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Social Psychological Factors in Adolescent and Adult Smoking:  
Findings and Conclusions from a 30-year Longitudinal Study

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Social Psychological Factors in Adolescent and Adult Smoking:  
Findings and Conclusions from a 30-year Longitudinal Study

Because cigarette smoking is the single largest cause of preventable mortality and morbidity in the United States (U.S. Department of Health and Human Services, 1994) and around the world, it has been a focus of both research interest and public health campaigns. In the United States, there has been much national attention to cigarette smoking, including issues of tobacco litigation, taxation, regulation of smoking in public places, and calls for smoking prevention among young people. Stricter enforcement of youth access laws, tobacco free school policies, and media campaigns have all been suggested as ways to deter adolescent smoking (Lynch & Bonnie, 1994; U.S. Department of Health and Human Services, 2000).

Despite these efforts, epidemiological studies of adolescent smoking rates show a mixed picture. Giovino (1999) reviewed national data and concluded that adolescent smoking declined during the late 1970s to the early 1980s, leveled off in the middle 1980s, and started to increase again in the 1990s.

With the importance of smoking in mind, especially among adolescents, our research team began a comprehensive longitudinal study of cigarette smoking in 1979. The study still continues, with the oldest of the original participants well into their 40s. The purpose of the current paper is to present an overview of this program --- its methodology, goals, some past and recent findings, and an indication of where this project is likely to go in the future. Clearly, the amount of published work stemming from this work is far too great for us to give a comprehensive presentation. There are over ---- published papers and chapters, as well as a book devoted to methodological and analytic issues that arise in such a complex longitudinal project (Rose, Chassin, Presson, & Sherman, 2000). Thus, after discussing the general goals of

the project and the methodology and measures of the main longitudinal study, we will present a very brief summary of some of the major research findings from the early and middle years of the project. Then, we will give a more detailed presentation of research issues that have proven to be especially important in recent years, are currently major foci of attention of the project, and are likely to occupy much of our attention in the future. These issues include the identification of multiple developmental trajectories of smoking, the role of implicit attitudes in smoking decisions and behaviors, and the intergenerational transmission of smoking attitudes and behaviors from parents to their children.

### Goals

The overall general goal of the research project has been to identify the social-cognitive factors that are involved in smoking attitudes, beliefs, judgments, and behaviors. That is, social psychological theories, especially those involving perception, representation, and cognition, have been brought to bear in order to answer important questions about smoking. Why do young adolescents start to smoke given the widespread knowledge of the serious health risks associated with smoking and given that the youths' first experience with smoking is typically a negative one? What factors might decrease the likelihood that a young non-smoker will initiate smoking? How do role changes throughout the lifespan affect the likelihood of smoking or the amount smoked? Are there different patterns of smoking or smoking histories that are associated with different smoking attitudes and beliefs? Can an understanding of these different patterns lead to a successful tailoring of interventions that might cause a smoker to reduce or eliminate smoking behavior? What are the roles of parents and peers in impacting the smoking decisions of young potential smokers? Why is it so difficult for smokers to quit smoking, and how can a better

understanding of the social psychological factors involved help to develop programs that have the best chance of leading to successful quitting without relapse?

These are among the questions that we have addressed across the 30+ years of the research program. As already mentioned, it will not be possible to address all of our goals and questions in a single paper. However, we shall try to provide a description that communicates the value of adopting a social-cognitive approach and of employing a longitudinal project to investigate and try to answer these important questions.

### *Methodology and Participants*

Our approach is best described as a major longitudinal study employing a cohort-sequential design, along with embedded substudies that are typically laboratory based (although some of our more recent substudies are web-based). Data collection for the longitudinal study began in 1980. Between 1980 and 1983, all consenting 6<sup>th</sup>-12<sup>th</sup> graders in a Midwestern county school system completed annual surveys. The total sample size of those who were assessed at least once during those four years was 8487. Follow-up surveys were conducted in 1987, 1993, 1999, and 2005. In addition, a new wave of data collection is currently in progress. In each case, 70% or more of the original sample were successfully retained. This sample is representative of the community from which it is drawn, one that is predominantly white and well educated. At the most recent follow-up completed in 2005, the smoking rate in the sample was 23%.

The measures employed in the large survey (and most of the measures have remained constant across the different waves of data collection, with some important additions as participants aged) include the following: a. items chosen from Jessor and Jessor's Problem Behavior Theory (1977). These variables are indicative of diverse processes and include

measures of social environment factors (parent and peer support and strictness), attitudes and beliefs (values and expectations for academic success), and personality factors (tolerance for deviance, locus of control). b. smoking behavior by the participant and by her/his parents and peers; c. attitudes and normative beliefs specific to smoking (adopting an Ajzen & Fishbein (1970) approach). d. prevalence estimates of smoking in the environment; e. beliefs about the social and health consequences of smoking.

