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Smoking and the Implicit Association Test: When the Contrast Category Determines the Theoretical Conclusions

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Two experiments sought to determine whether smokers and nonsmokers differ in their implicit associations to smoking behavior. Both experiments used the implicit association test (IAT) with the categories of smoking versus nonsmoking. Experiment 2 also included an IAT with the categories of smoking versus stealing. When the IAT contrasted smoking and nonsmoking, nonsmokers exhibited negative smoking attitudes, whereas smokers appeared to be ambivalent. Explicit attitude ratings were consistent in both their pattern and polarity. However, when the IAT was based on the categories of smoking versus stealing, performance was identical among smokers and nonsmokers. Thus, implicit and explicit attitudes toward smoking were congruent with each other, but only as measured by the IAT with a generic contrast category. Implications for measuring implicit attitudes, especially within applied contexts, are discussed.

The implicit association test (IAT; Greenwald, McGhee, & Schwartz, 1998) is a widely used method for assessing implicit attitudes. The IAT requires categorizing words that belong to target (e.g., flowers, insects) and attribute (e.g., pleasant words, unpleasant words) concepts. The trials of interest occur when the two concepts are mapped onto one response key. For example, during one block, participants might press one key for words related to flowers or pleasant words and another key for words related to insects or unpleasant words. During a separate block, these pairings are reversed (i.e., flowers or unpleasant vs. insects or pleasant). Participants' implicit associations are assumed to be stronger for the response mappings that they find easier to perform. In the preceding example, Greenwald et al. (1998) found that the vast majority of participants are quicker to categorize words when the response mappings place flowers and pleasant objects together.

Since Greenwald et al. (1998) first introduced the IAT, it has been used to assess implicit associations in a number of domains, including spider phobia (Teachman & Woody, 2003), attraction to violence (Gray, MacCulloch, Smith, Morris, & Snowden, 2003), and racial attitudes (Dasgupta, McGhee, Greenwald, & Banaji, 2000). One area in which the IAT may be particularly useful is within the context of behaviors that are socially unacceptable. It is within this context that one would generally expect people to be most likely to conceal their preferences, either from themselves, from others, or both (Westen, 1998). The IAT, by contrast, does not seem to be heavily influenced by such social desirability factors (Banse, Seise, & Zerbes, 2001; Kim, 2003).

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ASSESSING IMPLICIT ATTITUDES IN APPLIED CONTEXTS

A number of potential paradigms can be used to assess implicit attitudes. These include measures based on evaluative or lexical priming (Wittenbrink, Judd, & Park, 2001), the IAT (Greenwald et al., 1998), word stem completions (Hetts, Sakuma, & Pelham, 1999), the emotional Stroop task (Bosson, Swann, & Pennebaker, 2000), and the affective Simon task (De Houwer, Crombez, Baeyens, & Hermans, 2001), among other candidate assessment techniques (Robinson & Neighbors, in press). From an applied perspective, however, it is problematic that many of the available measurement techniques suffer from low internal consistency and poor test–retest stability (Bosson et al., 2000; Robinson & Neighbors, in press). For example, negligible test–retest correlations have been reported for measures based on emotional Stroop and evaluative priming paradigms (Bosson et al., 2000; Robinson & Neighbors, in press).

It is in this context that the IAT fares extremely well. Effect sizes, defined in terms of evaluative scores favoring one object (e.g., young target persons) over another object (e.g., old target persons), are large and consistent in their magnitude (Greenwald et al., 1998; Greenwald, Nosek, & Banaji, 2003). By contrast, evaluative biases favoring particular objects are usually quite a bit less robust when using other techniques, such as the evaluative priming paradigm (Greenwald et al., 1998). In addition to the magnitude of IAT attitude effects, the test also possesses internal consistency coefficients that are comparable to explicit self-report measures (i.e., in the neighborhood of .8–.9: Greenwald & Nosek, 2001). Finally, test–retest stability coefficients for the IAT are in the neighborhood of $r = .6$ (Greenwald & Nosek, 2001), which is quite respectable for implicit tests (Bosson et al., 2000; Robinson & Neighbors, in press).

The application value of any test depends on its reliability and validity. In terms of assessment, one wants a close relationship between observed scores and "true" scores, as is widely recognized within assessment contexts (Robinson & Neighbors, in press). To the extent that observed scores depart from true scores, there is a serious danger of making inappropriate conclusions concerning the person's standing on the construct of interest (Cronbach & Meehl, 1955). This is particularly problematic given that psychological interventions are costly and should not be delivered at random (Robinson & Neighbors, in press). Internal consistency and test–retest stability, although not sufficient for ensuring the assessment value of a test, are at least necessary conditions in this regard (Cronbach & Meehl, 1955). It is for these reasons that the IAT is such a potentially useful tool in applied research contexts (Greenwald & Nosek, 2001).

Within our particular assessment context, we were interested in the value of using the IAT to predict the likelihood of a person engaging in smoking behavior. Because smoking is often an involuntary habit, it would be useful to be able to tap the potential implicit attraction processes that render smoking a desirable activity. In support of such a goal, prior research on alcohol and marijuana use has shown that implicit associations involving drug-related words are useful in predicting the likelihood of substance use (Stacy, 1997). Similarly, within the context of smoking behavior, it could be that a measure of implicit attraction to smoking might be useful in predicting the likelihood of smoking behavior.

Furthermore, and of considerable applied importance, an implicit measure can be understood in terms of the cognitive processes that likely mediate appraisal, experience, and behavior (Robinson & Neighbors, in press). Such tendencies can be altered by cognitive training procedures (e.g., MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). In other words, understanding the (implicit) cognitive processes associated with a behavior necessarily provides a basis for intervention efforts, as has long been recognized within the literature on mood disorders and cognitive processing biases (Beck, 1976).

