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Some Evidence for Unconscious Lie Detection

Leanne ten Brinke, Dayna Stimson, and Dana R. Carney
Haas School of Business, University of California, Berkeley

Abstract
To maximize survival and reproductive success, primates evolved the tendency to tell lies and the ability to accurately detect them. Despite the obvious advantage of detecting lies accurately, conscious judgments of veracity are only slightly more accurate than chance. However, findings in forensic psychology, neuroscience, and primatology suggest that lies can be accurately detected when less-conscious mental processes (as opposed to more-conscious mental processes) are used. We predicted that observing someone tell a lie would automatically activate cognitive concepts associated with deception, and observing someone tell the truth would activate concepts associated with truth. In two experiments, we demonstrated that indirect measures of deception detection are significantly more accurate than direct measures. These findings provide a new lens through which to reconsider old questions and approach new investigations of human lie detection.

Keywords
deception detection, consciousness, evolution, social cognition

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Human beings lie frequently and about all manner of things. Sometimes lies are small, prosocial, and without negative consequence. Other times, lies destroy precious, hard-earned value in personal, professional, and civic life (Ekman, 1992). Because deception is ubiquitous, one's livelihood can depend on the ability to detect it accurately. However, when asked to make a simple decision about whether a person is lying or telling the truth, humans perform poorly. Individual studies consistently find human judgments of veracity to be no more accurate than the flip of a coin (Ekman & O'Sullivan, 1991; Porter, Woodworth, & Birt, 2000). Although a recent meta-analysis found average accuracy to be statistically greater than chance, that average was only 54% (Bond & DePaulo, 2006).

This general deception-detection incompetence is inconsistent with evolutionary theory, which suggests that the accurate detection of deception is critical to human survival (Dawkins & Krebs, 1979). Evolutionary theory suggests that for survival and reproduction, the ability to accurately detect deception must have evolved alongside the tendency to lie in a coevolutionary "competition"—after all, the acquisition of survival-related resources and attraction of quality mates may be enhanced both by successful deception and by keen detection of deception (Bond, Kahler, & Paolicelli, 1985). In this dance of skill, deceivers are always adapting to avoid detection, while targets of deception follow close behind in their counter-deception strategies, allowing only a few costly lies to evade detection before they become wise to deceivers' new strategies (Dawkins & Krebs, 1978; von Hippel & Trivers, 2011). As a result of increasing observer accuracy, the effectiveness of a deceiver's strategy decreases, and he or she must adopt a new strategy to outwit the victim—and the cycle begins anew.

Thus, although liars possess the basic architecture to continually transform those signals that betray their lies, lie detectors must have some mental architecture in place to support the commensurate shift in signal detection. However, results from studies of explicit lie-detection

Corresponding Authors:
Leanne ten Brinke, Haas School of Business, University of California, Berkeley, 2220 Piedmont Ave., Berkeley, CA 94720
E-mail: leannetenbrinke@berkeley.edu

Dana R. Carney, Haas School of Business, University of California, Berkeley, 2220 Piedmont Ave., Berkeley, CA 94720
E-mail: dcarney@berkeley.edu

accuracy fall short of supporting this notion; 54% accuracy provides little protection from manipulation by deceivers, especially given that this above-chance accuracy is driven by the accurate detection of truths (mean accuracy = 61%), not lies (mean accuracy = 47%; Bond & DePaulo, 2006). However, von Hippel and Trivers (2011) pointed to several ways in which the existing research may systematically underestimate lie-detection ability, and we offer one more—the existing research has focused on explicit assessments, but the mental architecture promoting this skill may be unconscious (Reinhard, Greifeneder, & Scharmach, 2013).

Although humans are poor lie detectors, evidence from primatology and neuroscience suggests that without conscious awareness, parts of the human brain can automatically detect deception, as can the brains of nonhuman primates (e.g., Grèzes, Frith, & Passingham, 2004; Wheeler, 2010). Taking these past findings together, we predicted that indirect measures of deception detection—measures capable of accessing parts of the mind that are less consciously accessible, relative to those that measure conscious thoughts—would demonstrate more deception-detection accuracy than would direct or conscious measures.

