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Unconscious Processes Improve Lie Detection

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Abstract

The capacity to identify cheaters is essential for maintaining balanced social relationships, yet humans have been shown to be generally poor deception detectors. In fact, a plethora of empirical findings holds that individuals are only slightly better than chance when discerning lies from truths. Here we report five experiments showing that judges' ability to detect deception greatly increases after periods of unconscious processing. Specifically, judges who were kept from consciously deliberating outperformed judges who were encouraged to do so, or who made a decision immediately; moreover, unconscious thinkers' detection accuracy was significantly above chance level. The reported experiments further show that this improvement comes about because unconscious thinking processes allow for integrating the particularly rich information basis necessary for accurate lie detection. These findings suggest that the human mind is not unfit to distinguish between truth and deception, but that this ability resides in previously overlooked processes.

Keywords: lie detection, detection of deception, unconscious processes, decision making, judgment

Unconscious Processes Improve Lie Detection

Although telling the truth is generally considered a virtue, lying appears to be a phenomenon of everyday life. For instance, college students and members of a community college reported lying to their romantic partners in 34% of all social interactions (DePaulo & Kashy, 1998). Similarly unsettling, 81% of participants admitted to telling at least one lie in the course of a job interview, with a mean amount of 2.19 lies (cf. Weiss & Feldman, 2006). Detecting such deception is vital for both individuals and society (Ekman, 1992). This is perhaps best illustrated in the legal context, where the veracity judgments of police officers and legal professionals often have serious consequences on both the individual and societal level (Ekman & O'Sullivan, 1991).

Despite the importance of lie detection for human and societal prosperity, recent reviews and meta-analyses suggest that individuals achieve, overall, an accuracy rate only slightly above chance level when judging the veracity of true or invented statements (e.g., 54%, Bond & DePaulo, 2006; Hartwig & Bond, 2011; Vrij, 2008), and that humans are better equipped to identify truths as non-deceptive than they are at detecting lies as deceptive (Bond & DePaulo, 2006). Moreover, to date, few individual or situational variables are known to consistently improve people's ability to detect deception (for an overview, see Granhag & Stromwall, 2004; Vrij, 2008). For example, meta-analytic evidence suggests that experts (e.g., police officers) are not better able to detect deception than were laypersons (Aamodt & Custer, 2006; Bond & DePaulo, 2006; Vrij, 2008; see O'Sullivan & Ekman, 2004, as well as Frank & Ekman, 1997; for specific contexts in which expertise may help). Relatedly, Aamodt and Custer (2006) found no significant relationship between detection accuracy and education, sex, age, or confidence.

These findings suggest that the human mind is unfit to distinguish between truth and deception, despite the vital importance of being able to do so. The present contribution seeks to challenge this perspective by proposing that lie detection may be poor when individuals consciously focus on discerning truth and lies, but can be substantially improved when individuals delegate lie detection to less conscious processes. Specifically, we designed five experiments to test the hypothesis that lie detection can be significantly improved above chance level when individuals are distracted from thinking consciously. In what follows, we delineate why this performance boost may be expected by drawing on the literature of lie detection and unconscious processes. We start by reviewing four reasons discussed in the literature for why lie detection performance is generally poor and then discuss, in a second step, why unconscious processes may help to overcome three of these constraints.

Four Reasons for Poor Lie Detection Accuracy

The lie detection literature is replete with findings documenting lie detection performance as being only slightly above chance level (for recent reviews, see Bond & DePaulo, 2006; Hartwig & Bond, 2011; Vrij, 2008). Below we review four reasons often put forward when trying to explain this evidence.

Few diagnostic cues. Although researchers have developed a number of theories to explain why people may behave differently when they are lying as opposed to when they are telling the truth (e.g. Buller & Burgoon, 1996; DePaulo et al., 2003; Ekman, 1992; Ekman & Friesen, 1969; Sporer, 2004; Sporer & Schwandt, 2006, 2007; Vrij, 2000; Zuckerman, DePaulo, & Rosenthal, 1981; Zuckerman & Driver, 1985), only a few cues such as detailedness or plausibility of the message, spontaneous corrections, or admitted lack of memory have been found to be reliably correlated with deception (see DePaulo et al., 2003). Based on a recent meta-analysis, Hartwig and Bond (2011) argue that this shortage of valid objective cues does not allow for high accuracy rates. We believe a less radical perspective is in order, assuming that the shortage of valid cues increases the importance of the "right circumstances," but does not render substantial increases in accuracy rate over chance level to be impossible. In line with this argument, Bond and DePaulo's (2006) meta-analysis revealed a number of moderators that influence accuracy rates in deception detection, such as a focus on paraverbal and content cues (in audiovisual presentations, audio presentations, or transcripts) compared to visual cues (in video only presentations). Moreover, recent research has shown that judges holding more accurate beliefs about cues to deception achieved higher accuracy in classifying true and deceptive messages (Forrest, Feldman, & Tyler, 2004; Reinhard, Scharmach, & Müller, 2013).

Lack of conscious processing capacity. A second explanation holds that integrating veracity cues into an overall judgment is a complex endeavour—perhaps too complex given the constraints imposed on conscious thinking. At least two considerations are important here. First, with respect to the cues themselves, Reinhard and Sporer (2008, 2010) suggested that not all deception cues are processed easily, but that cues used in credibility judgments vary with respect to the cognitive demands they place on judges. Some of the cues that judges might use to infer credibility are easily processed; for example, a judge's overall impression of the sender's nervousness or gaze aversion. Other cues, such as detailedness or plausibility, are cognitively more demanding because their assessment requires more scrutiny, and therefore more processing capacity in the course of lie detection (see Forrest & Feldman, 2000; Reinhard, Scharmach, & Stahlberg, in press; Reinhard & Sporer, 2008). Second, it has been argued that using a high number of possible cues should result in higher accuracy of classifying true and deceptive accounts (see Granhag & Strömvall, 2004; Vrij, 2008). Forming judgments based on more than one cue, however, is more demanding cognitively. Reinhard and Sporer (2008), for instance, showed that the processing of both verbal content information and nonverbal information is cognitively more demanding than the processing of nonverbal information alone. Their participants used both verbal and nonverbal indicators of deception for their credibility judgments under conditions of sufficient task involvement (Experiment 1) and when cognitive capacity was not limited (Experiments 2 & 3). In contrast, under low task involvement and high cognitive load, respectively, participants used nonverbal information for their credibility attributions only. Together, these considerations suggest that forming veracity judgments is likely to be a complex endeavor requiring appropriate cognitive resources. Given serious constraints on the human capacity to consciously handle several pieces of information (Miller, 1956), this complexity may constitute a significant hurdle.

Using the wrong cues. A third reason for low accuracy rates in lie detection may be that people inadvertently use the wrong cues when evaluating veracity because they hold false beliefs about cue validities. This argument receives support from a series of studies investigating laypeople's beliefs about deception (e.g., Akehurst, Koehnken, Vrij, & Bull, 1996; Global Deception Research Team, 2006; Reinhard, Burghardt, Sporer, & Bursch, 2002; Strömwall & Granhag, 2003). Akehurst and colleagues (1996), for example, observed that laypeople associate deception with an increase in nervous facial expressions, gaze aversion, self-manipulating behaviors, hand and leg movements, and with an overall nervous bodily expression (for conceptually similar evidence, see Breuer, Sporer, & Reinhard, 2005; Global Deception Research Team, 2006). Further research has shown that such beliefs are highly correlated with judgments of veracity, suggesting that individuals strongly draw on their naïve theories when trying to discern lies from the truth (e.g., Bond, Kahler, & Paolicelli, 1985; Reinhard et al., 2002). Yet, only a few of these cues are objectively related to deceptive behavior; in fact, most of these cues are not diagnostic about truth status and thus are misleading (see DePaulo et al., 2003; Sporer & Schwandt, 2006, 2007; Vrij, 2008). For example, in their meta-analysis on actual deception cues, DePaulo and colleagues (2003) found no evidence that liars avoid eye contact to a higher degree than truth tellers. Also, liars were not found to be more active in their body, hand, arm, or foot movements than were truth tellers. Recent studies even observed *less* hand and finger movements for liars than for truth tellers (Vrij, 2008; see also Sporer & Schwandt, 2007). Together, these findings suggest that individuals hold false beliefs about cue validities, and are led astray when relying on these false beliefs in veracity judgments. In line with this argument, Levine and colleagues (2011) recently reported that cues that guide attributed believability are independent from actual cues of deception.

Top-down processing. A fourth explanation can be derived from research arguing that people often rely on top-down processing routines when forming veracity judgments, such as judgmental rules of thumb and stereotypes. For example, O'Sullivan (2003) investigated the influence of the fundamental attribution error in deception judgments. She demonstrated that specific veracity judgments are highly correlated with lay judges' trait judgments of the communicator's trustworthiness. O'Sullivan (2003) argued that global cues often guide the search and use of specific cues in veracity judgments. Similarly pointing to top-down processing, Reinhard and Sporer (2010) found that judges strongly use the attractiveness of a source as a heuristic cue when judging the credibility of a statement ("If she is attractive, she must be honest." see also Aune, Levine, Ching, & Yoshimoto, 1993). Other researchers found that people with facial deformities were rated as less credible (Bull, 1979) and people with a baby-faced appearance were rated as more credible (Masip, Garrido, & Herrero, 2003, 2004). Likewise, individuals tend to commit the truth bias, the visual bias, the demeanor bias, and the expectancy violation bias when forming veracity judgments (see Burgoon, Blair, & Strom, 2008). Together, these findings suggest that individuals tend to rely on top-down processing routines when evaluating truth and deception. To the extent that this top-down processing produces bias, accuracy in deception detection should be hampered.

Unconscious Processes May Increase Lie Detection Performance

The four reasons reviewed above offer a rather pessimistic picture with respect to the human capacity for discerning lies from the truth (see Bond & DePaulo, 2006; Hartwig & Bond, 2011). Yet we believe there is reason to be more optimistic. This belief is fueled by our impression that the dominant setting in lie detection research is one of "conscious" thinking (see also Albrechtsen, Meissner, & Susa, 2009; DePaulo, Rosenthal, Rieder Green,

& Rosenkrantz, 1982). Specifically, individuals are generally asked to *consciously* deliberate about whether another person has lied or told the truth. What if the deficiencies generally documented in lie detection research are specific to this thinking mode, which is known to be severely limited (e.g., Miller, 1956)? Here we suggest that more accurate lie detection performance is likely in circumstances that are less fraught with the limitations imposed on conscious thinking. More specifically, we propose that unconscious thinking processes (Dijksterhuis, 2004) may help to form more accurate lie/truth judgments. To second this argument, in what follows, we review recent research on the merits of unconscious thought.

