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ABSTRACT

Title of Document: HOW AND WHEN IMPLICIT ATTITUDES ABOUT SMOKING AFFECT DECISION MAKING IN THE PERSONAL PROCESS OF SMOKING CESSATION.

Preston Greene, Doctor of Philosophy, 2014

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Recent theories of attitudes and cognition have made a distinction between explicit attitudes that are conscious, deliberate judgments people make when asked to do so, and implicit attitudes, or those that are made automatically and without conscious effort (Greenwald and Banaji, 1995). This study integrated research and theory of implicit attitudes about smoking with the Transtheoretical Model's understanding of the process individuals go through as they quit smoking, to test the moderating effect of motivation to change on implicit smoking attitudes and to evaluate the indirect (mediated) effects of implicit smoking attitudes on cigarette demand through explicit smoking attitudes. Participants were *N*=283 daily smokers who completed an online survey that measured characteristics of their smoking, motivational Readiness to change, decisional balance considerations (Pros and Cons of smoking), and demand

for cigarettes (Cigarette Purchase Task), before completing the Smoking Implicit Association Test. Results of multiple regression analyses indicated that as implicit attitudes about smoking became more positive, smokers reported on average more explicit positive attitudes (Pros of smoking) about smoking and less negative explicit attitudes (Cons of smoking) about smoking, beyond the effect Readiness for change had on those explicit smoking attitudes. Readiness to change did not moderate the effect of implicit smoking attitudes on decisional balance considerations. Decisional balance considerations were important predictors of smoker's responses on the smoking purchase task and accounted for the relationship between implicit smoking attitudes and choices on a hypothetical smoking purchase task. More positive implicit smoking attitudes indirectly predicted that smokers would purchase cigarettes at higher average prices before consumption dropped to zero, greater average maximum financial expenditure on cigarettes, and higher average price at which expenditure was maximized. These results may be useful for understanding how cigarette prices affect attitudes about smoking and increase the likelihood that people will quit.

HOW AND WHEN IMPLICIT ATTITUDES ABOUT SMOKING AFFECT DECISION MAKING IN THE PERSONAL PROCESS OF SMOKING CESSATION.

By

Preston Archer Greene.

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Introduction

Overview

Attitudes play a critical role in many theories of behavior and behavior change, particularly those of health behaviors and addictions (Allport, 1954; Ajzen & Fishbein, 1977; Bandura, 1977; Elder, Ayala, Harris, 1999; Schwartzer, 2008). The Transtheoretical Model of intentional behavior change integrates several theories, including those in which attitudes play a critical role, to develop a more comprehensive understanding of how individuals resolve or initiate health and addictive behaviors. Recent theories of attitudes and cognition however, have made a distinction between explicit attitudes that are conscious, deliberate judgments people make when asked to do so, and implicit attitudes, or those that are made automatically and without conscious effort (Greenwald and Banaji, 1995). While measures of implicit attitudes have been shown to add to the understanding of smoking behavior, little research has integrated this understanding with knowledge about the personal process of behavior change. This study aims to integrate research and theory of implicit attitudes about smoking with the Transtheoretical Model's understanding of the process individuals go through as they quit smoking, to identify and investigate how, and under what conditions, these implicit attitudes about smoking affect the process of smoking cessation. In particular, this study will investigate how implicit attitudes about smoking interact with individuals' readiness to change their smoking and affect their decisional considerations about smoking cessation. Furthermore, this study will examine how this interaction can help to understand the conditions under

which these unconscious, automatically formed attitudes about smoking can indirectly affect a person's choices on a hypothetical cigarette purchase task.

Background on Smoking

There is such clear and conclusive evidence about the negative health effects of smoking that health care providers are urged to assess smoking status as a "vital sign" and to educate their patients that there is no safe level of smoking (Fiore, Jaen, Baker et al., 2008; U.S. Department of Health and Human Services, 2010). In response to the evidence about the negative health effects of smoking, the majority of Americans have either quit smoking or avoided initiating smoking. As evidence of this shift in public opinion, smoking has come to be seen as a stigmatized behavior (Gibson 1994, 1997). Despite this, a significant proportion of the population initiates or continues to smoke, making smoking one of the greatest burdens on the health of Americans, prompting the U.S. Department of Health and Human Services (n.d.) to seek a reduction of smoking prevalence in the U.S. to 12% by 2020. Despite initial success, and many efforts to achieve this lofty goal, decline in smoking prevalence at the population level have stalled, and smoking prevalence among adults 18 years and older has been estimated recently to be 20.6% (NHIS, 2008 in U.S. Department of Health and Human Services, n.d.).

The persistence of smoking prevalence in the United States is not because of a lack of effective interventions to help smokers quit, or to prevent smoking in the first place. Reviews of interventions for smoking have identified a number of efficacious interventions, ranging from biological and pharmacologic interventions, to individual behavioral and psychological interventions, to societal and policy interventions

(Cochrane review; TTUD, 2008). Investigations into smokers' motivation for smoking have revealed that in fact, a majority of smokers (74%; Saad, 2008) report a desire to quit, fewer actually attempt to quit (39.8%, MMWR, 2008), yet the rate of successful cessation attempts is far lower, approximately 4.1% (Substance Abuse and Mental Health Services Administration, 2010). Despite the majority of current smokers reporting a desire to quit, a much smaller proportion of those smokers go on to make a quit attempt and successfully cease smoking. Because smoking is still a significant public health problem, it would be helpful to understand why so many smokers report a desire to quit, yet many fewer actually make a quit attempt. Understanding the personal process that individuals go through in changing behavior that includes initiation, modification, and cessation is the unique perspective of the Transtheoretical Model. One potential way to make the already efficacious interventions for smoking cessation more effective would be to target them to smokers who are most ready to quit. Capturing smokers' readiness to quit and understanding the process those individuals go through as they change their smoking behavior, both self-guided and with the assistance of formal intervention, served to form the basis of early research on the Transtheoretical Model. This investigation has helped to shift the focus of intervention outcomes from a monotonic function of cessation to one that includes increasing cessation related activities as a worthwhile outcome (DiClemente, 2003). The Transtheoretical Model includes various aspects of attitudes and behaviors that help to understand and negotiate the cessation process, including the Stages, Tasks and Processes of Change, Decisional Balance considerations, and Self-Efficacy to adhere to behavioral goals. It will be helpful to

first review the extant literature about the utility of the Transtheoretical Model as related to smoking cessation, as this forms the theoretical and empirical basis of the present study.

Overview of the Transtheoretical Model and Smoking Cessation

Intentional behavior change, like quitting smoking, is a multidimensional process according to the Transtheoretical Model (TTM). The Transtheoretical Model (TTM) attempts to understand phenomena related to attitudes, behaviors, and beliefs about behavior change, including the disparity created by smokers' self-reports of their desire to quit smoking, the number of smokers that quit smoking in a given year, and the number of smokers that quit in that same time period with the assistance of formal assistance. Prior to the advent of the TTM, little research had been devoted to the self-change process, or behavior change unaided by formal intervention. Early research by Prochaska and DiClemente (1983) led to an attempt to classify individuals at different points in the process of self-change, and these categories came to be known as the Stages of Change. The Stages of Change represent a useful heuristic for thinking about, assessing, and guiding individuals through the process of behavior change (DiClemente & Prochaska, 1998). The five Stages of Change are: Precontemplation, Contemplation, Preparation, Action, and Maintenance.

The Stages of Change represent temporal and motivational aspects of the process of change, or the *where* or *when* of change, and serve to connect the tasks of change (what) with the Processes of Change (*how*). In the Precontemplation stage, individuals are not thinking about changing or quitting smoking, whereas individuals in Contemplation have recognized a need or desire to quit but have not yet made a

decision to quit or change. When individuals have resolved to quit or change smoking, they move into the Preparation stage where they commit to this decision and may begin to make small changes or work on their change plan. The Action stage is characterized by attempts to implement the planned behavior change. When changes have been sustained for a significant period of time, typically delineated around 6 months, individuals are thought to have entered the Maintenance stage, where they will remain as long as the change they have made is sustained (DiClemente & Prochaska, 1998; DiClemente, 2005; DiClemente, 2003).

During each Stage of Change, different tasks are critical to progressing in the process of change (DiClemente, 2005). In the Precontemplation stage, awareness of a desire or need to change needs to be raised. When individuals become aware of a need to change, but remain ambivalent about making a decision to change, as they do in the Contemplation stage, they must resolve this ambivalence by recognizing more benefits of changing than maintaining the status quo, and tip the decisional balance in favor of changing (DiClemente, 2005). Individuals who have progressed to the Preparation stage need to strengthen their commitment to the decision to change and formulate a plan to successfully implement their intended change (DiClemente, 2003). When individuals begin to implement their change strategies in the Action stage, they must learn to modify their change plan to adapt to challenges and avoid relapse. When individuals can successfully do this and integrate their new behaviors into a successful new behavioral repertoire and avoid relapse, they have accomplished the task of the Maintenance Stage (DiClemente, 2005).

If the Stages of Change represent the *when* of change, and the tasks of change are the *what*, then the Processes of Change are the *how* individuals traverse the Stages of Change. The Processes of Change reflect 10 basic coping strategies that individuals commonly use to implement behavior change, and these 10 strategies were distilled from major systems of therapy (Prochaska, 1979). These 10 processes are generally divided into two categories, experiential processes, those that reflect emotionally or cognitively oriented change strategies, and behavioral processes which reflect behavioral change strategies or alteration of the individual's environment. Complementary to the Stages, Tasks, and Processes of Change, are the constructs of clients' Confidence and Temptation related to the behavior change of interest, and behavior specific Decisional Balance considerations. The constructs of both self-efficacy and the decisional balance can be envisioned as markers of change that help to give feedback about the change a person is making. In general, confidence rises throughout the early stages of change and plateaus in the action and maintenance stages, while temptation decreases over the early stages and plateaus at a low level in the action and maintenance stages (DiClemente, Fairhurst, & Piotrowski, 1995). In many ways confidence and temptation are inversely related across the Stages of Change. Decisional Balance considerations that reflect the pros and cons (or benefits and risks) of both the current behavior and of the potential change also appear to shift systematically across the Stages of Change (Prochaska, Velicer, Rossi, Goldstein, Marcus, Rakowski, Fiore, Harlow, Redding, Rosenbloom, Rossi, 1994). In the early Stages, the Pros of the behavior tend to outweigh the Cons of the behavior. However, as awareness of a desire to change increases, the Cons of the behavior tend to

increase. The Pros of the behavior appear to diminish in relation to the Cons in the Contemplation stage as individuals make a decision to change. Thereafter, the Cons of the behavior outweigh the Pros of the behavior.

While there are multiple dimensions of the TTM, the present study will focus only on several facets of the model. Additionally, the TTM has been applied in the study of both the initiation and cessation of many behaviors. For the purposes of the present study it will be most helpful to review the research on the aspects of the TTM that will be investigated in this study, that is, motivation to change and the decisional balance, and how they are related to the behavior change of interest, that being the cessation of tobacco smoking.

TTM and smoking cessation.

The TTM has been extensively applied to the investigation of the process of smoking cessation (see Spencer, Pagell, Hallion, & Adams, 2002) and numerous studies have examined the characteristics of smokers across the Stages of Change (Prochaska, DiClemente, & Norcross, 1992). Population studies indicate that the distribution of smokers across the stages, at any given time the majority of current smokers will be in the Precontemplation stage, with prevalence rates decreasing in a stepwise fashion across the Contemplation and Preparation stages (DiClemente, Delahanty, Fiedler, 2010; Fu et al., 2011; Velicer, Fava, Prochaska, Abrams, Emmons, Pierce, 1995) In fact, among current smokers, those in the Precontemplation stage tend to be more severe smokers across a number of different measures of nicotine dependence and use, including smoking for more years, smoking more cigarettes per day, having made fewer quit attempts, having less

motivation to quit smoking, and viewing themselves as being less likely to quit smoking (DiClemente, Delahanty, Fiedler, 2010). Since there are relatively fewer smokers in the Preparation or Action Stages of Change than in the earlier Stages of Precontemplation and Contemplation, it may be easier to recruit these smokers. Earlier Stage smokers also tend to be more "hardcore" smokers (DiClemente, Delahanty, Fiedler, 2010). This study will focus on these earlier stage smokers.

Readiness for change.

Readiness for change plays a key role in determining a smokers' Stage of Change. Assessment of individuals' readiness to change is often done informally in clinical practice or to understand a smoker's position on a Readiness algorithm or ruler that ranges from having no thoughts or intention to quit smoking to being actively engaged in the process of changing one's smoking behavior. The most common method of assessing Stage status is by use of a Staging algorithm, where smokers report their intention to quit or Readiness to change, as well as recent smoking behavior. Only three questions are needed to determine Stage of Change: 1) Are you currently a smoker?; 2) In the last year, how many times have you quit smoking for at least 24 hours? 3) Are you seriously thinking of quitting smoking? Response options for the third question are most commonly: a) Yes, within the next 30 days; b) Yes, within the next 6 months; c) No, not thinking of quitting. These response options provide an approximation of readiness to change. Readiness to change is important because it has implications for what type of intervention might be most helpful for a smoker to increase the likelihood that they will quit or enhance

their success in quitting. Readiness also has implications for how a given individual might respond to an intervention.

Readiness to change smoking is often assessed by a single question (described above) of a smoker's intention to quit smoking, and is used to roughly categorize individuals into the Precontemplation or Contemplation stages. Assessing Readiness with categorical response options is a well validated measure of Stage status but it does not appreciate the variations in Readiness within Stages. Biener & Abrams (1991) developed an alternative method to assess smokers' readiness to change by stretching several hierarchically related statements related to smokers' readiness for change across an 11-point continuum to produce a continuous measure of readiness. In the initial investigation of their Contemplation Ladder, Biener & Abrams (1991) found that their measure of readiness was able to distinguish between smokers (assumed to be more motivated to change) who attended a smoking cessation clinic from employees of a manufacturing company (assumed to be less motivated) who did not. Ladder scores were positively related to intention to quit smoking in the next six months, number of prior quit attempts, co-worker encouragement to quit, and minutes until first cigarette of the day. Ladder scores were also able to predict behaviors indicative of lower levels of readiness such as participation in smoking awareness events and giving saliva for cotinine assessment that were not predicted by a dichotomous question of intention to quit in the next six months (Biener & Abrams, 1991).

Since their development and validation of the Contemplation Ladder as a measure of readiness to quit smoking (Biener & Abrams, 1991), a number of studies

have investigated how Contemplation Ladder scores are related to smoking related variables and psychosocial constructs. Greater concern about the problem behavior appears to be related to individuals' readiness to change. For example, Bernstein and colleagues (2008) found that emergency department patients who attributed their hospital visit as related to their smoking or believed they had a smoking related illness reported greater readiness to quit than those patients who did not. Readiness to change as measured by the Contemplation Ladder also appears to discriminate those who will successfully quit smoking. Abrams, Herzog, Emmons and Linnan (2000) examined baseline TTM constructs as predictors of 2-year follow-up smoking status. Those who went on to quit smoking two years later had significantly greater readiness to change at baseline. The authors concluded that readiness to change was a reliable predictor of smoking cessation. Peters, Hughes, Callas, and Solomon (2007) found that readiness to change discriminated the quitting goals that smokers had, with smokers reporting the greatest readiness to change also reporting more immediate quitting goals. Those with more immediate quitting goals were also more likely to make a quit attempt in the 28 days of the study.

Since the proposed study is also concerned with how decisional balance considerations are related to smoking cessation, a review of how readiness to change is related to the decisional balance would help. Herzog, Abrams, Emmons, Linnan (2000) also examined predictor variables that could increase readiness to change as measured by the contemplation ladder. Experiential processes of change were consistent predictors of changes in readiness. The Cons of smoking were higher for smokers who at baseline had Contemplation Ladder scores between 3 and 7 and had

increased at one year follow-up to 8-10 compared with smokers who remained in the 3 to 7 group. While this analysis somewhat obscures the relationship between readiness and decisional balance considerations due to the categorization of smokers based on their Contemplation Ladder scores, it highlights that there is an association between readiness to change and decisional balance considerations that appears to be consistent with predictions of the TTM, that as readiness to change increases, the Cons of smoking should increase. However, perhaps due to the method used in this study, no differences in the Pros of smoking were found between those smokers whose readiness to change increased and those whose readiness remained constant (Herzog, Abrams, Emmons, Linnan, 2000). Smokers with readiness to change in that range (3-7) continue to see benefits of smoking, but are increasingly recognizing the negative aspects of their smoking behavior. To better understand how these decisional considerations are related to smoking cessation, a review of that research is necessary.

Decisional balance and smoking cessation.

The Decisional Balance was originally conceptualized by Janis and Mann (1977) as a representation of salient motivations involved in making any decision. Rather than merely understanding decision making in terms of absolute potential gains or losses, Janis and Mann described the decisional balance as instead involving the comparison of potential gains to losses. Janis and Mann (1977) postulated that the decisional balance could have utility in understanding smoking behavior, but their investigations of the decisional balance relied upon interview style assessments of decisional balance considerations, limiting the large scales systematic investigations of the

decisional balance with smokers. Horn (1976) also identified decision making as an important stage in the process of smoking cessation, identified similar salient categories of decisional considerations as Janis and Mann, and also included these elements into surveys of tobacco use, but he did not investigate smoking cessation.

