Cognition, Brain, Behavior. An Interdisciplinary Journal
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ISSN: 1224-8398
Volume XVIII, No. 4 (December), 283-297

WHICH CAME FIRST, THE TRUTH OR THE LIE? EFFECTS OF ORDER AND HABITUATION IN THE REACTION TIME-BASED CONCEALED INFORMATION TEST

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ABSTRACT

Most of the research on deception suggests that lying is significantly more costly from a cognitive point of view than truth-telling. This was documented by increased reaction times and decreased accuracy of deceptive responses. Recent evidence, however, indicates that the "dominance" of the truth response is malleable and that it can be altered through practice, in which case the deceptive response can become prepotent, thus less cognitively demanding. Our objective was to assess how initial deceptive responses affect subsequent truth telling and vice-versa in the Reaction Time-based Concealed Information Test (RT-based CIT). In order to reach our objective we administered the RT-based CIT to two experimental groups, one in which subjects were instructed to tell the truth about recognizing items from a mock crime in a first block, and then to deny it in a second block, and another group in which subjects first lied, and then told the truth. Results indicated that deceptive responses took longer and were less accurate in the Truth first group than in the Lie first group, suggesting that repeated practice with the truth negatively impacts subsequent deceptive responses. Interestingly, the opposite effect was also noted, meaning that subsequent honest responses were less accurate in subjects who practiced deception in the initial block. This suggests that performance on the RT-based CIT can be manipulated through previous exposure to tasks that require repeated truth telling or lying about crime-related items.

KEYWORDS: *memory detection, Reaction-time based Concealed Information Test, cognitive cost, practice effects, truth-telling, deception*

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INTRODUCTION

Truth has been considered a baseline, almost automatic output of the cognitive system (Spence, 2004). Lying or concealing information, on the other hand, is not considered a default response, and is generally viewed as more cognitively demanding than truth-telling (Vrij, Visser, Mann, & Leal, 2006; Vrij, Mann, & Leal, 2011). This is because deceptive responses not only require the inhibition of truthful ones, but also rely on creating an alternative version to the truth, on making sure this version remains consistent across time, and on monitoring the reaction of the interlocutor. Because of this greater complexity, it is not surprising that lying has been found to incur larger temporal costs compared to truth-telling. This idea is supported by evidence from an increasing number of studies using reaction-time as the main outcome of deception detection tasks (Farrow et al., 2003; Seymour, Seifert, Shafto, & Mosmann 2000; Seymour & Kerlin, 2008; Sheridan & Flowers, 2010; Spence, Farrow, Herford, Wilkinson, Zheng, & Woodruff, 2001; Vendemia, Buzan, & Simon-Dack, 2005; Verschuere & De Houwer, 2011; Visu-Petra, Miclea, & Visu-Petra, 2012; Walczyk, Roper, Seemann, & Humphrey, 2003). An essential fact about these studies is that the subject does not know beforehand what the truth value of the answer to an upcoming question will be (Sheridan & Flowers, 2010). Thus, the participant cannot prepare a response in anticipation. This means that he or she has to process the information in real time. In this context, created for example by the RT-based CIT (see the description below), the truth appears to be the default setting of the cognitive system (and of the perceptual motor system, as indicated by studies such as Duran, Dale, & McNamara, 2010) and producing a non-default response takes time because the automatic response must be suppressed and replaced with a deceptive one.

The preliminary findings of Sheridan and Flowers (2010) suggest that, regardless of the cognitive processes implicated by the complexity of the task or the manner of response, lying takes more time than telling the truth, called “the lying constant”. This means that the requirement of an additional amount of time to lie is present mostly because the truth needs to be inhibited so that the lie can be produced. However, a different hypothesis could be put forward: if the lie is the habitual response, a subsequent true statement could require a similar additional amount of time for inhibiting the deceptive response, which has become the prepotent one. Such an exercised prepotent value of the deceptive response may be a natural state of the cognitive system in the case of pathological liars (Dike, Baronoski, & Griffith, 2005; Yang, Raine, Narr, Lencz, LaCasse, Colletti, et al., 2007). This state can also be experimentally induced by frequent repetition of a deceptive response referring to certain critical incidents/stimuli, followed by the solicitation of a truthful response regarding the same incidents/stimuli. Two things need to be taken into consideration when analyzing this type of research. One is the *order effect*, which refers to the influence of initially telling the truth/lying on subsequently lying/ truth-telling. The other is the *habituation effect*, which refers to how repeated/habitual the communication of a truth/lie needs to be, in order to influence the subsequent communication of the lie/truth.

