HHS Public Access

Author manuscript

Addiction. Author manuscript; available in PMC 2018 March 01.

Published in final edited form as:

Addiction. 2017 March ; 112(3): 388–395. doi:10.1111/add.13503.

The Case for Investigating Social Context in Laboratory Studies of Smoking

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Abstract

Background—With increasing frequency, addiction is conceived of as a brain disease, and such accounts seem especially pertinent with regard to the rapid delivery of nicotine to the brain via cigarette smoke. Moreover, drug administration trials (cigarette puffs) suggest that the behavior of smoking becomes automatized, with individuals developing prototypic approaches to smoking a cigarette. Compared with presumably more social activities such as drinking alcohol, there may be little opportunity for social processes to influence smoking behavior. Yet survey research examining smoking motivation often reveals a broadly defined "social" factor and field research suggests that social context does influence smoking.

Argument—We posit that laboratory smoking research has largely ignored social contextual factors that may help to understand better the precise mechanisms underlying smoking behavior and smoking motivation.

Method—We reviewed laboratory studies examining the effect of social context (operationalized as modeling) on smoking behavior. Studies were identified by searching PsychInfo and Medline using the following keywords: smoking, nicotine, tobacco, cigarette, consumption, topography, puff, smoking behavior, cigarettes smoked, modeling, imitation, social context, social influence, peer pressure. The reference and citation lists of these studies were then searched to identify additional studies.

Conclusions—Few laboratory smoking studies target social context. Those few studies indicate that smoking behavior can be influenced by the presence of others. There is also some evidence that social context influences the effects of smoking as well as processes related to self-perception and self-regulation that reinforce smoking and hamper smoking cessation efforts.

For decades investigators have endeavored to understand why individuals smoke and to identify the factors that most influence smoking behavior. Much work has focused on neurobiological and pharmacological mechanisms underlying smoking motivation and smoking behavior [1]. This research has contributed to the characterization of addiction as a brain disease [2]. For instance, cigarette smoking is often thought to be motivated by the need to escape or prevent withdrawal [3], there is substantial evidence that tobacco smoking rapidly stimulates reward systems in the central nervous system [4], and over time chronic

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Conflict of interest declaration: none

exposure to tobacco produces neurobiological changes that make smoking more attractive and reinforcing [5]. Yet it also is clear that purely neuropharmacological explanations cannot entirely account for smoking behavior [6–8].

Theorists have expanded on these pharmacological explanations by noting how stimuli that become associated with drug use may activate drug-seeking behaviors [9]. Other research reveals that, independent of nicotine, sensory experiences associated with smoking can motivate smoking behavior. Smoking a denicotinized cigarette, for example, appears to produce many of the same subjective responses (e.g., euphoria) as does smoking a nicotine-containing cigarette, whereas injecting nicotine intravenously produces less powerful responses [10]. Rose concludes that "nicotine is not enough" [10 (p. 247)] and that smoking behavior is motivated in part by the psychological consequences of sensorimotor stimulation.

Smoking behavior also may be a function of habit. In an influential review, Tiffany observed that with repeated use, the act of smoking or drug taking becomes increasingly well learned, and addictive drug use becomes automatized [11]. The stimulus-bound nature of automatized behaviors suggests that once the smoking sequence is initiated (e.g., when one places a cigarette in his or her mouth), it will move to completion without intention. Tiffany's model is consistent with the view that smokers develop stable, prototypic approaches to smoking a cigarette "that are not easily influenced" [12 (p. 304)]. Such habit-driven behaviors may provide a psychological mechanism underlying much smoking, including the often discussed absent-minded relapse.

Taken together, it is clear that there has been progress toward understanding the mechanisms that influence smoking. These processes tend to focus on neurobiological and psychological aspects of *individuals*. Yet these factors alone seem to fall short of offering a comprehensive understanding of smoking, and social context also must be considered [6–8]. We argue here for increased research, and in particular laboratory research, to consider social context as an important factor that may prove useful for understanding smoking behavior from initiation to relapse.