Attempts to Explain Incompetence in Deception Detection

Researchers from social, forensic, and evolutionary psychology have advanced many theories in an attempt to explain the consistently poor accuracy of deception detection; however, most accounts fall short of explaining the full suite of findings. For example, some blame the lack of accuracy on the absence of a single telling cue, such as Pinocchio's nose: Deceptive behavior is subtle and variable across time and persons (e.g., DePaulo et al., 2003; Hartwig & Bond, 2011). Liars (as opposed to truth tellers) emit a complex array of nonverbal cues, and research suggests that—even in the presence of many deception cues—perceivers have inaccurate beliefs about which nonverbal cues to rely on (Global Deception Research Team, 2006). Moreover, deceivers do not necessarily feel or behave in keeping with predominant stereotypes; for example, the commonly held belief that liars avert their gaze and fidget is false (Bond & DePaulo, 2006). Other theoretical frameworks point to the fact that humans often live in conditions of such abundance and safety that they lack the motivation and suspicion necessary to detect deception (Vrij, Granhag, & Porter, 2010). These theories are consistent with findings suggesting that under conditions of environmental scarcity, deception-detection accuracy increases (Carney et al., 2013).

Deception Can Be Accurately Detected: Evidence From Primatology and Neuroscience

The evolutionary argument that humans should be accurate at detecting deception finds some traction in primate work, which suggests that nonhuman primates can both produce and detect lies successfully (Byrne & Corp, 2004; Menzel, 1974). Goodall (1986) and other researchers have documented sophisticated and accurate deception detection by chimpanzees. This ability allows them to find (and subsequently steal) food hidden by a dishonest counterpart. Likewise, capuchin monkeys accurately detect deception, choosing to ignore false alarm calls aimed at luring feeding monkeys away from a meal (Menzel, 1974; Wheeler, 2010). Strategies for acquiring (or maintaining) access to resources are precisely the mechanism thought to promote this ability in humans, too (Krebs & Dawkins, 1984).

Recent brain-imaging work suggests that three brain regions are activated when deceptive acts are correctly (rather than incorrectly) detected: the orbitofrontal cortex (involved in understanding other people's mental states), the anterior cingulate cortex (associated with monitoring inconsistencies), and the amygdala (associated with detecting threats; Grèzes et al., 2004; Lissek et al., 2008). Abnormal functioning in these regions is associated with deficits in basic social cognition in general, as well as impaired deception-detection accuracy (e.g., among autistics; Sodian & Frith, 1992). By contrast, aphasics—people who have damage to the left cerebral hemisphere (particularly the left orbitofrontal cortex), cannot comprehend spoken sentences, and therefore must rely on nonverbal cues—are more accurate at detecting deception than healthy observers (Etcoff, Ekman, Magee, & Frank, 2000). Together, these findings reveal the basic architecture supporting accurate deception detection and suggest that when conscious thought is impaired or stripped away, deception-detection accuracy is enhanced. In fact, Albrechtsen, Meissner, and Susa (2009), Ask, Granhag, Juhlin, and Vrij (2013), and Hartwig and Bond (2011) have all hinted at the possibility that the ability to detect deception accurately may linger below the reaches of conscious introspection.

The Unconscious Mind Is Equipped to Detect Deception

A dual-process perspective suggests that less-conscious parts of the mind are equipped with the architecture for accurate deception detection, but that conscious reasoning compromises accuracy by imposing attribution biases and incorrect stereotypes about how liars behave during deception (Evans & Stanovich, 2013; Vrij, Granhag, & Porter, 2010). Evidence for this notion comes from data showing that imposing cognitive load or interrupting conscious deliberation about a target's veracity increases explicit deception-detection accuracy by up to 15% (Albrechtsen et al., 2009; Reinhard et al., 2013). These results suggest (a) a tension between explicit and implicit processes of deception detection and (b) a consolidative or "corrective" mental design in which bottom-up accuracy of the unconscious is dampened by the extent to which cognitive resources are available to provide top-down interference (Gilbert, 1999). Indirect lie-detection strategies also increase accuracy; observers predict veracity more accurately when they rate the extent to which a potential liar appears to be ambivalent or thinking hard than when they directly judge whether the person is telling the truth or lying (Sporer & Masip, 2012; Vrij, Edward, & Bull, 2001).