To our knowledge, there are some preliminary studies which have tackled these two effects. For example, Osman, Channon, and Fitzpatrick (2009) have investigated the detrimental effect of truth telling upon subsequent lying (and vice-versa) in a forced-choice paradigm based on a blocked design. Similar to their line of reasoning regarding truth telling, we hypothesized that constant lying demands lead to the development of a task set (Mayr & Kliegel, 2000), and generate switching costs when another task set (i.e., truth telling) is demanded. However, this hypothesis was not supported by the results obtained by Osman et al. (2009), as the subjects who told the truth/lied first were not slower, but actually had faster reaction times in their subsequent deceptive/truthful responses. However, there are several shortcomings of this study (see Debey, Liefooghe, De Houwer, & Verschuere, 2014) which make its results difficult to integrate in the current analysis. Vendemia, Buzan, and Green (2005) designed a task-switching study which required participants to alternate between truth-telling and lying about the self on a trial-to-trial basis. They obtained longer RTs and more errors for deceptive responses; however, this type of design did not permit participants to build a task set for lying or truth telling. Previous results from a study on the habituation effect (Verschuere, Spruyt, Meijer, & Otgaar, 2011), revealed that when practiced repeatedly, lying "moves toward becoming the dominant response", interfering with subsequent acknowledgement of the truth. Also, several studies found participants who practiced lying to be more efficient liars than participants who practiced telling the truth in the training phase of the experiment (Verschuere et al., 2011; Van Bockstaele et al., 2012). In another study, Hu, Chen, and Fu (2012) used a *Differentiation of Deception Paradigm* (Furedy, Davis, & Gurevich, 1988) and found that instruction and training can significantly reduce reaction time in the case of deceptive responses. However, recently, Debey et al. (2014) investigated the cognitive costs of trial-by-trial switching between lying and truth telling. They used an RT-based deception task (the Sheffield lie test) with YES/NO questions about experimentally induced activities and neutral autobiographical facts. Their results suggested that there was no difference in terms of accuracy and reaction time between the cost of switching from lying to truth-telling and the cost of switching from truth-telling to lying, which means that task switching itself does not bring an essential contribution to the cognitive cost of lying. However, in the present study, we are using a different paradigm, the RT-based CIT and a blocked design in order to allow for habituation with an initial response (truthful or deceptive) and assess its impact on the opposite response.

The *Concealed Information Test (CIT)*, initially referred to as the *Guilty Knowledge Test* (Lykken, 1959) is a memory detection technique that works by revealing differences in physiological and behavioral responses (RT's) to certain stimuli between guilty* individuals who took part in a mock crime scenario and innocent individuals, who did not take part in the mock crime. In this recognition test, the participant is presented with several items, among which a critical or relevant item from the mock crime is embedded. For example, if the getaway car war blue, a question could be formulated as follows: The getaway car had a specific color. This was: a) green, b) red, c) white, d) *blue,* e) black. The rationale behind the original CIT is that only guilty participants would recognize the critical items (i.e. blue) from the mock crime, while the innocent participants will not be able to distinguish between critical items and irrelevants. Decades of research have consistently showed that the physiological reactions of the guilty participants to critical items are different from those of innocent participants (see Ben-Shakhar, 2012, for a review). To summarize, the purpose of the test is to disclose the possession of information that one has but is unwillingly to admit or recognize.

