The experimenter placed a cardboard box on the desk. Participants were told not to touch the box and to follow the instructions presented on the monitor. Before leaving the room the experimenter asked participants to start the presentation by pressing the space bar. Instructions were preceded by a computer-generated tone, notifying the participant of change in instruction. Immediately after participants pressed the space bar instructions occurred to (a) complete craving and mood rating. Next, they were told to (b) pick up the cover from the cardboard box, containing a bottle of water and a bottle opener, place them on the table, (c) open the bottle with the bottle opener, (d) place the lid next to the bottle on the table, hold bottle of water in their hands and (e) smell at the end of the bottle opening for approximately ten seconds. They were asked to (f) return the bottle on the table and (g) fill out craving and mood rating and ask for the experimenter. For the timeline of this procedure, see Figure 10 (for detailed information on instructions, see Appendix C).

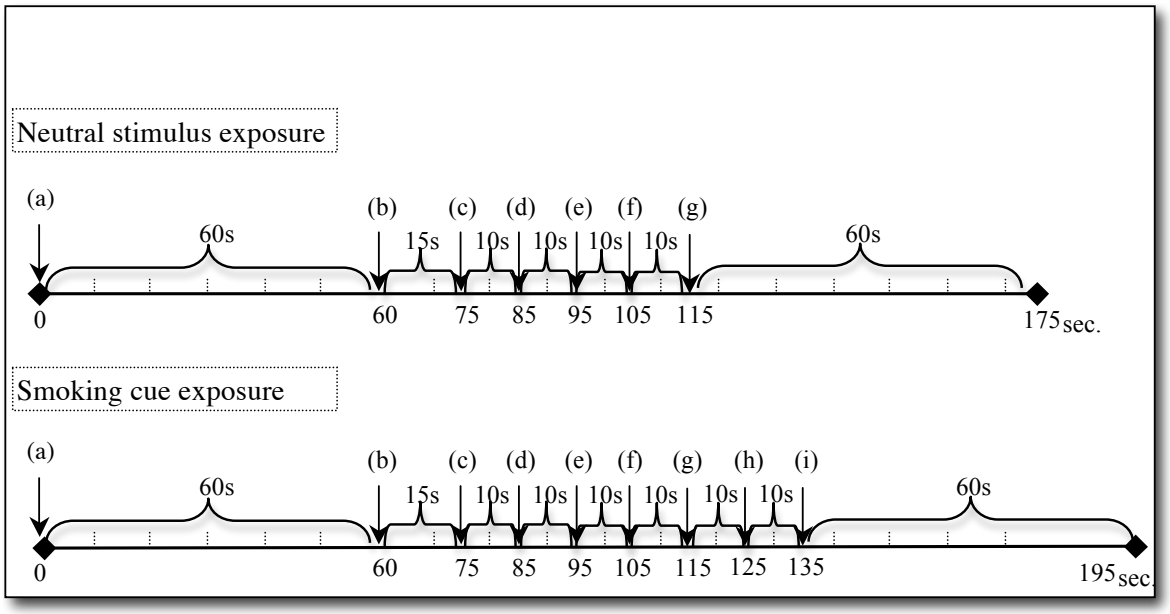

Figure 10. Timeline of neutral stimulus and smoking cue exposure.

Break. Participants were asked to complete the first part (items one to 68) of the FPI-R. During that time the experimenter placed another covered cardboard box on their desk, started the presentation with instructions either for cigarette or tobacco users, then left the room.

Smoking cue exposure. In line with the control cue exposure participants were first asked to (a) complete the craving and mood rating. Next, they were told to (b) pick up the cover of the cardboard box containing participants' own pack of cigarettes/tobacco and their lighter/matches and an ashtray, place them on the table, (c) unwrap the pack of cigarettes and smell at the open box for approximately ten seconds. After that they were asked to (d) remove a cigarette from the box, hold it in their hand, (e) take their lighter/matches, (f) light the cigarette with their lighter/matches without taking a puff by holding it in the flame for several seconds till tobacco begins to burn, (g) put down lighter and hold cigarette in their hands for ten seconds without smoking, (h) put down the cigarette without extinguishing it and (i) repeat measures of craving and mood. At the end, participants were told to extinguish the cigarette and ask for the experimenter. For the timeline of this procedure, see Figure 10 (for detailed information on instructions, see Appendix C).

Participants supplied another expired-air sample for assessment of CO level to determine their abstinence status during cue exposure.

Questionnaire battery. At the end of session one, participants completed a questionnaire battery (»Allgemeiner Fragebogen«) containing a demographic questionnaire, a brief questionnaire on tobacco and alcohol use, a questionnaire on somatic conditions, the QSU, the FTNA, the Readiness/Confidence Ruler, and the Intention to Quit Smoking Questionnaire followed by the final craving and mood rating (»assessment instruments«, p. 60; see Appendix A).

It is to be expected that questionnaires about craving themselves induce craving (Drummond et al., 2000; Sayette et al., 2000). Consequently, the questionnaire battery was administered at the end of the session. We judged that concerns about carryover effects of the questionnaire battery on cue exposures outweighed concerns resulting from carryover effects of cue exposures on the questionnaire battery.

After questionnaires were completed the experimenter gave back cigarettes/tobacco and lighter/matches, confirmed the appointment of session two and kept count of address changes. Before leaving, participants signed the confirmation of participation form (see Appendix B).

Experimental session 2 (t_2)

The second session, which was scheduled within five to seven days to the first lasted approximately 40-50 minutes (for detailed instructions, see Appendix B). Upon returning to the laboratory, abstinence status was ascertained. Smoking abstinence was defined as a self-report of not smoking more then one cigarette since LDS, verified by an expired air CO value of less than 8ppm (e.g., Shadel et al., 1998). The number of cigarettes and exact date and time were recorded if participant did smoke after LDS. The procedure for exposure trials along with craving and mood ratings were identical to session one (see Figure 9). In between exposure trials participants completed the second half of the FPI-R (item 69 to 138). The questionnaire battery at the end of the session was abbreviated to contain only the QSU and the Readiness/Confidence Ruler followed by the last craving and mood rating. Following the procedure of session one, the experimenter confirmed the follow-up appointment, kept count of address changes and participants signed the confirmation of participation form (see Appendix B).

Follow-up session (t_3)

The follow-up session lasted approximately 15 min. According to session two, abstinence status was determined by participants self-report, and confirmed by CO analysis. If participants had smoked after session two, the number of cigarettes and the exact date and time were recorded. At the end of the session the experimenter thanked participants for participating in the study and kept count of address changes. Before leaving participants signed the confirmation of participation form (see Appendix B) and the experimenter placed the name of the participant in the lottery.

Figure 11 displays a detailed timeline of the entire study. The third and fifth craving and mood ratings were assessed in the presence of the cues/stimuli. As a simplification this figure displays these ratings after cue/stimuli presentations.

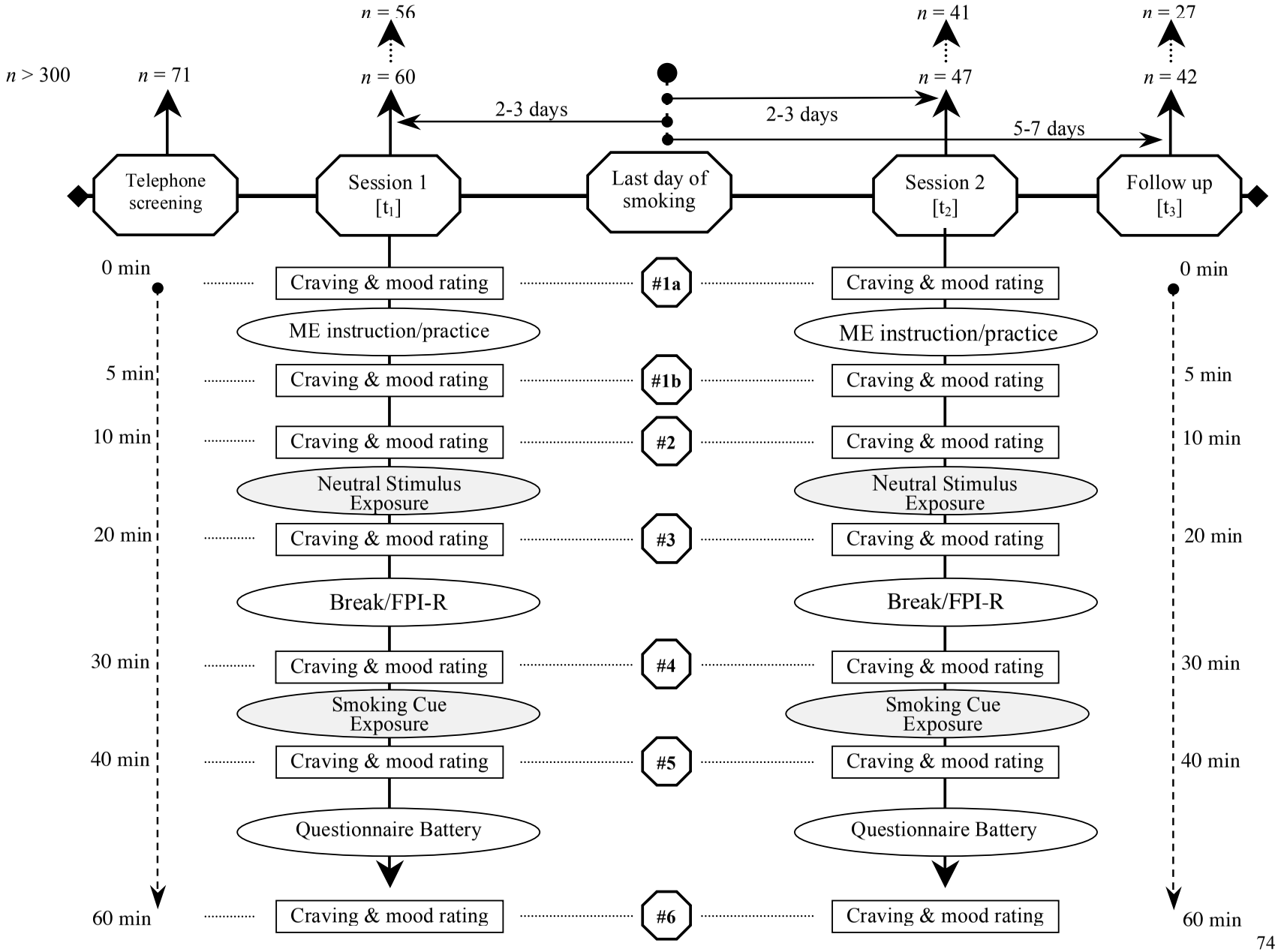

Figure 11. Detailed timeline of the study.

Definition of craving, cue reactivity

Craving. The definition of craving in the current study is based on the definition of Sayette et al. (2001; adapted from Baker, Morse & Shermann, 1987) describing craving as »emotional states reflecting the activation of motivational […] systems that have particular response patterns involving self-report, behavioral and cognitive correlates« (p. 1419).

Cue reactivity. Carter and Tiffany (1999, 2001) recommend to define cue reactivity as the »difference in responding to the drug-relevant cue compared with the drug-neutral cue« (p. 185). Considering Sayette et al. (2000) »a change in urge report from baseline to cue exposure often is considered the key measure of craving« (p. 1421). Taken both assumptions into account, cue reactivity will be defined in the present study as »the difference of (1) changes in craving report from pre to smoking cue exposure (smoking change score) compared to (2) changes in craving reports from pre to neutral stimulus exposure (neutral change score)«. Within this definition craving ratings pre smoking cue and neutral stimulus exposure will serve as individual pre-exposure baselines for the change scores. The difference score will be calculated by subtracting the neutral change scores from the corresponding smoking change score, for session one and session two, respectively.

Figure 12 displays the operationalization of cue reactivity within the present study. As mentioned above (see Figure 11), to simplify matters, the third and fifth craving and mood rating are displayed following cue/stimulus presentation instead of in the presence of the cue.

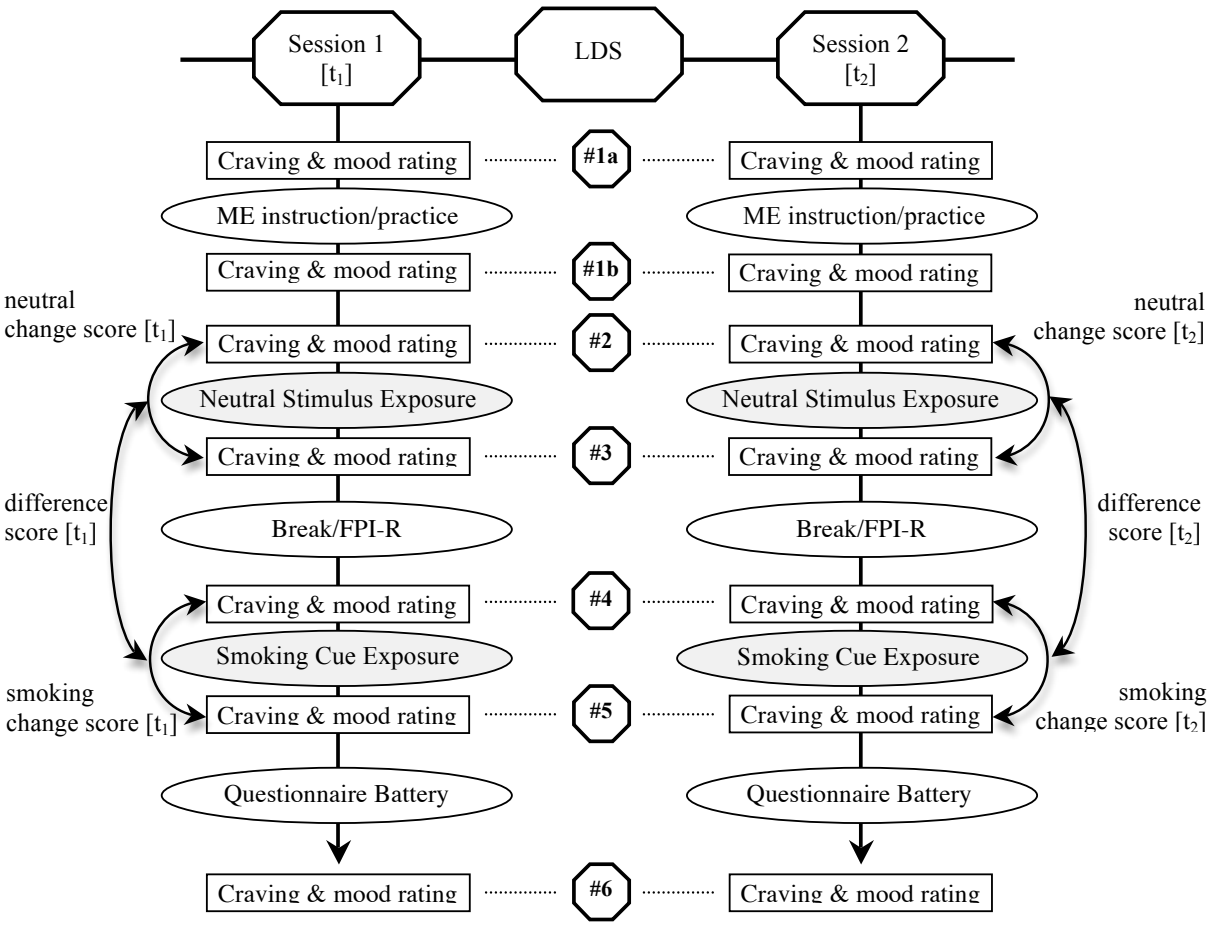

Figure 12. Operationalisation of cue reactivity within the present study.

With reference to the definition of craving and cue reactivity the hypotheses of the present study can be operationalized as follows:

Hypothesis 1a: nicotine dependent smokers will report the strongest cravings during smoking cue exposure at both times, pre (t_1) and subsequent (t_2) smoking cessation.

Hypothesis 1b: the smoking change score will be positive pre (t_1) and subsequent (t_2) LDS.

Hypothesis 1c: the degree of the smoking change score will be higher compared to the corresponding neutral change score pre (t_1) and subsequent (t_2) LDS.

Hypothesis 2: the degree of the difference score will be less pronounced subsequent LDS (t_2) as compared to pre LDS (t_1; cue specific craving, assessed by VAS and ME).

Hypothesis 3: overall craving ratings will be less pronounced subsequent LDS (t_2) as compared to pre LDS (t_1; overall craving, assessed by QSU).

RESULTS

Craving and mood ratings were assessed six times during each session (see Figure 13). Craving response measures included VAS and ME, affective valence was assessed using the MDBF (»assessment instruments«, p. 60).

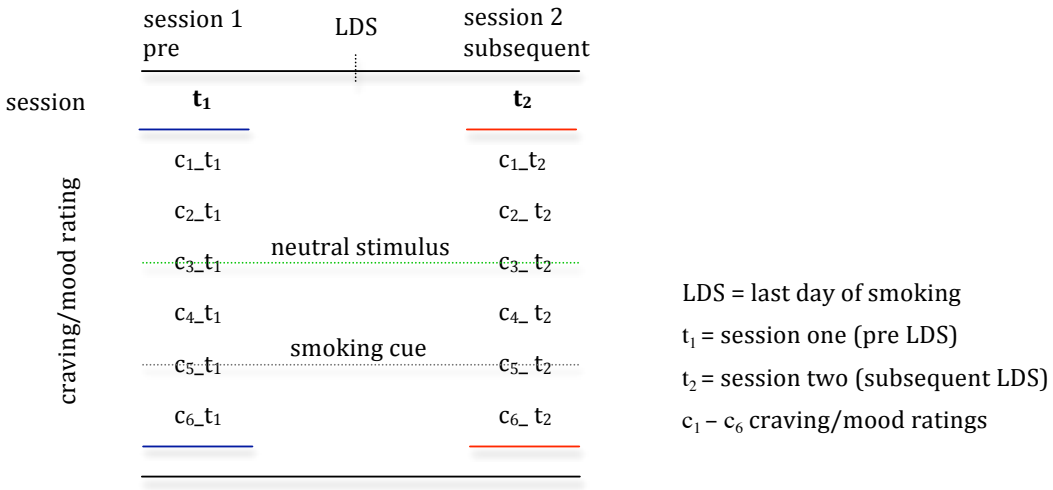

Figure 13. Design of the study.

Craving response measures

During smoking cue exposure ($c_5\_t_1$, $c_5\_t_2$) participants reported the strongest cravings. Additionally, initial craving ratings at session two ($c_1\_t_2$) reached high scores. Table 12 presents mean and standard deviations for craving ratings for both, VAS and ME throughout both sessions. Figures 14 and 15 display VAS and ME craving ratings over the course of the sessions.

Table 12

Mean and standard deviations for craving ratings throughout the sessions

	t_1 (pre LDS)				t_2 (subsequent LDS)			
	VAS		ME		VAS		ME	
craving rating	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
c_1	2.36	2.32	11.15	10.51	**3.94**	2.98	**20.30**	17.74
c_2	2.50	2.41	10.16	7.30	3.40	3.32	14.08	8.50
c_3	2.44	2.43	10.44	6.87	3.01	3.31	12.09	6.50
c_4	2.95	2.72	11.71	7.81	2.99	3.21	11.50	7.90
c_5	**4.92**	3.28	**23.28**	19.20	**4.17**	3.78	**20.04**	17.90
c_6	4.06	3.14	21.05	17.07	3.02	3.24	12.23	9.00

Note. Mean and SD for craving ratings at craving rating c_1-c_6, c_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, VAS = visual analog scale, ME = Magnitude Estimation, LDS =last day of smoking, t_1/t_2 = session one/two (pre/subsequent LDS). Bold numbers indicate high scores.

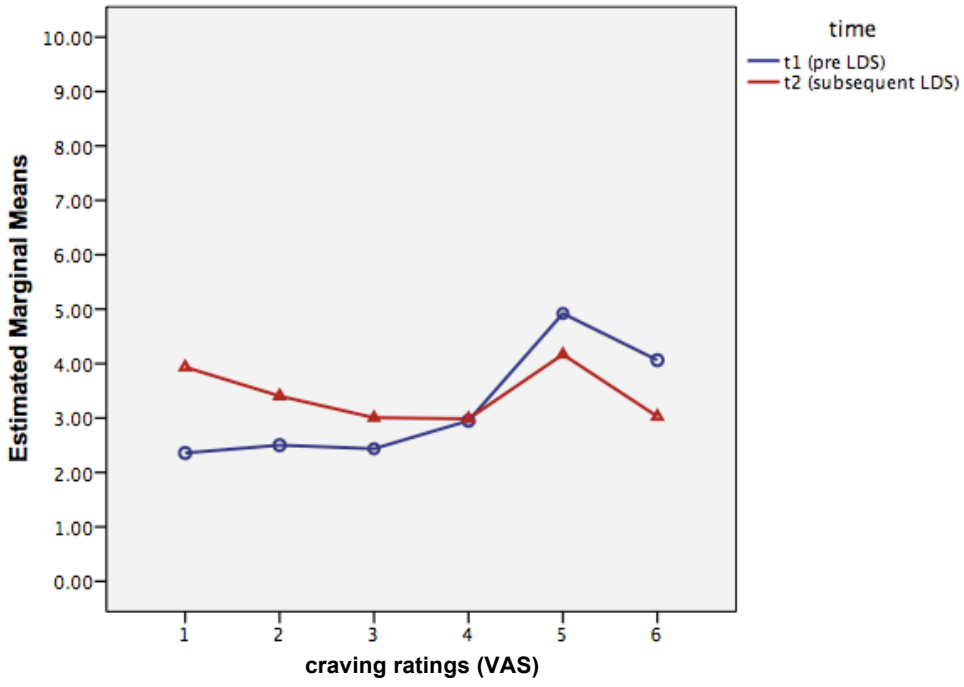

Figure 14. VAS craving ratings over the course of the sessions.

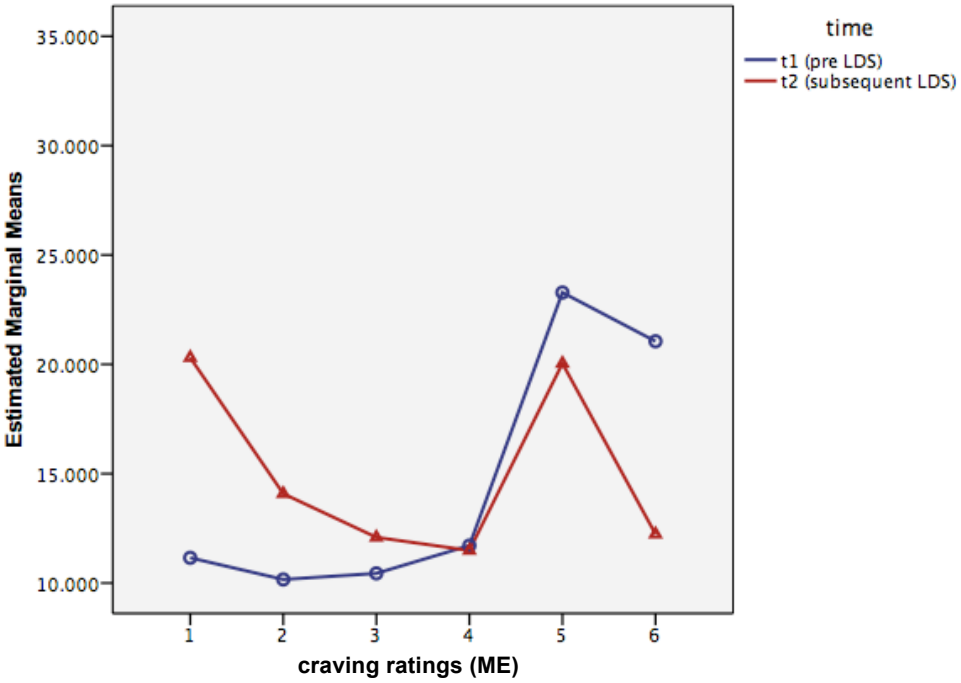

Figure 15. ME craving ratings over the course of the sessions.

Overall multivariate analysis of variance with repeated measurements

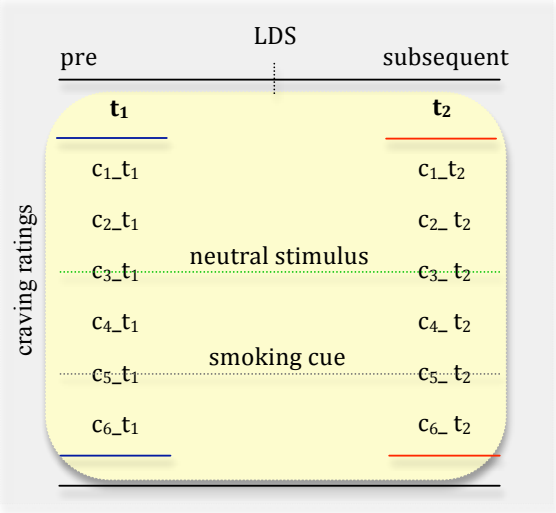

Figure 16. Illustration of the study design: highlighting of the overall MANOVA.

To test whether craving ratings changed during each experimental session, we performed an overall 2 (session: pre vs. subsequent LDS) x 6 (craving ratings: c_1 to c_6) multivariate analysis of variance (MANOVA) with repeated measurements with session and craving ratings as within-subjects variables and VAS and ME as dependent variable, respectively. The Bonferroni correction was used to adjust for multiple comparisons. Greenhouse-Geisser corrections were used to adjust degree of freedom for violations of the homogeneity of variance-covariance assumption for repeated measures factors.

Visual analog scale. Analyses revealed no main effect of session $F(1, 41) = .24$, $p = .627$, but a significant main effect of craving ratings $F(5, 41) = 12.82$, $p < .001$. The interaction of session x craving ratings also reached significance $F(5, 41) = 12.83$, $p < .001$. These results indicate that craving scores differ across craving ratings ($c_1 – c_6$) at both sessions.

Post-hoc analysis, via pairwise comparisons revealed that craving ratings during cue exposure (c_5) were higher compared to all other craving ratings, which indicates that the craving manipulation was successful. Aside from this, a significant difference was found between craving ratings c_2 and c_3. Another difference was found between c_3 and c_6, respectively. All other comparisons did not reach significance (all *p*'s >.121, see Table 13).

Magnitude estimation. ME produced comparable results. No main effect of session $F(1, 41) = .33$, $p = .570$ emerged, but a significant main effect of craving ratings $F(5, 41) = 7.36$, $p < .001$. The session x craving ratings interaction did approach significance $F(5, 41) = 6.62$, $p < .001$.

Pairwise comparisons for ME revealed a slightly different picture than VAS with a smaller amount of significant comparisons. Conform to VAS, craving ratings during cue exposure (c_5) were higher compared to craving ratings c_2 to c_4, but not compared to craving ratings c_1 and c_6. No other significant differences were found between craving ratings for ME (all *p*'s >.098; see Table 13).

Separate multivariate analysis of variance with repeated measurements for t_1 and t_2

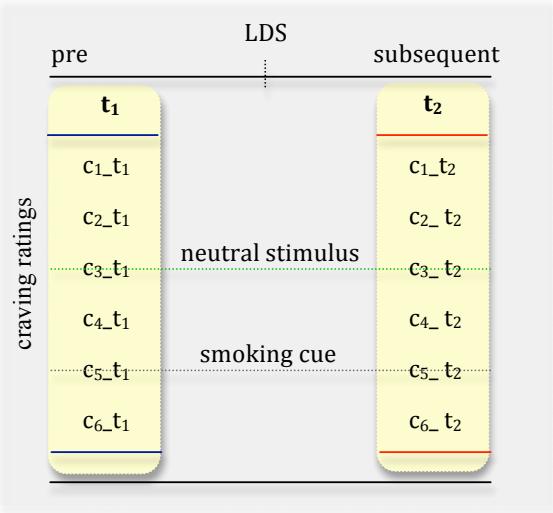

Figure 17. Illustration of the study design: highlighting of the separate MANOVA for session one and session two.

To further analyze potential effects of craving ratings for both sessions separately, we calculated a repeated measures MANOVA with craving ratings as within-factor (6 levels) for both sessions (see Table 13).

Visual analog scale at session one. Analysis revealed a main effect of craving ratings for session one $F(5, 41) = 19.17$, $p < .001$. This result indicates that craving ratings differ from each other across the six craving ratings within the first session.

Pairwise comparisons for session one revealed that smokers reported higher craving ratings during smoking cue exposure (c_5) and after completing the questionnaire battery (c_6) compared to all other craving ratings (c_1 to c_4). All other comparisons did not approach significance (all p's >.218; see Table 13).

Magnitude estimation at session one. Analyses indicated that a main effect of craving ratings emerged for session one $F(5, 41) = 9.54$, $p < .001$.

Pairwise comparisons for session one equal the ones for VAS, except that no difference was found for the comparison between craving rating c_6 and c_1 (see Table 13).

Visual analog scale at session two. Analyses revealed a main effect of craving ratings for session two $F(5, 41) = 5.41$, $p = .001$. This result indicates that during the second session the six craving ratings differed from each other.

Pairwise comparisons for session two revealed differences only between craving ratings c_5 and c_4 and craving ratings c_5 and c_6. No other significant difference occurred between craving ratings c_5 and c_1 to c_3 (all p's >.086; see Table 13).

Magnitude estimation ME at session two. In line with VAS, a main effect of craving ratings for session two $F(5, 41) = 4.58$, $p = .009$ emerged.

Pairwise comparisons for session two (subsequent LDS) reveal no significant differences between craving ratings (all p's >.082; see Table 13).

