Response Biases on the IRAP for Adults and Adolescents with Respect to Smokers and Non-smokers:

The Impact of Parental Smoking Status

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Abstract

The current research aimed to examine the implicit biases of smokers and non-smokers to others who did or did not smoke. Study 1 presented adult smokers and non-smokers with an Implicit Relational Assessment Procedure (IRAP) that assessed bias toward or against smokers and non-smokers. Study 2 replicated this with adolescent smokers and non-smokers. Both studies also presented self-report measures. Both adult and adolescent smokers produced IRAP effects that indicated pro-smoker biases; non-smokers' biases were relatively neutral. Trends in the data from Studies 1 and 2 led to a post hoc analysis of the non-smoker data to investigate the potential impact of parental smoking status on non-smokers' biases. Both the IRAP and self-report measures data suggested that parental smoking status increased positivity in attitudes toward smokers among non-smokers. Hierarchical logistic regression analyses indicated that the IRAP data in Study 1, but not Study 2, predicted smoking status above and beyond the self-report measures. The post-hoc analyses showed a similar trend. The consistency of the findings with the only existing IRAP study of attitudes toward smokers, as well as with the broader literature, supports the view that response biases toward smokers may not change fundamentally from adolescence to adulthood, and that parental smoking status may having a moderating influence on these biases.

KEYWORDS

IRAP, Smokers Attitudes, Parental Influence

Attitudes toward smokers have changed considerably in recent decades (Chapman & Freeman, 2008). The traditional positive characteristics of smokers as glamorous and independent have been replaced with malodorous and selfish stereotypes (Farrimond & Joffe, 2006). Goldstein (1991), for example, found that non-smokers favored non-smokers over smokers as measured by self-report. Indeed, the literature on attitudes toward smokers has relied extensively on questionnaires, which have been criticized for their potential sensitivity to extraneous sources of influence (e.g., self-presentation, see Barnes-Holmes et al., 2006; de Jong, 2002). In contrast, there are now numerous latency-based behavioral measures, assumed by some to reveal *implicit* attitudes. The most common of these measures is known as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). The basic idea is that participants should be faster when pairing two closely associated than weakly associated categories. However, while much research in this regard has investigated attitudes toward smok*ing*, little has employed these measures when investigating attitudes toward smok*ers*.

Of the limited research on attitudes toward smokers, Swanson, Rudman, and Greenwald (2001) found that while smokers demonstrated anti-smok*ing* biases, they identified themselves as being a "smoker" on an IAT. In other words, smokers engaged in behavior they did not appear implicitly positive toward, but this did not impact negatively on their self-esteem levels (measured by another IAT). This basic effect was replicated in a study by De Houwer, Custers, and De Clercq (2006). Furthermore, Dal Cin, Gibson, Zanna, Shumate, and Fong (2007) employed an IAT to assess the effect that a movie protagonist who smoked could have on implicit attitudes toward smoking. It was found that both smokers and non-smokers who identified with the protagonist were more likely to have stronger implicit associations between the 'self' and smoking. From this, the authors suggested that identification with a person who smokes may modify smoking-related thoughts. That is, individuals' implicit attitudes toward smoking behavior become more positive. This may consequently increase the likelihood that individuals who identify with smokers are more likely to engage in smoking in the future than those who do not identify with individuals who smoke (Tickle et al., 2006).

Another latency-based behavioral measure that has been used in this area is the Implicit Relational Assessment Procedure (IRAP). Unlike the IAT, however, the IRAP emerged directly out of Relational Frame Theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001), a modern behavioral account of human language and cognition. The primary conceptual unit of RFT is the derived stimulus relation and the IRAP was designed specifically to provide a measure of the strength of such relations, particularly those that had been established in the natural (pre-experimental) verbal environment (see Barnes-Holmes, Hayden, Barnes-Holmes, & Stewart, 2008). The basic idea behind the IRAP is that, all things being equal, participants should show a tendency to respond more quickly to stimulus relations that are consistent with their particular histories, than those that are not. This difference in response latencies across the two types of stimulus relations is often referred to as the IRAP effect. It is important to understand that the term IRAP effect, or the concept of a response bias as used throughout the current report, should not be interpreted as a proxy for a mental construct or implicit attitude in a cognitive or social psychological sense. Instead, these terms simply denote a tendency to respond in one particular direction over another on the IRAP (for a detailed account of the theoretical basis of the IRAP see Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010). As such, the absence of an IRAP effect should not be interpreted as the absence of a so-called implicit attitude or any other putative mental event, but simply the absence of a particular response bias on the IRAP itself. Thus, when we use the term attitude in the current paper, it simply denotes a tendency to show a response bias on the IRAP in one direction or another. There are now over 50 published studies using the IRAP, and the number of domains of interest has increased steadily, with a recent meta-analysis in the clinical domain yielding a relatively high level of predictive validity (Vahey, Nicholson, & Barnes-Holmes, 2015).

Despite the growth in IRAP studies, as far as we are aware, only one published preliminary study has used the IRAP to assess attitudes toward smokers and non-smokers (Vahey, Boles, & Barnes-Holmes, 2010). In this study, social acceptance and rejection words, identified from tobacco marketing campaigns, were used as target stimuli. On each trial, the terms *smoker* and *non-smoker* appeared with a social acceptance or rejection word, and 13 adolescent participants (5 smokers and 8 non-smokers)

selected either *similar* or *opposite*. It was hypothesized that participants who smoked would respond more quickly when confirming that smokers were *similar* to social acceptance words and results confirmed this bias. In contrast, non-smokers responded equally quickly when confirming that smokers were similar to social acceptance words as they did when pairing them with rejection words. The authors concluded that the IRAP may be a useful tool in exploring biases that may influence smoking behavior in an adolescent population. However, no further research using the IRAP to study attitudes toward smokers has been published since the pilot study by Vahey et al.

