How to Detect Deception in Everyday Life and the Reasons Underlying It

SARA AGOSTA[1]*, PATRIZIA PEZZOLI[2] and GIUSEPPE SARTORI[2]

[1]*Center for Neuroscience and Cognitive Systems, Italian Institute of Technology, Rovereto, Italy*
[2]*Department of Psychology, University of Padua, Padua, Italy*

Summary: The autobiographical Implicit Association Test (aIAT) evaluates which of two contrasting autobiographical events is true for an individual on the basis of implicit associations and corresponding reaction times in classifying sentences. In this research, white lies and corresponding reasons to lie were investigated. White lies are social lies. They are widespread in our in our daily lives, in the business world and in the forensic contexts. The ability to deceive is essential for polite interactions and, at times, self-preservation, but little research was conducted so far on this type of deception. The authors tested the efficiency of the aIAT in identifying a white lie and the real reason for producing a white lie, contrasting each participant's real motivation for lying and a false (faked) one. In both cases, aIAT differentiated truth from white lies and also identified the real reason from the faked one for all 20 participants. Copyright © 2013 John Wiley & Sons, Ltd.

INTRODUCTION

'Deception is a psychological process by which one individual deliberately attempts to convince another person to accept as true what the liar knows to be false, to gain some type of benefit or to avoid loss' (Abe, 2011).

Researches show that people cheat when a cost-benefit analysis fosters it, like in a legal framework (De Cataldo Neuburger, & Gulotta, 2008). On the other side, we are predisposed to believe what we see and hear (the *Truth bias*) and thus to be deceived. We cannot function as informed citizens, co-workers or partners without some degree of trust, but lying is widespread in our society, in the business world as well as in our daily lives (Feldman, 2009a, 2009b). For these reasons, such a growing literature on methods for detecting deception is not surprising (Ganis, Kosslyn, Stose, Thompson, & Yurgelun-Todd, 2003; Spence, 2004; Vrij, 2007; Ganis & Keenan, 2009).

Deceit is a normal and essential part of human interactions. It is one of the most common human behaviours, and it can even be unintentional. Even if we think we are telling the truth, sometimes we distort reality unconsciously because our memory works as a creative process (De Cataldo Neuburger & Gulotta, 2008).

A recent study by Serota, Levine, and Franklin (2010) investigated the prevalence of deception, based on a national survey, self reports, diary studies and the distribution of lies in an experimental setting. Self-report data for the US adult population show the average rate of lying is around 1.65 lies per day, but data were not normally distributed: most people told few or no lies in a given day but a few prolific liars told a disproportionately large share of the daily lies.

'White lies' may be considered a subtype of lies, also known also as 'social lies', which most people tell on a daily basis in order to place themselves or others in a more positive light (Granhag & Vrij, 2005). Feldman (2009a, 2009b) notes that common people usually think that white lies are 'little lies that don't hurt anyone' and are so negligible that

they should not be grouped with 'real' lies. What makes white lies benevolent is that they may be produced in order to avoid embarrassment or other unpleasant emotions in the recipient or in the liar himself. The main difference from real lies is thus the set of reasons why they are produced (De Paulo, Kashy, Kirkendol, Wyer, & Epstein, 1996).

De Paulo et al. (1996) proposed a taxonomy of everyday lies and the corresponding reasons underlying deceits. They distinguished between outright lies, 'in which the information conveyed is completely different from or contradictory to, the truth'; exaggerations, which are 'lies in which the liars overstate the facts or convey an impression that exceeds the truth'; and subtle lies which are based on evasions or omissions of relevant details.

They further classified everyday lies on the basis of their content as follows: (i) *feelings*—'lies about affects, emotions, opinions, and evaluations pertaining to people, objects, or events. Includes feigning feelings and appraisals that are more positive or less negative than they are, as well as the converse'; (ii) *achievements*, *knowledge*—lies about 'achievements, accomplishments, failures, shortcomings, knowledge, and lack of knowledge'; (iii) *actions, plans*—'lies about what the liars did, are doing, or are planning to do, or about where they were or where they are'; (iv) *explanations*—'lies about liars' reasons or explanations for their behavior'; and (v) *facts*—'lies about facts about objects, events, or people, or about possessions'.

