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Reports

How to like yourself better, or chocolate less: Changing implicit attitudes with one IAT task

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ABSTRACT

The current paper introduces a novel feature of implicit association tests (IATs) by demonstrating their potential to change implicit attitudes. We assume that such changes are driven by associative learning mechanisms caused by carrying out an IAT task. Currently, evaluative conditioning appears to be the only widespread paradigm for changing implicit attitudes. An IAT task could provide an alternative. In two experiments, participants initially reacted to only one IAT task. Implicit preferences subsequently assessed with different implicit measures depended on the initial IAT task. This was shown for implicit self-esteem and for implicit attitudes towards well-known candy brands. Findings are discussed in relation to task-order effects in IATs.

Virtually all objects are liked or disliked. Researchers have undertaken enormous efforts not only to measure attitudes towards objects, social groups, and the self, but also to detect means of changing them (e.g., Chaiken, Wood, & Eagly, 1996; Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975; Hovland, Janis, & Kelley, 1953; McGuire, 1968; Petty & Wegener, 1998). Appropriate methods of attitude change are of interest due to their wide-ranging applicability to fields such as advertising, anti-discrimination programs, clinical interventions, or election campaigns, to name just a few. Major strategies of attitude change affect either deliberate, rule-based processes assigned to a reflective system, or basic associative structures of an impulsive system that depends on basic learning processes (e.g., Strack & Deutsch, 2004). More concretely, links are created or strengthened if stimuli are presented or activated in close temporal or spatial proximity. These conditions are present in one main attitude *measure*, implicit association tests (IATs, Greenwald, McGhee, & Schwartz, 1998). We thus test whether IATs *change* attitudes while measuring them, in analogy to Heisenberg's uncertainty principle, and we demonstrate attitude change with regard to self attitudes and consumer attitudes.

Implicit attitudes[1] have been referred to as evaluations that are triggered automatically by the mere presence of the attitude object, often without a person's awareness and control (e.g., Bargh, 1994; Devine, 2001; Rydell, McConnell, Mackie, & Strain, 2006). Whereas previous models conceptualized implicit and explicit attitudes as a dichotomy (Wilson, Lindsey, & Schooler, 2000), the Iterative Reprocessing model (Cunningham & Zelazo, 2007) assumes that evaluative processing occurs on a continuum from relatively automatic to relatively reflective processing. Thus, changing implicit attitudes should affect attitudes in general (also see Petty, Tormala, Brinol, & Jarvis, 2006).

The paradigm typically used for changing implicit attitudes is evaluative conditioning (EC, for a review, see De Houwer, Thomas, & Baeyens, 2001). During EC a neutral stimulus is paired with an affective stimulus. This leads to a change in valence of the formerly neutral stimulus according to the valence of the affective stimulus. Analogical to the learning mechanism of Pavlovian conditioning (PC), the formerly neutral stimulus (NS) is equivalent to the conditioned stimulus (CS), whereas the affective stimulus corresponds to the unconditioned stimulus (US, De Houwer et al., 2001). However, other than in PC where signal or expectancy learning takes place, EC is described as the learning of likes and dislikes, that is, as the acquisition of preferences (Walther, 2002), and it is assumed to be a distinct form of learning (Baeyens & De Houwer, 1995; Baeyens, Eelen, & Crombez, 1995; Baeyens, Eelen, Crombez, & Van den Bergh, 1992). The major characteristics distinguishing EC from PC (cf. Walther, 2002) illustrate the suitability of EC from an application perspective, for instance, as a tool in advertising. For example, in contrast to PC, EC is not dependent on the awareness of the contingencies between CS and US. Moreover, single CS presentations subsequent to successful learning do not cause extinction in the case of EC. Thus, with EC, attitudes can be shaped without requiring participants' full attention, and learned associations of

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[1] The debate whether implicit and explicit attitudes are distinct constructs has not yet been settled. When we use the term "implicit attitudes" we refer to automatic evaluative processes that tap associative rather than reflective bases of information processing.

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a product and a positively valenced cue persist even when subsequently encountering the product in the absence of the appetitive US, as it is often the case in real-word settings (for research on the application of EC to advertisement, see Walther, Ebert, & Meinerling, 2009). Changes in implicit attitudes based on associative learning have been demonstrated in several studies (e.g., Baccus, Baldwin, & Packer, 2004; Dijksterhuis, 2004; Gibson, 2008; Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002; Karpinski & Hilton, 2001; Mitchell, Anderson, & Lovibond, 2003; Olson & Fazio, 2001; Rydell et al., 2006). For example, Dijksterhuis (2004) increased participants' implicit self-esteem through subliminal EC.