SMOKING BEHAVIOR AND IMPLICIT ATTITUDES TOWARD SMOKING

In recent years, it has been shown that people harbor implicit attitudes toward objects that may or may not correspond to their explicit attitudes (Banaji, 2001; Greenwald & Nosek, 2001; Robinson & Neighbors, in press). By examining both explicit and implicit attitudes toward smoking, it is possible to contrast two alternative hypotheses. One hypothesis is that although smokers may have more positive explicit attitudes than nonsmokers, their implicit attitudes toward smoking may be equally negative. In favor of this *implicit/explicit dissociation hypothesis* is the idea that repeated exposure to antismoking messages is likely to create implicit negative attitudes among both smokers and nonsmokers alike (Karpinski & Hilton, 2001). Also in favor of this hypothesis is the idea that defensive processes, such as those related to minimizing the health risks of smoking, may be relatively more effective in altering explicit attitudes than implicit attitudes, precisely because implicit attitudes are relatively immune from influences related to social desirability (Banse et al., 2001; Kim, 2003).

A second, mutually incompatible hypothesis is that smoking habits alter not only explicit attitudes but also implicit attitudes. In other words, smokers, relative to nonsmokers, may be more favorable toward smoking at both levels. We term this the *implicit/explicit congruence hypothesis*. In favor of this hypothesis is the idea that, in the absence of self-destructive tendencies, people are averse to engage in behaviors that they evaluate negatively. Indeed, it seems likely that smoking would be a difficult behavior to engage in if implicit associations were repeatedly and strongly negative (for related evidence, see Nosek, Banaji, & Greenwald, 2002). Also in favor of this hypothesis is the idea that smoking behavior brings certain rewards (e.g., a "nicotine fix") that likely influence implicit associations (Leung & McCusker, 1999; Sherman, Rose, Koch, Presson, & Chassin, 2003).

It is theoretically important to determine which of these two alternative hypotheses is correct. If the dissociation hypothesis is correct, then we are faced with the real puzzle of how people could engage in behavior that is implicitly devalued. In addition, we would seem to have a clear case (among smokers) of motivated distortion affecting explicit, but not implicit, attitudes (Swanson, Rudman, & Greenwald, 2001). On the other hand, if the congruence hypothesis is correct, then the distinction between implicit and explicit attitudes loses a bit of force, at least in this context. In addition, distinguishing which hypothesis is correct would help us to understand whether implicit associations reflect personal experiences with the object, which should be more positive among

smokers, or whether implicit associations reflect cultural knowledge (i.e., smoking is bad; Swanson et al., 2001), which should be relatively similar among smokers and nonsmokers (Karpinski & Hilton, 2001).

There are some prior data comparing smokers and nonsmokers with respect to their implicit attitudes toward smoking. However, the data are not entirely clear. Swanson et al. (2001) found, in two studies, no differences between smokers and nonsmokers in their implicit attitudes toward smoking. However, in a third study (Swanson et al., 2001; Study 3), there was a difference such that smokers were more implicitly favorable toward smoking (also Sherman et al., 2003, Study 2). In explaining why Study 3 results were different from their other two studies, Swanson et al. suggested that the pictorial nature of Study 3's stimuli might be involved. However, our sense is that there is another variable that might be more important. Specifically, Studies 1 and 2, which found no differences between smokers and nonsmokers, contrasted smoking objects with a set of objects that were distinct and evaluative (e.g., stealing-related objects). The distinct, evaluative nature of the contrasting category renders it likely that an IAT, constructed in this manner, is likely to measure both attitudes toward smoking and attitudes toward the alternate paired category (Nosek & Banaji, 2001). This explains why smoking can be an implicitly positive activity when contrasted with stealing (Swanson et al., Study 2) but an implicitly negative activity when contrasted with exercise (Swanson et al., Study 1).

A MODIFIED IAT

The present studies had multiple objectives. One was to determine whether the dissociation or congruence hypothesis better characterizes attitudes toward smoking. Within other attitudinal domains, the current picture is mixed. As Greenwald et al. (2002) reported, a moderate degree of implicit–explicit correspondence seems to characterize attitudes toward political candidates, preferred protein sources, and consumer goods. However, a low degree of implicit–explicit correspondence seems to characterize attitudes toward age groups, racial groups, and the self. Along the latter lines, Hummert, Garstka, O'Brien, Greenwald, and Mellott (2002) found that both old and young participants implicitly favored young people over old people in a version of the IAT. In addition, there was no significant correlation between explicit and implicit attitudes toward young and old age targets. These results favor the dissociation hypothesis in the context of age attitudes (Hummert et al., 2002).

In addition, however, we undertook the present studies in an effort to highlight methodological factors in the construction of the IAT. One potential limiting factor of the IAT is the need for a contrasting category (Nosek & Banaji, 2001). In many circumstances, this may not be a limitation. For example, it is reasonable to contrast White targets with Black targets, old targets with young targets, and the self with others (but see Karpinski, 2004, in regard to the last connection). However, there are other cases in which there is no obvious or natural contrast category. For example, if an investigator wanted to assess a person's implicit attitudes toward cold medicine, it would be desirable to do so without being required to come up with a distinct alternate category (e.g., pain relievers?). The same is true when the attitude object concerns smoking behavior. On the basis of similar considerations, Nosek and Banaji (2001) created a task called the *go/no-go association task*. The task involves responding to certain categories (e.g., smoking or bad words), but not others (e.g., good words), within particular blocks. The task can be constructed so that no contrast category is required. However, the task, as constructed at present, suffers from low internal consistency (*M* split-half $r = .20$: Nosek & Banaji, 2001). In this respect, the task is considerably less reliable than the IAT (*M* split-half $r = .90$: Greenwald & Nosek, 2001) and therefore less useful for many applied research purposes.

It seemed to us that the IAT could be altered to take advantage of the reliability of a choice reaction time format without the need for a distinct contrast category. In modifying the IAT, we were influenced by prior work on choice reaction time, particularly as related to the lexical decision task (Joordens & Becker, 1997; Neely, 1991). In the lexical decision task, words (*A*) are contrasted with nonwords (not *A*) rather than an unrelated category (*B*). Although it would be feasible and logical to use a lexical decision task within an IAT-like paired format (e.g., nonword or bad vs. word or good), the lexical decision task has a notable shortcoming: It does not require a great deal of semantic processing (Joordens & Becker, 1997). However, a categorization task modeled on the lexical decision task should tap semantic meaning without the requirement of a distinct contrasting category (Robinson, 2004).