The last 40 years have brought about evidence that processes outside conscious awareness may fundamentally influence perception, thinking, and behavior (for a recent review, see Bargh, 2011). One of the latest developments in this research tradition is Unconscious Thought Theory (UTT, Dijksterhuis & Nordgren, 2006), which holds that judgments and decisions may be formed in the absence of conscious awareness. UTT fundamentally distinguishes between two modes of thought: *Conscious thinking* (CT) is defined as decision-relevant processes that occur when individuals focus on the decisional target, whereas *unconscious thinking* (UT) is defined as decision-relevant processes that occur when individuals' conscious attention is directed elsewhere; that is, not on the decision. The two modes of thinking differ on a series of characteristics, of which those relevant in the present context are reviewed in what follows. Before doing so, we note that the merits of unconscious thought have not been undisputed and continue to be the subject of a lively and sometimes heated debate in the literature (e.g., Acker, 2008; Gonzalez-Vallejo, Lassiter, Bellezza, & Lindberg, 2008; Lassiter, Lindberg, Gonzalez-Vallejo, Bellezza, & Phillips, 2009; Newell & Rakow, 2011; Newell, Wong, Cheung, & Rakow, 2009; but see also Bargh, 2011; Strick et al., 2011; Strick, Dijksterhuis, & van Baaren, 2010).

Conscious versus unconscious processing capacity. One of the key differences between conscious and unconscious thinking pertains to processing capacity. Whereas conscious thinking capacity is generally believed to be severely constrained (e.g., Miller, 1956, the magic number 7), unconscious processes are assumed to have far greater processing capacity (e.g., Betsch, Plessner, Schwieren, & Gütig, 2001; Dijksterhuis, 2004; Dijksterhuis & Nordgren, 2006). As a consequence, unconscious thought should outperform conscious thought when decision-making problems are complex. In support of this hypothesis, Dijksterhuis (2004) observed that unconscious thinkers showed superior decision performance when the information basis was particularly rich (see also Dijksterhuis, Bos, Nordgren, & van Baaren, 2006; Dijksterhuis & van Olden, 2006). Similarly, Messner and Wänke (2011) reported that choices after periods of unconscious thinking led to higher satisfaction in large assortments, again suggesting that unconscious thought offers the necessary capacity to deal with particularly rich information sets. Finally, in a series of contributions, Ham and van den Bos (2010a, 2010b) observed that periods of unconscious thought resulted in more accurate justice and guilt judgments (compared to an accepted expert standard), as well as more utilitarian moral judgments (Ham, van den Bos, and van Doorn, 2009). Again, these changes were traced back to unconscious thought's greater capacity, which presumably allowed for dealing with the particularly rich and complex information basis necessary when forming justice, guilt, and moral judgments.

Using cues. Conscious and unconscious thinking are conceptualized as different with respect to the weighing of information cues (Dijksterhuis & Nordgren, 2006). Conscious thought, on the one hand, is believed to be poor with respect to the weighing of information cues (see also Wilson et al., 1993; Wilson & Schooler, 1991). For instance, Wilson and colleagues (1993) observed that compared to decisions formed immediately, conscious deliberation resulted in less satisfying choices. Presumably this was because conscious thinking led individuals to focus on decision cues that are verbalizable but not focal with respect to subsequent choice satisfaction, thus interfering with critical nonreportable processes (for conceptually related evidence in the realm of insight problem solving, see Schooler, Ohlsson, & Brooks, 1993). This "misleading" may be a function of undue salience in the decision context (for the critical role of the situation, e.g., Bargh & Chartrand, 1999), but also of false beliefs about what will likely be a satisfying choice (e.g., see the literature on affective forecasting; Wilson & Gilbert, 2003). Unconscious thought, on the other hand, has been argued to be better at weighing information cues (Dijksterhuis & Nordgren, 2006). This may be because it is less influenced by situational forces and consciously held naïve beliefs, but weighs cues more on the basis of ecological learning experiences and associatively represented network structures.

Top-down versus bottom-up processing. Finally, Dijksterhuis and Nordgren (2006) have suggested that whereas conscious thought works primarily top-down, unconscious thought works bottom-up. Bos and Dijksterhuis (2011), for instance, report evidence collected in a classic impression formation tasks. Both judgmental data and memory parameters suggest that conscious thinkers relied on a misleading stereotype whereas the judgments of unconscious thinkers were unbiased. Presumably this occurred because conscious thinkers processed information top-down, whereas unconscious thinkers worked bottom-up. Relatedly, Messner, Wänke, and Weibel (2011) reported that personnel selection decisions after periods of unconscious thought were free of gender and attractiveness biases, whereas conscious thinkers fell prey to these misleading heuristics. Supposedly this is because unconscious thinkers integrate the available information bottom-up, whereas conscious thinkers work top-down and are therefore misled when stereotypes do not carry truth value.

Though not specified in UTT, a precondition for bottom-up processing to yield unbiased results would appear to be an unbiased information basis. Indeed, if encoding is biased, decisions are likely biased, too. We therefore suggest that unconscious thought should work best when information encoding occurs unbiased. Because specific decision goals often cue specific stereotypes or schemas (e.g., Goal: Select a manager. Stereotype: Think manager, think male. Schein, 1973), it would seem commendable to provide the goal to form a decision only after encoding is completed. We adhered to this reasoning in designing the experiments reported in what follows.

When comparing these three characteristics of unconscious thought as defined in UTT (Dijksterhuis & Nordgren, 2006) with the reasons for poor lie detection reviewed above, at least two conclusions ensue: First, what is said to have resulted in poor lie detection performance in existing research—lack of conscious processing capacity, using the wrong cues, top-down processing—is symptomatic for conscious but not unconscious thinking. Second, periods of unconscious thought may be expected to allow for higher accuracy rates because unconscious thought (a) disposes one of the capacity necessary to integrate the particularly rich information necessary for accurate lie detection, (b) may be expected to be uninfluenced by consciously held yet not necessarily correct beliefs about cues to deception, and (c) should integrate the available information bottom-up instead of process the information with top-down stereotypes. As a consequence, compared to consciously formed decisions, periods of unconscious thought may be expected to allow for increases in detection accuracy. Moreover, lie/truth decisions promoted by periods of unconscious thought should reflect the integration of more, and more objectively accurate, pieces of information. The experiments reported herein will formally test these considerations. In line with general practice in lie detection research, participants in all experiments are asked to form veracity judgments about stimulus persons who either lied or told the truth (e.g., Ask, Greifeneder, & Reinhard, 2012; Bond & DePaulo, 2006; Reinhard, Sporer, Scharmach, & Marksteiner, 2011; Vrij, 2008). In addition, relying on experimental procedures from research on unconscious processes (e.g., Dijksterhuis, 2004), we varied whether veracity judgments were formed directly after watching the messages, after short periods of "conscious thought," or after short periods of "unconscious thought." We expect that veracity judgments formed after a short period of unconscious thought are significantly more accurate compared to veracity judgments formed directly after watching the messages or after a short period of conscious thought.

Experiment 1

Method

Participants and design. Sixty-six university students (36 women; M_{age} = 22.94 years) were randomly assigned to one of three conditions: *standard control* versus *conscious-thought* versus *unconscious-thought*.

Stimulus materials. Eight male students of economic sciences (age 22–29) posed as stimulus persons. The students were asked to recount in front of a digital video camera (a) their most recent internship and (b) one fictitious, randomly assigned internship. The order of internships (actual or fictitious) was counterbalanced. The stimulus persons participated in exchange for 15 Euros, with the possibility of gaining up to 15 Euros additionally if they told believable stories. Stimulus persons were seated behind a table; the recordings showed their upper bodies and part of the table; the interviewer was off camera. The stimulus persons had been asked to appear in business attire and care was taken that the room looked appropriate for an employment interview setting. Stimulus persons were given five minutes to prepare before recording. For this preparation they were provided with three questions ("When, where, and for whom did you do your internship?", "What exactly did you do in the internship?", and "What did you like/dislike about the internship?") and were asked to base their story on these questions. The resulting 16 accounts were detailed and comprehensive (M = 228s, SD = 37.43); average message length did not differ between true (M = 224s, SD = 31.89) and deceptive messages (M = 233s, SD = 44.02), $t(14) = 0.47$, p = .65. We created two sets of recordings with eight accounts each, whereby each stimulus person was featured only once. Each of the two sets contained four truthful and four deceptive accounts.

Procedure. We introduced the experiment as "an experiment about interpersonal impression formation." No further information was given at this point. Participants watched eight video recordings (in predetermined random order; identical for all participants). The recordings did not include any hints as to the possibility of deception. Following general practice in lie detection research, standard control participants were told that some of the applicants were lying and were explicitly asked to evaluate the truthfulness of each recording. Specifically, participants learned that some stimulus persons will be telling the truth in that they will report on a real internship they actually did, whereas other stimulus persons will be telling a lie, in that they will report on a fictitious internship. However, participants were not informed about how many applicants were lying or telling the truth. Moreover, before watching the recordings, we informed participants that they will be later asked to tell which stimulus persons told the truth, and which were lying. After each recording, standard control participants judged the truthfulness of the applicant's story (true vs. false).

Materials and proceeding were identical for unconscious-thought and conscious-thought participants, except for the following three variations. First, in contrast to standard control participants, conscious-thought and unconscious-thought participants were informed about the possibility of deception only after having watched the recordings, but watched the recordings with the simple instruction to form an impression of what they saw and heard. We introduced this change because we did not want information encoding for conscious-thought and unconscious-thought participants to be influenced by a judgment goal, so as to isolate the effects of thinking mode. Although justified from a theoretical perspective, this change created a confound between thinking mode and time of information presentation (conscious-thought and unconscious-thought vs. standard control), which we will further address in Experiment 3. Second, having watched all recordings and having been made aware of the possibility of deception, unconscious-thought participants were informed that they will be later asked to tell which stimulus persons told the truth, and which were lying. Unconscious-thought participants then worked on a taxing non–word-search puzzle for three minutes (see Bos, Dijksterhuis, & van Baaren, 2008). Specifically, in a matrix of 15 × 15 letters, we asked unconscious-thought participants to find as many previously indicated five- to eight-letter non-words as possible. This task was to direct participants' conscious awareness away from the video recordings, thereby creating conditions of unconscious thought (Dijksterhuis et al., 2006). Instead of working on the non–word-search puzzle, conscious-thought participants were given three minutes to actively deliberate over which of the stimulus persons had lied and which had told the truth. Finally, conscious-thought and unconscious-thought participants were handed a questionnaire including pictures of each of the eight applicants and were asked to indicate which applicants had lied versus told the truth. At the end of the experiment, participants were debriefed, paid, and thanked for participating.

