Stimulus Modality and Smoking Behavior: Moderating Role of Implicit Attitudes

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Abstract. This study investigated whether stimulus modality influences smoking behavior among smokers in South Eastern Nigeria and also whether implicit attitudes moderate the relationship between stimulus modality and smoking behavior. 60 undergraduate students of University of Nigeria, Nsukka were used. Participants were individually administered the IAT task as a measure of implicit attitude toward smoking and randomly assigned into either image condition that paired images of cigarette with aversive images of potential health consequences or text condition that paired images of cigarette with aversive texts of potential health consequences. A one- predictor and one-moderator binary logistic analysis indicates that stimulus modality significantly predicts smoking behavior ($p = < .05$) with those in the image condition choosing not to smoke with greater probability than the text condition. The interaction between stimulus modality and IAT scores was also significant ($p = < .05$). Specifically, the modality effect was larger for participants in the image group who held more negative implicit attitudes towards smoking. The finding shows the urgent need to introduce the use of aversive images of potential health consequences on cigarette packs in Nigeria.

Smoking, like other health-risk behaviours such as alcoholism and sexual risk behaviours, is usually initiated during adolescence. This is because adolescence is a period of high sensation seeking and experimentation irrespective of the risks involved. But the worrisome feature is that up to one third of adolescents who experiment with cigarettes will become daily smokers (as cited by Salawu, Danburam, Isa, & Agbo, 2010). This means that by adulthood, we will have quite a large number of smokers that can be categorized as heavy smokers. Apart from the hazards of inhaling tars, cigarette contains more than 4,000 poisonous chemicals which are carcinogenic and which damage the eyes, nose and throat with infections. The carbon monoxide in the cigarette smoke combines with the hemoglobin in the blood to form carboxyhemoglobin, which cannot carry oxygen, thus compromising the oxygen need of the individual. (Eze & Omeje, 1999).

Researchers have also reported that after one cigarette, there is an immediate increase in blood pressure and heart rate that persists for more than 15 minutes. People who smoke tend to show higher ambulatory blood pressure than non-smokers (Mancia et al, 2007). Also, the risk of myocardial infarction is 2–6 times higher and the risk of stroke is three times higher in smokers than non-smokers (National Heart Foundation of Australia, 2008). In patients with coronary heart disease, smoking cessation is associated with a 36% reduction in the risk of all-cause mortality (Critchley & Capewell, 2004) and also significantly reduces cardiovascular risk, risk of coronary heart disease and stroke.

The prevalence of cigarette smoking in Nigeria has become a source of concern to the populace especially health care givers. For example, a survey of 1,270 Nigerian adults in 1990 by World Health Organization (2001) showed that as many as 24% of men and 7% of women smoke cigarettes on a daily basis. This figure increased by as much as 32% from what it was in 1970. Also, Salawu et al. (2010) reported that between June and August 2006, a cross-sectional study involving 125 adolescents' ages 12 to 17 years randomly selected from a rural setting in northeast Nigeria showed that of 89 males 32 (36%) and of 36 females 9 (25%) were current light smokers; with over 85% of all smokers consumed less than 10 cigarettes a day. The prevalence of smoking in the study was 32.8%.

In the bid to find solution to high rate of smoking, several countries have devised a means of discouraging people from smoking. One of the most visible approaches is to mandate cigarette manufacturers to include a health warning message on cigarette packages. They have been implemented in an effort to enhance the public's awareness of the harmful effects of smoking. Warnings are usually in small typeface that depicts the negative consequences of smoking and placed along one of the sides of the cigarette packs. In 1973 Australia's first health warning on cigarette packages appeared as

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a simple message: 'Smoking is a health hazard' (Scollo & Haslam, 2008). Since 2006, graphic images depicting the effects of smoking cigarettes have been added and are required to be displayed on cigarette packets. It was also mandatory that such warnings must cover 30% of the front and 90% of the back of the box. The 10% of the back not occupied by a warning is used for the message "Sale to underage persons prohibited" (Australia Warnings, 2006).