In the present context, the category of smoking (*A*) could quite naturally be contrasted with the category of nonsmoking (not *A*). Within this categorization task both choices have relevance to smoking, much as both choices within the lexical decision task have relevance to lexical status. An additional feature of this modification of the IAT pertained to the choice of exemplars. The visual similarity of words and nonwords is an important determinant of the likelihood of semantic processing within the lexical decision task. If words (e.g., *peach*, *tree*) bear little similarity to nonwords (e.g., *xpduapf*, *yhchh*), a person can perform the task without accessing semantic meaning (Joordens & Becker, 1997). By contrast, if words (e.g., *peach*, *tree*) bear a greater degree of similarity to nonwords (e.g., *poech*, *trae*), then a greater degree of semantic processing occurs (Stone & Van Orden, 1993). We therefore chose nonsmoking words (e.g., *novelty*, *inherited*) that bore a good deal of visual similarity to smoking words (e.g., *nicotine*, *inhaling*). Addi-

tionally, the nonsmoking words came from heterogeneous categories. This renders it less likely that implicit attitudes toward nonsmoking words would contribute in any systematic way to overall IAT scores.

STUDY 1

In Study 1, we examined whether the modified IAT would reveal a difference between smokers and nonsmokers. To the extent that such a difference is found, it would suggest that implicit attitudes might be useful in predicting the likelihood of smoking behavior, and further research along these lines would be warranted. To the extent that such a difference is not found, it would suggest that implicit attitudes might have little relevance to smoking behavior and therefore that one should reasonably look elsewhere for predictors of smoking behavior. In Study 1, we expected smokers and nonsmokers to differ on the modified IAT task. In Study 2, we sought to replicate the results of Study 1. In addition, we sought to replicate Swanson et al. (2001, Study 2) in showing no group difference on an IAT that contrasts smoking with stealing. In both studies, we also examined explicit attitudes toward smoking as a way to examine questions related to dissociations between implicit and explicit attitudes.

Method

Participants. Participants were 48 undergraduates (24 women) selected on the basis of a screening questionnaire completed at the beginning of the semester. Smokers ($n = 20$) reported smoking at least one cigarette a day, and nonsmokers ($n = 28$) reported having never smoked. The basis of recruitment was not known to participants, and the study itself was described as one involving attitudes generally rather than smoking-related attitudes specifically. Debriefing questions confirmed participants' smoking status.

Procedure. The IAT required participants to categorize a word that was presented in the center of a computer monitor. Category names appeared on the upper left and upper right portions of the monitor. If the word belonged to the category on the upper left, participants pressed the "1" button on a response box (error < 1 msec). If the word belonged to the category on the upper right, participants pressed the "5" button on a response box. Incorrect categorizations were followed by the word *INCORRECT* in a red font for 1.5 sec. Correct categorizations were followed by a 100-msec blank screen.

The IAT had seven blocks: (a) 24 practice categorizations for the attributes (i.e., bad–good), (b) 24 practice categorizations for the targets (i.e., nonsmoking vs. smoking), (c) 16 practice categorizations for the first combined task (i.e., nonsmoking or bad vs. smoking or good), (d) 48 experimental categorizations for the first combined task (i.e., nonsmoking or bad vs. smoking or good), (e) 24 practice categorizations for a reversed target task (i.e., smoking vs. nonsmoking), (f) 16 practice categorizations for the second combined task (i.e., smoking or bad vs. nonsmoking or good), and (g) 48 experimental categorizations for the second combined task (i.e., smoking or bad vs. nonsmoking or good). Although the order of combined blocks does tend to influence IAT scores to some small degree (Greenwald et al., 2003), an invariant block order was chosen to ensure that the test was identical across individuals, as would be useful in an assessment context.

As discussed earlier, we matched each smoking word (e.g., *cigarettes*) with a word beginning with the same first letter and of roughly the same length (e.g., *cucumber*). This matching was done to increase the extent of semantic processing (e.g., Stone & Van Orden, 1993). The nonsmoking words were neither positive nor negative to any considerable extent and came from heterogeneous categories. We reasoned that the latter word choice factors would minimize systematic variance due to associations with the nonsmoking exemplars.[1]

After they completed the IAT, participants rated their (explicit) attitudes toward smoking with eight semantic differential bipolar pairs (*good* vs. *bad*, *healthy* vs. *unhealthy*, *sexy* vs. *unsexy*, *pleasant* vs. *unpleasant*, *harmless* vs. *harmful*, *sociable* vs. *unsociable*, *ugly* vs. *glamorous*, and *calming* vs. *stressful*; scale = –3 to +3). These items are identical to those used by Swanson et al. (2001).

Results

We followed the data reduction procedure outlined by Greenwald et al. (1998). This involved deletion of the first two trials, replacement of trials that were below 300 msec and above 3,000 msec with these values, deletion of inaccurate trials, and a log transformation of the raw latencies. Analyses were performed on these transformed latencies. For ease of interpretation, means are reported in milliseconds.[2]

To investigate smokers' and nonsmokers' implicit attitudes toward smoking, we performed a mixed-model ANOVA with two factors. The between-subjects factor pertained to smoking status (nonsmoker vs. smoker). The within-subject factor pertained to whether smoking objects were paired with good or bad words in an IAT block (i.e., smoking or bad vs. smoking or good). The main effect of smoking status was not significant ($F < 1$). The main effect of

[1]The smoking words were *cigarettes, tobacco, nicotine*, and *inhaling*. The nonsmoking words were *cucumber, telephone, novelty*, and *inherited*. The bad words were *disgusting, gross, terrible*, and *negative*. The good words were *pleasing, great, favorable*, and *positive*.