This classification can easily be expanded from everyday lies to lies 'into the trial'. An example of 'lie about knowledge' is denying of remembering something one is questioned about, more or less deliberately; a possible 'lie about actions' is creating an alibi to protect someone we care about; reporting a false motive means to lie about 'explanations'.

Our research was conducted on common people, who presumably would not be willing to report having told cheating or manipulative lies. Investigating white lies thus gave us the chance to open a new field of studies on deception using a memory detection technique.

In everyday life, we have the strong subjective belief that reasons underlying behaviours have a key causative role in triggering them. According to De Paulo et al. (1996) and Vrij (2007), the reasons to lie may differ in terms of (i) the person

*Correspondence to: Sara Agosta, Center for Neuroscience and Cognitive Systems, Italian Institute of Technology, Corso Bettini 31, 38068, Rovereto (TN),Italy.
E-mail: sara.agosta@iit.it

who benefits from the lie (whether self or other-oriented); (ii) the consequences of lying (in order to gain advantage or to avoid costs); and (iii) the type of lying (whether for materialistic or psychological reasons).

Self and other-oriented lies are told either to protect oneself or others psychologically (e.g. protect from embarrassment or loss of face).

Because white lies are social lies, situational factors help to cause this behaviour: a person is more likely to lie if that would conform him or her with the reference group and give him or her advantages (pondered with the possible disadvantages of being caught), and as much as he or she is in conflict with the recipient. This is the typical situation of the criminal trial (De Cataldo Neuburger & Gulotta, 2008).

Previous studies on white lies, summarised earlier, have mainly addressed the classification of white lies. No study, to our knowledge, has been conducted on the detection of white lies and their underlying reasons. This study investigates whether truthful descriptions may be distinguished from white lies using a variant of the Implicit Association Test (IAT); which has been shown to efficiently detect autobiographical memories (Greenwald, Mc Ghee, & Schwartz, 1998).

Great part of research on deception aimed at finding verbal and non-verbal cues to deception, but these cues concerned individuals whose motivation to lie was rarely as strong as it can be in a legal framework. Addressing our interest on the reasons why people lie may let us shed light on these motivational contents. Therefore, this paper will also investigate the possibility of distinguishing real and false reasons to lie using the autobiographical Implicit Association Test (aIAT).

This innovative type of aIAT might open a field of studies on the reasons underlying our behaviour. Practical applications of this method may involve all fields in which motivation evaluation is a key issue, such as forensic assessment.

The aIAT (Sartori, Agosta, Zogmaister, Ferrara, & Castiello, 2008) is a novel variant of the Implicit Association Test (Greenwald et al., 1998) that can be used to establish whether an autobiographical memory trace is encoded within the respondent's mind. The aIAT is a reliable method, validated in both forensic and clinical settings (Sartori, Agosta, & Gnoato, 2007; Sartori et al., 2008), which has the ability to reveal factual knowledge regarding autobiographical events that are presented in a verbal format.

More specifically, using the aIAT, it is possible to evaluate which of two alternative autobiographical events is true (Sartori et al., 2008).

Our research contributes to a broader field of studies aimed at validating the aIAT for the identification of constructs such as future medium and long-term intentions (Agosta, Castiello, Rigoni, Lionetti, & Sartori, 2011).

Furthermore, Agosta (2005), Verschure, Prati, and De Houwer (2009), and Hu, Rosenfeld, and Bodenhausen (2012) investigated whether the aIAT could be faked and found that expert coached or instructed participants could cheat the test. Agosta, Ghirardi, Zogmaister, Castiello, and Sartori (2010) showed that only coached fakers (and not naïve non-coached fakers) could alter the test outcome and that these coached fakers could be spotted from their pattern of response.