The first health warnings on cigarette packs introduced in Nigeria was 'Federal Ministry of Health warns that smoking is dangerous to health'. It was printed in small characters at the bottom of packets of cigarettes. Today the caution, which is now printed in larger characters at the sides and/or fronts of cigarette packs, reads 'Federal Ministry of Health warns that smokers are liable to die young'. Little is known about smoking behavior and awareness of health hazards in Nigeria and from the scanty statistics available, warning texts adopted in Nigeria may not have led to any notable decrease in smoking rate. Studies have been done on using images of potential adverse health consequences of smoking as well as other behaviors to reduce such risky behaviors. For example, Hollands, Prestwich, and Marteau (2011) reported that participants in the conditioning intervention (using aversive images) chose fruits as opposed to snacks in a behavioral choice task. Such interventions have also been reported among smokers (Hammond, Fong, Mc Donald, Brown, & Cameron, 2004).

Behavior is acquired through differential reinforcement. Specifically, behavior is acquired and maintained or weakened by contingent stimuli which follow it. That is, when an aversive stimulus is presented or a reinforcing stimulus is withdrawn, the probability that the action will be repeated declines (Kunkel & Berry, 1968). Hence, an aversive paradigm where a videotape presentation of a person taking alcohol is paired with a noxious odor may lead to a decline in the desire to take alcohol. This aversive paradigm that employs an image-based aversive stimulus instead of a physical one, according to Walters (2014), may be just as effective as the standard aversion model.

Although research has demonstrated the potential utility of the use of aversive stimuli in changing smoking behavior, such studies have not been carried out in Nigeria even though smoking has become a national health issue. In this study therefore, stimulus modality was manipulated by either pairing images of cigarette with aversive images of potential health consequences (image condition) or pairing images of cigarette with aversive smoking caution texts (text condition) to test their effects on smoking behavior among smokers in Nigeria. Consequently, it was hypothesized that participants who were presented with images of cigarette

repeatedly paired with aversive images of potential health consequences would choose not to smoke more than those presented with images of cigarette repeatedly paired with aversive texts of potential health consequences. This is because images may produce a more negative valence than aversive texts (hypothesis 1).

Implicit Attitude

An attitude is a positive or negative evaluation of some object. It is an assessment of whether an object or concept is good or bad, positive or negative, pleasant or unpleasant. The nature of evaluations that an object can trigger has led researchers to conclude that people can hold two distinct attitudes: implicit and explicit attitudes towards the same attitude objects (Wilson, Lindsey, & Schooler, 2000). The major difference is whether the evaluations are triggered automatically or deliberately. Explicit attitudes are a reflection of deliberate evaluative judgments (Whitefield & Jordan, 2009) and are therefore available to conscious awareness. It is measured using self report scales. Implicit attitudes on the other hand were defined by Greenwald and Banaji (1995) as "introspectively unidentified (or inaccurately identified) traces of past experience that mediate favorable or unfavorable feeling, thought or action towards a social object (concept)". Implicit attitudes are therefore unconscious and automatic evaluative judgments that are established through every day mental associations (of concepts and evaluations) and operate without awareness or intent. Implicit attitudes cannot be assessed through introspection but through indirect method.

The dual system models have offered an explanation on the independent functioning of implicit and explicit attitudes. According to the models, implicit and explicit processes come from two distinct cognitive systems. While explicit processes involve propositional and reflective processes implicit processes involve associative or automatic processes (Gawronski & Bodenhausen, 2006; Rydell, McConnell, Mackie, & Strain, 2006) with both processes playing a role in guiding behavior (Gawronski & Bodenhausen, 2006).