[2]Greenwald et al. (2003) reported a different scoring technique for the IAT. However, they also noted that alternate scoring procedures, such as algorithm reported in the original article (Greenwald et al., 1998), are unlikely to change substantive conclusions provided that studies have adequate power.

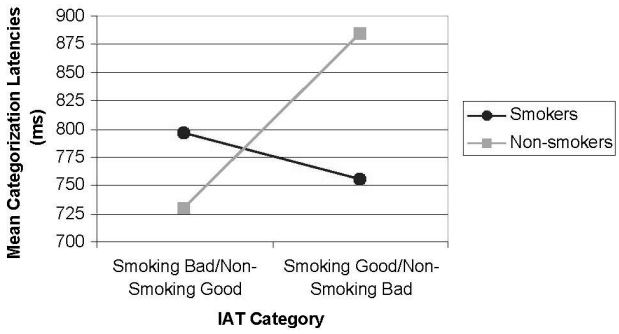

FIGURE 1 Mean categorization latencies for the smoking versus nonsmoking implicit association test (IAT), Study 1.

IAT block was significant, $F(1, 46) = 7.25$, $p = .01$, due to the fact that participants were faster in the block in which smoking was paired with bad (M = 757 msec) versus good (M = 830 msec) words. This main effect was qualified by a significant Smoking Status × Block interaction, $F(1, 46) = 17.11$, $p < .001$. This interaction, displayed in Figure 1, shows that smokers had more positive implicit associations toward smoking objects (IAT difference score = +41; the plus sign indicates that smoking was paired faster with good evaluations) than nonsmokers (IAT difference score = –154; the minus sign indicates that smoking was paired faster with bad evaluations).

Although smokers' and nonsmokers' IAT effects were significantly different, we wanted to determine whether the IAT effect was significant for each group of participants considered separately. To test this, we performed paired-sample t tests separately for nonsmokers and smokers. Although nonsmokers were significantly faster in the block in which smoking was paired with bad (M = 730 msec) versus good (M = 883 msec) words, $t(27) = –4.97$, $p < .001$, smokers' categorization times did not differ by block (smoking or bad: M = 795 msec; smoking or good: M = 754 msec), $t(19) = 1.05$, $p = .307$. These results suggest that nonsmokers evaluate smoking negatively, whereas smokers are more ambivalent in their implicit attitudes.

To provide further insight into the interaction, we examined whether smoking status influenced speed for each block (smoking or bad; smoking or good) separately. Smokers and nonsmokers were equally fast when smoking objects were paired with bad words (Ms = 795 and 729 msec, respectively), $F(1, 46) = 1.51$, $p = .225$; however, smokers were faster than nonsmokers when smoking objects were paired with good words (Ms = 755 and 884 msec, respectively), $F(1, 46) = 4.41$, $p = .041$. One interpretation of this pattern of findings is that both smokers and nonsmokers associate smoking with negative evaluations. However, smokers, but not nonsmokers, also associate smoking with positive evaluations. The combination produces ambivalence among smokers.

In analyzing the explicit attitude measures, we reverse scored the *ugly–glamorou*s item and then averaged the eight responses to create an explicit attitude score. Nonsmokers (M = –1.59) rated smoking as significantly more negative than smokers did ($M = 0.25$), $t(46) = –3.82$, $p < .001$. Furthermore, nonsmokers' average ratings differed significantly from zero, $t(27) = –12.29$, $p < .001$, whereas smokers' average ratings did not, $t(19) = 0.46$, $p = .650$. Note that the pattern of data for the explicit measure is exactly the same as the pattern of data for the implicit measure: In both cases, nonsmokers seem to possess a negative attitude toward smoking, whereas smokers seem to be ambivalent. To further examine parallels between the explicit and implicit attitude measures, we correlated the IAT difference score (higher = more favorable toward smoking) with the explicit attitude score (higher = more favorable toward smoking). There was a significant correlation, $r(48) = .40$, $p = .005$.

Discussion

In the typical version of the IAT, participants are asked to categorize stimuli into one of two distinct categories (e.g., Black names vs. White names). This procedure renders the IAT a relativistic measure (e.g., Karpinski, 2004); that is, one can make conclusions concerning a relative preference for one category (e.g., White names) over another (e.g., Black names), but one cannot determine whether attitudes toward one category, the other, or both, are most important in accounting for IAT difference scores (Nosek & Banaji, 2001; Nosek, Greenwald, & Banaji, in press). Study 1 introduced a modified procedure that we thought might circumvent some concerns related to the relativistic nature of the IAT. Specifically, we contrasted a smoking category with a nonsmoking category. In addition, the exemplars pertaining to the nonsmoking category were relatively nondistinct and nonvalenced. These procedural changes should systematically increase the importance of the smoking category, and systematically decrease the importance of the nonsmoking category, in affecting IAT performance.

The modified IAT indicated that smokers and nonsmokers have divergent implicit evaluations of smoking behavior. In this connection, IAT difference scores varied by smoking status (smoker vs. nonsmoker). Further analyses revealed a number of additional supportive results. IAT difference scores were significantly different than zero among nonsmokers, indicating a negative implicit attitude toward smoking. On the other hand, IAT difference scores were not significantly different than zero among smokers, indicating an implicit attitude that appears to be ambivalent.

Because the IAT difference score was not significantly different among smokers, it could be that smokers have either neutral or ambivalent attitudes toward smoking behavior. The present modification of the IAT cannot really distinguish between these two possibilities. However, given that the behavior in question is personally relevant for smokers, but not

for nonsmokers, we suggest that smokers are ambivalent about smoking, associating it with both positive and negative evaluations (Sherman et al., 2003). Further support for the ambivalence idea follows from additional analyses of Study 1 data. Both smokers and nonsmokers were equally fast in the block in which smoking was paired with negative evaluations; however, smokers were faster in the block in which smoking was paired with positive evaluations. Thus, it seems that everyone can associate smoking with negative evaluations, but only smokers can additionally associate smoking with positive evaluations. Such conclusions are in accordance with prior observations (Sherman et al., 2003).

