

**RESEARCH ARTICLE**

# Testing of a paper-and-pencil Personalized Single Category Implicit Association Test (SC-IAT-P)

## Mise à l'épreuve d'un test d'association implicite au format papier crayon: le SC-IAT-P

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The purpose of this series of studies is to test a paper-and-pencil procedure adapted from a computerized Implicit Association Test: the SC-IAT-P (Personalized Single Category Implicit Association Test, Bardin, et al. 2014). This adaptation combines the advantages of SC-IAT (Karpinski & Steinman, 2006), IAT-P (Olson & Fazio, 2004) and paper-and-pencil IAT (Lemm, Lane, Sattler, Khan & Nosek, 2008). It is capable of measuring implicit attitude toward a single object, limits the influence of extrapersonal associations, and is unquestionably easy to administer. The tool was used in three studies with two different goals. Study 1 highlights a link between paper-and-pencil SC-IAT-P and a computerized corollary in the field of tobacco-smoking. Study 2 reveals the ability of the tool to distinguish smokers from non-smokers according to their score and smokers who have already considered quitting from those who have never considered it. Finally, Study 3, carried out between the two rounds of the French presidential elections in 2012, highlights the difference of attitude between supporters on the Left and Right but also an effect of indecision. The discussion deals with the prospects offered by this tool and its limitations.

**Keywords:** paper & pencil SC-IAT-P; implicit attitude; tobacco-smoking; political sphere; indecision

Cette série d'études teste une adaptation en procédure papier crayon d'un test d'association implicite informatisé : le SC-IAT-P (Single Category Implicit Association Test Personalized, Bardin, Perrissol, Py, Launay, & Escoubès, 2014). Cette adaptation allie les avantages du SC-IAT (Karpinski & Steinman, 2006) de l'IAT-P (Olson & Fazio, 2004) et de l'IAT format papier crayon (Lemm, Lane, Sattler, Khan, & Nosek, 2008). Il mesure l'attitude implicite envers un unique objet, limite la contamination de la mesure par des associations extra-personnelles et son administration est d'une facilité indéniable. L'outil a été mis en oeuvre dans trois études portant sur deux objets. L'étude 1 permet de mettre en évidence un lien entre le SC-IAT-P papier crayon et son corollaire informatisé dans le domaine du tabac. L'étude 2 révèle la capacité de l'outil à discriminer les fumeurs des non-fumeurs en fonction de leur score au SC-IAT-P papier crayon mais également les fumeurs qui ont déjà envisagé d'arrêter de fumer de ceux qui n'ont jamais envisagé. Enfin, l'étude 3, réalisée pendant l'entre deux tours des élections présidentielles françaises de 2012, met en évidence une différence d'attitude entre les sympathisants de gauche et de droite mais également un effet de l'indécision. La discussion porte notamment sur les perspectives offertes par cet outil et ses limites.

**Mots-clefs:** SC-IAT-P papier crayon; attitude implicite; tabac; politique; indécision

The last two decades have seen the emergence of new methods for reporting the implicit attitudes of individuals.

These methods are based on the idea that cognitive processes are automatically triggered by the mere mention of the attitude object (Bargh, Chaiken, Gollwitzer, & Pratto, 1992). Implicit attitude is generally measured by computerized protocols based on reaction times. This research used three studies to test the paper-and-pencil equivalent of a recent computerized measure of implicit attitude, the SC-IAT-P [Personalized Single Category Implicit Association Test, Bardin, Perrissol, Py, Launay & Escoubès (2014)].

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Among the various tools for measuring implicit attitude (e.g. IAT Implicit Association Test, Greenwald, Mc Ghee, & Schwartz, 1998; GNAT, Go/No-Go Association Task, Nosek, & Banaji, 2001; EAST, Extrinsic Affective Simon Task, De Houwer, 2003; SC-IAT, Single Category Implicit Association Test, Karpinski & Steinman, 2006; etc.), the IAT is the best documented (Teige-Mocigemba, Klauer, & Sherman, 2010). Research using the IAT has been produced in fields as varied as racial prejudice, marketing, addictive behavior or politics (Lane, Banaji, Nosek, & Greenwald, 2007). Based on latency, the IAT is a categorization task of two opposite attitude objects or target concepts (e.g. insects vs. flowers) and two opposite evaluative attributes (e.g. negative vs. positive) performed on computer.

The participant uses two keys at the ends of the keyboard, one on the left and one on the right. These keys are identical for the whole protocol. The category labels are located on each side of the screen. The items (words or pictures) to categorize appear in the center of the screen. Participants have to press the right key or the left key as quickly as possible according to the instructions of the task to categorize the two attitude objects, evaluative attributes or a combination of these. The IAT involves five measurement stages: Simple categorization of target concepts (stage 1, e.g. Flowers vs. Insects), simple categorization of evaluative attributes (stage 2, e.g. Pleasant words vs. Unpleasant words), combined initial categorization (stage 3, e.g. Flowers + Pleasant words vs. Unpleasant words + Insects), simple categorization reversed (stage 4, the keys to categorize target concepts are reversed) and combined categorization inverted (stage 5, e.g. Insects + Pleasant words vs. Flowers + Unpleasant words). Thus, combined categorizations involve the association of target concepts and attributes on the same key.

The psychometric properties of the IAT have now been widely studied and the benefits of using this measure are well established. Implicit attitude as measured by the IAT is a good predictor of behavior. This link is particularly strong in the field of politics and for addiction phenomena (Greenwald, Uhlmann, Poehlman, & Banaji, 2009). For example, in the field of politics, Arcuri, Castelli, Galdi, Zogmaister and Amodori (2008) showed that the IAT between two Italian leaders [Berlusconi vs. Rutelli (Study 1) and Galan vs. Carraro (Study 2)] was not only predictive of voting intentions of individuals but also of their actual vote a few days later (Study 1). Moreover, even for individuals exhibiting indecision at the time of measurement, the IAT predicted their vote a few days later (Studies 1 and 2). Similarly, in the field of addictions, many studies attest to the predictive scores of IAT on smoking behavior (e.g. Huijding, De Jong, Wiers, and Verkooijen, 2005; De Houwer, 2006). Smokers show a more positive attitude toward smoking than non-smokers.