The current research attempted to conduct a more detailed study of attitudes toward smokers using the IRAP with both adult and adolescent smokers and non-smokers. Study 1 used the IRAP and self-report measures to investigate social attitudes toward smokers and non-smokers in adults. Study 2 replicated this procedure with adolescents. Based on the pilot study conducted by Vahey et al. (2010), we hypothesized that smokers in both of our studies would demonstrate pro-smoker biases and non-smokers would be relatively neutral. We also aimed to validate the IRAP as a tool for assessing implicit social biases toward smokers and non-smokers, using a known-groups design (i.e., a comparison of groups predicted to differ in terms of these social biases). As such, we aimed to build on a recently published meta-analysis of IRAP research in clinically relevant domains that reported strong predictive validity and potential for further use (Vahey, Nicholson, & Barnes-Holmes, 2015). Although we did not plan additional analyses over and above the two studies, the trends in the data suggested the potential utility of post-hoc analyses of the non-smokers data. This allowed some preliminary exploration of the putative relationship between the performances of adolescent non-smokers and adult non-smokers, and the influence of parental smoking.

Study 1

Participants

Thirty-five people participated in Study 1, 27 females and 8 males. Participants ranged from 21 to 55 years old (M = 28, SD = 4.12) and were recruited through university advertisements, friends, and acquaintances. This recruitment provided a mixed sample from the general population and university

students. All participants were Caucasian and of Irish birth. Predetermined criteria differentiated *smokers* from *non-smokers*. A smoker was any person who smoked tobacco at least weekly and was not currently attempting to quit. A non-smoker was any person who smoked tobacco on fewer than 10 occasions and indicated when asked explicitly that he or she did not anticipate commencing smoking tobacco in the future. Based on these definitions, 17 smokers and 18 non-smokers were recruited. Four participants were excluded (due to time constraints and failure to meet performance criteria on the IRAP described subsequently). Thus, data from 15 smokers (13 females and 2 males) and 16 non-smokers (12 females and 4 males) were analyzed.

Setting

Participants completed the study on an individual basis always in a quiet environment, with the researcher present throughout the duration of the sessions. No participants received any form of compensation for participation.

Apparatus and Materials

The IRAP and three self-report measures were used. Of the latter, one assessed smoking status, and two assessed general attitudes toward smokers.

Implicit Relational Assessment Procedure (IRAP). The IRAP presented two label stimuli (*Smoker* or *Non-smoker*) with 6 socially positive adjectives (*cool, independent, popular, fun, attractive,* and *respected*) and 6 socially negative adjectives (*lame, boring, needy, loner, weak,* and *loser*) as target stimuli, and two response options (*True* and *False*). The target stimuli were selected following a focus group with adult and adolescent smokers and non-smokers who did not thereafter participate. Based on the various sample-target combinations, the IRAP comprised 4 trial-types; *Smokers/Positive, Smokers/Negative, Non-Smokers/Positive,* and *Non-Smokers/Negative* (see Figure 1). The IRAP software (2008 version programmed in Visual Basic 6) recorded all response data, including accuracy and latency.

INSERT FIGURE 1 HERE

Self-report Measures.

Smoking History Assessment. A series of questions (see Appendix A) were used to guide a brief interview that primarily classified participants as smokers (e.g., *On how many of the past 30 days did you smoke cigarettes?*) versus non-smokers (e.g., *If you don't currently smoke please describe absolutely any previous experience, when and for how long, you have with smoking no matter how long ago*). Specifically, the measure assessed specific features of their smoking behavior, such as frequency, quantity, and current level of craving or deprivation, but there were no further assessments of use of other tobacco products other than cigarettes.

Feeling thermometers. The feeling thermometers presented 4 general statements corresponding to the 4 IRAP trial-types: *Smokers are liked, Smokers are disliked, Non-smokers are liked,* and *Non-smokers are disliked.* Participants responded on a thermometer in 10 degree intervals, from 0 (*Strongly disagree*) to 100 (*Strongly agree*).

Likert scales. The Likert scales presented the 24 IRAP statements (e.g., *Smokers are cool*), and participants responded on a 7-point scale, from -3 to +3 anchored at each end by the words *True* and *False*, respectively.

Procedure

All procedures were in accordance with the ethical standards of the institutional research committee and the 1964 Helsinki Declaration, and later amendments of this declaration or comparable ethical standards. Informed consent was obtained from all participants. The experimental sequence comprised the Smoking History Assessment, the IRAP, the Feeling thermometers, and the Likert scales.

Smoking History Assessment. Each participant completed the Interview first to assess smoking behaviors.

The IRAP. Prior to the first practice block, participants were verbally instructed on how to complete an IRAP. They were advised that each trial would involve the presentation of a word on top and one in the center of a computer screen, and that their task was to respond with *True* or *False*, as appropriate (see Figure 1). Participants were informed that the pattern of responding would switch to an

opposite pattern across each block (i.e., one pattern in one block, the alternate pattern in the next block, and so on). Blocks were paired in this alternating fashion. These instructions highlighted the criterion for fast (</= 2,000 ms) and accurate (>/= 80%) responding in accordance with the pattern designated for that block.