Velicer, DiClemente, Prochaska and Brandenburg (1985) used Janis and Mann's categories to construct a measure of decisional considerations about smoking and applied this measure to the investigation of smoking cessation. This measure, called the Decisional Balance Scale, yielded two subscales of the Pros of smoking and the Cons of smoking. Velicer and colleagues (1985) found difference in the Pros and Cons of smoking between groups of smokers based on current and past smoking behavior and intention to smoke. The Pros and Cons separately were predictive of transitions of individuals from one stage to another stage six months later, and the difference of the Pros and Cons (thought to represent the comparative nature of decisional balance considerations in Janis and Mann's theory) predicted stage transitions approximately as well as either score alone. The Decisional Balance Scale appeared to be a useful construct in understanding smoking cessation and since then has been validated and studied extensively (reviewed below; Velicer, DiClemente, Prochaska and Brandenburg, 1985).

As evidence in support of the construct of the decisional balance, Prochaska and colleagues (1994) reviewed empirical studies of the stages of change and decisional balance in 12 different behaviors. This research supported the measurement properties of the Decisional Balance Scale's two factors, the Pros and Cons (Prochaska et al., 1994). Additionally, changes in decisional balance

considerations were found across the stages of change as the TTM would predict; that is, in the Precontemplation stage, the Pros of the behavioral status quo outweighed the Cons, while in the Contemplation stage the Cons of the behavior outweighed the Pros, followed by decreases in both the Pros and Cons in the Action and Maintenance stages with Cons continuing to outweigh the Pros (Prochaska et al., 1994). In a related examination, DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, and Rossi (1991) found the difference of the Pros minus the Cons of smoking also differed significantly across the Precontemplation, Contemplation, and Preparation stages, with these difference scores changing from a positive number in the Precontemplation stage (due to more endorsement of the Pros of smoking), to an approximately zero number in the Contemplation stage, to a negative number in the Preparation stage (due to a greater endorsement of the Cons of smoking relative to the Pros).

This pattern of stage differences has been found by other researchers. Boudreaux and colleagues (1998) found a similar pattern of changes in decisional balance considerations across the stages of change in a sample of low-SES smokers. Dijkstra, De Vries, and Bakker (1996) found a similar pattern of decisional balance considerations across the stages of change, but instead of focusing on the Pros and Cons of the problem behavior as DiClemente et al. (1991) did, they examined changes in the Pros and Cons of quitting smoking. Guo, Aveyard, Fielding and Sutton (2009) found that decisional balance considerations prospectively predicted stage transitions in an online intervention for adolescent smokers. These findings of changes in decisional balance considerations led Prochaska (1994) to propose the "strong" and "weak" principles of stage progression. The strong principle contends

that to progress from the Precontemplation stage to the Action stage an approximately one standard deviation increase in the Pros of a health behavior change are necessary, while the weak principle holds that a similar progression can be achieved by a half standard deviation decrease in the cons of a health behavior change (Prochaska, 1994).

Summary of research on readiness and the decisional balance.

Several conclusions can be drawn from the research on readiness and decisional balance considerations. There are many ways to measure motivational readiness to quit smoking or consider quitting, and one such method that is often used is the Contemplation Ladder. There is a difference between the discrete stages of change and motivational readiness to change, and it is important to keep in mind that these continuous measures of motivation are not measures of discrete stages of change. However, readiness and the stages are closely related, and in general, as individuals progress through the stages of change motivational readiness tends to increase. Nevertheless, focusing on numbers on a ladder or ruler can lead to some confusion as practitioners often think that more motivated individuals are in a stage that is closer to cessation than they are in reality. Including past and current behavior can help make these considerations of an individual's readiness more accurate and informative.

Whereas readiness is frequently used as an analogue for stages of change, decisional balance is a related construct to the stages of change and to the task of decision making that is critical in the Contemplation stage and in progression from Contemplation to Preparation. Clear differences in decisional balance considerations

have emerged across the stages of change. In general, the Pros of smoking outweigh the Cons of smoking in the Precontemplation stage, until a person's motivation increases and they make a decision to change or quit, at which time the Cons of smoking begin to outweigh the Pros of smoking in the Contemplation stage and individuals move into Preparation. In many ways the decisional balance considerations reflect a person's attitudes toward smoking.

However, smoking has become a highly stigmatized behavior. Laws restrict smokers' behavior in many areas, smokers are viewed by nonsmokers as unhealthy, dirty, weak-willed, and morally unfit, and the majority of smokers are aware that their behavior increases their risk for heart disease, lung cancer, and premature death (Moore, 2005; Rozin & Singh, 1999; Shoplan & Brown, 1987). As a result of active demarketing efforts, social and cultural norms have been established that view cigarette smoking as an unacceptable behavior (Kim & Shanahan, 2003). As both a result of these demarketing efforts and the decline in smoking prevalence, smoking and smokers have been negatively stereotyped, and negative attitudes about smoking and stigma toward smokers have increased (Moore, 2005; Kim & Shanahan, 2003).

The social disapproval of smoking has important implications for measuring decisional balance considerations. When smokers engage in this largely disapproved of behavior, they may experience a dissonance-like tension (Festinger, 1957) and may engage in conscious cognitive bolstering to align their attitudes with their behavior (Festinger, 1957; Swanson, Rudman, & Greenwald, 2001). This social desirability may play a role in changes in decisional balance considerations as individuals negotiate the stages of change (e.g., as individuals move from Precontemplation to

Contemplation Cons of smoking begin to outweigh the Pros of smoking), and may also help explain why predicted covariation has not been found between decisional balance considerations and Contemplation Ladder scores (Herzog, Abrams, Emmons, Linnan, 2000). Efforts to achieve less overt measurement of attitudes have highlighted a distinction between implicit and explicit attitudes (Greenwald & Banaji, 1995) and these measures of attitudes may help to improve our understanding of smokers' decisional considerations and their relations with the process of smoking cessation. The distinction between these kinds of attitudes, how they affect smoking behavior, and how they might interact with the process of smoking cessation will be considered next.

Attitudes and Smoking

There are multiple definitions of attitudes, but a commonality between the majority of them is that they are valent evaluations of a target. Eagly and Chaiken (1993) define attitudes as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor." Krech, Crutchfield, & Ballachey (1962) defined attitudes as "enduring systems of positive or negative evaluations, emotional feelings, and pro or con action tendencies with respect to social objects." Attitudes are important because many theories of behavior, and particularly those applying to health behaviors and addictions, include attitudes as a critical aspect to understanding behavior (Allport, 1954; Ajzen & Fishbein, 1977; Bandura, 1977; Elder, Ayala, Harris, 1999; Schwartzer, 2008; DiClemente, 2003). Given this focus on attitudes in the understanding of behavior, it is not surprising to

note that many interventions to promote smoking cessation attempt to alter individuals' attitudes about smoking in some way. These theories and interventions have traditionally relied upon explicit measures of attitudes, which directly ask the respondent to report on their attitudes. However, these measures and their related understanding and measurement of attitudes including only explicit ones does not always predict behavior as well as many theories and interventions hypothesize that they should.

Many researchers have examined the question of the relation between attitudes and behavior. In general there appears to be a weak correlation between explicitly measured attitudes and behavior (LaPiere, 1934; in Dockery & Bedeian, 1989; Wicker, 1969). One of the earliest published reports to explore the so-called disparity between explicitly measured attitudes and behavior was LaPiere's (1934; in Dockery & Bedeian, 1989) "Attitudes Versus Action." LaPiere visited 251 U.S. business establishments (primarily restaurants and hotels) on a cross country trip with an apparent Chinese couple. At the conclusion of their trip, LaPiere mailed surveys to the 251 U.S. business establishments that LaPiere had visited with a Chinese couple, asking the businesses to respond to the question "Will you accept members of the Chinese race in your establishment?" with the response options of: "Yes", "No", and "Depends upon the circumstances." Ninety-two percent of the 128 businesses that responded replied that they would not accept Chinese patrons at their place of business, and only one establishment affirmed that they would accept Chinese patrons, despite the fact that LaPiere and his Chinese traveling companions had indeed been customers in these very same establishments. The attitudes about

Chinese customers held by the businesses (i.e., they would not accept them) was incongruent with their behavior (i.e., LaPiere and the Chinese couple had not been turned away from these businesses and had been served).

While LaPiere's research is often viewed as highlighting a disagreement between attitudes and behavior, Dockery and Bedeian (1989) reframe LaPiere's findings as identifying a difference between "true" attitudes and attitudes as measured by conventional questionnaires. Indeed, such a conclusion seems to be supported by those who argue that there is a discrepancy in the attitude-behavior relationship. For example, Wicker (1969) reviewed 31 studies of attitude consistency, concluding "it is considerably more likely that attitudes will be unrelated or only slightly related to overt behaviors than that attitudes will be closely related to actions."

Explicit measures of attitudes about smoking show similar inconsistency in predicting behavior. De Leeuw and colleagues (2008) examined the ability of adolescents' explicit smoking attitudes to predict future smoking behavior beyond current smoking behavior. Explicit smoking attitudes were inconsistently predictive of future smoking behavior, and compared to past smoking behavior, were weaker predictors of future smoking. The authors suggested that rather than attitudes shaping behavior, adolescents may modify their attitudes to conform to their behavior. Thus, while attitudes may be important in understanding behavior, attitudes alone, particularly when measured explicitly, provide an incomplete understanding of behaviors such as smoking.

Others argue that the inconsistency of the prediction of behavior from explicit attitudes is due to the influence of other causal factors on attitudes (Schuman and

Johnson, 1976). Fishbein & Ajzen (1975) agreed that LaPiere did not measure "true" attitudes, but rather measured what they called behavioral intention. However, while attitudes are inconsistently related to smoking behavior, they are also inconsistently related to behavioral intention not to smoke. Godin et al. (1992) examined theoretical predictors of smoking behavior (not smoking) according to Ajzen's (1991) Theory of Planned Behavior. These authors found, in two different samples, that explicit attitudes about not smoking predicted intention to not smoke among smokers, but this prediction was not observed among nonsmokers (despite significant variation in the nonsmokers' attitudes about not smoking). Furthermore, attitudes about not smoking were a stronger predictor of intention to not smoke among pregnant smokers than among a volunteer sample of smokers drawn from a random digit list of telephone numbers. The authors concluded that pregnancy was a significant event that accentuated participants' attitudes toward smoking. However, among pregnant nonsmokers no increase in strength of association was found between attitudes and smoking intention. In other words, theoretical predictors (such as attitudes about and intention not to smoke) of behavior according to the Theory of Planned Behavior were supported for people engaging in a behavior (smoking), however these predictors did not account for variation among non-smokers. If attitudes and behavior were closely linked, then attitudes about smoking should predict behavior for both smokers and non-smokers alike. Taken together, these findings suggest that attitudes can be important in understanding smoking, but the conditions of the association between attitudes and when may depend on past experience, significant life events, and motivation to smoke. Additionally, explicit measurement of attitudes about

smoking appears to represent only a partially valid measurement of the larger smoking attitudes construct.

Smoker's reports of their attitudes toward smoking may also be less related to their behavior because of stigma and social desirability influences. Smoking, though once viewed as a socially chic and acceptable behavior, is now widely recognized to be harmful to one's health. The impact of society on attitudes about smoking are many and varied, whether those influences are "actual, imagined, or implied" (Allport, 1985). As one possible example of these influences, the majority of smokers report a desire to stop smoking, although a much smaller proportion of smokers actually make a cessation attempt, and even fewer are successful in their attempts. Thus, because they are engaging in a stigmatized behavior, smokers engage in cognitive bolstering to reduce cognitive dissonance, and this may be another reason why smokers' explicit attitudes are not always correlated with their behavior (Swanson, Rudman, Greenwald, 2001)

Implicit Attitudes

Current perspectives in cognitive psychology have challenged the once widely held view that people consciously and systematically process and interpret experiences into intentional behavior (Bargh & Chartrand, 1999). In contrast to absolutist theories that contend that people consciously choose and control their behavior (Bandura, 1977,1986; Deci & Ryan, 1985) or not (Freud, 1950; Skinner, 1938), contemporary psychological theories use a dual-process perspective (Chaiken & Trope, 1999) and even quad-process models (Conrey, Sherman, Gawronski, Hugenberg, Groom, 2005) to understand the interplay between conscious choices and

cognitive processes automatically set into motion by one's environment on behavior (Bargh & Chartrand, 1999). These different influences are sometimes referred to as automatic and controlled (Bargh & Chartrand, 1999), conscious and unconscious (Jacoby, Lindsay, & Toth, 1992) or implicit and explicit cognition (Greenwald & Banaji, 1995). Explicit or controlled processes tend to be slow, serial, effortful, and prompted by conscious appraisal of events and can include logical thought, planning, and problem solving, whereas automatic or implicit process are fast, parallel, effortless, and outside of conscious awareness and include a range of cognitive processes such as bias, prejudice, attitudes and stereotypes (Waters & Sayette, 2006). Greenwald & Banaji (1995) build upon the definition of attitudes described above (Eagly & Chaiken, 1993) to include influences outside of consciousness and define implicit attitudes as "introspectively unidentified (or inaccurately identified) traces of past experience that mediate favorable or unfavorable feeling, thought, or action toward social objects" (pg. 8).

An important distinction is needed to clarify the nature of just what is meant when discussing implicit and explicit cognitions such as attitudes. Generally, explicit cognitive processes broadly refer to those cognitive processes that a person is aware of and implicit or automatic processes refer to influences on behavior that outside of conscious awareness. This distinction is obscured by the proliferation of measures designed to assess implicit cognitions (such as implicit attitudes) which are also referred to as implicit measures such as the Implicit Association Test (IAT; e.g., Greenwald et al. 1998), the Extrinsic Affective Simon Task (EAST; e.g., De Houwer, 2003) and others such as word association and affective priming tasks. Nosek,

Hawkins and Frazier (2011) take a descriptive approach to defining an implicit measures without commenting on the on the underlying psychological process and understand an implicit measure as one that "assesses mental content without requiring awareness of the relation between the response and the measured content." De Houwer (2006) takes a different approach by defining implicit measures on the basis of the functional properties of the measurement outcomes themselves, that is, a) the outcome functions as an index of an attitude or cognition despite the fact that participants are unaware of the impact of the attitude or cognition on the outcome; b) participants are not aware of the attitude or outcome; or c) participants have no control over the outcome. Thus, implicit measures do not merely indirectly measure an outcome that could be directly reported by a participant. For example, a reaction time measure itself may be assessing something else indirectly, but that measurement outcome may or may not be implicit unless it is hypothesized to meet the functional properties and definition described above. The MMPI indirectly measures personality (participants are not asked to directly report to what extent they believe they have certain personality traits), but this in and of itself does not make it an implicit measure. For example, participants have control over their answers, might realize that certain traits are being measured, and can manipulate the outcomes of the MMPI such as by faking bad or good (De Houwer, 2006).

Implicit attitudes and smoking.

Research into the conditions under which attitudes are predictive of behavior (i.e., in situations in which attitudes are strongly activated and/or when the person consciously perceives a link between the attitude and behavior; Ajzen & Fishbein,

1980; Fazio & Zanna, 1981) have improved the understanding of the attitude-behavior relationships. However, the reconceptualization of attitudes as operating both consciously and unconsciously has important implications for the attitude-behavior relationship (Greenwald & Banaji, 1995). Whereas explicit attitudes are inconsistently or weakly correlated with behavior at times and more robustly correlated with behavior at other times, an increased understanding of implicit attitudes may be able to fill some of the attitude-behavior knowledge "gap." This is especially true of attitudes for behaviors that are socially stigmatized, such as smoking.

Assessing implicit attitudes.

Although there are many implicit measures, the Implicit Association Test is a widely used and validated measure that produces a measurement outcome (termed the IAT effect) that is theorized to be a measure of implicit attitudes. Whether the IAT measures implicit attitudes is dependent on the design of the IAT, as it can be used to measure implicit self-identification, action tendencies, attitudes, etc. The concept behind the IAT effect for smoking is that when implicit smoking attitudes are more positive, mental associations between smoking stimuli and positive stimuli will be stronger (Waters & Sayette, 2006).

The IAT has been studied in relation to various aspects related to smoking. Implicit smoking attitudes as measured by the smoking IAT are related to smoking status, with evidence that smokers exhibit more positive implicit attitudes (that is, they more quickly pair positive stimuli and smoking stimui relative to neutral stimuli and more slowly pair smoking stimuli with negative stimuli) than non-smokers

(Chassin et al., 2002; Sherman et al., 2003; Swanson et al., 2001). Implicit smoking attitudes as measured by the IAT are also associated with level of smoking, with heavier smokers showing evidence of more positive implicit attitude than non-smokers (that is, smokers paired smoking stimuli with positive stimuli relative to pairing smoking stimuli with negative stimuli; Sherman et al., 2003). Both heavy and light groups of smokers showed more positive IAT measured implicit attitudes than nonsmokers (Sherman et al., 2003). Additionally, nicotine deprivation did not appear to significantly influence IAT measured implicit attitudes (Sherman et al., 2003). Sherman and colleagues (2003) also examine the effects different smoking related stimuli (e.g., pictures of lit cigarettes or pictures of cigarette packages) had on IAT measured implicit attitudes and found that stimulus type did not affect implicit attitudes measured by the IAT.

Given the evidence supporting the associations of explicit and implicit smoking attitudes with smoking, one might wonder to what degree implicit and explicit attitudes toward smoking agree, and whether implicit attitudes add in the prediction of smoking beyond explicit attitudes. Addressing the association between implicit and explicit smoking attitudes, Swanson, Rudman, & Greenwald (2001) found that smokers reported positive explicit attitudes toward smoking while nonsmokers reported negative explicit attitudes toward smoking; however, both smokers and nonsmokers held negative implicit smoking attitudes, although smokers' implicit attitudes were less negative than those of nonsmokers. Rudman, Phelan, & Heppan (2007) explored early life experiences with smoking as a potential source for the formation of implicit attitudes. The authors asked smokers to list early lifetime

experiences with smoking and recent smoking experiences, and then rate each experience (individually) as either positive or negative. Smokers were overall negative in their ratings of their early life experiences with smoking (things such as childhood events related to smoking such as being around parents that smoked and memories of their first cigarette), while their ratings about their most recent smoking experiences were reported as roughly neutral, neither positive or negative. Explicit attitudes about smoking were significantly related to smokers' beliefs (how positive or negative) about recent experiences with smoking, whereas implicit smoking attitudes were not. However, these relationships were reversed for early smoking experiences, with current explicit attitudes about smoking being unrelated to beliefs about early smoking experiences and significantly related to implicit attitude about smoking. These findings lead Rudman and colleagues to speculate that early life experiences may be more influential for the formation of implicit attitudes, and that more recent experiences are more influential in determining explicit attitudes. Huijding, de Jong, Wiers, & Verkooijen (2005) similarly found that smokers showed less negative implicit smoking attitudes than nonsmokers, whereas on a semantic differential measure of explicit smoking attitudes, smokers had slightly negative explicit attitudes toward smoking and nonsmokers held more negative explicit attitudes toward smoking.