Nevertheless, despite its qualities, the tool has certain limitations. The first more specifically concerns addiction objects. Two other limitations concern its contamination by extrapersonal associations (Olson & Fazio, 2004) and its relativity (Swanson, Rudman, & Greenwald, 2001). Finally, there are material constraints inherent in the use of such

measures. Regarding addiction objects, it is necessary to distinguish processes related to the addictive nature of the product from those related to the evaluation of the object of addiction as an ordinary attitude object. Thus, the processes underlying addiction could be expressed more in terms of "wanting" than "liking" (incentive sensitization theory of addiction, Robinson & Berridge, 1993). As part of this framework, Ostafin, Palfai and Weschler (2003) and Palfai and Ostafin (2003) on alcohol, and De Houwer, Custers and De Clercq (2006) on tobacco-smoking, tested an approach/avoid IAT. In this version, the evaluative attributes pleasant/unpleasant were replaced by approach/avoidance attributes ("will", "close", "come closer", "to" vs. "escape", "far", "avoid" and "away"). IAT approach/avoid scores differentiated non-smokers from smokers but no better than with a "traditional" IAT (pleasant/unpleasant). For alcohol as an attitude object, Palfai and Ostafin (2003) were able to demonstrate a link between IAT approach/avoid scores and whether or not subjects indulged in binge drinking (i.e. consuming large amounts per session), but not with consumption frequency. Thus, IAT approach/avoid could be used to measure the addictive aspect of a product like alcohol or tobacco. However, the pleasure of consumption would, in turn, be related more to the attitude as measured by more traditional implicit measures (IAT, SC-IAT, etc.).

With these traditional measures, scores obtained are often negative, independently of the subjects' smoking or alcohol dependence (Wiers & de Jong, 2006). These negative scores could therefore be interpreted as a manifestation of negative attitude toward these objects.<sup>1</sup> They could also refer to the second limitation of IAT. Thus, according to Olson and Fazio (2004), the test not only measures personal attitude: the valence of the attitude is contaminated by the "general opinion" (Wiers & de Jong, 2006) to the attitudinal object. For example, the negative score for the tobacco object can be interpreted as reflecting a collectively shared negative evaluation of tobacco. It may also reflect a possible contamination of the personal attitude by this collective evaluation (extrapersonal associations). Olson and Fazio (2004) succeeded in reducing such contamination by using a personalized IAT. With the personalized IAT, the "pleasant" vs. "unpleasant" or "negative" vs. "positive" labels of IAT are replaced by the labels "I like" vs. "I dislike", which activates a more personal attitude in the participant. Using IAT-P, De Houwer et al. (2006, Study 2) seek to limit the contamination of the measure by extrapersonal associations. Smokers have positive scores whereas non-smokers have negative scores. This pattern of results led the authors to conclude firstly that smokers have a positive attitude while non-smokers have a negative attitude and, secondly, that IAT-P would measure the sensory aspects of consumption.

The third limitation concerns the relativity of measurement with IAT. According to Swanson et al. (2001), the choice of categories for an attitude object which does not have any natural opposite (e.g. tobacco) may have an impact on the scores. Thus, the opposition between

the concepts of “smoking” and “stealing” will result in a more favorable assessment of tobacco than an opposition between “smoking” and “candy”. Similarly, when the test measures attitude toward flowers and opposes the target concepts “flowers” and “insects”, a better response time for the combination flowers + pleasant vs. insects + unpleasant does not necessarily express a negative attitude toward insects (Blaison, Chassard, Kop & Gana, 2006). To overcome this limitation, Karpinski and Steinman (2006) propose another variant of the IAT: the Single Category Implicit Association Test (SC-IAT), which measures a single target concept. The SC-IAT is a two-stage measure based on combined categorizations. In the first stage, participants have to categorize a target concept and evaluative positive attributes on one key and the negative evaluative attributes (e.g. pleasant + tobacco vs. unpleasant) on another key. In the second stage, the association is reversed, the participant has to associate the target concept and the negative evaluative attributes on one key and categorize evaluative positive attributes on the other key (e.g. pleasant vs. unpleasant + tobacco). SC-IAT can be used to measure a non-relative attitude, with simple instructions and a shorter administration time.

However, the category labels of evaluative attributes can refer more closely to the general opinion than the personal attitude of individuals (“pleasant” vs. “unpleasant” labels). Thus, it is likely that this test is also contaminated by extrapersonal associations. Accordingly, it only overcomes the above-mentioned second limitation of the IAT. Bardin, Launay, Escoubès, Perrissol and Py (2011) and Bardin et al. (2014) have proposed and tested an SC-IAT-P on smoking that draws on both IAT-P and SC-IAT. The test measures the attitude toward a single object and limits extrapersonal contamination. It has the same properties as the SC-IAT while using label categories favoring a more personal measure of attitude (“I like” vs. “I dislike”). In their study, participants performed a computerized version of SC-IAT and SC-IAT-P. Both measures only differ by the labels of evaluative categories of attributes (i.e. “Pleasant” vs. “Unpleasant” and “I like” vs. “I dislike” respectively for the SC-IAT and the SC-IAT-P versions). The internal consistency for the SC-IAT-P was stronger than for the SC-IAT (.70 compared with .46). Moreover, unlike the SC-IAT, the SC-IAT-P differentiated smokers from non-smokers on their score. Finally, the results seemed to suggest a limitation of the contamination of the SC-IAT-P by extrapersonal associations, which probably explains the relatively low correlation between the two tests (.25). Thus, with the SC-IAT, smokers returned negative scores likely related to negative extrapersonal associations (i.e. smoking seriously harms health). However, with the SC-IAT-P, their score was not significantly different from 0 and could be interpreted as the manifestation of an ambivalent attitude to smoking.

The last limitation concerns the administration of Implicit Association Tests. The tests are traditionally computerized and require strict conditions and the recording of participants’ response times. Such a protocol involves

a certain number of constraints: experimentation rooms and computers, substantial time required, protocol portability, recruitment of participants, etc. In order to simplify the use of the IAT, previous researchers have used a “paper-and-pencil” (p&p) version.

This p&p version of the IAT was used in the evaluation of racial prejudice (Lowery, Hardin, & Sinclair, 2001), gender stereotypes (Mast, 2004), attitudes toward obesity (Schwartz, Chambliss, Brownell, Blair, & Billington, 2003; Teachman & Brownell, 2001; Teachman, Gapinski, Brownell, Rawlins, & Jeyaram, 2003) and measuring the attitude to universities or colleges (Lane, Mitchell, & Banaji, 2005). Lemm, Lane, Sattler, Khan and Nosek (2008), meanwhile, undertook more specific work on the properties of the tool. They tested the type of stimuli (pictures vs. words), using different scores and calculation algorithms.

