



## Approach bias modification in inpatient psychiatric smokers



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### ABSTRACT

Drug-related automatic approach tendencies contribute to the development and maintenance of addictive behavior. The present study investigated whether a nicotine-related approach bias can be modified in smokers undergoing inpatient psychiatric treatment by using a novel training variant of the nicotine Approach-Avoidance-Task (AAT). Additionally, we assessed whether the AAT-training would affect smoking behavior. Inpatient smokers were randomly assigned to either an AAT-training or a sham-training condition. In the AAT-training condition, smokers were indirectly instructed to make avoidance movements in response to nicotine-related pictures and to make approach movements in response to tooth-cleaning pictures. In the sham-training condition, no contingency between picture content and arm movements existed. Trainings were administered in four sessions, accompanied by a brief smoking-cessation intervention. Smoking-related self-report measures and automatic approach biases toward smoking cues were measured before and after training. Three months after training, daily nicotine consumption was obtained. A total of 205 participants were recruited, and data from 139 participants were considered in the final analysis. Prior to the trainings, smokers in both conditions exhibited a stronger approach bias for nicotine-related pictures than for tooth-cleaning pictures. After both trainings, this difference was no longer evident. Although reduced smoking behavior at posttest was observed after both trainings, only the AAT-training led to a larger reduction of nicotine consumption at a three-month follow-up. Our preliminary data partially support the conclusion that the AAT might be a feasible tool to reduce smoking in the long-term in psychiatric patients, albeit its effect on other smoking-related measures remains to be explored.

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### 1. Introduction

Although the prevalence of tobacco smoking declined over the last few decades, tobacco smoking still constitutes one of the most common addictive behaviors. In addition, according to the National Health Interview Survey, 70% of current smokers desire to quit smoking, but only less than 5% succeed to refrain from smoking for at least three months (Centers for Disease Control and Prevention, 2002). Also, the attendance of smoking cessation programs is rather low (Hughes, 2003). This indicates a high need to develop low-threshold, easy-to-access research-based interventions. In addition, there is strong evidence for a high association of tobacco

smoking and mental illness, with the prevalence of smoking being two to three times higher in the mentally ill than in the general population (Leonard et al., 2001). In addition, psychiatric smokers consume more than one third of all cigarettes smoked (Dani and Harris, 2005), signaling that smoking intensity is dramatically high in this particular group. As a result, psychiatric smokers experience a higher incidence of tobacco-related diseases such as cardiovascular diseases, lung diseases, and cancer (Colton and Manderscheid, 2006) and mortality (Lawrence et al., 2003). Smoking can also alter the efficacy of medications which might lead to exaggerated and more frequent psychiatric symptoms, an increased number of hospital admissions and the prescription of higher medication doses (Williams and Ziedonis, 2004; Dalack and Glassman, 1992). Despite this, psychiatric smokers are characterized by a reduced motivation to quit, and tobacco smoking among these patients remains ignored or even encouraged by professional

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health care providers (Prochaska et al., 2014). Although the American Psychiatric Association (2006) identifies psychiatric hospitalizations as promising settings to treat nicotine dependence, tobacco treatment in psychiatry settings constitutes an underserved field. Therefore, clinically sound, hospital-based tobacco cessation trials are needed in order to inform clinical practice.

According to dual-process models of addiction, addictive behavior arises from an imbalance between a reflective, regulatory system and an automatic, approach-oriented system (Deutsch and Strack, 2006; Wiers et al., 2013a). Specifically, the reflective system relies on symbolic processing, is goal-directed, limited in capacity and incorporates fast and flexible learning, whereas the automatic system relies on memory associations, is goal-independent, hard to control, relatively unconsciously and hard to change (Wiers et al., 2013a; Stacy and Wiers, 2010). In particular, cigarette smoking and frequent exposure to nicotine-related cues leads to a sensitized automatic approach-oriented system at the expense of the regulatory system (Wiers et al., 2013a). As a result, strengthened automatic processes underlying nicotine dependence can lead to various cognitive biases including attention, memory, and automatic approach biases (Bardin et al., 2014; Bradley et al., 2008; Mogg et al., 2005). Recent research has repeatedly linked the automatic approach bias to nicotine dependence and tobacco craving (Machulska et al., 2015; Wiers et al., 2013b). In this context, the Approach-Avoidance-Task (AAT) – initially designed to assess automatic avoidance tendencies in anxious individuals (Rinck and Becker, 2007) – has proved to be a useful and valid task for re-training automatic approach tendencies in the field of alcohol use (Wiers et al., 2009; for re-training see Eberl et al., 2013; Wiers et al., 2011), cannabis and heroine dependence (Cousijn et al., 2011; Zhou et al., 2012), and recently nicotine dependence (Machulska et al., 2015; Wiers et al., 2013b). During AAT, participants view a series of pictures on a computer screen and receive instructions to ignore image content and to react to a content-irrelevant feature such as picture orientation, by either pulling or pushing a joystick attached to the computer. Pulling the joystick increases picture size, while pushing the joystick decreases it. This “*zooming feature*” creates a sense of approaching vs. avoiding the picture by combining arm movements with visual feedback. Also, this feature disambiguates the task because without visual feedback it remains unclear whether participants interpret arm movements with reference to their own body (as intended by the AAT) or with reference to the object depicted on the computer screen (Rinck and Becker, 2007). The rationale behind this task is that reaction times vary as a function of picture content. Most recently, it was shown that current smokers are faster at pulling nicotine-related pictures than at pushing them, indicating an automatic approach bias for nicotine stimuli (Machulska et al., 2015). Hence, similar to other cognitive biases, an approach bias toward nicotine might be a maintaining factor in nicotine dependence, as ex-smokers and non-smokers do not show this pattern of behavior (Wiers et al., 2013b).