Further support for the notion that smokers have ambivalent attitudes came from the explicit data of Study 1. Because the attitude scale was based on a bipolar conception of attitude valence (as is common in the literature), we could compare smokers and nonsmokers to each other as well as to the neutral midpoint of the evaluation scale. Three findings involving the implicit and explicit scores were highly parallel. First, smoking status affected both in the same direction. Second, on both measures nonsmokers had scores that were significantly different from zero; by contrast, on both measures smokers had scores that were not significantly different from zero. Third, there was a significant correlation. The combination of findings, in sum, appears to support the implicit/explicit congruence hypothesis rather than the implicit/explicit dissociation hypothesis, at least in this context.

STUDY 2

In Study 2, we sought to replicate the results of Study 1. In addition, we asked Study 2 participants to complete a second IAT that contrasted smoking versus stealing (as in Swanson et al., 2001, Study 2). We expected the present modified IAT to support the implicit/explicit congruence hypothesis. By contrast, we expected the more traditional IAT to support the implicit/explicit dissociation hypothesis. To the extent that we can obtain these divergent findings within the context of a single sample of participants, we would gain more evidence for the potential value of the present modification of the IAT.

Method

Participants. Participants were 52 undergraduates (23 women) selected on the basis of a screening questionnaire completed at the beginning of the semester. Smokers ($n = 24$) reported smoking at least one cigarette a day, and nonsmokers ($n = 28$) reported having never smoked. Recruitment and debriefing procedures were identical to Study 1.

Procedure. Participants completed two IATs: one identical to the one in Study 1 and one that used the categories of smoking versus stealing (as in Swanson et al., 2001, Study 2). The general procedures, including the use of category labels, a response box, and accuracy feedback, were the same as in Study 1. The words and categories in the smoking versus stealing IAT were taken from Swanson et al. (2001, Study 2).

Within assessment contexts, it is desirable to keep the testing conditions identical across participants. We adopted such a procedure in Study 2, but several order variables deserve note. As in Study 1, the block pairing smoking and positive evaluations was first in both IATs. Although the order of combined blocks does exert some small influence on the size of the IAT effect (Greenwald et al., 2003), such an invariant order of blocks was used to facilitate comparisons across participants. Participants also completed the modified IAT before the smoking-versus-stealing IAT. Although counterbalancing the order of IATs may be generally advocated, extensive prior research has indicated that different IAT orders do not tend to influence the magnitude of IAT effects occurring within a particular IAT task (Greenwald et al., 2002). Finally, and as in Study 1, participants completed the IATs before the explicit attitude measures. This was in part due to our concerns related to contextual effects on IAT performance (e.g., Blair, 2002). By contrast, we know of no data showing that explicit self-report measures can be influenced by prior completion of a cognitive processing task (Robinson, Solberg, Vargas, & Tamir, 2003). These considerations aside, effects involving the order of implicit and explicit measures have been characterized as negligible (Nosek et al., in press). In sum, the invariant order of measures adopted in Study 2 seemed legitimate, given our particular interest in assessment and the relatively minimal order effects that have been reported in previous research.

Results

We used the data reduction procedure outlined in Study 1. We first analyzed data from the modified IAT measure. Latencies were examined as a function of smoking status (smoker vs. nonsmoker) and block (smoking or bad vs. smoking or good) in a mixed-model ANOVA. The effects were similar to those in Study 1. Specifically, there was no main effect of smoking status ($F < 1$). There was, however, a main effect of block, $F(1, 50) = 17.94$, $p < .001$, such that categorization was faster when smoking was paired with negative evaluations ($M = 812$ msec) compared with positive evaluations ($M = 902$ msec). Finally, the interaction between smoking status and block was significant, $F(1, 50) = 5.82$, $p = .02$. This interaction, displayed in Figure 2, reveals that smokers' ($M = –41$) and nonsmokers' ($M = –131$) IAT effects (higher = more favorable toward smoking) were different.

As in Study 1, we performed paired-sample t tests on the means for each block, separately for smokers and nonsmokers. Nonsmokers were significantly faster in the block involving smoking objects paired with negative evaluations ($M = 813$ msec) compared with positive evaluations ($M = 945$ msec), $t(27) = –4.80$, $p < .001$. On the other hand, among

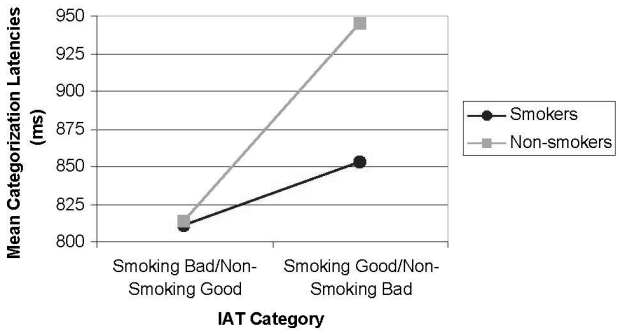

FIGURE 2 Mean categorization latencies for the smoking versus nonsmoking implicit association test (IAT), Study 2.

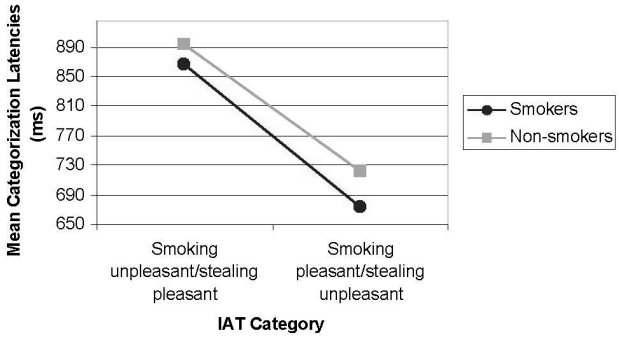

FIGURE 3 Mean categorization latencies for the smoking versus stealing implicit association test (IAT), Study 2.

smokers, there was no difference between performance on the smoking/negative (M = 811 msec) and smoking/positive (M = 853 msec) blocks, $t(23) = 1.27$, $p = .216$. Note that these results are identical to those in Study 1.

