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The Implicit Association Test as a measure of implicit consumer attitudes

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Abstract This article reports two experiments that sought to determine if the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), a method for assessing strengths of automatic associations, can be applied to measure consumer attitudes. The first experiment compared implicit attitudes toward juices and sodas. Analysis revealed significant correlation between IAT-measured implicit attitudes and

explicit measures of attitudes and behavior toward these product categories. The second experiment investigated implicit attitudes of female Ss toward low calorie products and high calorie products. The IAT attitude measure correlated with dieting activity: Ss who had eating habits restricting high calorie food intake showed implicit attitudes favoring low calorie products.

Introduction

During the last 20 years, social psychologists have increasingly appealed to automatic processes (Greenwald & Banaji, 1995; Bargh, 1996; Pratto, 1994; Bargh, Chaiken, Govender & Pratto, 1992; Bargh, 1989) in understanding social judgment and behavior. Associated with this trend is the increasing use of reaction time as an indicator of automatic or implicit processes (Bargh, 1996; Zarate & Smith, 1990; Lalonde & Gardner, 1989; Fazio, Sanbonmatsu, Powell & Kardes, 1986; Gaertner & McLaughlin, 1983).

One method of researching automatic processes that has become very popular over the last 5 years is the Implicit Association Test (Greenwald et al. 1998; Swanson, Rudman & Greenwald, ■■■■; Karpinski & Hilton, ■■■■; Brendell, Markman & Messner, ■■■■). The method consists of doing a computerized categorization task. The task lets Ss categorize stimuli into four different categories: two contrasted target concept categories (in the study of Greenwald et al., 1998, experiment 1, flowers and insects), and two

contrasted attribute categories (pleasant and unpleasant). The categorization task consists of presenting the Ss with a stimulus which the Ss are to categorize quickly in one of two groups (presented as labels on the left and on the right of the computer screen). Each of these two groups represents one target concept category and one attribute category. Ss categorize the stimuli by pressing a key on the left (corresponding with the labels on the left side of the screen) or on the right side (corresponding with the labels on the right side of the screen) of a computer keyboard. After completing a categorization task with only two categories, Ss conduct a combined categorization task (consisted of 4 categories: attribute category and target concept category together). This task is done two times: once when the first concept category is paired with *positive* attributes and the second category with *negative*, and once as a reversed task, when the first concept category is paired with *negative* attributes and the second category with *positive*. In this manner, Ss make categorizations in which both target concept categories are paired with both attribute categories.

Shorter reaction times for stimuli belonging to a target concept category which is paired with positive attributes

and prolongation of the reaction time when this target concept category is paired with negative attributes, is interpreted as an indication of a more positive implicit attitude toward this concept category than toward the other concept category with which it is tested. Thus far the IAT has been shown to be a very useful tool for research on automatic attitudes in several areas: racial attitudes (Dasgupta & Greenwald, 1990), stigmatized behavior, such as smoking (Swanson, et al., 1998), and gender stereotypes (Rudman, Greenwald & McGhee, 1998).

Automatic processes have most frequently been researched in the context of stereotypes and prejudice (Brauer, Wasel & Niedenthal, 2000; Greenwald et al., 1998; Greenwald & Banaji, 1995; Zarate & Smith, 1990; Lalonde & Gardner, 1989). The present work introduces these techniques to marketing and consumer research. In the mid-20th century, marketing researchers assumed that consumers make choices consciously and rationally. In the 1960's, interest among psychologists in consumer behavior increased. It became clear that this assumption required modification because more evidence became available which indicated that consumers' behavior is not the consequence of entirely rational cognitive processes, especially where fast-moving-consumer-goods — fmcs — are concerned. It became evident that also emotions and unconscious motives needed to be taken into consideration in understanding responses to advertising and other aspects of consumer choice. In the case of advertising, people are typically not aware of the extent to which advertising influences their attitudes and behavior. Usually advertising increases brand awareness and affects consumers' brand images, which are beyond people's conscious control, but only rarely is influencing conscious decisions to choose a certain advertised product (Shapiro, 1999). Brand image, in its turn, has a tremendous impact on product perceptions: in marketing researches where products are tried, it is often found that people have very different perception of product features (even such features as taste of coffee, strength of beer, sweetness of juice etc.) depending on if the product is tested "blind", without being conscious which brand is tested, or with the brand clearly displayed (Lannon, 1993).