To shift explicit decisions toward greater accuracy, researchers have provided participants who act as lie detectors with detailed information about deceptive behavior. Training programs have had modest success, ranging from gains of 4% (Frank & Feeley, 2003) to gains of more than 30% (Shaw, Porter, & ten Brinke, 2012). Although such effortful and cerebral approaches can increase deception-detection accuracy, evidence points overwhelmingly to the idea that somewhere below the reaches of conscious access, such accuracy already exists. In the experiments reported in this article, we sought direct empirical support for that proposition.

Overview of the Experiments

We hypothesized that indirect measures of deception detection—capable of accessing less-conscious parts of the mind—would demonstrate greater accuracy than direct, or conscious, measures. Experiment 1 used a high-stakes mock-crime paradigm to produce videos of people (N = 12) who were either lying or telling the truth about stealing $100. We then used these videotaped stimuli to test our hypothesis with the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998; Nosek, Greenwald, & Banaji, 2007). Experiment 2 further tested the hypothesis by using subliminally presented images and a semantic-classification task (Draine & Greenwald, 1998). In both experiments, naive participants also made direct judgments of whether each videotaped person was lying or telling the truth.

Experiment 1

We created a set of videotaped targets who insisted that they had not committed a crime; half of these people were genuinely pleading their innocence, and the other half were lying. We used these targets to test the hypothesis that indirect measures of deception detection would demonstrate more accuracy than traditional, direct self-report measures.

Method

Participants. Seventy-two undergraduate students (51 female, 21 male) watched the pleader videos and completed direct and indirect measures of deception-detection accuracy. Participants were paid $16 and were 20.7 years old on average (SD = 3.1 years).

Development of pleader videos. A high-stakes mock-crime paradigm was borrowed from prior work in criminal justice (Kircher, Horowitz, & Raskin, 1988) and social psychology (e.g., Frank & Ekman, 2004; see DePaulo et al., 2003) to develop the videos used in the main experiment. Participants (N = 12; 6 male, 6 female), hereafter referred to as suspects, were randomly assigned to steal $100 from an envelope that had been placed among a stack of books in the testing room (steal condition; n = 6) or not to steal the $100 (no-steal condition; n = 6). They were told that they would earn the $100 if they convinced the experimenter that they had not stolen the money (regardless of whether they had) and that they would also be entered into a lottery to win an additional $500. Failure to convince the experimenter resulted in a loss of the $100 prize. After these instructions were given, the experimenter left the room, and each suspect received instructions for one of the conditions. The instructions for the steal condition were as follows:

> STEAL THE MONEY OUT OF THE ENVELOPE!!! Be very quiet. Put the envelope and books back exactly as you found them. Put the money ON YOU somewhere—pocket, sock, wherever, but make sure the experimenter can't see it (obviously). When you are done STEALING the money come back to the computer and click "continue."

The instructions for the no-steal condition were as follows:

> DO NOT steal the money in the envelope. Leave the money in the envelope and put it back where you found it. Be very quiet. Put the envelope and books back exactly as you found them. When you are done putting the money and envelope back in the books, come back to the computer and click "continue."

After the possible theft, the experimenter reentered, turned on a video camera, and began the interrogation. Suspects were asked a series of 10 questions in an affectively neutral, firm manner. These questions included *baseline questions* (i.e., neutral questions pertaining to verifiable facts but not the mock theft) and *pleading questions* (i.e., questions about the possible theft; Kircher et al., 1988). Baseline questions included "What are you wearing today?" and "What is the weather like outside?" The pleading questions were adapted from Frank and Ekman (2004) and included "Did you steal the money?" "Why should I believe you?" and "Are you lying to me now?" These interrogations were videotaped. The resulting 12 mock-crime videos (6 genuine, 6 deceptive) lasted an average of 97 s (SD = 21.62 s) and captured frontal views of the suspects from the shoulders up. These videotaped stimuli are available from the authors for research use.