Implicit cognition researchers have called for a shift in the study of implicit attitudes from what is referred as the "Age of Measurement," the first 15 years of research on implicit cognition that focused primarily on developing methods for assessing implicit cognition and their utility in understanding human behavior, to a so

called “Age of Mechanism” (Nosek, Hawkins, & Frazier, 2011). This call seeks to move research on implicit cognition away from questions of identification and description to more sophisticated questions that explore how and why implicit cognition influences behavior. Although this might seem to be a call that would promote investigation of how implicit cognition affects other cognitive processes or behavior, Bargh and colleagues (2012) argue that our descriptive understanding of implicit cognition has only begun. In their review of recent research on implicit cognition, Bargh and colleagues (2012) note that “if there is one take home message… it is that skill acquisition is not the only route to automaticity.” Integrating findings of implicit cognition across various psychology subdisciplines, Bargh and colleagues (2012) articulate that there are well documented direct environmental influences on implicit cognition, that important mediators and moderators of implicit cognition have been identified, that some basic mechanisms of the function of implicit cognition have been described (such as executive processes and working memory in unconscious goal pursuit), and even that there appear to be evolutionary origins to some automatic cognitive processes that are apparent in infants as young as 3 months. Given the accumulation of evidence related to implicit and automatic cognition, it is likely that these automatic cognitive processes trigger explicit cognitive processes, which then in turn affect other unconscious processes. Related to implicit smoking attitudes, these recent reviews suggest that there is still much to be understood about how implicit smoking attitudes are developed, how they are influenced by environmental factors, and even how the personal process of smoking cessation affects implicit smoking attitudes. Research is needed on both how implicit

smoking attitudes affect explicit attitudes and processes as well as how explicit cognitions affect implicit smoking cognitions. How explicit cognitions affect implicit attitudes has been studied widely, however, a less well-developed area of research is how implicit smoking attitudes affect or predict behavior relative to explicit smoking attitudes or cognition.

In the only published study comparing the predictive ability of implicit and explicit smoking attitudes on prospective smoking status, Chassin and colleagues (2010) examined explicit and implicit smoking attitudes and their relationships with smokers' experienced failures to control their smoking, and their plans to quit. This longitudinal study followed N=449 smokers for 18 months. At baseline, smokers' plans to quit, past failed quit attempts and implicit and explicit smoking attitudes were examined as predictors of smoking cessation a year and a half later. Having a quit plan and experienced failure in a cessation attempt were also examined (separately) as moderators of the effects of implicit and explicit smoking attitudes on smoking cessation at 18 months. Explicit smoking attitudes predicted smoking cessation 18 months later for smokers with low levels of experienced failure to control their smoking. For smokers with higher levels of experienced failure of controlling their smoking in past cessation attempts, explicit smoking attitudes were not predictive of smoking cessation. This finding possibly indicates that when people feel that they have control over their behavior, controlled cognitive processes such as explicit attitudes can override the influence of implicit processes.

Implicit smoking attitudes were also predictive of prospective smoking cessation outcomes. For smokers with a plan to quit, implicit smoking attitudes predicted

cessation when smokers also had high levels of experienced failure to control their smoking. This finding was consistent with dual process theory, the social psychology literature, and experimental laboratory studies of attitudes that suggest that when people perceive that their free will is compromised in some way (such as when experiences of failure to quit are more salient) impulsive processes and automatic associations (such as implicit smoking attitudes) are significant predictors of behavior (Chassin et al., 2010). One surprising finding however was that for smokers without a plan to quit, implicit attitudes predicted smoking cessation only for smokers who also had low levels of experienced failure to control their smoking.

Chassin et al.'s (2010) study is important because it showed that implicit attitudes appear to be related to the process of smoking cessation. It also supports the idea that implicit attitudes are better predictors of smoking than explicit attitudes under conditions when controlled cognitive processing are lowered (such as when smokers perceived greater lack of control over quitting when they have experienced past difficulty quitting). However, these findings raise more questions about how implicit attitudes are related to the process of smoking cessation. Chassin and colleagues (2010) used the Theory of Planned Behavior (Ajzen, 1985) to understand the influence of perceptions of control, attitudes, and motivation (in this study, plans to quit were viewed as motivation) on smoking cessation. The Transtheoretical Model uses similar constructs such as motivation, perceptions of control (self-efficacy) and attitudes about smoking (decisional balance considerations) to understand the process of smoking cessation, but makes more specific predictions about how and when these

should influence behavior. However, implicit attitudes have yet to be studied in conjunction with TTM constructs.

Moderators of implicit attitudes.

Since implicit attitudes have not been integrated into the TTM yet, it is helpful to speculate about how they may be related. Dual process theories of cognition can inform this research to make theory grounded hypotheses about implicit attitudes in the process of change. In addition to the more general theories of cognition such as the dual process model, Friese, Hoffman, & Schmitt (2008) theorized about more specific aspects of cognition from a dual process perspective. Specifically, these authors organized and reviewed the literature on implicit measures predicting behavior and delineated two categories of moderators of the effects of implicit attitudes on behavior. The first category of moderators of implicit attitudes relates to dynamic or state-like factors that affect implicit attitudes, whereas the second category relates to more static or dispositional factors related to implicit attitudes. Within each category (dynamic vs. dispositional) Friese, Hoffman, & Schmitt (2008) identified roughly three different determinants of the moderation of the influence of automatic processing on behavior: the opportunity to control automatic processes, the motivation to control automatic processes, and situational influences on reliance on automatic processes. Of greater relevance to the current research are the situational moderators of the influence of automatic processing and that research will be reviewed in greater depth.

Opportunity to control implicit cognition.

Situational factors that influence the opportunity to engage in explicit cognitive processing can include states that preclude more explicit cognitive processing. For example, individuals in states of impaired executive functioning capacity (such as during drug or alcohol intoxication) have limited opportunity to control the influence of automatic cognitive processes on their behavior. Individuals facing time pressures to make decisions are also more likely to use automatic cognitive processes such as implicit attitudes over explicit, controlled cognitive processes. States of induced fear of mortality and states when self control has been depleted have also been shown to limit the opportunity individuals have to engage in effortful, explicit cognitive processing (Friese, Hoffman, & Schmitt, 2008). Although these situations do not make it impossible for explicit cognitive processing to take place, in the absence of (or limited) opportunity to engage in controlled cognitive processing, individuals will use more automatic processes such as implicit attitudes.

Motivation to control implicit cognition.

Given low motivation to control cognitive processing, implicit attitudes will also better predict behavior than explicit cognition. This moderator recognizes that an important aspect of effortful cognitive processing is intention and motivation to do so, and this moderator is of greatest interest in the present research. Situational factors that affect the motivation to control the influence of automatic processes on behavior might include many things. Hedonic need states are one such situation where implicit cognitions may be more salient in influencing behavior. For instance, implicit attitudes about condom use help explain lower rates of condom use with casual sex

partners. Despite explicit attitudes favoring safe sex and condom use (that do predict condom use with regular partners), many individuals fail to use condoms "in the heat of the moment" and that behavior is better predicted by implicit attitudes (Marsh, Johnson, and Scott-Sheldon, 2001). Cigarette smoking, and attempts at quitting, can be viewed similarly. Implicit smoking attitudes may influence smoking behavior to a greater extend than explicit smoking attitudes when individuals are unmotivated to control their smoking. Attempts to control addictive behaviors such as cigarette smoking are by their nature intentional, effortful actions that will require corresponding intentional and effortful cognitive processing. Couched within the framework of the TTM, greater readiness to change their smoking may increase the use of effortful, controlled cognitive processes and restrict the influence of automatic smoking attitudes.

Reliance on implicit cognition.

The third moderator states that other situations and states can affect the reliance on either controlled or automatic processing. Mood states are an often cited example of a moderator of reliance upon automatic or controlled processes to direct behavior. Independent of opportunity or motivation to control automatic cognitive processes, mood can increase or decrease reliance on controlled or automatic processing (Friese, Hoffman, & Schmitt, 2008). Mood states have also been found to influence depth of information processing and memory, and higher order cognitive processes such as interpretation, judgment, decision making, risk-perception, and reasoning (Blanchette & Richards, 2010; Bodenhausen, Kramer, & Susser, 1994). For example, happy moods produce greater reliance on stereotypes and generally appear

to make cognitive processing more flexible yet more shallow (Bodenhausen, Kramer, & Susser, 1994). Negative affect states such as sad or anxious moods in contrast appear to be characterized by more extensive, detail-oriented processing, albeit often in a restricted or ruminative manner (Bodenhausen, Gabriel, & Lineberger, 2000). Dyck and colleagues (2010) found right amygdala activation in automatic processing of emotion and left amygdala involvement in effortful and cognitively controlled emotion processing, suggesting that there are functional and neuroanatomical differences in implicit versus explicit cognitive processing in difference affect states.

The second category of moderators of implicit-explicit processing organizes dispositional or individual difference moderators of cognitive processing. Although this body of research is indeed fascinating, it is less pertinent to the present research but will be reviewed briefly. There are dispositional or trait-like examples of each of the three classes of moderators discussed above for situational factors. For example, some individuals may generally rely more on automatic processing or conversely may rely on more "intuitive" processing than others (dispositional reliance on processing). On the other hand, other individuals may be predisposed to a style of cognitive processing that is more effortful. Some behaviors are simply more difficult to control (less opportunity to be controlled) with effortful processing (e.g., non-verbal behaviors are more influenced by automatic processing while verbal behaviors are more affected by controlled processes; Friese, Hoffman, & Schmitt, 2008). Individuals can also have trait motivation to use one type of cognitive processing over another for certain behaviors. Need for cognition (NFC) is one type of dispositional motivation that influences automatic processing, with individual with a greater need

for cognition engaging in more effortful controlled cognitive processing and relying less on automatically activated cognitive associations (Friese, Hoffman, & Schmitt, 2008).

Taken together, these can help to understand how implicit attitudes may be related to the process of smoking cessation by integrating known and hypothesized moderators already recognized in the TTM. While implicit smoking attitudes affect smoking behavior, these effects should not be limited only to the physical act of smoking, but also extend to a myriad of smoking related behaviors such as access and purchasing of cigarettes, keeping adequate supplies of cigarettes on hand, and possessing necessary items related to smoking such as ashtrays and lighters. The Cigarette Purchase Task is a hypothetical choice task that measures aspects related to smoking behavior that are related to smoking behavior and should be affected by both implicit and explicit smoking attitudes.

Cigarette Purchase Task

Behavioral economic perspectives of drug abuse maintain that relative reinforcing efficacy (RRE), or the behavior-strengthening or maintaining properties of a drug, is a multi-dimensional construct that uniquely predicts changes in substance use behavior over time (MacKillop, Murphy, Ray, Eisenberg, Lisman, Lum, Wilson, 2008; MacKillop & Murphy, 2007). The utility of the RRE construct has been criticized because it's measurement in laboratory studies of can be costly, difficult, and problematic to translate into clinical or applied studies (Jacobs & Bickel, 1999; MacKillop & Murphy, 2007; MacKillop et al., 2008). Purchase task measures of RRE however appear to be easier to use in clinical and applied research

and show good convergent and divergent validity (MacKillop et al., 2008). Rather than administering varying levels of a substance to individuals as in laboratory measures of RRE, these measures describe hypothetical situations where participants are asked how much of a substance they would purchase at escalating price intervals, which can be used to derive estimates of RRE.

Behavioral economic theories tend to underemphasize the conscious control individuals have on their behavior, but in an interesting study of adolescent smokers, Murphy, MacKillop, Tidey, Brazil, and Colby (2010) found that lower motivation to change smoking (measured by the Contemplation Ladder) was associated with greater smoking demand intensity (number of cigarettes that would be purchased at the lowest price). Thus the Cigarette Purchase Task may be a good outcome measure to understand different dimensions (e.g., craving, nicotine dependence) of a person's smoking behavior other than quantity or frequency when other indicators are unavailable (such as expired CO or cotinine levels). It also appears that the Cigarette Purchase Task is sensitive enough to detect changes due to readiness for change even in a sample of less dependent (adolescent) smokers.

Integrated Summary

Much is already known about the process of smoking cessation and also about implicit attitudes, but relatively little is known about how implicit attitudes affect the personal process of smoking cessation. The Transtheoretical Model (DiClemente, 2003) helps understand behavior change as a process that includes Stages of Change, tasks related to those stages, and Processes of Change that individuals use to accomplish those tasks and progress through the stages. Motivation to change is a

critical factor in successfully changing behavior, and individuals often begin a change process in the Precontemplation stage with low motivation. Motivation increases as individuals move through the stages and change their behavior. There are many ways to measure motivation, and there is research support for using the Contemplation Ladder (Biener & Abrams, 1991) to understand smokers' motivation to quit smoking and parallel stage status and tasks.

The critical task for individuals to accomplish in order to progress from the Contemplation stage to the Preparation stage is to make a decision to change their behavior. Janis & Mann (1977) conceptualized competing considerations related to any decision in terms of a decisional balance that can be tipped in favor or disfavor of either side of a decision. The Decisional Balance Scale (Velicer et al., 1985) measures smokers' decisional balance considerations related to smoking and evinces clear changes as individuals move through the Precontemplation, Contemplation, and Preparation Stages of Change.

The Decisional Balance Scale measures the overt evaluations of costs and benefits of smoking behavior, and these considerations are consistent with definitions of explicit attitudes (Krech, Crutchfield, & Ballachey, 1962; Eagley & Chaiken, 1993). Contemporary psychological theories of attitudes, however, describe dual-process models of cognition that have distinguished between implicit and explicit attitudes (Bargh & Chartrand, 1999). Implicit attitudes about smoking can improve the understanding of the relationship between attitudes and behavior. Friese, Hoffman, & Schmitt (2008) describe conditions under which implicit attitudes might affect behavior. However, only one study has investigated the influences of explicit

and implicit smoking attitudes on smoking cessation, and this study did not include an understanding of the personal process of smoking cessation (e.g., the Transtheoretical Model of intentional behavior change; Chassin et al., 2010). Integrating implicit attitudes into a personal process understanding of smoking cessation may lead to a greater understanding of how individuals quit smoking and thus more effective smoking cessation interventions.

Hypotheses and Rationale

The purpose of the current study was to better understand how smoking related attitudes impact the personal process of smoking cessation. The main aim of this study was to examine how implicit smoking attitudes affect smokers' decision making process. This proposed study attempted to integrate findings from dual process models of substance abuse cognition with a Transtheoretical perspective to assess and evaluate how implicit attitudes about smoking impacted smokers' explicit decisional balance considerations, and how implicit smoking attitudes interacted with smokers' motivation to change in terms of their readiness to quit smoking. In addition, this study investigated how explicit decisional balance considerations mediated the effect of implicit smoking attitudes on a hypothetical smoking purchase task, and if that mediation was conditional upon smokers' readiness to change.

Hypothesis 1.

Association between implicit attitudes and decisional balance is moderated by motivation to change. The first hypothesis examined how implicit attitudes about smoking as measured by the smoking IAT are related to smokers' explicit decisional

balance considerations as measured by the smoking Decisional Balance Scale. It was hypothesized that the agreement between implicit smoking attitudes and explicit decisional balance considerations would vary as a function of smokers' motivational readiness to change as measured by the Contemplation Ladder. Friese, Hofmann, & Schmitt (2008), proposed several moderators of the relative weight of either automatic or controlled cognitive processes on behavior. They reviewed evidence that suggested that when motivation to control behavior is high, the relative influence of automatic processes will be weakened and will be overridden by controlled cognitive processes. This first hypothesis tested this theory by examining the influence of smokers' motivation to control their smoking, or readiness to change, on smokers' automatic cognitive processes about smoking as measured by the smoking IAT (see Figure 1). Specifically, it was hypothesized that when readiness to change (motivation to control behavior) is low, implicit smoking attitudes will be more positive. However, as motivation increases, smokers would rely more on controlled cognitive processes and the influence of implicit smoking attitudes would be reduced. Thus when readiness is high, implicit smoking attitudes would be more negative.