In situations such as the one described above, self-reported measures do typically not suffice as indicators of people's brand images and product perceptions, and applied researchers as well as their academic counterparts are trying to introduce methods that provide a better measurement of them. So far, applied researchers have attempted to develop qualitative techniques in order to study the issues that are beyond consumers' consciousness; especially the so called "projective techniques", such as antropomorphization, animalization, sentence completion (Hussey & Duncombe, 1999; Greenbaum, 1993; Branthwaite & Lunn, 1985). Despite their popularity in commercial research, these qualitative projective techniques are generally not accepted in academic research, mostly because of their qualitative nature and the subjectivity of their analysis.

In contrast, academic consumer psychologists have chosen the other way, i.e., to develop quantitative techniques, which are supposed to be less sensitive to self-presentation bias and/or can better research the consciousness of the consumer. In the 70's most attention was devoted to physiological measures (Bagozzi, 1991). Physiological measures were mostly popular in the context of reactions to advertising;

interest in physiological measures was based on the hope that they have a better potential to research the Ss' "real attitude", and as a consequence would be more successful in predicting consumer behavior. Though the first researches of consumer behavior using physiological measurements were done in the 1920's, they are nowadays almost forgotten because of (i) the complex and expensive instruments that are required for them; and (ii) the difficulties and ambiguities of the interpretation of their data.

In the two studies discussed in the present article, an attempt was made to study implicit consumer attitudes with the use of the IAT. Experiment 1 focused on product categories toward which consumers can be expected to have "simple" attitudes, that is, products for which there are no inherent to the product reasons to believe that consumers experience some internal conflict or ambivalence toward the product (for example, a conflict between cognitive and affective components of their attitudes toward the products).

In Experiment 2, the focus was on product categories for which more "complex" attitudes can be expected to exist, i.e., high and low calorie products. Attitudes toward high and low calorie products are characterized by a certain ambivalence: on the one hand many people hold positive attitudes toward some aspects of both product categories (e.g. taste in case of high-calorie products, and effect on body weight of low-calorie products), while at the same time they hold negative attitudes toward other aspects of such products (e.g. taste in case of low-calorie products, and effects on body weight in case of high-calorie products).

Experiment 1

The objective of this experiment was to explore if the IAT could be applied to the study of consumer behavior. In the study Ss were presented with a classification task in which they classified brands of juices or sodas in a standard IAT setup. In line with Greenwald et al. (1998 – experiments 2 and 3), it was assumed that when two sets of stimuli are categorized, in combination with positive and negative words, the implicit attitude is more positive toward that category where the shortest reaction times are obtained. For example, if an S would perform the task faster where juice brands are paired with pleasant words, as compared to the task where soda brands are paired with pleasant words, this would indicate that that S has a positive implicit attitude toward fruit juices than toward sodas.

Predictions were that in case of attitudes toward fruit juices and sodas implicit attitude (reflected in IAT effect) will be correlated with: a) Ss' explicit ratings of fruit juices and sodas, and b) with (self-reported) behavior.

Method

Participants

A total of 71 persons participated: 55 female and 16 male. All Ss were undergraduate students of the Department of Psychology at the University of Warsaw (age 19–25). For

their participation in the experiment Ss were paid 5 PLN (at the time the equivalent of 1.33 US\$).

Materials

Explicit measures

Subjects completed a set of questionnaire measures of behavior and attitude toward the two product categories. The questionnaire contained the following questions:

- (Self-reported) behavior: frequency of drinking of sodas and juices (one question about sodas, one about juices, 5-point frequent/infrequent scale);
- Affect: liking of sodas and juices (one question each, 10 cm like-dislike scales);
- Separate evaluation of sodas and juices on 6 different bipolar dimensions (healthy/unhealthy, natural/artificial, tasty/not tasty, good against thirst/not good against thirst, I try to have it at home/I don't try to have it at home, I try to drink it often/I don't try to drink it often) — total of 12 questions (6 for sodas, 6 for juices), each rated on a 5-point agree/disagree scale. These dimensions were on an a-priori basis grouped into the following scales:
 - behavioral intention (try to have at home, try to drink often);
 - subjective beliefs (tasty, quenches thirst well);
 - objective beliefs (healthy, natural).

Knowledge of brands and preferences for the soda and fruit juice brands used as target stimuli in the study. These questions were only used to ensure that all Ss knew all the brands used in the IAT task (see below); no Ss participated who did not know all the brands.

