



# An experimental investigation of the functional relationship between social phobia and cigarette smoking



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## HIGHLIGHTS

- We recruited smokers either high or average in social phobia (SP) symptoms.
- Participants attended two experimental sessions: one neutral and one social stress.
- There were no significant SP group by condition effects on smoking topography.
- Smoking decreased negative affect for high SP smokers under social stress.
- This effect was specific to high SP smokers under social stress.

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## ABSTRACT

**Introduction:** Individuals with social phobia (SP) represent a large group with elevated rates of cigarette smoking and cessation rates lower than that of individuals without psychopathology. For individuals with SP, cigarette smoking may be used to reduce social anxiety in anticipation of and during social situations. However, no study to date has experimentally examined this association. The aim of the current study was to experimentally examine the relationship between cigarette smoking and SP as a function of induced social stress.

**Method:** We recruited daily smokers ages 18–21 who scored in either a clinical or normative range on the Social Interaction Anxiety Scale (SIAS). Participants included 54 smokers (42.6% female, 77.8% White, age  $M(SD) = 19.65(1.18)$ , CPSD  $M(SD) = 7.67(4.36)$ , 46.30% high SP) who attended two sessions: one social stress session and one neutral session.

**Results:** Results indicated that high SP smokers experienced significant decreases in negative affect (NA) following smoking a cigarette when experiencing social stress. This effect was specific to high SP smokers under social stress and was not observed among individuals' average in SP or when examining changes in positive affect.

**Conclusions:** For individuals with SP, cigarette smoking may be maintained due to changes in NA associated with smoking specifically in the context of social stress. These results speak to the importance of targeted cessation interventions that address the nature of smoking for individuals with SP.

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## 1. Introduction

### 1.1. Cigarette smoking and social phobia

Individuals with psychological disorders are overrepresented among U.S. smokers, experience a disproportionate amount of the smoking-related public health burden, and, as such, are an important target for prevention and intervention efforts (Schroeder & Morris, 2010). Psychological comorbidities for which cigarette smoking may be used to cope with or manage psychological symptoms may be the most problematic for smoking outcomes (Gehricke et al., 2007). A growing body of

research suggests that Social Phobia (SP), a highly prevalent disorder for which 12.1% of the population meets diagnostic criteria (Ruscio et al., 2008), exhibits this relationship with tobacco use such that SP symptoms predict the initiation of cigarette smoking (Johnson et al., 2000), nicotine dependence (Sonntag, Wittchen, Höfler, Kessler, & Stein, 2000), and poor cessation outcomes (Lasser et al., 2000; Ruscio et al., 2008). Moreover, there are significantly greater rates of smoking among individuals with SP than among individuals without psychological comorbidities; specifically, 54.0% of individuals with SP are lifetime smokers and 35.9% of individuals with SP are current smokers (Lasser et al., 2000; Ruscio et al., 2008).

In teasing apart potential mechanisms underlying the relationship between cigarette smoking and SP, a negative reinforcement model is relevant. From a negative reinforcement framework, individuals with SP would smoke cigarettes in order to reduce or avoid feelings of

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distress in relation to social situations or in anticipation of social situations. There has been some support for this negative reinforcement link between SP and cigarette smoking in early adolescence prior to the onset of regular smoking such that adolescents high in SP report greater urge to smoke during peer interactions than adolescents without elevated SP symptoms (Henry, Jamner, & Whalen, 2012), suggesting that tobacco use may develop and escalate as a method to regulate social anxiety.

Strong theory and etiological data suggest the temporal ordering of SP, cigarette smoking onset, and nicotine dependence (e.g., Sonntag et al., 2000). However, there are only a few studies that have examined the functional utility of cigarette smoking for individuals with SP symptomatology. The studies that have examined smoking and SP suggest that SP symptoms are positively related to self-reported smoking to cope behaviors during social situations as well as to cigarette craving when deprived of nicotine (Watson, VanderVeen, Cohen, DeMarree, & Morrell, 2012). Furthermore, the relationship between SP symptoms and nicotine dependence is mediated by affiliative attachment motives, suggesting that among individuals with elevated SP symptomatology, cigarette smoking may help to cope with the feelings of loneliness or social rejection associated with SP (Buckner & Vinci, 2013). Other studies have not specifically assessed SP symptomatology, but have utilized experimental manipulations to induce social stress among samples of smokers and have found that in response to social stress, the urge to smoke is positively associated with self-reported and observer-reported anxiety (Niaura, Shadel, Britt, & Abrams, 2002) and that, in turn, smoking a cigarette is related to lower levels of self-reported anxiety (Gilbert & Spielberger, 1987). Taken together, these studies further support a unique negative reinforcement relationship between SP and tobacco use.