When assessing implicit attitudes in those and hundreds of other studies, IATs are often used (Greenwald et al., 1998; for a review, see Lane, Banaji, Nosek, & Greenwald, 2007). In addition, millions of people from more than 30 nations have taken IATs on various internet sites (e.g., http://implicit.harvard.edu). In each combined task of an attitude IAT, pairs of attitude objects and affective concepts (e.g., self and positive on the left versus others and negative on the right, henceforth, the self+/others− task) are presented on the computer screen, along with associated stimuli (me, bad, etc.) that are to be classified fast using a left versus right response key. Reaction-times in the self+/others− task (congruent task) are compared to those in a reversed task (where others and positive are on the left versus self and negative on the right, henceforth, the others+/self− or incongruent task). The reaction-time difference between tasks, the IAT effect, is taken as an indicator of implicit attitudes.

We raise the hypothesis that associative learning takes place during each IAT task. Whereas procedurally, the EC paradigm differs fundamentally from an IAT task, the common component could be that both cases involve associative learning based on the spatio-temporal contiguity of an attitude object and an affective stimulus. More concretely, during each IAT task mental representations of target-plus-attribute compound concepts (e.g., self+) are activated (for similar accounts see De Houwer (2003) and Steffens et al. (2004)). This should result in associative learning, thus eventually leading to changes in the underlying attitudes.

If our assumption is correct that performing an IAT task changes attitudes, this does not only provide a conceptual replication of implicit attitude change with a paradigm different from EC, allowing for more general conclusions; but numerous applications are also conceivable. An obvious advantage of an IAT task is that the contingencies involved are easy to implement: using a paper-and-pencil task (cf. Karpinski & Hilton, 2001) on a daily basis to increase implicit self-esteem would require no technical support. In the following, we investigated whether performing an IAT task changes attitudes and whether behavioral consequences can be observed.

Prestudies 1–3

Participants initially reacted to only one (combined) IAT task. We predicted that this would lead to a relative implicit preference for the concept paired with positive versus negative. As concepts characterized by weak a priori attitudes are more susceptible to conditioning (e.g., Cacioppo, Marshall Goodell, Tassinary, & Petty, 1992), we used letters of the alphabet (I versus O) and names of unknown social groups (Luupites versus Niffites) as attitude objects (Gregg, Seibt, & Banaji, 2006; Nuttin, 1985, 1987). Each participant performed one IAT task. For instance, we manipulated whether this was an I+/O− or an O+/I− task. In each case, different implicit measures administered subsequently showed a significantly more positive implicit attitude towards the concept initially paired with positive compared to negative, showing that reacting to one IAT task changed implicit attitudes.

Experiment 1

In order to test whether reacting to one IAT task also changes established implicit attitudes, we investigated self-esteem.

Participants

In exchange for candy, 59 students of a large German university participated, 61% of them female (age: 18–46 years, $M = 22$, $SD = 3$). Given $N = 59$ and $\alpha = .05$, a large effect of the between-subjects factor initial IAT task ($f = .40$) could be detected with a statistical power of .86 (Faul, Erdfelder, Lang, & Buchner, 2007).

Materials and procedure

Participants were led to separate experimental cubicles. All instructions were presented on iBooks. Participants were randomly assigned to type of IAT task (self+/others− or others+/self−) that consisted of three blocks comprising 42 trials each. More concretely, target concepts were *I* (German: *ich*) versus *others* (German: *andere*), corresponding stimuli: *I*, *me*, *self*, versus *others*, *you*, *those*. Attribute concepts were *positive* versus *negative*, corresponding stimuli: *positive*, *good*, *pleasant*, versus *negative*, *bad*, *unpleasant* (cf. Steffens, Kirschbaum, & Glados, 2008). Two response keys on the keyboard were marked with colored dots. The cover story was that a very difficult task would follow, so participants were to practice reacting accurately and quickly. Accordingly, the computer program was visibly named "Practice trials." The IAT task was identical to one combined task. The reaction–stimulus interval was 200 ms. Feedback on reaction-times and errors was provided after each block. After informing participants they had practiced enough, implicit attitudes were measured with different implicit measures: first with a response window priming task (RWP, Draine & Greenwald, 1998), then with two go/no-go association tasks (GNAT, Nosek & Banaji, 2001).