The aIAT includes stimuli belonging to four categories. Two categories are logical categories represented by sentences that are always true (e.g. 'I am in front of a computer') or always false (e.g. 'I am climbing a mountain') for the respondent and relate to the moment of testing. Two other categories are represented by alternative versions of an autobiographical event (e.g. 'I went to Paris for Christmas' versus 'I went to London for Christmas') only one of the two being true. The aIAT, as with any IAT, requires the accomplishment of five classification blocks: three single classification blocks (true versus false, Paris versus London or London versus Paris) and two critical double classification blocks in which stimuli for one logical category and one autobiographical event are responded to with the same button (e.g. left button—true and Paris; right button—false and London, and vice versa). Because the pairing of a truly autobiographical event with true sentences, which are certainly true, should facilitate the response, the specific pattern of response times (RTs) for these two critical blocks indicates which autobiographical event is either true or false. The true autobiographical event is identified because, in one of the two double blocks, it determines faster RTs when it shares the same motor response with true sentences. Because it has been demonstrated that the aIAT can accurately (91% accuracy) determine which of two autobiographical events is true, the aIAT might be considered a promising memory detection technique (Sartori et al., 2008). Lower accuracy rates emerged in other experiments (Verschure et al., 2009) could be due to the use of negative sentences and negative reminder labels, which we carefully avoided.

In short, the aIAT was used for detecting white lies and the reason for telling the same lies. Each single participant was administered two types of aIATs. The first aIAT was aimed at identifying a white lie in contrast to a true event. Longer RTs were expected when associating certainly true and white lie categories. The second aIAT was aimed at spotting the real reason, used to motivate the behaviour in a socially acceptable way, compared with a false reason. As aIAT represents memories and intentions using sentences, this feature renders the aIAT adequate to describe reasons in full.

METHODS

Participants

Twenty healthy volunteers took part in the experiment; 10 men and 10 women, with an age range of 23–58 years, and a mean age of 31 years. All of them had normal or corrected-to-normal vision and gave a signed informed consent.

Materials

Participants, in a preliminary written questionnaire, described the details of a white lie they told and the corresponding truthful position behind it. They were explicitly asked to report white lies they told at least a month before. We chose this temporary restriction thinking in advance of a forensic application, which often assumes investigating events happened even long time before testing. As a consequence, they reported lies

that were somehow salient. Even if this seems to collide with the daily basis on which white lies are told, we had to necessarily take this risk when interviewing participants. For example, one of our participants told her friend Maria of having seen Maria's ex-boyfriend going home alone (white lie), while instead she had seen him going back home with another woman (truthful description).

The participants were also asked to explain their real reason for the white lie; in other words, why did they lie? What did they want to obtain by lying? The participant, cited in the example earlier, reported that she lied because she wanted to protect her friend's feelings (real reason). Afterwards, participants were asked to imagine having been sincere and to report the consequences they would have run into. We built the counter reason as if that was what they wanted, in order that the real reason connected to the white lie could be compared with a false reason objecting the truthful description. It has been demonstrated that the autobiographical events that are selected for testing with

the aIAT should be mutually exclusive (Agosta et al., 2010). Accordingly, we presented subjects with mutually exclusive reasons. Back to our example, our participant would have been sincere for tattling so that was chosen as the false reason for lying.

After the interviews, the individual reports of the participants were classified on the basis of the taxonomy proposed by Vrij (2007) and Bond and De Paulo (2006). The classification of the results is set out in Table 1. Half of the participants had personal interests in lying, whereas the other half told a lie for someone else's benefit. Regarding the consequences of the lie, 60% wanted to gain advantage, whereas 40% of the participants lied in order to avoid costs. As regards the third dimension (i.e. psychological versus materialist reason), all the participants gave psychological reasons, as highlighted in the 'label' column in Table 1.

Table 2 shows the sentences and labels used to build the two aIATs (i.e. the white lie aIAT and the reason aIAT) in the case described earlier.