Social Context

Social context, sometimes referred to as the social environment, has been described as the "immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact" [13, p. 465]. Prior laboratory studies have employed social cues to elicit craving (e.g., participants interact with a confederate who lights up a cigarette, or are administered a social anxiety stressor) [14]. With work by Harakeh and colleagues as an exception, however, research generally has not been designed to investigate underlying social processes involved in smoking motivation or behavior, and often the social aspect of the cue is not addressed beyond the premise that it is a smoking cue. Yet it is notable that for many years researchers outside the laboratory have recognized that smoking is influenced by social context [15]. Surveys often find that social factors emerge as a motivation or reason for smoking [16]. Field studies relying on ecological momentary assessment technology (e.g., electronic diaries) find that smokers are especially

likely to smoke when socializing [17], or when exposed to the smoking behavior of others [18, 19]. Furthermore, the presence of others who are not smoking may suppress smoking behavior below the rate at which one smokes when alone [20]. Finally, longitudinal research finds that youth smoking is associated with the number of smokers in their social environment. This relation has been attributed to vicarious learning processes [21], though the extent to which it is driven by selection vs. socialization effects, or moderated by familiarity (e.g., close friend vs. acquaintance) is less clear. Disentangling these effects in the natural environment (e.g., by assigning participants to smoke with unfamiliar peers, thereby holding selection and other socialization effects constant) is challenging, suggesting the need for experimental research. Unfortunately, to date there has been surprisingly little laboratory research systematically investigating social contextual factors associated with smoking.

This paper considers the effects of social context on four aspects of the smoking experience: (1) smoking behavior, (2) acute effects of smoking, (3) social identification to being a smoker, and (4) self-regulation with regard to smoking cessation outcomes. This is by no means an exhaustive set of smoking domains to have social implications. We believe, however, that these four domains are prime examples of a broader set of smoking-related experiences that would benefit from an enhanced social psychological perspective. Accordingly, our aim is to make a case for experimental smoking research that systematically and comprehensively examines social context. When appropriate, this paper also considers the effect of social context on other consummatory behaviors (e.g., drinking, eating).

Smoking Behavior

Social context may influence smoking behavior simply by providing smokers with cues to smoke [18, 22]. For example, participants smoke more when viewing images or videos of other people who are smoking than images or videos of other people who are not smoking [22–24]. However, images and videos are non-interactive cues, and interactive cues (e.g., the behavior of another smoker with whom one is interacting) may serve as more potent, or perhaps more complex cues for participants.

Surprisingly, few laboratory studies have assigned participants to smoke in the presence vs. absence of a peer confederate who also is smoking. We conducted a review of laboratory studies that included this manipulation to test for an effect of modeling on smoking behavior. We identified studies by searching the PsychInfo and Medline databases via Ebscohost using a combination of keywords related to smoking behavior (smoking, nicotine, tobacco, cigarette, consumption, topography, puff, smoking behavior, or cigarettes smoked) and modeling processes (modeling, imitation, social context, social influence, or peer pressure). The reference and citation lists of these studies were then hand searched to identify additional studies. Of the identified studies, we included those in which daily smokers were assigned to smoke with confederates in at least one condition, and for which smoking behavior (number of cigarettes smoked, puffs taken) was assessed. We excluded studies in which non-experimental methods and non-daily smokers were used, and for which behavioral measures of smoking were omitted.

We found seven laboratory studies that assigned participants to smoke in the presence or absence of a confederate [15, 25–30]; six of these found a significant effect of social context (modeling). Specifically, these six studies found that smoking confederates, compared to non-smoking confederates or smoking in isolation, influenced participants' smoking behavior, leading to differential smoking patterns [15, 25–29]. The seventh study found no difference between participants who smoked with a smoking confederate and those who smoked in isolation [30]. In addition, although it did not use a face-to-face interaction, an eighth study found that daily smokers smoked more in digital (webcam) interactions with smoking vs. non-smoking confederates, which challenges the notion that imitation is driven solely by sensory cues (e.g., the smell of a lit cigarette) [31].

Fewer studies have examined the effect of modeling on participants' rate of smoking, operationalized as smoking more when interacting with a heavy-smoking confederate and smoking less when interacting with a light-smoking confederate. Nevertheless, modeling has been observed in two studies that have paired participants with either a heavy-smoking or light-smoking confederate [12, 26]. Although these results require replication, they suggest that partner smoking may serve as a cue for increased smoking, while partner non-smoking may inhibit smoking [27]. Thus, the interactive and immersive nature of "social" cues may offer a qualitatively distinct influence on smoking behavior, relative to traditional smoking cues.