The RWP consisted of three blocks of 40 trials each. The primes were *I* versus *others*. In order to show generalizability, we used different target stimuli (*warm*, *loveable*, *attractive*, versus *useless*, *repellent*, *inferior*). The RWP procedure followed that described by Musch (2000). Participants were instructed to react only to the attributes presented and to "ignore anything that may flash on the screen" before an attribute appeared (i.e., the primes). Attribute targets as well as primes were displayed in randomized order. Participants' task was judging under time pressure (i.e., within a short response window) if the attribute target presented was positive or negative. The prime (e.g., *I*) was presented for 60 ms and there was a 10-ms interval between prime and target (e.g., *loveable*). After participants had reacted, the target remained on the screen for 500 ms. There was a 1 s interval between trials (see Steffens et al. (2008), for further details). The labels positive and negative were presented in the upper left and right corners of the screen, respectively. Notably, in the initial IAT task, we counterbalanced whether *positive* was assigned to the left versus right key. Otherwise, the priming effect could have been based on the priming stimuli priming "positive," "left," or both. In other words, our design allowed to distinguish an association between self and valence from an association between self and key side (cf. De Houwer, 2003). The RWP effect is based on error differences. A more positive attitude towards the self than towards others is inferred from higher error rates when responding to negative after self than others as prime, plus higher error rates when responding to positive after others than self as prime.

In the subsequent GNATs, one assessing implicit attitudes towards self, the other, towards others, the same stimuli were used. For example, participants were asked to react in one task to self and positive stimuli (“go-trials”) and ignore negative stimuli (“no-go trials”), in the other task, they reacted to self and negative, ignoring positive stimuli. Only three categories were used, and two thirds of the trials were go-trials. Each GNAT comprised two blocks of 42 trials. Each stimulus belonging to one of the two categories on the top of the screen required pressing the space bar. Response deadline was 1000 ms, reaction-times were measured, and the response–stimulus interval was 200 ms. The GNAT effect was computed as the mean reaction-time difference between the two tasks. Order of the two GNATs as well as task order within the GNATs were held constant (Others+, Others−, I−, and I+). Before participants were thanked and debriefed, explicit attitudes were collected as additional DVs, but findings are not reported because no effects were found in any experiment.

Design

The design was a 2 × 2, with type of IAT task (I+/Others− versus Others+/I−) and key assignment during IAT task (positive on the left versus right) as between-subjects variables. Dependent variables were RWP effect and GNAT effects.

Results and discussion

All analyses were conducted with $\alpha = .05$. As one would expect, participants became significantly faster across blocks of the initial IAT task, $F(2, 57) = 16.47$, $\eta_p^2 = .37$ (*M*s = 882 and 722 ms in Blocks 1 and 3, respectively).

RWP

Fig. 1 shows that participants in the Self+/Others− condition displayed a larger preference for self than those in the Others+/Self − condition, yielding a main effect of IAT task in the 2 × 2 ANOVA, $F(1, 55) = 4.52$, $\eta_p^2 = .08$. Not surprisingly, there was also an overall preference for self over others, $F(1, 55) = 4.69$, $\eta_p^2 = .08$. We also observed a significant interaction of type of IAT task and key side, $F(1, 55) = 4.00$, $\eta_p^2 = .07$, caused by a larger effect of type of IAT task when key side matched during priming and preceding IAT task (other $F < 2$).

GNATs

Positive GNAT effects indicate a positive attitude towards self (GNAT I) and others (GNAT Others), respectively (see Fig. 2). Participants who had reacted to I+/Others− showed a more positive attitude towards *I* and a more negative attitude towards *Others* than those who had reacted to Others+/I−. The 2 × 2 ANOVA revealed the expected interaction between GNAT effect and type of IAT task, $F(1, 53) = 5.32$, $\eta_p^2 = .09$. *I* was evaluated more positively after reacting to I+/Others− than Others+/I− (simple main effect: $F(1, 53) = 4.76$, $\eta_p^2 = .08$), and *Others* was evaluated more positively after reacting to Others+/I− than I+/Others− (simple main effect: $F(1, 53) = 2.60$, $\eta_p^2 = .05$). Again, there was an overall preference for self over others ($F(1, 53) = 29.50$, $\eta_p^2 = .36$).