Implicit measures

Subjects completed an IAT task measuring their implicit attitudes toward two groups of beverages: fruit juices and sodas. The list of Polish pleasant and unpleasant words was created based on the list of English stimuli used in previous experiments (Greenwald et al. 1998). The original set of stimuli was modified in order to control the length of the words and to avoid the use of (Polish) words with a negation prefix (e.g. "unhappy" - see Maison & Bruin, 1999 for a further discussion of the stimuli used). The following list of stimuli was used in the experiment: (pleasant words) sun, luck, love, fun, happiness, pleasure, holiday, friendship; (unpleasant words) disease, death, murder, accident, poison, war, tragedy, vomit.

Much attention was paid to the issue what types of product-related stimuli would be used. Because the main purpose of the experiment was to verify if the IAT could be used to consumer behavior and attitudes toward product categories, we tried to find comparable categories for which it could be assumed that people have a clear preference one over another, while some prefer one category, and some the another. Finally, the choice was made to use fruit juices and sodas as categories in the task.

Another concern was choice of exemplars of the target category. It was decided that potential interference from strong brand images should be avoided. Therefore categories had to be chosen such that all of them were more or less comparable in terms of amount of advertising (all chosen

brands, at least in the time of conducting the study, were not strongly advertised). Brand names were chosen based of the Polish list of best known brands in each category. In order to create higher comparability between the two categories only fruit flavored drinks were chosen, intentionally avoiding cola flavor brands (Coca-Cola, Pepsi), because these are strong brands with a very large amount of advertising. The list of target stimuli was: (soda brands) Fanta, Sprite, 7up, Mirinda; (fruit juices brands) Hortex, Fortuna, Clippo, Tymbark.

The IAT task was completed on PC-type desktop computers, on which the Inquisit program (Footnote 1) was installed. In the center of the computer screen the stimuli were randomly presented; the Ss' task was to assign each stimulus to one of two categories. Ss responded to the categorization task by pressing either the "A" key with the left index finger or the "5" key on the numeric keypad with the right index finger.

Procedure

Upon entry in the laboratory, Ss were asked to complete the questionnaire that measured explicit attitudes toward different type of drinks (sodas and fruit juices). Immediately after completing the questionnaire the Ss conducted the IAT task. The entire study was conducted individually. Each participant completed a total of 5 classification tasks: 1 – single categorization for the attributes (pleasant/unpleasant – 30 trials); 2 – single categorization for the target concept (Sodas/Juices; 30 trials); 3 – combined categorization task – practice and data collection trials (Sodas+pleasant/Juices+unpleasant – 20 trials practice and 40 trials data collection); 4 – single categorization for the target concept (as block 2) but with reversal of the side of the screen on which was presented the category to which the words needed to be categorized (30 trials); 5 – combined categorization task – practice and data collection trials (as block 3) but reversed categorization of target categories (Juices+pleasant/Sodas+unpleasant – 20 trials practice and 40 trials data collection). Half of the Ss did the task in the order presented above; for the other half tasks 2 and 3 were interchanged with tasks 4 and 5. Only the data from tasks 3 and 5 were used for analysis.

Results and Discussion

Data reduction

The first trial of each experimental task was excluded from analysis because these response latencies were typically longer. Also trials that had latencies longer than 3000 ms and shorter than 300 ms were recoded to 3000 ms and 300 ms respectively, to control for inattention or anticipation (as suggested by Greenwald et al., 1998). Of each experimental task, the first trial was excluded from analysis because these response latencies were typically longer. Latencies were log-transformed to reduce skewness before computing means. One S was excluded from the analyses because of an error rate higher than 30%, and the suspicion that (s)he either misunderstood the task, or did not carry it out seriously (the average error rate of the other Ss was 6.0%). All analyses reported here involve the remaining 70 Ss.

Table 1. Evaluation of sodas and juices - explicit attitudes toward drinks (Soda vs. Fruit Juices – Experiment 1). Note: judgements were made on a 5-point scale. A higher value means a more positive judgment. All differences statistically significant, $p < 0.005$.