The observed effect of modeling on smoking behavior converges with results reported in the alcohol and food literatures. Participants drink more alcohol on average when they are exposed to heavy-drinking as opposed to light-drinking models, and this effect has been noted across laboratory, semi-naturalistic (e.g., barlab), and naturalistic (e.g., actual bar) settings [32–34]. Similarly, reviews consistently find an effect of modeling on food intake [35]. This effect appears to override the effects of hunger and satiety [36] and occurs even among people who are trying to lose weight [37]. Interestingly, many people deny modeling's influence on their own food intake, though they recognize its influence on the intake of others [38].

These laboratory data with alcohol and food have contributed to novel interventions, particularly in the treatment of alcohol use disorder. For example, Collins and Marlatt [32] found that clinicians might reduce alcohol consumption in heavy drinkers by exposing them to a moderate- or light-drinking model. It remains to be seen whether smoking cessation treatments would benefit from including a modeling component, although this possibility warrants further consideration. Bandura's social-cognitive theory provides one example of a comprehensive framework for evaluating the impact of modeling on smoking, focusing on the attributes of the model, attributes of the observer, and functional value of the modeled behavior [39].

Taken together, these laboratory findings suggest that despite pharmacological and neurobiological differences across substances, smoking seems to share with eating and drinking the capacity to be regulated at least in part by social processes. This is a nontrivial conclusion, as smoking presents as an especially "pharmacologic" addiction given the speed with which nicotine reaches the brain and the precise effects it has on nicotinic acetylcholine

receptors [40]. Furthermore, traditional conceptualizations of smoking suggest that over time, daily smokers learn to carefully calibrate their smoking behavior to maintain optimal nicotine levels, and with ample practice develop smoking routines that are unlikely to change under normal circumstances.

Acute Effects of Smoking

In addition to assessing smoking behavior, researchers have studied acute hedonic effects of nicotine, assuming that rewarding (and negative affect-relieving) experiences would reinforce smoking [3]. As with smoking behavior itself, we believe that research on the effects experienced during or immediately following smoking also must account for the influence of social context. While these effects can take many forms, here we briefly consider the effects of smoking with others on the valence and coordination of affect and on social integration.

Valence and coordination of affect

Studies testing alcohol [41] and caffeine [42] demonstrate that being in a group can alter the emotional effects of consuming these substances. With respect to nicotine, animal researchers report a synergistic interaction between the rewarding effects of nicotine and social interaction [43, 44]. In dual-smoker, but not in single-smoker couples, smoking following a disagreement in the laboratory increases positive affect and the coordination of emotional experiences between partners independent of emotional valence [45, 46]. These findings are in line with those from alcohol studies showing that drinking with others increases the extent to which partners experience positive affect and attend to or regulate one another [47, 48]. Further work is needed to determine whether smoking also helps partners to capitalize on positive experiences, and to perform more effectively on tasks requiring cooperation. More generally, these findings highlight the need for human research investigating the effect of social context on emotional experiences associated with nicotine when consumed in a dyad or small group (e.g., relaxant effects, withdrawal-relief, craving contagion).

Social integration

We are unaware of laboratory research examining the impact of smoking on initial group formation, when social integration may be especially valued [49]. New methods, which rely on group-level measures such as coordinated facial expressions of group members and content-free speech analyses, have been developed to test other drugs and also may prove useful for studying smoking [48]. As noted, smoking can serve as a stabilizing force in existing relationships [45]. Accordingly, smoking together may provide smokers with opportunities to bond. Although there is little experimental research examining this topic, longitudinal studies suggest that certain types of relationships (e.g., peer, familial) may influence or be influenced by smoking in unique ways [50]. Further, although it can be challenging to translate animal findings into human research, there is evidence that the familiarity of peer groups influences nicotine self-administration in rats [51]. Social psychological research examining the various stages of social integration from initial group

formation to close relationships [49] may offer new directions for productive laboratory research.