In sum, using the concepts *I* versus *Others*, Experiment 1 demonstrated changes in well-established implicit attitudes caused by performing one IAT task: two implicit measures revealed higher implicit self-esteem for participants who had responded to *I* and positive versus *Others* and negative compared to those in the reversed condition. With regard to priming, we observed an interac-

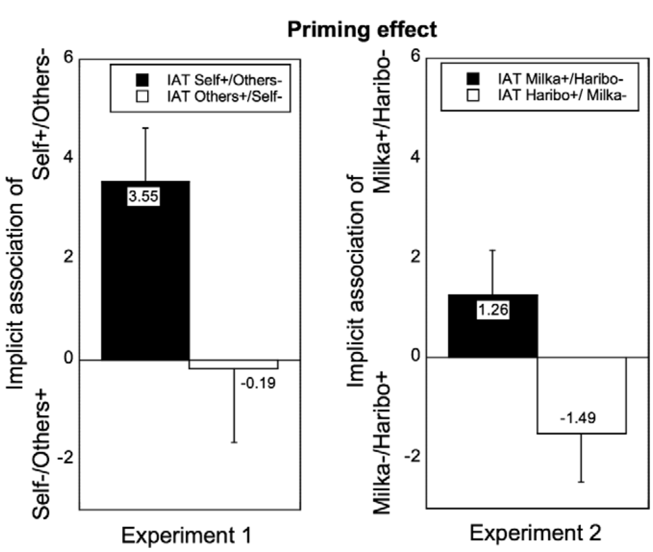

Fig. 1. Average error difference in the response window priming task (priming effect) assessing attitudes towards self compared to others (Experiment 1), and attitudes towards Milka compared to Haribo (Experiment 2), separately for experimental conditions. Error bars reflect standard errors of means.

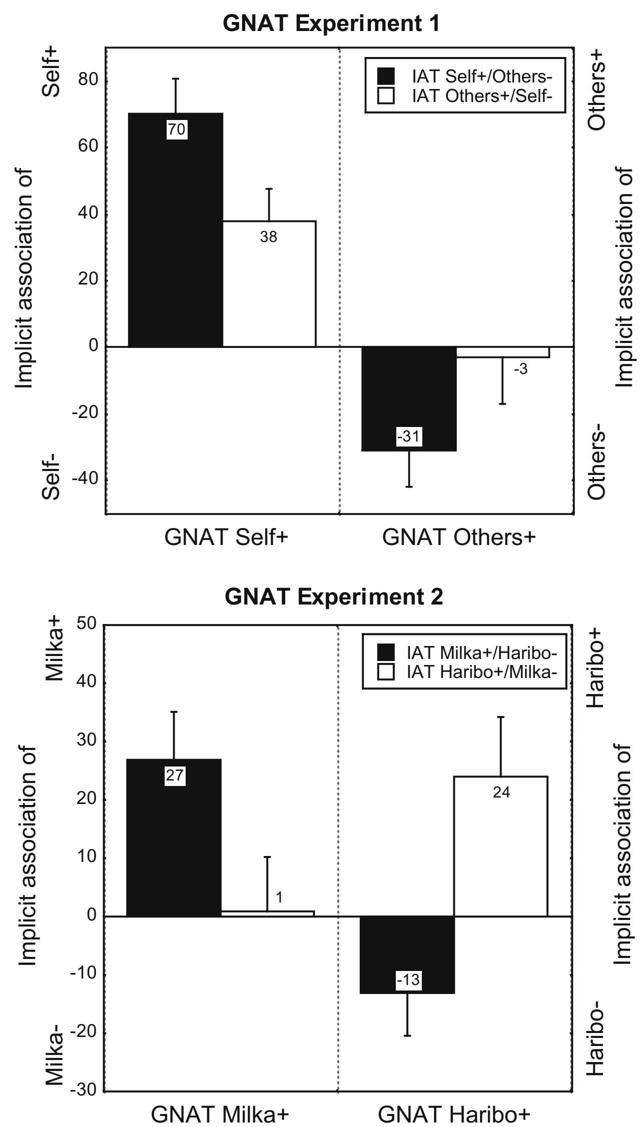

Fig. 2. Average reaction-time difference (GNAT effects in milliseconds). GNATs assessing attitudes towards self and others in Experiment 1 (upper panel), and towards Milka and Haribo in Experiment 2 (lower panel), separately for experimental conditions. Error bars reflect standard errors of means.

tion of type of IAT task and key side of attribute concepts during IAT task, indicating that next to a learning process affecting the underlying evaluative associations, a further learning process established associations between attitude object and response.