Table 13

Pairwise comparisons of VAS and ME craving ratings at both sessions

		pairwise comparisons mean t_1 & t_2						pairwise comparisons t_1						pairwise comparisons t_2					
		VAS			ME			VAS			ME			VAS			ME		
		M	SE	sig. [a]	M	SE	sig. [a]	M	SE	sig. [a]	M	SE	sig. [a]	M	SE	sig. [a]	M	SE	sig. [a]
c_1	c_2	.194	.185	1.000	3.606	1.531	.353	-.144	.209	1.000	.990	1.138	1.000	.532	.272	.861	6.222	2.798	.478
	c_3	.426	.198	.559	4.465	1.620	.131	-.078	.215	1.000	.713	1.243	1.000	.929	.311	.071	8.218	2.798	.082
	c_4	.179	.209	1.000	4.129	1.895	.529	-.593	.287	.680	-.560	1.870	1.000	.950	.323	.081	8.817	3.171	.124
	c_5	-1.398*	.353	**.004**	-5.931	3.133	.984	-2.563*	.488	**.000**	-12.128*	3.741	**.036**	-.233	.409	1.000	.267	4.523	1.000
	c_6	-.399	.317	1.000	-.914	2.860	1.000	-1.706*	.438	**.005**	-9.900	3.428	.093	.907	.373	.292	8.072	3.425	.351
c_2	c_1	-.194	.185	1.000	-3.606	1.531	.353	.144	.209	1.000	-.990	1.138	1.000	-.532	.272	.861	-6.222	2.798	.478
	c_3	.232*	.073	**.046**	.859	.520	1.000	.066	.098	1.000	-.277	.387	1.000	.398	.128	.054	1.996	.792	.237
	c_4	-.015	.165	1.000	.522	1.220	1.000	-.449	.227	.826	-1.550	1.306	1.000	.418	.254	1.000	2.595	1.570	1.000
	c_5	-1.592*	.365	**.001**	-9.537*	2.582	**.010**	-2.420*	.461	**.000**	-13.119*	3.422	**.007**	-.765	.400	.947	-5.955	3.318	1.000
	c_6	-.593	.259	.414	-4.520	2.211	.713	-1.562*	.367	**.002**	-10.890*	3.077	**.016**	.376	.300	1.000	1.849	1.880	1.000
c_3	c_1	-.426	.198	.559	-4.465	1.620	.131	.078	.215	1.000	-.713	1.243	1.000	-.929	.311	.071	-8.218	2.798	.082
	c_2	-.232*	.073	**.046**	-.859	.520	1.000	-.066	.098	1.000	.277	.387	1.000	-.398	.128	.054	-1.996	.792	.237
	c_4	-.247	.154	1.000	-.337	1.004	1.000	-.515	.201	.218	-1.273	1.160	1.000	.021	.221	1.000	.599	1.298	1.000
	c_5	-1.824*	.361	**.000**	-10.396*	2.445	**.002**	-2.485*	.443	**.000**	-12.842*	3.359	**.007**	-1.162	.398	.086	-7.951	3.139	.230
	c_6	-.825*	.260	**.044**	-5.379	2.007	.159	-1.628*	.361	**.001**	-10.613*	2.989	**.015**	-.022	.266	1.000	-.146	1.431	1.000
c_4	c_1	-.179	.209	1.000	-4.129	1.895	.529	.593	.287	.680	.560	1.870	1.000	-.950	.323	.081	-8.817	3.171	.124
	c_2	.015	.165	1.000	-.522	1.220	1.000	.449	.227	.826	1.550	1.306	1.000	-.418	.254	1.000	-2.595	1.570	1.000
	c_3	.247	.154	1.000	.337	1.004	1.000	.515	.201	.218	1.273	1.160	1.000	-.021	.221	1.000	-.599	1.298	1.000
	c_5	-1.577*	.310	**.000**	-10.059*	2.299	**.001**	-1.971*	.407	**.000**	-11.569*	3.249	**.015**	-1.183*	.331	**.014**	-8.550	3.034	.112
	c_6	-.578	.207	.121	-5.043	1.758	.098	-1.113*	.262	**.002**	-9.340*	2.723	**.021**	-.043	.262	1.000	-.745	1.368	1.000
c_5	c_1	1.398*	.353	**.004**	5.931	3.133	.984	2.563*	.488	**.000**	12.128*	3.741	**.036**	.233	.409	1.000	-.267	4.523	1.000
	c_2	1.592*	.365	**.001**	9.537*	2.582	**.010**	2.420*	.461	**.000**	13.119*	3.422	**.007**	.765	.400	.947	5.955	3.318	1.000
	c_3	1.824*	.361	**.000**	10.396*	2.445	**.002**	2.485*	.443	**.000**	12.842*	3.359	**.007**	1.162	.398	.086	7.951	3.139	.230
	c_4	1.577*	.310	**.000**	10.059*	2.299	**.001**	1.971*	.407	**.000**	11.569*	3.249	**.015**	1.183*	.331	**.014**	8.550	3.034	.112
	c_6	.999*	.306	**.034**	5.017	2.632	.958	.857	.356	.309	2.229	3.865	1.000	1.140*	.343	**.028**	7.805	2.889	.151
c_6	c_1	.399	.317	1.000	.914	2.860	1.000	1.706*	.438	**.005**	9.900	3.428	.093	-.907	.373	.292	-8.072	3.425	.351
	c_2	.593	.259	.414	4.520	2.211	.713	1.562*	.367	**.002**	10.890*	3.077	**.016**	-.376	.300	1.000	-1.849	1.880	1.000
	c_3	.825*	.260	**.044**	5.379	2.007	.159	1.628*	.361	**.001**	10.613*	2.989	**.015**	.022	.266	1.000	.146	1.431	1.000
	c_4	.578	.207	.121	5.043	1.758	.098	1.113*	.262	**.002**	9.340*	2.723	**.021**	.043	.262	1.000	.745	1.368	1.000
	c_5	-.999*	.306	**.034**	-5.017	2.632	.958	-.857	.356	.309	-2.229	3.865	1.000	-1.140*	.343	**.028**	-7.805	2.889	.151

Note. c_1= beginning, c_2/c_3= preceding/during the presentation of the neutral stimulus, c_4/c_5= preceding/during the presentation of the smoking cue, c_6= following the completion of the questionnaire battery. VAS= visual analog scale. ME= Magnitude Estimation, t_1/t_2= session one/two (pre/subsequent LDS), M= mean difference (significant at the .05 level), SE= standard error; [a]= based on estimated marginal means; *= Adjustment for multiple comparisons: Bonferroni. Bold/highlighted numbers indicate significant scores.

Analysis of corresponding craving ratings (t_1/t_2)

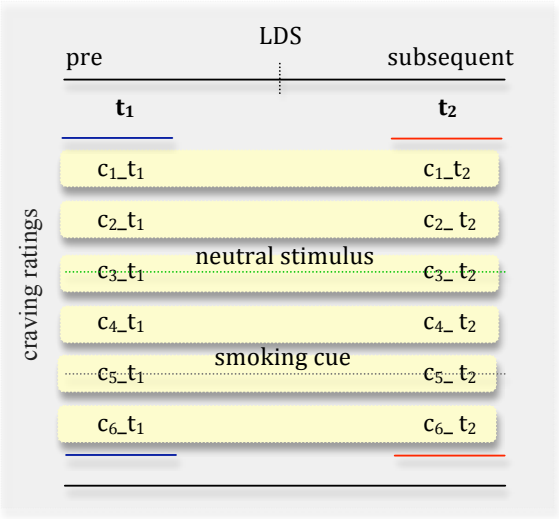

Figure 18. Illustration of the study design: highlighting of the analysis of corresponding craving ratings.

To examine whether craving ratings differ for all craving ratings during session one from the corresponding ratings during session two paired sample *t* tests were used (see Table 11, Figure 19, Figure 20).

Visual analog scale. Craving ratings at craving rating c_1 where higher ($t(41) = -3.21$, $p = .003$, $d = -.6$) whereas craving ratings at craving rating c_6 were lower ($t(41) = 2.10$, $p = .042$, $d = .32$) at session one compared to session two. All other comparisons did not reach significance (all *p*'s >.085). Also, when corrected for multiple comparisons (<.01) the difference reported at craving rating c_6 was not significant.

Magnitude estimation. In line with VAS, craving ratings at craving rating c_1 were higher ($t(41) = -3.21$, $p = .003$, $d = -.63$) whereas craving ratings at craving rating c_6 were lower ($t(41) = 3.95$, $p < .001$, $d = .65$) at session one compared to session two. Additionally, craving ratings at craving rating c_2 were lower at session one compared to session two ($t(41) = -3.08$, $p = .004$, $d = -.49$). When corrected for multiple comparisons (<.01) all differences reported stayed significant. All other comparisons did not reach significance (all *p*'s >.125).

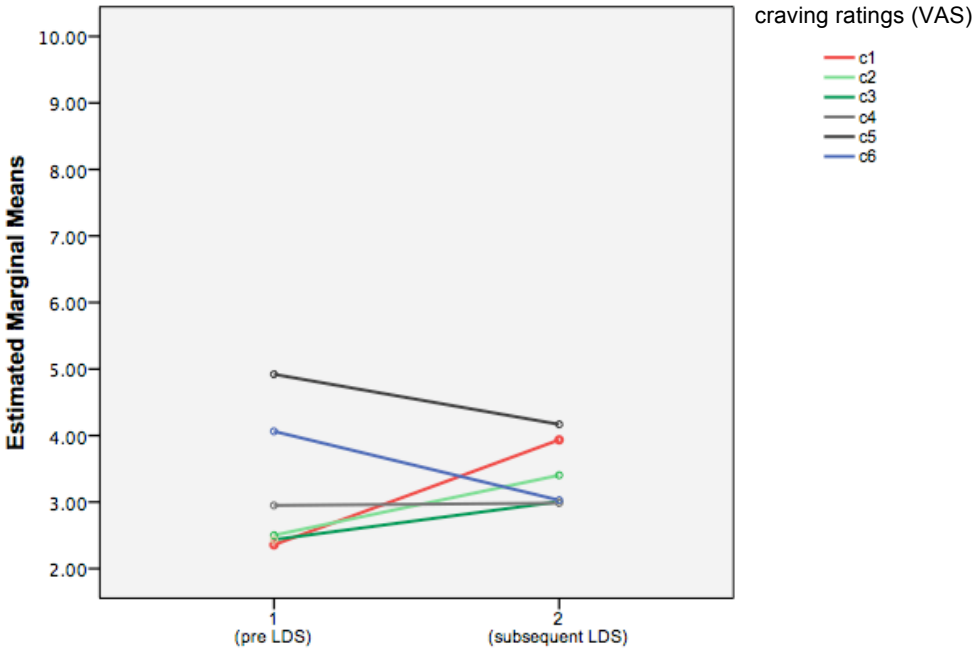

Figure 19. VAS craving changes from session one to session two.

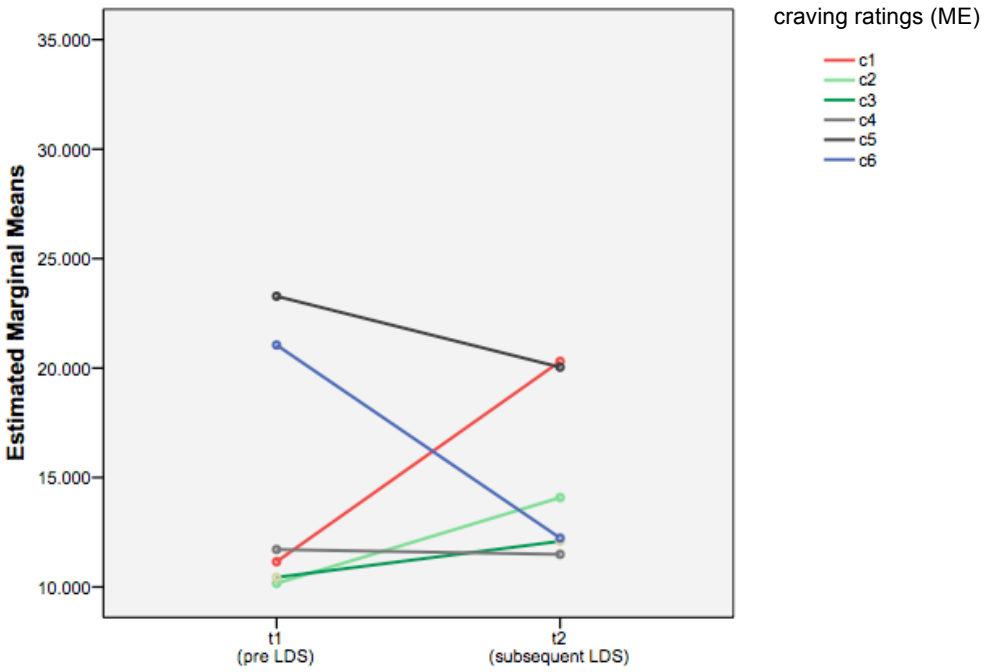

Figure 20. ME craving changes from session one to session two.

Comparisons of smoking vs. neutral craving change scores

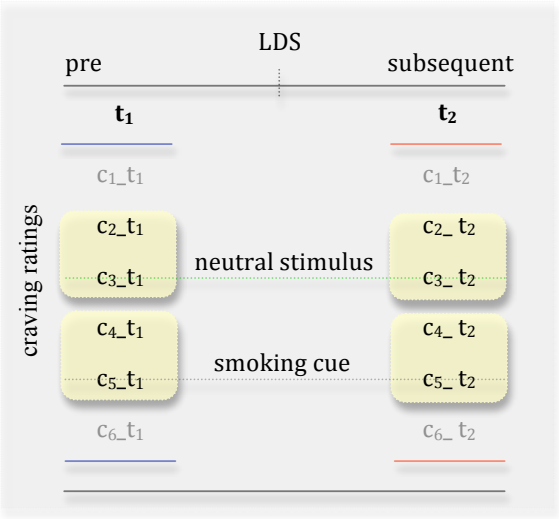

Figure 21. Illustration of the study design: highlighting of the comparisons of craving change scores.

For the purpose of the present study, cue reactivity was defined as the difference between changes in self-reported craving induced by the presentation of a smoking cue and a neutral stimulus, respectively (see Figure 12).

We predicted that the exposure to smoking cues elicits craving preceding (session one) and following (session two) smoking cessation (hypothesis 1b, see Figure 6) operationalized by a positive smoking change score pre (t_1) and subsequent (t_2) LDS. Moreover, we predicted that nicotine dependent smokers report stronger craving ratings to smoking cues as compared to neutral stimuli pre (t_1) and subsequent (t_2) smoking cessation (hypothesis 1c, see Figure 6), operationalized by a higher degree of the smoking change score compared to the corresponding neutral change score pre (t_1) and subsequent (t_2) LDS.

To test the first hypotheses, a 2 (session: pre and subsequent LDS) x 2 (craving change scores: neutrals vs. smoking change score) multivariate analysis of variance (MANOVA) was performed (see Figure 22 and 23).

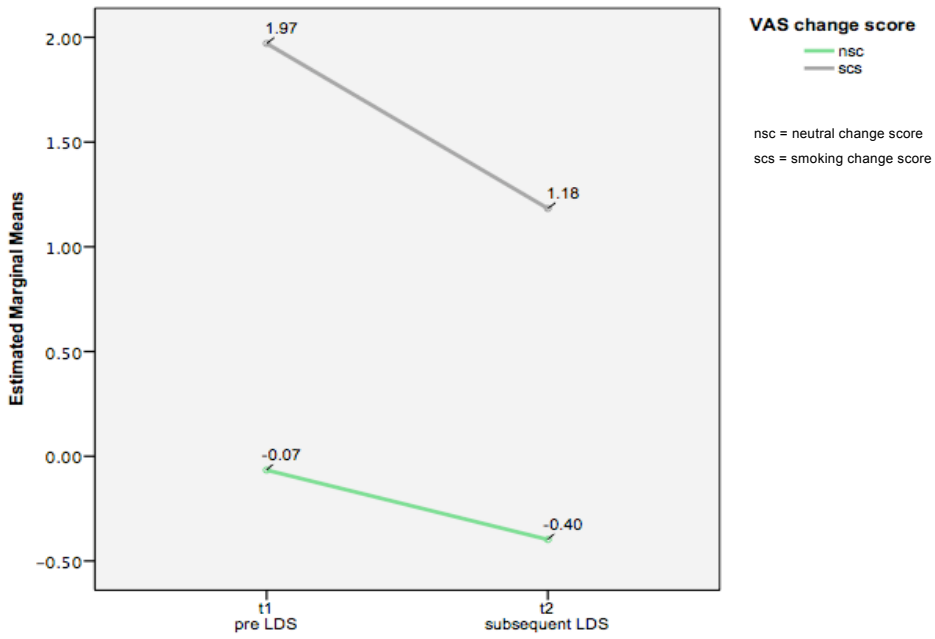

Figure 22. VAS change scores.

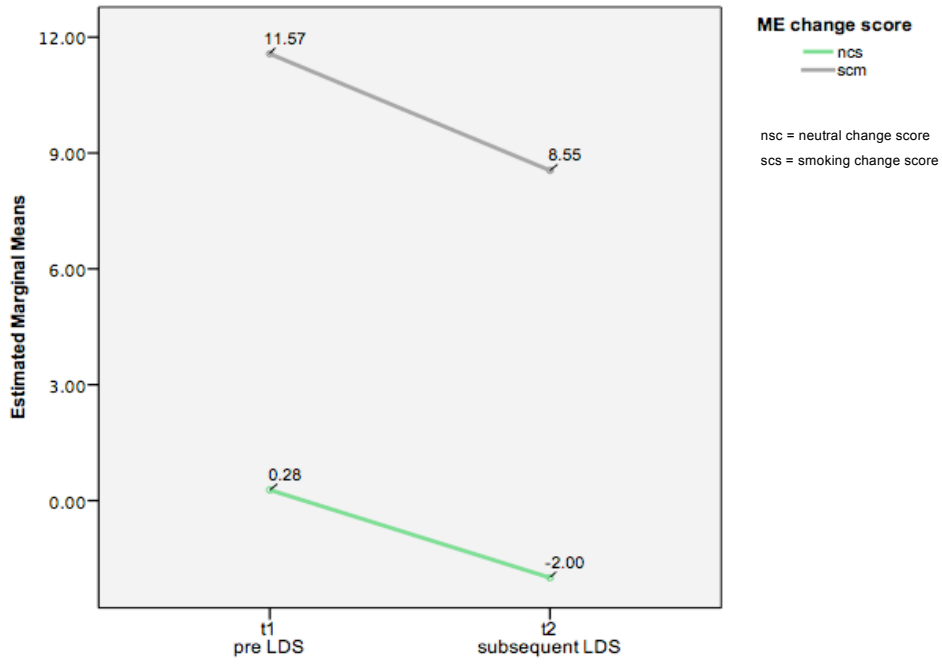

Figure 23. ME change scores.

Visual analog scale. The MANOVA revealed main effects of session (pre/subsequent LDS) $F(1, 41) = 6.90$, $p = .012$ and craving change score (smoking/neutral change score) $F(1, 40) = 32.02$, $p < .001$. The interaction of session × craving change score, however, did not reach significance, $F(1, 40) = .99$, $p = .327$. These results suggest that craving change scores are higher for session one compared to session two and that this effect is independent from the type of craving change score (neutral vs. smoking change score). They also indicate that changes in craving reports from pre to smoking cue exposure (smoking change score) were higher then changes in craving reports from pre to neutral cue exposure (neutral change score) and that this effect is independent from session one and session two.

Magnitude estimation. Unlike VAS, the MANOVA revealed no main effect of session (pre/subsequent LDS) $F(1, 41) = 1.49$, $p = .230$ but a main effect of craving change score (smoking/neutral change score) $F(1, 40) = 22.30$, $p < .001$. The interaction of session × craving change score, however, did not approach significance, $F(1, 40) = .03$, $p = .864$.

To compare craving change scores at both sessions separately, a paired-sample *t* tests was used.

Visual analog scale. Calculations revealed positive smoking change scores of both sessions (see Table 13). Furthermore, the extend of the smoking change score was higher compared to the corresponding neutral change score at session one and session two, respectively. Effect sizes were large (see Cohen, 1988; see Table 14).

Magnitude estimation. Comparisons between craving change scores via paired-sample *t* tests and effect sizes were in line with VAS for both sessions (see Table 14).

Table 14

Comparison of craving change scores for both sessions

		Paired Differences											
		VAS						ME					
		M	SD	t	df	Sig.	*d*	M	SD	t	df	Sig.	*d*
t_1	scs	1.97	2.60	4.95	40	**<.001**	**1.1**	11.57	20.80	3.46	40	**.001**	**.76**
	nsc	-.07	.63					.28	2.48				
t_2	scs	1.18	2.12	4.21	40	**<.001**	**.98**	8.55	19.43	3.43	40	**.001**	**.74**
	nsc	-.40	.82					-1.99	5.07				

Note. Mean and SD for change scores, scs = smoking change score ($c_5 - c_4$), nsc = neutral change score, (c_3-c_2); VAS = visual analog scale, ME = Magnitude Estimation, t_1/t_2= session one/two (pre/subsequent LDS), Sig. (2-tailed), *d* = Cohen's *d.* Bold/highlighted numbers indicate significant scores.

Results of the MANOVAs and *t* tests confirm hypotheses 1b and 1c. They revealed a positive smoking change score pre (t_1) and subsequent (t_2) LDS (hypothesis 1b) and a higher degree of the smoking change score compared to the corresponding neutral change score pre (t_1) and subsequent (t_2) LDS (hypothesis 1c) for both, VAS and ME.

Comparisons of craving difference scores

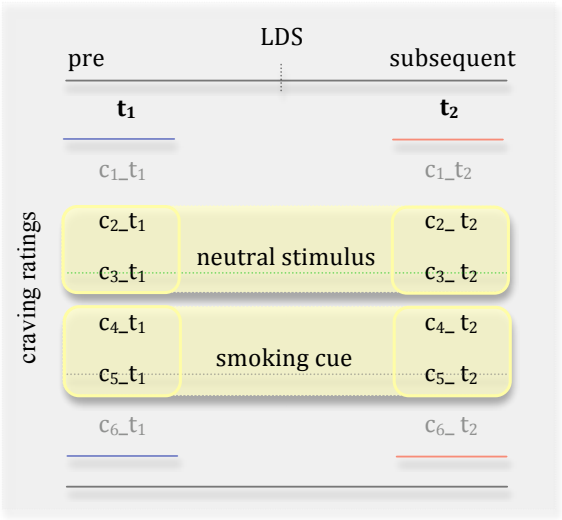

Figure 24. Illustration of the study design: highlighting of the craving difference scores.

The main hypothesis of the study (hypothesis 2, see Figure 6), that nicotine dependent smokers would report higher cue specific craving ratings pre LDS (t_1) compared to subsequent LDS (t_2) was tested calculating a difference score by subtracting the neutral change score (c_3 minus c_2) from the corresponding smoking change score (c_5 minus c_4), for both sessions (see Figure 12). Referring to our operationalization, hypothesis 2 would be verified if the degree of the craving difference score will be less pronounced subsequent LDS (t_2) as compared to pre LDS (t_1).

For a better illustration Figure 25 and 26 display the extent of the craving change scores at both sessions for VAS and ME in a different way then Figure 22 and 23.

Visual analog scale. Results of the paired-sample *t* tests for the comparison between craving difference scores for both sessions indicate a tendency towards a higher craving difference score and therefore higher cue-specific craving pre LDS compared to subsequent LDS. However, differences were not significant and show a small effect size (see Table 15).

Magnitude estimation. Results for ME show the same tendency then VAS with a smaller effect size (see Table 15).

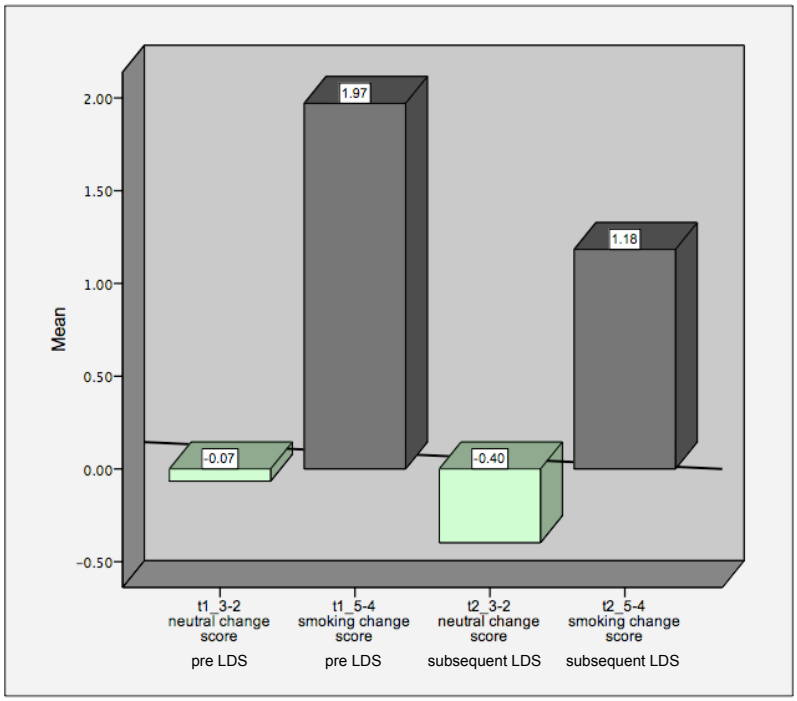

Figure 25. VAS change scores.

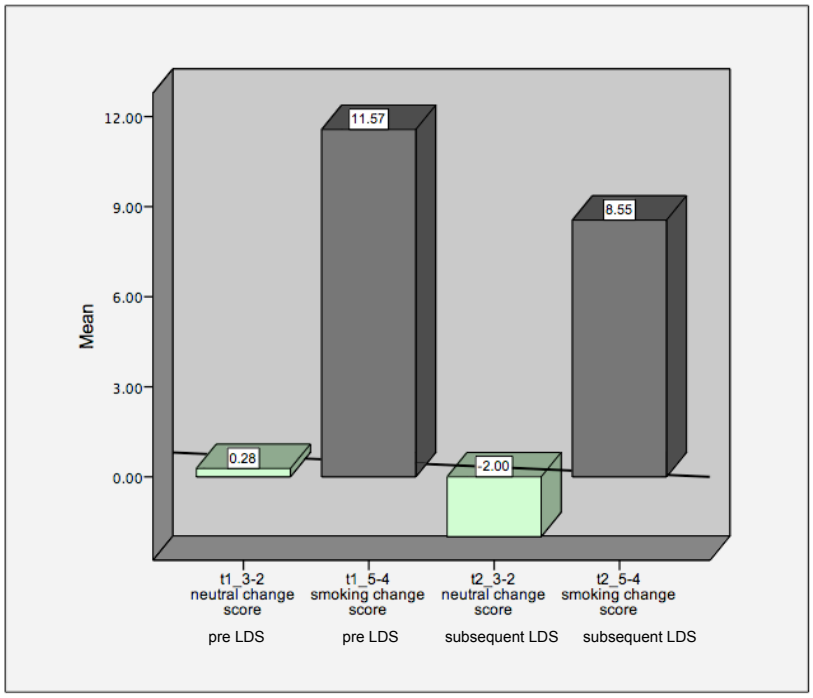

Figure 26. ME change scores.

Table 15

Comparisons of craving difference scores

		Paired Differences											
		VAS						ME					
		M	SD	t	df	Sig.	*d*	M	SD	t	df	Sig.	*d*
Diff score	t_1	2.04	2.63	.99	40	.327	.38	11.29	20.89	.172	40	.864	.04
	t_2	1.58	2.40					10.55	19.69				

Note. Mean and SD for difference scores, difference score = smoking change score (c_5-c_4) - neutral change score (c_3 – c_2), VAS = visual analog scale, ME = Magnitude Estimation, t_1/ t_2 = session one/two (pre/subsequent LDS), Sig. (2-tailed), *d* = Cohen's *d*.

Results of the paired-sample *t* tests show a tendency towards a less pronounced craving difference score at session two (subsequent LDS) as compared to session one (pre LDS). The difference did not reach significance for VAS and ME, therefore hypothesis 2 could not be confirmed.

These results are also reflected in the 2 (session: pre vs. subsequent LDS) x 2 (craving change scores: neutrals vs. smoking change score) multivariate analysis of variance (see p. 89).

Redefined craving change scores

Within the aforementioned definition of cue reactivity, craving ratings pre smoking cue and neutral stimulus exposure serve as individual pre-exposure baselines for the change scores. In this definition initial craving ratings (c_1) are not taken into account. As can be seen in Figure 14 and 15 initial craving ratings were higher subsequent LDS (t_2) compared to pre LDS (t_1). Furthermore, a comparison between initial craving ratings at both sessions revealed a significant difference of VAS and ME (»analysis of corresponding craving ratings« (t_1/t_2), p. 85)

To address for high initial craving ratings at session two the baseline for the craving change scores was redefined. Therefore, cue reactivity was redefined as »the difference of (1) changes in craving reports from baseline to smoking cue exposure (redefined smoking change score: c_5 minus c_1) compared with (2) changes in craving reports from baseline to neutral stimulus exposure (redefined neutral change score: c_3 minus c_1; see Figure 27)«.

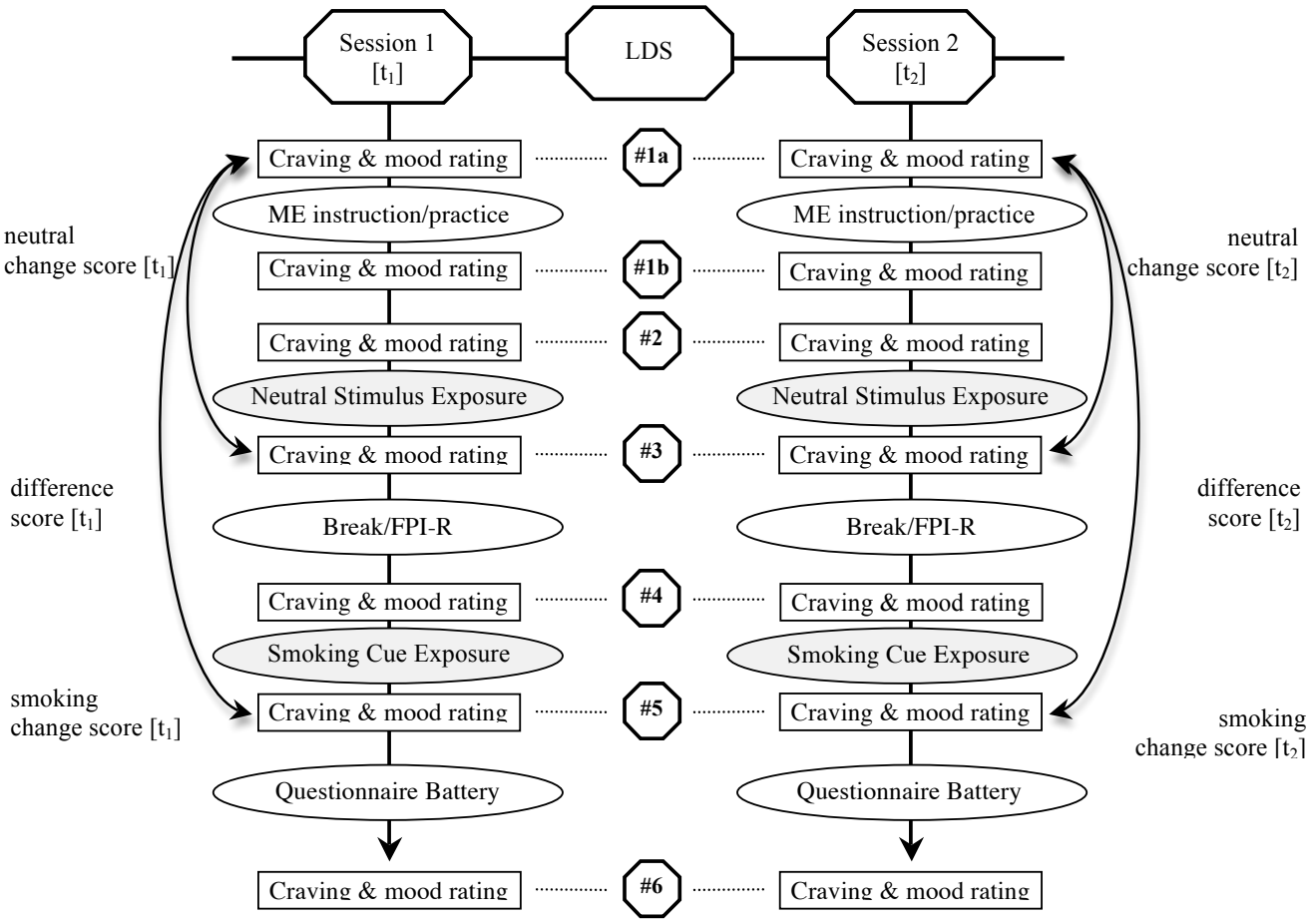

Figure 27. Redefined operationalization of cue reactivity within the present study.

Comparisons of redefined smoking vs. neutral craving change scores

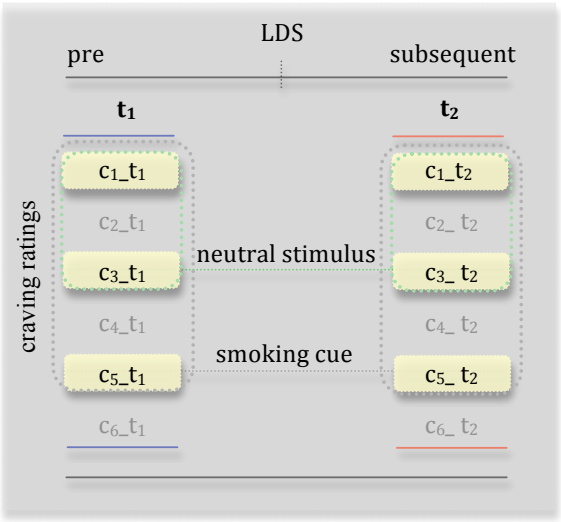

Figure 28. Illustration of the study design: highlighting of the redefined craving change scores.

To test the first hypothesis of the current study according to this redefined operationalization, a 2 (session: pre and subsequent LDS) x 2 (redefined craving change scores: redefined neutrals vs. smoking change score) multivariate analysis of variance (MANOVA) was performed (see Figure 29 and 30).