We next compared smokers' and nonsmokers' response latencies for each combined category. Smokers and nonsmokers did not significantly differ when smoking objects were paired with bad words (Ms = 811 and 813 msec, respectively), $F(1, 50) = 0.01$, $p = .909$, but there was some tendency toward a difference when smoking objects were paired with good words (Ms = 853 and 945 msec, respectively), $F(1, 50) = 2.65$, $p = .11$.

We next analyzed the data from the smoking-versus-stealing IAT (see Figure 3 for means). We again performed a mixed-model ANOVA with smoking status as a between-subjects variable and block as a within-subject variable. The main effect of smoking status was not significant, $F(1, 50) = 1.34$, $p = .252$. The main effect of block was significant, $F(1, 50) = 158.70$, $p < .001$. Unlike the modified IAT, this version of the IAT indicated that participants were faster to associate smoking with a positive evaluation (M = 699 msec) than with a negative evaluation (M = 880 msec). Also unlike the modified IAT, this version of the IAT yielded no Smoking Status × Block interaction, $F(1, 50) = 1.98$, $p = .165$. In other words, using the smoking-versus-stealing version of the IAT, smokers and nonsmokers appear to have the same implicit attitudes toward smoking, a pattern also observed in the first two studies of Swanson et al. (2001).

We next analyzed the data pertaining to explicit attitudes. The results were the same as in Study 1; specifically, nonsmokers rated smoking (M = –1.48) more negatively than smokers (M = 0.45) did, $t(49) = –3.59$, $p = .001$. Furthermore, as in Study 1, nonsmokers' average ratings differed significantly from zero on the bipolar evaluation scale, $t(26) = –14.25$, $p < .001$, whereas smokers' average ratings did not differ from zero on this scale, $t(23) = 0.80$, $p = .430$. Thus, as in Study 1, the explicit attitude results paralleled the results from the modified IAT; however, they were not parallel to the results from the smoking-versus-stealing IAT. Study 2 is important in that it shows that different conclusions related to implicit–explicit correspondence can be drawn depending on the IAT in question.

Correlations between implicit and explicit attitudes reinforce the preceding points. As in Study 1, the explicit attitude measure was correlated with the modified IAT difference score, $r(51) = .40$, $p = .004$. This suggests that the two measures are tapping similar, rather than divergent, evaluations. However, the explicit attitude measure was not correlated with the smoking-versus-stealing IAT difference score, $r(51) = .05$, $p = .718$, which suggests that implicit and explicit attitudes are dissociated.

Discussion

The results of Study 2 replicated those of Study 1 in many important respects. As in Study 1, we found a Smoking Status × Block interaction affecting performance within the modified IAT. As in Study 1, nonsmokers exhibited negative implicit evaluations of smoking, in that they were faster in the block in which smoking and unpleasant were paired relative to the block in which smoking and pleasant were paired. As in Study 1, smokers were equally fast in the two blocks, suggesting a degree of ambivalence in their implicit evaluations of smoking. As in Study 1, explicit attitudes toward smoking exactly mirrored these patterns in that smokers' explicit attitudes were more positive, nonsmokers had explicit attitudes toward smoking on the negative side of the bipolar evaluation scale, and smokers had explicit attitudes that did not differ from the neutral midpoint of the bipolar evaluation scale. As a further indication of convergence across the two attitude measures, we found a moderately sizable correlation between explicit and implicit attitudes (r = .40). Given the replication across studies, these conclusions seem reasonably sound.

In Study 2, but not Study 1, we also had participants complete an IAT in which smoking and stealing categories were contrasted, as in a prior study by Swanson et al. (2001). Conclusions regarding performance on this more traditional IAT

should be regarded as more preliminary for three reasons. First, we did not counterbalance the two IATs but rather always administered the smoking-versus-stealing IAT second. Second, we were able to administer this traditional IAT in only one of the two studies. Third, whereas Swanson et al. contrasted smoking with several objects across their studies (e.g., smoking vs. stealing, smoking vs. exercise), we used only one of their comparisons. These qualifications aside, our results involving the smoking-versus-stealing IAT were identical to those from Swanson et al. Of most importance, smoking status (i.e., smoker vs. nonsmoker) did not influence performance with the task, suggesting that all people, smokers and nonsmokers alike, have similar implicit attitudes toward smoking. Of additional importance, we found, as did Swanson et al., that performance within the smoking-versus-stealing IAT was unrelated to the person's explicit attitudes toward smoking.

Therefore, the findings involving our modified IAT must be contrasted with the findings involving the smoking-versus-stealing IAT. The latter IAT revealed a considerable implicit–explicit dissociation among smokers. The dissociation in mean patterns, in combination with the lack of correlation between the measures, suggests the possible presence of motivated distortion. This is obviously a different conclusion than one would draw on the basis of performance on the modified IAT. We therefore conclude that it appears to matter, both methodologically and theoretically, which contrasting category is paired with smoking in the IAT.

GENERAL DISCUSSION

We were interested in the question of whether smokers and nonsmokers have similar or dissimilar implicit attitudes toward smoking. Prior results that have examined this question have produced mixed findings (Sherman et al., 2003; Swanson et al., 2001). We believed that we could offer further progress on these issues by conducting research with a modified IAT that contrasts smoking versus nonsmoking. Across two studies, we found that smokers' implicit attitudes, as assessed with this modified IAT, were similar to their explicit attitudes, both in terms of mean patterns and correlation-related correspondence. Study 2 also provides evidence that divergent conclusions can be reached when the IAT contrasts two distinct categories (i.e., smoking vs. stealing), as is conventional in the IAT literature. The results have implications for basic and applied research, as we discuss next.