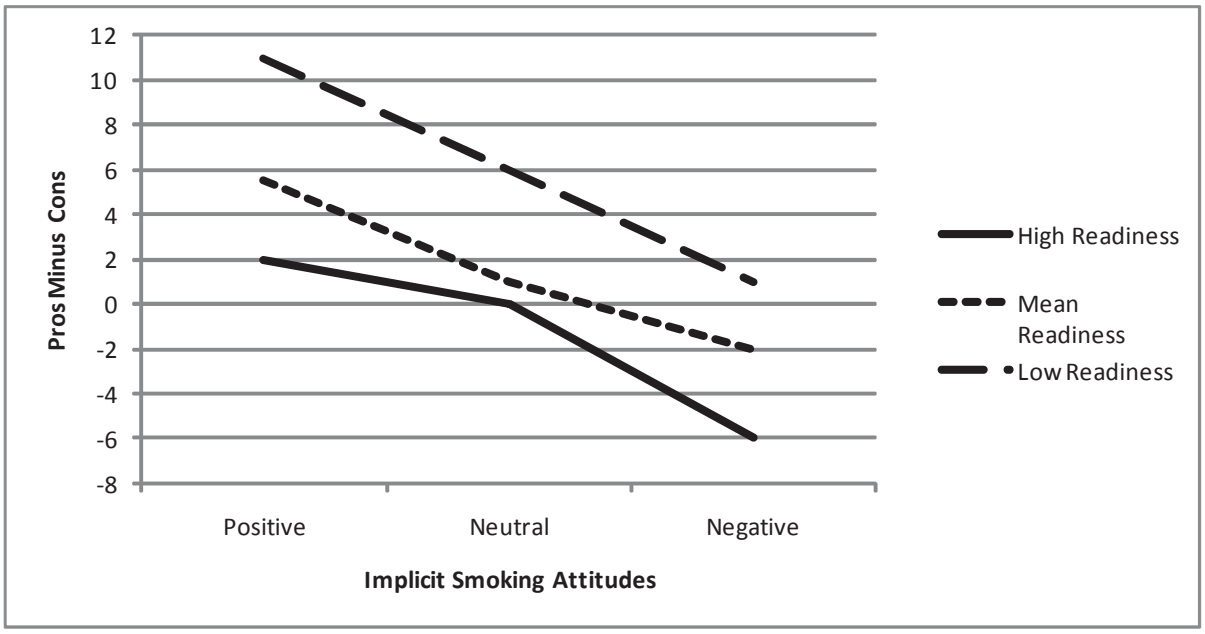

Figure 1. Hypothesized interaction between readiness to change and implicit smoking attitudes in predicting decisional balance considerations

Hypothesis 2.

The indirect effects of implicit attitudes through decisional balance considerations on a smoking purchase task are conditional on readiness to change. The second hypothesis tested expanded the findings of the first tested hypothesis to examine the predictive utility of implicit smoking attitudes on a hypothetical smoking purchase task. Smoking purchase tasks ask smokers to make decisions about how much money they would spend on cigarettes at escalating prices, allowing calculation of various demand metrics that correlate well with a number of dependence and use measures. Because such tasks require individuals to make decisions about how much money they would spend on cigarettes are various prices, they can be thought to reflect more controlled cognitive process. According to dual process model theories reviewed by Friese, Hofmann, and Schmitt (2008), as controlled cognitive processing increases relative to automatic processing, controlled processes are assumed to inhibit

or override automatic processing. Motivation is one of several moderators proposed to shift the relative weight of automatic versus controlled processing. The influence of automatic processes then may directly influence behavior when motivation to control a behavior is low; yet when motivation to control the behavior is high, the effects of automatic processes may be indirect through controlled cognitive processing as these controlled processes inhibit or override the automatic processes.

This aim of the present study was to test a model of these predictions. Specifically, motivational readiness to change as measured by the Contemplation Ladder was thought to moderate the relationship between implicit smoking attitudes as measured by the smoking IAT and decisional balance considerations as measured by the smoking Decisional Balance Scale. When Readiness is low, implicit smoking attitudes would directly predict responses on the hypothetical smoking purchase task (smokers will be using less controlled processing). However, when Readiness is high, the direct influence of implicit smoking attitudes on the purchase task would be weaker and would be mediated by decisional balance considerations, which would more strongly correlate with responses on the hypothetical smoking purchase task (as motivation to control behavior increases, controlled cognitive processing will outweigh automatic processing). The hypothesized model is diagrammed in Figure 2.

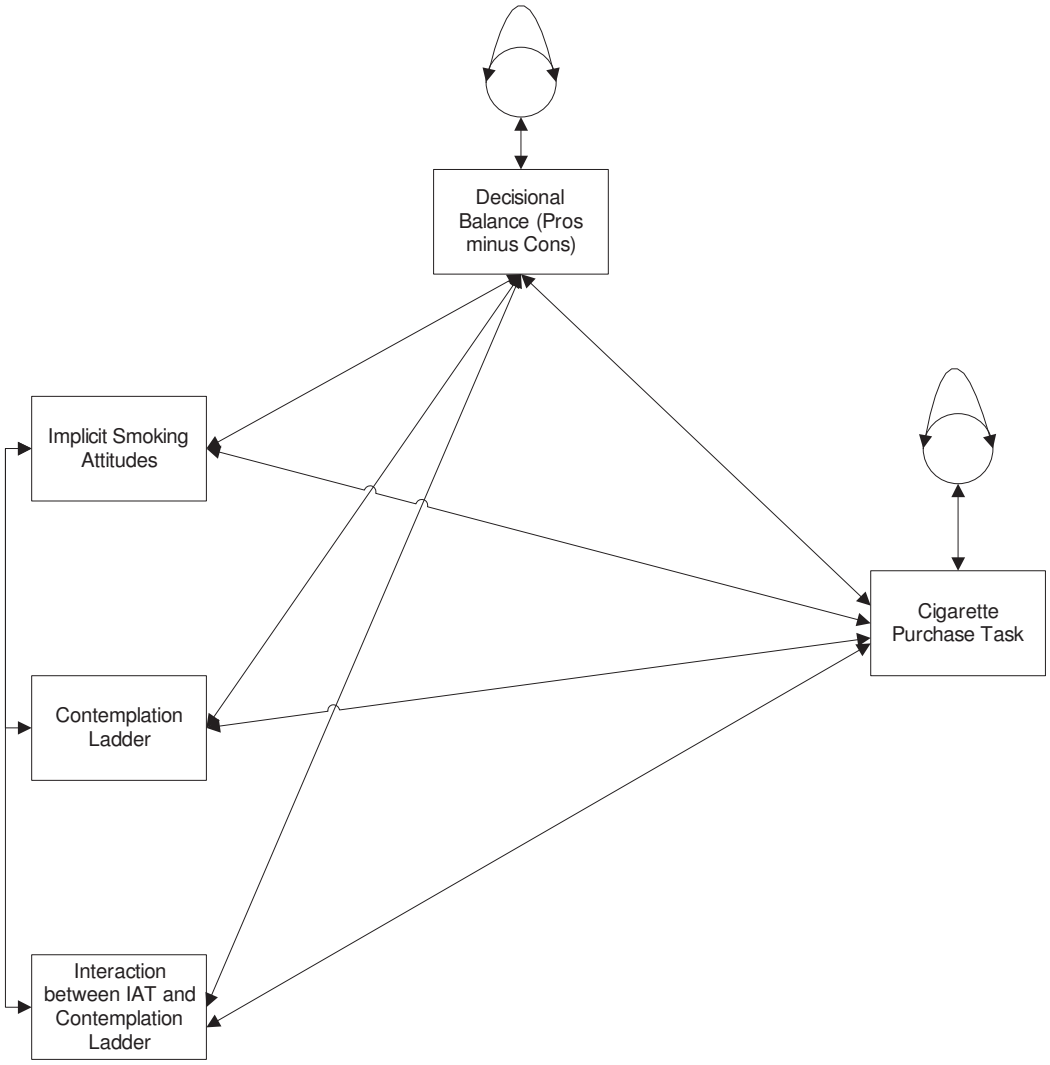

Figure 2. Path model for hypothesis 2.

Method

Participants

Participants were current smokers recruited through a variety of sources. Recruitment and administration of the survey was conducted online, so participants came from a number of different online sources. Advertisements seeking volunteers were placed on Craigslist online community sites, on Facebook (a popular online social networking website), in Google search results, and on the online portal for a local university (the myUMBC website for the University of Maryland, Baltimore County).

All potential participants were screened prior to enrolling in the study. Potential participants under the age of 18, participants who did not speak English as a first language, those who did not smoke, and current smokers who reported having smoked less than 100 cigarettes in their lifetime or who smoked less than 5 cigarettes per day were excluded from eligibility to participate in this study. Additionally, current smokers who reported that they were seriously considering quitting smoking in the next 30 days were excluded. Participants using computer operating systems other than Microsoft Windows were also be excluded because the Inquisit software used to administer the smoking IAT was not compatible with other operating systems. In exchange for participation in the study, participants were eligible to enter a drawing for one of three $50 Visa gift cards.

Measures

Demographic and smoking history eligibility screening questionnaire.

Participants were asked to complete a demographic and smoking history questionnaire. Information was collected regarding their age, sex, and ethnicity. The smoking history questionnaire assessed the number of cigarettes participants smoke per day, length of time in minutes before they smoke their first cigarette in the morning, the longest prior period of smoking abstinence, number of prior quit attempts, past participation in smoking cessation treatment, the smoking status of their parents, the age that they started smoking, and how many of their four closest friends smoke.

Implicit attitudes toward smoking.

Participants completed a smoking valence variant of the Implicit Association Test (IAT; Greenwald et al. 1998), which was administered online via Inquisit 3 Web software. There are a variety of ways to administer the IAT, but there are several advantages of administering the IAT online via the Inquisit software. Among these is the capability to administer the IAT online, and because it can seamlessly integrate with online survey software.

Briefly, the IAT is a reaction time measure that requires participants to categorize stimuli into four different categories using two response keys. Typically, two of the four categories represent the target concepts (e.g., cigarettes vs. geometric shapes), while the other two categories correspond to attribute dimensions (e.g., positive vs. negative, approach vs. avoid, etc.). In this version of the IAT, there were

eight smoking stimulus pictures related to smoking (three pictures of someone holding a cigarette, two pictures of a burning cigarette in an ashtray, one picture of someone lighting a cigarette, on picture of cigarettes laying on a table, and one picture of cigarettes and a lighter on a table) and eight pictures of geometric shapes (rectangle, square, circle, pentagon, triangle, parallelogram, trapezoid, and octagon) representing the target concepts. The attribute dimension stimulus words were eight adjectives with a positive meaning (wonderful, nice, friendly, pleasant, great, excellent, terrific, and fabulous) and eight words with a negative meaning (awful, rotten, stupid, dreadful, horrible, nasty, disgusting, and ugly). All stimuli were presented in the center of a black screen. Words were presented in either green or white letters. The words smoking, shape, good, and bad were used for category labels. Smoking and shape labels were presented in white letters, while the good and bad labels were presented in green letters. Participants responded by pressing either the "e" or "i" buttons on their keyboard (corresponding to left and right categorization, respectively). Participants first practiced classifying the separate pairs of attributes and targets using the two keys in practice trials. Then, during the critical trials of the IAT, target and attribute categories were paired and participants were asked to categorize stimuli using the two response keys (e.g., smoking stimuli and positive words with one key, geometric shapes and negative words with the other key). After a block of trials with one combination of pairs, the associations were reversed (e.g., smoking stimuli and negative words on one key, geometric shapes and positive words with the other). Performance should be better (i.e., faster and with less errors of classification) when concepts that are associated in memory are classified with the

same response key (also called the compatible trials) than when concepts that are weakly or not at all associated in memory share a response key (sometimes referred to as incompatible trials). One of these combinations (i.e., compatible or incompatible) leads to faster and more accurate performance relative to the other, a performance difference that is referenced as the IAT effect. The IAT effect is thought to reflect the strength of implicit associations between the targets and attribute categories. To the extent that response latencies are faster (shorter) and more accurate for trials where participants categorize smoking stimuli and positive words with the same key than when smoking stimuli and negative words are categorized with the same key, participants have more positive implicit attitudes toward smoking.

The resultant reaction times are used to calculate a measure *D*, or the IAT effect which can range from +2 to -2. To calculate this IAT *D* effect, the guidelines recommended by Greenwald et al. (2003) for scoring the IAT were utilized. First, reaction times of greater than 10,000 milliseconds were deleted. Second, observations of subjects for whom greater than 10% of trials have reaction time latency of 300 milliseconds or less were deleted. Thirdly, standard deviations were computed using all trials from stages 3 and 6 together, then again for trials in stages 4 and 7. In step four, the mean response time latency for stages 3, 4, 6 and 7 were calculated separately. In step five, the mean differences in reaction times between stage three subtracted from stage six, and stage four subtracted from stage seven were computed. These mean differences were then divided by the standard deviations for the respective stages calculated in step three. These two ratios were then averaged together to form the final estimate *D*.

Readiness to change.

Readiness to consider smoking cessation is frequently measured with a brief, single item measure often referred to as a Readiness Ruler or Contemplation Ladder. Biener and Abrams (1991) described the Contemplation Ladder as a better measure of consideration of quitting rather than an indicator of readiness to make a quit attempt, and that it was a better indicator of attitudes of smokers in earlier Stages of Change rather than later Stages of Change. The Contemplation Ladder depicts a ladder with numbers on each rung of the ladder. Above the ladder is text stating: "Each rung on this ladder represents where various smokers are in their thinking about quitting. Choose the number that indicates where you are now." Next to several of the numbered rungs are indicators of the meanings of the readiness they indicate, with text next to "0" indicating it represents "No thought of quitting," next to the number "2" is "Think I need to consider quitting someday," next to "5" is "Think I should quit but not quite ready," next to "8" is "Starting to think about how to change my smoking patterns," and next to the top rung, "10," is "Taking action to quit." The Contemplation Ladder has exhibited good concurrent and predictive validity and was significantly correlated with smokers' intention to quit and predicted subsequent participation in activities that involved quit attempts (Biener and Abrams, 1991; Herzog, Abrams, Emmons, Linnan, 2000).

Decisional balance.

Decisional Balance considerations were measured by the Smoking Decisional Balance Scale (SDB, Velicer et al., 1985). This 20-item scale includes 10-items

measuring individuals' perceptions about ten potential gains or benefits of smoking, also called Pros, and ten potential disadvantages or losses of smoking, or Cons. These twenty Pros and Cons come from one of four categories assessing gains and losses for the smoker themselves, gains and losses related to significant others, self-approval or self-disapproval, and approval or disapproval of others. Participants were asked to rate their agreement with how important each of these 20-items is in their decision to smoke on 5-point Likert scales ranging from *not at all* (1) to *extremely* (5). Both of the 10-item Pros and Cons subscales of the SDB demonstrate high internal consistency (Cronbach's alpha = .87 [Pros] and .90 [Cons]). Summary scores for both the Pros and Cons subscales, and then the Cons summary score were subtracted from the Pros summary score to yield a measure of the importance of the Pros of smoking relative to the Cons. Summary scores of the Pros and Cons subscales of the DBS have shown predictive validity for future smoking, and have been associated with Stage of Change, with smokers in earlier Stages of change reporting more Pros of smoking, and those in later Stages of Change reporting more Cons of smoking (Velicer et al., 1985).

Cigarette purchase task.

Purchase tasks are hypothetical tasks which generate several measures of the relative reinforcing efficacy of a drug. All purchase tasks are similar in structure in that they ask participants how much of an explicit quantity of a drug they would purchase at escalating prices. This study utilized a cigarette purchase task described by Murphy et al. (2011) that was an iteration of purchase tasks developed by

MacKillop et al. (2008) and Jacobs and Bickel (1999). Participants were first provided an instructional set for the task:

"Imagine a TYPICAL DAY during which you smoke. The following questions ask how many cigarettes you would consume if they cost various amounts of money. The available cigarettes are your favorite brand. Assume that you have the same income/savings that you have now and NO ACCESS to any cigarettes/nicotine products other than those offered at these prices. In addition, assume that you would consume cigarettes that you request on that day; that is, you cannot save or stockpile cigarettes for a later date. Please respond to these questions honestly."
Participants were then asked to respond to the following question: "*How many cigarettes would you smoke if they were __ each?*" at the following 25 prices in ascending order: zero (free), 1¢, 5¢, 13¢, 25¢, 35¢, 50¢, $1, $1.50, $2, $2.50, $3, $4, $5, $6, $7, $8, $9, $11, $35, $70, $140, $280, $560, $1120."

Cigarette Purchase Task data was to calculate five indices of demand reflecting the quantitative relationship between demand for cigarettes and escalating price: 1) breakpoint (first price at which cigarette consumption is zero; 2) demand intensity (cigarette consumption at the lowest price); 3) O_{max} (output maximum, or maximum financial expenditure on cigarettes); 4) P_{max} (price maximum, or price at which expenditure is maximized); and 5) elasticity of demand (sensitivity of cigarette consumption to increases in cost). For the first four of these estimates, observed values were used. To calculate the elasticity of cigarette demand, demand curves were estimated by fitting each participant's reported consumption across the range of prices to the exponential demand curve equation proposed by Hursh and Silberberg (2008) to produce derived elasticity of demand estimates: $\ln Q := \ln Q_0 + k(e^{-\alpha P} - 1)$. In this equation, Q is the quantity of cigarettes consumed, k specifies the range of the dependent variable (cigarette consumption) in logarithmic units, and α specifies the rate of change in consumption with changes in price (elasticity). The value of k is constant across all curve fits and was set at a value of 3.5. Individual differences in

elasticity are thereby scaled with a single parameter (α) which is standardized and independent of reinforcer magnitude. Larger α values reflect greater price sensitivity (elasticity). Demand curves were fit according to the Hursh and Silberberg (2008) guidelines using the calculator provided on the Institute for Behavioral Resources website (www.ibrinc.org/ibr/centers/bec/BEC demand.html). This nonlinear regression was used to generate an R^2 value, reflecting percentage of variance accounted for by the equation. When fitting the demand curve data, the first zero consumption value (i.e.,, breakpoint) was replaced by an arbitrarily low but nonzero value of .00001, which was necessary for the logarithmic transformations and is consistent with recommendations in the literature (i.e., Jacobs and Bickel, 1999). No other subsequent consumption values of zero will be included in estimation of demand curves. Derived and observed estimates of cigarette demand have shown good concurrent and divergent validity and are consistent with drug self-administration laboratory studies (MacKillop, Murphy, Ray, Eisenberg, Lisman, Lum, Wilson, 2008). Some authors have noted relatively poor fit of the demand curve equation for data from participants whom smoke lightly and more quickly reach a price where they would not purchase any cigarettes (observed with adolescent smokers; Murphy, MacKillop, Tidley, Brazil, Colby, 2011). Consistent with other analyses of cigarette purchase task data and recommendations of Tabachnick & Fidell (2007), outliers defined as $Z > 3.29$ were recoded as one unit above the next highest nonoutlying value (Mackillop et al., 2012; Mackillop et al., 2008; Murphy et al., 2011).