According to Teachman and Brownell (2001) and Sakaquaptewa, Vargas, and Von Hippel (2010), the p&p version of the IAT is based on the same logic as its computerized equivalent. It therefore probably has the same limitations as the computerized IAT. Saporito, Ryan and Teachman (2011) in their study on the treatment of mental illness point to the relativity of IAT and state that, during the pre-test for their study, the p&p version did not prove effective. They therefore used a variant of BIAT (Brief IAT, Sriram & Greenwald, 2009; Nosek, Bar-Anan, Sriram, Axt, & Greenwald, 2014) with paper and pencil. Originally, the computerized BIAT simply required the participant to press a key on the keyboard for stimuli relative to a particular attitude (target concept) and pleasant evaluative attributes and press another key for all other items (i.e. another attitude object and the unpleasant evaluative attributes) without specifying to which categories they belong. Subsequently, a second attitude object is associated with pleasant words. The task is therefore identical to that required by the IAT except as regards the instructions, since the attitude objects are never explicitly associated with unpleasant evaluative attributes. Indeed, the IAT highlights the opposition between the concepts and evaluative attributes on each key, while the BIAT focuses on the pleasant words, with the attitude object being opposed to all other categories of items.

As long as the measurement remains relative (opposition of two target concepts), according to Saporito et al. (2011), “*an explicitly labeled target comparison category is not needed*” (p.13). They therefore created a version of the paper and pencil tool with a single target concept whereas originally, the computerized and validated version required the use of two concepts.

This version has two blocks of measurements, each about the association of the target concept with one of the evaluative attributes (respectable and shameful). Participants are shown all the items before performing the task and then have twenty seconds to complete it. The task consists in circling the words to be categorized according to the instructions, and crossing out the other words. In this respect, the BIAT seems closer to the GNAT (Go/No-Go Association Task, Nosek & Banaji, 2001) than the IAT.

This test appears to be promising. Nevertheless, it seems to generate a higher number of errors than the p&p IAT. In addition, the authors use the p&p BIAT version referring only to its computerized version and without providing any proof of its relevance in its p&p version. The authors also point out that “*the use of the brief IAT employing a single target category is novel and its psychometric properties are not well established. As a result, it may be that the implicit-explicit discrepancy is due in part to the version of the IAT used*” (p.17). Finally, while in this case it avoids the problem of the relativity of IAT measurements, it is also likely to be contaminated by extrapersonal associations. Finally, the SC-IAT-P could be an interesting tool for use in a p&p version, as it addresses both the major criticisms of the IAT. A p&p version could therefore provide a quick and easy tool for testing large groups of people simultaneously without the above-mentioned limitations of the p&p versions of the IAT, the IAT-P or BIAT.

In this context, it was necessary to ensure first that the tool possessed good discriminant and nomological validity and secondly that it could be used on a substantial number of persons simultaneously (e.g. amphitheater). Concerning its nomological validity, to our knowledge, Bardin et al. (2014) and Bardin, Perrissol, Fos, Py, Dagot (in press) are the only authors who have used the computerized SC-IAT-P on tobacco as an object. It therefore seemed appropriate in a first study to use the same object and the same experimental material to compare the results between the SC-IAT-P computer version and its p&p equivalent. This choice meant that it was not necessary to consider the quality of the tool in its computerized version, since it had already been validated. The goal was therefore to verify that the p&p SC-IAT-P measures the same construct as the computerized SC-IAT-P and thus correlates with the latter for the tobacco object. This study was also designed to reveal implicit attitude differences regarding smoking behavior. Such a project can only be undertaken with small numbers of participants simultaneously, given the practical constraints inherent in the computerized SC-IAT-P.

Regarding the ability of the tool to overcome the experimental constraints of its computerized equivalent, it was appropriate to attempt to reproduce in a second study the same pattern of results in terms of discriminant validity in experimental design when asking large numbers of people to take the test simultaneously (i.e. amphitheater). However, smoking behavior is related not only to the attitude of individuals, but also, for smokers, to its addictive nature. A third study was therefore necessary to verify the discriminant validity of the tool on an attitude object unrelated to any addiction, as the addictive nature of the object influences the link between attitude and behavior and for which the implicit and explicit attitudes correlate strongly. In this sense, political attitude could be a relevant object. The third study therefore aimed to differentiate individuals on their implicit attitude score according to their political orientation and voting intention in the context of the 2012 French presidential election.

## Study 1

### Method

#### Participants

Forty-four participants selected at random took part in this study. The sample consisted of 12 men and 32 women (14 smokers consuming at least one cigarette a day, 30 non-smokers) with a mean age of 31.25 years ( $SD = 9.28$ ).

#### Material

##### The computerized SC-IAT-P

The computerized SC-IAT-P was identical to the one employed by Bardin et al. (2014). The categories of labels were “*J’AIME*” (“I LIKE”) and “*JE N’AIME PAS*” (“I DISLIKE”) The items of the target concept “tobacco” were the eight pictures (9 cm by 7 cm) related to cigarettes used by De Houwer et al. (2006). Feedback was given to the participant for each answer in the form of a red cross for an error and a green circle for a correct answer. This feedback appeared in the center of the screen before proceeding to the next item. The items to categorize “I like” were: *vacances* (holidays), *victoire* (victory), *cadeau* (gift), *bonheur* (happiness), *festif* (festive), *fleur* (flower), *offrir* (give), *heureux* (happy), *beauté* (beauty) and *douceur* (gentleness). The words to categorize as “I dislike” were: *guerre* (war), *douleur* (pain), *blesure* (injury), *infection* (infection), *funérailles* (funeral), *vomir* (vomit), *purulent* (purulent), *triste* (sad), *torture* (torture) and *hideux* (hideous). To categorize these items, participants had to use the keys “a” and “p”, which are both on the same line of an azerty keyboard. The web-based Inquisit 3.04 software was used to collect data.

##### The paper-and-pencil SC-IAT-P

The p&p SC-IAT-P consisted of four separate pages numbered from 1 to 4. Above the numbering it was clearly stated whether it was a training phase (pages 1 and 3) or a measurement phase (pages 2 and 4). The first page (**Figure 1**) consisted of a column in the center of the page composed of 23 items to be classified in the categories “I like”, “I dislike” and “tobacco”. Participants had to categorize by checking on the right of the column both the items they liked and the items concerning tobacco, while on the left of the column, they had to check the items they did not like.

The second page (**Figure 2**) was composed of 46 items divided into two columns identical to those of the training phase except that it was inscribed “measuring phase”. The third and fourth pages were identical to pages 1 (training phase) and 2 (measuring phase). The categorization was reversed however, by associating the tobacco concept with the “I dislike” evaluative attributes *via* checkmarks to the left of the column and evaluative attributes to be classified as “I like” to the right. The items used were the same as in the computerized version.