Results

Classification accuracies (in %) for all, true, and deceptive messages across all thinking mode conditions are displayed in Table 1. With a mean value of 54.73% (SD = 19.42), classification accuracy was—overall—significantly above chance (50%), $t(65) = 2.20$, $p = .032$.

We used signal detection analysis for hypothesis testing (e.g., Stanislaw & Todorov, 1999; Swets, Dawes, and Monahan, 2000). Signal detection analysis generally yields two parameter estimates, discrimination ability *d'* (d prime; here a measure of the ability to detect truths/lies) and response bias *C* (Criterion; here a measure of true/false response tendencies, often referred to as judgmental or truth bias).

d' was subjected to a 3 (thinking mode: standard control vs. conscious-thought vs. unconscious-thought) × 2 (gender: male vs. female) factorial ANOVA.[1] In line with our hypothesis, the effect of thinking mode on *d'* was significant, $F(2, 60) = 4.06$, $p = .022$, η_p2 = .12 (see Figure 1). Planned contrast analyses further revealed that participants in the unconscious-thought condition were significantly better in detecting deception ($M_{\text{unconscious-}}$

$_{\text{thought}}$ = .63, *SD* = 0.99) than participants in the standard control condition ($M_{\text{standard control}}$ = .02, *SD* = 0.75), $F(1, 60) = 5.40$, $p = .023$, $d = 0.69$, and participants in the conscious-thought condition ($M_{\text{conscious-thought}}$ = .10, *SD* = 0.79), $F(1, 60) = 4.28$, $p = .043$, $d = 0.60$. Further, participants in the standard control condition and participants in the conscious-thought condition did not significantly differ in detection accuracy, $F(1, 60) = 0.10$, $p = .76$. Gender of participants and the interaction of thinking mode with gender had no significant effects on *d'*, all *p*s > .28.

In the present research, there were no ex ante reasons to expect that the three thought conditions would differently affect *C*, judgmental bias. Nevertheless, to offer a complete picture, *C* was subjected to the same ANOVA as described above. No significant effect for *C* was obtained, $F(2, 60) = 1.44$, $p = .244$, $\eta_p2 = .05$ ($M_{\text{standard control}}$ = -.09, *SD* = 0.44 vs. $M_{\text{conscious-thought}}$ = .13, *SD* = 0.31 vs. $M_{\text{unconscious-thought}}$ = -.08, *SD* = 0.35), indicating that the manipulation of thinking mode did not significantly influence participants' judgmental bias. Moreover, gender and the interaction of thinking mode with gender had no significant effects on *C*, all *F*s < 1.[2]

Discussion

The results from Experiment 1 confirmed the hypothesis that lie/truth judgments formed after short periods of unconscious thought were significantly more accurate than judgments formed right after watching the message (standard control) or after periods of conscious thought. Presumably this is because unconscious thought helps to overcome some of the constraints posed on conscious thinking modes, such as low processing capacity, which may hamper the integration of many different and complex cues (Granhag & Strömvall, 2004; Vrij, 2008).

Experiment 2

The results reported in Experiment 1 are noteworthy in several respects, perhaps most importantly because prior research consistently sustained the conclusion that lie detection accuracy is generally only slightly better than chance (Bond & DePaulo, 2006; Hartwig & Bond, 2011). In contrast to this almost general rule, periods of unconscious processing resulted in a remarkable accuracy advantage both over chance and over the other two thinking modes. Against this background, it appeared desirable to replicate the reported pattern of results with a different set of materials in a different type of domain (see Miller & Stiff, 1993; as well as Vrij, 2008, for the importance of replications in lie detection research). We designed Experiment 2 to fulfill this goal, by employing the same experimental design, yet a new and quite different set of recordings; namely, interviews about personal attitudes. We expected to replicate the pattern observed in Experiment 1; that is, lie/truth judgments formed after a short period of unconscious thought are significantly more accurate compared to veracity judgments formed directly after watching the messages or after a short period of conscious thought.

Method

Participants and design. A total of 116 students of the University of Mannheim (62 women; M_{age} =22.84 years) participated in exchange for six Euros in an experiment lasting 15 minutes. Participants were randomly assigned to one of three conditions; standard control, conscious-thought, and unconscious-thought.

Stimulus materials and procedure. Stimulus materials featured 32 students lying or telling the truth about their attitude toward a movie or TV series (for more details, see Reinhard, 2010). In the truth condition, participants were asked to take about one minute to describe a movie they really liked or disliked. The participants in the deception condition were asked to describe a movie they actually liked (disliked) as though they really disliked (liked) it. All participants were instructed to appear as truthful as possible, and told that they could receive an extra reward of five Euros if the interviewer who was blind to the experimental conditions believed that they indeed liked or disliked the movie (for more details, see Reinhard, 2010). Asking individuals to describe objects or other people they like/dislike in a truthful or deceptive way is a common method for creating true or deceptive messages about personal attitudes, and it was used, for example, by DePaulo and colleagues (1982), DePaulo and Rosenthal (1979), and Frank and Ekman (1997). For all recordings, the camera was positioned about three meters away from the chair on which the participant was seated, such that participants' head and upper body could be seen. Recordings lasted about 30 seconds; average message length did not differ significantly between true (M = 29.69s, SD = 4.49) and deceptive messages (M = 28.98s, SD = 3.64), $t < 1$.

We created four video sets each containing eight recordings. Each participant watched one set of eight video recordings in predetermined random order (identical for all participants). The recordings did not include any hints as to the possibility of deception.

Results

Classification accuracies (in %) for all, true, and deceptive messages across all thinking mode conditions are displayed in Table 1. Overall, the percentage of correct lie–truth classifications was M = 57.00% (SD = 20.41), which is significantly above chance level, $t(115) = 3.70$, $p < .001$.

In line with our hypothesis, the effect of thinking mode on d' was significant, $F(2, 110) = 6.10$, $p = .003$ (see Figure 2). Planned contrast analyses further revealed that participants in the unconscious-thought condition were significantly better in detecting deception ($M_{\text{unconscious-thought}} = .64$, $SD = 0.89$) than participants in the standard control condition ($M_{\text{standard control}} = .07$, $SD = 0.76$), $F(1, 110) = 9.31$, $p = .003$, $d = 0.69$, and participants in the conscious-thought condition ($M_{\text{conscious-thought}} = .16$, $SD = 0.83$), $F(1, 110) = 6.28$, $p = .014$, $d = 0.56$. As expected, participants in the standard control condition and participants in the conscious-thought condition did not significantly differ in detection accuracy, $F(1, 60) = 0.23$, $p = .63$. Gender and the interaction of thinking mode with gender had no significant effects on d', all ps > .28.

Again, the effect of thinking mode on *C* (criterion; a measure of judgmental bias) was not significant, $F(2, 110) = 0.68$, $p = .51$, $\eta_p 2 = .012$ ($M_{\text{standard control}} = .33$, $SD = 0.38$ vs. $M_{\text{conscious-thought}} = .36$, $SD = 0.33$ vs. $M_{\text{unconscious-thought}} = .26$, $SD = 0.29$), indicating that the manipulation of thinking mode did not significantly influence participants' judgmental bias. Unexpectedly, a marginally significant main effect of gender on *C* was observed, $F(1, 110) = 3.30$, $p = .073$, $\eta_p 2 = .029$ ($M_{\text{females}} = .37$, $SD = 0.34$ vs. $M_{\text{males}} = .26$, $SD = 0.33$), suggesting that female compared to male participants tended to judge more recordings as true, independent of objective truth status. The interaction of thinking mode with gender on *C* was not significant, $F(2, 110) = 1.57$, $p = .21$.[3]

Discussion

Experiment 2 replicates the results observed in Experiment 1 with different stimulus materials. Both experiments suggest that detection accuracy is superior after periods of unconscious thought. That similar findings were obtained with different sets of materials strongly attests to the generality of the observed pattern of results and strongly increases confidence in the reported evidence.

Experiment 3

Experiments 1 and 2 offered a clear pattern of results indicating that unconscious-thought participants formed more accurate veracity judgments than both conscious-thought and standard control participants. Although the comparison of unconscious-thought and conscious-thought is methodologically sound, one could argue that these groups cannot be directly compared to the standard control participants due to a methodological confound. Specifically, for conceptual reasons, the time at which participants learned about the possibility of deception varied between the standard control versus conscious-thought and unconscious-thought groups. In the standard control group, it appeared desirable to inform participants about the possibility of deception before showing the recordings, so as to connect the present findings with existing research on lie detection (which generally offers this information first). In the conscious-thought and unconscious-thought groups, however, our primary concern was to avoid differences in encoding so as to isolate the effects of processing that we are interested in. We therefore opted to present information about the possibility of deception only after the recordings were shown. As a consequence of these choices, there is a small possibility that accuracy differences between standard control and unconscious-thought participants need not stem from differences in thinking mode, as argued above. To address this concern, we added a new condition in Experiment 3 in which participants formed veracity judgments immediately after having seen the recordings (just like standard control participants), but without knowing about the possibility of deception beforehand (just like unconscious-thought and conscious-thought participants). We predicted that this new control condition (immediate) will show results similar to that of standard control and conscious-thought participants.[4]

A second methodological issue captured our attention: One could argue that upon seeing a specific recording, participants in the standard control condition did not directly form a judgment, but pondered the issue for some moments. By way of this, standard control participants might have taken advantage of conscious or even unconscious processing, too. This argument might explain why standard control participants performed similarly poorly than conscious-thought participants, but cannot explain why their performance is in sharp contrast to the performance of unconscious-thought participants. Nevertheless, to address this issue, we decided to include yet another control group. Specifically, in one condition henceforth labeled “online,” participants were asked to judge veracity directly and spontaneously after each recording.

Finally, to further increase confidence in the observed findings and their generalizability, we employed a different set of materials in Experiment 3; namely, videos about deceptive or truthful alibi reports. Irrespective of this change in material, we expected to replicate the pattern observed in Experiments 1 and 2, and more specifically hypothesized that lie/truth judgments formed after a short period of unconscious thought are significantly more accurate compared to veracity judgments formed in all other conditions.

Method

Participants and design. A total of 120 students of the University of Applied Sciences Ludwigshafen (59 women; M_{age} = 23.83 years) participated in exchange for five Euros in an experiment lasting 20 minutes. Participants were randomly assigned to one of five conditions: standard control vs. online vs. immediate vs. conscious-thought vs. unconscious-thought.