Procedure

Recruitment and informed consent.

Recruitment procedures were roughly similar across all recruitment venues. Prospective participants saw advertisement announcing a research study looking for individuals who smoke cigarettes. Those prospective participants interested in the study were directed to follow a hyperlink to the survey site. There, participants were presented with informed consent documentation. Individuals provided consent to participate in the research by clicking “Agree” or “Disagree” at the bottom of the webpage containing the informed consent information.

Eligibility screening and survey questionnaires.

Following consent to participate in the study, participants completed the smoking history and demographic questionnaire to ensure eligibility for participation in the study. Participants not eligible for participation were directed to a page thanking them for their interest in the study. Eligible participants continued with the study and then completed the Contemplation ladder, the Smoking Decisional Balance Scale, and finally the Cigarette Purchase Task. After completing these measures, participants were directed to follow a link to the smoking IAT on the Inquisit Web servers. After completion of the IAT, participants were thanked for their participation.

Analysis

Descriptive analyses were used to assess participant characteristics.

Hypothesis 1.

To test the hypothesis of an association between implicit smoking attitudes and smoking decisional balance considerations dependent upon smokers' motivation to change an ordinary least squares (OLS) multiple regression analysis was conducted. Of interest was the regression of the interaction term between implicit smoking attitudes and smokers' motivation to change on decisional balance considerations (pros and cons separately). Aiken and West (1991) advocated use of the simple slopes approach for testing and examining significant interactions whereby meaningful values of the moderator are chosen (typically the mean $\pm$ 1SD) and significance of the interaction terms at these values is examined. Another approach for examining interaction effects involves seeking values of the moderator at which the regression coefficient of the outcome of interest on the independent variable is significant, also called the Johnson-Neyman (J-N) technique after it's originators (Johnson & Neyman, 1936). This method results in a *region of significance* or a range of values at which the moderator is significant. The J-N technique approach was used to probe significant moderators for this first hypothesis.

Hypothesis 2.

To test for the presence of the moderated mediation relationship (or conditional indirect effect) described in Hypothesis 2, the recommendations for testing and examining such effects described by Preacher, Rucker & Hayes (2007) will be followed. These authors describe several methods for testing conditional indirect effects within an OLS regression or SEM framework, including extensions of the second order delta method to derive standard errors of an indirect effect with

which confidence intervals can be created, as well as using bootstrapping to construct asymmetric confidence intervals of the indirect effect. Although more computationally intensive, the authors advocate the use of bootstrapped confidence intervals to test the significance of estimates of conditional indirect effects. Bootstrapped confidence intervals were used in this study because they do not require the assumption of normally distributed standard errors of conditional indirect effects. Because mediated effects are often non-normally distributed, bootstrapping is preferred. Secondly, bootstrapping has exhibited stronger statistical power to detect mediated effects under simulation conditions (Preacher, Rucker, & Hayes, 2007). Because statistical power is of concern to this study, bootstrapping is preferred to the traditional Sobel test of mediated effects, which have been criticized for being overly conservative and likely to reject significant mediated effects detected by other methods such as bootstrapping (Mackinnon, Lockwood, Hoffman, West, & Sheets, 2002). To conduct this analysis, the PROCESS SPSS macro described by Preacher, Rucker & Hayes (2007) and available on the personal website of Kristopher Preacher at www.quantpsy.org will be used. It should be noted that because indirect effects of the cigarette purchase task on implicit smoking attitudes through decisional balance considerations are hypothesized to be conditional upon the moderator, motivation to change, the traditional steps advocated by Baron and Kenny (1986) of establishing indirect effects are not necessary because they should be found only at certain levels of the moderator. In the event that no moderation effect is found in Hypothesis 1, that interaction term will be dropped in Hypothesis 2 and only the mediated effect will be examined.

Results

Recruitment and Enrollment

A description of the recruitment process and number of participants meeting inclusion criteria is depicted in Figure 3. A total of $N = 7,216$ people visited the study web page and viewed the consent form. Only 20.4%, $n = 1,477$, of those who viewed the form consented to participate. Of those $n = 1,477$,who consented to participate, $n = 253$ had missing data on at least one screening question and were thus excluded. More than half (53%, $n = 788$) of those who consented to participate completed all screening questions, met criteria for inclusion, and completed some portion of the survey. The reasons for participants not meeting inclusion criteria were: not using a computer with a Windows operating system, $n = 182$; smoking less than 5 cigarettes per day, $n = 168$; were not native speakers of English, $n = 90$; had quit smoking either recently or in the past, $n = 53$; when asked how often they smoked responded "Not at all," $n = 48$; were not 18 years of age, $n = 20$.

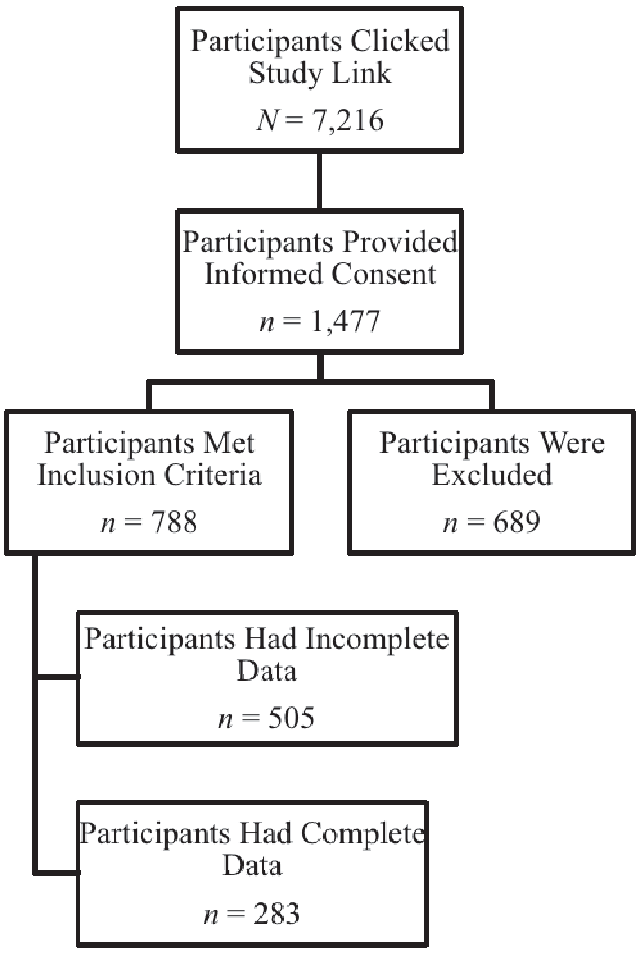

Figure 3. Flowchart of participant recruitment.

Thirty-six percent (36%, $N = 283$) of consented participants meeting inclusion criteria provided complete data. Sixty-four percent (64.1%) of consented participants meeting inclusion criteria were missing data on at least one measure; the IAT was overwhelmingly the most commonly missing data with $n = 502$ (63.7% of consented participants meeting inclusion criteria), likely due to problematic linking between the survey items and the IAT procedure, incompatible computer requirements, or problematic responding (either too fast or too slow responses). Those with lower educational attainment and reporting race other than White were more likely to be missing IAT data. Participants missing IAT data were older on average than their

counterparts with complete IAT data, reported lower average Contemplation Ladder scores, and reported heavier consumption across Cigarette Purchase Task indices, with the exception of Elasticity of demand. Participants with missing IAT data did not differ in their ratings of the Smoking Decisional Balance, and did not differ by gender from participants with complete IAT data.

Participant Characteristics

Descriptive characteristics of the final sample of participants providing valid data $N = 283$ are presented in Table 1. The average age of participants was 35.93 years of age ($SD = 14.24$). The sample was majority female (54.09%), White without Hispanic, Latino, or Spanish descent (82.29%), and had completed at least some college (63.25%). The smoking characteristics of the sample were consistent with regular, heavy smokers. Participants smoked on average of 29.56 days ($SD = 2.19$) out of the past thirty days, and smoked an average of 18.71 cigarettes ($SD = 8.20$) per day. Seventy-nine percent (79.51%) of participants smoked their first whole cigarette prior to age 18, more than half (58.30%) had been asked by a doctor whether they smoked cigarettes in the past year, and eighty percent (80.57%) of participants reported that at least two of their four closest friends were smokers. Sixty-five percent (65.02%) of participants smoked their first cigarette within 30 minutes after waking, and more than half (54.42%) had made at least one quit attempt in the past year. Using that staging algorithm to classify participants into Stages of Change for smoking cessation, twenty-five percent (25.44%) of participants were in the Precontemplation stage, sixty percent (60.42%) were in the Contemplation stage, and fourteen percent (14.13%) were in the Preparation stage for smoking cessation.

Participants reported mean Readiness Ruler scores of 4.91 (*SD* = 2.90), consistent with the ambivalence that is characteristic of smokers in the Contemplation stage who comprised the majority of the sample. Also consistent with characteristics of smokers contemplating change, participants reported slightly more Pros of smoking, *M* = 3.06, *SD* = 0.86, than Cons of smoking, *M* = 2.88, *SD* = 1.05. Participants exhibited a slightly negative average implicit smoking attitude of -.18 (*SD* = 0.58), which is consistent with other studies using the IAT to measure implicit smoking attitudes.

Table 1.
Characteristics of the Sample (N=283)

Variables	*n or M*	*% or SD*	*Minimum*	*Maximum*	*Skew*	*Kurtosis*
Gender (Female)	152	54.09%				
Age	35.93	14.24	18.02	68.52	.46	-1.06
Education level						
Less than H.S.	11	3.89%				
H.S. graduate or GED	93	32.86%				
Some college completed	121	42.76%				
College graduate	46	16.25%				
Post-graduate degree	12	4.24%				
Race/Ethnicity						
White without Hispanic, Latino or Spanish descent	223	82.29%				
White with Hispanic, Latino or Spanish descent	13	4.79%				
Black/African American	19	7.01%				
Asian, American Indian, Native Hawaiian or Pacific Islander	16	5.91%				
Number of cigarettes per day	18.71	8.20	6	32	.24	-1.00
Readiness	4.91	2.90	0	10	-.16	-.90
Pros of smoking	3.06	0.86	1	5	-.04	-.55
Cons of smoking	2.88	1.05	1	5	.06	-.94
Stage of smoking cessation						
Precontemplation	72	25.44%				
Contemplation	171	60.42%				
Preparation	40	14.13%				
Implicit attitude toward smoking (IAT D)	-0.18	0.58	-1.39	1.18	.09	-.82
Elasticity	.005	.008	.00	.06	3.10	12.78
Breakpoint	80.78	247.12	1	1120	3.78	13.00
Intensity	44.91	37.51	5	100	.66	-1.35
O_{max}	529.92	1704.66	1	9750	4.29	18.51
P_{max}	69.59	250.91	1	1120	3.92	13.67

Cigarette purchase task demand indices also exhibited responses consistent with behaviors of smokers contemplating change. The average price where participants would purchase no cigarettes, or breakpoint, was $80.78 (*SD* = $247.12). The average number of cigarettes that would be purchased by participants at the lowest price (free), or intensity, was 44.91 cigarettes (*SD* = 37.51). The sensitivity of cigarette purchase to price, or the elasticity of demand, was .005 (*SD* = .008). The average maximum monetary expenditure on cigarettes was $529.92 (*SD* = $1,704.66). The average price where monetary expenditure was maximized was $69.59 (*SD* = $250.91). Taken together, these average demand indices are consistent with heavy smokers.

Pearson correlation coefficients were calculated to estimate the bivariate relations between study variables and are presented in Table 2. Readiness to change was negatively related to both implicit smoking attitudes and the Pros for smoking, and was positively related to Cons for smoking. Additionally, implicit smoking attitudes were positively related to Pros for smoking and were negatively related to Cons for smoking. Pros of smoking were positively related to two cigarette purchase task indices, Intensity of demand and Omax. Cons for smoking were negatively related to the Breakpoint and positively related to Intensity. Among the cigarette purchase task indices, elasticity of demand was negatively related to Breakpoint, Intensity, Pmax, and Omax. Breakpoint was positively related to Pmax and Omax. Intensity was positively related to Omax. Pmax and Omax were positively correlated.

Table 2.

Bivariate Relations Among Study Variables

	1	2	3	4	5	6	7	8	9
1. Readiness for change	1.00								
2. Implicit smoking attitudes	-0.17**	1.00							
3. Pros for smoking	-0.19**	0.15*	1.00						
4. Cons for smoking	0.55**	-0.21**	0.08	1.00					
5. Alpha	0.07	-0.07	-0.07	0.03	1.00				
6. Breakpoint	-0.06	-0.01	0.11	-0.13*	-0.19**	1.00			
7. Intensity	-0.03	0.04	0.21**	0.19**	-0.24**	0.07	1.00		
8. Pmax	-0.04	-0.01	0.10	-0.09	-0.17**	0.82**	0.004	1.00	
9. Omax	-0.06	-0.03	0.15*	-0.05	-0.19**	0.66**	0.16**	0.73**	1.00

*=$p<.05$; **=$p<.01$

Results for Hypothesis 1

Two separate multiple regressions were performed with Pros for smoking and Cons for smoking as the dependent variables and Readiness for change, implicit smoking attitudes, and their interaction as independent variables. Predictors were mean centered prior to creation of the interaction term to facilitate interpretation. Results for the multiple regressions are presented in Table 3.

Table 3.
Ordinary Least Squares Regression Model Coefficients for Hypothesis 1 (N=283)

	Cons of Smoking					Pros of Smoking				
	Unstandardized beta (*B*) (SE)	95% CI		*t* or F	*p*	Unstandardized beta (*B*) (SE)	95% CI		*t* or F	*p*
Readiness	0.19 (0.02)	0.16,	0.23	10.62	<0.01	-0.05 (0.02)	-0.08,	-0.02	-2.85	<0.01
IAT *D*	-0.21 (0.09)	-0.39,	-0.03	-2.30	0.02	0.17 (0.09)	-0.001,	0.35	1.96	0.05
Readiness by IAT *D*	-0.03 (0.03)	-0.09,	0.03	-0.93	0.35	-0.04 (0.03)	-0.09,	0.02	-1.34	0.18
R^2	0.32			43.55	<0.01	0.06			5.53	<0.01

For the Cons for smoking, the regression of the set of predictors was significant, $F(3, 279) = 43.55$, $p < .001$. The R^2 value of .32 indicates that 32% of the variability in participants' scores on the Cons for smoking subscale of the Smoking Decisional Balance Scale was predicted by Readiness for change, implicit smoking attitudes, and the interaction between Readiness and implicit smoking attitudes. Table 3 provides a summary of the relative importance of the individual predictors. Readiness for change, $B = 0.19$, $t(279) = 10.62$, $p < .001$, 95% CI [0.16, 0.23], and implicit smoking attitudes, $B = -0.21$, $t(279) = -2.30$, $p < .05$, 95% CI [-0.39, -0.03] were significant predictors. It was hypothesized that there would be a significant interaction between implicit smoking attitudes and Readiness for change on Cons for smoking. However, the test of the overall interaction between implicit smoking attitudes and Readiness for change on Cons for smoking was not significant, $B = -0.03$, $t(279) = -0.93$, $p = .35$, 95% CI [-0.09, 0.03].

The regression coefficients indicate that as average Readiness for change increased so did the Cons for smoking. Conversely, as participants' average implicit smoking attitudes became more positive, they reported less Cons for smoking. The null finding for the interaction between Readiness for change and implicit smoking attitudes in predicting the Cons for smoking suggests that Readiness for change and implicit smoking attitudes are significant, yet independent predictors of negative smoking decisional balance considerations.

The regression of the set of predictors for Pros for smoking was also significantly different from zero, $F(3, 279) = 5.53$, $p < .01$. Six percent (6%) of the variance in participants' scores on the Pros for smoking subscale of the Smoking

Decisional Balance Scale was predicted by Readiness for change, implicit smoking attitudes, and the interaction between Readiness and implicit smoking attitudes. As with the Cons for smoking, Readiness for change, B = -0.05, $t(279)$ = -2.85, p <.001, 95% CI [-0.08, -0.02], and implicit smoking attitudes, B = 0.17, $t(279)$ = 1.96, p =.05, 95% CI [-0.001, 0.35], were significant predictors of the Pros for smoking, yet the interaction between Readiness for change and implicit smoking attitudes did not predict Pros for smoking, B = -0.04, $t(279)$ = -1.34, p = .18, 95% CI [-0.09, 0.02].

Readiness for change was negatively related to Pros for smoking such that as average Readiness for change increased the Pros for smoking decreased. As with prediction of the Cons for smoking, the inverse was found for implicit smoking attitudes such that as average implicit smoking attitudes became more positive participants reported more Pros for smoking. Readiness for change and implicit smoking attitudes appear to be significant, independent predictors of the Pros for smoking given the lack of prediction of their interaction.

Taken together, these results indicated that hypothesis one was only partially supported. Though implicit smoking attitudes and Readiness for change were significant predictors of smoking decisional balance considerations, their interaction was not significant, indicating that the effects of implicit smoking attitudes on explicit decisional balance considerations were independent of the effects of Readiness for change. Because the second hypothesis for this research was to examine the indirect effects of implicit smoking attitudes on participants' responses on the hypothetical smoking purchase task conditional on their readiness for change, the decision was made to modify this hypothesis to examine the indirect effects of implicit smoking

attitudes on cigarette purchase task indices controlling for the independent effects of Readiness for change.