The IRAP consisted of blocks of 24 trials, with each of the 4 trial-types presented 6 times within each block. On each trial, a label (e.g., *Smoker*) appeared on top, a target (e.g., *popular*) in the middle, and both response options (*True and False)* on the bottom left- and right-hand corners. Participants selected a response by pressing *D* (for the left option) or *K* (for the right). After a response that was defined as correct for a block of trials (see below), the screen cleared, and the next trial appeared. After an incorrect response, a red X appeared until a correct response was emitted.

The feedback contingencies alternated across blocks in one of two patterns. One pattern was defined as pro-smokers, the other as pro-non-smokers, and each alternate block required one of these patterns (i.e., each pair of blocks contained one block that required responding in accordance with one pattern and another block that required responding in accordance with the alternative pattern). The pro-non-smokers pattern required that participants respond as follows: Smokers-Negative/True; Smokers-Positive/False; Non-smokers-Negative/False; Non-smokers-Positive/True. The pro-smokers pattern required the opposite: Smokers-Negative/False; Smokers-Positive/True; Non-smokers-Negative/True; Non-smokers-Positive/False. Hence, correct responding involved switching between each pattern from block to block. The order in which the two types of blocks were presented was counterbalanced across participants.

The IRAP commenced with a minimum of two practice blocks. If participants failed to achieve both accuracy and latency criteria across a pair of blocks, they received automated feedback, and practice blocks continued to a maximum of 4 block pairs. Failing to meet the criteria after 4 pairs of practice blocks terminated participation and these data were discarded. When criteria were reached on a pair of practice blocks, participants proceeded to 3 pairs of test blocks. No performance criteria were employed for participants to progress through test blocks, but accuracy and latency feedback were

presented at the end of each block to encourage participants to maintain the criteria. The program automatically recorded response accuracy (based on the first response emitted on each trial) and response latency (time in ms. between trial onset and emission of correct response). The exact instructions that participants received can be obtained by request from the second author.

Feeling thermometers and Likert scales. After the IRAP**,** participants completed the feeling thermometers and Likert scales.

Results and Discussion

Analytic Strategy

The IRAP data were analyzed according to practices commonly used in IRAP research (see below). A 2x4 mixed repeated measures ANOVA examined the effects for the 4 trial-types across the two groups to determine main and interaction effects for smoker identity and trial-type. One sample t-tests then were used to determine the significance of any of the D_{IRAP} scores. The means and standard deviations also were calculated for participant scores on the self-report measures followed by independent t-tests to assess any differences. Next, a correlation matrix explored the potential relationships among the D_{IRAP} scores and the self-report measures. Finally, two hierarchical logistic regression analyses determined whether response biases on the IRAP increased prediction of smoking status beyond the thermometers and Likert scales.

IRAP

The primary datum was response latency (i.e., time in ms. between trial onset and a correct response). In accordance with previous IRAP studies, response latency data were transformed into *D*-IRAP scores (see Barnes-Holmes, et al., 2010, for details). This transformation was derived from the *D*-algorithm used with the IAT and served to control for the impact of extraneous variables such as age and cognitive ability on latency-based data (Greenwald, Nosek, & Banaji, 2003). Four individual *D*-IRAP scores were calculated, one for each of the trial-types, with positive scores indicating pro-non-smoker and anti-smoker biases and negative scores indicating anti-non-smoker and pro-smoker biases. An overall *D*-IRAP score also was calculated by averaging across the four trial-types.

Preliminary analyses examined the effects for the 4 trial-types, using a 2x4 mixed repeated measures ANOVA, with trial-type as the within-participant variable and smoker identity as the between-participant variable. The main effect for smoker identity was significant, $F(1, 29) = 8.34$, $p = .007$, $\eta p^2 = .22$, but the interaction with trial-type was not ($p > .8$). Thus, only the overall *D*-IRAP score (i.e., averaged across the four trial-types) per participant was analyzed subsequently. The scores for each group were subjected to one-sample *t*-tests, to determine if they differed significantly from zero. The *t*-test for the smokers was significant, $M = -.162$, $SD = .193$, $t(14) = -3.25$, $p = .006$, but the *t*-test for non-smokers was not, $M = .043$, $SD = .203$, $p > .05$. In effect, smokers produced a significant pro-smoker bias on the IRAP, but non-smokers showed a neutral effect.

Self-report Measures

Feeling thermometer analyses. The feeling thermometers required participants to rate 4 statements, each relating to an IRAP trial-type. Prior to analysis, the data were transformed from a 0-100 scale to a -50 (strong pro-smoker bias) to +50 scale (strong pro-non-smoker bias). An overall thermometer score was calculated by averaging each participant's 4 thermometer responses. Both Smokers and Non-smokers showed a pro-non-smoker bias ($M = 13.18$, $SD = 16.08$ versus $M = 20.38$, $SD = 15.10$ respectively), but these two groups did not significantly differ from each other, $t(29) = -1.28$, $p = .21$.

Likert scale analyses. Participants responded from -3 (True) to +3 (False) on 24 Likert scales, each mapping onto an IRAP trial. The data were transformed, such that minus scores represented a pro-smoker's response, whereas plus scores represented a pro-non-smoker's response. An overall Likert score was calculated by averaging all 24 responses. Both Smokers and Non-smokers showed a pro-non-smoker bias ($M = .52$, $SD = .73$ versus $M = 1.38$, $SD = .69$ respectively), and these two groups differed significantly from each other, $t(29) = -3.34$, $p = .002$, $d = .06$.