Stimulus materials and procedure. The material used in this study was created by Reinhard et al. (2012). Twenty male students from the University of Mannheim participated in a study with the possibility of earning up to 30 Euros. The procedure was adapted from Vrij, Mann, Kirsten, and Fisher (2007), and differed for truth versus lie recordings.

For *truth recordings*, participants were guided to an initial experimental room in which a table had been prepared with a Backgammon board, the appropriate amount of tokens, and two dices. In this room, participants met a “game partner,” who was introduced as another participant, but in fact was a confederate. It was ensured that all participants were knowledgeable at playing Backgammon beforehand.

After entering the room, participants signed a consent form and sat down at the table with the confederate. The experimenter told the participants to start playing and then left the room. The confederate had been instructed to keep the topics of conversation constant by evading any topics other than participants’ experience with Backgammon, the rules of the game, and participants’ field of study.

While playing, participants were interrupted three times. First, the experimenter entered the room to ask if everything was okay and to let down the window shutter. Second, the confederate interrupted the game to answer an apparently important phone call, leaving the room for approximately one minute. The third interruption happened when a second confederate entered the room to look for her wallet. Upon finding her wallet, she claimed that the cash contents (20 Euros) were missing. She then asked the two players if they had seen anybody touching her bag or wallet; all negated.

At this point, participants were asked to go to another room where they would be interviewed about the missing money. They received 10 Euros for their participation up to this point, and were told they could earn another 20 Euros if they could successfully convince the interviewer that they had not stolen the money. This rather substantial reward was chosen to address the issue of sufficient stakes for stimulus persons raised in the literature (Frank & Ekman, 1997; Vrij, 2008).

For *lie recordings*, participants did not play Backgammon. Instead, they entered a room, received 10 Euros, and were asked to take 20 Euros from a wallet and to hide the money somewhere on their person. They were then told that they would go to a different room later where they would be interviewed about the missing money, and were instructed to deny having taken the money. They were also provided with an alibi about what had happened in that room and could take as much time as they needed in order to familiarize themselves with the alibi. Here is what they read:

> You participated in a psychological study. You entered the room and your game partner was already sitting at a table, which had a Backgammon board, tokens, and two dices on it. The experimenter asked you to start playing and then left the room. You played Backgammon with your game partner, and while playing, you talked about the rules, your experience with Backgammon, and your field of study. After a couple of minutes, the experimenter entered the room, asked if everything was okay, let down the shutters, and left again. After a couple more minutes, your game partner's cell phone rang and he left the room for about a minute to take the call. You remained at the table and waited for him. Then he returned to his place and you continued playing. Suddenly a woman entered to get her bag which she had forgotten

in the room after the experiment. The bag was lying by the wall behind your game partner's seat. The woman looked in her wallet and noticed that 20 Euros were missing. She asked you both whether you had seen anybody touching her bag and wallet. You both negated. Up to that point, the entire game had lasted approximately 10 minutes.

Participants were allowed to alter the alibi to some extent, if necessary, in order to appear as trustworthy as possible. In sum, participants in the lie condition had the same information about the Backgammon game as participants in the truth condition, without actually having engaged in the activities they were going to present in their alibi. Moreover, unlike participants in the truth condition, they in fact had taken 20 Euros from the wallet.

Participants in both conditions were then asked to enter the adjacent room where yet another confederate posed as the interviewer. The interviewer asked all participants the same questions, beginning with: "You are suspected of having taken 20 Euros from this woman's wallet. Have you taken the money from the wallet?" Further questions were: "What have you been doing the entire time in the first room?"; "Did anybody else enter the room while you were playing?"; "Please tell me about the game of Backgammon you were playing"; "I have noticed that your game partner left the room to take a call. What did you do in the room while he was outside?"; "… So you would have had the opportunity to take the money while your game partner was outside?"

After the recording, all participants were given the additional 20 Euros or were told they could keep the money they were hiding on their body, respectively, and were fully debriefed.

Length of recordings did not differ significantly as a function of truth status (M_{truth} = 147.6 s, SD = 27.9; M_{lie} = 142.9 s, SD = 26.3), $F(1, 18) = 0.15$, $p = .70$, $r = .08$. The videos were divided into five sets with four videos each, both containing two true and two deceptive statements. Each participant watched one set of four video recordings in predetermined random order (identical for all participants). The recordings did not include any hints as to the possibility of deception.

Procedure. Procedures for standard control, unconscious-thought, and conscious-thought participants were parallel to those in Experiments 1 and 2. Participants in the online condition were treated identically as in the standard control condition, but were instructed to form a veracity judgment directly and spontaneously after having watched each video. Parallel to the conscious-thought and unconscious-thought condition, participants in the immediate condition watched the recordings with the simple instruction to form an impression of what they saw and heard. Only after having watched all recordings and having been made aware of the possibility of deception were participants in the immediate condition asked to indicate which person had lied versus told the truth. At the end of the experiment, we debriefed, paid, and thanked all participants.

Results

Classification accuracies (in %) for all, true, and deceptive messages depending on thinking mode conditions are displayed in Table 1. Overall, the percentage of correct lie–truth classifications was M = 50.83% (SD = 31.91), which is not significantly above chance level, $t(119) = 0.29$, $p = .78$.

Classification accuracy measure *d'* was subjected to a 5 (thinking mode: standard control vs. conscious-thought vs. unconscious-thought vs. immediate vs. online) × 2 (gender: male vs. female) ANOVA. In line with our hypothesis, the effect of thinking mode on *d*' was significant, $F(4, 110) = 4.76$, $p = .001$ (see Figure 3). As expected, planned contrast analyses found that unconscious-thought participants were significantly better in detecting deception ($M_{\text{unconscious-thought}} = .52$, $SD = 0.65$) than standard control participants ($M_{\text{standard control}} = -.12$, $SD = 0.44$), $F(1, 110) = 12.10$, $p = .001$, $d = 1.16$, conscious-thought participants ($M_{\text{conscious-thought}} = -.10$, $SD = 0.64$), $F(1, 110) = 11.35$, $p = .001$, $d = 0.96$, participants in the online condition ($M_{\text{online}} = -.22$, $SD = 0.77$), $F(1, 110) = 16.04$, $p < .001$, $d = 1.04$, and participants in the immediate condition ($M_{immediate}$ = .07, SD = 0.67), $F(1, 110) = 6.05$, $p = .015$, $d = 0.66$. Moreover, participants in the standard control condition, conscious-thought condition, online condition, and immediate condition did not significantly differ from each other in detection accuracy, all ps = .12. Gender of participants and the interaction of thinking mode with gender had no significant effects on *d*', all ps > .25. Finally, as before, the effect of thinking mode on *C* (criterion; a measure of judgmental bias) was not significant, $F(4, 110) = 1.99$, $p = .10$, $\eta_p 2$ = .068 ($M_{standard\ control}$ = .39, SD = 0.24 vs. $M_{conscious\text{-}thought}$ = .37, SD = 0.20 vs. $M_{unconscious\text{-}thought}$ = .26, SD = 0.18 vs. M_{online} = .27, SD = 0.20 vs. $M_{immediate}$ = .34, SD = 0.19). Likewise, the main effect of gender and the interaction of thinking mode with gender on *C* were not significant, $F < 1$.[5]

Discussion

Replicating Experiments 1 and 2 with yet a different set of materials, Experiment 3 found clear support that classification accuracy for true and deceptive messages is superior after periods of unconscious thought, thus attesting to the findings' generalizability. In addition, Experiment 3 was designed to address methodological issues inherent in the design of Experiments 1 and 2. Specifically, for conceptual reasons outlined above, the standard control condition differs from the unconscious-thought and conscious-thought conditions in the timing of when participants learn about the possibility of deception, thus creating a potentially problematic confound. To address this concern, a new control group was added in Experiment 3 (labeled immediate). A second methodological concern pertained to the possibility that standard control participants might have taken advantage of unconscious processing by shortly pondering the issue before forming their judgment. Though being directly refuted by the results reported in Experiments 1 and 2, it nevertheless appeared commendable to address this issue formally by adding still another control group (labeled online). Of importance, detection accuracy of both the immediate and the online condition (a) was significantly lower than unconscious-thought participants' detection accuracy, and (b) did not significantly differ from detection accuracy in both the standard control and the conscious-thought condition. This pattern of results casts strong doubt about the methodological concerns raised above, and suggests that both standard control and conscious-thought are suitable comparison conditions for evaluating the performance of unconscious-thought participants; in Experiments 4 and 5, we will therefore again focus on these experimental conditions.

Going beyond the context of lie detection, the results of Experiment 3 allow for addressing a debate recently raised in the literature on unconscious thought. Specifically, Lassiter and colleagues (2009) contended that unconscious thought is an artefact and best explained in terms of a judgment formed online directly upon being asked to form an impression; supposedly, it is this online judgment that unconscious thinkers recall following the distraction period. The various control groups assessed in the present experiment, especially the immediate and online conditions, cannot be reconciled with this position, but strongly suggest that unconscious thinking is more than recalling a previously formed online-judgment. This conclusion conceptually dovetails with evidence reported by Strick and colleagues (2010), who observed that online judgments are not predictive of offline judgments in conditions of unconscious thought.

It is interesting to note that the materials employed in Experiment 3 (mock crime scenarios) might have elicited some suspicion about the messages' truth status in unconscious-thought participants even during message presentation. This might have created an implicit "detection goal," rendering Experiment 3 different from Experiments 1 and 2, in which unconscious-thought participants' likely started to wonder about truth status only when prompted about this possibility, that is, after message presentation. Although providing the decision goal only after information presentation appears commendable from a theoretical perspective (see bottom-up principle), unconscious-thought participants performed similarly well in the three experiments. Interestingly, this parallels evidence obtained in earlier research, in which unconscious-thought participants did well regardless of whether the decision goal was provided before information presentation (e.g., Dijksterhuis, 2004; Messner et al., 2011) or only after the information encoding stage (e.g., Bos et al., 2008; Dijksterhuis et al., 2006). To our knowledge, these inconsistencies in procedure in particular, and the encoding stage in general, have not been considered in theorizing on UTT. This appears noteworthy as an unbiased information basis would appear to be a critical precondition for unbiased (bottom-up) decision making. How, then, can we explain that the timing of decision goal provision proved irrelevant in unconscious-thought studies so far? One way is to assume that in existing unconscious thought experiments, stereotypes or decision goals did not affect information interpretation; put differently, we need to assume that stereotypes did not bias the information as such. With this assumption in place, the presence of stereotypes or decision goals during information encoding may not hinder, but even help unconscious thought to do well. First, in all of the above reviewed experiments, participants are asked to form an impression of the information, thus considering all the information given. Second, schema-inconsistent information is encoded more deeply (e.g., Hastie & Kumar, 1979). Third, schema-inconsistent information is likely considered when individuals try to form complete and integrated impressions (as in bottom-up processing), but not when individuals try to form coherent impressions (as in top-down processing, see Stangor and McMillan, 1992). To the extent that schema-inconsistent information is particularly conducive to form good decisions (as, for instance, in Messner et al., 2011), stereotype-induced differences in encoding are hence to the advantage of those processing unconsciously.