### *Research in the Early Years*

During the first four years of the project (1980 – 1983), the survey questionnaire was completed by all 6<sup>th</sup> – 12<sup>th</sup> graders in the community school system who agreed to participate. Because these participants were in the 12 – 18 year old range (the time when smoking initiation is most likely), it made the most sense to focus our initial research on the social psychological factors that predicted smoking initiation for adolescents who were making the transition to smoker from never having smoked. We investigated several kinds of predictors. First, we assessed the role of factors taken from Jessor and Jessor (1977). In particular, we focused on three kinds of variables --- participants' attitudes toward smoking; participants' personality scores on factors related to tolerance for and likelihood of engaging in deviant behaviors; and factors in our participants' social environment, including parent and peer attitudes and beliefs in general and specific to smoking. Interestingly, we found that all three factors predicted smoking initiation for non-smokers. However, the strength of the different factors changed with the ages of the participants. For very young teenagers who had never even tried smoking, the personality and the social environment factors were the strongest predictors. For older adolescents who had already experimented with cigarettes, it was their own attitudes about smoking and behavioral

intention that best predicted smoking initiation (Chassin, Presson, Sherman, Carty, & Olshavsky, 1984).

In another study, we explored the roles of participants' self-images and the socially shared image of a smoking adolescent in predicting behavioral intentions to smoke. We found that the social image of a teen smoker that is held by adolescents included many negative aspects (e.g., unintelligent, aggressive), but also several important positive aspects (e.g., mature, sociable). Importantly, we found that the more the self-image of a currently non-smoking adolescent matched the predominant image of an adolescent smoker, the more likely was the non-smoker to intend to smoke (Chassin, Presson, Sherman, Carty, & Olshavsky, 1981).

Finally, we investigated the role of a social perception factor in predicting smoking initiation among adolescents. One of our measures asked participants to estimate the prevalence of smoking in their environment – by men, women, male peers, and female peers. In general, our participants overestimated the prevalence of smoking, perhaps because it is such a salient and easily noticed behavior. However, adolescents who smoked estimated significantly higher numbers of smokers than did adolescents who did not smoke (Sherman, Presson, Chassin, Carty, & Olshavsky, 1983).

### *Research in the Middle Years*

As our participants aged into their 20's and early 30's, they had graduated from high school and moved on to new roles. These roles included college student, worker and wage earner, spouse, and parent. There is far less smoking initiation once people reach their mid 20's. Thus, it made sense to shift our focus away from the predictors of smoking initiation to other aspects of smoking behavior that had more relevance for the age of our participants. We focused on several such factors during the middle years of our project. First, we explored the importance

of new role adoption as well as role conflict and stress in predicting smoking behaviors. We found that those who smoked in adolescence were less likely to be students, less likely to attain post-high school education, more likely to have ever been married, and more likely to divorce. Those who smoked in young adulthood were less likely to have achieved post-high school education, less likely to be married, and more likely to have been divorced (Chassin, Presson, Sherman, & Edwards, 1992). In terms of role stress, our data showed a significant relation between stress in the occupational, marital, and parental roles (as well as conflict among the roles) and higher quantity of cigarette smoking (Todd, Chassin, Presson, & Sherman, 1996).

Second, we paid more attention to smoking cessation rather than initiation. In several studies, we investigated the social psychological factors that best predicted smoking reduction, cessation, and relapse. For example, two of our studies focused on cessation among young adults. One examined prospective predictors of both quit attempts and successful cessation. A higher likelihood of making a quit attempt was associated with being female, attaining some college education, perceiving smoking as dangerous to health, valuing health, smoking to control affect, smoking for sensorimotor reasons, being married, and occupying more social roles. Successful cessation was associated with attaining some college education, smoking less than a pack a day, perceiving oneself as being less likely to be smoking in a year, having fewer smoking friends, valuing health, having sensorimotor motives for smoking, having lower levels of stimulation motives, having more sensory reasons for quitting, feeling lower social pressure reasons for quitting, being employed, and not living with children (Rose, Chassin, Presson, & Sherman, 1996). The second study identified predictors of long-term abstinence from smoking versus relapse among our participants who quit smoking as young adults. Overall, two-thirds of the participants maintained successful long-term abstinence, while one-third relapsed to



smoking. The strongest predictor of avoiding relapse was marrying a non-smoker. Other predictors included making one lifetime quit attempt, having as a young adult only one parent show smoked, and working in a completely smoke-free building. In this study, the factors related to smoking in the social environment played the largest role in predicting long-term abstinence versus relapse (Macy, Seo, Chassin, Presson, & Sherman, 2007).

Third, by this time, many of our participants had children who needed care, time, attention, and resources. A number of these same participants also had aging parents who required care and attention. People who have obligations to care for both their children and their parents at the same time have been referred to as the sandwich generation (Hamill & Goldberg, 1997; Hunter, Sundel, & Sundel, 2002). We investigated the association between membership in the sandwich generation and health behaviors (Chassin, Macy, Seo, Presson, & Sherman, 2010). Multigenerational caregivers were more likely than others to engage in unhealthy and health-risk behaviors. In addition to more frequent cigarette smoking, these behaviors included being less likely to check food labels or eat food based on health information, less likely to use seat belts, and less likely to exercise regularly. The mechanisms underlying these effects are likely to involve a combination of reduced available time, depressed affect, a reduced salience of personal health goals, and heightened levels of stress.