The p&p SC-IAT-P was based on the p&p IAT (Lemm et al., 2008), which placed items in the “tobacco” concept category on alternate lines with those concerning the evaluative attributes “I like” or “I dislike”. The items associated with the concept “tobacco” appeared within a box against a gray background and were in capital letters while evaluative attributes appeared against a white background and

**ENTRAINEMENT**

**1**

JE N' AIME PAS	J' AIME TABAC
<input type="radio"/> TABAC	<input type="radio"/>
<input type="radio"/> vacances	<input type="radio"/>
<input type="radio"/> FUMEUR	<input type="radio"/>
<input type="radio"/> victoire	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> guerre	<input type="radio"/>
<input type="radio"/> MARLBORO	<input type="radio"/>
<input type="radio"/> cadeau	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> douleur	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> accident	<input type="radio"/>
<input type="radio"/> TABAC	<input type="radio"/>
<input type="radio"/> festif	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> infection	<input type="radio"/>
<input type="radio"/> CAMEL	<input type="radio"/>
<input type="radio"/> funérailles	<input type="radio"/>
<input type="radio"/> FUMEUR	<input type="radio"/>
<input type="radio"/> fleur	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> vomir	<input type="radio"/>
<input type="radio"/> TABAC	<input type="radio"/>

Figure 1: Training stage p&p SC-IAT-P.

**PHASE DE MESURE**

**2**

JE N' AIME PAS	J' AIME TABAC
<input type="radio"/> TABAC	<input type="radio"/>
<input type="radio"/> torture	<input type="radio"/>
<input type="radio"/> FUMEUR	<input type="radio"/>
<input type="radio"/> victoire	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> cadeau	<input type="radio"/>
<input type="radio"/> MARLBORO	<input type="radio"/>
<input type="radio"/> infection	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> beauté	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> accident	<input type="radio"/>
<input type="radio"/> TABAC	<input type="radio"/>
<input type="radio"/> festif	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> fleur	<input type="radio"/>
<input type="radio"/> CAMEL	<input type="radio"/>
<input type="radio"/> funérailles	<input type="radio"/>
<input type="radio"/> FUMEUR	<input type="radio"/>
<input type="radio"/> offrir	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> heureux	<input type="radio"/>
<input type="radio"/> TABAC	<input type="radio"/>

JE N' AIME PAS	J' AIME TABAC
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> douceur	<input type="radio"/>
<input type="radio"/> MARLBORO	<input type="radio"/>
<input type="radio"/> guerre	<input type="radio"/>
<input type="radio"/> TABAC	<input type="radio"/>
<input type="radio"/> beauté	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> purulent	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> triste	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> torture	<input type="radio"/>
<input type="radio"/> FUMEUR	<input type="radio"/>
<input type="radio"/> heureux	<input type="radio"/>
<input type="radio"/> TABAC	<input type="radio"/>
<input type="radio"/> cadeau	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>
<input type="radio"/> triste	<input type="radio"/>
<input type="radio"/> FUMER	<input type="radio"/>
<input type="radio"/> victoire	<input type="radio"/>
<input type="radio"/> CAMEL	<input type="radio"/>
<input type="radio"/> guerre	<input type="radio"/>
<input type="radio"/> CIGARETTE	<input type="radio"/>

Figure 2: Measurement stage p&p SC-IAT-P.

were in lower-case letters. This difference was consistent with the recommendations of Nosek, Greenwald and Banaji (2007) according to whom the categories to which items belong should be made as clear as possible by the use of fonts or different colors. The items used in this p&p version were those tested and used with the computerized SC-IAT-P. They were placed in an order created at random by a computer script.

#### Explicit measures

Participants were asked whether they smoked or not. De Houwer et al. (2006) and Bardin et al. (2014) had chosen to consider participants were smokers if they smoked at least one cigarette a day. Accordingly, this criterion was also selected in this study. Smokers therefore also had to specify whether they smoked at least one cigarette a day. They were also asked about their weekly consumption.

#### Procedure

Participants were alone or in small groups and completed first the p&p SC-IAT-P and then the computerized SC-IAT-P. For the p&p SC-IAT-P, it was explained that the task was to categorize, by checking the appropriate box as fast as they could, the items according to the instructions specified, with as few mistakes as possible. It was also stressed that they should not correct their errors or stop at any point. Particular emphasis was placed on the need to work downwards from the top without skipping any items. After verifying that participants fully understood the instructions, the experimenter then asked the participants to take sheet "1" and told them that they were going to have ten seconds to execute the task at his signal. They had to take their pen off the paper as soon as he signaled the end of the task. He also explained that this was a training phase. Once the task was completed, the experimenter asked them to move to sheet "2", indicating that this was the measurement phase, identical to the first, and they had twenty seconds to categorize as many items as they could. They were also told that if they came to the end of the first column of items, they should continue with the second. The same procedure was then applied to sheets 3 (ten seconds) and 4 (twenty seconds).

The order in which the phases were combined was counterbalanced between subjects. Participants were then requested to complete an explicit questionnaire (smoking behavior, age and sex), and then completed the computerized version of the SC-IAT-P.

## Results

#### Descriptive statistics

Participants checked 24.16 ( $SD = 6.52$ ) and 27.14 ( $SD = 4.85$ ) out of 46 items (i.e. 52.52% and 59% of the items) respectively for the phases "I like + tobacco" and "I dislike + tobacco".

#### Calculation of implicit attitude scores

The scores of the p&p SC-IAT-P were calculated following the procedure recommended by Lemm et al. (2008) (product: square root of difference) which considers the number of items checked correctly for the first phase ("I like + tobacco" combination) and the number of items checked correctly for the second phase ("I dislike +

tobacco" combination). For each participant, the phase for which the number of items checked is highest is therefore called "Phase A", the other phase being called "Phase B". The score is obtained by the product of Phase A/Phase B with the square root of the difference between these two phases. This calculation is summarized by the following expression:

$$(X / Y) * \sqrt{X - Y};$$

X is the number of items in Phase A and Y is the number of items in Phase B. If the number of items in the second phase is higher than the number in the first phase then the score is multiplied by  $-1$  in order to maintain the polarity of the effect. This calculation makes it possible to match a negative attitude toward smoking to a negative score and vice versa. Karpinski and Steinman (2006) recommend excluding data from participants with over 20% of errors for the computerized SC-IAT. However, no participant returned more than 20% of errors, for both either the p&p or the computerized versions of the "tobacco" SC-IAT-P.

The SC-IAT scores for the computerized version were calculated in accordance with the algorithm ( $D$  score) proposed by Karpinski and Steinman (2006). The responses from the training phases were excluded from the calculation of the score. Non-responses and those given in less than 350 ms were eliminated. The response times for errors were replaced by the average time for the phase, and a penalty of 400 ms was added. The average association between tobacco response times and positive association ("I like") was deducted from the average response time to the negative association ("I dislike"). The first score was then divided by the standard deviation of all the correct answers of the two phases. A positive  $D$  score therefore corresponded to a positive attitude toward smoking. Conversely, a negative  $D$  score indicated an implicit negative attitude.