Correlations between IRAP and Self-report Measures

The overall D_{IRAP} scores from the IRAP did not significantly correlate with the two self-report measures (p's > .11).

Prediction of Smoker Identity

Two hierarchical logistic regression analyses determined whether the IRAP offered increased prediction of smoking status beyond the thermometers and Likert scales. In one analysis, the Likert score was entered as the first step predictor of smoker identity, and proved to be a significant predictor (β = 1.83, p = .01), accounting for 24% of the variance. When the overall *D*-IRAP score was entered as the second step, it significantly increased the variance (39%) accounted for by the model (β = 6.44, p = .04, *R2* change = .15). In the second analysis, the thermometer score was entered as the first step, but it was weak and non-significant (β = .03, p = .21), accounting for only 4% of the variance. When the overall *D*-IRAP score was entered as the second step, it increased the variance (24%) accounted for by the model (β = 6.45 p = .02, *R2* change = .20).

Summary

The overall *D*-IRAP score was relatively neutral for the non-smokers, but smokers showed a pro-smoker bias: the difference between the groups was significant. On both self-report measures, both groups showed a pro-non-smoker bias; only the Likert scale yielded a significant between-group difference. The IRAP increased the amount of variance accounted by each of the self-report measures.

Study 2

Findings from Study 1 were broadly consistent with the known-group predictions, where smokers were generally more positive about smokers than were non-smokers. The next study aimed to replicate Study 1, using adolescent smokers and non-smokers. Would the same pattern of biases, and relationships among these, emerge with this younger population? Addressing this question might help clarify whether the attitudes of adults had emerged across time or were present in the early stages of smoking and thus were perhaps critical in the initiation of the behavior.

Participants

Thirty-five people participated in Study 2, 16 females and 19 males. Participants ranged from 13 to 17 years old (M = 15, SD = 2.13) and were recruited through an advertisement in a secondary school. Predetermined criteria from Study 1 again categorized participants as *Smokers* or *Non-smokers*,

and identified 17 smokers and 18 non-smokers. Participants (3) who failed to meet IRAP performance criteria were again excluded from analyses. The data from 16 smokers (6 females and 10 males) and 16 non-smokers (8 females and 8 males) remained.

Setting

Participation was conducted individually in a quiet office at a secondary school in Ireland. The researcher remained present throughout the duration of each session.

Apparatus and Materials

All materials and apparatus were identical to Study 1, with the exception of a modified consent form (for both adolescents and their parents) and information sheet provided to parents/guardians. Participants were briefed as to the general nature of the study and were given a hand-out with information for their parents/guardians to review. This hand-out did not refer specifically to smoking behavior, but to health-risk behaviors generally. This was to avoid participants being scrutinized by parents and teachers. Participation only commenced on receipt of a consent form signed by both the participant and their guardian, and following a 24 hour period in which they could change their minds. At no point were participants identified as smokers or non-smokers outside of the experimental session.

Procedure

All aspects of the procedure from Study 2 were identical to Study 1.

Results and Discussion

Analytic Strategy

The analytic strategy for Study 2 was similar to that employed for Study 1.

IRAP

The IRAP response latency data again were transformed into *D*-IRAP scores. Preliminary analyses examined the effects for the 4 trial-types, using a 2x4 mixed repeated measures ANOVA. The main effect for smoker identity was significant, $F(1, 29) = 4.17$, $p = .05$, $\eta p^2 = .13$, but the interaction with trial-type was not; thus, the overall relative *D*-IRAP score was again used. The scores for each group were subjected to one-sample *t*-tests, and similar to Study 1, this yielded a significant effect for

smokers, M = -.206, SD = .178, $t(14)$ = -4.48, $p < .001$, but not for non-smokers, M = -.044, SD = .254, p = .49. In effect, smokers produced a significant pro-smoker bias, but non-smokers showed a neutral effect.

Self-report Measures

Feeling thermometer analyses. The mean overall thermometer scores and standard deviations for both groups were: Smokers, M = 2.70, SD = 10.72 and Non-smokers, M = 21.94, SD = 18.68. While both groups showed a pro-non-smoker bias, the difference between them proved significant, $t(29)$ = -3.49, p = 0.002, d = -1.26. Although the difference in the two means is large, the scale ranges from -50 to +50, and thus a score of approx. 20 (for the non-smokers) does not indicate a particularly strong pro non-smoking bias per se (i.e., less than half the maximum it could be).

Likert scale analyses. The mean overall Likert scores and standard deviations for both groups were: Smokers, M = -.18, SD = .83 and Non-smokers, M = 1.33, SD = .87. Non-smokers showed a pro-non-smoker bias, while smokers showed a relatively weak pro-smoker bias, and this difference was significant, $t(29)$ = -4.92, $p < 0.001$, d = -.90.

Correlations Between IRAP and Self-report Measures

The IRAP D_{IRAP} scores only correlated strongly with the feeling thermometer, r (31) = .348, p = .05, suggesting that a pro-non-smoker bias on the IRAP was associated with a pro-non-smoker bias on the thermometer.