Cognitive biases during the course of addiction can be changed systematically as shown in Cognitive Bias Modification (CBM) programs. For instance, studies using a modified AAT where picture content and arm movements were confounded (i.e., presentation of all drug-related pictures in push-format and all alternative pictures in pull-format) have yielded encouraging results in the treatment of alcohol dependent patients. After four sessions of alcohol-avoidance training, abstinent patients' initial approach bias for alcohol changed into an avoidance bias, and relapse rates at one-year follow-up were approximately 10% lower than in various control conditions (Eberl et al., 2013; Wiers et al., 2011). In addition, change in alcohol-approach bias mediated this clinical effect. These results point to the fact that the re-training AAT could be a promising and feasible novel tool to change dysfunctional approach

biases toward drug stimuli, and thereby enhance treatment outcome. Furthermore, the AAT training bears the advantage not only to train addicted individuals to avoid drug-associated stimuli (e.g., alcohol), but provides an alternative stimulus category to be approached (e.g., non-alcoholic drinks). However, studies using the alcohol re-training AAT so far only addressed the prevention of relapse in abstinent alcoholics who were highly motivated to remain abstinent. Effects of the training on the reduction of other addictive drugs (e.g., nicotine) and other variables associated with drug use (i.e. craving, attitude toward drug use etc.) and the impact of different motivational states of abstinence are rather scarce. For instance, only a single study demonstrates the usefulness of single-session nicotine-avoidance training in changing implicit attitudes toward smoking (Macy et al., 2015). Another pilot study implemented a web-based nicotine-approach bias re-training and reported reduced smoking behavior (Wittekind et al., 2015). However, interpretation of these results is constrained by the fact that smoking reduction was not directly assessed (Macy et al., 2015), that no active control group was applied or that information on training frequency was entirely missing (Wittekind et al., 2015). Moreover, to our knowledge, no study so far tested the effect of multi-session training on long-term smoking behavior or tested whether smoking cessation therapy efficacy can be increased by the additional application of an AAT training, as suggested previously (Attwood et al., 2008; Field et al., 2009; Wiers et al., 2011). In the present study, we aimed to address these shortcomings and therefore examined the effect of multiple sessions of nicotine-avoidance AAT-training as an add-on to a short cognitive behavior therapy-oriented smoking intervention on long term smoking reduction.

We hypothesized that providing smokers under inpatient psychiatric treatment with a training variant of the nicotine-AAT as compared to sham-control training would diminish an initial nicotine-related approach bias and reduce daily nicotine consumption. Furthermore, we assumed that change in nicotine approach bias would mediate this treatment outcome. Finally, we expected both training variants would lead to improvements in associated measures such as explicit smoking-related cognitions, degree of nicotine dependence and/or motivation to quit smoking.

## 2. Methods

### 2.1. Participants

We recruited 205 adult smokers who had been admitted to inpatient psychiatric therapy. The study was conducted in detoxification, rehabilitation and depression units of the LWL-Clinic in Dortmund, Germany. Smokers were included if they had smoked cigarettes within the last 30 days and had smoked more than 100 cigarettes in their entire lifetime. Our final sample consisted of both smokers who were motivated to quit but also participants without any predefined abstinence goal. Exclusion criteria were an indication of schizophrenia spectrum or other psychotic disorders (4), neurological syndromes, such as Korsakoff's syndrome (7), insufficient German language skills (5) and withdrawal at (5) or immediately after the first session (36). One patient indicated to having already stopped smoking a month earlier, and two patients stated smoking a pipe or an e-cigarette exclusively and were therefore subsequently excluded from further analyses. Hence, our final sample comprised 145 patients. Participation was entirely voluntary, and patients were not paid for participation. All patients received a booklet including information on nicotine dependence.

The study was approved by the local Ethics Committee of the Ruhr-Universität Bochum and was conducted in accordance with the Declaration of Helsinki. Participants provided a written

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