Three variables were measured to assess evidence of deception: self-reported emotional distress (suspects' ratings of how afraid, frightened, scared, and jittery they felt), physiological stress (salivary cortisol reactivity 10 min after arrival and approximately 27 min after the manipulation), and nonverbal tells. Nonverbal tells were defined as reliably coded changes in behavior (relative to baseline; taken primarily from DePaulo et al., 2003) that signal deception: less speaking time, faster speech rate, more nervousness, more lip presses, less cooperativeness, more vocal uncertainty, more one-sided shoulder shrugs. The three variables were z-scored and combined by principle component analysis to produce a deception-stress composite variable. As expected, deceptive pleaders showed more evidence of deception-related stress (M = 0.66, SD = 0.99) than did truth tellers (M = −0.66, SD = 0.42), $F(1, 11) = 9.05$, $p < .013$, $d = 1.81$ (these data accompany the set of videotaped stimuli freely available from the authors).

Procedure. Participants viewed pairs of pleader videos (one truth teller, one liar) presented sequentially and in counterbalanced order in the middle of a computer screen. Each video was presented in an area that was approximately 4 × 4 in. A unique pseudonym was displayed across the top of the screen (above the video) for each pleader (e.g., "John"; pseudonyms were balanced for length and commonality within and across pairs). After each pair of videos was presented, participants saw the pleaders' images on the screen. First, they completed a direct, self-report judgment of whether each pleader was lying or telling the truth (i.e., forced-choice format; Bond & DePaulo, 2006).

Next, we tested whether participants were more likely to conceptually link the deceptive pleader's face with deception-related concepts than with truth-related concepts and whether they were more likely to conceptually link the truthful pleader's face with truth-related concepts than with deception-related concepts (for use of the same paradigm to reveal deceptive intentions, see Ask et al., 2013). Specifically, participants completed an IAT juxtaposing the two targets. In the IAT, the category labels "truth" and "lie" were displayed in the upper right and left corners of the screen (the left/right positions were counterbalanced), and one of the pseudonyms was displayed with each label (varied across blocks). Still photographs from each video and words associated with lies ("untruthful," "dishonest," "invalid," "deceitful) and truths ("truthful," "honest," "valid," "genuine") were presented in the center of the screen. Participants were asked to classify photos into the right- or left-hand category according to the correct pseudonym and to classify words as being related to truths or lies. A five-block IAT format (with category counterbalancing and scoring procedures by Greenwald, Nosek, & Banaji, 2003) was used.

Accurate deception detection was operationalized as a mental association between the liar or truth teller and congruent deception-related concepts. The principle underlying the IAT is that stimuli that share conceptual features are more mentally associated than those that do not. In this context, we were interested in whether observing someone tell a lie would, outside of awareness, activate mental concepts associated with deception.

This procedure was performed six times to gather direct and indirect measures of deception detection accuracy for all 12 pleader videos.[1] Each IAT provided an effect size (d score) representing the strength of association between the liar and deception concepts and between the truth teller and truth concepts (relative to incongruent pairings). Indirect deception detection was measured as the average d score across the six IATs; higher values and scores above zero indicated greater accuracy and discrimination above chance, respectively.

Results and discussion

No evidence for direct (self-report) deception-detection accuracy. Explicit accuracy in discriminating liars from truth tellers was poor (M = 46.83%, SD = 13.54). This accuracy rate was marginally below chance (50%), $t(71) = -1.97$, $p = .053$, $d = -0.23$, but fell well within the range of accuracy outcomes included in the meta-analysis by Bond and DePaulo (2006). Detection of lies specifically (M = 43.75%, SD = 14.92) was below chance, $t(71) = -3.56$, $p = .001$, whereas accuracy for truthful statements did not differ from chance (M = 48.61%, SD = 19.53), $t(71) = -0.60$, $p = .55$. No effects of participants' gender were evident, ps > .05. These findings support the claim that consciously considered self-report deception detection is not very accurate.

Some evidence for indirect deception-detection accuracy. Mean d scores (M = 0.06, SD = 0.19) were significantly greater than zero, $t(71) = 2.63$, $p = .011$, $d = 0.32$. Thus, it appears that viewing a liar automatically activates concepts associated with deception, and viewing a truth teller automatically activates concepts associated with truth. Female participants achieved significantly greater indirect accuracy (M = 0.10, SD = 0.17) than male participants (M = −0.03, SD = 0.20), $t(70) = -2.74$, $p < .01$, $d = -0.65$. This gender difference is consistent with previous findings that women's person-perception accuracy is greater than men's (Hall, 1978).