Table 4.

Ordinary Least Squares Regression Model Coefficients for Hypothesis 1 Without Interaction Term (N=283)

	Cons of Smoking				Pros of Smoking			
	Unstandardized beta (*B*) (SE)	95% CI	*t* or F	*p*	Unstandardized beta (*B*) (SE)	95% CI	*t* or F	*p*
Readiness	0.19 (0.02)	0.16, 0.23	10.61	<0.01	-0.05 (0.02)	-0.09, -0.02	-2.86	<0.01
IAT *D*	-0.21 (0.09)	-0.38, -0.03	-2.25	0.03	0.18 (0.09)	0.01, 0.35	2.02	<0.05
R^2	0.32		64.91	<0.01	0.05		7.38	<0.01

Results for Hypothesis 2

Because the moderating effect of Readiness for change on the relation between implicit smoking attitudes and decisional balance considerations was not supported, the indirect effect of implicit smoking attitudes on cigarette purchase task indices through decisional balance considerations was estimated excluding the interaction term with Readiness for change. For completeness, the results of regressions of Pros and Cons for smoking on implicit smoking attitudes and Readiness for change without their interaction are presented in Table 4. No substantive differences in terms of the overall model test and regression coefficients for implicit smoking attitudes and Readiness for change were observed between the results of the regressions including and excluding the interaction term of implicit smoking attitudes and Readiness for change.

Consistent with the proposed analyses, the indirect effects (effects that are mediated) of implicit smoking attitudes on cigarette purchase task indicators through the Pros and Cons for smoking were estimated by regressing the cigarette purchase task indicators on implicit smoking attitudes, Readiness for change, and the Pros and Cons for smoking. Results of these regressions are summarized separately in Tables 5, 7, 9, 11, and 13. Per the analysis method chosen to test the mediated effects, bootstrapped 95% confidence intervals (5,000 resamples; results did not differ when resamples were increased to 50,000) were constructed around the estimates for the mediated (indirect) effects. Summaries of the direct, indirect (mediated through the Pros and Cons for smoking), and total (combined direct and indirect) effects of

implicit smoking attitudes on the cigarette purchase task indices are presented in Tables 6, 8, 10, 12, and 14.

Breakpoint.

Results for the prediction of Breakpoint are presented in Table 5. The overall regression of Breakpoint on the set of predictors was significant, $F(4, 278) = 2.70$, $p = .03$, and accounted for four percent (4%) of the variance in Breakpoint. Neither Readiness for change, $B = 5.18$, $t(278) = 0.83$, $p = .41$, 95% CI [-7.16, 17.52], nor implicit smoking attitudes, $B = -26.89$, $t(278) = -1.03$, $p = .30$, 95% CI [-78.08, 24.30], directly predicted Breakpoint scores. However, both the Pros for smoking, $B = 41.20$, $t(278) = 2.32$, $p = .02$, 95% CI [6.19, 76.22], and Cons for smoking, $B = -44.25$, $t(278) = -2.56$, $p = .01$, 95% CI [-78.22, -10.27], significantly predicted Breakpoint scores. Pros for smoking were positively related to Breakpoint such that as participants reported more favorable evaluations of smoking they also reported that they would continue to purchase cigarettes at higher prices. Conversely, the Cons for smoking were negatively related to Breakpoint such that as participants reported seeing more negative aspects of smoking they also reported that they would stop purchasing cigarettes at lower prices.

Table 5.
Ordinary Least Squares Regression Model Coefficients for Hypothesis 2 Predicting Breakpoint (N=283)

	Unstandardized beta (*B*) (SE)	95% CI	*t* or F	*p*
Readiness	5.18 (6.27)	-7.16, 17.52	0.83	0.41
IAT *D*	-26.89 (26.01)	-78.08, 24.30	-1.03	0.30
Pros of Smoking	41.20 (17.89)	6.19, 76.22	2.32	0.02
Cons of Smoking	-44.25 (17.26)	-78.22, -10.27	-2.56	0.01
R^2	0.04		2.70	0.03

A summary of mediated effects predicting Breakpoint is presented in Table 6. The overall effect of implicit smoking attitudes on Breakpoint was not significant, c = -10.46, $p > .05$. However, the total indirect effect of implicit smoking attitudes on Breakpoint through the Pros and Cons for smoking was significantly different from zero, c' = 16.43, $p < .05$, such that as implicit smoking attitudes became more positive they indirectly were associated with higher prices at which participants would continue to purchase cigarettes. The indirect effect of implicit smoking attitudes on Breakpoint through the Pros of smoking was significant, ab = 7.36, $p <$ .05, and indicated as with total indirect effect, that more positive implicit smoking attitudes were indirectly related to higher Breakpoint through the Pros for smoking. The indirect effect of implicit smoking attitudes through the Cons for smoking was also significant, ab = 9.07, $p < .05$, and positive. Comparing the indirect effects of implicit smoking attitudes on Breakpoint through the Pros and Cons for smoking revealed that the indirect effect of implicit smoking attitudes through the Pros for

smoking was significantly less (*ab* = -1.71, $p < .05$) than the indirect effect of implicit smoking attitudes on Breakpoint through the Cons for smoking.

Table 6.
Total, Direct, and Indirect Effects of Implicit Smoking Attitudes Predicting Breakpoint (N=283)

	Estimate	*SE*	*LLCI*	*ULCI*
Total Effect	-10.46	25.80	-61.25	40.33
Direct Effect	-26.89	26.01	-78.08	24.30
Overall Indirect Effect	16.43*	7.83	5.08	37.74
→Pros of Smoking	7.36*	5.92	0.14	25.35
→Cons of Smoking	9.07*	5.23	1.79	23.82
Contrast Pros minus Cons	-1.71	7.97	-16.23	16.03

Note: Direct effects are estimates of the effect of Implicit Smoking Attitudes on Breakpoint from the full model presented in Table 5. Indirect effects are the mediated effects of Implicit Smoking Attitudes on Breakpoint through Smoking Decisional Balance

Intensity.

Results for the prediction of Intensity are presented in Table 7. The overall regression of intensity of cigarette demand (number of cigarettes that would be purchased if free) on implicit smoking attitudes, Readiness for change, Pros and Cons for smoking was significant, $F(4, 278) = 6.59$, $p < .001$, and accounted for nine percent (9%) of the variance in Intensity. Implicit smoking attitudes were not directly related to intensity of demand, $B = 2.85$, $t(278) = 0.74$, $p = .46$, 95% CI [-4.72, 10.42]. Readiness for change was marginally related to intensity of demand, $B = -1.78$, $t(278) = -1.92$, $p = .06$, 95% CI [-3.60, 0.05]. Both the Pros for smoking, $B = 6.74$, ($t(278) = 2.56$, $p = .01$, 95% CI [1.57, 11.92], and Cons for smoking, $B = 9.21$, $t(278) = -2.56$, $p = .01$, 95% CI [4.19, 14.23], predicted higher intensity.

Table 7.
Ordinary Least Squares Regression Model Coefficients for Hypothesis 2 Predicting Intensity (N=283)

	Unstandardized beta (*B*) (SE)	95% CI	*t* or F	*p*
Readiness	-1.78 (0.93)	-3.60, 0.05	-1.92	0.06
IAT *D*	2.85 (3.85)	-4.72, 10.42	0.74	0.46
Pros of Smoking	6.74 (2.63)	1.57, 11.92	2.56	0.01
Cons of Smoking	9.21 (2.55)	4.19, 14.23	3.61	<0.01
R^2	0.09		6.59	<0.01

A summary of mediated effects predicting Intensity is presented in Table 8. The overall effect (direct and indirect effects) of implicit smoking attitudes on intensity was not significant, $c = 2.17$, $t(278) = 0.55$, $p = .58$. The total indirect effect of implicit smoking attitudes on intensity of cigarette demand through the Pros and Cons for smoking was also not significantly different from zero, $c' = -0.68$, $p > .05$. However, the mediated effect of implicit smoking attitudes on intensity of demand through the Pros of smoking was significant, $ab = 1.20$, $p < .05$, and indicated that more positive implicit smoking attitudes were predicted greater intensity of cigarette demand when mediated by the Pros for smoking. The indirect effect of implicit smoking attitudes through the Cons for smoking was also significant, $ab = -1.89$, $p < .05$. However the effect was in the opposite direction from the mediated effect of implicit smoking attitudes through the Pros for smoking such that more positive implicit smoking attitudes predicted less intense cigarette demand when mediated the Cons for smoking. Comparing the mediated effects of implicit smoking attitudes on intensity of demand through the Pros and Cons for smoking revealed that the indirect effect of implicit smoking attitudes through the Pros for smoking was significantly

different (difference in effect *ab* = 3.09, $p < .05$) than the indirect effect of implicit smoking attitudes on intensity of demand through the Cons for smoking. This significant difference in the indirect effects, along with the opposite direction of these effects, helps to explain why the overall indirect effect was not significant despite significant independent indirect effects.

Table 8.
Total, Direct, and Indirect Effects of Implicit Smoking Attitudes Predicting Intensity (N=283)

	Estimate	*SE*	*LLCI*	*ULCI*
Total Effect	2.17	3.92	-5.55	9.88
Direct Effect	2.85	3.85	-4.72	10.42
Overall Indirect Effect	-0.68	1.39	-3.41	2.12
→Pros of Smoking	1.20*	0.78	0.07	3.32
→Cons of Smoking	-1.89*	0.97	-4.39	-0.39
Contrast Pros minus Cons	3.09*	1.09	1.24	5.54

Note: Direct effects are estimates of the effect of Implicit Smoking Attitudes on Intensity from the full model presented in Table 7. Indirect effects are the mediated effects of Implicit Smoking Attitudes on Intensity through Smoking Decisional Balance

Pmax.

Results for the prediction of Pmax are presented in Table 9. The regression of Pmax on Readiness for change, implicit smoking attitudes and the Pros and Cons for smoking was not significant, $F(4, 278) = 1.77$, $p = .14$, and accounted for three percent (3%) of the variance in the price where financial expenditure on cigarettes was maximized. Neither the direct effect of implicit smoking attitudes, $B = -20.57$, $t(278) = -0.77$, $p = .44$, 95% CI [-77.89, 31.74], nor Readiness for change, $B = 4.54$, $t(278) = 0.71$, $p = .48$, 95% CI [-8.07, 17.15], was significantly related to the price at which expenditure was maximized. Pros for smoking, $B = 38.21$, ($t(278) = 2.10$, p

=.05, 95% CI [2.43, 74.00], were related to the price at which expenditure on cigarettes was maximized, indicating that as participants viewed more positive aspects of cigarette smoking they also reported higher prices at which their financial expenditure on cigarettes would be maximized. However, the Cons for smoking, B = -33.74, $t(278)$ = -1.91, p =.06, 95% CI [-68.46, 0.98], were marginally related to the price maximization.

Table 9.
Ordinary Least Squares Regression Model Coefficients for Hypothesis 2 Predicting Pmax (N=283)

	Unstandardized beta (B) (SE)	95% CI	t or F	p
Readiness	4.54 (6.40)	-8.07, 17.15	0.71	0.48
IAT D	-20.57 (26.58)	-77.89, 31.74	-0.77	0.44
Pros of Smoking	38.21 (18.18)	2.43, 74.00	2.10	0.04
Cons of Smoking	-33.74 (17.64)	-68.46, 0.98	-1.91	0.06
R^2	0.03		1.77	0.14

A summary of mediated effects predicting Pmax is presented in Table 10. The overall effect (direct and indirect effects) of implicit smoking attitudes on price maximization was not significant, c = -6.83, t(278) = -0.26, p = .79. The total indirect effect of implicit smoking attitudes on prices at which their financial expenditure on cigarettes would be maximized through the Pros and Cons for smoking was significantly different from zero, c' = 13.74, $p < .05$. The significant mediated effect of implicit smoking attitudes on price maximization through the Pros and Cons of smoking indicates that as participants reported more positive implicit attitudes about smoking they also reported higher prices at which their financial expenditure on cigarettes would be maximized through the Pros and Cons for smoking. However,

only the indirect effect of implicit smoking attitudes on price maximization through the Cons of smoking was significant, $ab = 6.91$, $p < .05$, indicating that more positive implicit smoking attitudes were indirectly related to higher prices at which financial expenditure on cigarettes would be maximized through the Cons for smoking. The indirect effect of implicit smoking attitudes through the Pros for smoking was not significant, $ab = 6.82$, $p > .05$. Comparing the indirect effects of implicit smoking attitudes on price maximization through the Pros and Cons for smoking revealed that the indirect effects of implicit smoking attitudes through the Pros for smoking were not significantly different (difference in effect $ab = -0.09$, $p > .05$) than the indirect effect of implicit smoking attitudes through the Cons for smoking. In other words, there was no difference in the mediated effect of implicit smoking attitudes on price maximization through the Pros of smoking that through the Cons of smoking.

Table 10.
Total, Direct, and Indirect Effects of Implicit Smoking Attitudes Predicting Pmax (N=283)

	Estimate	*SE*	*LLCI*	*ULCI*
Total Effect	-6.83	26.23	-58.45	44.79
Direct Effect	-20.57	26.58	-72.89	31.74
Overall Indirect Effect	13.74*	7.89	2.18	34.79
→Pros of Smoking	6.82	5.57	-0.01	25.04
→Cons of Smoking	6.92*	5.24	0.17	22.13
Contrast Pros minus Cons	-0.09	7.40	-14.73	15.89

Note: Direct effects are estimates of the effect of Implicit Smoking Attitudes on Pmax from the full model presented in Table 9. Indirect effects are the mediated effects of Implicit Smoking Attitudes on Pmax through Smoking Decisional Balance

Omax.

Results for the prediction of Omax are presented in Table 11. The regression of Omax on Readiness for change, implicit smoking attitudes and the Pros and Cons for smoking was not significant, $F(4, 278) = 2.09$, $p = .08$, and accounted for three percent (3%) of the variance in the maximum financial expenditure on cigarettes. Neither the direct effect of implicit smoking attitudes, $B = -194.04$, $t(278) = -1.08$, $p = .28$, 95% CI [-584.67, 160.59], nor Readiness for change, $B = 4.69$, $t(278) = 0.11$, $p = .91$, 95% CI [-80.77, 90.15], was significantly related to the price at which expenditure was maximized. Pros for smoking, $B = 322.66$, ($t(278) = 2.62$, $p < .01$, 95% CI [80.11, 565.21], were related to the maximum expenditure on cigarettes, indicating that as participants viewed more positive aspects of cigarette smoking they also showed greater maximum financial expenditure on cigarettes. However, the Cons for smoking, $B = -130.41$, $t(278) = -1.09$, $p = .28$, 95% CI [-365.76, 104.94], were not related to the maximum financial expenditure on cigarettes.

Table 11.
Ordinary Least Squares Regression Model Coefficients for Hypothesis 2 Predicting Omax (N=283)

	Unstandardized beta (*B*) (SE)	95% CI	*t* or F	*p*
Readiness	4.69 (43.41)	-80.77, 90.15	0.11	0.91
IAT *D*	-194.04 (180.15)	-584.67, 160.59	-1.08	0.28
Pros of Smoking	322.66 (123.21)	80.11, 565.21	2.62	<0.01
Cons of Smoking	-130.41 (119.56)	-365.76, 104.94	-1.09	0.28
R^2	0.03		2.09	0.08

A summary of mediated effects predicting Omax is presented in Table 12. The overall effect (direct and indirect effects) of implicit smoking attitudes on maximum

expenditure was not significant, c = -109.69, t(278) = -0.61, p = .54. The total indirect effect of implicit smoking attitudes on maximum financial expenditure on cigarettes through the Pros and Cons for smoking was significantly different from zero, c' = 84.35, $p < .05$, indicating that as participants reported more positive implicit attitudes about smoking they also exhibited greater maximum financial expenditure on cigarettes through the Pros and Cons for smoking. However, only the indirect effect of implicit smoking attitudes on maximum financial expenditure through the Pros of smoking was significant, ab = 57.62, $p < .05$, indicating that more positive implicit smoking attitudes were indirectly related to greater maximum financial expenditure on cigarettes through the Pros for smoking. The indirect effect of implicit smoking attitudes through the Cons for smoking was not significant, ab = 26.73, $p > .05$. Comparing the indirect effects of implicit smoking attitudes on maximum financial expenditure on cigarettes through the Pros and Cons for smoking revealed that the indirect effects of implicit smoking attitudes through the Pros for smoking were not significantly different (difference in effect ab = 30.89, $p > .05$) than the indirect effect of implicit smoking attitudes through the Cons for smoking.

Table 12.
Total, Direct, and Indirect Effects of Implicit Smoking Attitudes Predicting Omax (N=283)

	Estimate	*SE*	*LLCI*	*ULCI*
Total Effect	-109.69	177.95	-459.99	240.60
Direct Effect	-194.04	180.15	-584.67	160.59
Overall Indirect Effect	84.35*	54.56	7.45	237.28
→Pros of Smoking	57.62*	41.54	3.13	183.05
→Cons of Smoking	26.73	30.84	-12.39	116.60
Contrast Pros minus Cons	30.89	48.74	-60.07	137.27

Note: Direct effects are estimates of the effect of Implicit Smoking Attitudes on Omax from the full model presented in Table 9. Indirect effects are the mediated effects of Implicit Smoking Attitudes on Omax through Smoking Decisional Balance

Elasticity.