A Modified IAT

Within a number of contexts, it makes sense to contrast attitudes toward one set of objects (e.g., old people) with attitudes toward a seemingly opposite set of objects (e.g., young people). However, many attitude objects do not have an opposite category. Flowers can be contrasted with insects, or plants, or perhaps an almost unlimited number of opposite categories. Smoking is somewhat naturally contrasted with nonsmoking, but it is unlikely that people naturally contrast smoking with exercise or stealing. Similarly, should an investigator want to determine attitudes toward alcohol, sex, or recycling, it would seem desirable to investigate attitudes toward these objects in particular without contamination from attitudes toward another distinct, possibly valenced, category (Nosek & Banaji, 2001; Robinson, 2004).

In other words, pairing the target category with a distinct, valenced alternative is not optimal within many assessment contexts. Especially to the extent that the alternative category evokes strong evaluative reactions, a real concern is that performance may reveal as much or more about the contrast category (e.g., stealing) as it reveals about the target category (e.g., smoking). Indeed, some evidence for this idea comes from an IAT contrasting smoking and exercise (Swanson et al., 2001, Study 1), in which virtually everyone evaluated exercise more positively. By contrast, in an IAT contrasting smoking and stealing (Swanson et al., Study 2), virtually everyone evaluated smoking more positively. In other words, drastically different implicit attitude scores emerge when smoking is paired with a normatively positive (i.e., exercise) or a normatively negative (i.e., stealing) alternative category (Swanson et al., 2001).

In this research, we paired smoking objects with nonsmoking objects, a strategy that is desirable for several reasons. First, the nontarget category has direct implications for attitudes toward the target category. A person either values smoking more or not smoking more. Second, we sought to increase the likelihood of semantic processing by making target (e.g., *cigarettes*) and nontarget (e.g., *cucumber*) words comparable in length and initial letter (e.g., Stone & Van Orden, 1993). Third, the nontarget words were not particularly valenced. Thus, attitudes are likely to have more to do with associations toward target (vs. nontarget) objects. Last, nontarget objects came from heterogeneous, nonspecified categories. This makes it unlikely that variations in task performance have much to do with a person's attitudes toward the nontarget objects.

In short, we recommend a modified IAT for contexts in which one wants to take advantage of the reliability of the IAT while avoiding some of the pitfalls that can result from its relativistic nature. The modified IAT measure appeared to be valid in that it was sensitive to group differences (smokers vs. nonsmokers), produced means that were highly parallel to those obtained on the explicit attitude measure, and correlated with the explicit measure. We should note that the modification of the IAT was motivated by prior work on categorization tendencies and their personality-related correlates (Robinson, 2004; Robinson, Vargas, & Crawford, 2003). For example, whereas speed to evaluate objects as positive versus negative appears to be beneficial to subjective well-being (Fazio & Powell, 1997), speed to evaluate objects as neutral versus negative appears to

be detrimental to subjective well-being (Robinson, Vargas, Tamir, & Solberg, 2004). Such results suggest that the contrasting category is of critical relevance in interpreting categorization performance (Robinson, 2004).

In terms of basic research, the developments reported here warrant further, more detailed focus. First, we contrasted the smoking category with a nonsmoking category. The use of the nonsmoking category appeared to work well within the present context, but it could be problematic in other contexts. When determining whether an exemplar (e.g., cigarettes) fits a particular category (i.e., smoking) or not (i.e., nonsmoking), there may be a natural tendency to first assume category membership and only later reject the nonfitting stimulus (Gilbert, 1991). Thus, in general, one might expect faster categorization times for category matches relative to category mismatches (Anderson & Reder, 1974). Such an implicit tendency to favor matches over mismatches could potentially undermine an implicit attitude measure based on such procedures, although again there was no evidence for this point here.

Second, it is not clear whether our modified IAT benefited from the heterogeneity of nonsmoking stimuli, the neutral nature of such stimuli, or both. In further work involving modifications of the IAT, it may be useful to examine the present procedures versus those in which a coherent neutral category is used. For example, would one obtain similar results with an IAT contrasting smoking with furniture? We suspect that performance within this alternative modified IAT would mirror performance within our version of a modified IAT. However, we have no direct evidence for this contention. We therefore encourage further research on these basic methodological questions, which, as we have shown, can have significant implications for one's theoretical conclusions. As Ostrom (1989) suggested, method and theory go hand in hand when determining the predictive value of attitude constructs.[3]

Distinguishing Negative and Positive Attitudes Toward Smoking

The present results provide some rationale for distinguishing performance on combined (i.e., smoking or good, smoking or bad) IAT blocks, as doing so may reveal additional insights. In breaking down our Smoking Status × Block interaction, we found theoretically interesting results. Smokers and nonsmokers did not differ in performance on the block in which smoking was paired with a negative evaluation. This suggests to us that all people possess some negative feelings about smoking behavior. However, smokers and nonsmokers did tend to differ in performance on the block in which smoking was paired with a positive evaluation.

These results suggest that, at the implicit level, smokers may have both negative and positive feelings about smoking. This dual pattern of implicit associations among smokers has some intuitive appeal. On the one hand, smokers engage in a behavior that they know is harmful to their health and is disliked by the general public. On the other hand, smokers engage in cigarette smoking on a daily basis. They presumably do so, unless they are masochists, because such behavior provides pleasure. Such pleasure should alter associations to smoking behavior (Leung & McCusker, 1999).