Experiment 2

Experiment 2 aimed at replicating the findings, drawing on different attitude objects with well-established a priori evaluative associations, namely the two candy brands *Milka* (a chocolate manufacturer) and *Haribo* (a producer of gummy bears) that are among the most famous and popular candy brands in Germany. This allowed testing whether the hypothesized attitude change results in immediate behavior change.

Participants and design

In exchange for candy, 83 students of a large German university participated, 89% of them female (age: 18–33 years, $M = 22$, $SD = 2$). The design was identical to Experiment 1.

Materials and procedure

Except for the stimulus material all was identical to Experiment 1. Target concepts in the initial IAT task were *Milka* versus *Haribo*, corresponding stimuli: *Milka*, *chocolate*, and a colloquial expression ("*Schoko*") versus *Haribo*, *gummy bears*, and a synonym ("*Goldbär*"). The attribute dimension remained *positive*, *negative*. RWP primes were *Milka*, *Haribo*, the targets, *delicious*, *tasty*, *delicate*, versus *disgusting*, *nasty*, *loathsome*. GNATs used the same stimuli as priming. Order of GNATs and task order were constant (Haribo+, Haribo−, Milka−, and Milka+). After the study participants chose between chocolate and gummy bears for compensation to explore effects on behavior.

Results and discussion

Again, reactions became significantly faster across blocks of initial IAT task, $F(2, 81) = 76.47$, $\eta_p^2 = .65$ (Block 1: $M = 843$ ms, Block 3: $M = 659$ ms).

RWP

Participants in the Milka+/Haribo− condition displayed a larger preference for Milka than those in the Haribo+/Milka− condition (Fig. 1), reflected in a main effect of type of IAT task, $F(1, 79) = 4.16$, $\eta_p^2 = .05$. Again, there was an interaction of type of IAT task and key side, $F(1, 79) = 4.07$, $\eta_p^2 = .05$ (other $F < 1$), due to a larger effect of type of IAT task when key side of the evaluative concepts matched during priming and IAT task.

GNATs

Participants who had reacted to Milka+/Haribo− showed a more positive attitude towards Milka and a more negative attitude towards Haribo than those who had reacted to Haribo+/Milka− (Fig. 2). This interaction was corroborated, $F(1, 71) = 10.31$, $\eta_p^2 = 13$. Whereas Milka was evaluated more positively in the Milka+/Haribo− compared to the reversed condition (simple main effect: $F(1, 71) = 4.32$, $\eta_p^2 = .06$), Haribo was evaluated more positively in the Haribo+/Milka− condition (simple main effect: $F(1, 71) = 8.83$, $\eta_p^2 = .11$).

Choice

Type of IAT task had no direct effect on candy choice, with only 42% of the participants in the Milka+ condition choosing Milka, as compared to 51% in the Haribo+ condition. In a logistic regression analysis, in Step 1, the implicit preference for Milka over Haribo as measured with the averaged GNAT effects predicted choosing chocolate over gummy bears, Wald $\chi^2_{(1)} = 4.33$; Nagelkerke's $R^2 = .09$; 55% of cases were correctly classified.[2] In Step 2, with IAT task added, correct classifications increased to 62%, Nagelkerke's $R^2 = .15$. Implicit preference for Milka over Haribo predicted choice behavior, Wald $\chi^2_{(1)} = 6.24$, and IAT task missed the preset criterion of statistical significance, Wald $\chi^2_{(1)} = 3.27$ ($p = .07$). Apparently, including IAT task improved prediction because choice was more closely associated with the residual variance in the GNAT after partialling out IAT task.

In sum, using popular candy brands, the implicit measures consistently revealed preferences in line with the preceding IAT task. Participants in the Milka+/Haribo− condition showed a more positive implicit attitude towards Milka than those in the Haribo+/Milka− condition, and vice versa for attitudes towards Haribo. With respect to priming we again obtained an interaction between type of IAT task and key side, implying that two learning processes take place during an IAT task: in addition to category–valence associations, category–response associations are learned.