	Sodas	Juices
Frequency of drinking	3.23	4.07
I have at home	2.71	4.32
I often drink	2.39	4.50
Good for thirst	3.13	3.90
Tasty	3.54	4.68
Natural	1.88	4.58
Healthy	1.84	4.71

Explicit attitudes toward sodas and juices

In the questionnaire, the Ss rated juices more positively than sodas. They expressed greater liking, and evaluated them as more natural, healthier, tastier, and better against thirst than sodas. Moreover Ss declared to drink juices more often than sodas (Table 1).

Although juices were on all dimensions evaluated more positively than sodas, the largest discrepancy between the evaluations of these two types of drinks concerned only two dimensions: natural and healthy, for which sodas received extremely negative ratings.

Implicit attitudes toward sodas and juices – IAT effect

Comparison of the reaction times in the task in which one category was paired with positive words with those obtained in the task in which the other category was paired with positive words, provides a measure of implicit attitudes toward the two categories. Faster reaction times for one category together with pleasant words indicates a more positive implicit attitude toward that category.

In the present experiment, on average Ss had significantly shorter reaction times (RT) when the category juices was paired with positive words, as compared to the pairing sodas with positive words: Soda+unpleasant/ Juices+pleasant task RT=698 ms; Juices+unpleasant/ Soda+pleasant task RT=783 ms; $t[69]=5.63$, $p < 0.0001$ (Footnote 2). This finding indicates that Ss, in general, had more positive implicit attitudes toward juices than toward sodas.

Correlations between explicit and implicit attitudes

In order to analyze the correlation between IAT effect (implicit attitudes) and explicit ratings of sodas and juices, the explicit ratings were on an a priori basis reduced into five variables that were expected to be related to different aspects of the attitude/behavior complex: self-reported behavior (1 item only), behavioral intention (items “drinking”, “having at home”), liking (general preference for one type of drink), “objective” beliefs (healthy, natural), and “subjective” beliefs (tasty, quenches thirst well). The calculation of these 5 variables was a two-stage process: first, difference scores were computed for all the individual ratings in such a manner that higher scores indicated a more

favorable rating of sodas (i.e., the juices rating was subtracted from the soda rating). Next – the resulting difference scores were added up, according to the combinations of items shown above. For the resulting data, low values indicate a favorable rating of juices, and high scores a favorable rating of sodas.

The IAT effect for each subject was calculated by computing the mean latency for the Soda+unpleasant/Juices+pleasant task minus the mean latency for the Juices+unpleasant/Soda+pleasant task. Thus, higher positive values of the IAT effect indicate a more favorable implicit attitude toward sodas. Significant positive correlation between IAT effect and the explicit measures were significant for 4 out of 5 explicit measures (Table 2). Implicit attitude was correlated with behavior ($r=0.20$; $p < 0.047$), behavioral intention ($r=0.29$; $p < 0.008$), liking ($r=0.38$; $p < 0.001$), and subjective beliefs ($r=0.40$; $p < 0.0001$). The correlation with objective beliefs was not significant. The correlations between IAT and the individual items showed the same pattern of results.

Discussion

This experiment provides evidence that the IAT can be used successfully to assess consumer behavior. First, the IAT revealed significant differences between Ss’ reactions to different beverage categories, and second, these differences were positively related to Ss’ explicit ratings of the two beverage categories (self-reported behavior, intention, liking and beliefs). Interestingly, the only explicit variables that show no correlation with the IAT effect are the “objective” beliefs (healthy and natural). This observation parallels the insight that consumers’ “objective” beliefs about fmcg products are often at best only weakly related to their market behavior.

Experiment 2

Experiment 1 showed that the IAT effect can be correlated with some aspects of explicit attitudes: level of liking products, beliefs about those products and behavior connected to it (having at home, drinking). In the previous experiment the area of the researched were non-ambivalent attitudes and therefore there was no reason to expect discrepancy between explicit and implicit measures. However, the promising value of the IAT method lies in its potential to shed more light on situations in which there is inconsistency between people’s explicit beliefs about, and attitudes toward different characteristics of the target object, and, consequently, behavior is likely to follow one but not the other.