#### *Current research focus*

1. *Multiple developmental trajectories of smoking behavior.* A recent major goal of our longitudinal study has been to describe developmental trajectories of cigarette smoking from adolescence to mid-life and to understand the predictors and outcomes of these trajectories. A basic premise of this research is that interventions that are designed to prevent individuals from

starting to smoke or to encourage smokers to quit would be more effective if they were targeted at the factors that predict these smoking trajectories.

As with many forms of substance use, adolescence is the typical age period during which most people begin to smoke (USDHHS, 1994). However, although most forms of substance use show “maturing out” (i.e., declines in use) beginning in the mid-20s (Chen & Kandel, 1995), cigarette smoking is more persistent. For example, an overall group level analysis of our data showed that, although there was a significant increase in smoking from adolescence to young adulthood, there was a nonsignificant decline after the mid-20s (Chassin et al., 1996). The greater persistence of smoking than of other forms of substance use from adolescence to adulthood may be due both to the addictive potential of smoking and also to the fact that smoking is legal and not intoxicating. Thus cigarette smoking produces less conflict with the responsibilities of adult roles than do other forms of substance use. In our data, even though the overall decline after the mid-20s was non-significant for the total sample, those individuals who assumed adult social roles (i.e., spouse, parent, wage-earner) after the mid-20s were more likely to quit smoking (Chassin et al., 1996).

Although cigarette smoking is typically initiated in adolescence and shows substantial continuity (with some declines) from adolescence to adulthood, there is also substantial variability in trajectories of smoking behavior. That is, there are subgroups of individuals who do not follow these overall trends and who show instead differing age patterns of smoking. An important goal of our research has been to describe these multiple trajectories, and to identify their antecedents and consequences. Theoretically, variability in developmental trajectories has potentially important implications for understanding the causes of cigarette smoking. For example, although most smoking begins in adolescence, when we followed our adolescent

sample into young adulthood, approximately one-third of our young adult smokers showed “late onset.” That is, they were smokers in young adulthood but they had been nonsmokers in adolescence (Chassin et al., 1991). Moreover, these “late onset” smokers showed more psychosocial conventionality (i.e., less deviance) in Jessor and Jessor’s (1977) terms than did “early onset” smokers. In addition, not all smoking was “persistent.” Of those who were smokers during adolescence, approximately one-third were no longer smoking at the young adult follow-up. Persistent smokers (compared to non-persistent smokers) had more parents who smoked cigarettes, so they might have more genetic susceptibility to nicotine addiction or family environments that were more encouraging of smoking (Chassin et al., 1991). Thus, our longitudinal data showed substantial changes in smoking status with age, and also substantial deviation from the typical pattern of adolescent onset and persistent smoking.

As our participants aged into adulthood, we were more able to directly examine multiple trajectories of smoking, using latent class growth analysis to empirically identify clusters of smoking trajectories from age 11 to age 31 (Chassin et al., 2000). In addition, we considered two a priori groups, stable abstainers (who showed no smoking at any measurement) and a small group of “erratics” who showed multiple fluctuations between smoking and nonsmoking over the years, in a pattern that would be difficult to model statistically. Results of our analysis identified four smoking trajectory groups. Early stable smokers began to smoke at approximately 12-13 years of age and were smoking 1-10 cigarettes per day by age 15. By age 18-19, they were smoking at a high level (more than 10 per day), and they stayed at this level over the course of the study. The late stable group showed some infrequent smoking in the high school years, but a transition to at least weekly smoking at about age 18. Compared to the early onset group, they reached their highest level of smoking at an older age (age 24) and stabilized at a lower level of

smoking (slightly more than 10 cigarettes per day). There was also an experimenter group that began to smoke at an early age but never escalated to heavy smoking (not exceeding one per week). They reached their maximum levels at age 16-17 and then reported no more smoking after age 20. Finally, there was a group of “quitters,” who smoked at rather heavy levels between age 20 and 21, but reported no further smoking after age 25. Thus, we found important variability in trajectories of smoking in terms of age of onset, speed of acceleration from initiation to regular smoking, amount of smoking, and persistence of smoking.