Interestingly, although schema-inconsistent information is encoded more deeply, this encoding advantage fades over time (e.g., Stangor & McMillan, 1992). Because unconscious thought experiments usually last no longer than 60 minutes (certainly not several days), previous work might have benefitted from the deeper encoding of schema-inconsistent information without succumbing to the problem of trace decay. From this perspective, future research may fruitfully incorporate a time-perspective in unconscious thought experiments, exploring, for instance, whether the finding that unconscious thought participants form less stereotypical judgments (e.g., Bos & Dijksterhuis, 2011; Messner et al., 2011) vanishes with longer time intervals. To conclude, from a theoretical perspective, unbiased information encoding appears commendable for later unbiased judgments. However, when the impact of stereotypes is limited to the how of encoding (and does not bias what is encoded), the processing advantages tied to schema-inconsistent information may even help unconscious thought to do well, at least in the short run. Very cautiously, one may conclude from this evidence that the benefit of unconscious thought may also be found in applied settings where judges often have some reason to be suspicious when first encoding the relevant information.

Experiment 4

In the previous experiments, we chose the labels "conscious thought" and "unconscious thought" so as to connect the present findings with the existing terminology in the literature (e.g., Dijksterhuis, 2004). There is likely little debate about the label "conscious thought," because it closely reflects what participants are asked to do—after having been given the goal to discern lies from truths, participants are asked to consciously deliberate. In contrast, it has been argued that the conditions we labeled as "unconscious thought" might be better referred to as "distraction," since after having been given the goal to discern lies from truths, participants were not told to think unconsciously, but were *distracted* from conscious goal-directed deliberation. On the level of operationalization, "distraction" would thus appear to be the more appropriate label. However, against the background of the existing literature, the label "unconscious thought" appears more appropriate conceptually.

On a more general level, these alternatives in labeling—unconscious thought versus distraction—reflect an ongoing discussion about the nature of unconscious thought. On the one hand, Dijksterhuis and colleagues (e.g., Dijksterhuis, 2004; Dijksterhuis & Nordgren, 2006) have purported and empirically substantiated that what happens during the distraction period is an active thinking process that results, for instance, in a more polarized perspective on decision alternatives. Moreover, recent fMRI research suggests that during unconscious thought, neural activity other than that of the distractor task can be observed (Creswell, Bursley, & Satpute, in press). On the other hand, one could argue that the distraction period merely offers the bliss to forget irrelevant or non-diagnostic information. For instance, in lie detection, a period of distraction may render highly salient but non-diagnostic cues less accessible, thereby reducing individuals' tendency to focus on the wrong ones (see also the notion of "set-shifting" or "fresh look" in creativity research, e.g., Schooler & Melcher, 1995). Similarly, one could argue that what remains after the distraction period is the gist and not the details of the watched recordings. To the extent that the gist reflects more of the diagnostic cues and less of the non-diagnostic ones, relying on the gist after the distraction period could increase judgment accuracy.[6] From this alternative perspective, the increase in detection accuracy during the distraction period is not due to an active unconscious thinking process as purported by Dijksterhuis and colleagues (e.g., Dijksterhuis, 2004; Dijksterhuis & Nordgren, 2006), but to benedictory forgetting.

To our knowledge, two sets of findings have addressed these competing hypotheses (Bos, Dijksterhuis, & van Baaren, 2008; Zhong, Dijksterhuis, & Galinsky, 2008). In both sets of evidence, the authors introduced a new condition labeled "mere-distraction" that relied on the same distraction manipulation than the unconscious-thought condition. Unlike the unconscious-thought condition, however, participants in the mere-distraction condition learned about the processing goal only after the distraction period. If mere-distraction participants do as well as unconscious-thought participants, one may conclude that what happens during the conditions labeled as unconscious-thought may not be different from forgetting. However, if unconscious-thought participants do better than mere-distraction participants, one may conclude that what happens during unconscious thought is different from forgetting. In both sets of findings, unconscious-thought participants outperformed mere-distraction participants, suggesting that there is more to the conditions labeled unconscious thought than the mere bliss of a “fresh look” or forgetting.

Although previous evidence on mere-distraction is available in the literature, it appeared desirable to rule out the possibility of mere-distraction in the present context of lie detection. Perhaps the most important reason is that by refuting a highly intuitive and prominent alternative account, further (albeit indirect) evidence is accrued for the tenet that it is active unconscious thinking processes that increases lie detection accuracy. For this reason, we extended Experiment 2 by adding a mere-distraction condition.

Method

Participants and design. A total of 83 students of the University of Mannheim (38 women; M_{age} =22.06 years) participated in exchange for 5 Euros in an experiment lasting 15 minutes. Participants were randomly assigned to one of four conditions; standard control, conscious-thought, unconscious-thought, and mere-distraction.

Stimulus materials and procedure. We reemployed the materials from Experiment 2: that is, true and deceptive messages about stimulus persons’ attitudes toward a movie or TV series. Four video sets each containing eight recordings were used. Each participant watched one set of eight video recordings in a predetermined random order (identical for all participants). The recordings did not include any hints as to the possibility of deception.

Procedures for standard control, unconscious-thought, and conscious-thought participants were parallel to Experiment 1 to 3. For the mere-distraction condition, we followed the proceeding introduced by Bos and colleagues (2008, Experiments 1a and 1b): after watching the recordings, mere-distraction participants were told that this part of the experiment is now over. Unlike the unconscious-thought condition, mere-distraction participants then directly worked on the distractor task without being informed about the possibility of deception or the goal to discern lies from truths (this information was provided only after the distractor task).

Results

Classification accuracies (in %) for all, true, and deceptive messages across all thinking mode conditions are displayed in Table 1. Overall, the percentage of correct lie–truth classifications was M = 53.62% (SD = 18.88), which is not significantly above chance level, $t(82) = 1.74$, $p = .085$.

The classification accuracy measure *d'* was subjected to a 4 (thinking mode: standard control vs. conscious-thought vs. unconscious-thought vs. mere-distraction) × 2 (gender: male vs. female) ANOVA. In line with our hypothesis, the effect of thinking mode on *d*' was significant, $F(3, 75) = 4.04$, $p = .010$ (see Figure 4). Planned contrast analyses further revealed that participants in the unconscious-thought condition were significantly better in detecting deception ($M_{\text{unconscious-thought}} = .62$, $SD = 0.96$) than participants in the standard control condition ($M_{\text{standard control}} = .08$, $SD = 0.56$), $F(1, 75) = 5.75$, $p = .019$, $d = 0.70$, participants in the conscious-thought condition ($M_{\text{conscious-thought}} = -.16$, $SD = 0.68$), $F(1, 75) = 11.74$, $p = .001$, $d = 0.94$, and participants in the mere-distraction condition ($M_{\text{mere-distraction}} = .12$, $SD = 0.72$), $F(1, 75) = 4.15$, $p = .045$, $d = 0.58$. As expected, participants in the standard control condition, participants in the conscious-thought condition, and participants in the mere-distraction condition did not significantly differ from each other in detection accuracy, all ps > .24. Gender, and the interaction of thinking mode with gender, had no significant effects on *d*', all Fs < .1.

Again, the effect of thinking mode on C (criterion; a measure of judgmental bias) was not significant, $F(3, 75) = 1.55$, $p = .21$, ($M_{\text{standard control}} = .40$, $SD = 0.29$ vs. $M_{\text{conscious-thought}} = .35$, $SD = 0.26$ vs. $M_{\text{unconscious-thought}} = .21$, $SD = 0.27$ vs. $M_{\text{mere-distraction}} = .39$, $SD = 0.27$), indicating that the manipulation of thinking mode did not significantly influence participants' judgmental bias. The main effect of gender, and the interaction of thinking mode with gender, on C, were not significant, all $ps > .20$.

Discussion

Experiment 4 was designed to test whether the high levels of detection accuracy observed in the conditions labeled as unconscious-thought in Experiments 1 to 3 can be alternatively explained by blissful forgetting. To this end we added a new condition labeled mere-distraction, which was identical to the previous unconscious-thought conditions, apart from providing the decision-goal only after the distraction period. If mere-distraction participants had done as equally well as unconscious-thought participants, one could have concluded that similar processes go on in both conditions, such as blissful forgetting. However, unconscious-thought participants were significantly better than mere-distraction participants in discerning lies from truth, suggesting that different processes underlie the effects observed in the conditions of unconscious-thought versus mere-distraction. It should be noted, however, that the evidence reported herein does not itself demonstrate that unconscious thought is taking place; it is only evidence for the occurrence of some process other than what happens during mere distraction. At a minimum, therefore, labeling the unconscious-thought conditions as “distraction” would be inappropriate. So as to connect the present findings with the literature, and in taking note of recent findings by Creswell and colleagues (in press), it appears justified, at present, to retain the label “unconscious-thought.”

Experiment 5

Experiments 1 to 4 consistently demonstrate the superior lie detection performance of participants after periods of unconscious thought. What has remained open so far, however, is how such superior performance can be explained. Experiment 5 is to add this critical piece of evidence by focusing on the underlying processes. To reiterate, poor detection performance is generally traced back to a lack of conscious processing capacity, to using the wrong cues, and to top-down processing on the basis of stereotypes (Bond & DePaulo, 2006; Vrij, 2008). Although these processing deficiencies are symptomatic for conscious processing (Dijksterhuis & Nordgren, 2006), unconscious thought presumably disposes of the necessary capacity to integrate a large number of complex cues, more appropriately weighs cues according to their objective validities, and integrates information from the bottom up. Experiment 5 aims to test these assertions by analyzing which information cues unconscious-thought participants—in contrast to standard control and conscious-thought participants—rely on. Specifically, it is hypothesized that unconscious processes may allow for integrating more information in a less stereotypically biased manner. To the extent that integrating many pieces of information increases reliability, and that less reliance on stereotypical, salient, or easily verbalized information cues increases validity (see also Schooler et al., 1993; Wilson et al., 1993), conditions of unconscious thought should result in superior performance compared to judgments formed immediately or after periods of conscious thought. We tested these considerations by (a) coding recordings with respect to a total of 27 nonverbal, paraverbal, and verbal cues, (b) establishing which cues are diagnostic for deception detection (cue validities), and (c) determining how many and which cues correlate with participants' judgments in the standard control, conscious-thought, and unconscious-thought conditions, as an indication of information use.