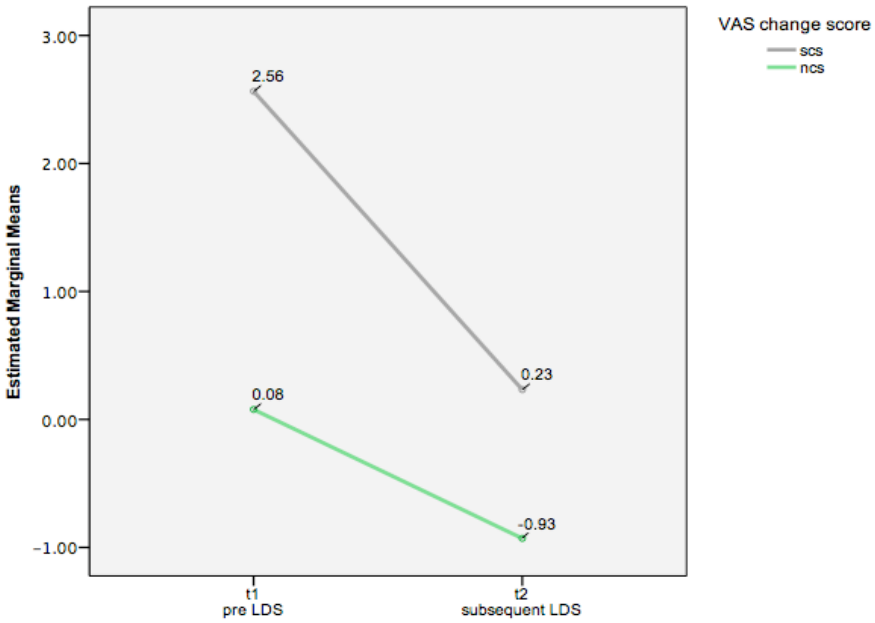

Figure 29. Redefined VAS change scores.

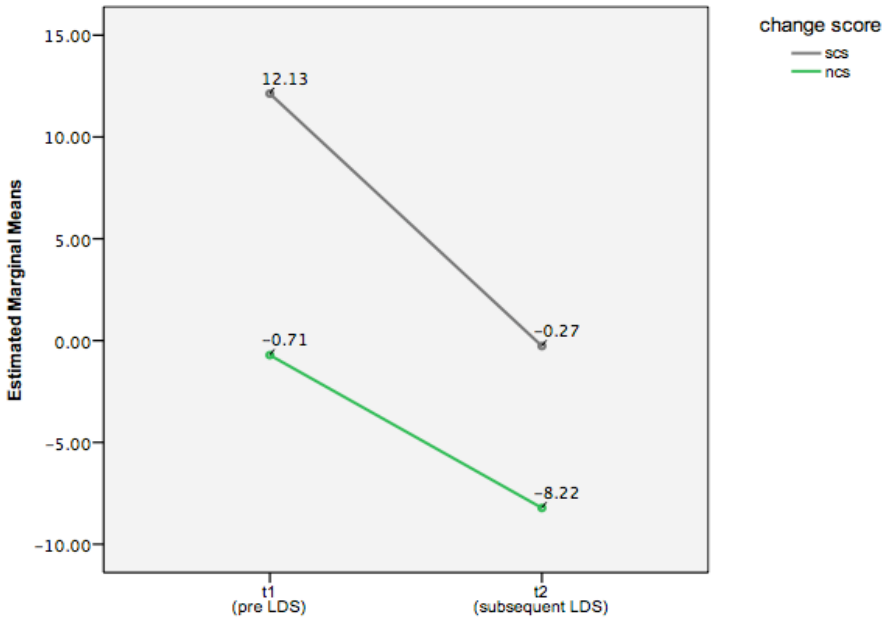

Figure 30. Redefined ME change scores.

Visual analog scale. The 2 (session: pre and subsequent LDS) x 2 (redefined craving change scores: redefined neutral vs. smoking change score) multivariate analysis of variance (MANOVA) revealed a main effect of session (pre/subsequent LDS) $F(1, 41) = 16.01$, $p < .001$ and of redefined craving change score (redefined smoking/neutral change score) $F(1, 41) = 25.59$, $p < .001$. The interaction of session × redefined craving change score also reached significance, $F(1, 41) = 9.27$, $p = .004$.

These results indicate that redefined craving change scores were higher for session one compared to session two and that this effect differed depending on the type of redefined craving change score (redefined neutral vs. smoking change score). They also suggest that changes in craving reports from baseline to smoking cue exposure (redefined smoking change score) were higher then changes in craving reports from baseline to neutral cue exposure (redefined neutral change score) and that the pattern differed between session one and session two.

Magnitude estimation. The MANOVA for ME revealed deviant results. Analyses revealed a main effect of session (pre/subsequent LDS) $F(1, 41) = 6.89$, $p < .012$, and a

main effect of redefined craving change score (redefined smoking/neutral change score) $F(1, 41) = 18.08$, $p < .001$. The interaction of session × redefined craving change score did not reach significance, $F(1, 41) = 1.30$, $p = .261$.

To compare redefined craving change scores for both sessions separately, paired-sample *t* tests were used (see Table 16).

Visual analog scale. The results revealed positive redefined smoking change scores and a significant difference between redefined neutral and smoking change scores for both sessions. Effect sizes pre and subsequent LDS were large (see Cohen, 1988) indicating that smoking cues illicit higher craving ratings than neutral stimulus (see Table 15).

Magnitude estimation. Comparisons between redefined craving change scores via paired-sample *t* tests were in line with VAS (see Table 16). Effect sizes were medium to large pre LDS (t_1) and small subsequent LDS (t_2).

Table 16

Comparison of redefined craving change scores with c_1 as baseline for both sessions

		Paired Differences											
		VAS						ME					
		M	SD	t	df	Sig.	*d*	M	SD	t	df	Sig.	*d*
t_1	scs	2.56	3.13	-5.62	40	**<.001**	**1.0**	12.13	23.95	-3.82	40	**<.001**	.7
	nsc	.08	1.38					-.71	7.96				
t_2	scs	2.32	2.62	-2.92	40	**.006**	**1.4**	-.27	28.96	-2.53	40	**.015**	.3
	nsc	-.93	1.99					-8.22	17.91				

Note. Mean and SD for redefined change scores, scs = smoking change score ($c_5 - c_1$), nsc = neutral change score, ($c_3 - c_1$); VAS = visual analog scale, ME = Magnitude Estimation, t_1/t_2= session one/two (pre/subsequent LDS), Sig. (2-tailed), *d* = Cohen's *d.* Bold/highlighted numbers indicate significant scores.

Results of the MANOVAs and *t* tests confirm hypothesis 1b and 1c. They revealed a positive redefined smoking change score pre (t_1) and subsequent (t_2) LDS (hypothesis 1b) and a higher degree of the redefined smoking change score compared to the corresponding redefined neutral change score pre (t_1) and subsequent (t_2) LDS (hypothesis 1c) for both, VAS and ME.

Comparisons of redefined craving difference scores

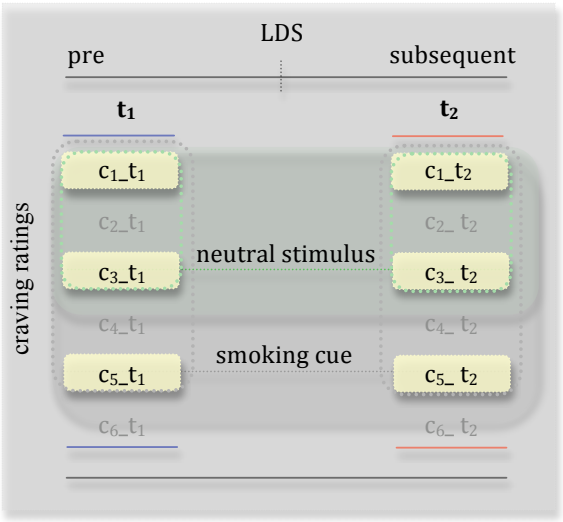

Figure 31. Illustration of the study design: highlighting of the redefined craving difference scores.

To test the main hypothesis with the redefined operationalization the difference score was calculated once more by subtracting the redefined neutral change score (c_3 minus c_1) from the corresponding redefined smoking change score (c_5 minus c_1), for both sessions (Figure 27). Referring to our redefined operationalization, hypothesis 2 would be verified if the degree of the redefined difference score will be less pronounced subsequent LDS as compared to pre LDS. For a better illustration Figure 32 and 33 display the redefined craving change scores for VAS and ME in a different way then Figure 29 and 30.

Visual analog scale. Results of the paired-sample *t* tests for the comparison between redefined craving difference scores for session one and session two indicate that participants reported higher cue-specific craving pre LDS compared to subsequent LDS. Effect sizes for changes in redefined craving difference scores pre LDS compared to subsequent LDS were medium (see Cohen, 1988; see Table 17).

Magnitude estimation. Differences showed the same tendency for ME as for VAS but did not reach significance. Effect sizes for changes in redefined craving difference scores pre LDS compared to subsequent LDS were small (see Cohen, 1988; see Table 17).

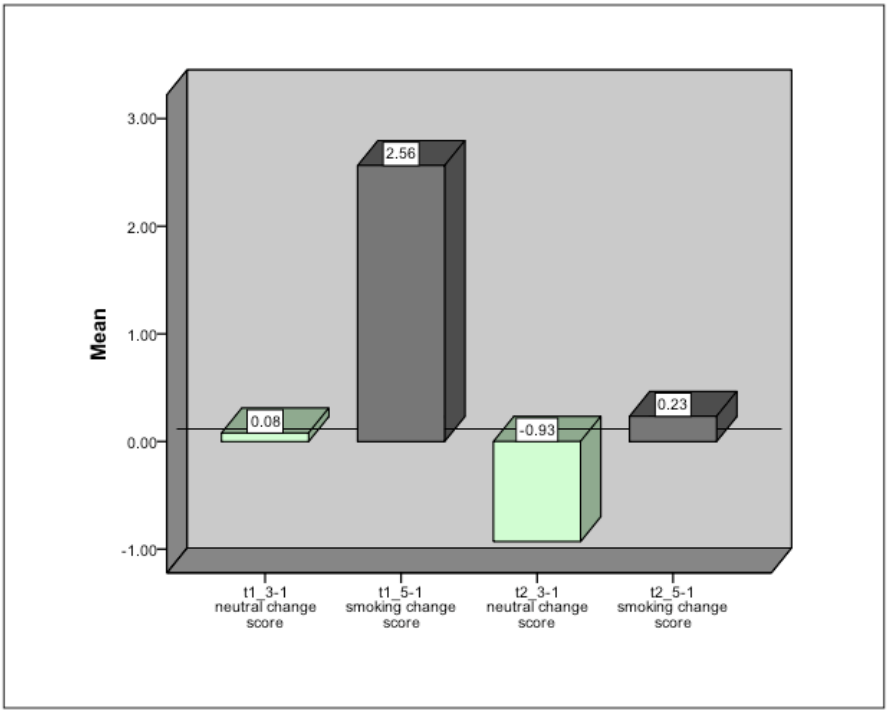

Figure 32. Redefined VAS change scores.

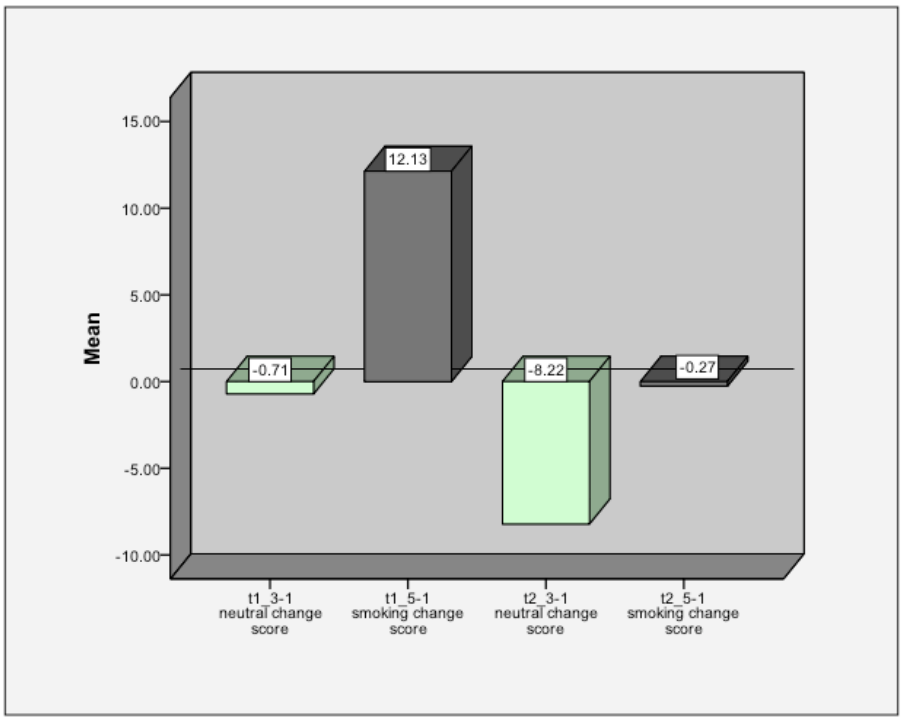

Figure 33. Redefined ME change scores.

Table 17

Comparisons of redefined craving difference scores

		Paired Differences											
		VAS						ME					
		M	SD	t	df	Sig.	*d*	M	SD	t	df	Sig.	*d*
redef diff score	t_1	2.49	2.83	3.04	40	**.004**	.49	12.84	21.51	1.14	40	.261	.23
	t_2	1.16	2.55					7.95	20.10				

Note. Mean and SD for redefined difference scores, redefined difference score = smoking change score ($c_5 - c_1$) - neutral change score ($c_3 - c_1$), VAS = visual analog scale, ME = Magnitude Estimation, t_1/ t_2 = session one/two (pre/subsequent LDS), Sig. (2-tailed), *d* = Cohen's *d.* Bold/highlighted numbers indicate significant scores.

Results of the paired-sample *t* tests confirm hypothesis 2 for VAS, with a less pronounced redefined craving difference score subsequent LDS as compared to pre LDS. The difference did not reach significance for ME, therefore hypothesis 2 could only be confirmed by VAS.

These results are also reflected in the 2 (session: pre and subsequent LDS) x 2 (redefined craving change scores: redefined neutrals vs. smoking change score) multivariate analysis of variance (MANOVA, see p. 96).

Composite urge score

As an additional approach to assess accumulated urge produced by initial drug deprivation and subsequent cue exposure we composed a composite urge score that includes VAS and ME. It accounts for initial craving levels and for an increase of craving during cue exposure by multiplying initial pre-cue exposure baseline VAS scores by a subsequent cue exposure ME score. In line with Sayette et al. (2001) we divided the ME score during smoking cue exposure (ME c_5) by ten, and then multiplied that value by the VAS score at time one (VAS c_1). This value was square root transformed to address a positive skew.

To compare composite urge scores at session one and session two a paired-sample *t* tests was applied. Results indicate no significant differences and a low effect size between composite urge score at session one (*M* = -339.41, *SD*= 920.97) and composite urge score at session two (*M* = -316.75, *SD*= 611.00), ($t_{(41)}$ = .195, *p* < .846, *d* = .03; Figure 34).

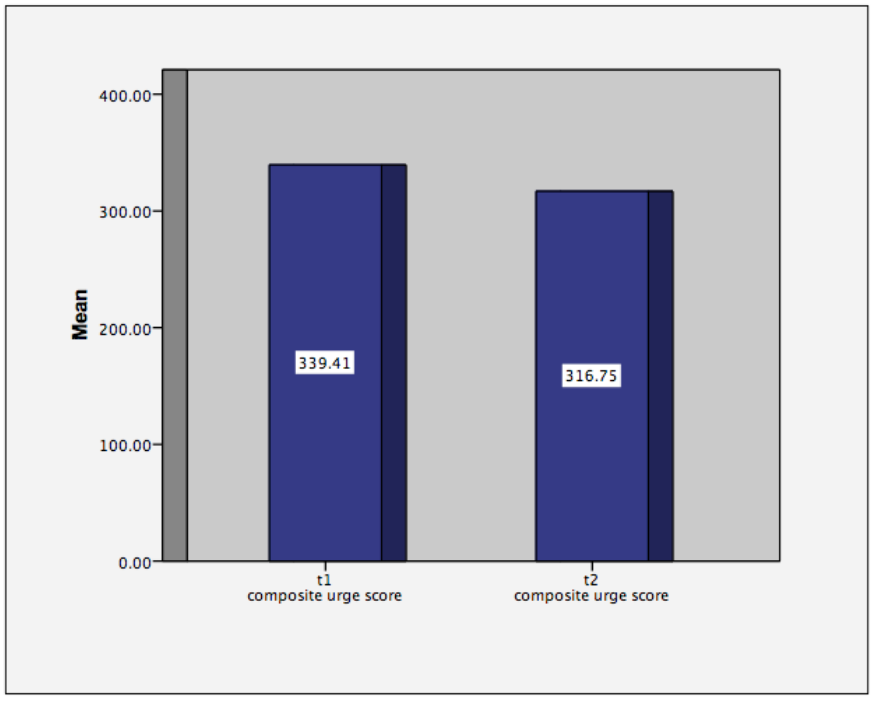

Figure 34. Composite urge scores.

Cue-specific vs. overall craving

We assumed that nicotine dependent smokers report higher overall craving ratings preceding smoking cessation compared to subsequent smoking cessation (hypothesis 3: overall craving, see Figure 6). The aforementioned results of craving measures were based on comparing the strength of the responses (craving) to smoking-related cues with the ones to neutral stimuli, and therefore focused on cue reactivity and cue-specific craving.

The QSU, however, was applied at the end of both experimental sessions independent of the presentation of the cues and stimuli. Representing overall craving a summery score of the 32 items of the QSU was used in the paired-sample *t* test (Batra, Collins, Torchalla, Schröter, & Buchkremer, 2008). The results revealed higher overall craving ratings pre LDS (M = 102.88, SD = 35.04) compared to subsequent LDS (M = 76.88, SD = 32.50) and a large effect size, 9.65, $t_{(41)}$= 4.2, p < .001, d =.77 (see Figure 35). The total scores on the QSU can be classified as mild pre LDS and moderate subsequent LDS (see »tobacco use and nicotine dependence«, p. 64).

The results of the QSU confirm hypothesis 3, that overall craving ratings will be less pronounced subsequent LDS (session two) as compared to pre LDS (session one).

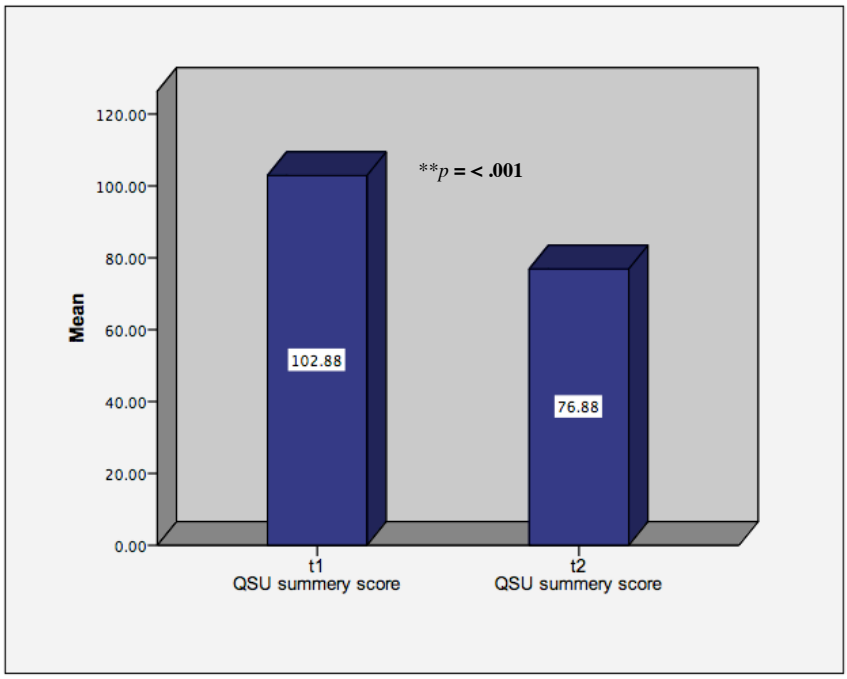

Figure 35. QSU summery scores.

Affective valence

Corresponding to the VAS and ME craving ratings, mood ratings were assessed six times within one session. Figure 36 to 38 display mood ratings for all three MDBF subscales over the course of the sessions. Table 18 presents mean and standard deviations for MDBF mood ratings throughout session one and session two.

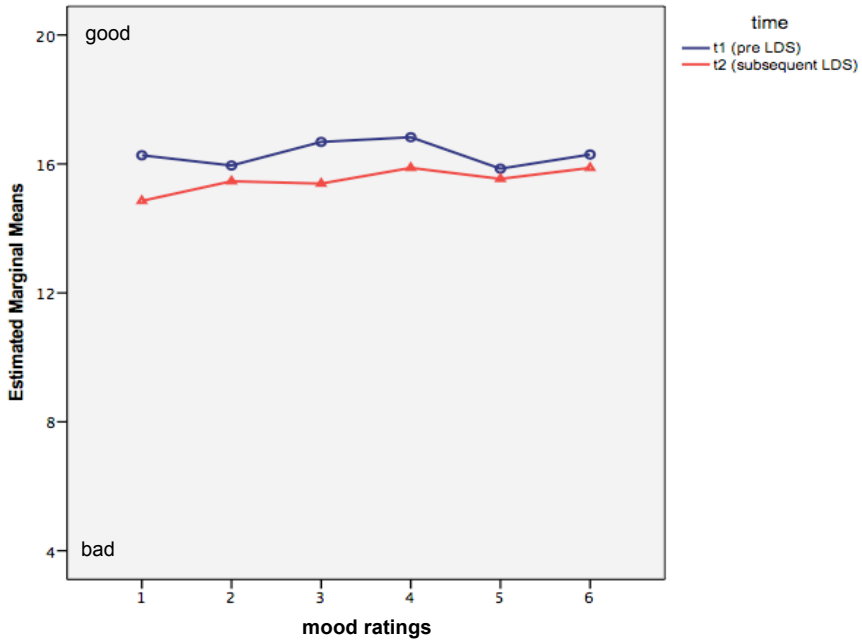

Figure 36. MDBF (good vs. bad) mood ratings over the course of the study.

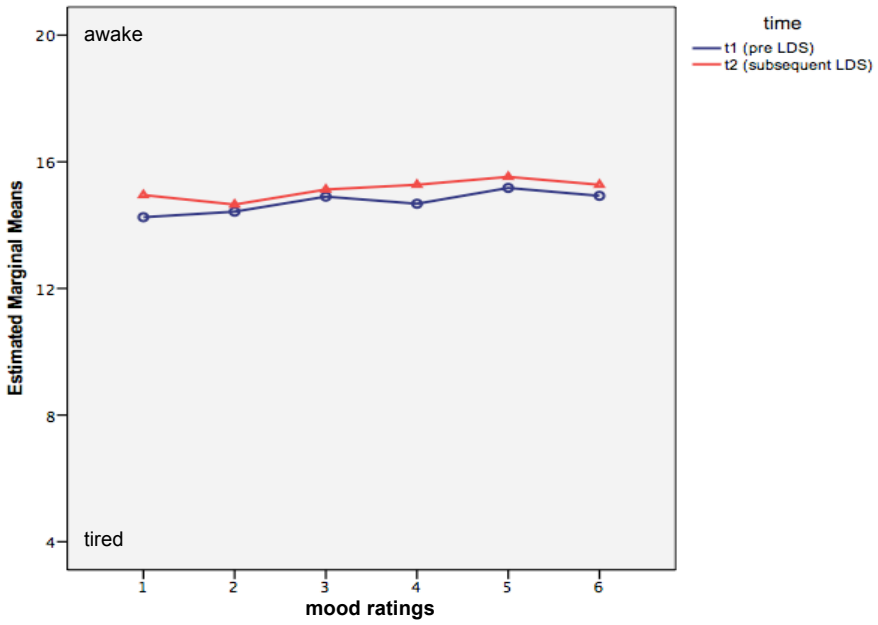

Figure 37. MDBF (awake vs. tired) mood ratings over the course of the study.

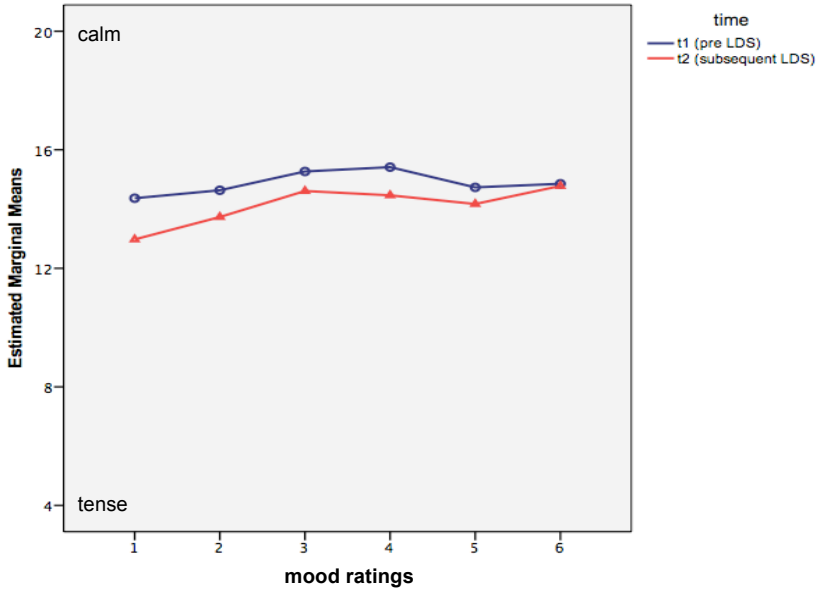

Figure 38. MDBF (calm vs. tense) mood ratings over the course of the study.

Table 18

Mean and standard deviations for mood ratings throughout the sessions

	MDBF											
	t_1 (pre LDS)						t_2 (subsequent LDS)					
	GB		AT		CT		GB		AT		CT	
mood rating	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
c_1	16.27	2.78	14.25	3.87	**14.37**	2.86	**14.85**	3.07	14.95	3.62	**12.98**	3.95
c_2	15.95	3.11	14.43	3.97	14.63	3.29	15.46	2.66	14.65	3.71	13.73	3.49
c_3	16.68	2.81	14.90	4.11	15.27	2.86	15.39	2.90	15.12	3.38	14.61	3.55
c_4	16.83	2.73	14.68	4.15	15.41	3.07	15.88	2.96	15.28	3.55	14.46	3.78
c_5	**15.85**	2.99	**15.18**	3.96	14.73	2.98	15.54	3.12	**15.53**	3.31	14.17	4.25
c_6	16.29	2.80	14.93	3.92	14.85	3.33	15.88	2.48	15.28	3.54	14.78	3.77

Note. Mean and SD for mood ratings at mood ratings c_1-c_6, c_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, MDBF = Multidimensional Mood Questionnaire, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense, LDS = last day of smoking t_1/t_2 = session one/two (pre/subsequent LDS). Bold = lowest or highest scores.

Overall multivariate analysis of variance with repeated measurements

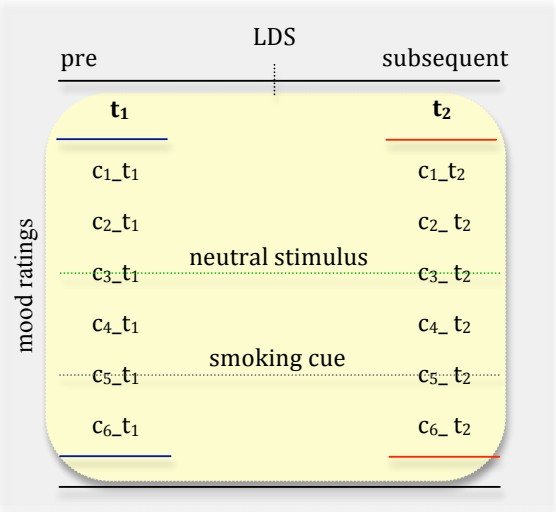

Figure 39. Illustration of the study design: highlighting of the overall MANOVA.

To test whether mood ratings changed during each experimental session, we performed an overall 2 (session: pre vs. subsequent LDS) x 6 (mood ratings: c_1 to c_6) multivariate analysis of variance (MANOVA) with repeated measurements with session and mood ratings as within-subjects variables and the three subscales of the MDBF as dependent variables, respectively. The Bonferroni correction was used to adjust for multiple comparisons. Greenhouse-Geisser corrections were used to adjust degree of freedom for violations of the homogeneity of variance-covariance assumption for repeated measures factors.

Feeling good vs. feeling bad. Analyses revealed a main effect of session (pre/subsequent LDS) $F(1, 41) = 4.71$, $p = .036$, and a main effect of mood ratings $F(5, 41) = 3.82$, $p < .007$. The interaction of session x mood ratings did not reach significance $F(5, 41) = 2.27$, $p < .065$. These results suggest that that mood scores differ across mood ratings ($c_1 – c_6$) at both sessions (t_1/t_2).

Post-hoc analysis for the subscale feeling good vs. feeling bad, via pairwise comparisons, revealed significant differences between mood rating c_4 and c_1 as well as mood ratings c_4 and c_2. All other comparisons were not significant (all *p*'s >.117; see Table 19).

Being awake vs. being tired. The MANOVA revealed no main effect of session (pre/subsequent LDS) $F(1, 41) = .35$, $p = .558$. A main effect of mood ratings was found, $F(5, 41) = 4.98$, $p = .001$. The interaction of session × mood ratings did not reach significance, $F(5, 41) = .45$, $p = .760$. These results indicate that mood scores differ across mood ratings ($c_1 – c_6$) but not across sessions.

Pairwise comparisons for subscale being awake vs. being tired revealed a difference between mood rating c_2 and c_5. The comparison between mood rating c_2 and c_6 reached significance ($p = .50$). All other comparisons were not significant (all *p*'s >.062; see Table 19).

Feeling calm vs. feeling tense. In line with the aforementioned, no main effect of session (pre/subsequent LDS) $F(1, 41) = 2.01$, $p < .164$ emerged, but a significant main effect of mood ratings ($F(1, 41) = 7.23$, $p < .001$). The interaction of session x mood ratings did not reach significance $F(5, 41) = 1.48$, $p < .220$. These results indicate that mood scores differ across mood ratings ($c_1 – c_6$) but not across sessions.

Pairwise comparisons for subscale feeling calm vs. feeling tense revealed differences between mood ratings c_1 and c_3, c_4 and c_6. Aside from this, a significant difference was found between mood rating c_2 and c_4. All other comparisons did not approach significance (all *p*'s >.070; see Table 19).