Prediction of Smoker Identity

Again, two hierarchical logistic regression analyses determined whether the IRAP increased the prediction of group status by the self-report measures. For the first analysis, when the overall Likert score was entered as the first step, it proved significant (β = 4.76, p = .01), accounting for 57% of the variance. When the overall *D*-IRAP score was entered as the second step, it did not increase significantly the variance (61%) as accounted for by the model (β = 3.85, p = .23, *R2* change = .04). For the second analysis, the overall score for the feeling thermometers also proved a significant predictor of smoker identity when entered as a first step (β = .09, p = .01), accounting for 26% of the

variance, and when the overall *D*-IRAP score was entered as a second step, it again did not significantly increase the variance (28%) as accounted for by the model (β = 2.01 p = .37, *R2* change = .02).

Summary

The IRAP effects for adolescents were similar to those recorded with adults in Study 1: neutral effects for the non-smokers and a pro-smoker bias for smokers. The thermometer data were also consistent across the two studies, with both groups in each case showing a pro-non-smoker bias, with a significantly stronger effect recorded for non-smokers. Interestingly however, the pro-non-smoker bias recorded with adult smokers appeared much stronger than that shown by adolescent smokers. On the Likert scale in both studies, non-smokers showed a pro-non-smoker bias. However, while the adult smokers in Study 1 showed a pro-non-smoker bias, the adolescent smokers in Study 2 showed a relatively weak pro-smoker bias. In both studies, the two groups differed significantly. Finally, the IRAP significantly enhanced the variance accounted for by both self-report measures in terms of smoker identity in Study 1, while this was not the case in Study 2.

Assessing the Impact of Parental Smoking Status (Studies 1 and 2 Combined)

One interesting effect from Study 2 centered on the weak *pro-smoker* bias observed with adolescent non-smokers. One possible explanation is that some non-smokers, especially adolescents, reside in families with smokers. Indeed, much previous research has indicated that parental smoking identity impacts the smoking behavior of their offspring (e.g., Alves et al., 2016; Andrews, Hops, & Duncan, 1997; Distefan, Gillpin, Choi, & Pierce, 1998; Wang, Hipp, Butts, Jose, & Lakon, 2016). Indeed, a study conducted by Andrews, Hampson, Greenwald, Gordon, and Widdop (2010) suggests that parental smoking status influences pro-smoking attitudes. This study assessed attitudes toward smoking among 5th grade children and found that children with family members who smoked showed more favorable attitudes toward smoking on the IAT. In order to explore this possible influence with the IRAP, we combined and analyzed the data from the non-smoking participants from both of the

current studies. Smoking participants were not included because the smoking identity of parents was not collected for this group and we acknowledge an opportunity missed in this regard.

The Smoking History Assessment indicated that 6 adolescent non-smokers grew up with non-smoking parents and 10 with parents who smoked. To conduct further analyses on the possible role of this variable on IRAP and self-report measures, these data were combined with the same data from Study 1 (12 adult non-smokers with non-smoking parents and 4 with parents who smoked). This yielded a total of 14 non-smokers who grew up with parents who smoked, and 18 non-smokers who did not (N = 32).

IRAP

Preliminary analysis of the IRAP data examined the effects for the 4 trial-types, using a 2x4 mixed repeated measures ANOVA. It found a significant main effect for trial-type, $F(3, 90) = 12.11$, $p < .001$, $\eta p^2 = .29$, and a significant interaction with parental smoking status, $F(3, 90) = 3.13$, $p = .03$, $\eta p^2 = .09$; parental smoking status was non-significant ($p = .15$). Because of the significant interaction effect, unlike the analyses conducted for the individual studies, we continued analyses at the trial-type level.

The four mean *D*-IRAP trial-type scores, with standard error bars and separated according to parental smoking status are presented in Figure 2. Both groups showed no bias on the 2 negative trial-types. However, on *Smokers-Positive*, the offspring of smokers were more pro-smoker than the offspring of non-smokers. On the *Non-smokers-Positive* trial-type, the offspring of non-smokers were more pro-non-smoker than the offspring of smokers.

INSERT FIGURE 2 HERE

Four one-way follow-up ANOVAs (one per trial-type) indicated that the 2 groups differed significantly on *Smokers-Positive*, $F(1,30) = 4.43$, $p = .04$, $\eta p^2 = .13$, and *Non-smokers-Positive*, $F(1,30) = 5.47$, $p = .03$, $\eta p^2 = .15$. Of 8 one sample *t*-tests, only 2 proved significant: *Smokers-Positive*, $M = -.48$, $t(13) = -5.99$, $p < .001$ for the smoking parent group and *Non-smokers-Positive*, $M = .486$, $t(17) = 4.182$, $p = .001$ for the non-smoking parent group.

Self-report Measures

Feeling thermometer analyses. Participants whose parents did not smoke reported significantly greater pro non-smoking biases (M = 27.25, SD = 14) compared to participants whose parents did smoke (M = 13.32, SD = 17.13), $t(30) = -2.53$, $p = .02$, $d = -.90$.

Likert scale analyses. Both groups of participants whose parents smoked and did not smoke showed a pro-non-smoker bias (M = 1.36, SD = .80 and M = 1.34, SD = .78 respectively), but these two groups did not significantly differ from each other, $t(30) = -3.34$, $p = .95$, $d = .02$.

Correlations Between IRAP and Self-report Measures

Of the 8 possible correlations (between each trial-type and the two self-report measures), only *Smokers-Positive D*-IRAP scores correlated positively with the overall thermometer score, $r = .36$, $p = .04$, suggesting that a pro-non-smoker bias on the IRAP was associated with a pro-non-smoker bias on the thermometer.