Method

Participants and design. A total of 216 university students (95 women; M_{age} = 23.88 years) participated in exchange for 1 Euro. Participants were randomly assigned to one of three conditions: standard control, conscious-thought, and unconscious-thought.

Materials. We employed a set of 72 video recordings more fully described in Reinhard (2010). All recordings were transcribed according to specified transcription rules, which included codes for unfilled and filled pauses, sentence breaks, slips of the tongue, incomplete words, incomplete sentences, and grammar errors. We then asked independent coders to rate the occurrence of a total of 27 objective verbal, paraverbal, and nonverbal cues (see Table 2), identified in previous research either as *objective* (DePaulo et al, 2003; Ekman, 1992; Sporer & Schwandt, 2006, 2007; Vrij, 2008) or as *believed* cues of deception (Global Deception Research Team, 2006; Hartwig & Bond, 2011). The ratings of verbal and paraverbal content cues were directly based on the transcripts. Paraverbal cues in the transcripts were counted with a word processor separately for each transcript. For the frequency counts of nonverbal deception cues, the video recordings were muted in order for raters not to be distracted by the verbal content.

Procedure. Procedures were identical to those of Experiments 1 and 2, except that each participant judged only one video recording (see Reinhard et al., 2012). Moreover, the time for conscious thought and unconscious thought was restricted to two minutes. Again, participants were asked to evaluate truthfulness.

Results

Classification accuracy. Because participants judged only one video, we analyzed the number of participants who correctly classified their recording as lie or truth with logistic regression. Specifically, the number of participants who correctly classified their message was entered as the dependent variable, and thinking mode, gender of participants, and the interaction of the two variables as independent variables. Only a main effect of thinking mode emerged, *Wald* = 11.75, $p = .001$. As expected, more participants in the unconscious-thought condition (77.8%) classified their message correctly than in the conscious-thought (45.8%) and the standard control (48.6%) conditions, indicating that only in the unconscious-thought condition did more participants classify the message correctly than would be expected by chance. Moreover, the correlation between truth status and lie/truth judgment was significant for participants in the unconscious-thought condition, $r(72) = .59$, $p < .001$, but not in the conscious-thought , $r(72) = -.08$, $p = .49$ and standard control condition, $r(72) = -.03$, $p = .80$. We also included participants' response (lie vs. truth) as a control variable in the above described logistic regression to preclude that the effects of thinking mode on classification accuracy are driven by a higher number of participants judging their message as true or deceptive in one of the conditions. As expected, however, the main effect of thinking mode remained highly significant, *Wald* = 12.92, $p < .001$.

Actual use of verbal content, nonverbal, and paraverbal cues in veracity judgments. We first established which information cues were objectively diagnostic for detecting deception by calculating the difference in mean frequency of cue occurrence for true versus deceptive messages separately for every cue. Results are expressed as effect sizes (*d*) in Table 2, column 6; larger values indicate more frequent cue occurrence in *true* messages. In line with recent meta-analayses (DePaulo et al., 2003; Sporer & Schwandt, 2006, 2007), we found, for instance, that truth tellers referred more often to their mental status, showed less postural shifts, and more facial pleasantness. Moreover, in our messages, truth tellers showed less vocal tension and used shorter filled and unfilled pauses as well as less word and phrase repetitions.

Next we separately correlated cue frequencies with participants' lie/truth judgments for the three thinking modes (Table 2, columns 2 to 4). In the unconscious-thought condition, 5 out of 27 possible correlations were significant. Specifically, unconscious-thought participants were more likely to judge their message as true when the stimulus person objectively showed less posture shifts, more facial pleasantness, and more fidgeting (nonverbal cues), as well as when the message was presented with less vocal tension and shorter unfilled pauses (paraverbal cues). Importantly, four out of five of the employed cues were objectively diagnostic for deception detection in our messages. In contrast, for standard control participants, only two cues (eye contact and involved/expressive) were significantly correlated with lie/truth judgments. Note that neither of these cues proved to be a diagnostic cue for differentiating lies from truth in our recordings (see cue validities, column 6), which parallels earlier findings suggesting that, for instance, eye contact is a salient cue that is stereotypically (but not actually) associated with lying (see Hartwig & Bond, 2011). Similarly, for conscious-thought participants, only two cues (consistency and attractiveness) were significantly correlated with lie/truth judgments. Again, both cues were not diagnostic for differentiating between true versus deceptive recordings, which parallels earlier evidence (see Vrij, 2008). In sum, compared to the standard control and conscious-thought conditions, a statistically higher number of statistically significant (and diagnostically relevant) correlations were observed in the unconscious-thought condition (binomial test, $p < .003$).

To further corroborate the hypothesis that decisions reflect stronger reliance on objective cues in conditions of unconscious-thought compared to conscious-thought and standard control, we applied a method used by Hartwig and Bond (2011). We first converted objective cue validities (objective r_{pbs}, Table 2, column 5) to Fisher's *Zr*s. Second, separately for the three experimental conditions, we converted the correlations between cue frequencies and participants' lie/truth judgments (henceforth referred to as judgment cues, Table 2, columns 2 to 4) to Fisher's *Zr*s. In analyses across cues (not participants), we then correlated the *Zr*s for actual deception cues with the *Zr*s for judgment cues, again separately for the three experimental conditions. These analyses resulted in three cross-cue Pearson's *r*s, which reflect the relation between objectively valid deception cues and cue use in judgments within the three thinking conditions. As expected, for the unconscious-thought condition, the relation is positive and highly significant, pointing to a strong tendency to rely on objectively valid cues ($r = .79$, $p < .001$). In contrast, for the standard control and conscious-thought, the correlations failed to reach conventional levels of significance, ($r = -.27$, $p = .18$ and $r = .09$, $p = .66$, respectively). Also as expected, the relation of objectively valid deception cues to judgment cues in the unconscious-thought condition was significantly different from those in the standard control and conscious-thought condition (all *p*s < .001; no significant difference between standard control and conscious-thought, $p = .11$). These results strongly suggest that unconscious-thought participants relied on more objectively accurate cues, whereas standard control and conscious-thought participants' decisions reflect the use of misleading cues.

Discussion

Experiment 5 replicated the primary finding that unconscious-thought participants more successfully detect lies from the truth. More importantly, by coding information cues, establishing cue validities, and determining how many and which cues participants actually relied on, we observed that unconscious-thought participants used both a *higher number* of and *more diagnostic* cues than standard control or conscious-thought participants for detecting deception. Experiment 5 thus supplies a critical piece of evidence and allows for understanding how the superior performance of unconscious-thought participants comes about.

We suggest that the high correlation between objectively valid deception cues and cue use in judgments in the unconscious-thought condition reflects reliance on more diagnostic cues. Interestingly, one could also argue that this high correlation may be traced back to a third variable: accuracy. This is because covariance between the messages' actual truth status and objective cues implies, to some extent, correlation between objective cues and subjective judgments when detection accuracy is high (i.e., high correlation between actual truth status and subjective judgments). As a result, it is possible that the high correlation between objectively valid deception cues and cue use in the unconscious-thought condition does not reflect reliance on the cues we identified as diagnostic, but to other variables influencing accuracy, such as other valid cues not coded in our messages. Thus, the present analyses do not allow for conclusively deciding about which specific cues helped unconscious-thought participants to achieve high accuracy rates. However, because accuracy is generally determined by the extent of reliance on valid or invalid cues (see Hartwig & Bond, 2011), we would argue that the method of Study 5 is a promising approach to investigate the process of unconscious processes in deception detection. Further research using the method of Study 5 (coding a specific number of objective cues) and also studies using simulated interviews in which specific cues are manipulated experimentally (e.g., Stiff et al., 1989, Reinhard & Sporer, 2008) may help to further elucidate the question of which cues judges in a unconscious-thought condition rely on.

General Discussion

Previous research in the field of deception detection has observed that individuals without any special training are often no better than chance at detecting lies from truth (Bond & DePaulo, 2006; Ekman, 1992; Hartwig & Bond, 2011). This poor performance was related to a set of reasons, including a relative scarcity of diagnostic cues (see DePaulo et al., 2003; Hartwig & Bond, 2011), limitations in conscious processing capacity when integrating complex and many cues (e.g., Miller, 1956), tendencies to rely on false lay beliefs about what convicts liars (e.g., Akehurst et al., 1996), and reliance on misleading top-down processing routines (e.g., O'Sullivan, 2003). Overcoming at least some of these constraints should increase accuracy in lie detection. In line with this reasoning, and building on recent evidence on the merit of unconscious processes in decision making (e.g., Dijksterhuis et al., 2006), we hypothesized that lie detection accuracy may be significantly increased when individuals think unconsciously; that is, rely on "cognitive and/or affective task-relevant processes that take place outside conscious awareness" (Dijksterhuis, 2004, p. 586). This hypothesis draws on a series of principles characterizing unconscious thought, most notably that unconscious compared to conscious thought supposedly has greater processing capacity, succumbs less to weighing deficiencies, and works bottom-up, thus falling prey less easily to misleading top-down processing (see Dijksterhuis & Nordgren, 2006). These characteristics may allow unconscious thought to overcome the constraints previously identified as causing poor lie detection performance. Against this background, we tested whether short periods of unconscious processing allow for detection accuracy superior to both conscious thought and chance level. A set of five experiments yielded unanimous support for this hypothesis.

The superior detection performance of unconscious thought was hypothesized to emerge from the capacity to deal with the particularly rich and complex information basis necessary for accurate lie detection, thus allowing for integrating more, and more diagnostic pieces of information. In support of this conceptual argument, we observed that unconscious-thought participants relied on more information cues than standard control or conscious-thought participants. To the extent that relying on more cues increases reliability, judgments of unconscious-thought participants should be more accurate by virtue of statistical principles, even if each of the employed cues carries some error component. In addition, we observed that unconscious-thought participants relied on more diagnostic information cues, again contributing to better performance when telling lies from the truth. Specifically, we observed that standard control and conscious-thought participants relied relatively more on salient and stereotypical cues (which are not necessarily valid, see DePaulo et al., 2003; Hartwig & Bond, 2011; Reinhard et al., 2011), whereas judgments of unconscious-thought participants were less biased in these respects, but reflected the use of more objective cues.