Social Identification

Tajfel describes social identity as “that part of an individual’s self-concept which derives from his knowledge of his membership of a social group (or groups)” [52 (p. 69)], and some have suggested that smoking *forces* one to form a social identity given the significance of the behavior [53]. A recent review concluded that identifying as a smoker can have social benefits (e.g., increased feelings of inclusion), and that social contextual factors can affect the extent to which one identifies as a smoker [54]. Accordingly, smoking cessation may lead to the loss of one’s perceived membership to a group of close others, which may explain in part why social identification influences smoking cessation outcomes [55]. Novel treatment approaches are being developed to help quitting smokers establish new social identities that may promote cessation maintenance [55]. Further laboratory work is needed to evaluate the effectiveness of these approaches, and to understand the mechanisms underlying such effects (e.g., affirmation of values consistent with smoking cessation, broadening of one’s self-construal).

Normative influence is one process associated with social identification that may help to explain the impact of social context on smoking [21]. Normative influence may be active, as in the case of peer pressure, or passive, as in the case of others’ behavior, which is thought to implicitly communicate social norms. Laboratory research has consistently found a stronger effect of passive as compared to active normative influence [56], and this finding is consistent with longitudinal research showing that the smoking status of individuals tends to be associated with the smoking norms of their close others [57]. Asch’s seminal work on conformity suggests that social norms influence people in multiple ways, ranging from private acceptance of a given norm to public conformity [58]. Experimental research may be useful to identify the best ways to account for these norms and social pressures when addressing smoking initiation and cessation. One tactic may involve exposing adolescents to anti-smoking norms and negative smoking prototypes, as this approach has shown promise in laboratory studies aimed at modifying adolescents’ evaluation of drinking prototypes [59].

Self-Regulation

Most smokers want to quit smoking to improve their health but struggle to exercise sufficient self-regulation in order to succeed. Researchers have suggested that self-regulation failure often occurs for reasons of underregulation (e.g., becoming overwhelmed by craving) [60, 61]. Baumeister et al. propose that self-regulation failure also results from misregulation, when individuals exert control in a way that fails to bring about the desired result [60]. From this perspective, the act of smoking may represent an effort to address a critical problem for the smoker, which may be influenced by social contextual factors. For instance, one may choose to smoke in order to bond with friends, which may explain why social factors (e.g., social support, norms) are one of the most frequently endorsed barriers to smoking cessation in survey studies [62]. In this sense, the aim of improving one’s health by quitting smoking becomes less relevant than satisfying other goals, and in some cases it may be unclear if

pursuit of these alternative (often social) goals is necessarily a failure of self-regulation [63]. Recognition of the multiple goals, including social ones, addressed by smoking leads to a push for more comprehensive approaches to intervention [63].

While self-regulation most often has been conceptualized as an individual's exertion of control in pursuit of a goal, this idea has been broadened to account for transactive goal dynamics theory [64]. Investigators posit that interdependent persons (e.g., romantic partners) can serve as subparts of a single self-regulating system. That is, given their high level of interdependence, close relationship partners come to share self-regulatory resources when pursuing a goal, and thereby achieve differential levels of success as a dyad than they would have as independent agents. This theory offers a heuristic framework to consider health behaviors such as smoking cessation, and laboratory research is indicated to investigate whether smoking cessation outcomes can be explained in part by social contextual factors (e.g., relationship and/or partner characteristics). In summary, laboratory research using both explicit and implicit measures of socio-cognitive self-regulatory processes is likely to advance understanding of smoking cessation.

Implications

Of the hundreds of laboratory smoking studies conducted, very few focus explicitly on social contextual factors. As noted above, however, studies that have investigated these factors suggest that social context has comprehensive effects on multiple aspects of smoking, including smoking behavior, the acute effects of smoking, social identification, and self-regulation. These experiments are in accord with survey and field data that have pointed to social mechanisms underlying smoking. We believe that experimental research across all stages of use, from initiation to relapse, is needed that integrates social processes more directly into current neurobiological and behavioral approaches that typically focus on smokers in isolation. As one example, genetic variation has been shown to moderate perceived social bonding when drinking with peers in the laboratory [65]. It would be informative to learn whether this effect also is observed when smoking with peers, and whether it predicts real-world cessation outcomes. Such an approach is consistent with the proposition that addiction is a "systemic behavioural disorder arising from and maintained by psychological, social and biological processes operating both independently and in concert" [66 (p. S56)], and converges with Levanthal's recent sociopharmacological analysis of tobacco addiction [8].