Table 19

Pairwise comparisons of mood ratings in both test sessions (MDBF)

		MDBF pairwise comparisons mean t_1 & t_2								
		GB			AT			CT		
		M	SE	sig. [a]	M	SE	sig. [a]	M	SE	sig. [a]
c_1	c_2	-.146	.212	1.000	.063	.212	1.000	-.512	.227	.440
	c_3	-.476	.234	.726	-.412	.196	.628	-1.268*	.263	**.000**
	c_4	-.793*	.247	**.039**	-.375	.236	1.000	-1.268*	.261	**.000**
	c_5	-.134	.291	1.000	-.750	.246	.062	-.780	.360	.542
	c_6	-.524	.243	.557	-.500	.215	.378	-1.146*	.270	**.002**
c_2	c_1	.146	.212	1.000	-.063	.212	1.000	.512	.227	.440
	c_3	-.329	.177	1.000	-.475	.188	.233	-.756	.253	.070
	c_4	-.646*	.171	**.008**	-.438	.199	.505	-.756*	.203	**.009**
	c_5	.012	.255	1.000	-.812*	.236	**.021**	-.268	.310	1.000
	c_6	-.378	.200	.998	-.563	.180	.050	-.634	.252	.239
c_3	c_1	.476	.234	.726	.412	.196	.628	1.268*	.263	**.000**
	c_2	.329	.177	1.000	.475	.188	.233	.756	.253	.070
	c_4	-.317	.164	.895	.037	.148	1.000	0	.217	1.000
	c_5	.341	.247	1.000	-.338	.173	.874	.488	.321	1.000
	c_6	-.049	.193	1.000	-.088	.165	1.000	.122	.268	1.000
c_4	c_1	.793*	.247	**.039**	.375	.236	1.000	1.268*	.261	**.000**
	c_2	.646*	.171	**.008**	.438	.199	.505	.756*	.203	**.009**
	c_3	.317	.164	.895	-.037	.148	1.000	0	.217	1.000
	c_5	.659	.235	.117	-.375	.187	.773	.488	.292	1.000
	c_6	.268	.149	1.000	-.125	.150	1.000	.122	.176	1.000
c_5	c_1	.134	.291	1.000	.750	.246	.062	.780	.360	.542
	c_2	-.012	.255	1.000	.812*	.236	**.021**	.268	.310	1.000
	c_3	-.341	.247	1.000	.338	.173	.874	-.488	.321	1.000
	c_4	-.659	.235	.117	.375	.187	.773	-.488	.292	1.000
	c_6	-.390	.196	.807	.250	.174	1.000	-.366	.254	1.000
c_6	c_1	.524	.243	.557	.500	.215	.378	1.146*	.270	**.002**
	c_2	.378	.200	.998	.563	.180	.050	.634	.252	.239
	c_3	.049	.193	1.000	.088	.165	1.000	-.122	.268	1.000
	c_4	-.268	.149	1.000	.125	.150	1.000	-.122	.176	1.000
	c_5	.390	.196	.807	-.250	.174	1.000	.366	.254	1.000

Note. c_1= beginning, c_2/c_3= preceding/during the presentation of the neutral stimulus, c_4/c_3 = preceding/during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, MDBF = Multidimensional Mood Questionnaire, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense, t_1/t_2 = session one/two (pre/subsequent LDS), M= mean difference (significant at the .05 level), SE= standard error; [a]= based on estimated marginal means; *= adjustment for multiple comparisons: Bonferroni. Bold/highlighted numbers indicate significant scores.

Comparisons of redefined smoking vs. neutral mood change scores

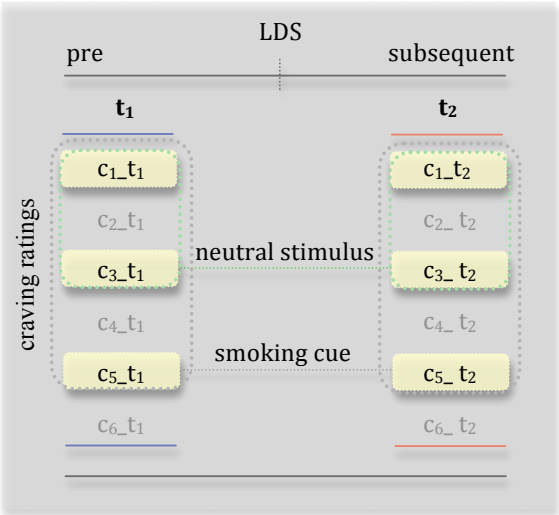

Figure 40. Illustration of the study design: highlighting of the redefined mood change scores.

Regarding the redefined mood change scores (see Figure 27) in which initial mood ratings of session one and session two serve as individual pre-exposure baselines, cue reactivity is defined as »the difference of (1) changes in mood reports from baseline to smoking cue exposure (redefined smoking change score: c_5 minus c_1) compared with (2) changes in mood report from baseline to neutral stimulus exposure (redefined neutral change score: c_3 minus c_1).

Redefined neutral and smoking mood change scores and redefined mood difference scores were calculated for the three subscales of the MDBF. Figure 41 to 43 display the extent of the mood change scores at session one and session two for all three subscales of the MDBF.

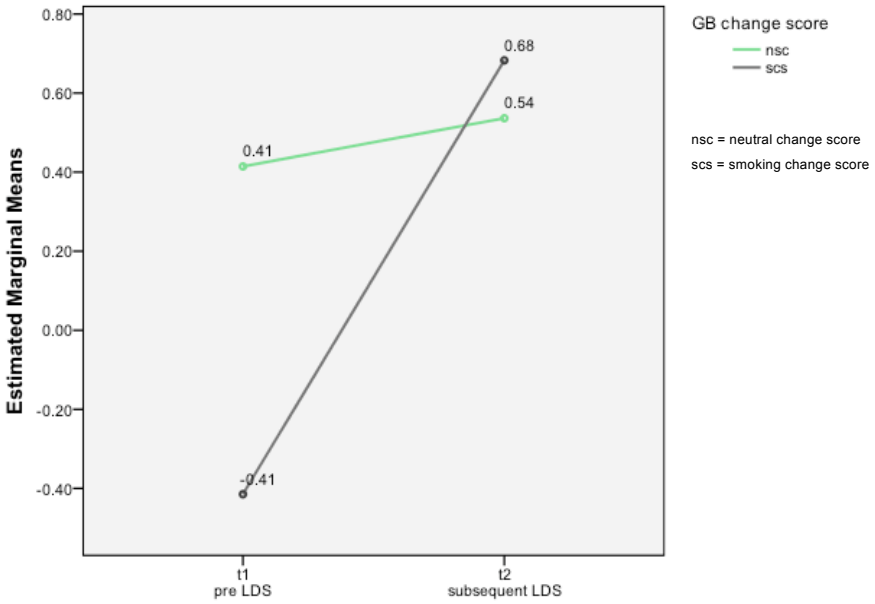

Figure 41. Redefined change score for subscale feeling good vs. feeling bad.

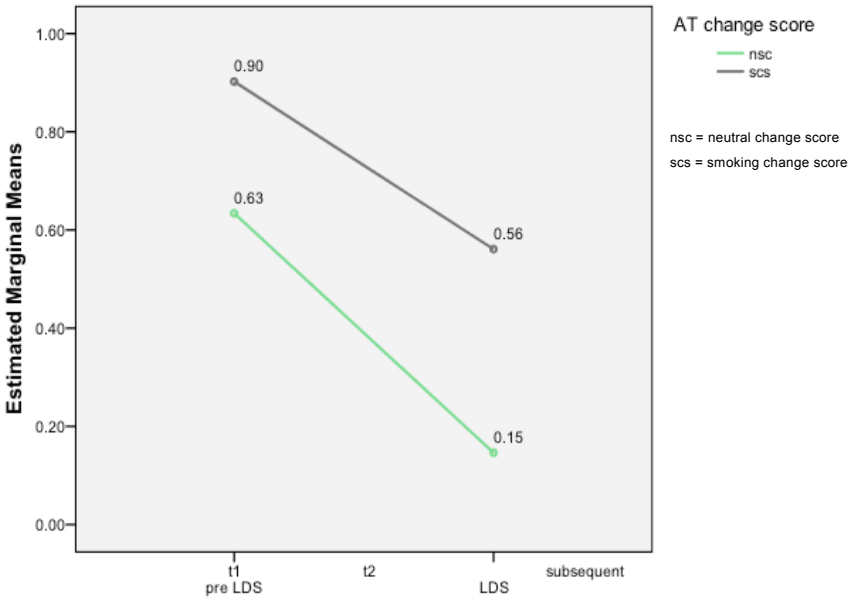

Figure 42. Redefined change score for subscale being awake vs. being tired.

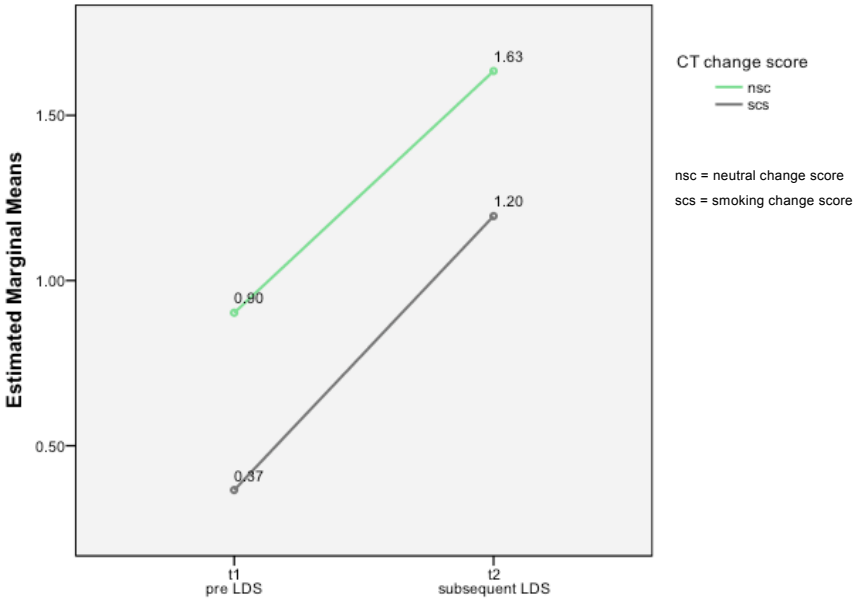

Figure 43. Redefined change score for subscale feeling calm vs. feeling tense.

To test whether our craving manipulation also affected mood ratings a 2 (session: pre and subsequent LDS) x 2 (redefined mood change scores: redefined neutrals vs. smoking change score) multivariate analysis of variance (MANOVA) was performed for all three subscales.

Feeling good vs. feeling bad. No main effect of session (pre/subsequent LDS) $F(1, 41) = 1.88$, $p = .178$ and redefined mood change score (redefined smoking/neutral change score) $F(1, 41) = 1.91$, $p = .175$ emerged.

Being awake vs. being tired. The MANOVA revealed no main effect of session (pre/subsequent LDS) $F(1, 41) = .85$, $p = .362$. A main effect of redefined mood change score (redefined smoking/neutral change score) $F(1, 41) = 4.09$, $p = .05$ emerged. The interaction of session × redefined mood change score did not reach significance, $F(1, 41) = .13$, $p = .724$. These results indicate that changes in mood reports from baseline to smoking cue exposure (redefined smoking change score) were higher then changes in mood reports from baseline to neutral cue exposure (redefined neutral change score). This effect remains stable over time.

Feeling calm vs. feeling tense. The MANOVA revealed no main effect of session (pre/subsequent LDS) $F(1, 41) = 2.77$, $p = .104$ or redefined mood change score (redefined smoking/neutral change score) $F(1, 41) = 2.31$, $p = .137$.

Comparisons of redefined mood difference scores

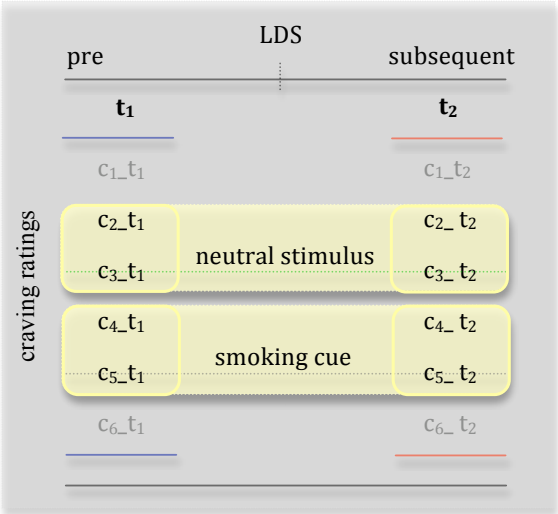

Figure 44. Illustration of the study design: highlighting of the redefined mood difference scores.

Analogous to craving ratings redefined mood difference scores were calculated by subtracting the redefined neutral change score (c_3 minus c_1) from the corresponding redefined smoking change score (c_5 minus c_1), for session one and session two, respectively.

Feeling good vs. feeling bad. Results of the paired-sample *t* tests for the comparison between redefined mood difference scores for session one and session two revealed a significant difference and medium effect size for subscale feeling good vs. bad, indicating that individuals developed worse feelings within session one (pre LDS) compared to session two (subsequent LDS; see Table 20).

Being awake vs. being tired. The comparison of redefined mood difference scores for subscales being awake vs. being tired did not approach significance; effect sizes were very small (see Table 20).

Feeling calm vs. feeling tense. The comparison of redefined mood difference scores for subscales feeling calm vs. feeling tense did not approach significance; effect sizes were very small (see Table 20).

These results are also reflected in the 2 (session: pre and subsequent LDS) x 2 (redefined mood change scores: redefined neutrals vs. smoking change score) multivariate analysis of variance (MANOVA, see p. 111, 112)

Table 20

Comparisons of difference scores for MDBF

		MDBF Paired Differences																	
		GB						AT						CT					
		M	SD	t	df	Sig.	*d*	M	SD	t	df	Sig.	*d*	M	SD	t	df	Sig.	*d*
redef. Diff score	t_1	-.83	1.92	-2.12	40	**.041**	-0.45	.27	1.92	-.36	40	.724	-.08	-.54	2.67	-.18	40	.857	-.04
	t_2	.15	2.38					.41	1.45					-.44	2.68				

Note. Mean and SD for difference scores, redefined difference score = smoking change score ($c_5 - c_1$) - neutral change score ($c_3 - c_1$), MDBF = Multidimensional Mood Questionnaire, GB = subscale feeling good vs. bad, AT = being awake vs. being tired, CT = subscale feeling calm vs. tense, t_1/ t_2 = session one/two (pre/subsequent LDS), Sig. (2-tailed), *d* = Cohen's *d.* Bold/highlighted numbers indicate significant scores.

Motivation

Readiness/Confidence Ruler. Both, importance of abstinence and abstinence self-efficacy were assessed at the end of both sessions (Miller and Rollnick, 2002; German-language version Demmel, 2008, see Figure 45, 46). Importance to quit smoking stayed at the same high level pre LDS (M = 9.17 SD= 1.50) and subsequent LDS (M = 8.98 SD= 1.80; $F(40, 41) = .63$, p =.529, $d = .15$). Confidence, on the contrary, was lower pre ($M = 6.24$ $SD = 2.71$) as compared to subsequent LDS ($M = 7.66$, $SD = 2.01$; $F(40, 41) = 4.27$, $p < .001$, $d = -.6$).

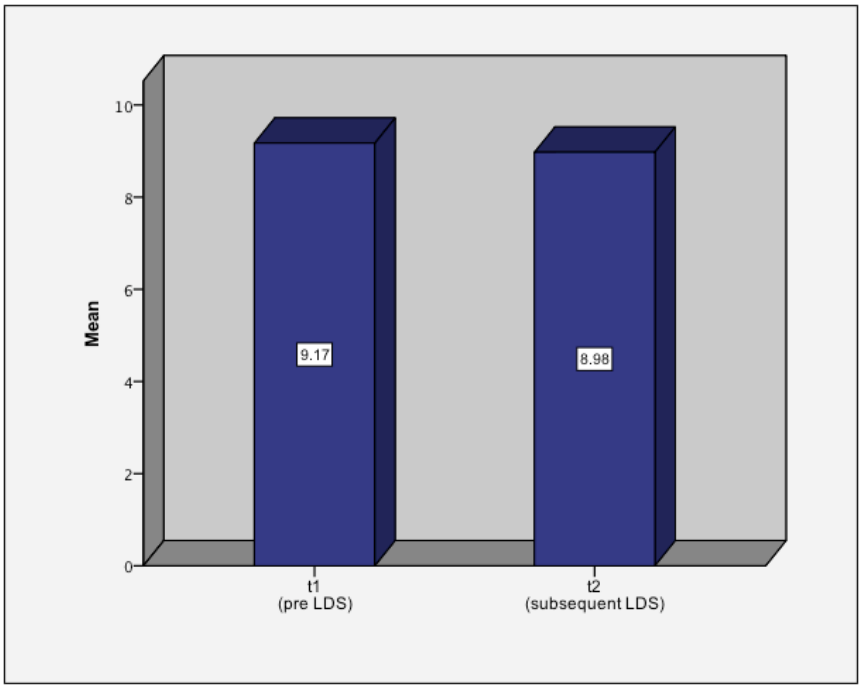

Figure 45. Importance to quit smoking.

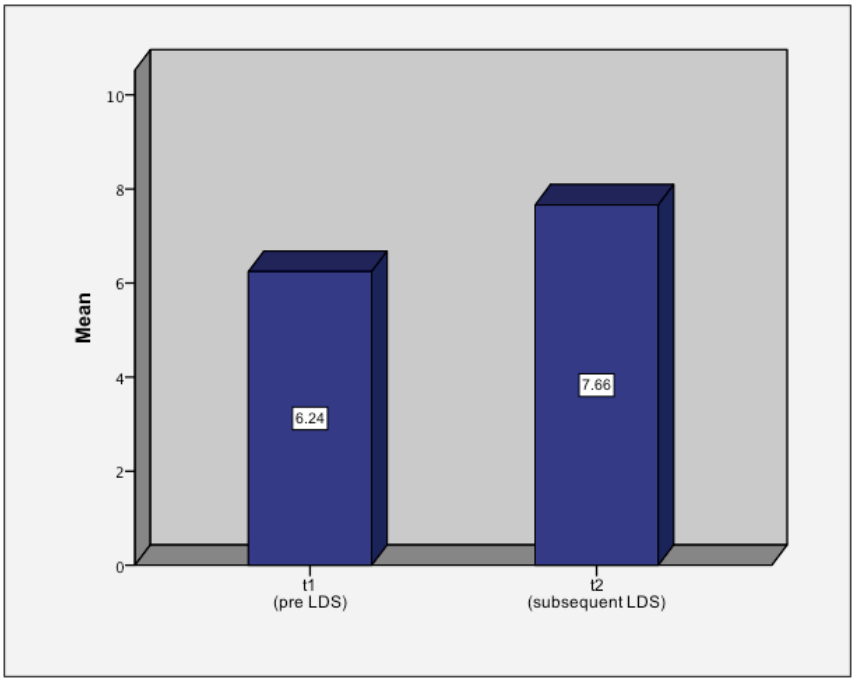

Figure 46. Confidence to quit smoking.

Correlations

Association between craving and affective valence

To investigate the relation between affective valence and craving response measures, Pearson correlations were calculated between VAS and ME and the three subscales of MDBF, separately for both sessions (see Table 22 to 25). For a better comparison of mean and standard deviation of craving and mood ratings Table 12 and 18 have been combined into table 21.

Visual analog scale. During session one, significant negative correlations between the subscale feeling good vs. feeling bad of the MDBF and craving ratings c_2 and c_4 (both at the 0.05 level) as well as significant negative correlations between the subscale feeling calm vs. feeling tense and craving ratings c_5 (at the 0.01 level) and c_6 (at the 0.05 level) were observed.

During session two, significant negative correlations between the subscale feeling good vs. feeling bad and feeling calm vs. feeling tense and all craving ratings c_1 to c_6 (all at the 0.01 level) were found. For subscale being awake vs. being tired no significant correlations were found with any craving rating, neither for session one nor for session two.

Magnitude estimation. Correlational analyses revealed that all three subscales of the MDBF were not associated with self-reported craving at any craving rating for both, session one and session two (all p,s>.131) except for one negative correlation between subscale feeling calm vs. feeling tense and craving rating c_6 at session one.

Table 21

Mean and standard deviations for craving and mood ratings throughout the sessions

	t_1 (pre LDS)										t_2 (subsequent LDS)									
	craving				mood (MDBF)						craving				mood (MDBF)					
	VAS		ME		GB		AT		CT		VAS		ME		GB		AT		CT	
rating	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
c_1	2.36	2.32	11.15	10.51	16.27	2.78	14.25	3.87	14.37	2.86	**3.94**	2.98	**20.30**	17.74	**14.85**	3.07	14.95	3.62	**12.98**	3.95
c_2	2.50	2.41	10.16	7.30	15.95	3.11	14.43	3.97	14.63	3.29	3.40	3.32	14.08	8.50	15.46	2.66	14.65	3.71	13.73	3.49
c_3	2.44	2.43	10.44	6.87	16.68	2.81	14.90	4.11	15.27	2.86	3.01	3.31	12.09	6.50	15.39	2.90	15.12	3.38	14.61	3.55
c_4	2.95	2.72	11.71	7.81	16.83	2.73	14.68	4.15	15.41	3.07	2.99	3.21	11.50	7.90	15.88	2.96	15.28	3.55	14.46	3.78
c_5	**4.92**	3.28	**23.28**	19.20	**15.85**	2.99	**15.18**	3.96	14.73	2.98	**4.17**	3.78	**20.04**	17.90	15.54	3.12	**15.53**	3.31	14.17	4.25
c_6	4.06	3.14	21.05	17.07	16.29	2.80	14.93	3.92	14.85	3.33	3.02	3.24	12.23	9.00	15.88	2.48	15.28	3.54	14.78	3.77

Note. Mean and SD for craving and mood ratings at craving/mood ratings c_1-c_6, c_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, VAS = visual analog scale, ME = Magnitude Estimation, MDBF = Multidimensional Mood Questionnaire, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense LDS = Last day of smoking, t_1/t_2 = session one/two (pre/subsequent LDS). Bold numbers indicate high/low scores.

Table 22

Correlation between VAS and MDBF subscales for session one

				VAS t_1					
				c_1	c_2	c_3	c_4	c_5	c_6
MDBF t_1	c_1	GB	Cor[a]	-.185	-.168	-.223	-.298	-.107	-.157
			Sig	.247	.295	.161	.059	.507	.328
		AT	Cor[a]	.182	.109	.080	.064	-.021	.149
			Sig	.255	.499	.620	.692	.895	.354
		CT	Cor[a]	.135	-.058	-.128	-.104	-.059	-.223
			Sig	.399	.717	.426	.517	.714	.160
	c_2	GB	Cor[a]	-.201	**-.331***	**-.391***	**-.431****	-.214	**-.322***
			Sig	.207	.035	.011	.005	.179	.040
		AT	Cor[a]	.113	.043	-.011	-.033	-.095	.025
			Sig	.488	.793	.944	.837	.558	.879
		CT	Cor[a]	-.015	-.272	**-.337***	**-.359***	-.235	**-.431****
			Sig	.928	.085	.031	.021	.139	.005
	c_3	GB	Cor[a]	-.089	-.168	-.223	-.292	-.104	-.158
			Sig	.579	.294	.161	.064	.519	.323
		AT	Cor[a]	.188	.150	.080	.085	-.057	.119
			Sig	.239	.351	.618	.599	.722	.460
		CT	Cor[a]	.057	-.104	-.144	-.039	.072	-.034
			Sig	.724	.518	.368	.807	.656	.832
	c_4	GB	Cor[a]	-.040	-.127	-.229	**-.310***	-.094	-.202
			Sig	.803	.428	.150	.049	.559	.205
		AT	Cor[a]	.160	.073	-.002	-.033	-.094	.047
			Sig	.318	.651	.989	.838	.557	.772
		CT	Cor[a]	.096	-.062	-.134	-.222	-.075	-.231
			Sig	.550	.698	.403	.163	.642	.146
	c_5	GB	Cor[a]	-.304	**-.405****	**-.445****	**-.398****	-.291	-.268
			Sig	.054	.009	.004	.010	.065	.091
		AT	Cor[a]	.107	.033	-.017	-.005	-.059	.087
			Sig	.505	.835	.915	.975	.716	.587
		CT	Cor[a]	-.203	**-.391***	**-.449****	**-.428****	**-.415****	**-.429****
			Sig	.204	.011	.003	.005	.007	.005
	c_6	GB	Cor[a]	-.200	-.237	-.305	**-.332***	-.167	-.229
			Sig	.210	.135	.052	.034	.295	.150
		AT	Cor[a]	.121	.062	.000	-.007	-.131	.058
			Sig	.452	.701	.996	.967	.414	.717
		CT	Cor[a]	-.049	-.220	-.308	**-.364***	-.223	**-.365***
			Sig	.761	.167	.050	.019	.161	.019

Note. c_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, VAS = visual analog scale, MDBF = Mehrdimensionaler Befindlichkeitsfragebogen, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense, t_1 = session one (pre LDS), Sig = Sig. (2-tailed); **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed), [a]Pearson Correlation. Bold/highlighted numbers indicate significant scores.

Table 23

Correlation between VAS and MDBF subscales for session two

				VAS t_2					
				c_1	c_2	c_3	c_4	c_5	c_6
MDBF t_2	c_1	GB	Cor[a]	**-.496****	-.472**	-.418**	-.370*	-.305	-.388*
			Sig	.001	.002	.007	.017	.053	.012
		AT	Cor[a]	-.193	-.032	.015	.029	-.134	.029
			Sig	.228	.844	.923	.859	.402	.855
		CT	Cor[a]	**-.562****	-.612**	-.569**	-.524**	-.401**	-.505**
			Sig	.000	.000	.000	.000	.009	.001
	c_2	GB	Cor[a]	-.394*	**-.436****	-.395*	-.324*	-.224	-.300
			Sig	.011	.004	.011	.038	.160	.057
		AT	Cor[a]	-.147	-.055	-.020	-.056	-.143	.008
			Sig	.358	.733	.902	.729	.372	.960
		CT	Cor[a]	-.534**	**-.651****	-.636**	-.555**	-.456**	-.560**
			Sig	.000	.000	.000	.000	.003	.000
	c_3	GB	Cor[a]	-.454**	-.507**	**-.488****	-.400**	-.251	-.345*
			Sig	.003	.001	.001	.010	.113	.027
		AT	Cor[a]	-.238	-.128	-.102	-.135	-.159	-.097
			Sig	.134	.427	.526	.402	.321	.545
		CT	Cor[a]	-.488**	-.615**	**-.632****	-.552**	-.399**	-.562**
			Sig	.001	.000	.000	.000	.010	.000
	c_4	GB	Cor[a]	-.399**	-.433**	-.431**	**-.428****	-.293	-.434**
			Sig	.010	.005	.005	.005	.063	.005
		AT	Cor[a]	-.215	-.118	-.100	-.115	-.151	-.089
			Sig	.177	.461	.536	.474	.347	.579
		CT	Cor[a]	-.518**	-.595**	-.591**	**-.572****	-.422**	-.616**
			Sig	.000	.000	.000	.000	.006	.000
	c_5	GB	Cor[a]	-.535**	-.582**	-.546**	-.501**	**-.557****	-.542**
			Sig	.000	.000	.000	.001	.000	.000
		AT	Cor[a]	-.325*	-.203	-.163	-.181	-.265	-.136
			Sig	.038	.204	.307	.257	.094	.396
		CT	Cor[a]	-.606**	-.704**	-.668**	-.623**	**-.670****	-.724**
			Sig	.000	.000	.000	.000	.000	.000
	c_6	GB	Cor[a]	-.514**	-.587**	-.549**	-.539**	-.475**	**-.541****
			Sig	.001	.000	.000	.000	.002	.000
		AT	Cor[a]	-.246	-.181	-.133	-.168	-.256	-.095
			Sig	.121	.258	.408	.294	.106	.556
		CT	Cor[a]	-.518**	-.614**	-.564**	-.572**	-.507**	**-.645****
			Sig	.001	.000	.000	.000	.001	.000

Note. c_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, VAS = visual analog scale, MDBF = Mehrdimensionaler Befindlichkeitsfragebogen, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense, t_2 = session two (subsequent LDS), Sig = Sig. (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed), [a]Pearson Correlation. Bold/highlighted numbers indicate significant scores.

Table 24

Correlation between ME and MDBF subscales for session one

				ME t_1					
				c_1	c_2	c_3	c_4	c_5	c_6
MDBF t_1	c_1	GB	Cor[a]	-.159	-.125	-.041	-.209	.080	.085
			Sig	.322	.438	.797	.190	.617	.595
		AT	Cor[a]	-.062	-.170	-.136	-.203	.066	.108
			Sig	.702	.287	.398	.202	.682	.502
		CT	Cor[a]	-.084	-.120	-.043	-.109	.122	**-.436****
			Sig	.603	.455	.788	.496	.449	.004
	c_2	GB	Cor[a]	-.100	-.235	-.222	**-.327***	.019	-.055
			Sig	.535	.139	.162	.037	.906	.733
		AT	Cor[a]	-.073	-.223	-.201	-.244	.021	.013
			Sig	.652	.167	.213	.129	.897	.935
		CT	Cor[a]	-.011	-.010	-.018	-.160	.025	**-.418****
			Sig	.946	.948	.911	.317	.877	.007
	c_3	GB	Cor[a]	-.098	-.180	-.138	-.277	.097	.023
			Sig	.542	.259	.389	.080	.546	.884
		AT	Cor[a]	-.052	-.154	-.103	-.132	-.016	.009
			Sig	.746	.338	.520	.412	.923	.957
		CT	Cor[a]	-.057	.069	.161	.143	.164	**-.343***
			Sig	.725	.670	.315	.372	.305	.028
	c_4	GB	Cor[a]	.002	-.133	-.088	-.190	.042	-.022
			Sig	.988	.407	.584	.234	.796	.891
		AT	Cor[a]	-.035	-.193	-.150	-.206	-.004	.037
			Sig	.830	.227	.350	.196	.982	.819
		CT	Cor[a]	.022	.050	.085	-.125	.015	**-.455****
			Sig	.892	.754	.599	.435	.927	.003
	c_5	GB	Cor[a]	-.166	-.295	-.301	-.261	-.004	.047
			Sig	.300	.061	.056	.099	.980	.771
		AT	Cor[a]	-.097	-.214	-.161	-.143	.012	.064
			Sig	.547	.178	.316	.373	.940	.690
		CT	Cor[a]	-.152	-.156	-.225	-.208	-.026	-.232
			Sig	.344	.330	.156	.191	.870	.145
	c_6	GB	Cor[a]	-.104	-.232	-.228	-.262	.057	.021
			Sig	.519	.144	.151	.098	.723	.897
		AT	Cor[a]	-.095	-.252	-.210	-.223	.006	.058
			Sig	.555	.112	.187	.161	.970	.717
		CT	Cor[a]	-.105	-.065	-.087	-.173	.068	**-.386***
			Sig	.515	.685	.591	.279	.674	.013

Note. c_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, ME = magnitude estimation, MDBF = Mehrdimensionaler Befindlichkeitsfragebogen, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense, t_1 = session one (pre LDS), Sig = Sig. (2-tailed); **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed), [a]Pearson Correlation. Bold/highlighted numbers indicate significant scores.

Table 25

Correlation between ME and MDBF subscales for session two

				ME t_2					
				c_1	c_2	c_3	c_4	c_5	c_6
MDBF t_2	c_1	GB	Cor[a]	.013	**-.357***	**-.423****	-.092	.017	-.112
			Sig	.937	.022	.006	.567	.917	.487
		AT	Cor[a]	.026	-.062	.005	.190	-.141	.140
			Sig	.871	.702	.974	.233	.378	.383
		CT	Cor[a]	.192	**-.353***	**-.381***	-.122	-.065	-.177
			Sig	.228	.024	.014	.449	.687	.270
	c_2	GB	Cor[a]	.106	-.229	-.228	-.077	-.027	.069
			Sig	.509	.150	.151	.631	.866	.667
		AT	Cor[a]	.127	.019	.084	-.042	-.097	.203
			Sig	.429	.907	.602	.796	.546	.204
		CT	Cor[a]	.300	-.184	-.195	-.169	-.172	-.112
			Sig	.056	.250	.222	.292	.283	.485
	c_3	GB	Cor[a]	.156	-.141	-.206	-.029	-.151	.068
			Sig	.332	.378	.196	.858	.346	.671
		AT	Cor[a]	.156	.050	.033	.067	-.087	.135
			Sig	.329	.757	.839	.679	.590	.401
		CT	Cor[a]	.298	-.090	-.211	-.074	-.202	-.083
			Sig	.059	.577	.184	.645	.204	.608
	c_4	GB	Cor[a]	.167	-.021	-.143	-.110	-.071	-.013
			Sig	.298	.898	.373	.492	.659	.934
		AT	Cor[a]	.172	.095	.083	-.066	-.016	.106
			Sig	.281	.556	.605	.684	.920	.509
		CT	Cor[a]	.250	-.075	-.203	-.218	-.078	-.162
			Sig	.115	.641	.203	.171	.630	.311
	c_5	GB	Cor[a]	.228	-.040	-.199	-.049	-.215	-.232
			Sig	.151	.804	.212	.762	.177	.145
		AT	Cor[a]	.236	.132	.081	.151	-.198	.073
			Sig	.138	.412	.613	.345	.215	.650
		CT	Cor[a]	**.354***	-.068	-.216	-.090	-.240	**-.335***
			Sig	.023	.672	.176	.575	.131	.032
	c_6	GB	Cor[a]	.287	-.046	-.135	-.103	-.189	-.125
			Sig	.069	.776	.401	.522	.237	.434
		AT	Cor[a]	.208	.051	.078	-.054	-.110	.105
			Sig	.191	.750	.630	.739	.495	.512
		CT	Cor[a]	.279	-.111	-.212	-.173	-.084	-.188
			Sig	.077	.491	.184	.279	.603	.239

Not. ec_1= beginning, c_2 = preceding the presentation of the neutral stimulus, c_3 = during the presentation of the neutral stimulus, c_4 = preceding the presentation of the smoking cue, c_5 = during the presentation of the smoking cue, c_6 = following the completion of the questionnaire battery, ME = magnitude estimation, MDBF = Mehrdimensionaler Befindlichkeitsfragebogen, GB = subscale feeling good vs. bad, AT = subscale being awake vs. tired, CT = subscale feeling calm vs. tense, t_2 = session two (subsequent LDS), Sig = Sig. (2-tailed); **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed), [a]Pearson Correlation. Bold/highlighted numbers indicate significant scores.