Results for the prediction of Elasticity are presented in Table 13. The regression of price sensitivity, or elasticity, on Readiness for change, implicit smoking attitudes and the Pros and Cons for smoking was not significant, $F(4, 278) = 0.76$, $p = .55$, and accounted for one percent (1%) of the variance in price elasticity of demand. Neither implicit smoking attitudes, $B = -0.0007$, $t(278) = -0.78$, $p = .44$, 95% CI [-.002, .001], Readiness for change, $B = 0.0001$, $t(278) = 0.62$, $p = .54$, 95% CI [-.0003, .0005], or the Pros, $B = -0.0005$, $t(278) = -0.93$, $p = .35$, 95% CI [-.001, .006], or Cons, $B = -0.0000$, $t(278) = 0.05$, $p = .96$, 95% CI [-.001, .001], were related to elasticity of demand.

Table 13.
Ordinary Least Squares Regression Model Coefficients for Hypothesis 2 Predicting Elasticity (N=283)

	Unstandardized beta (*B*) (SE)	95% CI	*t* or F	*p*
Readiness	0.0001 (0.0002)	-.0003, .0005	0.62	0.54
IAT *D*	-0.0007 (0.0008)	-.002, .001	-0.78	0.44
Pros of Smoking	-0.0005 (0.0006)	-.001, .006	-0.93	0.35
Cons of Smoking	0.0000 (0.0006)	-.001, .001	0.05	0.96
R^2	0.01		0.76	0.55

A summary of mediated effects predicting Elasticity is presented in Table 14. The overall effect (direct and indirect effects) of implicit smoking attitudes on price elasticity of demand was not significant, c = -0.0008, t(278) = -0.92, p = .36. The total indirect effect of implicit smoking attitudes on elasticity of demand through the Pros and Cons for smoking was not significantly different from zero, c' = -0.0001, p > .05. The separate indirect effects of implicit smoking attitudes on elasticity of demand through the Pros of smoking (ab = -0.0001, p > .05) and Cons of smoking (ab = 0.0000, p > .05) were not significant. The indirect effects of implicit smoking attitudes through the Pros for smoking on elasticity of demand was not significantly different from the indirect effects through the Cons for smoking, ab = -0.0001, p > .05.

Table 14.
Total, Direct, and Indirect Effects of Implicit Smoking Attitudes Predicting Elasticity (N=283)

	Estimate	*SE*	*LLCI*	*ULCI*
Total Effect	-0.0008	0.0008	-0.002	0.0009
Direct Effect	-0.0007	0.0008	-0.002	0.001
Overall Indirect Effect	-0.0001	0.0002	-0.0004	0.0002
→Pros of Smoking	-0.0001	0.0001	-0.0004	0.0001
→Cons of Smoking	0.0000	0.0001	-0.0002	0.0002
Contrast Pros minus Cons	-0.0001	0.0002	-0.0005	0.0003

Note: Direct effects are estimates of the effect of Implicit Smoking Attitudes on Elasticity from the full model presented in Table 13. Indirect effects are the mediated effects of Implicit Smoking Attitudes on Elasticity through Smoking Decisional Balance

Discussion

Summary and Integration of Results

This study sought to understand how, if at all, implicit attitudes about smoking were related to the personal process of smoking cessation, and how they influence smoker's decision making in a hypothetical smoking purchase task. The present research sought to examine two main questions: 1) how do smokers' unconscious, or implicit attitudes about smoking affect conscious attitudes about smoking, and 2) how do implicit smoking attitudes differentially affect smokers' choices on a hypothetical cigarette purchase task depending on their Readiness to quit smoking? Taken as a whole, the results of this study indicate that smokers' attitudes about smoking that are outside of conscious awareness (implicit attitudes) are important predictors of both smokers' conscious attitudes about smoking (explicit attitudes) as well as smokers' choices on a hypothetical cigarette purchase task. This study examined the cognitive influences on the personal process of smoking cessation from a dual process model perspective that consists of an implicit or automatic process and an explicit or controlled process. Whereas the role of explicit cognition has been well established in the process of smoking behavior change, this study has demonstrated the utility of smoking related cognition outside of conscious awareness in predicting decision making about smoking, an important step in the cessation process

The present research provided mixed support for the hypothesis that implicit smoking attitudes would vary as a function of smokers' Readiness for change in predicting explicit decisional balance considerations. Implicit attitudes about smoking were significant predictors of explicit decisional balance considerations. As implicit

attitudes about smoking became more favorable towards smoking, smokers reported on average more favorable explicit attitudes (Pros of smoking) about smoking and fewer unfavorable explicit attitudes (Cons of smoking) about smoking. However, the effect of implicit smoking attitudes on explicit decisional balance considerations did not vary by smokers' motivational Readiness for change. Although implicit attitudes about smoking predicted the Pros and Cons of smoking as expected, implicit smoking attitudes did not interact with motivational Readiness to change in these predictions as hypothesized. Both implicit smoking attitudes and motivational Readiness to change independently influenced explicit decisional considerations.

The findings of this study also supported predictions for the second main focus of this research. The second aim of this study examined how implicit smoking attitudes, explicit smoking attitudes, and motivational Readiness influenced participants' reported demand for cigarettes using a hypothetical cigarette purchase task. Overall, decisional balance considerations (explicit smoking attitudes) were important predictors of smoker's responses on this smoking purchase task. Explicit decisional considerations of Pros and Cons for smoking had the greatest impact on the different dimensions of the purchase task. As smokers reported more advantages of continuing to smoke (Pros of smoking) they indicated that they would smoke more cigarettes if they were free (greater Intensity), that they would stop purchasing cigarettes at higher average prices (higher Breakpoint), that they would spend a greater amount of money on cigarettes overall (greater Omax), and would have a higher price at which their financial expenditure was maximized (greater Pmax). As smokers reported seeing more disadvantages or losses of continuing to smoke (Cons

of smoking) they reported on average that they would consume more cigarettes if they were free (higher Intensity), and indicated lower average prices at which they would stop purchasing cigarettes (lower Breakpoint). Neither implicit smoking attitudes nor motivational Readiness for change directly predicted choices on the hypothetical smoking purchase task, although Readiness to change was a borderline (p = .06) predictor of Intensity of demand.

This second aim also sought to examine the effects of implicit smoking attitudes on cigarette purchase task indices mediated by explicit decisional balance considerations. Consistent with predictions, there were no direct effects of implicit smoking attitudes on smokers' purchase task choices. However, implicit smoking attitudes did indirectly predict smoking purchase task choices when mediated by explicit smoking attitudes (Pros and Cons of smoking). The Pros and Cons of smoking together completely accounted for the relationship between implicit smoking attitudes and smokers' purchase task choice indicators Intensity and Breakpoint. More favorable implicit attitudes about smoking indirectly (through the combined effect of the Pros and Cons of smoking) predicted higher average prices at which smokers would stop purchasing cigarettes (higher Breakpoint), greater average financial expenditure on cigarettes (higher Omax), and higher average price at which expenditure was maximized (higher Pmax). Looking at the effect of implicit smoking attitudes on smoking purchase task indices through the Pros and Cons of smoking separately revealed different patterns of findings. The Pros of smoking alone completely accounted for the relationship between implicit smoking attitudes and smokers' Breakpoint, Intensity, and Omax. Through the Pros of smoking, more

favorable implicit attitudes about smoking predicted higher average prices at which smokers would stop purchasing cigarettes (higher Breakpoint), greater consumption of cigarettes if they were free (higher Intensity), and greater average financial expenditure on cigarettes (higher Omax). The Cons of smoking alone also completely accounted for the relationship between implicit smoking attitudes and smokers' Breakpoint and Intensity, but in a different pattern. Through the Cons of smoking, more favorable implicit attitudes about smoking predicted higher average prices at which smokers would stop purchasing cigarettes (higher Breakpoint), and less consumption of cigarettes if they were free (lower Intensity). The Cons of smoking also accounted for the relationship between implicit smoking attitudes and the average price at smokers' financial expenditure was maximized (Pmax). More favorable implicit attitudes about smoking predicted a higher average price at which financial expenditure on cigarettes was maximized (higher Pmax) through the Cons of smoking.

Explanations for Findings – Hypothesis 1

There are several potential explanations for the pattern of findings related to the first aim of this study, which examined whether Readiness for change and implicit smoking attitudes interacted in predicting explicit decisional balance considerations. The significant Pearson product-moment correlation coefficient suggested a small to medium positive relationship between implicit smoking attitudes and smokers' Readiness to change such that as implicit smoking attitudes became more positive smokers reported less Readiness for change. This suggests that implicit attitudes

about smoking and Readiness for change measure in a small way some common psychological process.

However, the interaction term between Readiness to change and implicit smoking attitudes in predicting explicit decisional balance considerations was not significant (p = .35 for predicting Cons of smoking and p = .18 for predicting the Pros of smoking). One explanation for this finding might be that in addition to Readiness to change, some third variable may be related to and interact with both Readiness and implicit attitudes about smoking. Readiness to change and implicit smoking attitudes predicted 32% of variance in the Cons for smoking and only 5% of variance in the Pros for smoking, indicating that the majority of smokers' ratings of the Pros and Cons for smoking are determined by factors not accounted for by these regression models. Although potential confounds were attempted to be accounted for and no other variables in this study were correlated with either Readiness to Change or implicit smoking attitudes, it is nevertheless likely that other variables not included in this study were important determinants of the interaction between Readiness to change and implicit smoking attitudes.

A second explanation for the lack of an interaction between implicit smoking attitudes and Readiness to change in predicting the Pros and Cons for smoking may be that the true nature of the relationship between implicit smoking attitudes and Readiness to change is different than those predicted. Although hypothesized to be interactive in nature, implicit smoking attitudes may simply be additive influences rather than interactive in nature. These results support the interpretation that both implicit smoking attitudes and Readiness for change are separately important

predictors of decisional balance considerations. The lack of finding a moderating influence of Readiness to change on the effect of implicit smoking attitudes on decisional balance considerations may signify that theoretical considerations for a moderating relationship are incorrect. Instead of interacting, implicit smoking attitudes and Readiness to change appear to be separate, yet related, additive influences on decisional balance considerations of the Pros and Cons for smoking.

Alternatively, the lack of an interaction between implicit smoking attitudes and Readiness may reflect the underlying construct measured by Readiness to change, rather than a true lack of interaction; in other words, there may simply have been no interaction between this measurement of Readiness and implicit smoking attitudes. Readiness is a multifaceted construct that in many ways is a summary of tasks to be accomplished across the stages of change. Instead of examining interactions between Readiness to change and implicit smoking attitudes, future studies may be better served to look for interactions between implicit smoking attitudes and the tasks underlying Readiness. For example, tasks associated with stage transitions may be an important third factor in understanding the role implicit attitudes have in predicting decision making. This study demonstrates that implicit smoking attitudes, Readiness to change, and decision making are related to stage tasks of awareness or concern about smoking as problematic. Although the Smoking Decisional Balance Scale measure asks about some of the most commonly endorsed benefits and detriments reported by smokers such as health concerns, and relieving stress, some smokers may weigh other Pros and Cons not queried more heavily, including cost of cigarettes, social stigma, or weight gain. Other stage related tasks including behavioral

intentions were not assessed, and studies of attitudes related to smoking cessation have found that decision making is related to intentions to smoke (Umeh & Barnes, 2011).

A third potential explanation for the finding that Readiness did not interact with implicit smoking attitudes may reflect the sample of this study more than the underlying theory being tested. The present study sought to recruit current smokers not currently attempting to quit. However, there was no attempt to enroll a sample of smokers with either equal or population representative relative to the smokers' stage of change for smoking cessation. The sample of the present study was composed primarily of smokers in the Contemplation stage (60.42%), followed by smokers in the Precontemplation (25.44%) and Preparations stages (14.13). Had a sample with more equal distribution of smokers across these three stages been recruited, the hypothesized interaction may have been found. Several studies that have examined the distribution of current smokers by stage of change have found roughly equal proportions of smokers in the Precontemplation and Contemplation stages (40%) and the remaining smokers (20%) in the Preparation stage (Velicer, Fava, Prochaska, Abrams, Emmons, Pierce, 1995; de Granda-Orive et al., 2004; Etter, Perneger, Ronchi, 1997). However, the sample of this study consisted mostly of smokers in the Contemplation stage, who likely experience a higher degree of ambivalence about their smoking than individuals in either the Precontemplation or Preparation stages. This ambivalence may have introduced just enough "noise" in the data to obscure the hypothesized finding. Conversely, implicit attitudes may be one explanation for the phenomenon of ambivalence. For example, when implicit attitudes are diametrically

opposed to explicit attitudes, the product of these conflicting cognitions may be the inaction characteristic of ambivalence about change. It's unclear whether there has been a shift in the population toward more smokers considering change (in Contemplation) or if this reflects some aspect of the recruitment process for this study.

A fourth and final explanation for the lack of interaction between implicit smoking attitudes and Readiness for change may be related to the test of the interaction term in the regression model. It may be that implicit smoking attitudes and Readiness for change do interact in affecting smoking decisional balance considerations, but not in a linear fashion as was the hypothesis tested by the regression model conducted. Perhaps implicit smoking attitudes and Readiness interact in a quadratic, or other nonlinear manner not tested by the hypothesis test of the regression coefficient. No such hypothesis was tested due to lack of theoretical basis for such a hypothesis. Nonetheless, it remains possible that an interaction exists between implicit smoking attitudes and Readiness to change, however it may not have been captured in the way the present study tested it.

Explanations for Findings – Hypothesis 2

Because Readiness to change did not moderate the effect of implicit smoking attitudes on decisional balance considerations in Hypothesis 1 as originally speculated, Hypothesis 2 examined how decisional balance considerations mediated (rather than moderated-mediated) the effect of implicit smoking attitudes on cigarette purchase task indicators. As predicted by the theory of Friese, Hofmann, and Schmitt (2008), explicit attitudes about smoking (decisional balance considerations)

completely accounted for the relationship between implicit smoking attitudes and cigarette purchase task demand indices. This suggests that controlled cognitive processes such as explicit decision making override the effects of implicit smoking attitudes. Although there are several factors that may affect decision making and the relative influence of implicit smoking attitudes over explicit smoking attitudes, Readiness to change did not appear to have that effect and in fact approached significance ($p = .06$) as a predictor of only one purchase task indicator.

While the predicted mediated relationship of cigarette purchase task demand indices on implicit smoking attitudes was found, this pattern was not consistent across all purchase task indicators. Only Breakpoint and Intensity were predicted by the set of predictors, with Omax approaching significance. A negligible association was found between Breakpoint and Intensity ($r = .07$), eliminating concern that the pattern of findings of prediction of these two outcome variables was redundant. Breakpoint and Intensity represent two extreme ends of demand for cigarettes (i.e., consumptions at the lowest cost, or Intensity of demand and the cost that would fully suppress cigarette consumption, or Breakpoint). Several considerations may explain why these two opposite ends of cigarette demand were significantly predicted. It was initially thought that elasticity of demand would be the outcome most sensitively related to the predictors of this study. Breakpoint and Intensity of demand reflect different aspects of elasticity of demand – absolute inelasticity in the case of Intensity and the upper limit of elasticity of demand in the case of Breakpoint. Given that these outcomes are at the ends of the continuum of elasticity, they may have been more sensitive to detecting changes produced by these predictors. Another consideration that may have

contributed to these findings with Breakpoint and Intensity, but not the other cigarette purchase task indicators, may be that Breakpoint and Intensity reflect opposite ends of cigarette consumption, whereas Pmax, Omax, and elasticity reflect more price considerations.

The other cigarette purchase task indicators examined in this study as outcomes may not have been predicted for other reasons. Overall elasticity of demand may not have been as sensitive to prediction because it is a global summary of demand sensitivity to price. Being global and summative in nature, it may be too crude a measure to capture attitudinal influences. Pmax and Omax may not have been related to the predictors for entirely different reasons. Pmax was essentially collinear with Breakpoint, and Omax was also highly correlated with Breakpoint. Neither of these may have been predicted by the variables of interest in this study because they reflect transition points of the cigarette demand curve from elastic to inelastic demand. Omax and Pmax may not have been predicted by the study variables because these facets of cigarette demand are more related to cost than consumption of cigarettes. The predictors in this study were largely consumption related, and included only minimal cost considerations. If the Smoking Decisional Balance Scale included more statements assessing smokers' decisional considerations related to cost of cigarettes then these outcomes may have also been predicted.

Although seemingly overridden by explicit decisional considerations, implicit smoking attitudes still played a small yet important role in predicting the cigarette purchase task indices of Breakpoint and Intensity of demand. Implicit smoking attitudes predicted outcomes which reflect opposite ends of demand related to

cigarette consumption, rather than cost, which may indicate that implicit smoking attitudes as measured in this study really measured implicit attitudes about cigarette consumption. Although implicit attitudes are often thought to be more general and less nuanced, perhaps there could be implicit "value" attitudes about cigarettes that include a cost aspect. Such implicit attitudes about smoking may predict Omax, Pmax, or elasticity of demand, outcomes that are more related to cost than consumption of cigarettes.

Finally, it was originally thought that implicit smoking attitudes would be indirectly to cigarette purchase task indicators equally, that there would be no differences between the mediated effects of implicit smoking attitudes on purchase task indicators through the Pros for smoking than through the Cons for smoking. While this was the case for Breakpoint, it was not so for Intensity of demand for cigarettes. The effects of implicit attitudes on Breakpoint were relatively equal in magnitude, despite being in opposite directions as would be expected. However, the effect of implicit smoking attitudes on Intensity was positive through both the Pros and Cons for smoking, and the effect of implicit smoking attitudes was significantly greater through the Cons for smoking. This is perhaps because more variance was accounted for in the Cons for smoking by implicit smoking attitudes, and therefore may have produced a larger magnitude effect on Intensity. However, it is unclear why this occurred only in predicting Intensity, and not Breakpoint. One potential explanation may be differences in the bivariate correlations of the Pros and Cons for smoking with Intensity and Breakpoint. The Pros of smoking were significantly

correlated only with Intensity, whereas the Cons for smoking were significantly correlated with both Intensity and Breakpoint.