Experiment 2

Results of Experiment 1 suggested that less-conscious processing can reveal accurate discrimination between liars and truth tellers. However, Experiment 1 had methodological limitations inherent to the IAT. First, videos were watched in pairs, each including one liar and one truth teller. The contrast in pleader sincerity could have artificially increased accuracy. Second, the images of liars and truth tellers presented in the context of the IAT were supraliminal. Use of subliminal images would provide a stricter test of our hypothesis. Thus, in Experiment 2, we used a semantic-classification task in which images of liars and truth tellers were presented subliminally.

Method

Participants. Sixty-six undergraduates (42 female, 24 male) completed the study for $16 in compensation. Participants were 20.33 years old on average (SD = 1.82 years).

Procedure. The same set of 12 videos (6 genuine, 6 deceptive) used in Experiment 1 were presented in randomized pairs, which resulted in two unmatched pairs (truth-lie) and four matched pairs (two truth-truth, two lie-lie). Participants viewed one pair of videos and then completed a semantic-classification task following the method of Draine and Greenwald (1998). After watching the first pair of videos, participants completed a practice block of 8 trials to familiarize themselves with the task and then proceeded to a test block of 64 trials. For each subsequent pair of videos, participants completed a test block of 64 trials without a practice block.

In the test blocks, each trial began with a 1,000-ms fixation point (+) in the center of the computer screen. This was followed by an abstract face (taken from Cunningham et al., 2004), presented for 187 ms; a face stimulus, presented for 17 ms (or one screen refresh); and the abstract face, presented again for 187 ms (Fig. 1). The face stimuli were still photographs captured from the previously watched videos; their subliminal presentation ensured that any spreading activation based on the pleader's sincerity was unconscious.[2] One of eight target words ("truthful," "honest," "valid," "genuine," "untruthful," "dishonest," "invalid," or "deceitful") then appeared in the center of the screen until the participant sorted the word as belonging to the category of "truth" or "lie"; these category labels appeared in the upper right and left

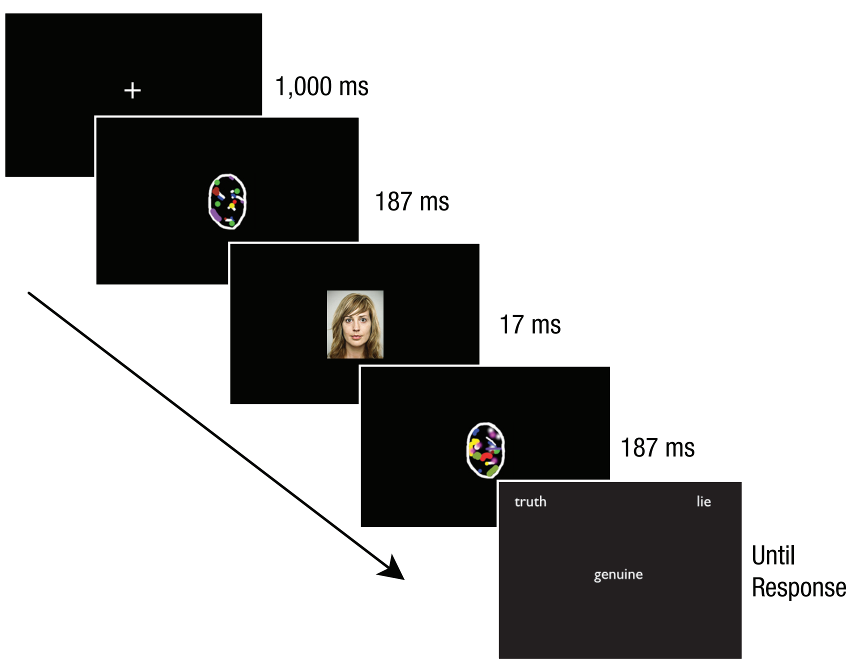

Fig. 1. Trial sequence in the semantic-classification task of Experiment 2. Each trial began with a fixation point, which was followed by an abstract face, a face stimulus, and the abstract face a second time, in a forward- and backward-masking procedure. A target word then appeared in the center of the screen until the participant indicated whether the word belonged to the category of "truth" or "lie."

corners of the screen (left/right position was counterbalanced across participants). The practice block did not include subliminal primes; instead, a black screen appeared between the fixation point and each target word. These trials familiarized participants with the task and provided them with accuracy feedback (a red "X" was presented following an incorrect response).