Implicit attitudes have been theorized to be important determinants of behaviors especially health related behaviors (Ajzen, 2001). In line with this, positive attitudes towards certain behaviors are expected to increase the likelihood of engaging in such behaviors. Thus positive attitude towards smoking is supposed to be an important determinant of smoking behavior. Some findings are however opposed to this association. For example, in a study of implicit attitudes towards smoking, Swanson, Rudman and Greenwald (2001) found that although smokers' implicit attitudes toward smoking were more positive than that of nonsmokers,

overall verbal and pictorial smoking stimuli were implicitly more strongly associated with negative than with positive attributes. In another experiment to assess smoking associations with implicit Association Test (IAT), Huijding, Jong, Wiers, and Verkooijen (2005) reported that smokers' attitudes were less negative than those of nonsmokers although they both showed negative associations with smoking. Also, implicit attitudes in a smoking or a non smoking setting were assessed and the authors found a negative attitude in both settings. Following these findings, Huijding et al. (2005) argued that habitual smokers' attitude toward smoking may not be a major determinant of smoking behavior but that implicit attitude may actually be a moderating factor. This study tested the moderating effect of implicit attitude on smoking behavior. It is hypothesized that implicit attitudes will moderate the relationship between stimulus modality (image vs text) and choosing not to smoke (hypothesis 2).

Methods

Participants

Sixty male undergraduates of the University of Nigeria, Nsukka participated. They were all volunteers who are categorized as current smokers (persons who had smoked more than 100 cigarettes in their life times and still smoke at the time of this experiment). Their mean age was 23.1 years. The favorite cigarettes for all participants were Benson & Hedges and Dorchester.

Measures

Measure of implicit attitude

The Implicit Attitude Test (IAT; Greenwald, McGhee, & Schwartz, 1998) was used to measure implicit attitude. The IAT is a computerized categorization task in which participants categorize stimuli into four different categories: two target and two attribute categories. Participants are presented with stimuli from all four categories on a computer screen (each of two categories consist of one target and one attribute category presented as labels on the left and on the right of the computer screen). In this study, following Huijding et al. (2005), the two target categories used were smoking (with 10 exemplars: Tobacco, smoking, nicotine, cigarettes, cigar, smokers, benson & hedges, dorchester, ashtray, lighter) and exercise (with 9 exemplars: Swimming, diving, sports, aerobics training, running, biking, tennis, athletics, exercise). Two attribute categories used were pleasant (with 10 exemplars: Kindness, peace, talent, success, joy, sunshine, good, party, warmth, love) and unpleasant (with 10 exemplars: Assault, war, junk, failure, abuse, brutal, filth, bad, substance, vomit). Marlboro and rolling tobacco were replaced with benson & hedges and dorchester while slime was replaced with substance so as to make the terms more familiar to the participants.

The IAT task was conducted individually. Each individual went through 5 blocks. Blocks 1, 2 and 4 were practice categorization tasks while blocks 3 and 5 were combined categorization tasks. Block 1 required target practice categorization for the target concept (smoking *vs.* exercise; 20 trials); Block 2 required attribute practice categorization for the attributes (pleasant vs. unpleasant; 20 trials); Block 3 required combined categorization of all stimuli presented randomly to one of two combined category-attribute pair (e.g. E key for smoking-pleasant and I key for exercise-unpleasant; 20 trials practice and 40 trials data collection); Block 4 required reversed target practice categorization for the target concept (exercise vs. smoking; 20 trials); Block 5 required combined categorization of all stimuli to both the target and attribute categories with the target reversed (e.g. E key for exercise-pleasant and I key for smoking-unpleasant; 20 trials practice and 40 trials data collection). The assumption is that responses tend to be faster when the two categories that are associated in memory share the same response key than when they are not. Reaction times in the task in which one category was paired with pleasant words are compared with those obtained in the task in which the other category was paired with pleasant words. Only data from blocks 3 and 5 were used for analysis. The IAT effect for each participant was calculated as the log transformed difference in mean reaction time between blocks 3 and 5. Higher positive values of the IAT effect indicate a higher positive implicit attitude toward smoking. The IAT has been shown to be a good tool for measure of implicit attitude (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). It has also been found to have a high internal consistency (Ottaway, Hayden, & Oakes, 2001)

Measure of smoking behavior

Smoking choice task was used to measure smoking behavior. After the experiment, participants in both groups were told that they have five minutes to rest before going into the next phase of the experiment. As a distraction task, both groups were asked to write the names of twenty of their best friends. This is to allow the stimulus presentation to slither into the unconscious. After the distraction task, both groups were presented with two packets each of Benson & Hedges and Dorchester cigarettes and a lighter and were told that they were free to pick a cigarette of their choice if they choose to smoke. Participants were not allowed to light the cigarette. If they chose to take a cigarette to smoke, they were given a score of 1; if they chose not to take a cigarette to smoke, they were given a score of 2.