In the Reaction Time-based Concealed Information Test (RT-based CIT, Seymour & Kerlin, 2008; Verschuere, Crombez, Degrootte, & Rosseel, 2009) subjects are also presented with critical and irrelevant items, but a third category of items is introduced: the *"target"* items, which are items belonging to the same categories as the critical items (called here "probes") and the irrelevants, and are explicitly told to remember them. When they see a target item, subjects have to admit the fact that they recognize it by pressing a certain key (*Yes* response) as fast as possible and when they see a probe or irrelevant item, they have to deny the fact that they recognize it, by pressing another key (*No* response); the irrelevants also require a NO response, because the subject had never encountered them before. Each item is presented one at a time on the screen and the subject has to make a speeded response (under a second) by pressing one of the two keys. A "concealed information effect" is obtained by contrasting the reaction times and accuracy of the responses to probe items and irrelevant items. The bigger the difference between the two types of items, the larger the "concealed information effect". Several studies that used the RT-based CIT indicate that only guilty subjects present longer reaction times and poorer accuracy in their responses to probe items compared to irrelevant ones (Gamer, Bauerman, Stoeter, & Vossel, 2007; Seymour & Kerlin, 2008; Seymour et al, 2000; Verschuere et al., 2010; Visu-Petra et al., 2012). The validity of this procedure is also supported when compared to the classical CIT based on physiological measures (Verschuere et al., 2010; Visu-Petra, Buş, & Miclea, 2011).

Truth telling could be an automatic state of the cognitive system, unaffected by previous lies. However, telling the truth after having previously denied it might be resource consuming. In the RT-based CIT, this should be visible in enhanced RTs/error rates. We are currently exploring, in a blocked design, how repeated

* We are using the term only in order to indicate that some participants committed a mock crime (a standard procedure in this area of research) and have no intention to refer or to emphasize the emotion of guilt. Throughout the text the term refers only to the experimental group.

initial lying would differentially affect subsequent truthful responses (and vice-versa) to crime-related items (probes), and to irrelevant items in an RT-based CIT. Considering that previous studies that used a blocked design in another experimental paradigm have yielded inconsistent results, our investigation could bring additional evidence for the dynamic interplay of truthful and deceptive responses in a memory detection context. Based on the preliminary literature in this direction, we anticipated that establishing a specific response set (deceptive or truthful) will negatively impact the opposite type of response, which will be translated in increased errors and RTs for this subsequent response. However, an alternative possibility is that only practiced truthful responses will interfere with subsequent deceptive ones, and not vice-versa, since the truth is considered to represent a ”default” state of the cognitive system.

METHOD

Participants

The participants were bachelor level psychology students (N = 43). The majority of them were females (81.40%) and they voluntarily took part in the study after being recruited during classes or after going through an online recruitment system. The participants were all in their first (32%) and second (68%) year of study, their ages ranging from 19 to 39 years (M = 21.83; SD = 3.9). All of them had normal or corrected-to-normal vision and wore glasses or contact lenses if necessary. All subjects initially went through a mock crime scenario, followed by the RT-based CIT for which participants were divided in two groups: a Truth first group (n = 23) and a Lie first group (n = 20).

Instruments - RT-based CIT

After committing a mock crime (see below), participants were invited in another room where a different experimenter conducted the session. In this procedure, an RT- based CIT test was administered. The items utilized in this study were pictures belonging to three categories of items: *probes* (the six critical items from the mock crime), *targets* (items that had to be detected, also from the same category as the probes) and *irrelevants* (four of them for each probe; items that are also from the same category as the probes, but were not previously encountered during the experiment). The six targets were presented at the beginning of the recognition test; the subjects viewed a presentation with the six target items, each item being presented on the screen for 10 sec. The instructions specified that the task consisted in memorizing the physical characteristics of each item in order to reproduce them later. After three successive runs of the presentation, the subject was required to describe each item. A minimal standard was applied in order to ensure good retention, consisting of a minimum of four relevant features of each item (e.g., color, shape etc.); when the standard was not met, the subject viewed the item in question for an extra 10 sec. Finally, after the verbal description of the target items, the subjects viewed the presentation once more.