We also found different predictors of these trajectory groups (Chassin et al., 2000). As adolescents, the early stable and erratic groups were the least socially conventional. They had high tolerance for deviance, were the most external in locus of control, had the least parental support, and were least likely to obtain some college education. They also had the most parents and friends who smoked, and they had the most optimistic beliefs about the health and psychological consequences of smoking. Thus, they showed the highest levels of smoking risk on multiple factors. In contrast, the experimenter subgroup showed some adolescent rebellion (high tolerance for deviance, friends who smoked, positive beliefs about smoking) but greater parental support and higher levels of education. Perhaps their stronger ties to conventional institutions (school and family) helped to limit their smoking trajectories. Experimenters were also less likely to have parents who smoked, which might mean that they had less genetic vulnerability. The late onset group was relatively socially conventional in adolescence and had high parental support, which might have protected against their smoking. However, they had high levels of college education, and typically began to smoke during their years at college. Perhaps the reduction in adult supervision combined with the pressures of college produced their late onset smoking. Finally, the group who quit smoking also had high education levels, and they

showed the most negative beliefs about smoking, which might have motivated their cessation attempts.

In a later study, we re-estimated these models at an older age, tracking smoking among our participants until their early 40s (Chassin et al., 2009). These models that considered later ages of smoking produced a larger number of trajectory groups (six rather than four empirically identified groups) but with similar patterns. Differences between the two latent class growth models included a distinction between experimenters and developmentally limited smokers (with developmentally limited smokers starting somewhat older and smoking more before stopping) and between high school onset and adult onset smokers. However, most of the empirically classified participants were classified into the same trajectory group as in the earlier model. When tracking participants into their early 40s, our results re-confirmed the “early onset persistent group” as the most committed smokers. In fact, members of this group had the highest rates of tobacco dependence as well as the lowest levels of educational attainment (Chassin et al., 2009).

Taken together, the results of our long-term longitudinal study suggest that multiple trajectories of smoking are informative for understanding the causes of cigarette smoking and the causes of smoking cessation, and for understanding how smoking is transmitted across generations. Although smoking typically begins in adolescence and is quite persistent, there is substantial variability in patterns of smoking over age. Moreover, this variability in age of onset, steepness of acceleration to high levels of smoking, and persistence over time is systematically related to different predictors and consequences of smoking. From a public health point of view, the early-onset persistent subgroup may be particularly important, both because of its high levels of smoking and tobacco dependence, and also because they pass this risk to the next generation.

In contrast, developmentally limited groups (including experimenters) may have less genetic vulnerability to smoking as well as protective environments, whereas negative beliefs about smoking may help the “quitters” eventually overcome their smoking behavior. Similar findings concerning the importance of multiple trajectories have been reported for adolescent antisocial behavior (Moffitt & Caspi, 2001), in which early onset life course persistent antisocial groups and adolescent limited antisocial groups show different predictors and outcomes. From a research perspective, it is important to note that variability in age of onset, steepness of acceleration, and persistence over time is not captured in typical static, cross-sectional measures of smoking (although retrospective data could be gathered). Thus, an assessment of smoking at any one particular time will create a heterogeneous group of smokers--obscuring potentially important subgroups who have different risk factors. A clearer understanding of the processes underlying smoking behavior could potentially be produced by using developmental trajectories of smoking as the “phenotypes” to be studied.

*2. The intergenerational transmission of smoking attitudes and behaviors* Cigarette smoking shows significant heritability, with estimates ranging from 46% to 84% (Barta, Patkar, Berrettini, Weinstein, & Leone, 2003; Li, 2003). Heritability estimates are somewhat smaller for adolescent samples, but still quite substantial (Hopfer, Crowley, & Hewitt, 2003). These data suggest that cigarette smoking is both genetically and environmentally influenced.

Given these findings, cigarette smoking would be expected to show intergenerational transmission, and parental smoking should be a powerful influence on adolescent smoking. Once our original sample had children of their own who were of smoking age, it became possible for us to study such intergenerational transmission. Past research investigating the influence of parental smoking on adolescent smoking revealed conflicting evidence, with some studies

(Bricker et al., 2006; Chassin et al., 2005) showing strong effects of parental smoking and others showing weak effects (Conrad, Flay, & Hill, 1992). We suspected that parental current smoking status is too crude a phenotype to provide insight into the etiology and intergenerational transmission of smoking behavior. Therefore, as indicated in the previous section, we tried to identify more refined and informative parental smoking phenotypes. These were reflected in our categories of smoking trajectories, which took into account the age of smoking onset and the time course (in terms of speed of escalation, peak use, and persistence over time; Chassin, Presson, Sherman, & Pitts, 2000; Chassin, Presson, Sherman, Wirth, & Curran, 2009).

We found that these different trajectories varied in the risk that they carry for intergenerational transmission of smoking (Chassin et al., 2008). In particular, the early-onset, steep escalation, persistent group of adult smokers showed the greatest level of intergenerational transmission of smoking to their adolescent children. Thus, developmental phenotypes of parental smoking behavior based on longitudinal data from adolescence to adulthood predicted adolescent smoking behavior in the next generation. In other words, history matters in terms of risk for the intergenerational transmission of smoking.