In order to explore this line of thinking, Experiment 2 involved an area of consumer behavior in which it could be expected that the explicit attitude toward the researched category would be ambivalent (with positive and negative aspects at the same time) and therefore its relations with implicit attitudes and behavior would also be more complex. For the study were chosen two groups of products: high-calorie foods (which, it was assumed, are eaten because they are tasty though people may feel guilty about this), and low-calorie foods (eaten because they are good for your health,

Implicit attitude (n=70)	1	2	3	4	5	6
		Beh	IBeh	Pref	SB	OB
1. IAT effect (log[RT])	—	0.20*	0.29*	0.38**	.40**	0.04
Explicit measures						
2. BEH - (Self reported) behavior		—	0.70**	0.66**	0.49**	0.18
3. IBEH - Behavioral intention			—	0.75**	0.53**	0.32**
4. PREF - Liking (preference)				—	0.71**	0.18
5. SB - Subjective beliefs (tasty, good for thirst)					—	0.18
6. OB - Objective beliefs (healthy, natural)						—

Table 2. Correlation between Implicit and Explicit measures (Soda vs. Fruit Juices – Experiment 1). Note: table shows results of one-tailed significance tests. * — $p < 0.05$; ** — $p < 0.001$; **bold**** — $p < 0.0001$. A positive correlation between explicit and implicit measures indicates that a more positive score of one category as expressed in explicit measures is related to an IAT effect which shows a more positive implicit attitude toward the same category.

but not always tasty). It was assumed that these products are most “conflicting” for women. Therefore only female Ss participated in the study.

High and low calorie products create many ambivalent feelings and approach-avoidance conflict (Shiv & Fedorikhin, 1999; Percy & Lautman, 1994). On the one hand the media generally stress the concept of a healthy life style, and a lot is said about the importance of low calorie food for health. On the other hand marketers of high calorie products are often stressing taste in their advertising. Another function of high calorie food is as gratification; to help to cope with bad mood. This situation creates in our culture very ambivalent feelings toward high calorie products, which — in extreme cases — can result in eating disorders (Percy & Lutman, 1994). For women this ambivalence toward high calorie products is further strengthened by the “beauty ideal”, which stresses that in order to be attractive, women should be slender.

In the experiment, Ss completed an IAT attitude measure that involved classifying low and high calorie products. Predictions were that: (1) Ss’ explicit ratings of both product categories would reveal the conflict between tasty and healthy products discussed above (high calorie products: more tasty, less healthy and low calorie products: less tasty, more healthy); (2) implicit attitude toward low vs. high calorie products would be correlated with explicit attitude toward those products; (3) implicit attitude toward low vs. high calorie products would be correlated with (self-reported) avoidance behavior toward high calorie products (“though they are tasty, I avoid them because they are not healthy”).

Method

Participants

A total of 51 females participated in the experiment. All Ss were undergraduate students of the Department of Psychology at the University of Warsaw (age 19–25). For the participation in the experiment Ss were paid 5 PLN (at that time the equivalent of 1.33 US\$).

Procedure

The procedure in this second experiment was similar to that of Experiment 1, except that the list of stimuli in the IAT task was different, as was the questionnaire filled in at the beginning of the study (for further descriptions of both, see below).

Materials

Explicit measures. Subjects completed a questionnaire consisting of two parts: evaluation of high and low calorie products (explicit attitudes) and several rating scales about (i) concerns about eating food, (ii) guilty feeling after eating tasty/ high calorie food, and (iii) attitude toward the own body.

This questionnaire contained the following statements: Separate ratings of both product categories on four characteristics (7 – point semantic differentials, scored from 1 to 7): 1 – not tasty/7 – tasty, 1 – not healthy/7 – healthy, 1 – not nice/7 – nice, 1 – not fashionable/7 – fashionable; Concerns about eating food (habits and behavior; 6 – point scale 1 – disagree/6 – agree): “I especially eat low calorie food”, “I always eat what I want”, “When I buy something, I am always concerned about calories”; “I often deny myself eating what I like”; “I avoid sweets”; Guilty feelings about food (6 – point scale, 1 – disagree/6 – agree): “After eating something I often regret eating it”, “I often feel guilty when I eat sweets”; Attitudes toward the own body (6 – point scale 1 – disagree/6 – agree): “In order to look best, I should loose weight”; “If I would be jogging in a swimming suit I would look attractive”; “I like to dress in revealing clothes” (the literal meaning of the last item is difficult to translate into English).

Implicit measures

Subjects completed an IAT task measuring implicit attitudes toward two groups of food products: high and low calories, chosen based on pilot study. The list of stimuli included: (high calorie stimuli) chocolate, nuts, candy bars, cookie, chips and (low calorie stimuli) fruits, lettuce, juice, yogurt, salad. The list of Polish pleasant and unpleasant words was the same as in Experiment 1.