Predicting Parent Smoker Identity

Four logistic regression analyses determined whether the scores from the 2 IRAP trial-types on which the two groups differed significantly (*Smokers-Positive* and *Non-smokers-Positive*) would increase the variance accounted for by either of the self-report measures. The first analysis included the thermometer score as a first step, which significantly accounted for 14% of the variance ($\beta = .063$, $p = .03$). Including *Smokers-Positive D*-IRAP scores as a second step did not significantly increase the variance accounted for (18%; $\beta = 1.29$, $p = .21$). The second analysis included thermometer score as a first step and *Non-smokers-Positive D*-IRAP score as the second step. The IRAP score did significantly increase the variance accounted for to 29% ($\beta = 2.49$, $p = .03$, *R2* change = .15). A third analysis included Likert score as the first step, which accounted for very little variance ($p = .95$). Including *Smokers-Positive D*-IRAP as the second step increased the variance accounted for significantly to 10% ($\beta = 1.87$, $p = .05$, *R2* change = .10). The fourth analysis again included the Likert score as a first step, and *Non-smokers-Positive D*-IRAP scores as the second step, which again significantly increased the variance accounted for to 13% ($\beta = 2.1$, $p = .04$, *R2* change = .13).

Summary

When the adult and adolescent non-smoking participants were combined and compared in terms of whether their parents were smokers or non-smokers, a significant interaction effect emerged between IRAP trial-type and parental smoker identity. That is, the groups differed from one another on positive trial-types only. On *Smokers-Positive,* the offspring of smokers were more pro-smoker than the offspring of non-smokers. On the *Non-smokers-Positive* trial-type, the offspring of non-smokers were more pro-non-smoker than the offspring of smokers. On the thermometer measure, both groups showed a pro-non-smoker bias, with the offspring of non-smoking parents showing a significantly stronger effect. Both groups also showed a pro-non-smoker bias on the Likert scale. The *Smokers-Positive D*-IRAP scores correlated positively with the overall thermometer score. In general, the IRAP accounted for more variance in predicting smoking status than the two self-report measures.

General Discussion

Very few studies have assessed implicit attitudes toward smokers (e.g., Swanson et al., 2001), and only one has employed the IRAP (Vahey et al., 2010). While a direct comparison between the current study and the previous non-IRAP work on attitudes toward smokers is difficult because the methods differ in a number of ways, the results here appear to be broadly consistent with this previous research. For example, Swanson et al. reported that while disliking smoking generally, smokers did not dislike themselves as a result and were positive about themselves on an IAT. This result could be seen as consistent with the fact that smokers in the current study produced positive pro-smoker biases on the IRAP. In the Dal Cin et al. (2007) study, both smokers and non-smokers showed stronger implicit associations between themselves and smoking when they identified in some way with a smoking protagonist presented in a film. Perhaps, this previous finding bears some relation to the current results indicating that the offspring of smokers were more positive toward smokers than the offspring of non-smokers.

With respect to the only other IRAP study that assessed attitudes toward smokers, adolescent smokers showed a pro-smoker bias (Vahey, et al., 2010). This effect was replicated here with both

adults (Study 1) and adolescents (Study 2). The consistency of the findings across all three IRAP studies supports the suggestion that in broad terms, response biases on the IRAP toward smokers may not change fundamentally from adolescence to adulthood (Shafey, Dolwick, & Guindon, 2003). For example, whilst adult smokers and non-smokers were more clearly differentiated by the regression analyses than the two adolescent groups (smokers and non-smokers) on the IRAP, the opposite was true in terms of the self-report measures. The adult groups in Study 1 were differentiated from one another by the Likert measure, but not by the thermometer. The adolescents, however, were differentiated from one another by both the Likert and thermometer measures, with significant differences between the groups. In addition, according to the regression analyses, both thermometer and Likert measures accounted for approximately 20% additional variance for the adolescents than they each accounted for in the adult population. This suggests that younger participants were less willing to declare pro-non-smoker attitudes. This conclusion seems to fit with that of Swanson et al. (2001), who proposed that as smokers age, they experience increasing levels of criticism for smoking and learn to mask pro-smoker attitudes in order to gain social acceptability within larger groups. Adolescent smokers are likely to have far less experience in this regard and, as such, feel no need to mask such attitudes. Furthermore, the adolescent sample was more pro-smoker than the adult sample in general, suggesting that such attitudes would actually be more acceptable to adolescent smokers' peers and therefore unnecessary to mask.

An alternative interpretation, however, could be that as people who smoke get older, they have more personal contact with the negative health consequences of smoking. In any case, the current study was cross-sectional rather than longitudinal, and thus the foregoing interpretations should viewed as highly speculative.

At a general level, the pro-non-smoker biases on the self-report measures shown by both groups of non-smokers in the current study support the perception that attitudes toward smokers have become more negative in recent decades (Chapman & Freeman, 2008). Interestingly, bias scores on the IRAP were relatively neutral for both non-smoking groups. In contrast, both adult and adolescent smokers

showed a significant pro-smoker bias on the IRAP. This discord, especially for smokers, between the outcomes on the IRAP and self-report measures further supports the use of the IRAP in this domain.