For further investigations about the relation between affective valence and craving, Pearson correlations were calculated between corresponding (redefined) change and difference scores of VAS/ME and the three subscales of MDBF, separately for session one and session two.

Visual analog scale. (Redefined) change and difference scores of the subscale feeling awake vs. feeling tired of the MDBF were not associated with corresponding (redefined) change and difference scores of VAS, neither for session one or session two (all *p*,s>.184). The other two subscales of the MDBF, feeling good vs. feeling bad and feeling calm vs. feeling tense show no association with the corresponding (redefinded) change and difference score for session one. Subsequent LDS (t_2) correlations between corresponding redefined smoking change score of subscale feeling good vs. feeling bad und VAS (*r*=-.378, *p*=.015) and for redefined smoking change score of subscale feeling calm vs. feeling tense and VAS (*r*=-.435, *p*=.004) reached significance. Furthermore, significant correlations emerged between corresponding redefined difference scores of VAS and subscale feeling good vs. feeling bad (*r*=-.469, *p*=.002) and between corresponding redefined difference scores of VAS and subscale feeling calm vs. feeling tense (*r*=-.500, *p*=.001) for session two.

Magnitude estimation. Correlational analyses revealed that corresponding (redefined) change and difference scores of all three subscales of the MDBF were not associated with ME for both, session one and session two (all *p*'s>.-101).

Importance and confidence

Confidence to quit smoking at session one was associated with confidence to quit smoking at session two (*r*=.632, *p*<.001), with VAS and ME smoking change scores at session two (VAS: *r*=-.477, *p*=.002; ME: (*r*=-.488, *p*=.001) and with VAS and ME difference score at session two (VAS: *r*=-.429, *p*=.005; ME: *r*=-.541, *p*<.001).

DISCUSSION

This cue reactivity study examined the influence of smoking status (smoking vs. smoking cessation) on self-reported urge and affective valence under controlled laboratory conditions. We expected that participants would experience their peak of craving during smoking cue exposure at both times, before and after LDS ($c_5\_t_1$, $c_5\_t_2$) with higher craving ratings preceding LDS (t_1) compared to subsequent (t_2) LDS.

According to Sayette et al. (2000) and Carter and Tiffany (1999, 2001) cue reactivity was defined in the present study as »the difference of (1) changes in craving report from pre to smoking cue exposure (smoking change score) compared to (2) changes in craving reports from pre to neutral stimulus exposure (neutral change score)«. Within this definition craving ratings pre smoking cue and neutral stimulus exposure served as individual pre-exposure baselines for the craving change scores. To address high initial baseline ratings preceding LDS ($c_1\_t_2$) the baseline for the craving change scores was redefined, with initial craving ratings for session one and session two as baselines. The (redefined) craving difference score was calculated by subtracting the (redefined) neutral change scores from the corresponding (redefined) smoking change scores.

Concerning cue-specific craving (VAS, ME), participants reported the strongest cravings during smoking cue exposure at both times, pre and subsequent LDS ($c_5\_t_1$, $c_5\_t_2$) for both measures, VAS and ME (verifying hypothesis 1a). Additionally, initial craving ratings at session two ($c_1\_t_2$) reached high scores. Pre (t_1) and subsequent (t_2) LDS the exposure to smoking cues elicited craving in nicotine dependent smokers (verifying hypothesis 1b). The results also showed that nicotine dependent smokers reported stronger craving ratings to smoking cues as compared to neutral stimuli pre (t_1) and subsequent (t_2) LDS (verifying hypothesis 1c).

The main results of this studies are that nicotine dependent smokers showed a tendency of higher craving during the cue reactivity session preceding LDS (t_1) compared to subsequent (t_2) LDS (hypothesis 2). This tendency was more pronounced for VAS then for ME. When high initial craving ratings at session two were factored into analyses (redefined change and difference score) this tendency became significant for VAS.

As an additional approach to assess accumulated urge produced by initial drug deprivation and subsequent cue exposure a composite urge score was composed, in which initial pre-cue exposure baseline VAS craving ratings are multiplied by a subsequent cue exposure ME score. Results did not reach significance.

Results focusing on overall craving assessed by the QSU show less pronounced craving ratings subsequent LDS as compared to pre LDS (verifying hypothesis 3).

As a control variable, affective valence was assessed through the MDBF. Results show that mood ratings have a different pattern and course then craving ratings.

Magnitude and course of craving

Looking at the course of craving and the maximum peak for VAS for both sessions (see Figure 14, Table 12) it becomes apparent, that reported craving ratings range from 2.36 to 4.92 and therefore represent only the bottom half of the VAS scale that has a maximum end point of ten. It was anticipated that the smoking cue exposure and a nicotine-deprived state at the beginning of the laboratory session at session two (preceding LDS) would lead to high craving ratings and even to ceiling effects. To eliminate an inadequate range on the scale to accurately quantify potential increases in urges elicited by cue exposure (Sayette et al., 2000) ME was chosen in the present study as a second craving response measure. Therefore medium craving ratings for VAS appear to be low. This finding however is consistent with several other studies (e.g., Miranda et al., 2008, Rohsenow et al., 2007). A review of cue reactivity studies also indicates that individuals often report only mild urge states during drug cue exposure (e.g., less than 40% of the maximum value on their respective urge scales; Wertz & Sayette, 2001a).

One possible explanation might be that the abstinence-seeking addicts were motivated to reduce their urge because they perceive they will be unable to satisfy it. Therefore, they might selectively generate and evaluate information to permit a rational appraisal of the issue, in a manner more suitable to their motives. As a result they may report their urges as

being lower than in situations where they anticipate being able to satisfy their urge (Kunda, 1990).

An additional explanation might be a reduction of craving due to a reduction of availability. Numerous studies have proven that availability influences cue reactivity and craving in a way that individuals addicted to drugs report stronger craving when they perceive their drug as being available for use (e.g. Bailey, Goedeker, & Tiffany, 2010, Wertz & Sayette, 2001a). Different types of availability (see »classification of availability«, p. 46) may have an impact on craving ratings within the present study.

First, the laboratory itself as a low smoking-relevant environment, might already have signaled a low physical availability (see »contextual factors«, p. 43 and »physical and cognitive availability«, p. 45) and therefore led to a reduction of craving (e.g. Thewissen et al., 2008). Second, at session one, participants were still smokers but already had the intention to quit smoking. This resolution might already have lead to a restriction of cognitive availability, which in turn might have caused a reduction in craving (see Table 26, Figure 48). This conforms to the findings of Wertz and Sayettte (2001) that addicts not currently trying to quit smoking report urges about twice as strong as do those undergoing cue exposure assessment at the start of treatment (Wertz & Sayette, 2001).

Besides increases of urge through smoking cue presentation ($c_5\_t_1$/$c_5\_t_2$), participants reported higher craving ratings at the end of the first session ($c_6\_t_1$), for both, VAS and ME (see Figure 14, 15). This pattern did not arise for session two. Subsequent LDS (t_2) no significant differences were found in the course of craving for ME. For VAS, craving ratings even decreased from smoking cue exposure ($c_5\_t_2$) to filling out the questionnaires at the end of the session ($c_6\_t_2$). This conforms to observations of other researchers that following peak craving levels urge ratings begin to drop rather quickly (Niaura et al., 1999; Sayette & Parrott, 1999; Shiffman et al., 2003, Sayette et al., 2005).

Furthermore, initial VAS craving ratings ($c_1\_t_2$) reached high scores subsequent LDS. These results are in line with analysis of corresponding craving ratings (»analysis of corresponding craving ratings«, see p. 85), where craving ratings at craving rating c_1 were lower at session one compared to session two whereas craving ratings at craving rating c_6 were higher at session one compared to session two.

High final craving ratings at session one ($c_6\_t_1$; see Table 12) could be promoted by completing the questionnaire battery including craving questionnaires (e.g. QSU). Shadel et al. (2001), however, came to the conclusion that »investigators who use the QSU-Brief can be reasonably sure that the scores that result are not biased due to reactivity effects« (p. 265). An alternative explanation could be a carryover effect of the smoking cue exposure. This would confirm our decision against counterbalancing the order of cues (see »cues, stimulus and presentation mode«, p. 57), so that responses to neutral stimuli could not be affected by the pre-exposure to smoking cues.

Additionally, high craving ratings at the end of the first session compared to lower craving ratings at the end of the second session could be explained in the matter of availability due to smoking status (smoking vs. smoking cessation). Up until LDS, which was scheduled two to three days subsequent session one, participants were still smoking. Therefore, during the last craving rating at session one, participants might have anticipated that the end of the session is near and that they would be able to smoke a cigarette soon. As mentioned above, during the session, when smoking was prohibited, local physical availability was low. At the end of session one though, distal physical and cognitive availability were high (see Table 10). In terms of Wertz and Sayette (2001a) the *perceived drug use opportunity* was considered high and the cigarette cue as well as the questionnaire battery at the end of the session could have signaled imminent use, which, in turn, would lead to and explain increases of craving.

At session two (subsequent LDS) participants had stopped smoking so that the local and distal cognitive availability (see Figure 5 and 47) can be considered low. In terms of Wertz and Sayette (2001a) there was a lack of perceived drug use opportunity. The cigarettes were physical available but without a perceived opportunity to use it, neither during the session nor afterwards. Therefore, the cigarettes did not signal imminent use (see »availability«, p. 44; »perceived drug use opportunity«, Wertz & Sayette, 2001a), which, in contrast to session one, could have caused a decrease in craving at the end of this session.

High initial craving ratings at the beginning of session two (c_1_t_2) can be explained by deprivation and withdrawal (e.g. Bailey et al., 2010; McClernon et al., 2009). In the current study not only availability varies from session one to session two based on the smoking status but also deprivation. Therefore, Figure 5 will be expanded by deprivation (see Figure 47).

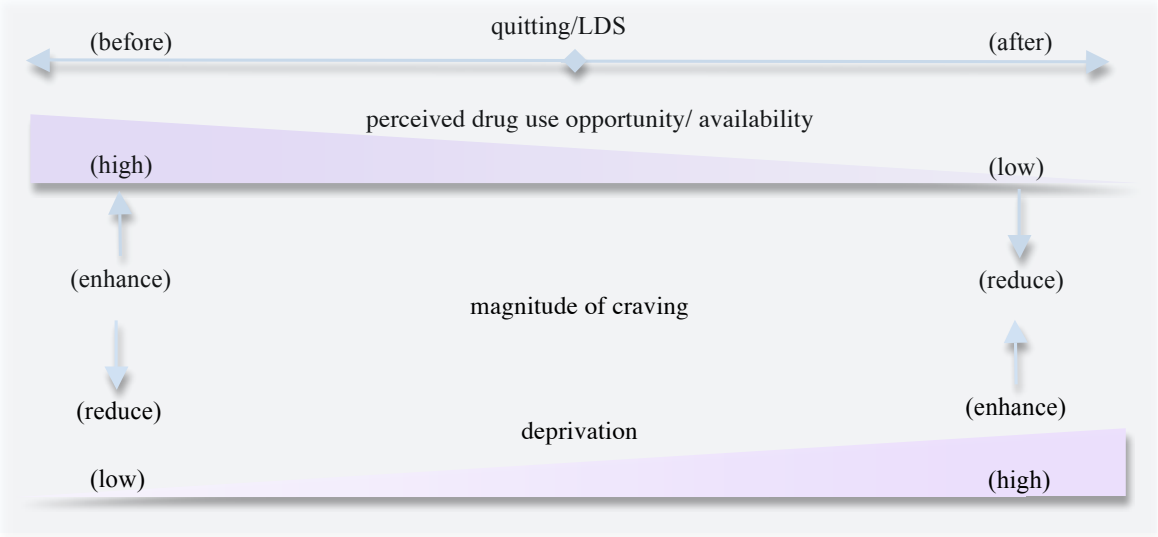

Figure 47. Assumed link between smoking status, availability, deprivation and craving.

Subsequent LDS participants, who were nicotine dependent smokes, have not smoked for about three days, which caused a high degree of deprivation. Pre LDS, when participants were still smoking, they were only minimally deprived as not being allowed to smoke during the experiment. Sayette (2001) reported a marginally significant interaction, such that deprivation especially increased urge among nicotine dependent smokers. Maude-Griffin and Tiffany (1996) and Bailey et al. (2010) found that abstinent smokers reported generalized increases in craving relative to non-abstaining smokers. Considering these findings, it seems plausible that initial craving ratings subsequent LDS are high, representing a generalized increase in craving due to deprivation (see Figure 47).

Hypotheses

Hypotheses 1a/b/c

We expected that participants would experience their peak of craving during smoking cue-exposure at both times, before and after LDS ($c_5\_t_1$, $c_5\_t_2$; hypothesis 1a). We also predicted that the exposure to smoking cues elicits craving in nicotine dependent smokers pre (t_1) and subsequent (t_2) smoking cessation (hypothesis 1b) operationalized by a positive smoking change score pre (t_1) and subsequent (t_2) LDS. Moreover, we predicted that nicotine dependent smokers report stronger craving ratings to smoking cues as compared to neutral stimuli pre (t_1) and subsequent (t_2) smoking cessation (hypothesis 1c), operationalized by a higher degree of the smoking change score compared to the corresponding neutral change score pre (t_1) and subsequent (t_2) LDS.

Results show that these measures were sensible to our craving manipulation. Both, VAS and ME increases were highest during smoking cue exposure pre and subsequent LDS ($t_1\_c_5/t_2\_c_5$; confirming hypothesis 1a). Although urge to smoke was significantly increased by smoking cues, the magnitude of this effect was modest (see »magnitude and course of craving«, p. 123). Furthermore, a positive smoking change score was found pre (t_1) and subsequent (t_2) LDS (confirming hypothesis 1b). Results also showed that the degree of the smoking change score was higher compared to the corresponding neutral change score pre (t_1) and subsequent (t_2) LDS (confirming hypothesis 1c). These results were significant for both, VAS and ME and independent of the type of craving change score baseline (initial craving rating vs. pre cue/stimulus exposure). Thus, we are confident that our smoking cue exposure assessment battery worked and was administered at the optimal point in the study.

These results are consistent with findings of Sayette et al. (2001), where the cue exposure procedure of the present study was adapted from. Moreover, recent studies (e.g. Attwood et al., 2008) are in line with these results.

Hypothesis 2

We predicted that nicotine dependent smokers would report higher cue-specific craving pre LDS (t_1) compared to subsequent LDS (t_2; Hypothesis 2). Referring to our operationalization, this hypothesis is verified if the degree of the difference score is less pronounced subsequent LDS as compared to pre LDS. Results for VAS and ME showed a tendency of a higher cue reactivity of nicotine dependent smokers pre LDS compared to subsequent LDS. When high initial craving ratings at session two were factored into analyses (redefined change and difference score) this tendency became significant for VAS. This goes along with recent findings that both, exposure to cigarette cues and increasing availability of those cues produced higher levels of craving to smoke (Bailey et al., 2010).

Craving change and difference scores. That the results did not reach significance may be explained by the calculation of the difference score, more precisely, of the change scores that compose the difference score. Within the definition of the change scores craving ratings pre smoking cue (c_4) and neutral stimulus (c_2) exposure served as individual pre-exposure baselines. Subsequent LDS high initial baseline craving ratings decrease slowly from c_1 to c_3 leading to a negative neutral change score (see Figure 22, 23). Because of the fixed order of cues, with the neutral stimulus presented first, only the neutral change score was affected by high initial baseline ratings. For that reason not only the smoking change score was higher at session one compared to session two, as hypothesized, but also the neutral change score, which was expected to stay at the same level. The difference between the two smoking change scores exceeded the one between the two neutral change scores. Therefore, the degree of the difference score was still less pronounced subsequent LDS as compared to pre LDS but the difference did not reach significance.

Additionally, the small difference between the two difference scores may be due to the fact that the change of cognitive availability manipulated through smoking cessation from session one to session two was less pronounced as expected. As mentioned above (see »magnitude and course of craving«, p. 123) participants were still smoking at session one, but already had the intention to quit. Furthermore, participants reported a high importance of abstinence not only after but also before quitting (see Figure 45). This might already have lead to a restriction of cognitive availability at session one.

It seems reasonable to assume that there is not only a difference in cognitive availability between nicotine dependent smokers and smokers restraining form smoking during smoking cessation. Besides, a distinction of nicotine dependent smokers with and with no recent intention to quit might exist that has an impact on availability. This is in line with findings of Wertz and Sayettte (2001) that addicts not currently trying to quit smoking report urges about twice as strong as do those undergoing cue exposure assessment at the start of treatment (Wertz & Sayette, 2001).

This leads to the conclusion that there might be a continuum of cognitive availability decreasing from no recent intention to quit over recent intention to quit to smoking cessation (see Figure 48).

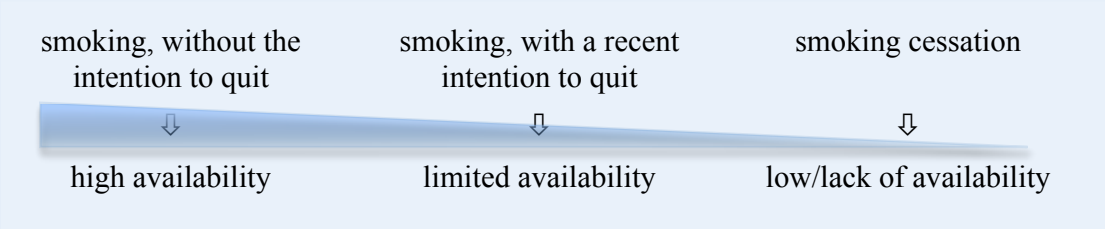

Figure 48. Availability and smoking status.

Therefore, the *availability manipulated through smoking cessation* should be reclassified in the current study. At session one, at witch participants already had the intention to quit smoking within a few days, the availability manipulated through smoking status should rather be described as *limited* local and distal cognitive availability. For an overview of the reclassification of availability in the present study, see Table 26.

Table 26.

Reclassification of availability in the present study

	session one (t_1)		session two (t_2)	
	experimental	smoking status: smoking, with intention to quit	experimental	smoking status: smoking cessation
local				
physical	availability	---	availability	---
cognitive	unavailability	ltd. availability	unavailability	unavailability
distal				
physical	availability	---	availability	---
cognitive	---	ltd. availability	---	unavailability
definition	high expectation of perceived drug use opportunity[1]		lack of perceived drug use opportunity[1] abstinence seeking[2]	

Note. ltd. = limited; experimental = experimentally manipulated availability; smoking cessation = availability manipulated through smoking cessation; [1] Wertz and Sayette (2001); [2] Tiffany (1990).

In sum, the limited availability at session one could have lead to smaller effects and therefore explain why the difference between the two difference scores of session one and session two is less pronounced then predicted.

That the results of the difference score did not reach significance may also be due to the fact that in the present study, deprivation and availability were manipulated by smoking status (smoking vs. smoking cessation) and not experimentally. Therefore, deprivation and availability were not manipulated independently. At session one a high availability was attended by a low deprivation and at session two a low or lack of availability went along with a high deprivation (see Figure 47).

As mentioned above, deprivation will lead to a generalized increase in craving that explains high initial baseline ratings at session two. Yet, the focus of hypothesis 2 is centered on cue-induced craving, not on overall craving. Drummond's (2000), however proposes, that deprivation or withdrawal not only enhances overall craving but also cue-induced craving. He draws a clear distinction between the concepts of »withdrawal craving« and »cue elicit craving». Withdrawal craving is defined as a »subjective experience of craving in the context of unconditioned [...] withdrawal« (Drummond, 2000

p. 136). It is ought to be related to the severity and time course of withdrawal, representing a tonic unconditioned response. Cue elicited craving, however, represents a short lived, phasic conditioned response. It occurs, by definition, only in the presence of the cues. Drummond (2000) proposes a relationship between these cravings, such that cue reactivity (including cue-elicited craving) would be enhanced during withdrawal.

Considering this relationship and the evidence that deprivation, abstinence or withdrawal produce a generalized increase in craving (Bailey et al., 2010) one would assume that subsequent LDS participants cue-specific craving would be increased through deprivation due to smoking cessation. Furthermore, if deprivation leads to higher craving in general and to higher cue elicit craving in particular, deprivation (due to smoking cessation) would work against our hypothesis and could overlap and diminish the effects of availability at session two. Subsequent LDS availability would lead to a decrease of craving in the presence of the cue, whereas deprivation would enhance craving ratings (see Figure 47).

Although plausible, the assumption that cigarette abstinence amplifies smokers' cue-specific craving has inconsistent empirical support. Carter et al. (2006) found a trend that smoking cues evoked higher craving in deprived smokers than non-deprived smokers. Other researchers, however, did not obtain such evidence of any selective increase in deprived smokers' craving to smoking-related cues (Dawkins, Powell, West, Powell, & Pickering, 2006; McBride et al., 2006; McClernon, Kollins, Lutz, Fitzgerald, Murray, Redman et al., 2008). There again, direct comparisons between satiated versus abstinent conditions showed greater brain reactivity in response to smoking cues following abstinence (McClernon et al., 2009). McClernon et al. (2009) suggest that smoking abstinence significantly amplifies neural responses to smoking-related cues in brain regions subserving visual sensory processing, attention, and action planning. Moreover, greater abstinence-induced craving was significantly correlated with increased smoking cue activation in areas involved in action planning and decision-making. These findings, however, indicate that drug abstinence can increase the salience of conditioned cues.

Additionally, Bailey et al. (2010) found main effects for cigarette deprivation and availability. Deprivation produced generalized increases in craving reactivity whereas immediate cigarette availability boosted craving reactivity to smoking cues. However, no consistent evidence was found that "even under conditions of immediate cigarette

availability, deprivation enhanced cue-induced craving selectively" (Bailey et al., 2010, p. 369).

Redefined craving change and difference scores. In the present study high initial craving ratings at session two were factored into analyses of the change and difference score (redefined change and difference score) to account for the generalized increase of craving induced by deprivation. As mentioned above, within this analysis, hypothesis 2 has been confirmed for VAS. Participants reported significantly higher cue-specific craving pre LDS as compared to subsequent LDS.

This result is in line with the finding of Shiffman et al. (1997) that the degree of craving differed among smokers depending on their smoking status (smoking vs. smoking cessation) with higher craving ratings before quitting. These »apparently counterintuitive findings« (Wertz and Sayette, 2001a, p. 10) may be explained through availability. The results imply that deprivation had an impact on overall craving in the present study but not on cue-induced craving. The low cognitive availability or lack of perceived drug use opportunity (see »availability«, p. 44; »perceived drug use opportunity«, Wertz & Sayette, 2001a) after quitting smoking decreased cue-specific craving. This conforms to the conclusion of Bailey et al. (2010). Given that cigarette availability can increase craving reactivity to smoking cues, cigarette unavailability may restrain any increased cue–reactivity that deprived smokers might normally show if given the opportunity to smoke (Bailey et al., 2010).

Composite urge score. As an additional approach a composite urge score was composed (Sayette et al., 2001). The results indicated no significant difference and a low effect size between composite urge score for session one and two. An explanation for the different findings of the redefined VAS difference score and the composite urge score may be that the goal of the composite urge score was »not to assess change in urge, but to measure accumulated urge produced by initial drug deprivation and subsequent cue exposure«, Sayette et al., 2001, p. 1421).

Hypothesis 3

The summary score of the QSU was used to represent overall craving (Batra et al., 2008). It was applied at the end of each session, therefore being independent of cue specific craving. The results of the QSU are in line with results of VAS and ME craving ratings at craving rating c_6 (see »analysis of corresponding craving ratings«, p. 85). These results confirm hypothesis 3, with craving ratings being less pronounced subsequent LDS as compared to pre LDS. This again supports the apparently counterintuitive findings of Shiffman et al. (1997) that the degree of craving differs among smokers depending on their smoking status (smoking vs. smoking cessation) with craving ratings tending to be higher prior to quitting then after quitting.

As mentioned above these results can be explained by availability. At session one (pre LDS), the distal physical and cognitive availability was high, causing an increase of craving. At the end of session two, distal physical availability equates session one, but local and distal cognitive availability was low due to smoking cessation. The cigarettes were physical available at session two but without a perceived opportunity to use it. Therefore, cigarettes did not signal imminent use at the end of the session (see »availability«, p. 44; »perceived drug use opportunity«, Wertz & Sayette, 2001a), which led to a decrease of craving.

Mood and Affective valence

As a control variable affective valence was assessed with the MDBF following each craving rating. The investigation of participants' mood ratings pre LDS revealed mood ratings on the upper half of the scale (12.98 to 16.83 on a scale ranging from zero to 20). Considering the course of mood participants rated highest negative mood (feeling good vs. feeling bad) and highest alertness (being awake vs. being tired) during smoking cue

presentation. Highest tenseness (feeling calm vs. feeling tense) ratings were reported at the beginning of the first session. This conforms to the findings of Warthen and Tiffany (2009) in which responses to cue presentations revealed that participants' experienced higher negative mood and lower positive mood when shown smoking cues compared with neutral stimuli. Furthermore, Conklin et al. (2010) reported a significant cue effect in a way that the exposure to smoking cues led to greater reports of negative mood compared to non-smoking cues.

Subsequent LDS highest negative mood and tenseness were reported at the beginning of session two. Highest alertness ratings were assessed during smoking cue presentation. It also appears logical that at the beginning of session two, when deprivation is high, participants feel tenser and developed the worst feelings. These findings go along with the findings of other researchers reporting that abstinence from smoking significantly decreased self-reported baseline measures of mood and alertness (McBride et al., 2006).

Overall, participants still report mood ratings on the upper half of the scale.

Considering the association between mood and craving ratings, correlational analyses were performed. Correlations between mood and craving ratings revealed that all three subscales of the MDBF were not associated with self-reported ME craving at any craving rating for both sessions except for one negative correlation between subscale feeling calm vs. feeling tense and craving rating c_6 at session one (see Table 24 and 25).

Concerning VAS ratings, no correlations between MDBF subscale being awake vs. being tired and craving ratings occurred for both sessions (see Table 22 and Table 23).

During session one, significant negative correlations between the subscale feeling good vs. feeling bad of the MDBF and craving ratings c_2 and c_4 were observed. Furthermore, significant negative correlations between the subscale feeling calm vs. feeling tense and craving ratings c_5 (at the 0.01 level) and c_6 (at the 0.05 level) were examined. Subsequent LDS mood (feeling good vs. feeling bad and feeling calm vs. feeling tense) and craving ratings correlate inverse with one another.

In sum, several variables are inter-correlated significantly for VAS and MDBF. Correlations between mood and craving can be seen for the respective sessions (e.g., MDBF subscale feeling good vs. feeling bad at session one, mood rating c_4 is correlated

with VAS craving rating c_4; see Table 22), but also across the several sessions (e.g., MDBF subscale feeling good vs. feeling bad at session two, mood rating c_4 is correlated with VAS craving rating c_4 at session two, but also with craving rating c_1, c_2, c_3 and c_6 at session two; see Table 23). Overall, the single correlations between the mood scores and the craving ratings are not very specific with respect to their occurrence over the session point. This is particularly the case at session two, in which the many correlations suggest rather overall rating effects instead of meaningful and specific relationships.

In sum, correlational analyses indicate that mood and craving ratings proceed independently of one another.

Study limitations and conclusions

Several limitations of this study should be mentioned. We decided against counterbalancing the order of cues so that responses to neutral stimuli could not be affected by any carryover effect. We judged that concerns about carryover effects outweighed concerns resulting from not counterbalancing presentation of neutral stimulus and smoking cues. Nevertheless, this procedure propounds the drug salience of the cue with time spent in the laboratory, which is a threat to the internal validity. Furthermore, it »may tend to yield smaller effect sizes«, (Carter & Tiffany, 1999, p. 336). Moreover, as mentioned above, due to the fixed order of cues, with the neutral stimulus presented first, only the neutral change score was affected by high initial baseline ratings. Future studies should take into account that a deprived state at the beginning of a session can lead to high baseline ratings. Therefore, a decision needs to be made if the concerns about high initial baseline ratings are more important then the ones resulting from not counterbalancing presentation of cues/stimuli.

The present study was also limited by its reliance on self-reports. Non-verbal measures are generally less vulnerable to the response biases or reactivity created by self-report measures, but their indices of cue reactivity are unspecific and ambiguous and derive from

general measures of physiological responses. Still, self-reports might be biased. As mentioned earlier, smokers who quit might selectively generate and evaluate information to permit a rational appraisal of the issue in a manner more suitable to their motives. Otherwise, there is proof that smokers do spontaneously experience craving, independent of an explicit assessment of craving. Researchers therefore can be confident that »self-reports [...] have adequate and accurate content validity and, also that craving self-reports do not suffer from reactivity biases« (Shadel et al., 2004, p. 812). Nevertheless, besides self-reports other assessment instruments, e.g. facial coding system or reaction time measures could be applied (see »assessment instruments«, p. 36).

Most important, the results of the study should be interpreted with caution given that no control group design was used. Future research should include, for example, two control groups: one including subjects who do not quit smoking and one group consisting of non-smoking individuals in order to better understand the specific mechanism contributing to craving reactions after smoking cue exposure in subjects who quit smoking. Taken the continuum of cognitive availability (see Figure 48) into account, the first group can be divided into (a) smokers who did not quit smoking yet but with the intention to stop smoking at session one and at session two and (b) smokers who did not quit smoking and do not have the intention to stop smoking at both sessions. Comparisons of the first control group with the experimental group of the recent study would give insight in whether the results are due to smoking cessation or if the same results would have emerged without this manipulation. In addition, comparisons with the second group would give information about the question if availability varies between smokers with and without the intention to quit smoking at session one. Furthermore, comparing smokers with and without the intention to quit might lead to a more potent availability manipulation and therefore to clearer results.

Research on craving and *availability manipulated through smoking cessation* will always have the disadvantage that after quitting smoking the low or lack of availability will be paired with (a high degree of) deprivation. To provide an insight into the relationship between availability and deprivation future research on experimentally manipulated availability is needed, using the cue availability procedure (see »cue availability

paradigm«, p. 46). Within this procedure, it is possible to manipulated availability and deprivation independently. On a trail-by-trail basis, for example, cue availability can be manipulated (e.g., 0%, 50% or 100% probability to smoke a cigarette within one session) within a group of high vs. low deprived smokers.

This approach can even be expanded by manipulating the availability through the smoking status using a 2 (deprivation: high vs. low) x 3 (availability through stage of change: smokers without the intention to quit; smokers with the intention to quit within the next days/weeks; smoking cessation) x 3 (experimental availability: 0%, 50% or 100% probability to smoke a cigarette within one session) design.