Table 1. Each participant's classification of their reasons to lie, according to the taxonomy proposed by Vrij (2007) and De Paulo et al. (1996). Each reason is classified on the basis of the benefit (self or other-oriented) and on the basis of the direction of the lie itself (gain advantage versus avoid cost)

| Subject | Benefit | | Direction | | Label |
	Self	Others	Gain advantage	Avoid costs	
1	✓		Maintain discretion		Decency
2	✓		Maintain harmony		Stability
3		✓	Protect feelings		Protection
4	✓		Sense of guilt		Reputation
5	✓			Avoid discussion	Discussion
6	✓		Appear polite		Education
7	✓			Circumvent discussion	Serenity
8		✓		Prevent anxiety	Apprehension
9		✓		Prevent regret	Displeasure
10	✓		Appear polite		Courtesy
11		✓	Protect feelings		Kindness
12	✓		Sense of duty		Care
13		✓		Prevent anxiety	Sensibility
14		✓		Prevent resentments	Caution
15		✓	Protect feelings		Protection
16		✓	Sense of duty		Responsibility
17		✓		Avoid concerns	Care
18		✓		Prevent discontent	Caution
19	✓		Maintain discretion		Discretion
20	✓		Appear polite		Courtesy

Table 2. Examples of sentences used in order to build the white lies aIAT and the reasons aIAT. Each aIAT was individually modified on the basis of each participant's white lie and reported truthful description

White lie sentences (woman)	True sentences (alone)
I have seen G. with a woman	G. went to bed by himself
I have seen G. with A.	I have seen G. going home alone
G. slept with a woman	G. went back home alone
I knew he was sleeping with someone	Nobody slept with G.
G. went back home with A.	I was the only girl in the house
Real reason (protection)	Fake reason (gossip)
I wanted to prevent her from being sad	I wanted to tattle
I was afraid I could let her down	I felt like tattling
I wanted to mind my own business	I thought she wanted to know
I wanted to be prudent	I wanted to tattle about her ex-boyfriend
I wanted to save her feelings	I wanted to blurt it out

In presenting the sentences on the computer screen the aIAT, as with any IAT, displays reminder labels at the top of the screen to help the subject by providing a reminder of which hand is responding to what. Certainly true and false sentences were labelled respectively as 'true' and 'false'. Reminder labels referred to autobiographical events, and the reasons were chosen on the basis of each participant's report. In the previous example, we chose 'work' for the white lie and 'relax' for the truthful description in the white lies aIAT, and 'caution' for the real reason and 'affront' for the false reason in the reasons aIAT.

Procedure

Participants were seated in front of a computer, and they were required to complete two aIATs (white lies and reasons aIAT) in two different orders of blocks (direct and reversed). For each of the four aIATs, participants were presented with one sentence at a time. Their task was to classify each sentence within the correct category by pressing one of two keys, one on the right and one on the left of the keyboard. Two labels, representing the names of the classification categories, were shown on the right and on the left of the monitor as reminders. Sentences, which were certainly true and certainly false, concerning the moment and location of the testing, were alternated with sentences concerning the autobiographical event and reason under investigation. An error signal appeared after every incorrect response.

White lies autobiographical Implicit Association Test

In the first block of stimuli, 20 sentences were randomly presented, and participants had to classify them correctly and as fast as possible using the A key (e.g. 'I'm sitting in front of a computer') for certainly true sentences, and the L key for the false ones (e.g. 'I'm sitting in front of a television'). In the second block, 20 sentences referring to the autobiographical event under investigation were presented. They had to press the A key if the stimulus was a sentence describing the truthful description and the L key for the white lie. For example, 'I've seen G. going back home with a woman' was correctly classified with the A key (Woman), and 'I've seen G. going back home alone' with the L key (Alone). In the third block (60 trials), participants had to classify certainly true sentences and truthful description sentences with the A key and certainly false and white lie sentences with the L key. Back to the previous example, 'I'm sitting in front of a computer' and 'I've seen G. with a woman' required classification with the A key, whereas 'I'm sitting in front of a television' and 'I've seen G. going home alone' were classified with the L key (congruent condition). In the fourth block (40 trials), the classification was the same as in the second one, but here the assigned keys were reversed; using the A key, participants classified sentences concerning the white lie, and with the L key, they classified sentences describing the truthful description. In the fifth block (60 trials), the A key was used to classify certainly true sentences and white lie sentences, and the L key was used to classify certainly false sentences and truthful description sentences (incongruent condition).