We also have recently investigated possible social psychological mechanisms that might play a role in the intergenerational transmission of smoking. Current smoking level of parents and the modeling of such behavior by children could not explain the levels of intergenerational transmission of smoking. Nor could the level of parental education. We also tested whether adolescent personality characteristics could account for effects of parents' smoking trajectories on adolescent smoking. Again, the characteristics of neuroticism, openness, agreeableness, conscientiousness, and resistance to control could not explain the intergenerational effects.

However, strong candidates for the mediators of parental smoking trajectory effects on their children's smoking are parenting style and parents' attitudes and socialization messages about cigarette smoking. In one study (Chassin et al., 2005), we tested whether parenting style and smoking-specific parenting practices prospectively predicted adolescent smoking. With regard to general parenting style, two important dimensions have been identified: parental acceptance (nurturance, warmth, attachment) and behavioral control (monitoring, consistent discipline). A combination of these dimensions results in four parenting styles: 1. authoritative (high levels of acceptance and control); 2. authoritarian (high level of control, low level of acceptance); 3. indulgent (high level of acceptance, low level of control); 4. disengaged or neglectful (low levels of acceptance and control). In addition to these general parenting styles, we also investigated the role of parental socialization practices that were specific to smoking for effects on their children's smoking. For these specific practices, we focused on smoking-specific discussions between parents and children and on the degree to which parents did or would punish their children for smoking related behaviors.

Importantly, we found that general parenting had strong effects in prospectively predicting later smoking among adolescents who were initially nonsmokers. Consistent with previous literature (Hawkins, Catalano, & Miller, 1992; Jackson et al., 1994), adolescents who received low levels of both parental behavioral control and acceptance (i.e., disengaged, neglectful parents) were most likely to initiate smoking. These were produced above and beyond any effects of parental smoking, parental education, or family structure. In addition, the relations were strongest when adolescent, rather than parental, perceptions of general parenting were considered.



Although general parenting style was related to smoking-specific parenting practices, this association was relatively modest, and smoking-specific parenting practices independently predicted adolescent smoking. Because both disengaged parenting and communications and punishments specific to smoking are related to parental smoking status and smoking trajectory history, both general parenting and smoking-specific parenting are important in the intergenerational transmission of smoking. These results have implications for family based preventive interventions. We would suggest that both general and smoking-specific parental socialization practices serve as targets for such interventions. Although it may be easier to focus on the more specific practices, our findings indicate that, without also changing the more general socialization practices, adolescents of disengaged parents will still be at enhanced risk for smoking initiation.

Finally, with regard to intergeneration transmission, we have very recently explored the relation between the intergenerational transmission of implicit and explicit attitudes toward smoking and the prediction of adolescent smoking initiation. A more detailed account of the roles of implicit and explicit attitudes in smoking behavior will be explored in a subsequent section of this paper. Because explicit attitudes toward behaviors that involve strong social norms and social desirability, such as cigarette smoking, do not predict these behaviors well, emphasis has shifted to more implicit or uncontrollable measures of attitudes. In a recent study (Sherman, Chassin, Presson, Seo, & Macy, 2009), we investigated the extent to which both implicit and explicit attitudes toward smoking were transmitted from parents to children, as well as the extent to which these attitudes predicted adolescent smoking initiation. Although both social environmental and genetically influenced mechanisms are involved in the intergenerational transmission of attitudes (O'Bryan, Fishbein, & Ritchey, 2004; Olson, Vernon,

Harris, & Jang, 2001), research on the intergenerational transmission of attitudes has been limited to attitudes based on explicit measures, with few exceptions (Sinclair, Dunn, & Lowery, 2005).

We measured parents' and their adolescents' smoking at time 1, as well as their explicit attitudes (semantic differential items) and implicit attitudes (IAT). Adolescents who were initially nonsmokers were assessed at an 18 month follow-up in terms of their smoking status. As in past studies, the correlation between the implicit and explicit measures was quite modest, ranging from .02 to .13 for mothers, fathers, and children. Most importantly, for mothers (but not fathers), their implicit attitudes toward smoking strongly predicted the implicit attitudes of their nonsmoking children, and these implicit attitudes of the children predicted their smoking initiation at an 18 month follow-up. The finding of intergeneration transmission of implicit attitudes is quite unique in the literature. Olson and Fazio (1999) have suggested that such transmission is due more to subtle and non-verbal behaviors rather than explicitly communicated messages. The pathway from adolescents' implicit attitudes to their subsequent smoking initiation is also important. Previous research has found that implicit smoking attitudes are associated with smoking motivation, craving, and dependence (Payne, McClernon, & Dobbins, 2007; Waters et al., 2007). However, our findings are the first to report a prospective link between implicit attitudes and smoking initiation at a later time

The finding that mothers', but not fathers', implicit attitudes toward smoking were transmitted to their children corroborates recent work by Castelli and his colleagues regarding the intergeneration transmission of implicit racial attitudes (Castelli, Carraro, Tomelleri, & Amari, 2007; Castelli, Zogmeister, & Tomelleri, 2009). These studies reported that the racial

prejudices of young children were shaped primarily by the implicit racial attitudes of their mothers.