There are several remaining gaps in the literature on SP and cigarette smoking. Although self-report data from Watson et al. (2012) suggests that SP is related to smoking to cope with social situations, this relationship has yet to be experimentally examined and it remains unclear whether cigarette smoking modulates negative affect (NA) associated with social stress for socially phobic smokers. Additionally, no studies to date have assessed smoking behavior (i.e., via smoking topography) among socially phobic smokers in response to social stress. Thus, it remains unknown whether self-reported smoking to cope translates to differential smoking in response to a social stressor as compared to in response to a neutral mood.

## 1.2. Current study

Towards addressing these gaps in the extant literature, the primary aims of the current study were two-fold: 1) to examine the relationship between levels of SP (high SP, healthy control with average SP) and cigarette smoking-related outcomes (smoking topography) as a function of induced social stress (neutral, stress) and 2) to examine the relationship between levels of SP (high SP, healthy control with average SP) and NA as a function of induced social stress (neutral, stress). We hypothesized that in response to a social stressor, high SP smokers as compared to average SP smokers, would have: 1) greater smoking outcomes (greater puff number, greater puff volume, shorter interpuff interval (IPI) on measures of smoking topography) and 2) greater NA modulation as a function of smoking evidenced by significant increases in NA in anticipation of a social stressor followed by significant decreases in NA after smoking a cigarette.

## 2. Method

### 2.1. Participants

Participants were recruited from the University of Maryland, College Park campus using flyers and postings online. Interested individuals were advised to contact the study by phone or e-mail to complete an online screening to determine eligibility. Inclusion criteria for the study were as follows: 1) ages 18–21, 2) current regular smoking

defined as smoking  $\geq 5$  cigarettes/smoking day (CPSD) for the past 6 months and smoking on  $\geq 20$  out of the last 30 days, and 3) a score of either  $>35$  or between 9 and 24 on the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS cutoff values were selected in order to remain consistent with previous research (Mattick & Clarke, 1998). In the initial validation study of the SIAS, Mattick and Clarke (1998) found that individuals with SP had a mean of 34.6 with a standard deviation of 16.4 on the SIAS and that undergraduate students had a mean of 19.4 with a standard deviation of 10.1. Thus, in the present study, to categorize between high and average SP groups, the high SP group was at or above the SP sample mean (above 35) and the average SP group was within 1 standard deviation below and 0.5 standard deviations above the undergraduate mean (9–24).

In total, 73 participants attended at least one experimental session. From this sample of 73, three did not attend one of the experimental sessions, seven did not smoke at least one of the cigarettes, eight had missing topography data due to errors with topography equipment, and one had missing affect data, resulting in a final sample of 54 (42.6% female, age  $M(SD) = 19.65(1.18)$ ,  $n = 25$  high SP; Table 1). Those who were included in the final sample did not significantly differ from those who were excluded on age, gender, race/ethnicity, SP status, or CPSD (all  $p$ 's  $> .05$ ).

### 2.2. Measures

#### 2.2.1. Smoking history and current smoking information

Smoking history was assessed using the smoking history and current status indices agreed upon by a NCI consensus panel (Shumaker & Grunberg, 1986). Nicotine dependence was assessed using the modified version of the Fagerstrom tolerance questionnaire (mFTQ; Prokhorov et al., 2000). Timeline follow-back (TLFB; Brown et al., 1998) procedures were used to index the number of cigarettes smoked.

#### 2.2.2. Social phobia

The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) was used as a measure of SP symptomatology. The SIAS is a 20-item measure designed to assess the level of anxiety associated with the initiation and maintenance of social interactions using a 5-point scale, ranging from 0 to 4 (i.e., not at all characteristic or true of me to extremely characteristic or true of me).

#### 2.2.3. Affect

The 20-item Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure positive affect (PA) and negative affect (NA). The PANAS commonly is used to detect changes in emotional reactions to stimuli in the manner proposed here. The NA score was calculated by taking the sum of ratings for the 10 NA items and the PA score was calculated by taking the sum of ratings for the 10 PA items. The measure was administered three times during each session.

#### 2.2.4. Smoking outcomes

CReSSmicro (Plowshare Technologies, Inc., Baltimore, MD) is a battery-operated portable device that measures smoking topography variables (puff volume, puff number, puff duration, average flow, IPI, time, and date). From the basic topography measurements, we calculated four key variables of interest: 1) total number of puffs for each cigarette, 2) mean puff volume, defined as the average volume of all measured puffs, 3) total puff volume, defined as the sum of all measured puff volumes, and 4) mean IPI, defined as the average amount of time between measured puffs.

### 2.3. Procedure

The study consisted of two sessions held at the Center for Addictions, Personality and Emotion Research at the University of Maryland, College Park. All procedures were approved by the University of Maryland's Institutional Review Board.

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