Reasons autobiographical Implicit Association Test

The first block was the same as in the white lies aIAT. In the second block, participants had to press the A key when the sentences referred to the real reason (e.g. 'I wanted to prevent her from being sad') and the L key for sentences related to the false reason (e.g. 'I wanted to tattle about her ex boyfriend'). In the third block (congruent block), participants had to press the A key for certainly true sentences and sentences related to the real reason (e.g. 'I'm sitting in front of a computer' and 'I wanted to prevent her from being sad'), whereas the L key was associated with certainly false sentences and false reason sentences (e.g. 'I'm sitting in front of a television' and 'I wanted to tattle about her ex boyfriend'). In the fourth block, the A key classified sentences concerning the false reason and the L key classified those describing what they reported as the real reason. In the fifth block (incongruent condition), certainly true sentences and false reason sentences were classified using the A key, whereas false sentences and real reason sentences were classified using the L key.

Each subject completed the two aIAT-types twice, in the direct and reversed order, for a total of four aIATs. The paragraphs earlier have described the direct order of the blocks. The reversed order differed from this as the position of the third (congruent) and fifth blocks (incongruent) were exchanged, and consequently also the position of the second and fourth blocks.

Previous studies showed that 'adding additional practice to the reversed single discrimination practice block (fourth block) will reduce pairing order effects and even eliminates them' (Nosek, Greenwald, & Banaji, 2005). We doubled the number of trials in the fourth block (compared with the first and second practice blocks), for this reason. The direct version of both tests was always administered first, and the two test types were counterbalanced. Participants were expected to have faster reaction times in the congruent than in the incongruent blocks.

DATA ANALYSIS

The dependent measure considered was the D index. Prior to any analysis, reaction times shorter than 150 milliseconds, and longer than 10 000 milliseconds, were discarded (Greenwald, Nosek, & Banji, 2003). The D-IAT expresses the difference between the two critical blocks in terms of the standard deviation of latency measures and includes a penalty for incorrect responses. The difference between the present D measure and the d measure of effect size is that the standard deviation in the denominator of D is computed from the scores in both conditions, ignoring the condition membership of each score. By contrast, the standard deviation used in computing the effect size d is a pooled within-treatment standard deviation. The D-IAT was calculated by subtracting the average reaction times of the congruent block from the average reaction times of the incongruent block and then dividing this difference by the inclusive standard deviation (Greenwald, Nosek, & Banji, 2003).

The D-IAT for white lies and reason aIAT was submitted to a one sample t-test for comparison with 0 (2 tails).

RESULTS

Separate analyses were conducted for white lies and reason aIATs, and the results of these are set out in the paragraphs, which follow.

White lies

Both, the D-IAT measured on the direct order (*mean* = 0.55, *SD* = 0.29; 100% of correct truthful descriptions identified) and the D measured on the reversed order (*mean* = 0.45, *SD* = 0.26; 100% of correct truthful description identified) significantly differed from 0 (respectively, $t_{(19)} = 8.236$, $p \le 0.001$ and $t_{(19)} = 7.698$, $p \le 0.001$).

Reasons

Also for the reason aIAT, the D-IAT of the direct and the reversed order differed significantly from 0 (respectively, $t_{(19)} = 9.579$, $p \le 0.001$; $t_{(19)} = 8.771$, $p \le 0.001$). Mean D-indexes were 0.46 (*SD* = 0.21) for the direct (100% of real reasons identified) and 0.50 (*SD* = 0.26) for the reversed (95% of correct real reasons identified) tests.