Procedure

Participants were administered the IAT task. After the IAT task participants were randomly assigned into image condition (Pairing of images of cigarette with aversive images of potential health consequences) and text condition (Pairing of images of cigarette with aversive texts of potential health consequences). For participants in image condition two images of cigarettes with their packets (Benson & Hedges and Dorchester) projected on a screen 12 times in a random order were presented. Each cigarette image appeared for two seconds followed by the presentation of one of two aversive images for two seconds. For participants in text condition, each cigarette image appeared for two seconds followed by the presentation of one of two aversive texts for two seconds. The aversive images used were two images of a smoke damaged teeth/gum and skin. These have been reported to be highly related to cigarette smoking. The aversive texts also consisted of two texts that have also been used in so many countries: "Federal Ministry of Health warns that smokers are liable to die young" and "Federal Ministry of Health warns that smoking is dangerous to health". Both texts have been used in Nigeria.

Results

Descriptive characteristics of the participants are summarized in Table 1. Participants in the aversive image condition had a lower IAT scores than those in the aversive text condition but the difference was not significant ($t = -.47$, $df = 58$, $p > .05$). The image group also chose not to smoke more than those in the aversive text condition. Prior to analysis, data were screened for missing data and all continuous variables were centered. A one- predictor and one-moderator binary logistic regression model was fitted to the data to determine whether stimulus modality (image vs. text) predicts smoking behavior and whether IAT scores moderate the relationship between stimulus modality and smoking behavior. Binary logistic regression was used because the dependent variable (smoking behavior)

Table 1. *Descriptive characteristics of the participants*

	Image		Text	
Sample (*n*)	30		30	
Chose to smoke	6		14	
Chose not to smoke	24		16	
	M	*SD*	*M*	*SD*
IAT scores	.124	.037	.129	.035

Note: IAT = Implicit Association Test.

was dichotomous (i.e., choosing to smoke or choosing not to smoke).

Given the base rates of smoking options for a model that includes only the constant (intercept), 33% of the participants chose to smoke while 66% chose not to smoke. A test of the full model versus a model with constant only showed that the model fits the data and was statistically significant in distinguishing between choosing to smoke and choosing not to smoke, -2 Log Likelihood $= 65.066$, Goodness of Fit $= 5.231$ ($df = 7$, $p = .632$), χ^2 (3, $N = 60$) $= 11.316$, $p < .05$. The model was able to classify 87.5% of those who chose not to smoke and 40% of those who chose to smoke, for an overall success rate of 72%. Regression coefficients are presented in Table II.

Wald statistics indicate that stimulus modality significantly predicts smoking behavior ($Wald = 5.335$, $df = 1$, $p = < .05$). The coefficient of the stimulus modality predictor was negative (-1.754), indicating that those in the image group were predicted to choose not to smoke with greater probability than the text group, supporting Hypothesis 1. Specifically, the odd ratio (e^B) was found to be .173 which implies that as stimulus modality increases by 1, participants in the image group are $1/0.173 = 5.8$ times more likely to choose not to smoke than are participants in the text group. The interaction term between stimulus modality and IAT scores was also significant ($Wald$ statistics $= 5.161$, $df = 1$, $p = < .05$) indicating that implicit attitudes significantly moderate the relationship between stimulus modality and smoking behavior. The negative weight for this interaction means that the slope of the relationship is less positive for image group (1) and more positive for text group (0). Specifically, the modality effect was larger for participants in the image group who held more negative implicit attitudes towards smoking.