#### Analyses

Correlational analyses showed a significant link ( $r = .58$ ,  $p < .001$ ) between the computerized and the p&p versions of the SC-IAT-P. Given the small size of the sample, we replicated the analyses with a bootstrap method (BCA, 1000 bootstrap samples). The signs of confidence intervals 95% CI [.75; .41] confirmed the result.

Smokers showed a more favorable implicit attitude toward smoking,  $M = -0.07$  ( $SD = 0.37$ ) than non-smokers,  $M = -0.37$  ( $SD = 0.38$ ), when this was evaluated by the computerized SC-IAT-P,  $t(42) = 2.48$ ,  $p = .009$ ,  $d = 0.80$ . The same pattern of results was obtained for the p&p version,  $t(42) = 2.32$ ,  $p = .015$ ,  $d = 0.75$  [smokers,  $M = 0.45$  ( $SD = 1.98$ ), non-smokers,  $M = -2.49$  ( $SD = 3.85$ )]. The results obtained with the bootstrap method confirmed the previous results both for the computerized version 95% CI [.05; .55] and for the p&p version 95% CI [.97; 4.26];  $p = .009$ .

#### Discussion

This first study aimed at verifying the discriminant and nomologic validities of the p&p SC-IAT-P by measuring implicit attitudes toward smoking through a computerized

SC-IAT-P and its p&p equivalent. Not only did both tools have the same scoring pattern for discriminating between smokers and non-smokers, but the correlation between the tools was relatively high. This correlation suggests that both tools measure the same construct and that the differences in experimental material (use of photos in the computerized version and words in the pencil-and-paper one) therefore had limited impact. In this sense, following Nosek et al. (2007), the computerized version of the IAT can use words, sounds, images or a combination of these as exemplars. The difference would then simply be in processing time, since access to an evaluation is faster when the stimulus is presented through an image rather than a word (De Houwer & Hermans, 1994). Additionally, according to De Houwer (2001), the particular valence of exemplars of the category does not seem to have any effect on the results of the IAT. These initial results were obtained on a limited sample although additional analysis (bootstrap method) demonstrates their robustness. Moreover, the experiment was held with small groups simultaneously. It was therefore necessary to test the p&p SC-IAT-P with an experiment based on larger groups simultaneously, as this is one of its purposes. Moreover, in this first study, smokers had been considered as a homogeneous population without considering their willingness to quit. Yet the attitude of smokers' willingness to quit smoking is probably different from those who do not wish to do so.

## Study 2

The aim of this second study was to test the p&p SC-IAT-P in a large collective experiment. It aimed to highlight first a difference of implicit attitude measured by the p&p SC-IAT-P between smokers and non-smokers, and second a difference in terms of behavioral intention to quit smoking. Following Bardin et al. (2014) and the results of the previous study, the hypothesis was that the p&p SC-IAT-P would reflect significantly different attitude scores according to smoking behavior. Specifically, smokers should have a more favorable attitude toward smoking than non-smokers. Concerning smokers, an intention (past or present) to quit smoking should also be determinant. The Transtheoretical Model of Change (TMC, Prochaska, & DiClemente, 1992; Prochaska, DiClemente, & Norcross, 1992) is widely used in clinical procedures and in studies of addictive behaviors (Farkas et al., 1996), including smoking. It defines five stages of motivation, each stage corresponding to a decisional or "motivational" state of smoking and an attitude toward smoking. In the first stage (precontemplation), people do not want to quit smoking. The second (contemplation) concerns individuals who plan to quit within six months. In the third stage (preparation), individuals consider quitting smoking within thirty days and have already made an attempt in the last twelve months. Finally, the last two stages involve people who have stopped either in the last six months (action) or for more than six months (maintenance). Self-reported measures of attitude issues evolve according to the stage; the more stages through which smokers progress, the more they express negative attitudes toward smoking (Velicer, DiClemente, Prochaska, & Brandenburg, 1985). Indeed, the perception of "negative effects" of smoking increase

according to the smoker's stage of change (TMC). Thus, the closer people declare themselves to quitting, the more dominant negative effects related to tobacco consumption become. Meanwhile, estimates of psychoactive effects and the pleasure of smoking are revised downward as the individual progresses through the stages. Accordingly, it was expected that people who had already planned to quit smoking would have a less favorable attitude than people who had never considered it. Similarly, people intending to quit should have a more negative attitude than those who do not want to.

## Method

### Participants

One hundred and thirteen second-year psychology students participated in this study, made up of 51 smokers and 62 non-smokers. The sample was composed of 16 men and 97 women with an average age of 20.43 ( $SD = 1.40$ ) years. One participant indicated neither age nor sex. The average age did not differ regardless of gender or smoking behavior. Finally, among smokers, 16 were planning to quit smoking and 33 were not (2 smokers did not answer this question).

### Material

A booklet was distributed to participants. It included the measures of smoking behavior followed by the implicit measure of attitude. The measures were strictly identical to those used in the previous study except for three questions added for smokers on whether they had already considered quitting smoking in the past, their future intentions, and the deadline for implementation of a possible attempt to quit, for those who planned to do so.

### Procedure

The experiment took place in an amphitheater after a lecture. Smokers were invited to participate in the study only if they consumed at least one cigarette a day. Non-smokers only took part in the study if they were not former smokers.

The booklets were distributed by two experimenters. Participants were asked to complete the page of behavioral measurements and then wait before reading the rest of the document. They were then told that it was a study concerning a measure of attitudes toward smoking. Slides were projected, enabling an experimenter to explain clearly how the test worked and to display instructions. The procedure and guidelines were strictly identical to those of the previous study. The order in which the phases were combined was counterbalanced between subjects.

## Results

### Descriptive statistics

Participants checked 23.04 ( $SD = 5.79$ ) and 24.02 ( $SD = 4.76$ ) items (i.e. 50% and 52.21% of the items) respectively for the phases "I like + tobacco" and "I dislike + tobacco".

### Calculation of implicit attitude scores

The same algorithm was used to calculate the scores. One participant, a non-smoker, had more than 20% of errors in their responses in one of the measurement phases, and was therefore excluded from the analyses.

### Analyses

The order of categorization phases had no effect on the scores of the SC-IAT-P,  $t(94) = -0.90$ ,  $p = .37$ ,  $d = 0.17$ . Nevertheless, we tested the effects of interaction for all analyses. All were non-significant. For clarity, the following analyses show the results without the introduction of variable order and interaction. The implicit attitude toward smoking appeared statistically different concerning smoking behavior,  $t(106) = 4.80$ ,  $p < .001$ ,  $d = 0.88$ . Specifically, smokers  $M = 0.70$  ( $SD = 2.16$ ) had a score of implicit attitude toward smoking higher (i.e. more positive) than non-smokers  $M = -1.72$  ( $SD = 3.16$ ). For these smokers, regression did not highlight the effect of the weekly consumption of cigarettes on the implicit attitude toward smoking,  $\beta = 0.09$ ,  $F(1, 110) = 1.07$ ,  $p = .30$ . Smokers who planned to quit,  $M = 0.83$  ( $SD = 2.02$ ) did not have different scores from those who did not intend to,  $M = 0.59$  ( $SD = 2.26$ ),  $t(48) = 0.36$ ,  $p = .72$ ,  $d = 0.11$ . However, smokers who had at some time considered quitting smoking,  $M = 0.10$  ( $SD = 2.03$ ), differed from those who had never considered it  $M = 1.46$  ( $SD = 2.15$ ),  $t(48) = -2.28$ ,  $p = .027$ ,  $d = 0.65$ .