'Virtuousness' of reasons

False reasons on average were stated in a more negative fashion than real reasons. Thus, for a post-hoc analysis, we asked 10 participants (students, mean age 27, four men) to rate the virtuousness of each true and false reason, used in the main experiment, on a Likert scale from 1 to 10. The average 'virtuousness' for real reasons is 6.4, whereas for false reasons is 4.4 ($p \le 0.007$). On the other hand, the level of virtuousness does not seem to influence the D value; indeed, there is no difference in the D value of those comparisons in which the real reason is more virtuous than the false reason (0.48) and the (few) comparisons in which the false reason is more virtuous of the real reason (0.46). Moreover, there are no significant correlations between the difference in the virtuousness of the two reasons and the average D value ($r = -0.148$, $p < 0.53$) or the two single D-values, direct order ($r = -0.209$, $p < 0.38$) and reverse order ($r = -0.235$, $p < 320$).

In order to further disentangle the possible critical confound of 'virtuosness', we also run a control group of 10 participants (students, mean age 25.3, five men). Controls were matched with a subgroup of the 20 participants tested in the main experiment. Participants read the previous false reasons with negative valence and were asked to remember a specific episode in which one the same negative reasons was true for them. Control participants were then administered two-reason aIATs, both in the direct and reversed order. For control participants, the negative reason was true, and the positive reason was false. Also here, the D-IAT for the direct and the reversed order differed significantly from 0 (respectively, $t_{(9)} = 6.62$, $p \le 0.001$; $t_{(9)} = 2.39$, $p \le 0.04$). Mean D-indexes were 0.65 (*SD* = 0.31) for the direct (100% of real reasons identified) and 0.40 (*SD* = 0.52) for the reversed (80% of correct real reasons identified) tests. No significant difference was found between direct and reversed order ($t(9) = 1.31$, $p < 0.224$).

Criterion for D-IAT validity

Here, we also considered the appropriate criterion for judging that the aIAT identified a true (or false) memory. On the basis of our review of the literature (paper submitted for publication), we identified a window around D = 0 where the single subject classification accuracy falls below 80%. We set a [-0.2; 0.2] window in which we consider the D-IAT effect as 'small'. In the two experiments presented here (white lies and reasons aIAT), averaging the two D-IATs (direct and reversed order); only one subject (average D = 0.07) fell into that window in the reason aIAT. Taken singularly, for each order and type of aIAT we have 3/20 subjects that fall into the -0.2 – 0.2 window. Regarding the 'virtuosness' control group, in the direct order participants' D-values were above 0.2, while in the reversed order eight participants D-values were above 0.2 value

DISCUSSION AND CONCLUSIONS

Studies on white lies and reasons for lying have been mainly focused on fine-tuning the taxonomy (Bond & De Paulo, 2006) and, to our knowledge, no previous investigations have been carried out in order to develop a procedure for distinguishing truthful descriptions of autobiographical events from white lies, and their underlying real reasons from false reasons.

In this study we used a variant of the Implicit Association Test, the autobiographical Implicit Association test (the aIAT) in order to validate a procedure for identifying deception and its corresponding underlying reasons (Sartori et al., 2008). White lies are social lies, they are the result of social pressures in our daily lives. They help people preserve the peace in routine interactions, especially in contexts that have certain demands for personal conduct, like the workplaces (Shulman, 2007) and, we expect, the forensic contexts.

An example of white lie is: 'I told her she looked well, and her voice sounded good, when she looked less well than she did a few weeks ago'. Its corresponding reason is, 'Not to add worry as she undergoes chemotherapy treatments' (De Paulo et al., 1996). Standards of tact and politeness and expectations can make deception, to some degree, almost inevitable (Feldman, 2009a, 2009b).

This experiment collected participants' reports of their own white lies and the corresponding truthful descriptions. For example, one of our subjects reported that she told her friend Maria of having seen her ex-boyfriend going home alone (white lie), while instead she had seen him going back home with another woman (truthful description). As different subjects reported different white lies every subject was given a specific aIAT.