Discussion

In this study, we examined whether smoking behavior (that is choosing to smoke *vs.* choosing not to smoke) will be influenced by stimulus modality effect and whether the change in smoking behavior is moderated by implicit attitudes. To manipulate stimulus modality, participants in experimental group I (image group) were exposed to images of cigarette packets (Benson & Hedges and Dorchester) followed by aversive images of potential health consequences of smoking while those in experimental group II (text group) were exposed to images of cigarette packets (Benson & Hedges and Dorchester) followed by aversive texts of potential health consequences of smoking.

Result supported hypothesis 1; stimulus modality had a significant effect on smoking behavior with those in aversive image group choosing not to smoke

Table 2. *Logistic Regression Coefficients*

Predictor	B	*SE* β	*Wald's* χ^2	*df*	*p*	*e*β (Odds Ratio)
Constant	1.874	.656	8.150	1	.004	6.513
SM	−1.754	.759	5.335	1	.021	.173
(1 = Image, 0 = Text)						
Implicit Scores	33.977	18.470	3.944	1	.046	.018
SM x Implicit Scores	−47.245	20.795	5.161	1	.023	.000

Note: SM = Stimulus Modality.

significantly more than those in the aversive text group. Aversive stimuli produce a variety of behavioral effects and from the social learning theory, all behavior is learned and undesirable behaviors can be unlearned under the right associations. Within the classical conditioning paradigm, an undesirable behavior, such as smoking behavior, is paired with an aversive (unpleasant) stimulus, such as causing a strong felling of health risk. The unpleasant feelings become associated with that behavior leading to the development of a conditioned aversion to the undesirable behavior. In its most basic form, an aversive event is one that an organism will expend energy to minimize or avoid and it is operationally opposite to reward (Wise, 2004). In the context of this study, it is most probable that the presentation of unpleasant feeling of smoking health risks in image form produces a stronger aversion to smoking than presenting the same health risks in text form. Thus, participants in the image condition chose not to smoke than those in the text condition. Similar findings have been reported (e.g, Hammond et al. 2004; Hollands et al. 2011).

Also, in support of hypothesis 2, the effect of stimulus modality on smoking behavior was moderated by implicit attitudes toward smoking. Stimulus modality was shown to have greater effect on choosing not to smoke for participants in the image group who held more negative implicit attitudes towards smoking. Having a more negative implicit attitude towards smoking will likely reflect a more negative association with smoking such as the unpleasant feeling of having health problems. This finding is in line with the argument of Huijding et al. (2005) and suggests that cognitive associations play important role in smoking behavior. Many of the processes that affect behavior and influence perception are unconscious (Greenwald et al. 2009). That informed research on implicit cognitions and attempts to predict behaviors from implicit associations.

This research has some limitations. For example, the sample size of 60 may be relatively small and also the fact that we didn't use a control group that will be exposed to a blank screen after the presentation of cigarette image. In this study, we are interested in comparing two stimulus modalities on smoking behavior; the first is the text modality that is used in Nigeria but with little or no impact on smoking rate and the other is the image modality that has not been introduced in Nigeria. The aim being to establish the modality that will lead to a stronger aversion to smoking and use it to guide intervention processes. Although research findings have shown that the liking of a stimulus can be increased by pairing it with positive stimuli and decreased by pairing it with negative stimuli (see Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010; Houben, Schoenmakers, & Wiers, 2010), this is the first study in Nigeria that examined changes in smoking behavior using stimulus modality and demonstrated that attitude moderate the relationship between stimulus modality and smoking behavior. This study is especially important in Nigeria were the use of aversive images of potential health consequences of smoking are yet to be introduced on cigarette packs. The findings will be a positive direction for proper legislative and intervention processes and will help in directing the necessary changes required in cigarette packs health warnings in Nigeria. Further studies should test the generalizability of this finding especially in Africa were studies on smoking behavior are scanty. It is also possible that the mode of presentation of aversive image based health consequences of smoking will have effect on smoking behavior.

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