### Discussion

This second study was designed to test the p&p SC-IAT-P with a large simultaneous sample. From the perspective of ease of use, the test appeared understandable and quick to administer. The results obtained in this study are consistent with those of Study 1 since smokers had a more favorable attitude toward smoking than non-smokers. Moreover, smokers who had never considered quitting smoking had more positive attitude scores than those who had considered it in the past. This seems to confirm the discriminant validity of the p&p SC-IAT-P. This pattern of results also seems to confirm that the SC-IAT-P refers more to a personal attitude than an extrapersonal measure and that it is indeed necessary not to consider smokers as a homogeneous category. Some smokers (i.e. those who have never considered quitting smoking) may have a positive attitude toward smoking while others (i.e. those who already considered quitting smoking) may have a negative (or at least ambivalent) one and continue smoking because of their addiction. Information in the form of health warnings (prevention) or about the negative effects of smoking they have experienced have led them to change their attitude and behavior toward smoking. So while they all smoke, the differences of attitude between the two groups seems to induce different behaviors concerning quitting. In this sense, Bardin et al. (in press) have demonstrated that smokers who have at some time considered quitting are more sensitive to smoking prevention information than those who have never contemplated quitting, thereby strengthening their negative attitude and willingness to quit. Exposure to such information would then reinforce the negative associations for these tobacco smokers.

While, as predicted, having already attempted to quit smoking had an impact on the SC-IAT-P scores, no differences were obtained with the future intention to quit. This result can be explained by the social desirability

inherent in such behavior. Also, according to Hughes, Keely, Fagerström and Callas (2005), the intention to quit can change spontaneously over very short periods of time; this decision is particularly reversible. For example, 30 days later, from 17 to 34% of smokers no longer report the same intention of quitting. The behavioral intention to quit seems only slightly predictive of effective quitting behavior. As a precursor of behavioral intention (Fishbein and Ajzen, 1975), attitude in turn therefore seems only slightly predictive of quitting behavior. Nevertheless, it is possible that the problem lies more in the behavioral intention, which, in this area, is only slightly predictive of behavior. This weak prediction could be related to the addictive nature of the product, which may lead smokers to believe that they are incapable of quitting and thus play an important role in the development of effective behavior (Theory of Planned Behavior, Ajzen, 1991).

Finally, while the results of this study support the conclusion that, like its computerized equivalent, the p&p SC-IAT-P is able to measure implicit attitude towards tobacco, the choice of object remained problematic since it referred to an object of addiction and thus altered the link between an attitude object and behavior, or at least the associated behavioral intention. So it was necessary to test the p&p SC-IAT-P on a different attitude object that was not related to addiction and for which the link between attitude and behavior or behavioral intention was stronger.

### Study 3

This third study was designed to test the p&p SC-IAT-P on a subject of study for which explicit and implicit attitudes correlate strongly. According to Greenwald et al. (2009) the correlation between implicit and explicit attitudes is particularly high in the field of politics ( $r = .483$ ).

For Gawronski, Galdi, and Arcuri (2015), this strong correlation is explained by the fact that in this area individuals have conscious access to their attitude. However, Galdi, Arcuri and Gawronski (2008) and Friese, Smith, Plischke, Bluemke and Nosek (2012) were able to demonstrate a difference in outcome between undecided voters and those who had already decided. For the undecided, implicit attitude is a better predictor of actual voting behavior than explicit attitude. But for decided voters, explicit attitude better predicts the actual vote than implicit attitude. Berthet, Bartholomew and Kop (2015) failed to demonstrate a difference between the two categories of people in a study between the two rounds of the French presidential election between Nicolas Sarkozy and François Hollande. The authors considered that people were undecided when their intention to vote in the second round of the election was different from their actual vote in the first round. In both groups, implicit attitudes measured by two computerized IATs (Hollande vs. Sarkozy and their respective parties, the PS vs. the UMP) strongly correlated with measures corresponding to explicit attitudes (correlations between .59 and .69).

Thus in view of the strong correlation between implicit and explicit attitudes, it seemed relevant to use political

attitude to test the external validity of the p&p SC-IAT-P. As for Berthet et al. (2015), this third study was conducted during the period between the two rounds of the French presidential elections in 2012 (between April 22 and May 6) and concerned attitude toward the Right. Choosing the Right rather than the Left was guided by the assumption that voters would have an anchored attitude toward the Right after three presidential terms. The objective of this study was to verify that the implicit attitude toward the Right measured with the p&p SC-IAT-P was predictive of the participants' explicit political orientation.

### Method

#### Participants

One hundred and eight 2nd year psychology students participated in this study. The sample consisted of 78 individuals who reported a preference for the political Left (9 men and 69 women), 23 individuals who reported a preference for the political Right (4 men and 19 women) and 7 people who did not specify any political preference (4 women and 3 men). The mean age of the sample was 20.86 ( $SD = 2.55$ ) years. Fifty-six people were planning to vote for François Hollande, 19 for Nicolas Sarkozy, 20 were undecided and 12 did not intend to vote.

### Material

#### Paper-and-pencil SC-IAT-P

The p&p SC-IAT-P was adapted to measure political preference using target concepts related to the Right. The test was strictly the same as the p&p SC-IAT-P toward smoking except exemplars of smoking target concepts were mostly replaced by French politicians from the Right: Sarkozy, Copé, Right, Fillon and Baroin.

#### Explicit measures

Candidates were asked whether they had a political preference for the Right or the Left and on a seven-point Likert scale to what extent they thought the actions of the outgoing President (Nicolas Sarkozy) was beneficial to France and whether they supported his actions. Participants were also asked to what extent Nicolas Sarkozy was capable of solving France's problems. In addition, they indicated the candidate for whom they would vote, if their choice was already made.

#### Procedure

The procedure was identical to that of Study 2: individuals completed the explicit and implicit measuring procedures in an amphitheater. The experiment took place at the end of a lecture. The booklets were distributed by two experimenters. Participants were asked to complete the page of explicit measures and wait before looking at the rest of the document. They were then told that it was a study measuring attitudes toward politics. Slides were projected, enabling an experimenter to explain clearly how the SC-IAT-P worked.