The results indicate that the aIAT accurately discriminated truthful descriptions from white lies in all of the 20 participants. This identification was relying on a high average D value: 0.55 (direct aIAT) and 0.45 (reversed aIAT) and can be interpreted as a correspondence between the truthful description and the real autobiographical memory, and between the white lie and the false memory. The accuracy of the white lies aIAT is comparable with the one previously reported for other autobiographical memories (Sartori et al., 2008). Even if white lies seem to be benevolent and may be produced in order to avoid embarrassment or other

unpleasant emotions, this characteristic does not interfere with the average accuracy of the aIAT.

Discriminating lies and true statements is a precursor to a correct reconstruction of the events pertaining to a trail. Consequently, many techniques were developed in order to evaluate the truthfulness of reports and expose simulators and dissimulators. Some tools aim at identifying physical and biochemical signs of the emotional state of the examinee (polygraph, thermal imaging, voice stress analyzers, P300, TDCS, fMRI); others evaluate the veracity of statements, like *Statement Analysis* (Adams, 1996), *Statement Validity Assessment* (SVA; Raskin & Esplin, 1991; Porter & Yuille, 1996) and *Reality monitoring* (Johnson & Raye, 1981). Others, like personality inventories, take into account the link between deception and social desirability: in these cases, the subject wants to appear as he or she thinks the examiner wants him or her to be or as social conventions provide (De Cataldo Neuburger, & Gulotta, 2008). White lies are often the result of social desirability and may then be common in a forensic setting. This study provides evidence that this type of lies can be detected with the aIAT.

With regard to reasons for producing white lies, the same subjects were administered, an aIAT aimed at distinguishing their real reason and a designedly created false (but plausible) reason. In the previous example (see the sentences reported in Table 2), our participant lied in order to protect her friend's feelings (real reason) instead of being honest tattling about her friend's ex-boyfriend (false reason).

Results indicated that the aIAT can identify the real reason for telling a white lie in 19/20 of the subjects, with a D value of 0.46 (direct aIAT) and 0.50 (reversed aIAT). Only for one subject in the reversed order the aIAT did not classify correctly the truthful description.

A major point, related to the potential forensic application of the aIAT, concerns the appropriate criterion for judging that the aIAT identified a true (or false) memory. On the basis of our review of the aIAT literature (paper submitted for publication), as highlighted in the result session, we set a $[-0.2; 0.2]$ window in which we consider the D-IAT effect as 'inconclusive'.

More importantly, the forensic applicability of the aIAT critically depends on many complex factors. Schauer (2010) highlights a critical difference in terms of prosecution and defence, whereas the prosecutor, for sending people to prison, requires certainty 'beyond any reasonable doubt', in defence terms, it is enough to install a 'reasonable doubt'. From this point of view, a technique that may be unsatisfactory on the prosecution side could be useful on the defence side. Moreover, an innocent subject might be motivated in adding evidences to his or her side, whereas a guilty suspect will not collaborate in collecting data that might add further evidence against him or her.

The aIAT is a memory detection technique that can identify a true event in contrast with a white lie on the basis of implicit associations. In this research, aIAT reached 100% accuracy in identifying the truth and consequently also the lie.

Moreover, the same instrument was successfully used in order to identify the real reason for telling the white lies in contrast with a false reason. These results open the possibility to improve our research on the reasons underlying our behaviour with the aIAT.

REFERENCES

Abe, N. (2011). How the brain shapes deception: An integrated review of the literature. *The Neuroscientist*, 17 (5), 560–574.

Adams, S. H. (1996). Statement analysis: What do suspects' words really reveal? *FBI Law Enforcement Bulletin*, 12–20.

Agosta, S. (2005). A new lie-detector based on the IAT. *Master Degree Thesis*, Unpublished, University of Padua.