Table 3. Evaluation of low and high calorie products (Experiment 2). Note: judgements were made on 7-point scale (semantic differential, e.g. not tasty – tasty). Higher values mean stronger agreement with the keyword mentioned in the table.

	Low calories	High calories	t	p
Tasty	4.39	5.35	-2.54	0.014
Nice	4.75	5.20		ns
Healthy	6.25	2.27	15.37	0.0001
Fashionable	6.16	2.47	11.7	0.0001

The IAT task was completed on IBM-compatible desktop computers, using the Inquisit program. In the center of the computer screen the stimuli which the participants had to ascribe to one of two (or four) categories were randomly presented. Subjects responded to the categorization task by pressing either the “A” key with the left hand finger or the “5” key on the numeric keypad with the right hand finger.

Results and discussion

Data reduction

To the data from the second experiment the same data reduction procedure was applied as in Experiment 1: the first trial of each experimental task was removed before analysis and latencies longer than 3000 ms and shorter than 300 ms were recoded to 3000 ms and 300 ms respectively, and latencies were log-transformed). Of each experimental task, the first trial was excluded from analysis because these response latencies were typically longer. Also in this study one person was excluded from analysis because of an error rate higher than 30% (the average error rate of the other Ss was 6.5%). All analyses reported here involve the remaining 50 Ss.

Explicit attitudes toward low and high calorie products

As expected (prediction 1), Ss answers to the questionnaire showed ambivalent attitudes toward low and high calorie products. On the one hand low calorie products are perceived as healthier and more fashionable than high calorie products, on the other hand they are perceived as less tasty and less nice (however the latter difference was not statistically significant) than high calorie products (Table 3).

Implicit attitudes toward low and high calorie products – IAT effect

Comparison of the task when one category is paired with positive words with task when second category is paired with positive words provides the measure of implicit attitude

Table 4. Correlation between implicit and explicit measures (low vs. high calories – Experiment 2). Note: table shows results of one-tailed significance tests. * — $p < 0.05$; ** — $p < 0.001$; **bold**** — $p < 0.0001$. A positive correlation between explicit and implicit attitudes indicates that a more positive attitude to one category as expressed in explicit attitudes is reflected by IAT effect which expresses a more positive implicit attitude toward the same category.

n=50	1	2	3	4	5
Implicit attitude					
1. IAT effect (log)	—	0.22	0.44**	0.30*	0.10
Explicit measures					
2. Tasty		—	0.72**	0.12	-0.04
3. Nice			—	0.15	0.10
4. Healthy				—	0.30*
5. Fashionable					—

toward those categories. A shorter reaction time for one category when paired with positive words indicates a more positive implicit attitude toward that category.

Subjects had significantly shorter reaction times when the category “low calorie” was paired with positive words, than when “high calorie” was paired with positive words (high calories+unpleasant/ low calorie+pleasant task RT=729 ms low calories+unpleasant/ high calorie+pleasant task RT=996 ms; $t[49]=8.22$, $p < 0.0001$). This finding indicates that the subjects, on average, had more positive implicit attitudes toward low calorie products than toward high calorie products.

Correlations between explicit and implicit attitudes toward low and high calorie products

As previously explained, it was expected that a more positive explicit evaluation of a particular category of products would coincide with a more positive implicit attitude toward the same category. In order to test this hypothesis, the correlation between the IAT effect and the explicit measures was examined. The IAT effect for each subject was calculated by computing the latency for the high calorie+unpleasant/ low calorie+pleasant task minus the latency for the low calorie+unpleasant/high calorie+pleasant task. Higher positive scores for the IAT effect therefore indicate a more favorable implicit attitude toward high calorie products. For the explicit measures similar differences were calculated: the evaluation of high calorie products minus the evaluation of low calorie products. Therefore, a higher positive score indicates a more favorable evaluation of high calorie products.