General discussion

We showed that as a consequence of performing one IAT task (e.g., pairing self with positive and others with negative), implicit attitudes were altered, as indicated by two other implicit attitude measures. Replicating previous findings on implicit self-esteem and consumer attitudes, we thus showed that well-established attitudes can be altered through associative learning. In analogy to evaluative conditioning (EC), the target concepts in attitude IATs might act as conditioned stimuli and the attribute concepts as unconditioned stimuli. Whereas the paradigms of EC and an IAT task are undoubtedly different, their commonality seems to be that attitude change based on the spatio-temporal contiguity of a valenced stimulus and an attitude object takes place. Direct comparisons of both learning mechanisms are needed to test which of them changes implicit attitudes more effectively under what circumstances. Numerous real-world settings (e.g., clinical and educational ones) are conceivable where IAT tasks could be easily and meaningfully implemented. Moreover, the present findings add to the growing body of research showing that implicit attitudes need not be remnants of the distant past, for example, internalized childhood attitudes (Wilson et al., 2000), but can, instead, be changed quickly.

Implications for IATs

The change in implicit attitudes we observed yields a new look on task-order effects in IATs, the frequent finding that larger IAT effects are obtained when the attitude–congruent task is performed first. Nosek, Greenwald, and Banaji (2005) showed that task-order effects are reduced by an extended practice IAT task between the IAT tasks where participants react to the target concepts in the reversed way. Klauer and Mierke (2005) explained such findings as aftereffects of task-switching. They assumed that correct responding during the incongruent IAT task requires suppressing the attribute task set (i.e., evaluation). After having started with the incongruent task, this inhibition persists, thus leading to a slowdown in reactions in the congruent task and to smaller IAT effects. With the congruent task performed first, the attribute task set is activated. Subsequently suppressing the attribute task set is effortful, so reactions slow down in the incongruent task, increasing the IAT effect. With extended reversed practice between combined tasks, as shown by Nosek and colleagues, the aftereffects of the first task eventually fade.

[2] Including the RWP effect did not improve prediction.

Based on the present findings, we suggest an account of task-order effects in IATs that is not based on inhibition, but on implicit–attitude change. In order to explain the learning advantage of the first task, we draw on proactive interference: learning of new information is impaired by the former learning of similar but different information (Schneider & Shiffrin, 1977; Underwood, 1957). This is in line with recent findings in decision-making research (Betsch, Haberstroh, Glöckner, Haar, & Fiedler, 2001; Betsch, Haberstroh, Molter, & Glöckner, 2004): it takes longer to change previously learned associations (routines) than to learn new associations. Similarly, during an IAT task associative learning may take place. Concretely, when starting with the congruent task, time costs due to changing associations increase the reaction-times in the subsequent, incongruent task (that are inherently larger), thus leading to larger IAT effects. When starting with the incongruent task, increases in reaction-times due to changing associations are at the cost of the congruent task, resulting in smaller IAT effects. This explanation of task-order effects is in line with the proposal by Greenwald, Nosek, and Banaji (2003) that task-order effects result from negative transfer (e.g., Woodworth & Schlosberg, 1954), where practice at one task interferes with performance at another that requires different responses to the same stimuli.

Previous researchers have highlighted that attitudes towards the concept first paired with positive *appear* more positive. The present findings imply that these attitudes instead *are* more positive. Some of the association learning taking place should be offset by the subsequent task when a complete IAT is administered, but this learning of different associations will not completely wipe out initial learning (Schneider & Shiffrin, 1977; Underwood, 1957). With respect to other implicit attitude measures, it could be that those comprising a block structure are susceptible to changing implicit attitudes, whereas those measuring attitudes on a trial-by-trial basis are not.

Klauer and Mierke (2005) suggested that task-order effects in IATs are based on the suppression of evaluations during the incongruent task. Strongest suppression effects should be expected in the presence of strong evaluations. Our prestudies used stimuli characterized by weak a priori evaluations (e.g., *Niffite*). It is thus unlikely that our findings are best explained with suppression effects. However, we believe that Klauer and Mierke's findings cannot distinguish between reduced accessibility after an incongruent IAT task (their preferred explanation) and increased accessibility after a congruent IAT task. From that perspective, the process we postulate is quite similar to what they describe as "an effect on the accessibility of the attribute information" (p. 216).