For the item presentation and response time recording, the Superlab v. 2.0 software was used. Each picture was approximately 15 x 15 cm, except the items referring to names, which were approximately 20 x 10 cm. Each item remained on the screen for 1000 ms, after which, if a response was not given, a "too slow" message appeared. The inter-trial interval varied randomly between 500, 800 and 1000 ms in order to prevent automatic responding or preparation.

Two blocks of trials were used for both the Lie first and the Truth first groups. In the Lie first group (which is actually the standard way in which the RT-based CIT is used), all participants were instructed in the first block to respond by pressing a *Yes* button when they saw target items and a *No* button when they saw any other items, in order to conceal the fact that they took part in the "theft". There was a total of 108 trials/block (each probe, target and irrelevant was presented three times in random order). These instructions were repeated in a more concise version by being presented on the computer screen at the beginning of the test session. Emphasis was placed on the need to respond as quickly as possible to all the items (including the targets). Afterwards they were administered the Truth second block, in which they were required to admit recognition of all items they had encountered before. In the Truth first group, the order of these two blocks was reversed. The test began after a short training phase.

After task completion, a memory test was used in order to ensure that the subjects had remembered the target items. At the end of the experiment, participants were debriefed.

Procedure - Mock crime

The scenario (similar to the one used in Visu-Petra et al., 2012) took place in an official building of academic staff where participants committed the mock crime and interacted with the critical items. More specifically, upon arrival, each participant received a set of written instructions requiring them to steal the questions for an upcoming exam. They had to go into Professor Anton Ionescu's office, which was on the same floor of the building, and locate a black laptop bag in that room, with a Traxdata CD case inside. Then they had to open the CD case to verify if the CD with the exam subjects was inside and this is when they would notice that there is also a 100 RON banknote inside the CD case (approximately 20 Euros). They were also instructed to take a mobile phone and a photo camera from the professor's desk and put them, along with the CD and the money, in the black bag and bring it to the examination room. To make the situation more realistic, they were also told that the people working in the building are oblivious to the fact that this experiment is taking place, and they should be cautious not to be seen behaving suspiciously. When the participant returned, he/she was asked to verbally describe each item. This was done in order to ensure that the items and their characteristics were better encoded. Next, the items were taken out of sight and the participants received written instructions mentioning the fact that they are suspects in a theft and they will undergo a behavioral test, the purpose of which is to assess if they were involved in the crime or not.

RESULTS

RT-based CIT

First, descriptive data for all study measures (accuracy and RT), according to Stimulus type (Irrelevant, Probe or Target), Group (Truth first vs. Lie first), and to Condition (Lie vs. True) are presented in Table 1. In order to analyze the RT data, an elimination of outliers was first conducted. Since there was an established upper limit for RTs, we only eliminated responses faster than 200 ms as outliers (1.25 % of the data). We also removed additional outliers by excluding from the analysis reaction times that are lower than 3 standard deviations below the mean per condition for each participant (a further 0.44 % of the data). Regarding the accuracy scores for the CIT, mean percent correct of the responses to irrelevants and (deceptive) responses to probes were first calculated (Table 1). In order to directly compare these percentages, an arcsine transformation was then applied to this data (Cohen, 1988, cf. Gamer et al., 2007).

Table 1
Descriptive data for all study measures (accuracy and RT), according to Stimulus type (Irrelevant, Probe or Target), Group (Truth first vs. Lie first), and to Condition (Lie vs. True)

		TRUTH FIRST				LIE FIRST			
		TRUTH	SD	LIE	SD	LIE	SD	TRUTH	SD
RT	Irrelevant	683.59	71.82	655.21	65.16	630.79	60.81	629.66	100.90
	Probe	684.10	67.00	810.60	80.82	706.38	81.68	746.88	103.04
	Target	710.45	85.12	841.65	107.52	770.47	77.61	685.35	103.41
ACC	Irrelevant	92.33	3.31	94.45	3.21	98.44	2.34	97.94	2.93
	Probe	88.39	4.31	82.70	7.33	94.36	7.35	87.83	9.66
	Target	87.65	5.29	81.89	8.93	87.10	9.50	94.26	6.32