As expected (prediction 2), all correlations between implicit and explicit attitudes toward the food categories were positive (Table 4). More positive explicit attitudes toward low calorie products were associated with IAT effects that reflected more positive implicit attitudes toward low calorie products. Similarly, more positive explicit attitudes toward high calorie products, were associated with IAT effects reflecting implicit preference for those products. However only 2 of the 4 ratings measures were statistically

n=50	IAT	EH	GF	AB
Implicit attitude				
1. IAT effect (log) (higher value - stronger pref. for low calorie products)	—	0.34*	0.31*	-0.14
Explicit measures				
2. EH - eating habits/ behavior (higher value - choosing more low calorie and at the same time more avoiding high calorie products)		—	0.70**	-0.21
3. GF - guilty feeling (higher value - stronger guilty feeling when eating high calorie products)		—	-0.28*	—
4. AB - attitude toward own body (higher value - more satisfied with the own body)				

Table 5. Correlation between IAT and eating and body related attitudes (Experiment 2). Note: table shows results of one-sided significance tests. * — $p < 0.05$; ** — $p < 0.001$; **bold**** — $p < 0.0001$.

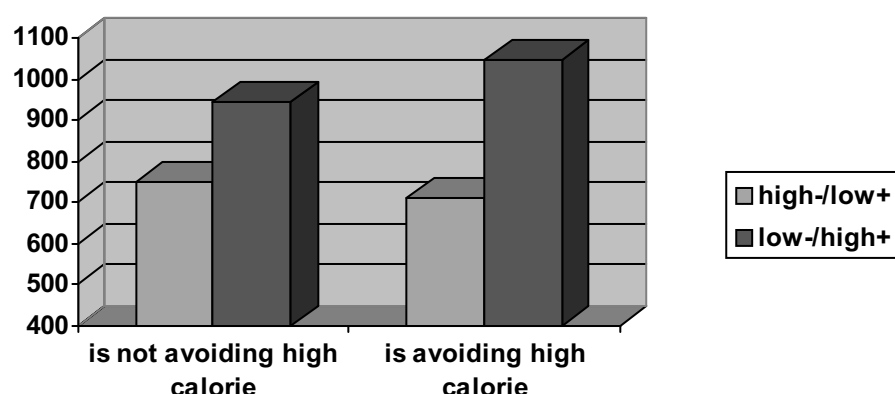


Figure 1. IAT task (categorization with negative vs. positive words) in two groups of participants: those who favor low calories products ($n=25$) and those who do not ($n=25$). (The difference in IAT effects between two groups: $t=2.23$, $p<0.049$. The IAT effect is the difference in reaction time when the category is paired with positive words and when the same category is paired with negative words. In this case stronger IAT effect [a larger difference in reaction time] indicates a stronger positive implicit attitude toward low calorie products.)

significantly correlated with the IAT measure: items “nice” ($r=0.44$; $p(\text{one-sided}) < 0.001$) and “healthy” ($r=0.30$; $p(\text{one-sided}) < 0.019$).

Correlation between eating and body related attitudes and implicit attitudes toward low and high calorie products

In order to investigate correlation between implicit attitudes toward low vs. high calorie products and different aspects of eating behavior, three scales were constructed based on the items in the questionnaire: EH (Eating Habits), GF (Guilty Feelings) and AB (Attitude toward the own Body). The EH scale consisted of the items “I especially eat low calorie food”; “I always eat what I want”; “When I buy something, I am always concerned about calories”; “I often deny myself eating what I like”; “I avoid sweets”. The GF scale consisted of the items “After eating something I often regret eating it”, “I often feel guilty when I eat sweets”. The AB scale consisted of the items “In order to look best, I should loose weight”; “If I would be jogging in a swimming suit I would look attractive”; “I like to dress in revealing clothes”.

Each of these scales was constructed by adding up the scores on the items. Before adding the scores up, items were recoded in such a manner that high scores on the resulting scale would coincide with:

- EH – choice of low calorie products and avoidance of high calorie products;
- GF – stronger guilty feeling when eating high calorie products;
- AB – higher satisfaction with the own body.

The IAT effect was found to correlate with self-reported eating habits and feelings of guilt (Table 5). For eating habits, a positive correlation of $r=0.34$ was found ($p < 0.007$), signifying that an IAT effect in favor of low calorie products co-varies with choice of low calorie products and at the same time with avoidance of high calorie products. The Ss who had an IAT effect in favor of low calorie products report that they eat more low calorie products, that they are concerned during shopping about calories, and that they do not always eat what they want. Also for feelings of guilt a positive correlation with the IAT effect was found ($r=0.32$; $p < 0.012$): a more favorable implicit attitude toward low calorie

products is related to guilty feelings toward eating high calorie products. No significant correlation was found between the IAT effect and evaluation of the own body.