To improve generalizability of findings future studies should gather real-time data and administer experimental, cue reactivity trials in natural settings. As an approach for selecting real-time data the cue reactivity ecological momentary assessment (CREMA), created by Warthen and Tiffany (2009), could be adopted. This procedure involves giving participants personal digital assistant (PDA) computers to complete real-time assessments when target events take place (e.g., after smoking a cigarette) or when the PDA signals the start of an assessment. With this technology craving and mood ratings, drug use behavior, and contextual variables can be gathered in real time in the natural environment. This would give an even better insight in the course of craving in the real live of the participants. Furthermore, it would prevent craving reductions because of a decrease of environmental or context availability due to the laboratory set up (see p. 125).

Assessing craving in the laboratory allows for much greater control but reduces real world generalizability. Assessment in the natural environment, on the contrary, improves generalizability of findings but limits experimental control. To avoid the limitations and make use of the advantages of both assessments, future studies should take two new approaches into account. (1) To bring »smokers real word« into the laboratory Conklin et al. (2010) developed a novel real world/laboratory exposure paradigm in which participants take pictures of their own environments in which they do and do not smoke which will be used as smoking cues and neutral stimuli in a cue reactivity paradigm. (2) Bordnick et al. (2004) developed the virtual reality (VR) nicotine cue reactivity assessment system (VR-NCRAS). They discovered that in response to VR smoking cues, there was a

robust increase in smokers' craving self-report compared to neutral VR environments (Bordnick et al., 2004; Bordnick et al., 2005). These studies indicate that »VR is a viable means of examining and assessing smokers' reactions to complex smoking cues observed in a contextually appropriate environment« (Carter et al, 2008, p. 75).

In sum, there are still many exciting and important scientific issues and unanswered questions about the construct of craving, smoking, addiction and relapse and the influence of availability and other modulating factors.

The recent study makes a contribution to the understanding of changes in craving before and after quitting. It enlightens the apparently counterintuitive findings of Shiffman et al. (1997) that craving prior to quitting tend to be higher then after quitting (Shiffman et al. ,1997) by explaining it by the modulating effect of availability. To »require [an even] greater sensitivity to the meaning of craving at each period«, (Wertz & Sayette, 2001a, p. 10) future studies should focus on the different stages of change (DiClemente, Prochaska, Fairhurst, et al., 1991), their associated availability and the impact on craving. And, to improve generalizability, »smokers real word« should be factored into future research (e.g. PDA, VR, CREMA).

SUMMERY

Drug craving has been entitled a »core feature of addiction« (Sayette, Martin, Wertz, Shiffman & Perrott, 2001). It has been associated with drug use, drug dependence, cessations and relapse (e.g. Bagot, Heishman & Moolchan, 2007). Various definitions of craving have been proposed and, according to them, a wide range of models and paradigms has been used to conceptualize craving (for reviews, see e.g. Drummond, 2001; Vukovic et al., 2008). Despite its importance, basic assumptions regarding the nature and assessment of craving remain highly contentious (Sayette et al., 2000). This may be due to difficulties concerning the definition of craving and the assortment of appropriate assessment instruments, respectively. Furthermore, numerous studies provide evidence that a variety of factors influence cue reactivity and craving, one of them being availability (e.g. Bailey et al., 2010). Research has shown that availability plays a major role in modulating cue-elicited craving in a way that it enhances craving (e.g. Juliano & Brandon, 1998; Cater & Tiffany, 2001; Wertz & Sayette, 2001a). Therefore, availability or perceived drug use opportunity (Wertz and Sayette 2001a) is a targeting field of research, on which the present study focused on.

In the current study a distinction has been made between »physical availability« (e.g., a cigarette is physically there) and »cognitive availability« (e.g., restrain from smoking during an experimental session or during smoking cessation). Furthermore, availability can be manipulated (1) experimentally, either (a) within a session (varying opportunity and access to the drug during the experimental session; »local availability«) or (b) with the prospect of being able to smoke at the end of the experiment (»distal availability«). Besides, availability can be varied (2) through smoking status (smoking vs. smoking cessation). The combination of physical and cognitive availability with the aforementioned facets results in a variety of potential manipulations of availability.

According to Tiffany et al. (2009), smoking represents an »excellent vehicle for exposing and untangling the complexities of craving processes« (p. 171). Moreover, answers about craving »generated through smoking research are likely to have considerable applicability to craving observed in other drug-abuse disorders« (Tiffany, Warthen, & Goedeker, 2009, p. 171). Therefore, the current study focused on nicotine

dependent smokers with the intention to quit smoking. The main aim of the study was to compare craving ratings of individuals addicted to nicotine before and after quitting. This may »require greater sensitivity to the meaning of craving at each period« (Wertz and Sayette, 2001a, p. 10) and help interpreting the obviously counterintuitive findings that craving ratings tend to be higher prior to quitting then after quitting (Shiffman et al., 1997).

In order to evaluate the influence of smoking status on self-reported urge 71 smokers interested in quitting smoking were recruited through newspaper advertisements and radio announcements to participate in two experimental and one follow-up sessions. During a three-month period, 60 nicotine dependent smokers participated in the first, 47 in the second experimental session which have been proceeded 2-3 days pre and subsequent a scheduled »last day of smoking« [LDS]. Within each experimental session a potent smoking cue exposure manipulation was used to elicit craving. All participants were exposed to smoking cues and neutral stimuli. The sight, smell, and touch of a burning cigarette, a new unwrapped pack of participants' own cigarettes (or tobacco), their own lighter (or matches), as well as an ashtray served as smoking cues. A bottle of water and a bottle opener served as the neutral stimulus, as being unlikely associated with the smoking cue. The order of presentation was fixed, with the neutral stimulus preceding smoking cues for all participants.

Cue availability was varied between the sessions by smoking status (smoking vs. smoking cessation). The manipulation of the experimental availability was predetermined, with local and distal physical availability and local cognitive unavailability for both sessions. For the purpose of the present study, cue reactivity was defined as the difference between changes in self-reported craving induced by the presentation of smoking cues and neutral stimulus, respectively. Reported cue-specific craving was assessed with a visual analog scale. To address potential ceiling effects the present study included an alternative approach, magnitude estimation (Sayette et al., 2000; 2001). Within this approach, smokers rate their current urges relative to baseline levels. Overall craving was assessed by the Questionnaire of Smoking Urges at the end of each experimental session. As a control variable, the current mood state was reported using a short version of the Multidimensional Mood Questionnaire. Self-report urge ratings and affective valence were assessed six times throughout the study. To assess differences that may affect craving, participants completed a questionnaire battery at the end of the session, containing a demographic questionnaire, a

brief questionnaire on tobacco and alcohol use, a questionnaire on somatic conditions, the german-language Version of the Fagerstroem Test for Nicotine Dependence, the Readiness/Confidence Ruler, and the Intention to Quit Smoking Questionnaire.

Considering the results of cue reactivity studies (Wertz & Sayette, 2001a), we expected that participants would experience their peak of craving during smoking cue exposure at both times, before and after LDS (Hypothesis 1a). We further predicted that the exposure to smoking cues elicits craving in nicotine dependent smokers pre and subsequent smoking cessation (Hypothesis 1b). Moreover, we predicted that nicotine dependent smokers report stronger craving ratings to smoking cues as compared to neutral stimuli pre and subsequent smoking cessation (Hypothesis 1c). In reference to the findings of cue reactivity and cue availability studies, we anticipated that a high expectation of perceived drug use opportunity due to smoking cessation will enhance the magnitude of craving whereas a low or the absence of perceived drug use opportunity will reduce the magnitude of craving (e.g. Bailey et al., 2010; Wertz & Sayette, 2001a). Therefore, as the main hypothesis of the study (Hypothesis 2; cue-specific craving) we predicted that nicotine dependent smokers will report higher cue-specific craving pre LDS compared to subsequent LDS. Additionally, we assumed that nicotine dependent smokers report higher overall craving preceding smoking cessation as compared to subsequent smoking cessation (Hypothesis 3; overall craving).

Results confirmed hypothesis 1a, b and c so that we were confident that our smoking cue exposure manipulation worked and that the smoking cues elicited craving at both sessions. Additionally to high craving ratings elicited by smoking cues participants reported high craving ratings at the end of session one and the beginning of session two. Overall though, craving ratings were modest.

The main results of the present study are that nicotine dependent smokers showed a tendency of higher craving ratings during cue reactivity session preceding LDS as compared to subsequent LDS. This tendency was more pronounced for the visual analog scale then for magnitude estimation. When high initial craving ratings at session two were factored into analyses, to account for the generalized increase of craving induced by deprivation, this tendency reached significance for visual analog scale. Participants reported higher cue-specific craving pre LDS as compared to subsequent LDS, which confirms hypothesis 2. Results of the Questionnaire of Smoking Urges are in line with

these results, confirming hypothesis 3. Overall craving ratings were less pronounced subsequent LDS as compared to pre LDS.

These results support the findings of Shiffman et al. (1997) that the degree of craving differed among smokers depending on their smoking status (smoking vs. smoking cessation) with higher craving ratings prior to quitting then after quitting. These »apparently counterintuitive findings« (Wertz and Sayette, 2001a, p. 10) were explained against the background of availability.

The finings of the present study indicate that during session two, the low cognitive availability due to smoking cessation decreased cue-specific craving, whereas during session one, high cognitive (and physical) availability increased craving ratings because participants were still smoking. Recent findings of Bailey et al. (2010) conform to this explanation. »Given that immediate cigarette availability can amplify craving to smoking-related cues, cigarette unavailability may suppress any heightened cue–reactivity that deprived smokers might display normally if given the opportunity to smoke« (Bailey et al., 2010, p. 365).

Furthermore, all other results of the present study were discussed with reference to the aforementioned types of availability. The lack of significant results in reference to hypothesis 2 was explained through availability manipulated through smoking status. Participants already had the intention to quit smoking at session one and reported a high importance of abstinence. Because of this resolution cognitive availability might have been reduced at session one and therefore led to a reduction in craving. As a result, the difference in cue reactivity (craving) between both sessions was less pronounced as expected. Therefore, future research should include subjects who do not wish to quit smoking in order to better understand the specific mechanism contributing to craving and availability.

Because availability has been manipulated through smoking status, availability and deprivation were not independent of one another. A low availability due to smoking cessation was attended by high deprivation and vise versa. Thus, high initial craving ratings at the beginning of session two were explained by deprivation and withdrawal (e.g. Bailey et al., 2010; McClernon et al., 2009), representing a generalized increase in craving due to deprivation. To be able to manipulate deprivation and availability independently, cue availability procedures were discussed for future studies.

Additionally, high craving ratings at the end of session one have been explained by a high distal physical and cognitive availability. Participants did not stop smoking yet; they knew that the end of the session is near and that they would be able to smoke a cigarette soon, which led to an increase of craving.

Moderate craving ratings, on the contrary, were explained due to a reduction in local physical availability induced by the laboratory setting which signals a low smoking-relevant environment. To overcome this limitation novel approaches were discussed. To bring »smokers real word« into the laboratory future studies should enhance the cue reactivity paradigm, e.g. by a real world laboratory exposure paradigm (Conklin et al., 2010) in which pictures of participants own environments serve as smoking cues and neutral stimuli. Furthermore, the virtual reality nicotine cue reactivity assessment system (Bordnick et al., 2004; Bordnick et al., 2005) could be applied. Additionally, as an approach for selecting real-time data and to improve generalizability, cue reactivity ecological momentary assessment created by Warthen and Tiffany (2009) could be used in future studies.

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Appendix

Appendix A: Questionnaires

Appendix B: Forms and Instructions

Appendix C: Cue Exposure Instructions

Appendix A: Questionnaires

Visual Analog Scale (VAS)

Magnitude Estimation (ME)

Multidimensional Mood Questionnaire (MDBF)

Questionnaire Battery (»Allgemeiner Fragebogen«), including

Demographic questionnaire

Brief questionnaire on tobacco and alcohol use

Documentation of somatic conditions

German-language version of the Questionnaire of Smoking Urges (QSU)

German-language version of the Fagerstroem Test for Nicotine Dependence (FTNA)

Readiness/Confidence Ruler

Intention to Quit Smoking Questionnaire

Medical Conditions and Medication - results

Intentions to quit smoking – questionnaire and results

Visuelle Analogskala

Die folgende Frage bezieht sich auf Ihre momentane Befindlichkeit.
Antworten Sie bitte möglichst spontan und machen Sie bitte an der Stelle,
die Ihrer momentanen Befindlichkeit entspricht, einen Strich.

Würden Sie jetzt gerne eine Zigarette rauchen?

0		10
nein, überhaupt nicht		ja, sehr gerne

Magnitude Estimation

Craving rating c_1

Wie stark ist Ihr Verlangen jetzt?

Magnitude Estimation

Craving rating c_1 to c_5

Der erste Wert war: _____

Wie stark ist Ihr Verlangen, eine Zigarette zu rauchen, jetzt
im Vergleich zu diesem ersten Wert?

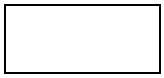
Magnitude Estimation

Craving rating c_6

Der erste Wert war: _____

Erinnern Sie sich bitte an das stärkste Verlangen, eine Zigarette zu rauchen,
das Sie jemals erlebt haben. Welchen Wert würden Sie diesem Verlangen geben?
Dieser Wert muss mindestens so hoch sein wie der von Ihnen vergebene höchste Wert,
kann aber auch darüber liegen.

Dem stärksten Verlangen, eine Zigarette zu rauchen, das ich jemals erlebt habe,
würde ich folgenden Wert geben:



Multidimensional Mood Questionnaire (MDBF)

Im Folgenden finden Sie eine Liste mit Wörtern, die verschiedene Stimmungen beschreiben. Bitte gehen Sie die Wörter der Liste nacheinander durch und kreuzen Sie bei jedem Wort den Kreis an, del die augenblickliche Stärke Ihrer Stimmung am besten beschreibt.

Geben Sie bitte bei jedem Wort ein Urteil ab und lassen Sie keines der Wörter aus.

Momentan fühle ich mich	überhaupt nicht				sehr
	1	2	3	4	5
1. zufrieden	○	○	○	○	○
2. ausgeruht	○	○	○	○	○
3. ruhelos	○	○	○	○	○
4. schlecht	○	○	○	○	○
5. schlapp	○	○	○	○	○
6. gelassen	○	○	○	○	○
7. müde	○	○	○	○	○
8. gut	○	○	○	○	○
9. unruhig	○	○	○	○	○
10. munter	○	○	○	○	○
11. unwohl	○	○	○	○	○
12. entspannt	○	○	○	○	○
	überhaupt nicht				sehr

Kennung_	Uhrzeit:	Datum:	T1 – T2 – T3

Angaben zur Person

Alter: _____ (bitte eintragen)

Geschlecht:
1 ☐ weiblich
2 ☐ männlich

Familienstand:
1 ☐ ledig
2 ☐ verheiratet, zusammenlebend
3 ☐ verheiratet, getrennt lebend
4 ☐ geschieden
5 ☐ verwitwet

Staats-angehörigkeit:
1 ☐ deutsch
2 ☐ andere: _____(bitte eintragen)

Muttersprache(n):
1 ☐ deutsch
2 ☐ andere: _____(bitte eintragen)

Wenn **„andere Muttersprache“**:
Sind Sie länger als drei Jahre in Deutschland zur Schule gegangen?

0 ☐ nein
1 ☐ ja

höchster erreichter Schulabschluss:
1 ☐ kein Abschluss
2 ☐ Sonderschulabschluss
3 ☐ Haupt-/Volksschulabschluss
4 ☐ Realschulabschluss/ Polytechnische Oberschule
5 ☐ (Fach-)Abitur
6 ☐ Hochschulabschluss
7 ☐ anderer Schulabschluss

Berufsausbildung:

1 ☐ keine
2 ☐ abgeschlossene Berufsausbildung/Lehre
3 ☐ abgeschlossenes Hochschulstudium
4 ☐ sonstige: _____

Die folgende Frage bezieht sich auf die Tätigkeit, die Sie überwiegend ausüben. Wählen Sie bitte nur eine Antwortkategorie aus.

Erwerbstätigkeit:

1 ☐ Auszubildende(r)
2 ☐ Angestellte(r), Beamte(r)
3 ☐ Arbeiter(in/Facharbeiter(in)
4 ☐ Selbständige(r)/Freiberufler(in)
5 ☐ Arbeitslose(r)
6 ☐ Schüler(in)/Student(in)
7 ☐ Hausmann/Hausfrau
8 ☐ Rentner(in)
9 ☐ sonstige

Brief questionnaire on tobacco and alcohol use

Welche Zigaretten rauchen Sie überwiegend?

1 ☐ Ultra Lights/Lights
2 ☐ Medium
3 ☐ Normal
4 ☐ selbstgedrehte Zigaretten (Tabak)

An wie vielen Tagen haben Sie während der letzten 30 Tage geraucht?

_____ Tage (bitte eintragen: 0 - 30)

Bezogen auf die letzten 30 Tage: Wie viele Zigaretten haben Sie an so einem Tag im Durchschnitt geraucht?

_____ Zigaretten (bitte eintragen)

Seit wie vielen Jahren rauchen Sie?

_____ Jahre (bitte eintragen)

Wie oft haben Sie den Versuch unternommen, mit dem Rauchen aufzuhören?

_____ Mal (bitte eintragen: Anzahl der Versuche)

Trinken Sie Alkohol? 0 ☐ nein
1 ☐ ja

Wenn “ja“:
Bezogen auf die letzten sechs Monate: Wie oft haben Sie Alkohol getrunken?

1 ☐ einmal pro Monat oder seltener
2 ☐ zwei- bis dreimal pro Monat
3 ☐ ein- bis dreimal pro Woche
4 ☐ viermal pro Woche oder öfter

Wenn "ja":
An wie vielen Tagen haben Sie während der letzten 30 Tage Alkohol getrunken? _____ (bitte eintragen: 0 - 30)

Wenn „ja“:
Wenn Sie während der letzten 30 Tage Alkohol getrunken haben: Wie viele Gläser von welchen Getränken haben Sie dann an einem typischen Tag getrunken?

1 ☐ Bier (0,33 l) _____ (Anzahl der Gläser)
2 ☐ Bier (0,501) _____ (Anzahl der Gläser)
3 ☐ Wein/Sekt (0,25 l) _____ (Anzahl der Gläser)
4 ☐ Spirituosen (0,02 l) _____ (Anzahl der Gläser)

Documentation of somatic conditions

Leiden Sie an einer chronischen Erkrankung?

1 ☐ ja
2 ☐ nein

wenn „ja“, welche: _____

Sind Sie zur Zeit krank?

1 ☐ ja
2 ☐ nein

wenn „ja“, welche Beschwerden: _____

Nehmen Sie zur Zeit Medikamente?

1 ☐ ja
2 ☐ nein

wenn „ja“, welche: _____ (Art & Dosierung)

German-language version of the Questionnaire of Smoking Urges (QSU)

Bei den folgenden Aussagen interessieren wir uns für Ihr momentanes Gefühl, also dafür, wie Sie sich genau jetzt, beim Ausfüllen des Fragebogens fühlen. Bitte achten Sie auf Verneinungen durch das Wort "nicht".

		0= stimmt überhaupt nicht 7= stimmt völlig							
1.	Rauchen würde mir jetzt dazu verhelfen, mich sehr gut zu fühlen.	0	1	2	3	4	5	6	7
2.	Ich wäre weniger reizbar, wenn ich jetzt rauchen könnte.	0	1	2	3	4	5	6	7
3.	Nichts wäre besser, als jetzt eine Zigarette zu rauchen.	0	1	2	3	4	5	6	7
4.	Mir fehlt das Rauchen jetzt gerade nicht.	0	1	2	3	4	5	6	7
5.	Ich werde rauchen, sobald ich wieder die Möglichkeit dazu bekomme.	0	1	2	3	4	5	6	7
6.	Ich möchte jetzt nicht rauchen.	0	1	2	3	4	5	6	7
7.	Rauchen würde meine schlechte Stimmung deutlich verbessern.	0	1	2	3	4	5	6	7
8.	Rauchen würde mir jetzt nicht helfen, mich zu beruhigen.	0	1	2	3	4	5	6	7
9.	Wenn ich jetzt eine Zigarette angeboten bekäme, würde ich sie sofort rauchen.	0	1	2	3	4	5	6	7
10.	Ich könnte ab sofort für eine lange Zeit auf das Rauchen verzichten.	0	1	2	3	4	5	6	7
11.	Jetzt eine Zigarette zu rauchen, wäre nicht angenehm.	0	1	2	3	4	5	6	7
12.	Wenn ich jetzt im Moment rauchen würde, wäre ich weniger gelangweilt.	0	1	2	3	4	5	6	7
13.	Das Einzige, was ich jetzt gerne hätte, wäre eine Zigarette.	0	1	2	3	4	5	6	7
14.	Wenn ich jetzt eine Zigarette rauchen würde, würde ich mich weniger müde fühlen.	0	1	2	3	4	5	6	7
15.	Jetzt zu rauchen würde mich glücklicher machen.	0	1	2	3	4	5	6	7
16.	Sogar wenn es jetzt möglich wäre, würde ich wahrscheinlich nicht rauchen.	0	1	2	3	4	5	6	7
17.	Ich habe jetzt gerade keinen Wunsch nach einer Zigarette.	0	1	2	3	4	5	6	7

		0= stimmt überhaupt nicht 7= stimmt völlig
18.	Mein Wunsch nach einer Zigarette scheint gerade so stark zu sein, dass er mich zu bewältigen droht.	0 1 2 3 4 5 6 7
19.	Wenn ich jetzt rauchen würde, erschiene mir fast alles in Ordnung.	0 1 2 3 4 5 6 7
20.	Ich sehne mich gerade nach einer Zigarette.	0 1 2 3 4 5 6 7
21.	Ich würde eine Zigarette jetzt nicht genießen.	0 1 2 3 4 5 6 7
22.	Eine Zigarette würde jetzt nicht gut schmecken.	0 1 2 3 4 5 6 7
23.	Ich verspüre letzt gerade den Drang nach einer Zigarette.	0 1 2 3 4 5 6 7
24.	Ich hätte die Dinge gerade besser im Griff, wenn ich rauchen würde.	0 1 2 3 4 5 6 7
25.	Ich werde rauchen, sobald ich die Möglichkeit dazu habe.	0 1 2 3 4 5 6 7
26.	Ich würde mich körperlich nicht besser fühlen, wenn ich jetzt rauchen würde.	0 1 2 3 4 5 6 7
27.	Eine Zigarette wäre jetzt nicht sehr befriedigend.	0 1 2 3 4 5 6 7
28.	Wenn ich jetzt eine angezündete Zigarette in der Hand hätte, würde ich sie wahrscheinlich gar nicht rauchen.	0 1 2 3 4 5 6 7
29.	Wenn ich jetzt rauchen würde, könnte ich klarer denken.	0 1 2 3 4 5 6 7
30.	Ich würde fast alles tun, um jetzt eine Zigarette zu bekommen.	0 1 2 3 4 5 6 7
31.	Ich muss jetzt rauchen	0 1 2 3 4 5 6 7
32.	Grade jetzt habe ich nicht vor zu rauchen.	0 1 2 3 4 5 6 7

German-language version of the Fagerstroem Test for Nicotine Dependence (FTNA)

1. Wie viel Zeit vergeht zwischen dem Aufwachen und Ihrer ersten Zigarette?

5 Minuten	☐ 3
6 bis 30 Minuten	☐ 2
31 bis 60 Minuten	☐ 1
Mehr als 60 Minuten	☐ 0

2. Finden Sie es schwierig, an Orten, wo das Rauchen verboten ist (z.B. Kirche, Bücherei, Kino usw.), das Rauchen zu lassen?

ja	☐ 1
nein	☐ 0

3. Auf welche Zigarette würden Sie nicht verzichten wollen?

die erste morgens	☐ 1
andere	☐ 0

4. Wie viele Zigaretten rauchen Sie im Allgemeinen pro Tag?

bis 10	☐ 0
1 bis 20	☐ 1
21 bis 30	☐ 2
31 und mehr	☐ 3

5. Rauchen Sie am Morgen im Allgemeinen mehr als am Rest des Tages?

ja	☐ 1
nein	☐ 0

6. Kommt es vor, dass Sie rauchen, wenn Sie krank sind und tagsüber im Bett bleiben müssen?

ja	☐ 1
nein	☐ 0

Readiness/Confidence Ruler

Wie wichtig ist es Ihnen, mit dem Rauchen aufzuhören?
Wie denken Sie im Moment darüber?
(Bitte eine Zahl ankreuzen)

unwichtig 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - 10 sehr wichtig

Wenn Sie sich jetzt vornehmen würden, mit dem Rauchen aufzuhören:
Wie zuversichtlich sind sie, dass Ihnen das geringen würde?
(Bitte eine Zahl ankreuzen)

überhaupt nicht 0 – 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 - 10 absolut

Intentions to quit smoking questionnaire

Kennung:	**Uhrzeit:** ① ② ③	**Datum:** .2002

Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,

zum Schluss möchten wir Ihnen noch eine Frage zu den Gründen stellen, die letztendlich dafür ausschlaggebend sind, dass Sie den Versuch unternehmen wollen, sich das Rauchen abzugewöhnen.

Bitte kreuzen Sie an, wie wichtig jeder der unten aufgeführten Gründe jeweils für Sie ist!

Welche Rolle spielten folgende Gründe bei Ihrem Entschluss, mit dem Zigarettenrauchen aufhören?

	0 = unwichtig 4 = sehr wichtig
1. Akute gesundheitliche Gründe (Arztverbot)	0 1 2 3 4
2. Akute gesundheitliche Gründe (eigener Entschluss)	0 1 2 3 4
3. Angst vor zukünftigen körperlichen Beschwerden	0 1 2 3 4
4. Sorge um die Gesundheit anderer Personen	0 1 2 3 4
5. Finanzielle Gründe (zu teuer)	0 1 2 3 4
6. Kein Geschmack/Genuss mehr daran	0 1 2 3 4
7. Wunsch oder Drängen von anderen (Familie, Kollegen, etc.)	0 1 2 3 4
8. Berufliche Gründe	0 1 2 3 4
9. Ärger, weil ich vom Rauchen abhängig bin	0 1 2 3 4
10. Sonstige Gründe (bitte angeben):	
a.	0 1 2 3 4
b.	0 1 2 3 4

Vielen Dank!

Medical conditions and medications – results (*N* = 56)

Chronische Erkrankung

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ja	17	30,4	30,4	30,4
	nein	39	69,6	69,6	100,0
	Gesamt	56	100,0	100,0	

Welche chronische Erkrankung

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig		39	69,6	69,6	69,6
	Allergien	1	1,8	1,8	71,4
	Asthma	1	1,8	1,8	73,2
	Asthma Bronchiale	1	1,8	1,8	75,0
	Athrose kleine Wirbelgel (Rücken); Bandscheibenvorfall	1	1,8	1,8	76,8
	Bluthochdruck	3	5,4	5,4	82,1
	Bronchitis	1	1,8	1,8	83,9
	Diabetis Typ 1	1	1,8	1,8	85,7
	Epilepsie	1	1,8	1,8	87,5
	Gefässverschluss	1	1,8	1,8	89,3
	Herzrythmusstörung (nicht org) erhöhte Cholisterinwerte	1	1,8	1,8	91,1
	Heuschnupfen	2	3,6	3,6	94,6
	Reflnx (Allergien)	1	1,8	1,8	96,4
	Schilddrüse	1	1,8	1,8	98,2
	Sinusitis, Schilddrüsenüberfunktion, WS-Syndrom	1	1,8	1,8	100,0
	Gesamt	56	100,0	100,0	

Sind Sie zur Zeit krank?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ja	6	10,7	10,7	10,7
	nein	50	89,3	89,3	100,0
	Gesamt	56	100,0	100,0	

Welche Beschwerden?

	Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	50	89,3	89,3	89,3
2x Herzinfarkt	1	1,8	1,8	91,1
Asthma	1	1,8	1,8	92,9
Athrose kleine Wirbe	1	1,8	1,8	94,6
Bronchitis, Nasennebenhöhlenvereiterung	1	1,8	1,8	96,4
HWS-Verwölbung	1	1,8	1,8	98,2
Schwindel	1	1,8	1,8	100,0
Gesamt	56	100,0	100,0	

Nehmen Sie derzeit Medikamente?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ja	26	46,4	46,4	46,4
	nein	30	53,6	53,6	100,0
	Gesamt	56	100,0	100,0	

Welche Medikamente?

	Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	31	55,4	55,4	55,4
ASS 100 (1/2); Cortisoninfusion	1	1,8	1,8	57,1
Blutdrucktabletten	1	1,8	1,8	58,9
Captomerck (1x/die)	1	1,8	1,8	60,7
Chromohexal 4x2 Hübe	1	1,8	1,8	62,5
Concor (2,5mg)	1	1,8	1,8	64,3
Delix 5 Plus (1/2); Bisorrolol (1/2); ASS (1); Sortis 20mg (1)	1	1,8	1,8	66,1
Dona 200-S (3x1)	1	1,8	1,8	67,9
Eisentabletten	1	1,8	1,8	69,6
Enalapril (10mg)	1	1,8	1,8	71,4
Euthyrox	1	1,8	1,8	73,2
Eutyrox 100/di	1	1,8	1,8	75,0
Hormone	1	1,8	1,8	76,8
Hormontabletten	1	1,8	1,8	78,6
Jodyrox	1	1,8	1,8	80,4
Kliogert (Hormon 1/die); Rhinofluimicil Spray	1	1,8	1,8	82,1
L-Thyroxin 100	1	1,8	1,8	83,9
L-Thyroxin 125mg, Tusiquenz (jew. 1x tä)	1	1,8	1,8	85,7
Maliasin 100mg (1x); Keppra 500mg (2x); Ergenyl Chrono 500mg (2x)	1	1,8	1,8	87,5
Patonzol (1/die))	1	1,8	1,8	89,3
Pille	2	3,6	3,6	92,9
Presomen (2x 1,25), Herz Ass 100 1x, Vertigo-Merese 3 x 1, Betakistin 12mg 4x1	1	1,8	1,8	94,6
Solosin	1	1,8	1,8	96,4
Vioxx (bei Beschwerden)	1	1,8	1,8	98,2
Votum, Doxazosin	1	1,8	1,8	100,0
Gesamt	56	100,0	100,0	

Intentions to quit smoking (*N* = 56) - results

Akute gesundheitliche Gründe (Arztverbot)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	29	51,8	51,8	51,8
	1	6	10,7	10,7	62,5
	2	4	7,1	7,1	69,6
	3	5	8,9	8,9	78,6
	sehr wichtig	12	21,4	21,4	100,0
	Gesamt	56	100,0	100,0	

Akute gesundheitliche Gründe (eigener Entschluss)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	6	10,7	10,7	10,7
	1	3	5,4	5,4	16,1
	2	4	7,1	7,1	23,2
	3	11	19,6	19,6	42,9
	sehr wichtig	32	57,1	57,1	100,0
	Gesamt	56	100,0	100,0	

Angst vor zukünftigen körperlichen Beschwerden

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	4	7,1	7,1	7,1
	2	4	7,1	7,1	14,3
	3	13	23,2	23,2	37,5
	sehr wichtig	35	62,5	62,5	100,0
	Gesamt	56	100,0	100,0	

Sorge um die Gesundheit anderer Personen

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	14	25,0	25,0	25,0
	1	7	12,5	12,5	37,5
	2	14	25,0	25,0	62,5
	3	11	19,6	19,6	82,1
	sehr wichtig	10	17,9	17,9	100,0
	Gesamt	56	100,0	100,0	

Finanzielle Gründe (zu teuer)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	19	33,9	33,9	33,9
	1	4	7,1	7,1	41,1
	2	9	16,1	16,1	57,1
	3	8	14,3	14,3	71,4
	sehr wichtig	16	28,6	28,6	100,0
	Gesamt	56	100,0	100,0	

Kein Geschmack/Genuss mehr daran

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	21	37,5	37,5	37,5
	1	6	10,7	10,7	48,2
	2	13	23,2	23,2	71,4
	3	12	21,4	21,4	92,9
	sehr wichtig	4	7,1	7,1	100,0
	Gesamt	56	100,0	100,0	

Wunsch oder Drängen von anderen (Familie, Kollegen, etc.)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	17	30,4	30,4	30,4
	1	15	26,8	26,8	57,1
	2	10	17,9	17,9	75,0
	3	2	3,6	3,6	78,6
	sehr wichtig	12	21,4	21,4	100,0
	Gesamt	56	100,0	100,0	

Berufliche Gründe

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	31	55,4	55,4	55,4
	1	13	23,2	23,2	78,6
	2	9	16,1	16,1	94,6
	3	3	5,4	5,4	100,0
	Gesamt	56	100,0	100,0	

Ärger wegen Abhängigkeit

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unwichtig	2	3,6	3,6	3,6
	1	1	1,8	1,8	5,4
	2	4	7,1	7,1	12,5
	3	10	17,9	17,9	30,4
	sehr wichtig	39	69,6	69,6	100,0
	Gesamt	56	100,0	100,0	

Sonstige Gründe

	Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	36	64,3	64,3	64,3
2	1	1,8	1,8	66,1
Angst vor Krebs	1	1,8	1,8	67,9
Bei Tagungen in der Minderheit (Unwohlsein)	1	1,8	1,8	69,6
einfach nicht mehr rauchen	1	1,8	1,8	71,4
Frust durch die Abhängigkeit	1	1,8	1,8	73,2
häufig die einzige, die raucht	1	1,8	1,8	75,0
Ich mag mich manchmal selbst nicht und halte mich für schwach	1	1,8	1,8	76,8
Konzentrationsmangel	1	1,8	1,8	78,6
Leistungsfähigkeit Sport	1	1,8	1,8	80,4
mehr Zeit für meine Familie	1	1,8	1,8	82,1
meine Tochter	1	1,8	1,8	83,9
schlechte Fitness	1	1,8	1,8	85,7
schlechtes Vorbild für meine Kinder	1	1,8	1,8	87,5
Selbstbestätigung	1	1,8	1,8	89,3
sonst bin ich vernünftig, nur beim Rauchen nicht	1	1,8	1,8	91,1
Tauchzeitverlängerung	1	1,8	1,8	92,9
totaler Frust, dass ich es nicht packe	1	1,8	1,8	94,6
unkontrolliertes Rauchen	1	1,8	1,8	96,4
Unterdrückung des Hungergefühls (Appetitlosigkeit)	1	1,8	1,8	98,2
Zuviel Hektik im Beruf	1	1,8	1,8	100,0
Gesamt	56	100,0	100,0	

Appendix B: Forms and Instructions

Letter containing information and instructions, a confirmation of their LDS and of all scheduled appointments (t_1, t_2, t_3),

Directions to the laboratory

Debriefing

Informed Consent

Confirmation of participation form

Overview of session

Telephone screening instructions

Instructions for t1 and t2

Report sheets for t1 and t2 and follow up

Information about results and lottery winners

WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER
Psychologisches Institut I
Psychologische Diagnostik und Klinische Psychologie

Westf. Wilhelms-Universität Münster · Psychologisches Institut I
Fliednerstr. 21 · D-48149 Münster

Sehr geehrter Herr .....,

hier sind - wie angekündigt - noch mal die wichtigsten Informationen . . .