We believe that the difference between an accessibility account of task-order effects in IATs and an attitude change account is gradual rather than categorical. According to the APE model (Gawronski & Bodenhausen, 2006), implicit attitudes, referred to as associative evaluations, change either by (a) an incremental change in the associative structure or (b) a temporal change in pattern activation. Whereas the first case implies the learning of a new evaluation, the latter refers to the differential activation of evaluations stored in associative memory. An accessibility account suggests a short-term change that eventually fades (even if it may last at least 24 h, see Dasgupta and Greenwald (2001)). An attitude change account suggests that some long-term change remains, even if that change is too small to be detected. Obviously, these options are hard to distinguish empirically. Future research should determine the longevity of IAT-induced attitude changes.

Implications for attitude change

The present findings are related not only to those on EC, but also to implicit learning. New associations are learned during a study phase that later influence the fluency with which stimuli are processed (e.g., Buchner, Steffens, Erdfelder, & Rothkegel, 1997), and that may influence reactions to new social stimuli, such as faces with certain characteristics (cf. Czyzewska, 2001, for a review; also see Kawakami, Phills, Steele, and Dovidio (2007) and Kawakami, Steele, Cifa, Phills, and Dovidio (2008), for an approach to change stereotypes by associative learning). It is possible that operant conditioning is a learning mechanism underlying the observed effects in implicit learning or IAT tasks. Organisms appear to have a fundamental desire for efficient behavior control (Hoffmann, 1993), which can be obtained by reacting fast and correct during a task. Thus, reacting fast could act as a reinforcer. If the effects on implicit attitudes we have observed are based on such a general learning mechanism, they will generalize to different attribute concepts. It is an open question whether equivalent effects can be observed in stereotype IATs, namely the learning of semantic associations, or whether half an IAT changes implicit attitudes, but not stereotypes.

In contrast to the strong effects on implicit attitudes, we observed only small effects of concept–valence pairings on explicit measures or choice behavior. Clearly, in the presence of strong a priori attitudes (e.g., loving chocolate), a binary choice reveals attitude change imperfectly. However, predicting choice behavior from implicit attitudes was improved when IAT task was taken into account, suggesting that the variance in the implicit measure associated with choice differs from the variance explained by IAT task. Such a pattern of implicit attitude change with little effect on explicit attitude and behavior can be explained with the APE model (Gawronski & Bodenhausen, 2006). Put shortly, when people notice the pairing of concepts with good and bad in the initial task, the evaluation that a given concept subsequently triggers is discounted as irrelevant and thus does not influence deliberate behavior. Accordingly, a delay between attitude induction and attitude measurement may provoke change in explicit attitudes, and different circumstances may reveal a stronger impact on behavior—deliberate choices do not directly reflect implicit preferences; for instance, dietary restraints counteract candy preferences (cf. Spruyt, Hermans, De Houwer, Vandekerckhove, & Eelen, 2007). A stronger relationship between implicit attitudes and deliberate choices should be found when cognitive capacity is reduced and a-priori preferences are weak (Friese, Hofmann, & Wänke, 2008; Gibson, 2008). Moreover, based on general principles of learning, we speculate that stronger, and long-lasting, IAT-induced attitude change occurs after repeated exposure to the same IAT task, spread over longer time intervals (cf. Baddeley, 1997). Whereas we believe that such IAT-based interventions can be used to target undesirable and/or maladaptive behaviors, given the relative transparency of the procedure (Steffens, 2004), they probably work best when no reactance is expected, that is, when participants themselves desire to change their attitudes and behavior.

In a nutshell, we have learned from the present research that performing one IAT task is a form of associative learning that changes implicit attitudes even towards established concepts, such as the self or mature brands. This finding is crucial with regard to real-life applications. It also allows to generalize findings on implicit attitude change beyond one specific paradigm (EC). Furthermore, our prestudies extend the scope of IAT tasks to attitude *formation*. What we hope future research to show is under what conditions this form of associative learning is more powerful or more easily applicable than known associative-learning paradigms; how many trials are needed to trigger learning; and how number of trials and learning intervals relate to the longevity of learning effects. Of further interest is the question whether IAT-induced learning extends to the learning of semantic associations and under what conditions it influences explicit attitudes and behavior.

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