It is worth highlighting that the effect sizes for the influence of unconscious thinking on classification accuracy were higher than those in many studies in social psychology in general, and in the area of detecting deception in particular (see Bond & DePaulo, 2006; Hauch, Sporer, Michael, & Messner, 2010). In fact, the effect sizes reported here are near to those observed when judges use specific interview techniques developed to detect deception (Blair, Levine, & Shaw, 2010; for overviews, see Vrij, 2008; Vrij, & Granhag, 2012). For example, Hartwig, Granhag, Strömwall, and Kronkvist (2006) developed a specific interview technique called *Strategic Use of Evidence* (SUE). In SUE, interviewers learn to make strategic use of the available evidence in police interviews in order to improve lie detection. SUE's core element is to withhold some of the available evidence and to ask questions about this evidence, assuming that liars display more statement-evidence inconsistency than truth-tellers. An interviewer relying on these cues should reach higher detection accuracy. In line with these assumptions, empirical evidence has shown that SUE increases classification accuracy to 85%. That unconscious thought helps to attain accuracy rates approaching those achieved by strategies such as SUE does not question the latter's merit, but highlights the critical advantage unconscious processing may grant in deception detection. One interesting and testable hypothesis may be that because the effects of SUE and unconscious thought are conceptualized as resulting from different processes, a combination of the two procedures may further increase detection accuracy.

Concerning methodology, it should be noted that within each experiment, not just one, but a set of deceptive versus truthful accounts was used, thus reducing the possibility of bias in materials. Moreover, across experiments, three different types of stimuli were used that displayed different stimulus persons in different contexts with different content topics. The results were found to be consistent within and across the five reported experiments, strongly attesting to the reliability and generalizability of the observed evidence. Perhaps most importantly, with the methodology introduced in Experiment 5, the present contribution is one of the first to allow for conclusions about the processes occurring when individuals think unconsciously. Here we showed that the methodology of identifying information cues, establishing cue validities, and testing how many and which of these cues are used across thinking modes allows for identifying why unconscious processes result in superior deception detection. We believe that this methodology may generally propel research and discussion about unconscious processes, which to date has often been silent about what exactly contributes to performance advantages of unconscious processing. Moreover, this methodology may help to objectify the sometimes heated debate in the literature. Together, Experiments 3 to 5 decisively add to the literature of unconscious thought by showing that unconscious thought is superior to online judgment formation (and hence cannot be equated to it, see Lassiter et al., 2009), that what happens during conditions of unconscious-thought is different from merely being distracted without processing goal, and that the superiority of unconscious thought can be explained by reliance on more, and more valid cues of information.

Going beyond methodology, the present results not only offer conclusions about why unconscious processing may be advantageous in deception detection, but also proffer an intriguing speculation: Given the superior performance of unconscious-thought participants, it would seem that evolution did not fail to equip the human mind with an apparatus able to distinguish between truth and deception (as seemingly evident in the hereto witnessed close to chance level in deception detection, e.g., Hartwig & Bond, 2011), and that this apparatus resides in previously overlooked thinking modes. This speculation converges with Hartwig and Bond's (2011, p. 655) assertions that "intuition outperforms explicit notions about deception" and "that deception judgments are largely driven by intuitions that may be inaccessible to the conscious mind." These lines of thought may also help to resolve the apparent contradiction between the importance of accurate lie detection, for instance, for trust to develop, and the seeming incapability of humans to detect lies from the truth (Granhag & Strömwall, 2004). The key is that previous research has mainly investigated detection accuracy with situations best characterized as "conscious thinking," which, however, is likely inapt to handle the particularly demanding challenges for correct lie detection. Based on the reported evidence, we argue that individuals are adept at distinguishing lies from the truth, but what may be needed is that individuals place more faith in unconscious processes. Interestingly, the superiority of unconscious processing is said to stem at least partly from "naturally" appropriate weighing (e.g., Dijksterhuis & Nordgren, 2006), and is thus a function of prior learning experiences and evolved associative network structures. To the extent that the weighing schemes become more accurate with more learning experiences, at least two interesting and testable conclusions ensue: First, those who repeatedly receive feedback about whether their lie/truth judgments were accurate should show particularly impressive detection performance after periods of unconscious thought. This conclusion highlights the importance of giving feedback to those being professionally occupied with deception detection performance. Second, one may speculate that the superiority of unconscious thought is more pronounced with older than with younger individuals, thus adding to the literature highlighting the particular capacity of older individuals, instead of focusing on the cognitive deficiencies related to physiological declines associated with aging (for a comprehensive review of age-related differences in cognition, see Salthouse, 2012).

With regard to practical implications, it is likely impossible to think unconsciously when decisions need to be made quickly. However, time permitting, the present results suggest that in the absence of conscious focus, unconscious processes may allow for higher classification accuracy because less stereotypical and more objectively valid deception cues are relied on. Judgments formed immediately or after periods of conscious thought, in contrast, seem to be hampered by reliance on stereotypical cues. These differences in information use are worth highlighting again because it is precisely such systematic (conscious) evaluations of stereotypical deception cues that have been recommended, for example, in police training manuals (Kassin & Fong, 1999; Masip, Alonso, Garrido, & Herrero, 2008; Meissner & Kassin, 2002; Sporer, 2004). Against the background of the present results, caution with respect to such recommendations appears in order. In contrast, one might speculate how unconscious processes might be incorporated into manuals accordingly. Very cautiously, we wish to close by inviting further research into the following three-step practical procedure: First, individuals should be asked to process the information of a given message with the explicit aim to form an overall impression only. That individuals in applied settings often seek to detect deception right away may render this goal more difficult, yet not impossible, to attain. For instance, instructions may stress that the general picture is important, much like when individuals are successfully asked to focus on global instead of local aspects (see, for instance, Förster & Dannenberg, 2010; Huntsinger, Clore, & Bar-Anan, 2010; Marguc, Förster, & Van Kleef, 2011); or individuals may be asked to focus on something other than the focal person upon first exposure. Note that this first step appears conceptually commendable, but may not be imperative, as the results of Experiment 3 demonstrate, in which unconscious-thought participants performed well above chance despite likely wondering about truth status during information presentation. In a second step, individuals should be made aware of the possibility of deception, or, if this is obvious in the respective area, only then be given the explicit goal to detect deception (consistent with Bos et al., 2008). However, following this instruction, it is important that conscious attention is drawn elsewhere. Recommendations may include, for instance, focusing on another task, such as replying to emails or making a phone call. At present, it is an open question as to how long this period of distraction should last, as distraction duration varies in the literature (see Strick et al., 2011). What can be said, however, is that periods of two to three minutes proved successful in the present experiments. Only then, in a third step, should individuals be asked to form veracity judgments. Again, in closing, we wish to stress that this three-step-model is not yet fit for a “roll-out” in applied settings, but is meant to provide pathways and testable hypotheses, propelling further research into ways of improving deception detection.

In sum, the present findings offer a solution to the apparent puzzle of humans’ seeming incapacity to distinguish lies from the truth and the critical need of being able to do so. Five experiments not only document that conditions of unconscious thought help individuals to attain higher accuracy rates in deception detection, but also shed some light on the processes underlying this performance boost.

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Footnotes

[1] Although participant gender was not of theoretical interest in the present line of experiments, earlier research has speculated about potential gender effects in the ability to detect deception (cf. Aamodt & Custer, 2006). To document the absence of such gender effects, participant gender was included as a control variable. In all experiments, analyses without gender as control variable yield similar significance levels.

[2] We also ran an analysis with set of messages as an additional independent variable. No significant main effect of set of messages or significant interaction effects with set of messages on *d'* were found, all *p*s > .074. The same analysis with *C* as dependent variable yielded, unexpectedly, a significant 2-way interaction of thinking mode × set of messages, $F(2, 54) = 3.89$, $p = .026$. Moreover, a significant 3-way interaction of thinking mode × gender of participants × set of messages on *C*, $F(2, 54) = 3.24$, $p = .047$, was observed. Because of very low cell sizes in some of the conditions ($n = 3$), we refrain from suggesting interpretations. All other *p*s > .19. Full results are available from the authors.

[3] An analysis with set of messages as an additional independent variable yielded, unexpectedly, a significant main effect of set of messages on *d',* $F(3, 92) = 9.18$, $p < .001$, $\eta_p2 = .23$ ($M_{set1} = .19$, $SD = 0.75$ vs. $M_{set2} = .10$, $SD = 0.84$ vs. $M_{set3} = .91$, $SD = 0.79$ vs. $M_{set4} = -.14$, $SD = 0.70$), suggesting that accuracy detection was higher in some sets than in others. Although unfortunate, this main effect appears negligible, because no interaction effects involving set of messages were observed, all *p*s > .21. The same analysis with *C* as dependent variable yielded no significant effects, all *p*s > .11.

[4] We decided to label this group “immediate” so as to allow for easier comparison with the literature on unconscious thought, which generally features the three conditions unconscious, conscious, and immediate (e.g., Dijksterhuis, 2004).

[5] An analysis with set of messages as an additional independent variable yielded no significant main effect of set of messages or interaction effects on *d'*, all *p*s > .40. The same analysis with C as dependent variable unexpectedly yielded a significant main effect of set of messages, $F(4, 72) = 3.64$, $p = .009$, $\eta_p 2 = .17$ ($M_{set1} = .40$, $SD = 0.19$ vs. $M_{set2} = .41$, $SD = 0.16$ vs. $M_{set3} = .25$, $SD = 0.26$ vs. $M_{set4} = .28$, $SD = 0.21$ vs. $M_{set5} = .27$, $SD = 0.18$). This main effect suggests that truth bias was more prevalent in some sets than in others. Although unfortunate, this main effect appears negligible because no significant interaction effects involving set of messages were observed, all *p*s > .17.

[6] We thank one of the reviewers for pointing out this possibility.

Table 1

Means (in %) and Standard Deviations of Accuracy of Lie/Truth Judgments as a Function of Thinking Mode in Experiments 1 to 4; Percentage of Participants correctly Classifying the Recording as True/False in Experiment 5.