Participants then saw an image of each pleader from the previous pair of videos, one after the other. They completed an explicit self-report judgment of each pleader's sincerity by responding to the following question: "Is this person lying or telling the truth?" This procedure (semantic-classification task followed by explicit judgment) was repeated for each of the six pairs of videos. Response times for trials in which there was an accurate response were retained for analysis. Scores (*d*) were calculated by subtracting the mean response time on congruent trials from the mean response time on incongruent trials and dividing the resulting value from the pooled standard deviation.

Results and discussion

No evidence for direct (self-report) deception-detection accuracy. Results for the explicit judgments were consistent with our hypothesis and with evidence from traditional deception-detection paradigms. Participants performed at chance level when their veracity judgments were conscious (M = 49.62%, SD = 11.36), $t(65) = -0.27$, $p = .79$, $d = -0.01$. Truthful statements were accurately detected at a rate greater than chance (M = 62.63%, SD = 22.66), $t(65) = 4.53$, $p < .001$. The detection of lies (M = 36.62%, SD = 17.59), however, was significantly below chance, $t(65) = -6.18$, $p < .001$.

Some evidence for indirect deception-detection accuracy. Automatic deception detection, as represented by *d* scores (M = 0.03, SD = 0.11), was significantly greater than zero, $t(65) = 2.26$, $p = .027$, $d = 0.27$. These results indicate that subliminally presented faces of liars and truth tellers activated and facilitated congruent concepts.[3]

Are indirect deception-detection measures more accurate than direct measures? To directly compare direct and indirect measures of deception-detection accuracy, we conducted a mini meta-analysis of Experiments 1 and 2 (see Fig. 2). The average effect size (r) was .28 for indirect (less-conscious) measures and –.11 for direct (conscious self-report) measures. As expected, automatic associations were significantly more accurate than controlled, deliberate decisions, $z = -3.32$, $p < .001$. These findings suggest that viewing a liar automatically and unconsciously activates deception-related concepts, and viewing a truth teller activates truth concepts, which supports our hypothesis that indirect measures of deception detection demonstrate greater accuracy than direct self-reports, which have dominated past research.

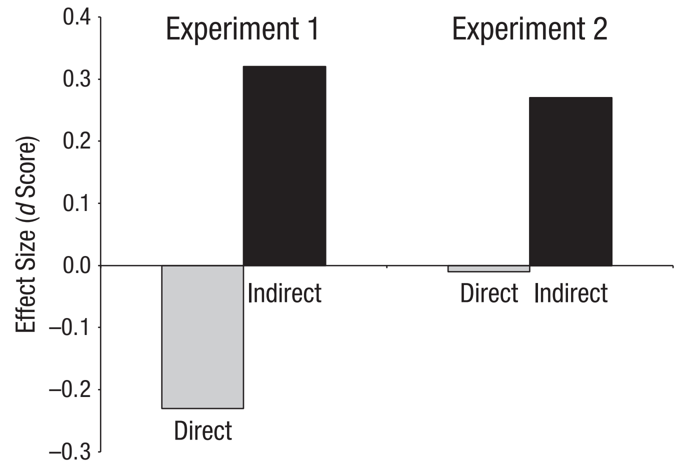

Fig. 2. Participants' accuracy in discriminating between liars and truth tellers in Experiments 1 and 2. For each experiment, the directional effect size for both direct judgments and an indirect measure is shown.