Note. RT = mean reaction times; ACC = mean accuracy (percent correct)

Reaction time

A mixed design ANOVA with Condition (Lie vs. True), and Stimulus type (probe vs. irrelevant) as within-subject variables and Group (Lie first vs. Truth first) as a between-subject variable revealed a non-significant effect of Group $F(1, 42) = 2.48$, n.s., meaning that overall RTs were not significantly longer in the Truth first group than in the Lie first group. There was also no significant main effect of Condition, $F(1, 42) = 1.45$, n.s., suggesting that overall RTs were not significantly longer in the Lie condition than in the True condition. There was, however, a significant main effect of Stimulus type $F(1, 42) = 200.74$, $p < .01$, partial $\eta^2 = .83$, revealing that, across conditions and groups, responses to probes (M = 736.99, SE = 10.66) were significantly slower than responses to irrelevants (M = 649.81, SE = 9.50). Furthermore, there was a significant Group X Condition interaction, $F(1, 42) = 7.95$, $p < .01$, partial $\eta^2 = .16$. Post hoc independent samples t-tests suggest that, while overall RTs for the True condition did not significantly differ between the two groups $t(42) = .18$, n.s., overall RTs for the Lie condition were significantly longer in the Truth first group (M = 732.91, SE = 13.93) than in the Lie first group (M = 668.59, SE = 14.59), $t(42) = 3.19$, $p < .01$. There was no significant Group X Stimulus type interaction, $F(1, 42) = 2.25$, n.s. On the other hand, a significant Condition X Stimulus type interaction was found, $F(1, 42) = 24.46$, $p < .01$, partial $\eta^2 = .37$, meaning that, as indicated by post hoc paired samples t tests, RTs to probes were significantly longer in the Lie condition (M = 760.86, SE = 14.47) than in the True condition (M = 714.06, SE = 13.69), $t(43) = 2.53$, $p < .05$, but there was no significant difference between the RTs in response to irrelevants between the two conditions, $t(43) = 1.07$, n.s. The three-way Group X Condition X Stimulus type interaction was also found to be significant, $F(1, 42) = 73.64$, $p < .01$, partial $\eta^2 = .64$. The post hoc analyses, in which we used paired samples t tests within each group, indicated that, in the Lie first group, RTs to irrelevants did not differ significantly between the two conditions, $t(20) = .06$, n.s., and neither did RTs to probes, $t(20) = 1.80$, n.s. But, in the Truth first group, RTs to probes were significantly longer in the Lie condition (M = 810.60, SE = 16.85) than in the True condition (M = 684.10, SE = 13.97), $t(22) = 8.38$, $p < .01$, although RTs to irrelevants were still not significantly different between the two conditions, $t(22) = 1.62$, n.s. Moreover, in the Lie first group, there was a tendency for responses to probes to take longer in the initial Lie condition (M = 760.86, SE = 14.47) than in the True condition (M = 714.06, SE = 13.69), although this tendency was not statistically significant, $t(20) = 1.80$, $p = .095$. It remains plausible that in a larger sample, this tendency could become significant. Also, RTs to irrelevants did not differ significantly between the two conditions in the Lie first group, $t(20) = .06$, n.s.