Our results also have implications for theories of what the IAT measures (Fazio & Olson, 2003). The present results offer modifications to the view that implicit associations merely reflect cultural knowledge (e.g., Karpinski & Hilton, 2001). Although it is true that smokers associated smoking with a negative evaluation equally as quickly as nonsmokers did (perhaps because of a common socialization basis), it is also true that smokers associated smoking with a positive evaluation relatively quickly (perhaps because of personal experiences). This combination suggests that IAT performance is multiply determined, reflecting both cultural and personal influences.[4]

Implicit Attitudes Within Applied Contexts

There is a good deal of consensus that, among humans, behaviors are subject to the dual influence of implicit and explicit attitudes (e.g., Chaiken & Trope, 1999; Wilson, Lindsey, & Schooler, 2000). The issue of implicit–explicit correspondence is important here. If implicit and explicit attitudes are redundant with each other, then there is little point in assessing implicit attitudes. However, work to date indicates that implicit and explicit attitudes, although sometimes correlated, are rarely so highly correlated that they are redundant measures (Brauer, Wasel, & Niedenthal, 2000; Cunningham, Preacher, & Banaji, 2001; Fazio & Olson, 2003; Greenwald & Nosek, 2001; Robinson & Neighbors, in press). Furthermore, there are quite a few studies that have documented the independent role of implicit and explicit attitudes in predicting behavior (e.g., Asendorpf, Banse, & Mücke, 2002; Banaji, 2001; Fazio, Jackson, Dunton, & Williams, 1995; McConnell & Leibold, 2001; Spalding & Hardin, 1999; Stacy, 1997; Wilson et al., 2000).

Such data do not force the conclusion that explicit attitudes are relatively useless in predicting behavior, as explicit

[3]We are grateful to two anonymous reviewers for the important questions outlined in the preceding two paragraphs.

[4]Although culture shapes all personal attitudes, it may be important to distinguish consensual cultural beliefs from their endorsement in the form of personal attitudes. The distinction is particularly relevant to implicit attitudes. For example, Devine's (1989) influential model of prejudice assumes that many, if not all, White Americans are implicitly prejudiced but that they differ in their endorsement of such implicit cultural norms. Similarly, there is evidence within the domain of other implicit attitudes, such as those regarding age (Hummert et al., 2002) and food preferences (Karpinski & Hilton, 2001), that many individuals act in a manner inconsistent with their (consensually shared) implicit associations to stimuli.

attitudes often do predict behavior (Ajzen, 1996); however, as noted earlier, so do implicit attitudes. Therefore, knowing both a person's explicit and implicit attitudes allows for more precise predictions than would be possible with either source of data considered alone (Banaji, 2001; Fazio et al., 1995; Fazio & Olson, 2003; Greenwald & Nosek, 2001; McConnell & Leibold, 2001; Robinson & Neighbors, in press; Wilson et al., 2000). From such a theoretical perspective, one might predict that implicit attitudes toward smoking, like explicit attitudes toward smoking, would be useful in predicting smoking behavior (e.g., as suggested by Chassin, Presson, Rose, Sherman, & Prost, 2002). Therefore, the time is ripe for conducting prospective studies predicting future smoking behavior on the basis of implicit attitudes toward smoking (Chassin et al., 2002).

Moreover, knowing a person's implicit attitudes toward smoking may be of value in clinical contexts. Clinicians may be tempted to take the client's self-reported attitudes toward smoking at face value. However, if conscious, self-reported attitudes toward smoking diverge from unconscious, implicit attitudes toward smoking, then clinicians would be well served to know this fact. Specifically, knowing that the client is ambivalent rather than fully (i.e., consciously and unconsciously) in support of the therapeutic goals represents invaluable clinical knowledge (Freud, 1926; Westen, 1998). In the case of explicit–implicit ambivalence, intervention effects should focus on this ambivalence before working on behavioral goals related to cigarette reduction or abstinence, as other work on intervention efforts shows (Hodson, Maio, & Esses, 2001; Shaffer & Simoneau, 2001; Vitousek, Watson, & Wilson, 1998).

Also, given that implicit attitudes often are predictive of behavior (e.g., Fazio et al., 1995; McConnell & Leibold, 2001; Stacy, 1997), it may be useful to target interventions on implicit attitudes themselves. This suggestion comports with a large clinical literature suggesting that maladaptive behaviors are often driven by unconscious, or at least preconscious, components of the mind (e.g., Borkovec, Ray, & Stöber, 1998; Ellis, 1962; Mathews, 1990; Sayette, 2004; Segal, Williams, & Teasdale, 2002; Westen, 1998).

An examination of recent developments in the literature on anxiety and attention may be warranted here. A large body of work has suggested that anxious individuals preferentially orient to threats within spatial attention tasks (e.g., MacLeod, 1999; Mogg & Bradley, 1998). Moreover, there are data indicating that orienting operations favoring threat predispose one to anxiety within relevant situations (MacLeod, 1999; MacLeod & Hagan, 1992). Putting these sources of evidence together, it may be that selective attention operations favoring threat are causal in the genesis or at least maintenance of anxiety (MacLeod, 1999; Mogg & Bradley, 1998). If so, interventions designed to reduce automatic orienting to threatening sources of information should be prophylactic in preventing anxiety from developing (MacLeod, 1999). To investigate such ideas, MacLeod et al. (2002; see also Mathews & MacLeod, 2002) used implicit cognitive tasks to train attention either toward or away from threatening words. All participants were subsequently exposed to a laboratory stressor. As predicted, participants who had been trained to systematically avoid threats in an implicit manner reacted with less negative affect to the laboratory stressor. Such results suggest that implicit training procedures may have considerable applied relevance in altering emotion and behavior (see also Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000).

By analogy, an examination of the implicit predictors of smoking behavior should have considerable clinical relevance. If implicit attitudes are causal contributors to smoking behavior (a possibility yet to be demonstrated), then altering implicit attitudes, through cognitive training procedures, should be an effective way of reducing smoking behavior. Such intervention possibilities clearly are quite speculative at present. Nevertheless, such intervention possibilities encourage the development of technologies best suited to predict the occurrence of potentially problematic behaviors such as smoking. In the long run, a continued focus on the implicit predictors of smoking behaviors is likely to have considerable dividends, both for basic and applied research.

CONCLUSION

Our results have important implications for present views of implicit attitudes, particularly as related to stigmatized behaviors. Engaging in a behavior that produces consistent aversion, whether implicit or explicit, does not seem particularly feasible from a functional perspective. Therefore, one would generally expect smokers to have more positive attitudes toward smoking. The present results demonstrate such a pattern as well as the marked convergence of implicit and explicit attitudes. Finally, the results also highlight methodological factors that should be of interest to basic and applied investigators using the IAT.

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