These findings suggest that it may be far more fruitful to focus on implicit measures of attitudes toward smoking than on explicit measures. For both the transmission of attitudes and the prediction of the actual smoking behaviors of their children, it is the implicit measures that are most powerful. Thus, it may not be important what parents say to their children about smoking. It may not even be critical what parents do in terms of their own smoking behavior. What might matter most are the attitudes toward smoking that parents hold that are implicit and perhaps below their own awareness. These attitudes may leak out in subtle and non-verbal behaviors, which then have strong effects on both the implicit attitudes and the subsequent behaviors of their children.

*3. The role of implicit attitudes in the initiation and change of smoking behavior.* Most early research that explored the role of attitudes in predicting smoking behavior employed explicit measures of these attitudes such as semantic differential or Likert scales. As indicated in the previous section, such explicit measures, especially for socially relevant behaviors, are subject to social norms and concerns about social desirability. Cigarette smoking is a behavior that has very strong social norms and concerns about social desirability. Thus, explicit measures of smoking often do a poor job of predicting smoking relevant behaviors.

More recently, psychologists have developed a variety of implicit measures of attitudes. Because implicit attitudes operate below the level of awareness and because they are difficult to control, implicit measures are not subject to issues of social norms or social desirability. Thus, these measures are ideal for assessing attitudes toward smoking and for exploring the relation between these attitudes and smoking related behaviors and smoking transitions.

In one of the first studies to examine the role of implicit attitudes toward cigarette smoking, Sherman, Rose, Koch, Presson, and Chassin (2003) investigated the effects of context and motivational state on implicit measures of attitudes. Although implicit attitudes were originally thought to be extremely stable and difficult to change, we found that both contextual and motivational factors could change these implicit attitudes. Because implicit attitudes are predictive of both smoking initiation and cessation, the fact that these attitudes can be changed by applying the appropriate techniques is very important.

Specifically in this research, we first manipulated the salience of different aspects of smoking. In one condition, we measured implicit attitudes toward smoking while participants who smoked were exposed either to pictures highlighting the sensory aspects of smoking (e.g., cigarettes burning in an ashtray) or to pictures highlighting the economic and health aspects of smoking (e.g., a carton of cigarettes in a grocery store with the warning label visible). We found that the implicit attitudes of smokers varied greatly as a function of the highlighted aspects of smoking. Their implicit attitudes toward smoking were significantly more positive in the sensory aspects condition than in the packaging condition, illustrating context dependency in these implicit attitudes.

In a second study, we varied the motivational states of smokers. One group was deprived of nicotine for at least four hours. The other group was “loaded” with nicotine right before the experimental session. We also included a nonsmoking comparison group. When smokers were nicotine deprived, their implicit attitudes toward smoking were extremely positive. When they were nicotine loaded, however, their implicit attitudes were quite negative, even more negative than the implicit attitudes of nonsmokers. There were no differences in the explicit attitudes of deprived and nicotine loaded participants.

This sensitivity of the implicit attitudes of smokers to contextual and motivational factors is extremely important. Inducing negative implicit attitudes in smokers is likely, as we shall see, to increase the probability of quitting, and inducing negative implicit attitudes in nonsmokers is likely to decrease the probability of their smoking initiation.

In subsequent research, we investigated these behavioral effects of differences in implicit attitudes toward smoking. In a previous section, we presented recent research (Sherman et al., 2009) that investigated the intergenerational transmission of implicit attitudes toward smoking, which found that mothers' implicit attitudes were strongly transmitted to their nonsmoking children. Importantly, these implicit attitudes of the children predicted their smoking initiation 18 months later. Thus, implicit attitudes of nonsmoking adolescents can be useful in predicting their likelihood of subsequent smoking. Changing these implicit attitudes might prevent such initiation, and targeting vulnerable adolescents (i.e., those with positive implicit attitudes) for prevention programs might also be useful in decreasing their likelihood of later smoking.

Finally, we recently explored the role of implicit and explicit attitudes in predicting smoking cessation (Chassin, Presson, Sherman, Seo, & Macy, 2010). Results showed that the effects of these attitudes varied with levels of past experienced to control smoking and with the development of specific plans to quit. One important result of this work showed that smokers with more negative implicit attitudes toward smoking were the most likely to have quit 18 months later. In addition, explicit attitudes predicted smoking cessation for smokers who had a little previous failure to control smoking. On the other hand, implicit attitudes predicted later successful cessation for smokers who had a good deal of previous experience with failures to control smoking, but only if they had a specific plan to quit. These results indicate that smoking cessation involves both controlled processes (as captured by explicit measures) and automatic

processes (as captured by implicit measures). We suggest that interventions designed to bring about smoking cessation consider a focus on changing both explicit and implicit attitudes. Changing implicit versus explicit attitudes requires very different approaches (Rydell & McConnell, 2006). For changing implicit attitudes toward smoking, interventions might include creating new associations in memory, retraining attention, and/or using practice to change controlled processes into automatized processes (Stacy & Wiers, 2006). For changing explicit attitudes, persuasive messages that focus on social norms or the social desirability of not smoking should be very useful.