The order in which the phases were combined was counterbalanced between subjects.

### Results

#### Descriptive statistics

Participants checked 24.13 ( $SD = 6.47$ ) and 24.37 ( $SD = 5.31$ ) items (i.e. 52.46 % and 52.98%) respectively for the "I like + Right", "I dislike + Right" phases.

#### Calculation of implicit attitude scores

SC-IAT-P scores were calculated according to the procedure proposed by Lemm et al. (2008) presented in Study 1. Five participants had more than 20% of errors with the SC-IAT-P toward Right and were therefore excluded from the analyses.

### Analyses

As expected, individuals who declared being on the Right had a more positive implicit attitude towards the Right,  $M = 2.05$  ( $SD = 3.84$ ), than individuals favoring the Left,  $M = -0.98$  ( $SD = 2.61$ ),  $t(88) = -4.14$ ,  $p < .001$ ,  $d = 1.03$ .

Similarly, among the 70 participants whose choice to vote in the second round was settled, those who reported they intended to vote for François Hollande had a more unfavorable attitude toward the Right,  $M = -1.23$  ( $SD = 2.57$ ), than those who reported they wanted to vote for Nicolas Sarkozy,  $M = 2.01$  ( $SD = 4.08$ ). The two means were significantly different,  $t(68) = -3.89$ ,  $p < .001$ ,  $d = 1.10$ .

Furthermore, attitude score toward Nicolas Sarkozy was calculated taking the mean of two explicit items concerning his political action. The correlation for these two items was  $r = .84$ ,  $p < .001$ . Participants had a mean attitude score of 2.98 ( $SD = 1.53$ ) on a 7-point scale. The implicit attitude measured with the p&p SC-IAT-P toward the Right was correlated with the explicit attitude toward Nicolas Sarkozy,  $r = .40$ ,  $p < .001$ ; the more people had a favorable implicit attitude toward the Right, the more their explicit attitude toward the outgoing President was positive. Regarding the item "Sarkozy is best placed to solve France's problems", the mean score of participants was 3.01 ( $SD = 3.74$ ). The correlation between implicit attitude and this item was  $.40$  ( $p < .001$ ). The higher the implicit attitude score (reflecting a positive attitude) of participants, the more they agreed with this item.

Finally, we calculated the correlations between explicit measures and p&p SC-IAT-P by separating the group of decided from undecided voters. For the decided group, the correlation between explicit items and SC-IAT-P was between  $.40$  and  $.45$  ( $p < .001$ ), whereas for the undecided, correlation was between  $.19$  and  $-.14$  (ns). Given the small number of undecided voters ( $n = 17$ ), a correlation analysis using the bootstrap method was conducted (BCa, 1000 bootstrap samples). Reverse polarity for the confidence intervals of the resulting correlations did not show significant correlation between explicit measures and implicit attitude for the undecided.

### Discussion

The purpose of this last study was to confirm that the p&p version of the SC-IAT-P has discriminant validity on an attitude not related to addiction. Also, the theme of politics has been the subject of numerous studies in which

implicit and explicit attitudes are usually highly correlated and predict behavior or behavioral intention. In this third study, people who intended to vote for Nicolas Sarkozy had a more favorable implicit attitude toward the Right than those who intended to vote for François Hollande. However, some results differ slightly from those of Berthet et al. (2015), who measured the attitude toward the Right between the two rounds of the same presidential election. Thus, Berthet et al. (2015) reported a stronger correlation between implicit and explicit measures than in our study (.60 vs. .40). In addition, they reported the same pattern of results for undecided voters, while in this study, no correlation could be demonstrated for the undecided.

There may be several reasons for these differences. The first concerns the difference between the explicit items used. In our study, questions were asked about Sarkozy's actions (assessment of his past, present and potential future actions). People could thus have a positive attitude toward Sarkozy's actions without assessing the person. However, the study by Berthet et al. (2015) focused on participants' opinions of the candidates (Sarkozy and Hollande) and their parties (UMP and PS). Yet, according to Gawronski et al. (2015), even small differences in the formulation of items can cause significant differences in the correlations obtained.

The second concerns differences in how implicit attitudes are measured (two computerized IATs between the PS vs. the UMP and Sarkozy vs. Hollande compared with a p&p SC-IAT about the Right). Beyond the differences in terms of attitude objects measured and the differences already highlighted between IAT and SC-IAT-P (relativity of measurement and contamination by extra-personal associations), such a result could also be related to the nature of the underlying process. Even if the IAT is regarded, like the SC-IAT, as a measure based on automatic, unthinking reactions, the calculation of the IAT scores proposed by Greenwald, Nosek and Banaji (2003) involves considering reaction time up to 3000 ms, and reducing times longer than this to 3000 ms. Such reaction times could be explained by partly-controlled processes so that IAT could be closer to explicit measures. Moreover, Fiedler and Bluemke (2005) demonstrated that it was possible to falsify the results of an IAT. Finally, concerning the difference in results on indecision, in this study, as in the studies by Friese et al. (2012) or Galdi et al. (2008), the undecided were the people who did not know who they would vote for, while in the study by Berthet et al. (2015), the undecided were the people who voted for one of the other candidates in the first round, i.e. neither Hollande nor Sarkozy. As the authors point out, changing one's choice of candidate between the first and second rounds does not necessarily mean indecision. A voter could know that they would vote for a minority candidate who was unlikely to get to the second round (e.g. Philippe Poutou) and that they would then vote for a different candidate in the second round. Undecided voters in the study by Berthet et al. (2015) simply have a less polarized attitude than people who voted for the same candidate in both rounds (e.g. activists working on a candidate's campaign). By measuring indecision in our study as in previous studies (Friese

et al., 2012; Arcuri et al., 2008, etc.), the classical results are reproduced and seem to contradict those of Berthet et al. (2015). Nevertheless, these factors should be considered carefully in view of the small sample for our study (particularly for undecided voters).