Agosta, S., Ghirardi, V., Zogmaister, C., Castiello, U., & Sartori, G. (2010). Detecting fakers of the autobiographical IAT. *Applied Cognitive Psychology*, 25(2), 299–306.

Agosta, S., Castiello, U., Rigoni, D., Lionetti, S., & Sartori, G. (2011). The detection and the neural correlates of behavioral (prior) intentions. *Journal of Cognitive Neuroscience*, 22(12), 3888–3902.

Bond, C. F. Jr., & De Paulo, B. M. (2006). Accuracy of deception judgements. *Personality and Social Psychology Review*, 10(3), 214–234.

De Cataldo Neuburger, L., Gulotta, G. (2008). *Trattato della menzogna e dell'inganno*. Milano: Giuffrè.

De Paulo, B. M., Kashy, D. A., Kirkendol, S. E., Wyer, M. M., & Epstein, J. A. (1996). Lying in everyday life. *Journal of Personality and Social Psychology*, 70 (5), 5979–5995.

Feldman, R. (2009a). *The liar in your life: The way to truthful relationships*. New York: Hachette Book Group.

Feldman, R. S. (2009b). *Liar: The truth about lying*. Croydon, UK: Virgin Books.

Ganis, G., Kosslyn, S. M., Stose, S., Thompson, W. L., & Yurgelun-Todd, D. A. (2003). Neural correlates of different types of deception: An fMRI investigation. *Cerebral Cortex*, 13, 830–836.

Ganis, G., & Keenan, J. P. (2009). The cognitive neuroscience of deception. *Social Neuroscience*, 4 (6), 465–472.

Granhag, P. A., & Vrij, A. (2005). Detecting deception. In N. Brewer, & K. Williams (Eds.), *Psychology and law: An empirical perspective*. New York: Guilford Press.

Greenwald, A. D., McGhee, D. E., & Schwarz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216.

Hu, X., Rosenfeld, J. P., & Bodenhausen, G. V. (2012). Combating automatic autobiographical associations: the effect of instruction and training in strategically concealing information in the autobiographical Implicit Association Test. *Psychological Science*, 23, 1079–1085.

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review*, 88, 67–85.

Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin*, 31, 166–180.

Porter, S., Yuille, J. C. (1996). The language of deceit: An investigation of the verbal clues to deception in the interrogation context. *Law and Human Behavior*, 20, 443–459.

Raskin, D. C., Esplin, P. W. (1991). Statement validity assessment: Interview procedures and content analysis of children's statements of sexual abuse. *Behavioral Assessment*, 13, 265–291.

Sartori, G., Agosta, S., & Gnoato, F. (2007). High accuracy detection of malingered whiplash syndrome. Paper presented at the International Whiplash Trauma Congress, Miami, FL.

Sartori, G., Agosta, S., Zogmaister, C., Ferrara, S. D., & Castiello, U. (2008). How to accurately detect autobiographical events. *Psychological Science*, 19, 772–780.

Serota, K. B., Levine, T. R., Franklin, J. B. (2010). The prevalence of lying in America: *Three studies of self reported lies*. *Human Communication Research*, 36, 2–25.

Shulman, D. (2007). *From hire to liar: The role of deception in the workplace*, Ithaca, New York: Cornell University Press.

Schauer, F. (2010). Neuroscience, lie-detection and the law. Contrary to the prevailing view, the suitability of brain-based lie-detection for courtroom or forensic use should be determined according to legal and not scientific standards. *Trends in Cognitive Sciences*, *14*, 101–103.

Spence, S. A. (2004). The deceptive brain. *Journal of the Royal Society of Medicine*, *97*(1), 6–9.

Verschure, B., Prati, V., & De Houwer, J. (2009). Cheating the lie detector: Faking the autobiographical IAT. *Psychological Science*, *20*, 410–413.

Vrij, A. (2007). *Detecting lies and deceit: Pitfalls and opportunities*. 2nd edn. Wiley series in the psychology of crime, policing and law. UK: University of Leicester.