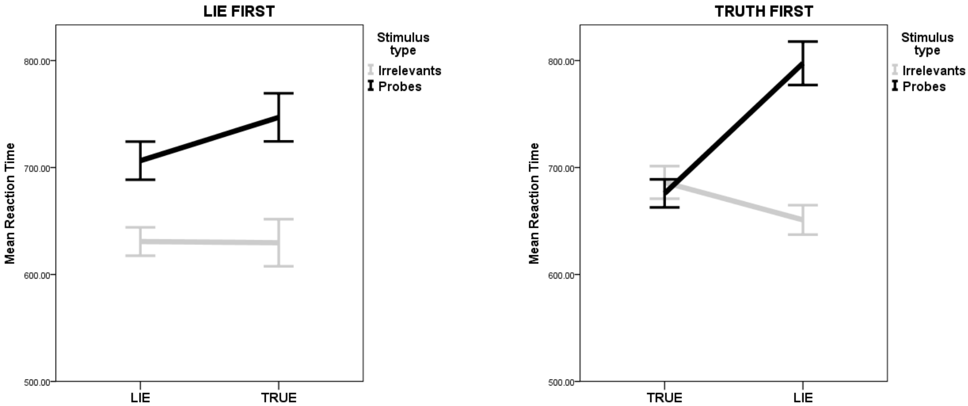

Figure 1.
Reaction times according to Group (Lie first vs. Truth first), Condition (Lie vs. True) and Stimulus type (Irrelevants vs. Probes). Error bars are at +/- 1 SE.

Accuracy

The same mixed design ANOVA was applied to the accuracy data. A significant main effect of Group was found, $F(1, 42) = 39.49$, $p < .01$, partial $\eta^2 = .49$, indicating that overall accuracy was significantly higher in the Lie first group ($M = 1.39$, $SE = .02$) than in the Truth first group ($M = 1.25$, $SE = .02$). No significant main effect of Condition was found, $F(1, 42) = 2.62$, n.s., meaning that accuracy was not significantly higher in the Lie condition than in the True condition. A significant main effect was found for Stimulus type, $F(1, 42) = 129.40$, $p < .01$, partial $\eta^2 = .76$, which suggests that responses to probes ($M = 1.25$, $SE = .02$) were significantly less accurate than responses to irrelevants ($M = 1.39$, $SE = .01$) across groups and conditions. Furthermore, the Group X Condition interaction was also found to be significant, $F(1, 42) = 7.61$, $p < .01$, partial $\eta^2 = .15$. Post hoc independent samples t tests indicated that overall accuracy for the Lie condition was significantly higher in the Lie first group ($M = 1.42$, $SE = .02$) than in the Truth first group ($M = 1.24$, $SE = .01$), $t(42) = 6.84$, $p < .05$, and the accuracy for the True condition was also significantly higher in the Lie first group ($M = 1.35$, $SE = .03$) than in the Truth first group ($M = 1.26$, $SE = .01$), $t(25.85) = 3.20$, $p < .01$. No significant Group X Stimulus type interaction was found, $F(1, 42) = 1.76$, n.s. The Condition X Stimulus type interaction was also found to be non-significant, $F(1, 42) = .022$, n.s. Finally, a significant Group X Condition X Stimulus type interaction was found, $F(1, 42) = 21.12$, $p < .01$, partial $\eta^2 = .34$. Paired samples t tests within each group were applied post hoc, and showed that, for the Lie first group, responses to probes were significantly more accurate in the Lie condition ($M = 1.38$, $SE = .04$) than in the True condition

(M = 1.24, SE = .04), t(20) = 2.79, p < .05, while responses to irrelevants did not differ significantly in accuracy between the two conditions, t(20) = .20, n.s.. In the Truth first group, responses to irrelevants were significantly more accurate in the Lie condition (M = 1.34, SE = .01) than in the True condition (M = 1.30, SE = .01), t(22) = 2.37, p < .05, and responses to probes were significantly more accurate in the True condition (M = 1.23, SE = .02) than in the Lie condition (M = 1.15, SE = .02), t(22) = 3.52, p < .01.