Integration with Literature

While the findings of this research were partially in concordance with original hypotheses, they both build upon and extend previous research in several important ways. The findings of this research provide convergence with findings of the effects of implicit smoking attitudes on smoking cessation behavior and theoretical considerations about the importance of implicit smoking attitudes. However some of these findings were divergent from previous findings, notably that Readiness for change did not moderate the effects of implicit smoking attitudes as predicted other authors.

Convergent findings.

This study was most similar to that of Chassin and colleagues (2010) who examined the ability of implicit smoking attitudes to predict smoking cessation. The present study built on Chassin and colleagues' (2010) work that demonstrated that implicit attitudes prospectively predicted smoking cessation 18 months later, but only for smokers who reported many experiences of failure to control their smoking and who had a plan to quit smoking in the next 18 months. While most studies of implicit smoking attitudes have examined implicit attitudes as the outcome, only Chassin and colleagues (2010) have studied implicit smoking attitudes as a predictor of smoking behavior.

Rather than studying smoking behavior, as Chassin and colleagues did, this study found that implicit smoking attitudes predicted an intermediate step to cessation, decision making about smoking. Whereas Chassin et al. (2010) studied the effects of implicit smoking attitudes on actual smoking behavior, this study extended those findings by examining the effects of implicit smoking attitudes on cessation related attitudes (decisional balance considerations) and smokers' choices on a hypothetical cigarette purchase task. Both studies are important in that they examine the ability of implicit smoking attitudes to predict smoking cessation and related attitudes; the majority of studies examine predictors of implicit smoking attitudes.

One of the limitations of Chassin and colleagues' (2010) study was the long time lapse between measurement of implicit attitudes and later measurement of smoking behavior. In addition to extending Chassin et al.'s (2010) findings by examining the effects of implicit smoking attitudes on cessation related attitudes and choices, rather than actual smoking behavior, this study examined those effects at the same measurement occasion. This is noteworthy because of the complex and dynamic nature of smoking behavior change. For example, although 20% of participants in Chassin et al.'s (2010) study with a plan to quit actually did quit smoking 18 months later, 12% of participants *without* a plan also achieved smoking cessation 18 months later. This research examined the effects of implicit attitudes on decision making, a necessary precursor to making a plan, at the same time. Thus, this study both builds on and extends Chassin and colleagues (2010) finding that more negative implicit smoking attitudes increased smoking cessation 18 months later for certain participants by finding the same relationship with concurrent smoking related decision making.

This study also extended research related to motivational influences on implicit attitudes. The central focus of this study was on implicit attitudes in predicting explicit attitudes about smoking related to decision making about cessation, and their interaction with Readiness for change. Implicit smoking attitudes were significantly, albeit modestly intercorrelated with Readiness for change. This finding is consistent with previous findings that implicit smoking attitudes varied by smokers' "motivational state," that is, whether smokers were deprived of nicotine or not and therefore more or less "motivated" to smoke to avoid unpleasant withdrawal effects (Sherman et al., 2003). Previous research on dual-process models of addiction have described motivation as having both an impulsive "appetitive motivation" as well as a more reflective component. This research makes a first step at clarifying the nature of the association between implicit smoking attitudes and reflective motivation, or Readiness to change (Wiers et al., 2013).

The present study also examined how motivation to change influenced the effects of implicit smoking attitudes on decision making about quitting smoking, as well as how implicit attitudes affected choices on a hypothetical smoking purchase task. Klinger & Cox (2004) posited a theory of motivation that included nonconscious processes fitting the description of implicit smoking attitudes in the present study. In their model, Klinger & Cox (2004) speculated that a complex set of determinants contributes to choices about substance use, and that these influences affect the individual's incentive value of the substance. Consistent with this theory, the present study found that implicit smoking attitudes indirectly affect choices about the relative reinforcing efficacy, or incentive value of cigarettes. The present study clarified the

nature of that relationship, and found that explicit attitudes about smoking (decisional balance considerations) account for the relationship between implicit smoking attitudes and evaluations of the incentive value of cigarette consumption.

Divergent findings.

Friese, Hoffman, & Schmitt (2008) theorized that state factors, including motivation to control automatic processes, would moderate the influences of implicit attitudes on behavior. These authors speculated that when individuals are not motivated to control their behavior, implicit attitudes will have a stronger effect in determining behavior, whereas when motivation to control behavior is high implicit attitudes will have a weak effect on behavior. The present study did not find support for their contention that motivation affects the influence of implicit attitudes. Rather than being dependent upon levels of motivation, this study found that implicit attitudes produced a small, but distinct effect on decisional balance considerations and choices on the smoking purchase task independent of Readiness to change. Rather than being intimately linked and dependent upon one another, this research indicates that although they are related to one another implicit attitudes and motivation exert independent effects on behavior.

The divergence of the present study's findings from the theory of Friese, Hoffman, & Schmitt (2008) may be due to different conceptualizations of the construct of motivation. Friese, Hoffman, & Schmitt (2008) viewed motivation as an appetitive influence where motivation is the result of a hedonic need such as for food or water. This study instead viewed motivation from a more nuanced and multifaceted perspective. Motivation certainly reflects aspects of a hedonic need for a

substance, such as to avoid withdrawal effects, but also includes concern, decision making, commitment, planning, and reprocessing. Future research on the effects of implicit cognition about substance use should include both this more nuanced view of motivation as well as the motivation for smoking from a hedonic need point of view to better understand the effects of implicit cognition.

Notable in considering the direct effects of Readiness to change, implicit smoking attitudes, and explicit decisional balance considerations on cigarette purchase task indicators is that fact that implicit smoking attitudes did not directly predict any of the five cigarette purchase task indicators. The relative reinforcing efficacy of substances such as cigarettes, as measured by the Cigarette Purchase Task, is thought to capture aspects of the impulsiveness that is characteristic in some misuse of substances. For example, some have hypothesized that impulsivity and demand for alcohol may be reflective of underlying common processes such as general sensitivity to reward of reinforcers (Gray & MacKillop, 2013). Implicit attitudes are similarly thought to be part of an impulsive system that determines behavior and choice (Hofmann & Friese, 2008; Friese, Wanke, Plessner, 2006). However, when examined along with Readiness for change and decisional balance considerations, implicit smoking attitudes did not predict purchase task choices directly and the effects of implicit attitudes were completely accounted for by decisional balance considerations, suggesting that this common impulsivity accounts only for a small proportion of explicit smoking choice behavior. The impulsiveness of choice to use substances may be over-emphasized to the detriment of the understanding of conscious, controlled,

and effortful choices that individual make to use or control their use of substances such as smoking cigarettes.

Explicit decisional balance considerations completely accounted for the relationship between implicit smoking attitudes and smokers' purchase task choice indicators of Breakpoint and Intensity. Breakpoint is thought to represent a unique facet of the behavior maintaining properties of a drug, and that heavy smokers should be less sensitive to increases in cigarette price (Murphy & Mackillop, 2006). However, this research suggests that a smoker's consumption of cigarettes is partially a function of their attitudes about smoking, both implicit and explicit. Furthermore, attitudes about smoking appear to influence choices that smokers make about purchasing cigarettes, at least in hypothetical cases. Because this study was correlational in nature, it is unclear whether price causes smoker's implicit and explicit attitudes about smoking to shift, which in turn alters their behavior, or whether implicit and explicit attitudes about smoking change which in turn affects their sensitivity to price. Only experimental manipulation can give insight into whether one causes change in the other and highlights the need for future experimental studies.

The findings of the prediction of cigarette consumption when price is zero, or Intensity, was unique among the models run. Overall, there was no significant indirect effect of implicit smoking attitudes on Intensity of cigarette demand. However, there were significant unique indirect effects of implicit smoking attitudes on Intensity. Interestingly, these effects were in the *opposite* direction, leading to a negligible and insignificant overall indirect effect on Intensity. More positive implicit

smoking attitudes predicted more Pros of smoking, and indirectly predicted greater consumption of cigarettes when they were free. Conversely however, although the direct effect of Cons of smoking on Intensity was positive (more Cons of smoking predicted greater Intensity), more positive implicit smoking attitudes indirectly predicted less Intensity of cigarette demand through the Cons of smoking. This finding is the least clear finding of this study, as smokers with more positive implicit smoking attitudes likely would report less Cons and then *greater* Intensity. In this case it appears that implicit attitudes predicted greater Intensity of demand and then the explicit decisional balance consideration (in this case the Cons of smoking) inhibited, overrode or interacted with the implicit attitude in some other way. As with findings related to Omax, positive correlations between Intensity of demand and nicotine dependence and daily smoking have been found (Murphy et al., 2011; Mackillop et al., 2008).

Because implicit smoking attitudes were related to explicit decisional balance considerations in the predicted directions, but in contrary directions in indirectly predicting Intensity of demand, these results suggest that there is a unique relationship between Intensity of demand and implicit and explicit smoking attitudes, specifically negative explicit attitudes. Perhaps negative explicit attitudes are markers or drivers of the explicit control over implicit attitudes. Studies of the decisional balance as individuals traverse the stages of change demonstrate that the Cons of smoking (or Pros of quitting) increase as motivation to change also increases as individuals approach behavior change (Prochaska et al., 1994). Such changes may underlie the regulation of implicit attitudes via effortful, controlled cognitive

processes and speak more broadly to a mechanism of behavior change. In other words, when explicit recognition of negative aspects of smoking outweighs the perception of the positive benefits of smoking, this may be the moment when effortful cognitive control harnesses nonconscious or implicit influences on behavior. Until people see the negative aspects of their behavior they are often not motivated to control it, and subsequently may not also be controlling the automatic influences on their behavior.

Contributions to the literature.

The present research makes several important contributions to the literatures of implicit cognition about substance use, decision making about substance use, and motivation to change behavior. This was the first study to examine implicit smoking attitudes and motivational Readiness to change together. Previous studies of implicit attitudes about substance use had considered motivation only from the perspective of motivation as a hedonic drive for a substance. This study broke new ground by considering implicit attitudes along with motivation from the multidimensional perspective of an individual process involving a series of tasks that individuals must successfully negotiate in order to sustain behavior change.

This study added to the literature on implicit cognition by investigating how motivational Readiness to change can function as a moderator of implicit attitudes, finding that Readiness to change did not moderate implicit smoking attitudes. Although implicit smoking attitudes were not moderated by motivational Readiness to change, this study did show that explicit attitudes about smoking (in this case,

decisional balance considerations) mediated the effect of implicit smoking attitudes on choices on a hypothetical smoking purchase task. This broadens the study of implicit attitudes to now include how they affect the personal process of behavior change.

In addition to extending the literature of implicit attitudes about substance use, this study added to the literature about decision making about substance behavior change. First, this study demonstrated how implicit smoking attitudes affect the evaluation of the risks and benefits of smoking in making decisions about changing smoking, demonstrating that these effects are independent above and beyond the effects of motivational Readiness to change. Second, this study investigated how implicit and explicit smoking attitudes affect choices on a smoking purchase task. Behavioral economic theories of substance use have attempted to characterize substance use to highly refined algorithm of choice and reflecting demand and the reinforcing contingencies related to a substance (Bickel, Johnson, Koffarnus, Mackillop, Murphy, 2014). This study expands the behavioral economic perspective to recognize that the individual equation of choices is influenced both by implicit smoking attitudes but also by the process of behavior change in which the choices are occurring. The behavioral economic perspective seems to suggest that attempts to reduce choices about substance use to a formula will be limited by the available inputs and ultimately limited by their ability to fully account for all of these variables. This research indicates that choices about smoking viewed from a behavioral economic perspective are determined by multiple direct and indirect causes.

Limitations

Some aspects of this study's design and execution limit the generalizability of these findings and the inferences that can be drawn from them. First, the present study used a correlational design; there was no experimental manipulation of any of the independent variables studied. While speculation can be made about the causal roles implicit smoking attitudes have on explicit decisional balance considerations or choices on the cigarette purchase task, the present study raises more questions about causality due to its observational nature. Secondly, this study was cross sectional in nature. Previous studies of the role of implicit attitudes on smoking cessation (e.g., Chassin et al., 2010) have been able to study the long-term impact implicit smoking attitudes and draw more detailed inferences about the longstanding effects implicit attitudes have. While the 18-month follow up period of Chassin and colleagues' (2010) study was too long, future studies could build on this study by examining the effects of implicit smoking attitudes after short-term follow-up periods. Third, while the cross sectional design of this study allowed for the collection of a large and heterogeneous sample, it is possible that the findings are related to the convenience sample that was collected. The sample that was collected was similar to the population of smokers in many ways, but there may have been other forms of bias in the sample or other under- or overrepresentation that might importantly affect these findings. As noted above, the sample collected was majority smokers in the Contemplation stage. This may have skewed the results in some ways, either by obscuring or exaggerating constructs of interest. The convenience sample may also limit the generalizability of the results or have introduced some other form of

ecological fallacy related to the sample that influenced these results. Fourth, this study examined decision making and choice behavior, not actual cessation. It is unclear if these constructs would predict actual cessation attempts or success in actual cessation of smoking behavior. Finally, this study used a bootstrap asymptotic confidence interval approach to evaluating mediated effect. There are several approaches to testing mediated effects (Baron & Kenny, 1986; Holmbeck, 1997). Although the bootstrap asymptotic confidence interval method is advocated by some an optimal approach to testing mediated effects as adequately powered, others argue for more conservative methods that minimize the likelihood of Type I errors, particularly in cases (such as in this study) with multiple intervening variables that function in opposing directions (Shrout & Bolger, 2002; Hayes, 2009; Mackinnon, Lockwood, Hoffman, West, & Sheets, 2002).

Summary and Future Directions

This study found that implicit smoking attitudes were uniquely related to smokers' decisional considerations about continuing to smoke. These decisional considerations ultimately proved to be fundamental in understanding the effect of implicit smoking attitudes on a smoking purchase task, as they completely accounted for the relationship between implicit smoking attitudes and purchase choices. Future studies can build on these findings in several ways. First, these findings underscore the important role implicit cognitions play in determining behavior, lending additional support for dual process models of cognition (Bargh & Chartrand, 1999). Some researchers have pursued modifying implicit cognitions (such as attitudes) in various ways (attentional retraining, counterconditioning, approach bias retraining;

Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). Wiers and colleagues (2013) have called for a greater understanding of the role motivation plays in cognitive bias modification both from an appetitive view but also from a controlled perspective. Future studies might experimentally manipulate implicit smoking attitudes to see how this then influences explicit smoking attitudes such as the Pros and Cons of smoking, Readiness for change, or responses on the smoking purchase task. Similarly, future studies could manipulate motivation to change, such as through feedback about smoking or with formal motivational enhancement interventions.

These findings indicate that both explicit and implicit cognitions are important in determining choice. Instead of manipulating implicit cognitions through implicit attitude retraining, explicit decisional considerations could be manipulated in order to modify the effect of implicit smoking attitudes on behavior or choice. For example, providing feedback about the negative health effects of smoking might increase explicit awareness of risk and elevate perception of the costs of smoking, thereby modifying the effect of implicit smoking attitudes on choice or behavior. Providing feedback that modifies explicit attitudes would likely also affect implicit attitudes to some degree. However, in the short term at least, feedback should modify primarily explicit attitudes, as studies of the formation of implicit attitudes indicate that they are shaped by early life experiences and likely the repeated reinforcement of smoking (Rudman, Phelan, Heppan, 2007). It is unclear whether explicit attitudes can be modified without in some way also affecting implicit attitudes, but this would be an important question for future research to examine.

While choice and explicit attitudes are of importance to smoking behavior, this research indicates that implicit smoking attitudes are also important. Examining other determining causes of implicit smoking attitudes then would be important future studies to conduct. For example, early life experiences with smoking and normative beliefs about smoking appear to be important determinants of implicit smoking attitudes, and future studies could examine the impact of cessation experiences and how they affect implicit smoking attitudes (Rudman, Phelan & Heppan, 2007).

The present study was focused exclusively on cigarette smoking as a tobacco use behavior. Many smokers are increasingly turning to alternative tobacco and nicotine products such as little cigars, hookahs, and electronic cigarettes. Including assessment of these alternative tobacco use behaviors would provide a more holistic assessment of the role implicit smoking attitudes have on important related tobacco use behaviors. Future studies could also differentiate implicit attitudes about smoking cigarettes from implicit attitudes about using electronic cigarettes or other alternative tobacco products. Similarly, future studies could examine how both implicit and explicit attitudes about smoking (and/or alternative tobacco products) are related to implicit and explicit attitudes about nicotine replacement therapy. For example if implicit attitudes about nicotine replacement therapy products are slightly negative, public health campaigns to shift implicit attitudes about nicotine replacement therapy products to be more positive might be a way to increase tobacco cessation.

Finally, the present study utilized a convenience sample that may have over- or underrepresented the population of smokers. Future studies might improve on this research by using a stratified sampling strategy to collect a sample representative of

the age, gender, racial, and socioeconomic composition of the population of smokers to reveal findings that might be more generalizable. While self-reports of smoking behavior are generally reliable, validating the self-reports of participants smoking behavior with expired carbon monoxide or cotinine validation would increase confidence in the findings that can be drawn from this study.

Building a broader and more accurate knowledge base is critical to developing improved prevention and cessation programs to eliminate the devastating personal and public health consequences of smoking. Taken together these results represent a small but important step toward improved prevention and cessation programs by better understanding how unconscious, or automatic beliefs affect considerations that people have about continuing to smoke. While these influences that are outside of our awareness are important, explicitly weighing the arguments for continuing a behavior are perhaps even more important in determining what behavioral choices people make. Future smoking cessation interventions might be improved by considering both explicit attitudes as well as unconscious automatic or implicit attitudes about smoking.

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