A related issue pertains to the extent to which the current study tested the predictive validity of the IRAP in the domain of smoking. While the IRAP only correlated with one self-report measure in one of the studies, it frequently increased the variance accounted for by the self-report measures. As mentioned in the introduction, there are a number of issues associated with the sole use of self-report measures. For example, these may be influenced by other social variables, such as not wanting to appear judgmental about smoking and addictive behaviors in general regarding others. Insofar as measures of implicit attitudes are suggested to be less susceptible to such influences, it seems important that research assesses both implicit and explicit attitudes in relation to potentially socially stigmatized behaviors.

In light of the current findings, future research could investigate the impact that pro non-smoking or prevention campaigns have in changing or undermining smoking behavior and how this might interact with the IRAP's ability to predict attitudes toward smokers and non-smokers. Given that prevention programs target non-smokers and that cessation programs target smokers, the current findings suggest that it may be important to consider the extent to which positive biases toward smokers, particularly among non-smokers, may increase the risk of those non-smokers subsequently becoming smokers.

Conclusions

In closing, although it should be recognized that the current research involved relatively low *N*s and the samples were somewhat ad-hoc, the conclusions arising from the data are broadly consistent with the literature. The IRAP was shown to reveal positive or neutral biases toward smokers (now recognized as a socially stigmatized group) that were not readily detected with the self-report measures. Furthermore, the fact that parental smoking status moderated biases toward smokers is broadly consistent with the finding that this status predicts risk factors for tobacco dependence itself (e.g., Alves et al., 2016; Distefan et al., 1998; Murray et al., 1985).

Compliance with Ethical Standards

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Ethical Approval: All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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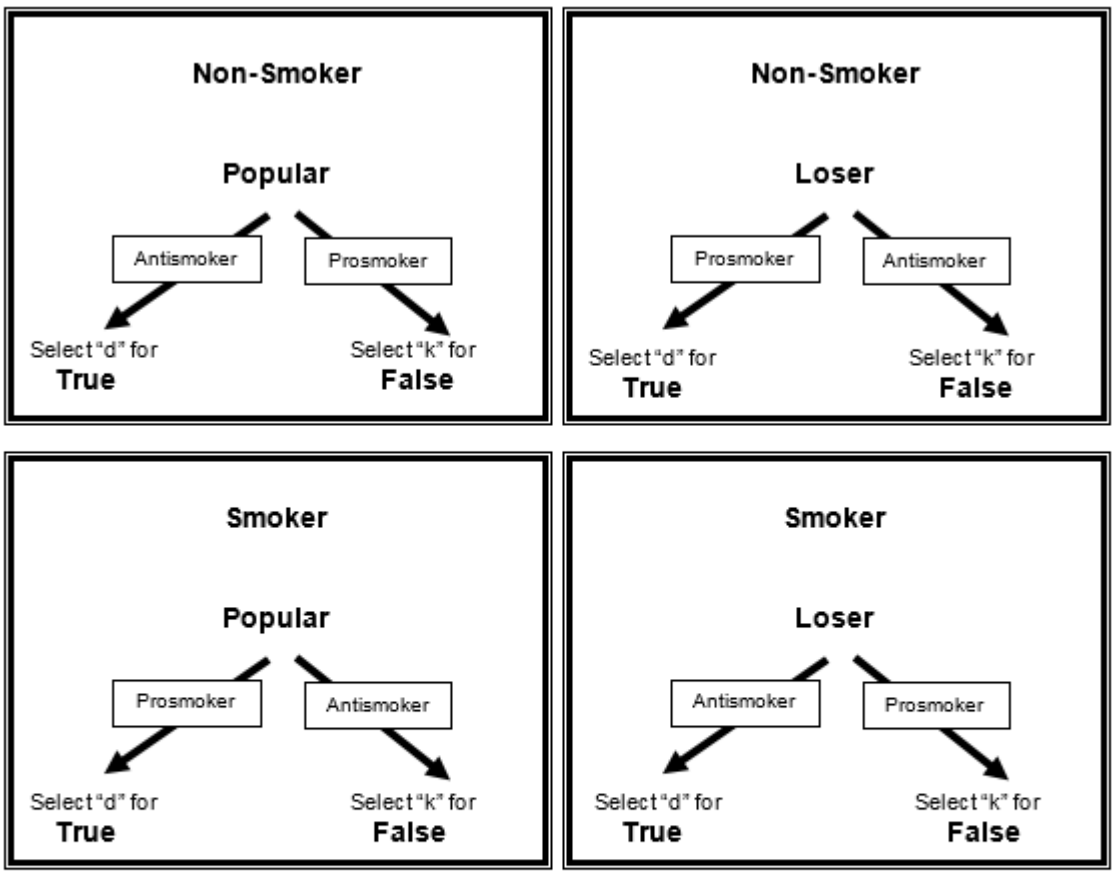


Figure 1: Diagrammatic representation of the four IRAP trial-types. Arrows and boxes containing the words *Prosmoker* and *Antismoker* did not appear on screen. The four IRAP trial types were denoted as: *Nonsmokers-Positive; Nonsmokers-Negative; Smokers-Positive;* and *Smokers-Negative.*