Ihre letzte Zigarette rauchen Sie am 12. Januar 2003 (Tag X). Wir haben drei Termine miteinander vereinbart:

10. Januar 2003, 13:30 Uhr
14. Januar 2003, 14:00 Uhr
19. Januar 2003, 13:30 Uhr

Die Untersuchungen finden jeweils am Psychologischen Institut I der Universität Münster statt (eine Wegbeschreibung ist beigefügt). Herr ....., Herr ..... oder ein anderer Mitarbeiter des Instituts erwarten Sie am Haupteingang (Pforte).

Wir möchten Sie bitten, jeweils 24 Stunden vor den vereinbarten Terminen keinen Alkohol zu trinken und auf die Einnahme anderer Substanzen (ausgenommen verordnete Medikamente) zu verzichten. Während der Studie sollten Sie außerdem keine Nikotinersatzpräparate (Kaugummi, Pflaster etc.) verwenden und keine Medikamente (zum Beispiel Zyban) zur Unterstützung der Nikotinentwöhnung einnehmen. Vielen Dank!

Ganz wichtig: Bringen Sie bitte zu den ersten beiden Terminen jeweils ein ungeöffnetes Päckchen Zigaretten Ihrer Marke sowie Ihr Feuerzeug oder ein paar Streichhölzer mit. Drehen Sie selbst? Dann bringen Sie bitte ein ungeöffnetes Päckchen Tabak Ihrer Marke mit. Merci!

Vielleicht möchten Sie - insbesondere wenn Sie an einer chronischen Erkrankung leiden - vor dem Tag X noch einmal mit Ihrem Hausarzt über die verschiedenen in der beiliegenden Broschüre beschriebenen Möglichkeiten der Nikotinentwöhnung sprechen: Wir möchten sicher sein, dass der Schlusspunkt für Sie der richtige Schritt ist.

Zögern Sie bitte nicht, sich an mich zu wenden, wenn Sie Fragen haben.

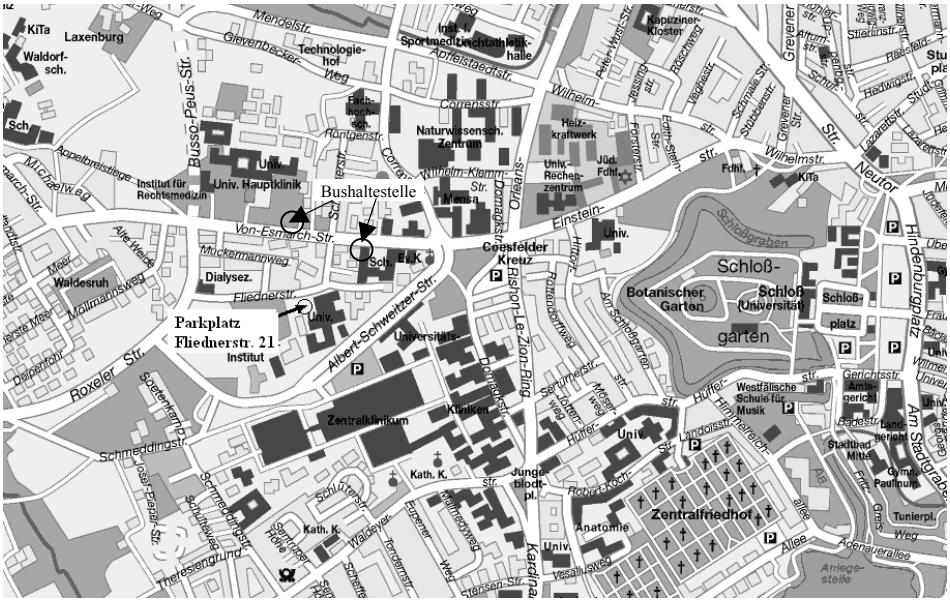
Mit freundlichem Gruß
gez.

Die letzte Zigarette

- Wegbeschreibung -

Die Untersuchungen finden am Psychologischen Institut I der Universität Münster in der Fliednerstraße 21 statt. Das Institut liegt in unmittelbarer Nachbarschaft der Universitäts-Kliniken (vis-à-vis der Klinik-Türme): Die Albert-Schweitzer-Str. trennt Kliniken und Psychologie.

Sie erreichen das Institut vom Bahnhof aus mit den mit den Buslinien 5 und 11 (Richtung Gievenbeck; Haltestelle Schreiberstraße) oder auf der Von-Esmarch-Str. (nach dem Coesfelder Kreuz an der zweiten Ampel bzw. am Fahrradladen links in die Fliednerstr. abbiegen). Rechts neben dem Institut (großer hässlicher Bau aus Beton) ist ein Parkplatz für Besucher.



WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER

Probandenaufklärung

- zum Verbleib bei den Teilnehmer/innen -

Die letzte Zigarette

Die Westfälische Wilhelms-Universität Münster führt in Kooperation mit der Christoph-Dornier-Stiftung für Klinische Psychologie eine Untersuchung zur Nikotinentwöhnung durch. An dieser Studie können starke Raucher teilnehmen, die mindestens 20 Zigaretten am Tag rauchen und bereit sind, während der Entwöhnung weitgehend auf fremde Hilfe (Akupunktur, Kurs etc.) sowie die Verwendung von Nikotinersatzpräparaten (Kaugummi, Pflaster etc.) zu verzichten. Die Teilnahme an der Studie soll für diese Raucher ein letzter Anstoß zur Entwöhnung nach der sog. Schlusspunktmethode sein: Von einem zuvor vereinbarten Stichtag an wird das Rauchen völlig aufgegeben. Vor Beginn der Studie werden alle Teilnehmer ausführlich über die Vor- und Nachteile alternativer Entwöhnungsmethoden informiert. Jeweils zwei bis drei Tage vor und nach dem Stichtag werden die Reaktionen auf den Rauch einer Zigarette untersucht. Darüber hinaus werden die Teilnehmer gebeten, eine Reihe verschiedener Fragebögen auszufüllen. Eine Woche nach dem Stichtag wird durch eine Bestimmung des CO-Gehaltes der Atemluft die Abstinenz von Nikotin überprüft. Teilnehmer, die jeden vereinbarten Termin wahrnehmen, werden nach Abschluss der Studie bei der Verlosung von drei Preisen berücksichtigt (1. Preis: 250 Euro; 2. Preis: 125 Euro; 3. Preis: 75 Euro).

Alle Angaben werden vertraulich behandelt und erst nach Anonymisierung ausschließlich für wissenschaftliche Zwecke ausgewertet. Die Teilnahme an dieser Studie ist freiwillig. Die Einwilligung kann jederzeit, ohne Angaben von Gründen und ohne nachteilige Folgen, widerrufen werden.

Bei Rückfragen wenden Sie sich bitte an Herrn Dr. Ralf Demmel, Universität Münster, Fliednerstr. 21, 48149 Münster, Telefon: (02 51) 83-3 41 94, Fax: (02 51) 83-3 13 31, E-Mail: demmel@psy.uni-muenster.de

WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER

Einverständniserklärung

Ich wurde heute über das Forschungsprojekt “Die letzte Zigarette” informiert. Ich erkläre mich damit einverstanden, an dieser Studie teilzunehmen und alle Daten, die im Verlauf der Untersuchung erhoben werden, für wissenschaftliche Zwecke zur Verfügung zu stellen.

Ich habe mich an die Anweisungen gehalten und 24 Stunden vor Beginn der ersten Untersuchung keine Medikamente, Alkohol oder Drogen zu mir genommen (ausgenommen verordnete Medikamente).

Ich wurde darüber informiert, dass die erhobenen Daten – unter Einhaltung der Vorschriften des Datenschutzes – ausschließlich zu wissenschaftlichen Zwecken auf elektronischen Datenträgern gespeichert und mittels statistischer Verfahren zusammengefasst und ausgewertet werden. In wissenschaftlichen Berichten werden nur Sammelstatistiken veröffentlicht, das heißt eine Zuordnung der erhobenen Daten zu bestimmten Personen ist nicht möglich.

Die vorliegende Einverständniserklärung bezieht sich lediglich auf Daten, die im Rahmen der genannten Untersuchung erhoben werden, und kann jederzeit, ohne Angabe von Gründen und ohne nachteilige Folgen, widerrufen werden.

Münster, den . . . . . .

. . . . . .

(Unterschrift)

Anwesenheit

Mit meiner Unterschrift bestätige ich, _____,

dass ich am 1. Termin der Studie „Die letzte Zigarette“

am: _____ / _____ 2003

um: _____ Uhr

teilgenommen habe.

Münster, den _____ / _____ 2003

_____
Unterschrift

Mit meiner Unterschrift bestätige ich, _____,

dass ich am 2. Termin der Studie „Die letzte Zigarette“

am: _____ / _____ 2003

um: _____ Uhr

teilgenommen habe.

Münster, den _____ / _____ 2003

_____
Unterschrift

Mit meiner Unterschrift bestätige ich, _____,

dass ich am 3. Termin der Studie „Die letzte Zigarette“

am: _____ / _____ 2003

um: _____ Uhr

teilgenommen habe.

Münster, den _____ / _____ 2003

_____
Unterschrift

Die letzte Zigarette:
Das Verlangen starker Raucher vor und nach Beginn der Abstinenz

Rekrutierung der Probanden:
⇨ Zeitungsanzeige

T_0 **Telefonscreening:**
⇨ Telefonscreening
⇨ Informationsschreiben (1)– Gruppe Q [Termin; Wegbeschreibung; Broschüre; Aufklärung Q]
⇨ Informationsschreiben (1)– Gruppe NQ [Termin; Wegbeschreibung; Aufklärung NQ]

T_1 **1. Untersuchung (2-3 Tage vor Tag X)**
⇨ Leitfaden (1):1ste Untersuchung – Gruppe Q & NQ
⇨ Instruktion (1) für VL – Gruppe Q & NQ
⇨ Einverständniserklärung – Gruppe Q & NQ

Skalen
⇨ Visuelle Analogskala – „craving“
⇨ MDBF – „Stimmung“
⇨ Magnitude Estimation - „craving“

Allgemeiner Fragebogen T1
⇨ Angaben zur Person (Soziodemographie/Dokumentationsstandards III)
⇨ Screening für Alkoholkonsum
⇨ Fagerstrom Test für Nikotinabhängigkeit (FTNA)
⇨ Importance & Confidence für Nikotin
⇨ Questionnaire of Smoking Urges (QSU)
⇨ „Aufhörgründe T_1“

Tag X und 2. Termin mit Gruppe Q & NQ überprüfen

X **Letzter Tag, an dem geraucht wird**

T_2 **2. Untersuchung (2-3 Tage nach Tag X)**
⇨ Leitfaden (2): 2te Untersuchung – Gruppe Q & NQ
⇨ Instruktion (2) für VL – Gruppe Q & NQ

Skalen
⇨ Visuelle Analogskala – „craving“
⇨ MDBF – „Stimmung“
⇨ Magnitude Estimation - „craving“

Allgemeiner Fragebogen T2
⇨ Screening für Alkoholkonsum
⇨ Fagerstrom Test für Nikotinabhängigkeit (FTNA)
⇨ Importance & Confidence für Nikotin
⇨ Questionnaire of Smoking Urges (QSU)
⇨ „Aufhörgründe T_2“

Termin für Nachuntersuchung mit Gruppe Q & NQ überprüfen

T_3 **Nachuntersuchung (ca. 7 Tage nach Tag X)**
⇨ „Aufhörgründe T_3“
⇨ Kontrolle, ob Probanden in der Zwischenzeit tatsächlich nicht geraucht haben

LEITFADEN (T0): TELEFONSCREENING

Kennung:	**Uhrzeit:**	**Datum:**	**2003**

(*Name*), Universität Münster. Ich rufe wegen der Raucher-Studie an. (*Name*) hatte ja angekündigt, dass ich noch mal anrufe. Passt es gerade? . . . OK! Darf ich Ihnen vorab noch ein paar Fragen stellen?

Wie alt sind Sie? _____ Jahre

Seit wann rauchen Sie? _____ Jahre

Während der letzten anderthalb Jahre: Wie viele Zigaretten haben Sie da so an einem Tag geraucht? Durchschnittlich?

_____ (Anzahl Zigaretten)

Wenn nicht bereits bekannt: Leiden Sie unter irgendeiner chronischen Erkrankung?

1 ❒ ja (⇨ Ausschluss)
2 ❒ nein

Wenn nicht bereits bekannt: Nehmen Sie irgendwelche Medikamente?

1 ❒ ja (⇨ Ausschluss)
2 ❒ nein

Wurden Sie schon einmal wegen irgendwelcher Probleme im Zusammenhang mit dem Konsum von Medikamenten, Alkohol oder illegalen Drogen behandelt?

1 ❒ ja (⇨ Ausschluss)
2 ❒ nein

Waren Sie jemals wegen psychischer Probleme bei einem Psychologen, Psychotherapeuten oder Psychiater in Behandlung?

1 ❒ ja (⇨ Ausschluss)
2 ❒ nein

Waren Sie schon einmal Patient in einer psychiatrischen oder psychosomatischen Klinik?

1 ❒ ja (⇨ Ausschluss)
2 ❒ nein

Wenn Einschluss, dann Tag X festlegen und Termine vereinbaren

Erster möglicher Termin: 10:30 Uhr
Letzter möglicher Termin: 18:30 Uhr
Dauer eines Termins: 60 Minuten (Termin 1 & 2) bzw. 30 Minuten (Termin 3)

OK! Wir werden Sie insgesamt dreimal sehen: Einmal vor dem Tag X und zweimal danach. Wir könnten jetzt den Tag X festlegen und die drei Termine in Münster vereinbaren. Jeder Termin dauert jeweils 30 bis 60 Minuten. Wir starten in der dritten Januarwoche, das heißt Sie koennten zum Beispiel am zweiten Januar-Wochenende aufhören. Was meinen Sie?

Der erste Termin sollte so zwei bis drei Tage vor dem Tag X sein, der zweite Termin zwei bis drei Tage nach dem Tag X und der dritte Termin sieben Tage nach dem Tag X.

Tag X: ____ | ____ 2003

1. Termin: ____ | ____ 2003, Uhrzeit: _____ Uhr

2. Termin: ____ | ____ 2003, Uhrzeit: _____ Uhr

3. Termin: ____ | ____ 2003, Uhrzeit: _____ Uhr

weiter . . .
Wir möchten Ihnen noch ein paar Unterlagen schicken, unter anderem eine Broschüre und eine Wegbeschreibung. Sie wohnen (nicht) in Münster? Die Postleitzahl? Die Straße? . . .

Name:

Straße:

PLZ/Wohnort:

Telefon:

Wenn Anschrift bekannt, dann
Sie bekommen dann in den nächsten Tagen noch mal Post von uns.

Wenn Ausschluss, dann

Alter
Wir dürfen lediglich Raucher unter 60 in die Studie aufnehmen . . .

Anzahl der Zigaretten
Wir können lediglich starke Raucher in die Studie aufnehmen . . .

chronische Erkrankungen
Da wir eine wissenschaftliche Studie durchführen und keine Behandlung anbieten, dürfen wir keine Raucher in die Studie aufnehmen, die unter chronischen Erkrankungen leiden . . .

Komorbidität
Da wir eine wissenschaftliche Studie durchführen und keine Behandlung anbieten, dürfen wir keine Raucher in die Studie aufnehmen, die bereits einmal wegen psychischer Probleme behandelt wurden . . .

. . . Darf ich Ihnen zwei andere Telefonnummern geben?

Rauchersprechstunde Münster
Tel: (02 51) 4 40 30; jeweils Mo & Do, 13:00 bis 14:00 Uhr und 18:00 bis 19:00 Uhr

Rauchertelefon BzGA
Tel: (02 21) 89 20 31; Mo bis Do: 10:00 bis 22:00 Uhr, Fr bis So: 10:00 bis 18:00 Uhr

Viel Erfolg und alles Gute!

1. Untersuchung
Instruktion (T1): Instruktionen für die Probanden (Gruppe Q & NQ)

Begrüßung:

Guten Tag/Guten Abend, Herr/Frau .....!
Mein Name ist .....
Schön, dass Sie gekommen sind. Ich hoffe, Sie haben den Weg zu uns gut gefunden. Bitte folgen Sie mir ins Labor.

Einleitung:

Der heutige Termin ist der erste von insgesamt drei Terminen. Ich erzähl‘ Ihnen kurz, was wir heute vorhaben:

Zuerst werden wir ein paar formale Dinge klären. Danach geht’s mit der eigentlichen Untersuchung los. Die Untersuchung besteht aus zwei Teilen:

1. einem kurzen Experiment. Den Ablauf des Experiments werde ich Ihnen erklären, wenn’s soweit ist.
2. und dem Ausfüllen von Fragebögen

Einverständniserklärung :

Dann bitte ich Sie, diese Einverständniserklärung sorgfältig zu lesen und zu unterschreiben. [*Einverständniserklärung aushändigen, unterschreiben lassen und überprüfen*]

Danke.

Fragebogen #1 - Visuelle Analogskala/MDBF (1): Teil 1

Ich werde Sie im Laufe der Untersuchung einige Male bitten, so einen Fragebogen auszufüllen [***Fragebogen #1*** *vorlegen*]: Bei allen Fragebögen in dieser Studie gibt es grundsätzlich keine richtigen oder falschen Antworten, sondern nur Antworten, die mehr oder weniger auf Sie zutreffen.

Bitte sehen Sie sich nun den Fragebogen an und füllen Sie ihn aus. Es ist ganz wichtig, dass Sie den Fragebogen *vollständig* ausfüllen! Ich werde das im Anschluss überprüfen, da wir nur vollständig ausgefüllte Fragebögen auswerten können. [*Fragebogen #1 ausfüllen lassen und auf Vollständigkeit überprüfen!*]

Bevor Sie die letzte Seite ausfüllen, werde ich Ihnen noch etwas dazu erklären

Magnitude Estimation Übung:

Jetzt stelle ich Ihnen einen Fragebogen vor, der etwas anders als die übrigen Fragebögen aufgebaut ist. Deshalb werde ich diese Methode mit Ihnen einüben. Es ist ganz leicht und geht ganz schnell. [*Magnitude Estimation Übungszettel aushändigen*]

Sie werden jetzt nacheinander eine Reihe von Linien unterschiedlicher Länge in zufälliger Reihenfolge sehen. Ihre Aufgabe ist es zu entscheiden, wie lang diese sind, indem Sie ihnen Zahlen zuordnen. Geben Sie der ersten Linie irgendeine Zahl, die Ihnen passend erscheint.

Dann vergeben Sie für die folgenden Linien so Zahlen, dass diese Ihren subjektiven Eindruck widerspiegeln. Wenn Ihnen eine Linie beispielsweise 20mal so lang erscheint wie die erste, dann geben Sie ihr eine Zahl, die 20mal so groß ist wie die erste. Wenn Ihnen eine Linie halb so lang wie die erste Linie erscheint, geben Sie ihr eine Zahl, die halb so groß ist wie die erste. Sie können ganze Zahlen, Brüche oder Dezimalzahlen verwenden. Für jede Linie haben Sie ungefähr 15 Sekunden Zeit.

Ist Ihnen soweit alles klar? Gut, ich starte jetzt den Übungsdurchgang. [*Magnitude Estimation Instruktionen über Bildschirm ablaufen lassen*]

Fragebogen #1 – Magnitude Estimation (1): Teil 2

Letzte Seite ausfüllen lassen

Zigaretten und Feuerzeug:

Dürfte ich jetzt noch Ihre neue, ungeöffnete Zigarettenschachtel oder Tabakpackung samt Feuerzeug oder Streichhölzer haben?

Danke. Ich werde sie Ihnen am Ende der Untersuchung wieder zurückgeben.

CO-Messung (1):

Ich werde nun eine Messung mit Ihnen durchführen. Mit der Messung werde ich den Nikotingehalt in Ihrem Atem überprüfen. Dafür brauchen wir dieses Gerät hier. [*Gerät zeigen*]

Ich erkläre Ihnen, wie das Ganze funktioniert:

1. Halten Sie das Gerät so in Ihrer Hand. [*demonstrieren*]
2. Wenn ich "Jetzt!" sage, halten Sie bitte für kurze Zeit die Luft an.
3. Umschließen Sie mit ihren Lippen dieses Mundstück hier [*auf das Mundstück zeigen*] und atmen Sie langsam und gleichmäßig aus!
4. Die Messung dauert 15 Sekunden. Die letzten drei Sekunden werden durch drei Piepstöne angezeigt.
5. Nach dem vierten, langgezogenen Ton ist die Messung zu Ende. Atmen Sie so lange aus, bis der letzte Ton ertönt!

15 Sekunden – das mag Ihnen jetzt lang erscheinen. Sie werden aber sofort merken, dass diese 15 Sekunden schnell um sind. [*Messung durchführen und Wert im Leitfaden notieren*]

Letzte Zigarette?:

Wann haben Sie das letzte Mal geraucht? [*Wert im Leitfaden notieren*]

Wie viele Zigaretten haben Sie heute bereits geraucht? [*Wert im Leitfaden notieren*]

Fragebogen #2 - Visuelle Analogskala/MDBF/Magnitude Estimation (2):

Füllen Sie nun diesen Fragebogen ein zweites Mal aus. [*Fragebogen #2 ausfüllen lassen und auf Vollständigkeit überprüfen!*]

Neutral Cue Exposure:

Wir kommen jetzt zum 2. Teil der Untersuchung: dem Experiment.

Damit ich Sie nicht ablenke oder störe, werde ich während des Experiments im Nachbarraum sitzen und nur einmal zwischendrin kurz rein kommen. Die nötigen Anweisungen erhalten Sie über den Bildschirm. Jedes Mal, wenn eine neue Anweisung auf dem Bildschirm erscheint, hören Sie auch einen Ton. Dieser Ton soll Sie darauf aufmerksam machen, auf den Bildschirm zu sehen und die neue Anweisung zu lesen. Machen Sie dann bitte das, was auf dem Bildschirm steht.

Zwischendurch werden Sie aufgefordert, Fragebögen zu beantworten – das kennen Sie ja bereits. (Visuelle Analogskala, MDBF und Magnitude Estimation) [*Fragebögen zeigen*].

Das Experiment wird rund 15 Minuten dauern. Sie werden im Laufe des Experiments zwei Dinge erhalten: Zuerst etwas Neutrales und dann etwas, was mit dem Rauchen zu tun hat. Bei der zweiten Untersuchung wird das übrigens genauso sein.

Haben Sie Fragen zu dem Experiment? Gut, dann kann‘s losgehen. [*Erste Box auf den Tisch legen (neutraler cue) - Raum verlassen*]

Instruktion über den Bildschirm:

Öffnen Sie jetzt bitte die Box und stellen Sie den Inhalt auf den Tisch.
Öffnen Sie jetzt bitte die Flasche und legen Sie den Verschluss neben die Flasche auf den Tisch.
Nehmen Sie jetzt bitte die Flasche in die Hand.
Riechen Sie jetzt bitte einmal an der Flaschenöffnung.
Stellen Sie jetzt bitte die Flasche wieder auf den Tisch.

Nehmen Sie jetzt bitte den Fragebogen #3 (**Visuelle Analogskala/MDBF/Magnitude Estimation (3))** und füllen Sie ihn jetzt bitte aus!

Bitte wenden Sie sich jetzt an Ihren Versuchsleiter!

[*wenn der Pbn den Fragebogen #3 ausgefüllt hat, kurz in den Raum gehen und die Box austauschen, anschließend Fragebogen #3 auf Vollständigkeit überprüfen!*]

FPI-R:

Ich bitte Sie jetzt noch diesen Fragebogen auszufüllen. [*den Probanden den FPI-R geben*]

Danke. Jetzt geht’s weiter mit dem Experiment. [*FPI-R auf Vollständigkeit überprüfen!*]

Smoking Cue Exposure:

Instruktion über den Bildschirm:

Nehmen Sie jetzt bitte den Fragebogen #4 (**Visuelle Analogskala/MDBF/Magnitude Estimation (4))** und füllen Sie ihn jetzt bitte aus!

Öffnen Sie jetzt bitte die neue Box und stellen Sie den Inhalt auf den Tisch.
Öffnen Sie jetzt bitte die Packung Zigaretten (den Tabak) und riechen einmal an der offenen Packung.
Nehmen Sie jetzt bitte eine Zigarette aus der Packung (drehen Sie sich jetzt bitte eine Zigarette) und halten Sie die Zigarette in ihrer Hand.
Nehmen Sie bitte ihr Feuerzeug (Ihre Streichhölzer) und halten Sie die Zigarette solange in die Flamme, bis sie anfängt zu glühen, ohne sie in den Mund zu nehmen!
Halten sie jetzt bitte die brennende Zigarette in der Hand.
Legen Sie jetzt bitte die brennende Zigarette in den Aschenbecher, ohne sie dabei auszudrücken.

Nehmen Sie jetzt bitte den Fragebogen #5 (**Visuelle Analogskala/MDBF/Magnitude Estimation (5)** und füllen Sie ihn jetzt bitte aus!

Drücken Sie jetzt bitte die Zigarette im Aschenbecher aus.

Bitte wenden Sie sich jetzt an Ihren Versuchsleiter!

[*wenn der Pbn den Fragebogen #6 ausgefüllt hat, in den Raum gehen und die Fragebögen #4 und #5 auf Vollständigkeit überprüfen!*]

Vielen Dank! Das war auch schon das Ende des Experiments.

Allgemeiner Fragebogens T1:

Füllen Sie jetzt bitte noch diesen Fragebogen (***allgemeiner Fragebogen T1***) hier aus. [*allgemeiner Fragebogen T1, bestehend aus:*]

- ⇨ *Angaben zur Person (Soziodemographie)*
- ⇨ *Screening für Alkoholkonsum*
- ⇨ *Fagerstrom Test for Nicotine Dependence (FTND)*
- ⇨ *Importance & Confidence für Nikotin*
- ⇨ *Questionnaire of Smoking Urges (QSU)*
- ⇨ *Aufhörgründe T1*

[*allgemeinen Fragebogen T1 ausfüllen lassen und auf Vollständigkeit überprüfen!*]

Terminvereinbarung: Tag X und Termin der 2. Untersuchung überprüfen

Zigaretten bzw. Tabak und Feuerzeug bzw. Streichhölzer dem Pbn zurückgeben]

2. Untersuchung
Instruktion (T2): Instruktionen für die Probanden (Gruppe Q & NQ)

Begrüßung:

Guten Tag/Guten Abend, Herr/Frau .....!
Mein Name ist .....
Schön, dass Sie wieder gekommen sind.

Eine Frage vorweg: haben Sie seit dem Tag X wieder geraucht?
[*wenn nicht, weiter*]

Einleitung:

Diese Untersuchung wird insgesamt wieder ca. 30 – 45 Minuten dauern
Auch der Ablauf ist wieder der gleiche
Zum Abschluss werden wir dann den Termin für die Nachuntersuchung festlegen

Fragebogen #1 - Visuelle Analogskala/MDBF (1): Teil 1

Wie beim ersten mal werde ich Sie im Laufe der Untersuchung einige Male bitten, so einen Fragebogen auszufüllen [***Fragebogen #1*** *vorlegen*]: Bei allen Fragebögen in dieser Studie gibt es grundsätzlich keine richtigen oder falschen Antworten, sondern nur Antworten, die mehr oder weniger auf Sie zutreffen.

Bitte sehen Sie sich nun den Fragebogen an und füllen Sie ihn aus. Es ist ganz wichtig, dass Sie den Fragebogen <u>*vollständig*</u> ausfüllen! Ich werde das im Anschluss überprüfen, da wir nur vollständig ausgefüllte Fragebögen auswerten können. [*Fragebogen #1 ausfüllen lassen und auf Vollständigkeit überprüfen!*]

Bevor Sie die letzte Seite ausfüllen, werde ich Ihnen noch etwas dazu erklären

Magnitude Estimation Übung:

Diesen Fragebogen, der etwas anders als die übrigen Fragebögen aufgebaut ist, kennen Sie ja bereits. Dennoch werden wir diese Methode mit Ihnen noch einmal einüben. Es ist ganz leicht und geht ganz schnell. [*Magnitude Estimation Übungszettel aushändigen*]

Sie werden jetzt nacheinander eine Reihe von Linien unterschiedlicher Länge in zufälliger Reihenfolge sehen. Ihre Aufgabe ist es zu entscheiden, wie lang diese sind, indem Sie ihnen Zahlen zuordnen. Geben Sie der ersten Linie irgendeine Zahl, die Ihnen passend erscheint. Dann vergeben Sie für die folgenden Linien so Zahlen, dass diese Ihren subjektiven Eindruck widerspiegeln. Wenn Ihnen eine Linie beispielsweise 20mal so lang erscheint wie die erste, dann geben Sie ihr eine Zahl, die 20mal so groß ist wie die erste. Wenn Ihnen eine Linie halb so lang wie die erste Linie erscheint, geben Sie ihr eine Zahl, die halb so groß ist wie die erste. Sie können ganze Zahlen, Brüche oder Dezimalzahlen verwenden. Für jede Linie haben Sie ungefähr 15 Sekunden Zeit.