*4. The processes underlying implicit attitude change toward smoking and their relation to smoking behavior.*

The inclusion of implicit measures already has proven to be of great use in understanding attitudes toward smoking and related behavior. At the same time, this research raises a number of new questions about the processes that underlie implicit attitude and how these processes influence behavior. Implicit attitudes are typically interpreted as reflecting the nature of the evaluative associations underlying an attitude object or the subset of associations that are activated by the object. However, other processes that have nothing to do with the nature of the underlying evaluative associations may contribute to scores on implicit measures such as the IAT. Consider the Stroop task (Stroop, 1935), which possesses the same basic structure as the IAT, in which two paired responses are either compatible or incompatible with one another. A young child who knows colors but does not know how to read will likely perform very well on the task, making few errors. An adult with full reading ability may or may not achieve the same level of success. In either case, these performances would be based on very different underlying processes. For example, for an adult to perform the task accurately, the automatic habit to read

the word must be overcome on incompatible trials (e.g., the word blue written in red ink). In contrast, the child has no automatic reading habit to overcome. Thus, performance on the task may reflect variation in a number of underlying processes.

The same principle applies to implicit measures of attitudes, many of which (including the IAT) have a Stroop-like structure of compatible (e.g., cigarettes/negative words; cuddly animals/positive words) and incompatible (e.g., cigarettes/positive words; cuddly animals/negative words) trials. The performance of two people who appear to have equally strong negative overall implicit attitudes about smoking may reflect very different underlying processes. Whereas one person may have strong negative associations that are successfully overcome, the other may have weaker associations that are not overcome so well. Thus, the same overall attitude “scores” may reflect different underlying processes.

One method to address this issue is via application of the Quadruple Process model (for reviews, see Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Sherman et al., 2008; Sherman, Klauer, & Allen, 2010). The Quad model is a multinomial model designed to disentangle the contributions of four qualitatively distinct processes to implicit measure performance. The four processes are: The automatic activation of an association (Association Activation, AC), the ability to detect a correct response (Detection, D, representing response monitoring), the success at overcoming automatically activated associations (Overcoming Bias, OB), and the influence of a general response bias that might guide responses in the absence of other available guides to response (Guessing, G).

In ongoing research, we are applying the Quad model to better understand how implicit attitudes about smoking may be changed and how specific component processes guide behavior. One application of the model is to examine differences in the implicit attitudes of smokers, non-

smokers, and ex-smokers. Smokers may demonstrate more favorable implicit attitudes toward smoking than others because they have more positive associations with smoking (AC) or because they are less able to overcome (OB) those positive associations. Likewise, the parameters of the Quad model may be associated with heterogeneity within smoking status groups. For example, important differences among smokers on factors such as reports of smoking motives, craving, withdrawal, number of failed quit attempts, and measures of impulsivity may be differentially related to the Quad model's estimates of automatic evaluations, response monitoring, and response inhibition. By understanding how these groups differ on these fundamental processes, we can better understand why some people start smoking and others do not, why some people are able to quit smoking and others cannot, and what specific processes might need to be addressed in interventions aimed at reducing smoking. In some cases, altering the underlying associations may be crucial in reducing smoking behavior. In other cases, training people to detect appropriate behavioral responses when tempted to smoke or to overcome the influence of their underlying associations may be more effective.

Application of the Quad model can also help to understand and develop theories about when and how interventions change implicit attitudes or smoking behavior. Implicit attitudinal measures are predictors of smoking transitions, but they should not be considered as static, immutable predictors, but rather as dynamic and modifiable by intervention. As described above, we (Sherman et al., 2003) have shown that implicit attitudes to smoking are modifiable by deprivation interventions. Application of the Quad model can help us to understand this and similar phenomena. It may be that deprivation alters the nature of automatic evaluative associations of smokers or, alternatively, saps their ability to regulate their automatic reactions to cigarettes, and thus leaves them more vulnerable to relapse.



In other research, we are studying how persuasive messages alter implicit attitudes and the different component processes of the Quad model. Specifying the underlying processes through which anti-smoking messages change implicit attitudes will aid in the development of more effective messages. If we can identify the manner in which a message is effective, then new messages can be targeted to address the same underlying processes. Eventually, it may be possible to develop a comprehensive theory of the process-specific effects of messages that vary in systematic ways. Thus, it may be possible to develop messages that specifically target evaluative associations, the ability to over-ride such evaluations, and the ability to determine appropriate behavior.

We also can examine how these messages alter the parameters of the Quad model under conditions of smoking deprivation versus satiation (giving a more ecologically valid picture of how messages can affect smokers during a period of quitting compared to before a quit attempt). These data will help us to understand when and for whom the different processes are most important in determining smoking behavior. It will also help us to identify process-specific interventions that target specific deficits (overly favorable automatic evaluations, weak ability to detect appropriate behavior or overcome evaluations).