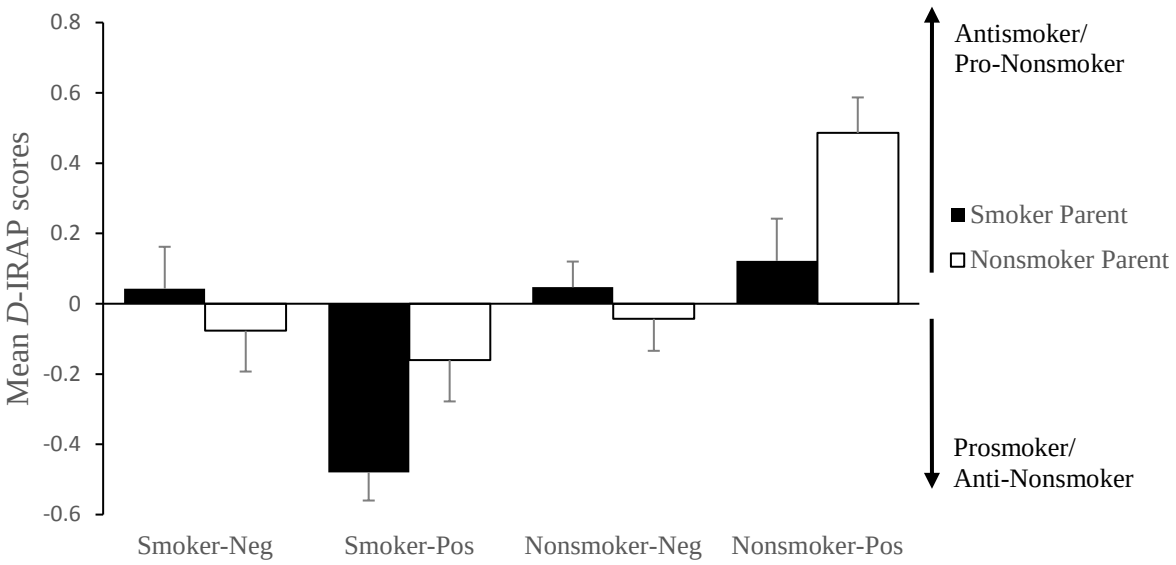


Figure 2: Mean D_{IRAP} Scores, with standard error bars, for each trial-type for each group in the post hoc analysis of the parental smoker identity data from Studies 1 and 2. Positive scores indicate an Antismokers bias/ Pro-Nonsmokers. Negative scores indicate a Prosmokers bias/ Anti-Nonsmokers.

Appendix A

Non-Smoker Smoking History Assessment

To be filled out by the researcher – Take notes to supplement answers where responses supplement the responses available on the sheet (e.g. any information with a bearing on smoking-status).

1. What is your cultural ethnicity, date of birth (& today's), sex, current occupation, and highest level of education (second-level; third-level, etc.)?

2. Have you ever lived in a home where people smoked indoors? Give brief details about whom, when, and for how long.

Have you ever lived in a home where people smoked outdoors? Give brief details about whom, when, and for how long.

3. How often do you usually think about the topic of smoking? Often versus seldom?

When you do think of the topic of smoking what do you typically think of?

4. If you don't currently smoke please describe absolutely any previous experience (when and for how long) you have with smoking no matter how long ago.

Then ask on how many *occasions* (not cigarettes) would they estimate they have smoked on in their lives.

How long since they last tried a cigarette?

5. Do you have any direct experience of the negative consequences of smoking (whether your health or someone in your personal life)? Please provide brief details:

Smoker Smoking History Assessment

To be filled out by the researcher – Take notes to supplement answers where it would provide more information regarding smoking-status.

1. What is your cultural ethnicity, date of birth, sex, current occupation, and current level of education (second-level; third-level, etc.)?

2. What time was your last cigarette at? (take note of time at intake & also current time & how long slept during that period)

3. How old were you when you first started smoking cigarettes FAIRLY REGULARLY? (enter "X" if never smoked regularly)

4. How old were you when you first started to buy cigarettes FAIRLY REGULARLY? (enter "X" if never smoked regularly)

5. Do you *buy* cigarettes on a regular basis (on more days than not)?

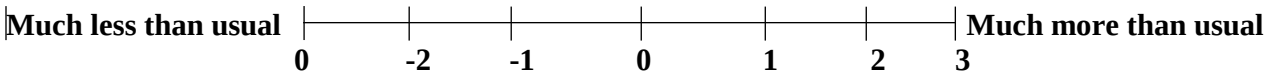
6. On how many of the past 30 days did you smoke cigarettes?

0-10 days 10-20 days 20-30 days 30 days

7. During the past 30 days, on the days you smoked how many cigarettes do you think you smoked on average each day?

Between ___ and ___ per day.

Are you currently smoking as usual, or more or less cigarettes per day than is usual for you?



Please give details of daily cigarette consumption *CURRENTLY* versus *USUALLY* (get ranges as before) and reasons for any differences (e.g. just money or because of quitting concerns?; extrinsic versus intrinsic):

8. How long ago did your most recent attempt to QUIT smoking *START*?
(Get participant to provide their best recall of date when they relapsed and calculate how long ago this was)

During this quit attempt how long were you able to quit for?

9. When did you last try to REDUCE how much you smoked?
(Get participant to provide their best recall how long ago it was when they started this attempt)

During this attempt to reduce the number of cigarettes you smoke, how long were you able to maintain the reduction in your cigarette consumption?

10. How many times in the past 12 months have you made what you would consider a "serious" attempt to quit smoking?

Between _____ and _____ times

11. How many times in your life have you made what you would consider a "serious" attempt to quit smoking?

Between _____ and _____ times

12. In the past 12 months, how many times have you quit smoking for at least 24 hours?

Between _____ and _____ times

13. How many times in your life have you quit smoking for at least 24 hours?

Between _____ and _____ times

14. What information resource or professional support have you previously used to help you stop smoking? Please give details of type and length of support, how well it worked, and how long ago