Ist Ihnen soweit alles klar? Gut, ich starte jetzt den Übungsdurchgang. [*Magnitude Estimation Instruktionen über Bildschirm ablaufen lassen*]

Fragebogen #1 – Magnitude Estimation (1): Teil 2

Letzte Seite ausfüllen lassen

Zigaretten und Feuerzeug:

Dürfte ich jetzt wieder Ihre neue, ungeöffnete Zigarettenschachtel oder Tabakpackung samt Feuerzeug oder Streichhölzer haben?

Danke. Ich werde sie Ihnen am Ende der Untersuchung wieder zurückgeben.

CO-Messung (1):

Zunächst werde ich wieder eine Messung mit Ihnen durchführen. Mit der Messung werde ich den Nikotingehalt in Ihrem Atem überprüfen, um zu überprüfuen, ob Sie tatsächlich nicht geraucht haben [Wert notieren]
Auch wenn Sie es bereits von der ersten Untersuchung hier kennen, werde ich Ihnen noch mal kurz erzählen, wie das genau funktioniert:

1. Halten Sie das Gerät so in Ihrer Hand. [*demonstrieren*]
2. Wenn ich "Jetzt!" sage, halten Sie bitte für kurze Zeit die Luft an.
3. Umschließen Sie mit ihren Lippen dieses Mundstück hier [*auf das Mundstück zeigen*] und atmen Sie langsam und gleichmäßig aus!
4. Die Messung dauert 15 Sekunden. Die letzten drei Sekunden werden durch drei Piepstöne angezeigt.
5. Nach dem vierten, langgezogenen Ton ist die Messung zu Ende. Atmen Sie so lange aus, bis der letzte Ton ertönt!

15 Sekunden – das mag Ihnen jetzt lang erscheinen. Sie werden aber sofort merken, dass diese 15 Sekunden schnell um sind. [*Messung durchführen und Wert im Leitfaden notieren*]

Letzte Zigarette?:

Wann haben Sie das letzte Mal geraucht? [*Wert im Leitfaden notieren*]

Wie viele Zigaretten haben Sie heute bereits geraucht? [*Wert im Leitfaden notieren*]

Fragebogen #2 - Visuelle Analogskala/MDBF/Magnitude Estimation (2):

Füllen Sie nun diesen Fragebogen ein zweites Mal aus. [*Fragebogen #2 ausfüllen lassen und auf Vollständigkeit überprüfen!*]

Neutral Cue Exposure:

Wir kommen jetzt zum 2. Teil der Untersuchung: dem Experiment.

Damit ich Sie nicht ablenke oder störe, werde ich wieder im Nachbarraum sitzen und nur einmal zwischendrin kurz rein kommen. Die nötigen Anweisungen erhalten Sie über den Bildschirm. Jedes Mal, wenn eine neue Anweisung auf dem Bildschirm erscheint, hören Sie auch einen Ton. Dieser Ton soll Sie darauf aufmerksam machen, auf den Bildschirm zu sehen und die neue Anweisung zu lesen. Machen Sie dann bitte das, was auf dem Bildschirm steht.

Zwischendurch werden Sie aufgefordert, Fragebögen zu beantworten – das kennen Sie ja bereits. (Visuelle Analogskala, MDBF und Magnitude Estimation) [*Fragebögen zeigen*].

Das Experiment wird rund 15 Minuten dauern. Wie in der ersten Untersuchung werden Sie werden im Laufe des Experiments zwei Dinge erhalten: Zuerst etwas Neutrales und dann etwas, was mit dem Rauchen zu tun hat.

Haben Sie Fragen zu dem Experiment? Gut, dann kann‘s losgehen. [*Erste Box auf den Tisch legen (neutraler cue) - Raum verlassen*]

Instruktion über den Bildschirm:

Öffnen Sie jetzt bitte die Box und stellen Sie den Inhalt auf den Tisch.
Öffnen Sie jetzt bitte die Flasche und legen Sie den Verschluss neben die Flasche auf den Tisch.
Nehmen Sie jetzt bitte die Flasche in die Hand.
Riechen Sie jetzt bitte einmal an der Flaschenöffnung.
Stellen Sie jetzt bitte die Flasche wieder auf den Tisch.

Nehmen Sie jetzt bitte den Fragebogen #3 (**Visuelle Analogskala/MDBF/Magnitude Estimation (3))** und füllen Sie ihn jetzt bitte aus!

Bitte wenden Sie sich jetzt an Ihren Versuchsleiter!

[*wenn der Pbn den Fragebogen #3 ausgefüllt hat, kurz in den Raum gehen und die Box austauschen, anschließend Fragebogen #3 auf Vollständigkeit überprüfen!*]

FPI-R:

Ich bitte Sie jetzt noch diesen Fragebogen auszufüllen. [*den Probanden den FPI-R geben*]

Danke. Jetzt geht’s weiter mit dem Experiment. [*FPI-R auf Vollständigkeit überprüfen!*]

Smoking Cue Exposure:

Instruktion über den Bildschirm:

Nehmen Sie jetzt bitte den Fragebogen #4 (**Visuelle Analogskala/MDBF/Magnitude Estimation (4))** und füllen Sie ihn jetzt bitte aus!

Öffnen Sie jetzt bitte die neue Box und stellen Sie den Inhalt auf den Tisch.
Öffnen Sie jetzt bitte die Packung Zigaretten (den Tabak) und riechen einmal an der offenen Packung.
Nehmen Sie jetzt bitte eine Zigarette aus der Packung (drehen Sie sich jetzt bitte eine Zigarette) und halten Sie die Zigarette in ihrer Hand.
Nehmen Sie bitte ihr Feuerzeug (Ihre Streichhölzer) und halten Sie die Zigarette solange in die Flamme, bis sie anfängt zu glühen, ohne sie in den Mund zu nehmen!
Halten sie jetzt bitte die brennende Zigarette in der Hand.
Legen Sie jetzt bitte die brennende Zigarette in den Aschenbecher, ohne sie dabei auszudrücken.

Nehmen Sie jetzt bitte den Fragebogen #5 (**Visuelle Analogskala/MDBF/Magnitude Estimation (5)** und füllen Sie ihn jetzt bitte aus!

Drücken Sie jetzt bitte die Zigarette im Aschenbecher aus.

Bitte wenden Sie sich jetzt an Ihren Versuchsleiter!

[*wenn der Pbn den Fragebogen #6 ausgefüllt hat, in den Raum gehen und die Fragebögen #4 und #5 auf Vollständigkeit überprüfen!*]

Vielen Dank! Das war auch schon das Ende des Experiments.

Allgemeiner Fragebogens T2:

Füllen Sie jetzt bitte noch diesen Fragebogen (***allgemeiner Fragebogen T2***) hier aus. [*allgemeiner Fragebogen T2, bestehend aus:*]

- ⇨ *Screening für Alkoholkonsum*
- ⇨ *Fagerstrom Test for Nicotine Dependence (FTND)*
- ⇨ *Importance & Confidence für Nikotin*
- ⇨ *Questionnaire of Smoking Urges (QSU)*
- ⇨ *Aufhörgründe T2*

[*allgemeinen Fragebogen T2 ausfüllen lassen und auf Vollständigkeit überprüfen!*]

Terminvereinbarung: Termin 3 - Nachuntersuchung

Ich möchte gerne den Termin für die Nachuntersuchung mit Ihnen besprechen
Damit Sie nicht umsonst zur Nachuntersuchung erscheinen müssen, werden wir mit Ihnen einen Termin für ein Telefongespräch vereinbaren. Dieses findet einen Tag vor der Nachuntersuchung statt.
In diesem Telefonat werden wir klären, ob Sie wieder mit dem Rauchen begonnen haben oder ob Sie ab dem festgelegten Tag X abstinent geblieben sind. Wir bitten um Verständnis, dass wir dies bei der Nachuntersuchung durch eine weitere Atemprobe überprüfen müssen.

Zigaretten bzw. Tabak und Feuerzeug bzw. Streichhölzer dem Pbn zurückgeben]

LEITFADEN (T1): 1. UNTERSUCHUNG – GRUPPE Q & GRUPPE NQ

Kennung:	**Uhrzeit:**	**Datum:**

Beginn	
Einverständniserklärung	
➢ **Fragebogen #1** [Visuelle Analogskala #1; $MDBF_{kurz}$ #1] – **erster Teil**	❑ ***vollständig?***
Magnitude Estimation Instruktion und Übung	
➢ **Fragebogen #1** [Magnitude Estimation #1] – **zweiter Teil**	❑ ***vollständig?***
Abgabe der Zigaretten (Tabak) und des Feuerzeuges (Streichhölzer)	
CO – Messung (1)	***Wert*: _____ ppm**
Wann war die letzte Zigarette vor der Messung?	***vor*: _____ Minuten**
Wie viele Zigaretten wurden an diesem Tag bereits geraucht?	**_____ Zigaretten**
➢ **Fragebogen #2** [Visuelle Analogskala #2; $MDBF_{kurz}$ #2; Magnitude Estimation #2]	❑ ***vollständig?***
Neutral Cue Exposure (Wasserflasche) ⇨ *Power-Point-Präsentation*	
➢ **Fragebogen #3** [Visuelle Analogskala #3; $MDBF_{kurz}$ #3; Magnitude Estimation #3]	❑ ***vollständig?***
Pause (In dieser Zeit: auswechseln der Box & **NEO-FFI)**	
➢ **Fragebogen #4** [Magnitude Estimation #4; Visuelle Analogskala #4; $MDBF_{kurz}$ #4]	❑ ***vollständig?***
Smoking cue exposure (Zigaretten/Tabak, Feuerzeug/Streichhölzer, Aschenbecher) ⇨ *Power-Point-Präsentation*	
➢ **Fragebogen #5** [Magnitude Estimation #5; Visuelle Analogskala #5; $MDBF_{kurz}$ #5]	❑ ***vollständig?***
CO – Messung (2)	***Wert*: _____ ppm**
Ausfüllen des allgemeinen Fragebogens T1 bestehend aus: Angaben zur Person (Soziodemographie/Dokumentationsstandards III); Fagerstrom Test für Nikotinabhängigkeit (FTNA); Screeningfragen Alkohol; Importance & Confidence für Nikotin; Questionnaire of Smoking Urges (QSU); Aufhörgründe; und **Fragebogen #6** [Magnitude Estimation #6; Visuelle Analogskala #6; $MDBF_{kurz}$ #6]	❑ ***vollständig?***
Teilnahmebestätigung (1. Termin) unterschreiben lassen	
Terminvereinbarung überprüfen [Tag X: & Termin für 2. Untersuchung]	
Zigaretten (Tabak) und Feuerzeug (Streichhölzer) zurückgeben	

Besonderheiten:

LEITFADEN (T2): 2. UNTERSUCHUNG – GRUPPE Q & GRUPPE NQ

Kennung:	**Uhrzeit:**	**Datum:**

Beginn	
➢ **Fragebogen #1** [Visuelle Analogskala #1; $MDBF_{kurz}$ #1] – **erster Teil**	❑ ***vollständig?***
Magnitude Estimation Instruktion und Übung	
➢ **Fragebogen #1** [Magnitude Estimation #1] – **zweiter Teil**	❑ ***vollständig?***
Abgabe der Zigaretten (Tabak) und des Feuerzeuges (Streichhölzer)	
CO - Messung	***Wert*: _____ ppm**
Gruppe Q: Haben Sie in der Zwischenzeit geraucht? Wenn ja: wieviele Wenn ja: wann	❑ ja ❑ nein Anzahl: _____ _____
Gruppe NQ: Wann war die letzte Zigarette vor der Messung?	***vor*: _____ Minuten**
Gruppe NQ: Wie viele Zigaretten wurden an diesem Tag bereits geraucht?	_____ **Zigaretten**
➢ **Fragebogen #2** [Visuelle Analogskala #2; $MDBF_{kurz}$ #2; Magnitude Estimation #2]	❑ ***vollständig?***
Neutral Cue Exposure (Wasserflasche) ⇨ *Power-Point-Präsentation*	
➢ **Fragebogen #3** [Visuelle Analogskala #3; $MDBF_{kurz}$ #3; Magnitude Estimation #3]	❑ ***vollständig?***
Pause (In dieser Zeit: auswechseln der Box & **NEO-FFI)**	
➢ **Fragebogen #4** [Magnitude Estimation #4; Visuelle Analogskala #4; $MDBF_{kurz}$ #4]	❑ ***vollständig?***
Smoking cue exposure (Zigaretten/Tabak, Feuerzeug/Streichhölzer, Aschenbecher) ⇨ *Power-Point-Präsentation*	
➢ **Fragebogen #5** [Magnitude Estimation #5; Visuelle Analogskala #5; $MDBF_{kurz}$ #5]	❑ ***vollständig?***
CO – Messung (2)	***Wert*: _____ ppm**
Ausfüllen des allgemeinen Fragebogens T2 ⇨ bestehend aus: Fagerstrom Test für Nikotinabhängigkeit (FTNA); Screeningfragen Alkohol; Importance & Confidence für Nikotin; Questionnaire of Smoking Urges (QSU); Aufhörgründe; und **Fragebogen #6** [Magnitude Estimation #6; Visuelle Analogskala #6; $MDBF_{kurz}$ #6]	❑ ***vollständig?***
Teilnahmebestätigung (2. Termin) unterschreiben lassen	
Terminvereinbarung überprüfen [Nachuntersuchung]	
Zigaretten (Tabak) und Feuerzeug (Streichhölzer) zurückgeben – fragen: „oder sollen wir sie lieber hierbehalten?“	

Besonderheiten:

LEITFADEN (T3): NACHUNTERSUCHUNG - GRUPPE Q

Kennung:	**Uhrzeit:**	**Datum:**

Beginn	
CO – Messung	***Wert*: _____ ppm**
Haben Sie in der Zwischenzeit geraucht?	❑ ja ❑ nein
Wenn ja: wieviele	Anzahl: _____
Wenn ja: wann	_____
Aufhörgründe T_3	❑ ***vollständig?***
Teilnahmebestätigung (Nachuntersuchung) unterschreiben lassen	
Adresse/Telefonnummer verändert (wegen Benachrichtigung Verlosung)? Wenn ja:	

Besonderheiten:

WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER
Psychologisches Institut I
Psychologische Diagnostik und Klinische Psychologie

Westf. Wilhelms-Universität Münster · Psychologisches Institut I
Fliednerstr. 21 · D-48149 Münster

5. November 2010

Forschungsprojekt:

„Die letzte Zigarette“

Liebe Teilnehmerinnen und Teilnehmer,

in einem letzten Brief möchten wir uns noch einmal ganz herzlich für Ihre Teilnahme an unserem Forschungsprojekt „Die letzte Zigarette” bedanken. Auch wenn Sie nicht an allen drei Terminen teilgenommen haben hoffen wir, dass diese Studie als „letzter Anstoß“ zu Ihrer Nikotinentwöhnung beitragen konnte.

Dank Ihrer aktiven Teilnahme war es uns erst möglich, weitere Erkenntnisse über die Nikotinentwöhnung zu erlangen. Einen Teil unserer Ergebnisse - die für Sie von Interesse sein könnten - möchten wir Ihnen deshalb auch nicht vorenthalten und haben diese auf der nächsten Seite kurz für Sie zusammengestellt.

Wie wir Ihnen bereits bei der Studie versichert haben, wurden und werden Ihre Angaben vertraulich behandelt und erst nach Anonymisierung ausschließlich für wissenschaftliche Zwecke ausgewertet. Nach Zusendung dieses Briefes wird auch Ihre Adresse - die unabhängig von Ihren Daten gespeichert wurde - aus unserer Datei gelöscht.

Wir danken Ihnen nochmals für die Teilnahme an unserem Forschungsprojekt und wünschen Ihnen für Ihre Zukunft alles Gute.

Im Namen des gesamten Projektteams

_____

Claudia Schlüssel, Dipl.-Psych.

WESTFÄLISCHE
WILHELMS-UNIVERSITÄT
MÜNSTER

Ausschnitt der Ergebnisse des Forschungsprojekts:

„Die letzte Zigarette“

Für die Teilnahme an dem Forschungsprojekt „Die letzte Zigarette“ haben sich insgesamt über 300 Personen interessiert. Hiervon konnten nach dem Telefoninterview 60 Personen ausgewählt werden, zu denen auch Sie gehörten.

Beschreibung der Personen
durchschnittliches Alter 44 Jahre

Teilnahme	Personen
1. Termin	60
2. Termin	47
3. Termin	42

Geschlecht	Personen
männlich	36 (60.0%)
weiblich	24 (40.0%)

Familienstand	Personen
ledig	11 (18.3%)
verheiratet, zusammenlebend	42 (70.0%)
verheiratet, getrennt lebend	01 (1.7%)
geschieden	06 (10.0%)

Schulabschluss	Personen
Hauptschul- / Volksschulabschluss	08 (30.0%)
Realschulabschluss	18 (30.0%)
(Fach-) Abitur	12 (20.0%)
Hochschulabschluss	11 (18.3%)
anderer	01 (1.7%)

Berufsausbildung	Personen
keine / abgebrochen	02 (3.3%)
Berufsausbildung/Lehre	45 (75.0%)
Hochschulstudium	11 (18.3%)
sonstige	02 (3.3%)

Erwerbstätigkeit	Personen
Auszubildende(r)	01 (1.7%)
Angestellte(r)/Beamte(r)	34 (56.7%)
Arbeiter(in) Facharbeiter(in)	08 (13.3%)
Selbstständige(r)/Freiberufler(in)	06 (10.0%)
Schüler(in)/Student(in)	01 (1.7%)
Hausmann/Hausfrau	05 (8.3%)
Rentner(in)	05 (8.3%)

Rauchen	
Rauchtage im letzten Monat	30 (min. 26.00; max. 30.00)
Konsum pro Rauchtag	28 (min. 3.00; max. 60.00)
Dauer des Konsums (in Jahren)	25 (min. 2.00; max. 42.00)
Anzahl der Abstinenzversuche	04

Rückfall	Personen
nicht nachvollziehbar	14 (23,3%)
Rückfall	19 (31,7%)
kein Rückfall	27 (45,0%

Zeit des Rückfalls	Personen
nach dem 1. Termin	09
nach dem 2. Termin	10

Verlangen (craving)	
Vor vs. nach dem Aufhören	Das Verlangen vor dem Aufhören war etwas stärker als nach dem Aufhören
Wasser vs. Zigarette	Das Verlangen nach der Zigarette war stärker als nach dem Wasser

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Forschungsprojekt:
„Die letzte Zigarette“

Liebe/r Frau/Herr _____,

Herzlichen Glückwunsch, Sie sind Gewinner unserer Verlosung und _____ Euro gehören Ihnen. Wir bitten Sie uns ihre Bank, Bankleitzahl und Kontonummer mitzuteilen (Dr. Ralf Demmel: Tel.: 0251-8334149; Fax: 0251-8331331; eMail: demmel@psy.uni-muenster.de), damit wir Ihnen Ihren Gewinn möglichst bald überweisen können.

Zudem möchten wir uns noch einmal ganz herzlich für Ihre Teilnahme an unserem Forschungsprojekt „Die letzte Zigarette” bedanken und hoffen, dass diese Studie als „letzter Anstoß“ zu Ihrer Nikotinentwöhnung beitragen konnte. Dank Ihrer aktiven Teilnahme war es uns erst möglich, weitere Erkenntnisse über die Nikotinentwöhnung zu erlangen. Einen Teil unserer Ergebnisse - die für Sie von Interesse sein könnten - möchten wir Ihnen deshalb auch nicht vorenthalten und haben diese auf der nächsten Seite kurz für Sie zusammengestellt.

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Wir danken Ihnen nochmals für die Teilnahme an unserem Forschungsprojekt und wünschen Ihnen für Ihre Zukunft alles Gute.

Im Namen des gesamten Projektteams

_____

Claudia Schlüssel, Dipl.-Psych.

Appendix C: Cue Exposure Instructions

ME Practice presentation (PowerPoint©)

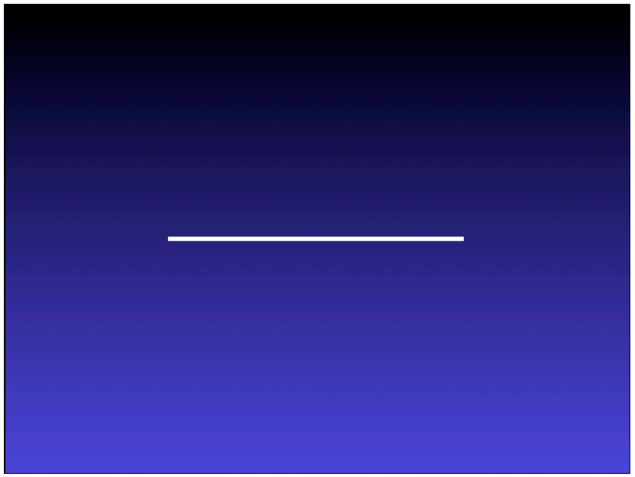
Neutral stimulus and Smoking cue presentation (PowerPoint©)

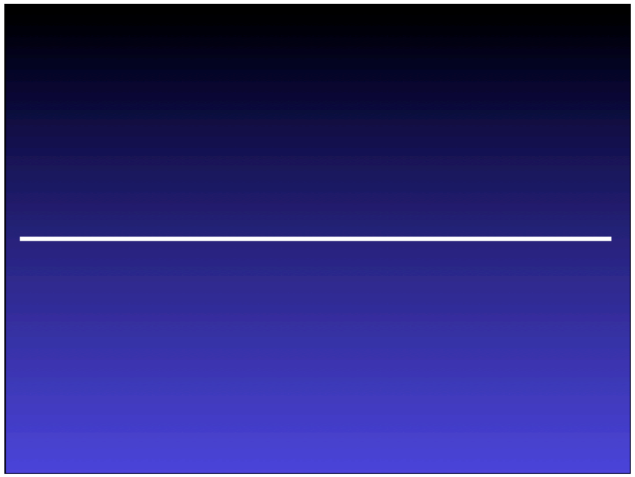
Magnitude Estimation practice

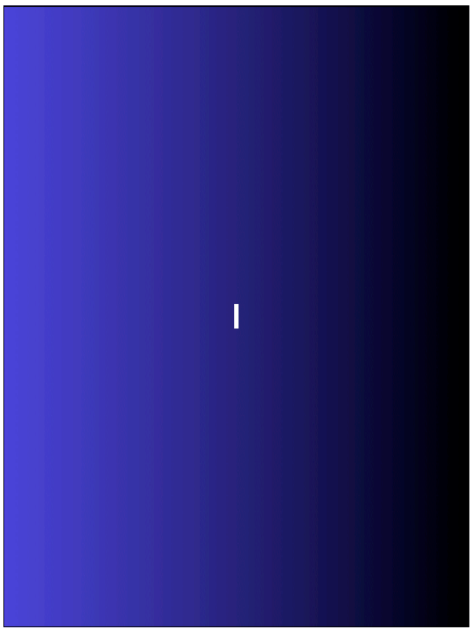
Linien

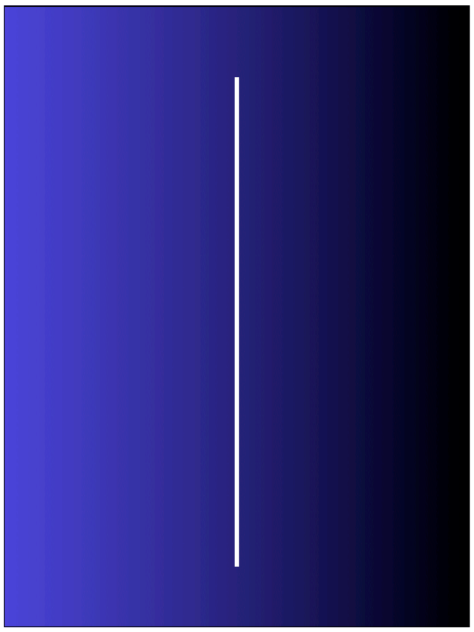
Bevor wir weitermachen, möchten wir eine neue Methode mit Ihnen üben.

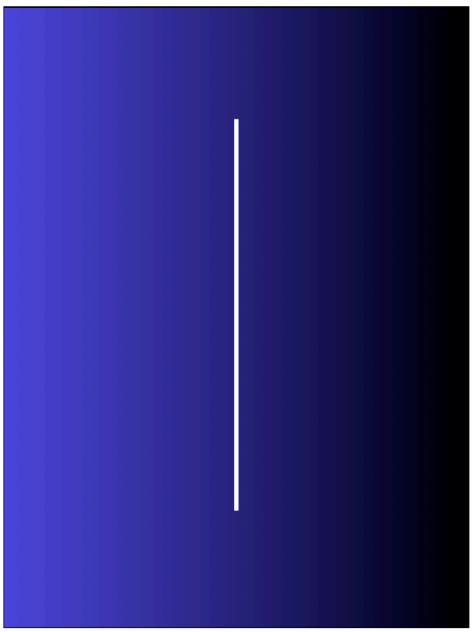
Sie werden jetzt nacheinander eine Reihe von Linien unterschiedlicher Länge sehen. Ihre Aufgabe ist es zu entscheiden, wie lang diese sind, indem Sie ihnen Zahlen zuordnen. Geben Sie der ersten Linie irgendeine Zahl, die Ihnen passend erscheint. Dann vergeben Sie für die folgenden Linien so Zahlen, dass diese Ihren subjektiven Eindruck widerspiegeln.
Wenn Ihnen eine Linie beispielsweise 20 mal so lang erscheint wie die erste Linie, dann geben Sie ihr eine Zahl, die 20 mal so groß ist wie die erste. Wenn Ihnen eine Linie halb so lang wie die erste Linie erscheint, geben Sie ihr eine Zahl, die halb so groß ist wie die erste. Sie können ganze Zahlen, Brüche oder Dezimalzahlen verwenden. Für jede Linie haben Sie 10 Sekunden Zeit.

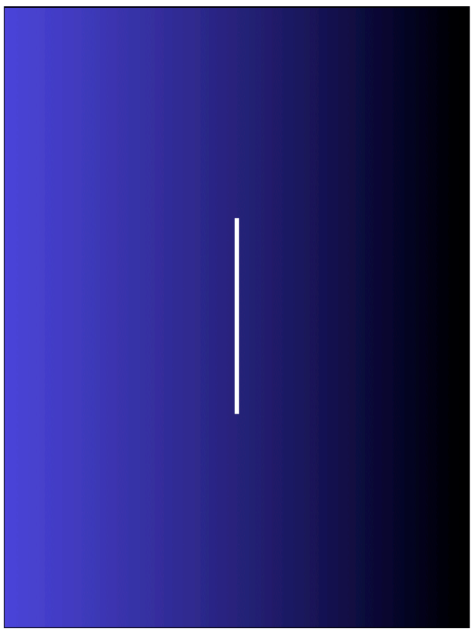








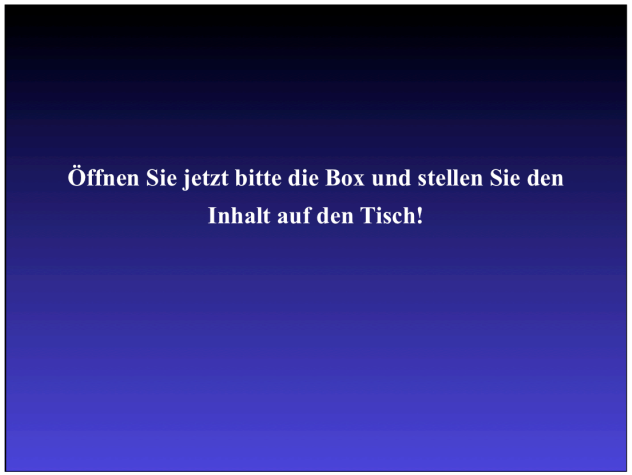




Verlangen

Wir möchten Sie nun bitten, Ihr Verlangen eine Zigarette zu rauchen, auf dieselbe Art und Weise einzuschätzen wie eben gerade die Länge der Linien. Geben Sie Ihrem momentanen Verlangen irgendeine Zahl, die Ihnen passend erscheint. Im weiteren Verlauf der Untersuchung werden Sie Ihr Verlangen dann noch einige Male im Verhältnis zu diesem ersten Wert einschätzen. Der erste Wert ist also der Bezugspunkt für alle folgenden Einschätzungen. Wenn das Verlangen Ihrem subjektivem Eindruck nach dann vier mal so stark ist wie zu Beginn der heutigen Untersuchung, geben Sie ihm eine Zahl, die vier mal so groß ist wie die erste. Wenn Ihnen das Verlangen, eine Zigarette zu rauchen, halb so stark erscheint wie zu Beginn der heutigen Untersuchung, dann geben Sie ihm eine Zahl, die halb so groß ist wie die erste. Benutzen Sie bitte keine negativen Zahlen. Null bedeutet, dass Sie kein Verlangen haben. Sie können alle positiven Zahlen verwenden, sowohl ganze Zahlen als auch Brüche oder Dezimalzahlen. Folgen Sie bitte Ihrem ersten Eindruck.

PowerPoint instructions for neutral stimulus and smoking cue exposure



Öffnen Sie jetzt bitte die Flasche und legen Sie den Verschluss neben die Flasche auf den Tisch!

Nehmen Sie jetzt bitte die Flasche in die Hand!

Riechen Sie jetzt bitte einmal lange und intensiv an der Flaschenöffnung!

Stellen Sie jetzt bitte die Flasche wieder auf den Tisch!

Nehmen Sie jetzt bitte den Fragebogen mit der Nr. 3 und füllen Sie ihn aus!

Wenn Sie fertig sind, wenden Sie sich bitte an den Versuchsleiter.

Danke!

Nehmen Sie jetzt bitte den Fragebogen mit der Nr. 4 und füllen Sie ihn aus!

Öffnen Sie jetzt bitte die Box und stellen Sie den Inhalt auf den Tisch!

Öffnen Sie jetzt bitte die Packung Zigaretten und riechen einmal lange und intensiv an der offenen Packung!

Nehmen Sie jetzt bitte eine Zigarette aus der Packung und halten Sie sie in Ihrer Hand!

Nehmen Sie bitte Ihr Feuerzeug / Ihre Streichhölzer!

Halten Sie die Zigarette solange in die Flamme, bis sie anfängt zu glühen, ohne sie dabei in den Mund zu nehmen!

Halten Sie jetzt bitte die brennende Zigarette in der Hand!

Legen Sie jetzt bitte die brennende Zigarette in den Aschenbecher ohne sie dabei auszudrücken!

Nehmen Sie jetzt bitte den Fragebogen mit der Nr. 5 und füllen Sie ihn aus!

Drücken Sie jetzt bitte die Zigarette im Aschenbecher aus!

Wenn Sie fertig sind, wenden Sie sich bitte an den Versuchsleiter.

Danke!

ACKNOWLEGEMENT

This thesis had been drawn up on the principle of »all good things in life are worth waiting for«. Therefore, I am very grateful for the steadfast encouragement of all the people who came along with me, all the way or part of it, from the beginning of this study till its completion which is now just a »few footsteps away«.

First and foremost I want to thank my advisor PD Dr. Ralf Demmel for his valuable assistance, support and advice and Prof. Dr. Fred Rist for his encouragement and constructive assistance. I appreciate all contributions of time and ideas and I am very thankful for allowing me some »extra time« to finish my dissertation.

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I would like to thank Prof. Dr. Brunna Tuschen-Caffier and Prof. Dr. Frank Neuner who enabled me to focus on my dissertation during the now and then overwhelming day-to-day-work.

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Last, but definitely not least I would like to thank my family, friends and colleagues for all their emotional support and never ending encouragement. My parents, who always supported me in all my pursuits and Andrew H. Kane, thanks for having been there for me and supporting me when everything began.

Danke!

Curriculum vitae

Claudia Schlüssel