*Conclusion: A look at the benefits of a long-term longitudinal project*

Our research team has been fortunate to be able to conduct such a long-term longitudinal study involving a health behavior as important as cigarette smoking. Ours is in fact the longest such study that has ever been done. Such a project is extremely difficult and challenging. Trying to track our participants, who now live all over the world, is a major task in and of itself. Of course, even when participants are found, they must be convinced to participate by answering a lengthy questionnaire and possibly by being available for other studies involving other family

members. This is also not easy, considering the fact that our participants have jobs, have family obligations, and earn sufficient money so that the rather small incentives that we can offer are not very meaningful. Yet we are able to recruit over 70% of the original sample at each wave of the data collection, primarily by convincing them of the uniqueness and the importance of our research. Another major challenge has been the kinds of cutting edge and complex analytic techniques that must be employed. Given the complexity of the design, the incomplete or missing data, the fact that participants may disappear for a wave or two and then reemerge, the potential bias in participant loss, and the need for time series analyses, keeping up with the newest analytic strategies has been challenging. In order to help others who are engaged in similar kinds of projects, we edited a book that discusses the appropriate analytic techniques for handling data sets such as ours (Rose, Chassin, Presson, & Sherman, 2000).

We would never have been able to be successful in keeping the project going for all these years without the generous and continuous grant funding from the National Institutes of Health from 1979 until the present time. But we believe that the project has been worthy of this support. The importance of long-term longitudinal research to study the causes and consequences of health relevant behaviors such as cigarette smoking can not be overstated. First, cross-sectional studies or short-term longitudinal studies do not allow the researcher to assess causal relations in a definitive way or to be able to probe for the underlying psychosocial mechanisms that underlie the effects. The fact that we have a very large number of participants and multiple data points allows us to assess causality and explore underlying psychological processes. For example, as pointed out earlier, assessing smoking behavior cross-sectionally at only one point in time is likely to obscure different subgroups of smokers who exhibit different risk factors. Our

longitudinal design allowed us to identify multiple trajectories of smoking that were extremely important for assessing the various causes and outcomes of smoking.

In addition to a clearer assessment of causality, our long-term study allows us to examine whether any effects, behavior changes, or health outcomes last over a long period of time or whether they are short-lived. For most research, effects are explored for only a brief period of time after some event or manipulation. We have been able to observe whether changes in smoking status, including smoking cessation, are more permanent or whether they last only briefly. Moreover, by arriving at a better understanding of the natural history of smoking behavior and by identifying and exploring the different trajectories of smoking behavior, we have been able to suggest how interventions might be tailored to the different types of smokers. The length of our project has also allowed us to collect relevant data from the children of our original participants. Thus, as we saw, we have been able to study the intergenerational transmission of smoking attitudes and behaviors. Obviously, an understanding of the processes involved in transmitting health relevant attitudes and behaviors from generation to generation is extremely important for the development of prevention programs that might be successful in keeping high-risk adolescents from becoming smokers. Although we have never been directly involved in the development of prevention programs or interventions aimed at cessation of smoking, our results have been available for use by others who do develop such programs and the findings have the potential for helping researchers both develop and test the success of these kinds of programs.

One important reason why this particular project has been so successful involves the make-up of the principal investigators. Jim Sherman was trained in experimental social psychology. Laurie Chassin had her training in clinical psychology, with a focus on adolescent

problem behaviors. Clark Presson's degree is in developmental psychology. These three researchers have been with the project since its inception. The continuity is very important.

In addition, the fact that three disciplines are represented in their training has allowed the project to address questions, to develop methodologies, to employ analytic techniques, and to build conceptual theories that derive from social, clinical, and developmental psychology. Certainly all three of these areas of psychology are extremely important in the study of complex health behaviors such as cigarette smoking. The fact that the principal investigators represent a variety of disciplines has also allowed us to publish our work in many different kinds of outlets that have very different readerships. Thus, our work is likely to have greater dissemination than most research. We have published our findings and theories in experimental social psychology journals, applied social psychology journals, clinical psychology journals, and developmental psychology journals, as well as in health psychology journals, journals that specialize in addictive behaviors, and public health journals. We have published theoretical chapters as well as monographs and a book that reach very different kinds of audiences. A key factor in the success of a project such as this one is reaching relevant audiences. This is especially true when the goals of the project are both theoretical and applied in nature. We have attempted to develop and test theories about the initiation, spread, natural history, and cessation of smoking. We have done both laboratory research and questionnaire survey research during the time of the project. Yet we have never lost sight of the practical and applied goals involved in the project. Our work has always tried to answer questions that would reduce smoking initiation among adolescents, allow smokers to quit or decrease their smoking, and improve health more generally in the population. We hope that we have been successful in meeting these goals

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