Experiment	Thinking mode	Lies			Truths			Overall		
		M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
1	Standard control	53.41%	19.36	22	46.59%	25.93	22	50.00%	14.94	22
	Conscious-thought	46.87%	18.52	24	57.29%	20.16	24	52.08%	15.05	24
	Unconscious-thought	66.25%	23.33	20	60.00%	26.16	20	63.13%	20.47	20
	Mean	54.92%	21.58	66	54.55%	24.38	66	54.74%	17.51	66
2	Standard control	50.61%	27.66	41	54.27%	22.98	41	51.52%	17.94	41
	Conscious-thought	50.68%	24.64	37	59.46%	28.47	37	54.39%	19.81	37
	Unconscious-thought	68.42%	28.88	38	65.79%	23.55	38	65.46%	21.24	38
	Mean	56.47%	28.19	116	59.70%	25.28	116	57.00%	20.41	116
3	Standard control	35.41%	31.21	24	50.00%	29.49	24	42.71%	22.70	24
	Conscious-thought	35.41%	34.51	24	54.17%	35.86	24	44.79%	31.26	24
	Unconscious-thought	70.83%	35.86	24	72.92%	29.41	24	71.88%	30.67	24
	Immediate	39.58%	36.05	24	41.67%	38.07	24	40.63%	34.43	24
	Online	50.00%	32.67	24	58.33%	35.09	24	54.17%	30.98	24
4	Standard control	44.55%	22.56	23	57.61%	15.87	24	51.09%	13.54	24
	Conscious-thought	42.06%	19.50	22	50.00%	21.82	22	46.02%	16.54	22
	Unconscious-thought	66.67%	26.61	21	63.10%	25.76	21	64.88%	22.92	21
	Mere-distraction	47.06%	23.18	17	58.82%	19.64	17	52.94%	17.42	17
	Mean	50.00%	24.69	83	57.23%	21.22	83	53.62%	18.88	83
5	Standard control	66.67%	na	36	30.56%	na	36	48.61%	na	72

Conscious-thought	50.00%	na	36	41.67%	na	36	45.83%	na	72
Unconscious-thought	61.11%	na	36	94.44%	na	36	77.78%	na	72
Mean	59.26%	na	108	55.56%	na	108	57.41%	na	216

Note: na = not applicable in Experiment 5.

Table 2

Columns 2 to 4: Point-Biserial Correlations Between Lie/Truth Judgments (r_{pb}) and Occurrence of Verbal Content, Nonverbal, and Paraverbal Cues to Deception for standard control (sc, n = 72), conscious-thought (ct, n = 72) and unconscious-thought participants (ut, n = 72) in Experiment 5. Column 5 and 6: Relation Between Objective Truth Status and Occurrence of Verbal Content, Nonverbal, and Paraverbal Cues to Deception, expressed as Point-Biserial Correlations (r_{pb}) and Effect Sizes (d); Column 7: Inter-coder Reliabilities for Objective Cues (r).

	Subjective			Objective		Reliability
	sc	ct	ut			
	r_{pb}	r_{pb}	r_{pb}	r_{pb}	*d*	*r*
			Verbal Cues			
Number of Words	.15	.11	-.12	-.10	-0.19	/
Consistency	-.21	.30*	-.07	-.10	-0.21	.52
Details (frequency)	.19	.02	-.14	-.12	-0.24	.87
Details (time)	-.12	.11	.04	-.02	-0.03	.50
Details (profoundness)	.15	-.10	-.07	-.12	-0.24	.66
Mental status	-.01	-.08	.15	.25	0.50*	.88
Admitted lack of memory	-.17	.12	-.04	.05	0.10	.89
			Nonverbal Cues			
Nervous	-.06	.04	.02	-.09	-0.18	.64
Smiling	-.07	.17	.14	.06	0.12	.93
Eye contact	.28*	-.07	.02	-.02	0.03	.98
Postural shifts	-.14	.09	-.25*	-.26	-0.55*	.72
Foot/leg movements	-.05	.01	.01	.02	0.04	.86
Hand/finger movements	-.09	-.05	.07	-.03	-0.06	.96
Chin raise	-.05	.04	.01	-.02	-0.03	.86
Involved/expressive	-.29*	.20	.10	.02	0.04	.69
Attractiveness	-.18	.28*	-.05	-.03	0.06	.69
Cooperativeness	.02	.08	.02	-.10	-0.20	.65
Friendly/pleasant	-.12	.01	.18	-.07	-0.13	.62
Facial pleasantness	-.06	.01	.24*	.31	0.64*	.86
Fidgeting	.04	-.11	.26*	-.02	-0.05	.83
			Paraverbal Cues			
Response length	.13	.21	-.10	-.10	-0.19	.99
Verbal/vocal uncertainty	-.06	.23	.11	.16	0.33	.59

Vocal pleasantness	-.05	-.01	-.02	.05	0.10	.87
Vocal tension	-.07	-.06	-.30*	-.27	-0.55*	.96
Unfilled pauses length	.12	-.01	-.25*	-.26	-0.55*	.68
Filled pauses length	.17	.02	-.12	-.28	-0.59*	.50
Word/Phrase repetitions	.04	-.01	-.18	-.24	-0.49*	.89

Note. Larger values of *d* indicate more frequent occurrence of cues in *true* messages.
* $p < .05$; ** $p < .005$; *** $p < .001$. All tests are two-tailed.

Figure 1. Classification accuracy (*d'*) as a function of thinking mode in Experiment 1. Error bars indicate standard error of mean (SEM).

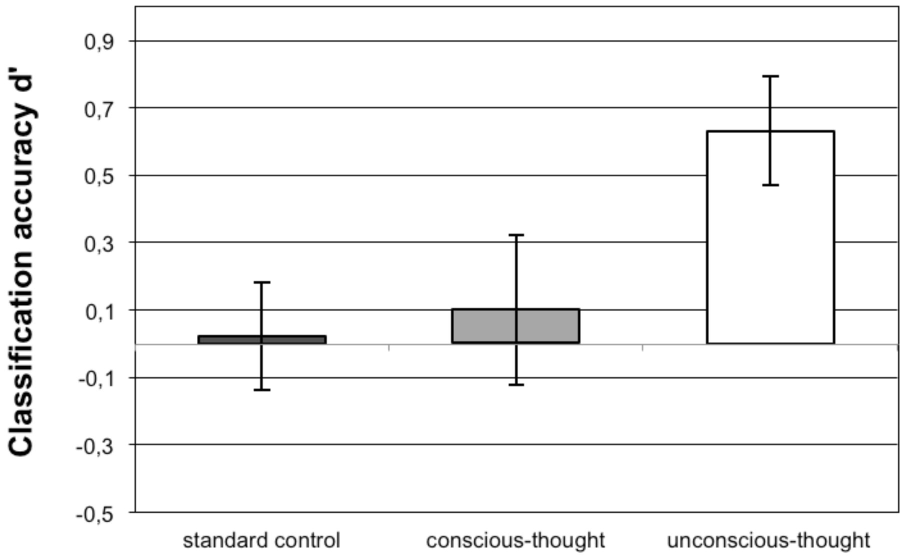

Figure 2. Classification accuracy (*d'*) as a function of thinking mode in Experiment 2. Error bars indicate standard error of mean (SEM).

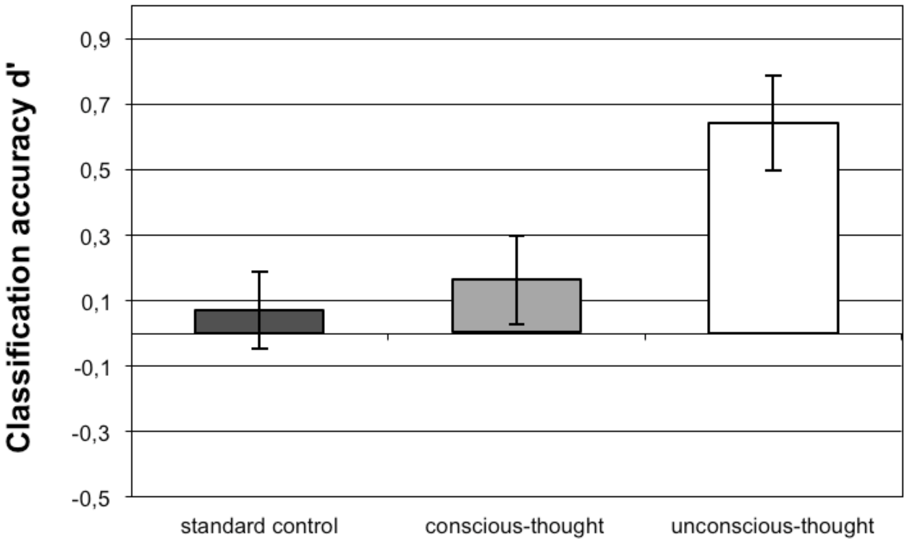

Figure 3. Classification accuracy (*d'*) as a function of thinking mode in Experiment 3. Error bars indicate standard error of mean (SEM).

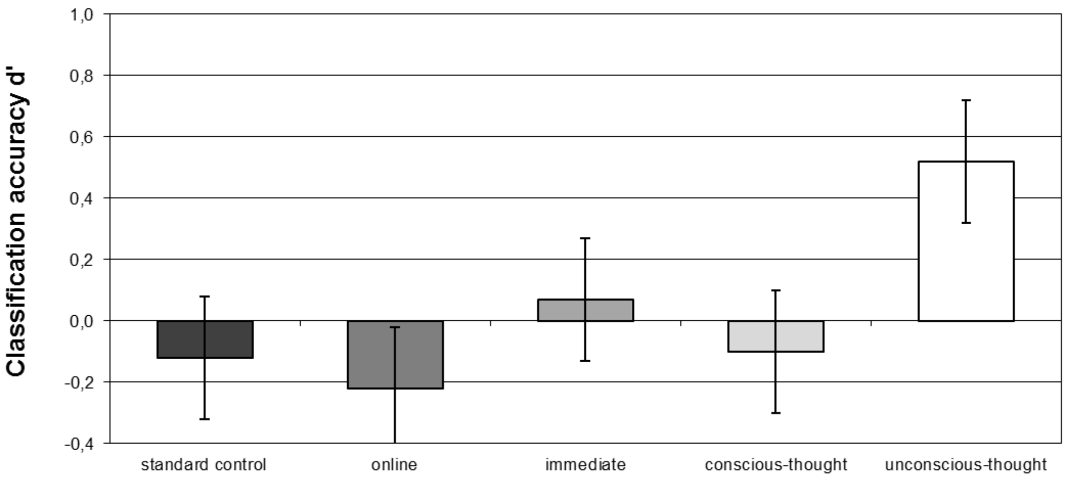

Figure 4. Classification accuracy (*d'*) as a function of thinking mode in Experiment 4. Error bars indicate standard error of mean (SEM).