There are two important factors that have likely discouraged experimental research into the social mechanisms underlying smoking. First, as noted, nicotine is associated with especially potent and immediate neurobiological effects, suggesting a less compelling role for nonpharmacological factors than, for example, alcohol consumption. Second, studies employing dyadic or group paradigms require large samples in order to be sufficiently powered, which tends to make these studies more expensive to conduct than studies of individual smokers. Nevertheless, research repeatedly identifies a social factor on smoking motivation questionnaires [16]. That is, social processes emerge as one of many factors influencing smoking, one that stands alongside other (presumably asocial) factors such as automaticity, associative processes, positive and negative reinforcement, and weight

management. We argue that social processes play a more pivotal role in smoking than many of these surveys suggest, as social factors are themselves central to many of these other factors. As just one example, weight management is a smoking factor with obvious social relevance [67].

Recognition of the pervasive influence of social factors across diverse motives for smoking highlights the need to understand social mechanisms underlying smoking. Theory-driven laboratory research is indicated to identify underlying mechanisms that mediate the impact of social factors on smoking across various stages of smoking and to address potential individual differences that may moderate these effects. Below we outline a few of these research directions.

Future Directions

Individual differences

Most laboratory investigations of social context and smoking have focused on daily smokers in late adolescence or young adulthood, although preliminary evidence suggests that nondependent “chippers” also may be sensitive to the presence of a smoking confederate [68]. Future research should explore in greater detail the extent to which social context influences smokers across different stages of dependence and at different ages, while recognizing that ethical issues may preclude the use of certain (e.g., underage) smokers. In addition, findings from the experimental alcohol literature suggest that the impact of personality traits associated with addiction (e.g., extraversion) may be most likely to emerge when social paradigms are used [69]. Furthermore, while it currently is difficult to study the effect of social contextual factors on humans using neuroimaging methods, these methods may reveal important information. For instance, social cues have been shown to activate dopaminergic reward pathways associated with substance use [70]. Further research is needed to determine whether variation in the strength of neural response to nicotine and social rewards is associated with unique patterns of smoking. Finally, although candidate gene studies have come under fire in recent years, work from the alcohol literature suggests that genetic differences are associated with individual variability in sensitivity to the drinking patterns of others [71]. Thus, there yet may be value to examining the potential moderating impact of key “social genes” on smoking behavior and the effects of smoking across social contexts.

Electronic cigarettes

The use of electronic cigarettes has increased dramatically in recent years [72], and peer influence has been identified as one of the leading reasons for electronic cigarette experimentation [73]. Further research is needed that includes electronic cigarettes in laboratory studies of social context, as these products affect social contextual factors such as normative influence (e.g., by increasing perceived acceptability of tobacco use in populations who have reduced their use of traditional nicotine cigarettes) [74].

Conclusion

The premise that social factors may affect addiction is not new [75] and at first glance, many papers reporting on smoking allude to social factors. Yet often “social context” appears as a general default explanation for unexplained variance (e.g., social factors are vaguely mentioned to explain why phenomena observed in the laboratory are not observed in the real-world). There is a divide between what smoking researchers mention in discussion sections regarding the importance of social context and how it is systematically studied in the laboratory. Neurobiological and intrapersonal psychological factors contribute a great deal to our understanding of smoking. Smoking also can be influenced, however, by the social context in which it occurs. Despite the paucity of extant experimental smoking studies investigating social context, we believe the available findings highlight the need to expand the scope of this research to include social contextual factors. These factors cannot be ignored if we strive to develop a comprehensive understanding of why people smoke. Accordingly, we hope to stimulate the conduct of theory-driven laboratory smoking research on social processes, which leverages findings drawn from experimental social psychology. Such research, when combined with efforts to unpack the biological and psychological processes underlying smoking, will lead to a more comprehensive understanding of smoking, help to prevent its initiation, and aid in its cessation.

Acknowledgments

This work was supported by National Cancer Institute Grant (R01 CA184779) to Michael Sayette. We are grateful to Drs. Eric Donny, Michael Pogue-Geile, and Ed Orehek for their feedback on prior drafts. We also thank Lea Martin for her helpful contributions.

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