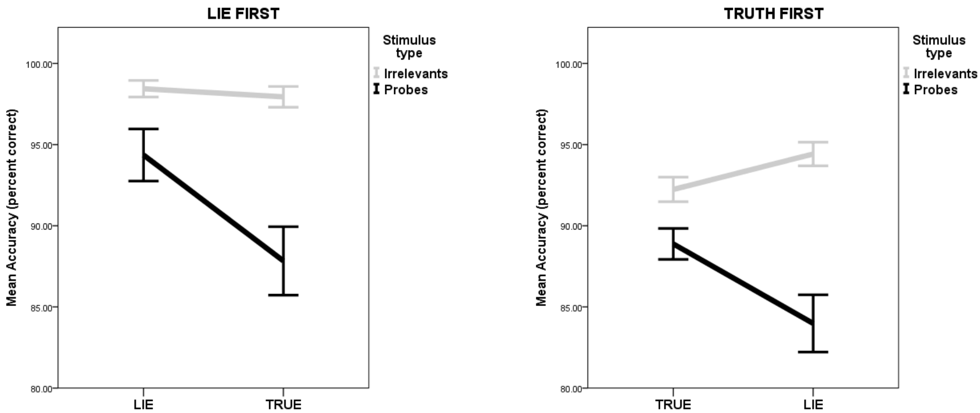

Figure 2.
Accuracy (percent correct) according to Group (Lie first vs. Truth first), Condition (Lie vs. True) and Stimulus type (Irrelevants vs. Probes). Error bars are at +/- 1 SE.

DISCUSSION

The purpose of this research was to analyze the potential interference between lying/truth telling and subsequent truth telling/lying. The impact of repeated interrogations upon verbal and non-verbal cues to deception has been previously investigated (Granhag & Stromvall, 2002), but not when lying and truth telling demands alternated. From the perspective of a general-purpose cognitive control mechanism subserving deceptive responses, switching to another response mode (telling the truth) after establishing a mental set (deception) should incur additional processing costs. An alternative view would be that there are deception-specific and truth-specific mechanisms, with truth being a baseline, automatic feature of the cognitive system; therefore, telling the truth should always be faster and easier than deceiving.

Our results revealed substantial differences between distinct item categories across these two test conditions and the two groups. As hypothesized, responses to *probes* - that is, to critical items previously encountered during the mock crime scenario - were significantly slower and less accurate than responses to irrelevants, which marks the presence of the concealed information effect. This is also supported by the fact that responses to probes when lying were significantly longer than responses to probes when telling the truth. Also worth mentioning is the fact that the participants who had to lie first delivered more accurate responses than the ones who had to tell the truth first. Furthermore, when they lied, after initially having told the truth, their responses were slower and less accurate. Their responses were also less accurate (and tended to be slower) when they had to tell the truth, after having initially lied. For the *irrelevant* items – items belonging to the same general category, but not encountered during the mock crime - when participants were required to lie, after initially having told the truth, their responses were more accurate, going in an opposite direction to the pattern of aforementioned responses to probes. Although responses to irrelevant items should theoretically stay the same, this increase in accuracy may be explained by the effect of practice with the same type of response across the two conditions. This practice effect was not visible in the case of probes, for which shifting to an opposite response was required in the second condition.