Figure 1 is an illustration of the difference in IAT effect between those who declare choosing especially low calorie food and those who do not (subjects were split based on the answers to one question: "I especially eat low calorie food"). In both groups the IAT effect is in favor of low calorie products (reaction time when low calorie products are paired with positive words is faster than when they are paired with high calorie products). However the size of the difference between reaction time in both tasks (the IAT effect) is different in two groups ($t[50]=2.23$; $p<0.049$). Those women who eat more low calorie products have stronger positive implicit attitude toward low calorie products and negative toward high calorie (bigger difference in reaction time), than those who less avoid high calorie products.

Discussion

As was expected women participating in the experiment had ambivalent explicit attitudes toward low and high calorie products. They perceived low calorie products as healthier and more fashionable than high calorie products, but also as less tasty than high calorie products. The results of the IAT showed that the Ss generally have more positive implicit attitudes toward low calorie products than toward high calorie products.

Explicit attitudes toward these products were positively correlated with the implicit attitude (as expressed by IAT effect). When subjects were perceiving low calorie products more positively and high calorie products less, their implicit attitudes showed also attitudes in favor of low calorie products. However, significant correlation was only obtained for the items "Healthy" and "Nice". For the items "Tasty" and "Fashionable", the correlation between explicit and implicit attitude was not significant. The implicit attitude toward low and high calorie products also was related to Ss' self-reported behavior toward those products. Those who avoid high calorie products, are concerned about calories when they buy food, and feel guilty when they eat high calorie products, they also have a larger IAT effect in favor of low calorie products than those who care less about calories.

General discussion

The two described studies investigated the usefulness of the Implicit Association Test as a measure of consumer attitudes. In the first experiment attitudes toward juices and sodas were studied. The first study showed that the Ss had a strong explicit preference for juices over sodas, which was mirrored by the results of the IAT. Moreover, it was found that implicit measures correlated with some aspects of explicit measures: self reported behavior, liking, and beliefs. No significant correlation could be found between the IAT and beliefs about presumably objective attributes of the brands (their healthfulness and naturalness).

In the second experiment the categories being examined were low and high calorie products. This study compared implicit and explicit reactions to two product categories for which Ss might experience ambivalence in their attitudes toward the product categories. The results of explicit measures confirmed the expectation of ambivalence: low calorie products were perceived as healthier than high calorie products, but high calorie products were perceived as more tasty than low calorie products. The results of the IAT showed more positive implicit attitudes toward low calorie products than toward high calorie products. Differences in explicit attitudes toward the two product categories were positively correlated with differences in implicit attitudes, although not all explicit measures correlated with the IAT. The implicit attitude toward low and high calorie products was also found to be related to Ss' self-reported behavior toward those products, including concern about calories when buying food, and guilty feelings about eating high calorie products.

The results of the two studies demonstrated that the Implicit Association Test can be applied to consumer attitudes and consumer behavior (cf. Brunel, Collins, Greenwald & Tietje, 1999; Swanson, et. al., ■■■■). There are several respects in which the present paper contributes to further understanding of the IAT and of consumer attitudes. First, IAT studies that have thus far been reported, typically included as an explicit attitude direct measures of Ss' attitudes toward the two categories which were contrasted in the IAT test. For example, in Greenwald et al.'s (1998) flowers/insects study, the *implicit* task involved the classification of insect and flower names, while the *explicit* measures concerned Ss' liking of insects and flowers. In both of the present studies the explicit measures covered a wider range, including beliefs and feelings about the target categories and self-reported behavior toward the target categories (e.g. "guilty feeling when eating high-calorie food", "quenching thirst", "try to have at home"). In both studies beliefs, feelings and behaviors connected to the target categories were correlating with the implicit attitudes.

Second, the reported experiments shed some light on possibilities for using the IAT to predict behavior. As mentioned in the introduction, both applied and academic researchers have for many years been searching for a methods that provide behavioral predictors. An interesting question is whether the IAT can be used as a predictor of Ss' behavior. Both of the present studies suggest that there are indeed grounds for this hypothesis, as both studies resulted in significant correlation between the IAT and Ss' *self-reported* behavior. Further research will have to address this issue more thoroughly.

Footnotes

(1) Inquisit is a program which was specially developed for psychological experimentation under the Windows 9x operating system, copyright 1996—1999 Millisecond Software.

(2) All analyses were done on reaction time and log transformed data. All statistical values presented in the text are based on analysis on log transformed data.

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