### General discussion

We made the assumption that adapting the p&p SC-IAT-P would overcome the constraints of the computerized version while preserving its strengths. The protocol is fast and for most participants seems to have a playful side. In the first study, the correlation between the p&p version and the computerized SC-IAT-P confer a certain nomological validity to the measures. In addition, the difference between the results for smokers and non-smokers attests to its discriminant validity. The results of Study 2 confirm its discriminant validity since it is not only able to distinguish smokers from non-smokers but also smokers who have previously attempted to quit smoking from those who have not. The results obtained with the p&p SC-IAT-P in Study 3 in the area of politics also confirm the discriminant validity of the tool. Using this theme overcame the problem of addiction posed by an attitude object such as tobacco. Implicit attitude produces results consistent with the explicit measures of attitude and voting intentions. In addition, the same difference between the results for undecided and decided voters was obtained as that usually found in the literature. These first results support the tool's validity. However, it should be noted that the three studies have limitations. The first relates to the reduced sample in each of these studies, even if the use of the bootstrap method partially overcomes this limitation. Moreover, as for the p&p IAT, the test design makes it impossible to study its internal consistency. Indeed, when Bardin et al. (2014) studied the reliability of the computerized version of the SC-IAT-P, they followed the recommendations of Karpinski and Steinman (2006) to calculate an adjusted value of  $r$  (the Spearman-Brown correction) which, from a conceptual point of view, is the equivalent of Cronbach's alpha for studying explicit measurement reliability (Karpinski & Steinman, 2006). This calculation is possible because the number of responses is fixed in the computerized version. In the p&p SC-IAT-P, as in the p&p IAT, the number of responses given by the participant does not reflect a predefined number of items but, among other factors, the ability of the participant to answer quickly. The p&p SC-IAT-P is also designed so that it is not possible to finish it. Thus, Lemm et al. (2008) point out that "*Paper IATs also do not allow for trial by trial timing, thus it is not possible to compute split-half or alpha reliability.*" (p.22).

Finally, the main limitation concerning the validation of the tool is the impossibility of verifying its test-retest reliability. This should be verified both in the computerized and the p&p versions since, to our knowledge, no study has tested the reliability of the SC-IAT and the SC-IAT-P. The strong correlation between IAT and SC-IAT ( $r = .78$ ) obtained by Karpinski and Steinman (2006) and the quite similar consistency of the two measures suggest that IAT and SC-IAT could have very similar reliability. Lane et al.

(2007) listed the studies in which IAT had undergone testing-retesting and reported that reliability was satisfactory, although the correlations ranged from .25 to .69. Similarly, the test-retest correlation for the p&p IAT verified by Lemm et al. (2008) was .62. Apart from the reliability of SC-IAT and SC-IAT-P in their computerized or p&p versions, questions arise concerning the reliability of all IAT measuring tools and their derivative versions and particularly the origin of the variations found in the literature.

Since the creation of the IAT, interest in implicit attitude measures has grown considerably. Thus, nearly 500 scientific papers containing the words “Implicit Association Test” or “IAT” are listed in the databases of psychology articles (PsycINFO, PsycARTICLES). Tests with paper-and-pencil versions, meanwhile, have remained less frequent. According to Mori, Uchida, and Imata (2008), the relatively low interest could be related to the loss of precision in the paper version inherent in the lower variability of the scores than in the computerized version.

Implicit measures of attitudes are now beginning to be used in classic studies of attitude (e.g., Galdi et al., 2008; Galdi Knobloch-Westerwick & Kleinman, 2012). However, this remains a minority option compared to self-reported measures. Although the protocols have been simplified and expanded since 1998, allowing researchers to choose between different versions, personalized or otherwise, the computerized versions are limited in the ways they can be applied. Therefore, even if the paper versions of these tests are less accurate and need to be improved, they nevertheless open up new perspectives for reducing the effects of social desirability on research into attitude change, or studies concerning the link between attitude and behavior, since they are cheap to run, require very little equipment (Vargas, Sequakaptewa, & von Hippel, 2005) and are easy to use. Indeed, since the studies presented in this paper, we have implemented this protocol several times under identical conditions (participants questioned in an amphitheater). The instructions were given by the experimenter orally, without a slideshow. This change does not seem to have caused any more problems in understanding, while producing the same pattern of results (Bardin, Perrissol, & Py, 2012).

Finally, the results obtained in the field of politics concerning indecision suggest avenues for application in other areas such as intentions to quit smoking. Indeed, like Friese et al. (2012) or Arcuri et al. (2008), our results support the postulate of an implicit attitude that precedes future behavioral intention, even though the individual may not be aware of this intention (Gawronski et al., 2015). Galdi, Gawronski, Arcuri, and Friese (2012) were able to demonstrate that the explicit attitude toward the entry of Turkey into the European Union was only predictive of selective exposure to information on the subject for people who already held a firm opinion. Undecided people, meanwhile, tended to selectively expose consult related information according to their implicit attitude as measured by a SC-IAT. Bardin et al. (in press) showed that the more smokers had a negative implicit attitude (measured by a SC-IAT-P) toward smoking, the more they

reported a desire to expose consult related prevention information. Thus, according to Gawronski et al. (2015), implicit measures of undecided correspond to an “*embryonic preference*” (p.14) not yet acknowledged explicitly, but that would develop due to biased processing of the information in view of this preference.

It would therefore be interesting to replicate these findings by differentiating three groups of smokers: the “happy smokers” (Lagrué, 2006) who are determined not to quit, the undecided wondering about possibly quitting without showing concrete or conscious intention, and those who have decided to stop. The “happy smokers” are individuals in the first stage (precontemplation) of the Transtheoretical Model of Prochaska and DiClemente (1992). Undecided smokers are more difficult to categorize in one of the stages of this model. Indeed, although the model is widely used in the field of tobacco smoking, one of the main criticisms regarding its implementation concerns the lack of any notion of indecision (Herzog, 2007). Among the questions asked, smokers must state whether they are considering quitting within 6 months and whether they are planning to quit within 30 days. Thus, a smoker who plans to quit in five months will be at a different stage to one who is thinking of quitting in 7 months (precontemplation vs. contemplation). Similarly, a smoker who is considering quitting after 31 days will be in the contemplation stage while one who plans to do so within 30 days will be in the preparation stage. According to Herzog (2007) and West (2005), these thresholds are arbitrary. To overcome this limitation, Herzog (2007) tested a modification of these items by adding a response category “do not know/undecided”. The results reveal that 30% and 33.1% of smokers answer that they do not know whether they will quit respectively within 30 days and 6 months. It might be interesting to use this version of the questionnaire to identify decided from undecided people within each stage. Undecided smokers who report a negative implicit attitude toward smoking might expose to smoking prevention information in order to strengthen their “embryonic attitude” more than decided smokers. However, as in the study by Galdi et al. (2012), the explicit attitude score would not predict this exposure. It is possible that implicit attitude could cause a selective search for information that would act as a future mediator for quitting. Specifically, the selective search for information would cause such subjects to develop an explicit negative attitude to smoking that would lead them to attempt to quit later on. Finally, the implicit attitude measured by a paper-and-pencil or computerized SC-IAT-P could help predict the likelihood that a smoker makes the decision to quit smoking while not even aware of it.

### Competing Interests

The authors declare that they have no competing interests.

### Note

- <sup>1</sup> However, given the debate on the meaning of zero in an IAT score (see Blanton & Jaccard, 2006; Greenwald, Nosek, & Sriram, 2006), caution is needed when interpreting the signs of scores.

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