How can we explain the decrease in accuracy – and the tendency towards an increase in response time – of truthful responses to probes after repeated practice with deceptive responses to the same items? As suggested by the results of Verschuere et al. (2011), when practiced repeatedly, lying "moves toward becoming the dominant response" interfering with subsequent acknowledgment of the truth. Two types of explanations might relate to this effect. First, a task switching hypothesis would suggest that after developing a task set for certain stimuli (i.e., lying for probes), switching to another response (telling the truth) would incur additional costs for the cognitive system (Rogers & Monsell, 1995). For the other stimulus types (targets and irrelevants), no switching costs are implied, the response being identical to the previous task set. Van Bockstaele et al. (2012) found that participants who lie more frequently have less difficulty lying than participants who tell the truth more frequently. Furthermore, they found that this effect of practice can endure over time, although it is limited to the specific stimuli used for practice. Hu et al. (2012) also found that instruction and training can significantly reduce the difference in reaction time between deceptive and honest responses. In fact, they discovered that this reaction time difference can be significantly reduced by simply explaining to the participants how the detection procedure works and instructing them to try and speed up their responses. Furthermore, another study conducted by Hu, Rosenfeld and Bodenhausen (2012) showed that this type of "speed up" instruction can actually reduce reaction time discrepancies enough for the deceptive responses of the participants to remain undetected. However, Hu et al. (2012b) made use of a different approach, using an autobiographical implicit associations test (aIAT), while Hu et al. (2012) used a Differentiation of Deception Paradigm (DDP, Furedy et al., 1988). The difference between these results may be explained by the fact that the two approaches involve different types of stimulus-response conflicts. Specifically, the aIAT stimulus-response conflict concerns recently established mental associations (see also Hu & Rosenfeld, 2012), while the DDP stimulus-response conflict concerns long-term mental associations (Hu et al., 2012). Since our design was based on switching from a “lie mode” to a “truth mode” (or vice-versa), it is possible that the results in the second condition are a simple reflection of task-switching costs, as they reveal a tendency for the truthful responses related to probes to be less accurate than the deceptive ones, when the latter were in the first condition, and more accurate than the deceptive ones, when the latter were in the second condition. Responses were also significantly slower for probes in the second condition than in the first one, but only when the first condition required participants to tell the truth and the second one required them to lie. Because responses to irrelevants are truthful in all conditions, there should be no task-switching costs. The fact that responses to irrelevants did not significantly differ between conditions only in terms of accuracy and only when participants had to lie after having told the truth, further supports the idea that our results reflect task-switching costs. This is because even when responses differed in terms of accuracy they were more accurate in the second condition than in the first, which can probably be explained by the fact that participants had previous “practice” in telling the truth in response to irrelevants.

Another hypothesis would be more specific with regard to deceptive processes, and relies on the fact that the truth is actively suppressed during deception (Spence et al., 2001), which makes it more difficult to be retrieved afterwards. In other words, the initial lie would not only affect the execution of the opposing response (switching costs), but it would also limit the accessibility of the truthful response (response suppression costs). Johnson, Barnhardt, and Zhu (2004) differentiate between cognitive processes involved in the intention (strategy) and the execution of a deceptive response. While the cognitive suppression hypothesis suggests specific costs in retrieving the truth after previously inhibiting it (intent stage), the switching hypothesis suggests that there are specific costs associated with performing a distinct response to an identical task set (execution stage). However, Debey et al. (2014) used a Sheffield lie test (Spence et al., 2001) to discover that task switching from truth-telling to lying has the same cognitive cost as switching from lying to truth-telling. This means that task switching might not contribute to the cognitive cost of deception as long as the repetition/switching ratio is balanced.

There are a number of limitations to the present study. First, the sample size for each group is relatively small. In future research, we may need to attain a more substantial sample size in order for the experiment to have sufficient statistical power so that smaller effects can be detected (such as the tendency for truthful responses to take longer, besides being less accurate, after previous lies.

To summarize, our results bring support to the first hypothesis, revealing that habitual lying has a negative effect on accuracy of subsequent truthful responses. This also supports recent findings on the matter (Hu et al., 2012; Van Bockstaele et al., 2012;Verschuere et al., 2011). While these studies found lying to be facilitated by previous/frequent lying, the present study complemented them by showing truth-telling to be impaired by previous lying. This is because our study and the other recent studies show two sides of the same hypothesis: because the initially developed task set refers to lying, a truthful response will be made more difficult (because of the set-switching costs), but also, a deceptive response will be made easier because the task set does not change, especially if this subsequent response refers to the same items as the initial deceptive response (Van Bockstaele et al., 2012). This type of research can help develop strategies to increase the reliability of the RT-based CIT. By increasing the predominance of truth-telling/lying, it may be possible to make lying/truth-telling more difficult. This means that we may be able to increase the difference (in RT and accuracy) between lying in response to probes and telling the truth in response to irrelevants by soliciting more truthful responses from the participants or by “training” them in truth telling.

ACKNOWLEDGEMENT

This writing of paper was made possible with the financial support of the Sectoral Operational Programme for Human Resources Development 2007-2013, co-financed by the European Social Fund, under the project POSDRU/159/1.5/S/132400 - “Young successful researchers – professional development in an international and interdisciplinary environment” awarded to the first and third author, and from the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2012-3-0323 awarded to the last author.

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