General Discussion

Across two experiments, indirect measures of accuracy in deception detection were superior to traditional, direct measures. These results provide strong evidence for the idea that although humans cannot consciously discriminate liars from truth tellers, they do have a sense, on some less-conscious level, of when someone is lying. The current results are consistent with previous findings that primates lacking self-awareness can demonstrate the ability to detect deception (Wheeler, 2010). They are also consistent with evidence that people can accurately discern liars from truth tellers when they are cognitively taxed or when they have injured certain parts of the brain (Albrechtsen et al., 2009; Etcoff et al., 2000). These findings provide long-sought support for the evolutionary perspective that accurate deception detection is adaptive and should be favored by natural selection (Krebs & Dawkins, 1984).

Characterizing human deception detection as an error-fraught process, no more accurate than chance, is a misleading summary of scientific insight on the topic, given interdisciplinary findings and the results presented here. But how does consciousness interfere with the natural ability to detect deception? Viewed from a dual-process perspective, our results—in combination with insights from Albrechtsen et al. (2009) and Hartwig and Bond (2011)—suggest that the unconscious can make efficient and effective use of cues to deception, but the resulting accurate unconscious assessments are made inaccurate either by consolidation with or correction by conscious biases and incorrect decision rules (Gilbert, 1999).

Future directions and limitations

Although these findings suggest few practical implications, they provide a new lens through which to examine future questions and shed light on a process through which accurate lie detection may occur. Future investigations should test the replicability of this effect and extend this work to different forms of deception. As suggested by the variability in accuracy reported by Bond and DePaulo (2006), new stimuli may lead to more or less accurate explicit responses than reported here; regardless, we expect that implicit measures would always outperform explicit judgments of deception, because the unconscious mind identifies and processes cues to deception (to the extent that they are available) more efficiently and effectively than the conscious mind.

Furthermore, an important question is whether implicit accuracy is associated with the enhanced ability to detect lies, truths, or both. The evolutionary-arms-race framework predicts selection for increased accuracy in the detection of lies, in particular. Although our focus on overall discrimination accuracy is the norm in deception-detection research, it is a limitation of the current work and the methods we chose to measure implicit responses. Accuracies reported by Reinhard et al. (2013), however, appear to support the arms-race prediction: Preventing conscious deliberation about credibility improved lie detection more than truth detection. Future research should use alternative measures of implicit thought that allow for the direct examination of truth and lie detection.

Conclusion

In short, although the detection of lies is of great importance in personal, professional, and civic domains, past research has indicated that conscious determinations of deception are error ridden—a dismal conclusion that contradicts evolutionary theory. Our findings suggest that accurate lie detection is, indeed, a capacity of the human mind, potentially directing survival- and reproduction-enhancing behavior from below introspective access.

Author Contributions

D. R. Carney and L. ten Brinke developed the study concept. D. R. Carney and D. Stimson contributed to the design of Experiment 1, and L. ten Brinke designed Experiment 2. D. Stimson ran all data-collection procedures. D. R. Carney and L. ten Brinke analyzed and interpreted the data. L. ten Brinke drafted the manuscript, and D. R. Carney provided critical revisions. All authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Open Practices

Data concerning the accuracy results reported in Experiments 1 and 2 can be found at the following URLs: http://www.leannetenbrinke.com/publications.html and http://faculty.haas.berkeley.edu/dana_carney/vita.html. The videos used and the data that describe the cortisol reactivity, self-reported stress, and nonverbal cues to deception of the liars and truth tellers in the mock-crime scenario are available from the authors. The people depicted in these videos have provided consent for the use of their videos in future (institutional-review-board-approved) research, but they have not provided consent for their videos to be distributed publically. These materials are freely available for use; please contact the corresponding authors directly for access. The complete Open Practices Disclosure for this article can be found at http://pss.sagepub.com/content/by/supplemental-data.

Notes

1. In both experiments, after completing all judgments, participants completed the 10-item personality inventory from Study 2 of Gosling, Rentfrow, and Swann (2003) and a demographic questionnaire. Descriptive statistics were calculated for gender and age only, and only gender was analyzed as a potential moderator of deception-detection accuracy. We did not run any additional conditions or measure any additional critical dependent variables not mentioned here.

2. At the end of the experiment, participants completed a subliminal-threshold sensitivity task to ensure that liar and truth-teller faces were presented below the level of conscious awareness, as intended. Following the same forward- and backward-masking procedure as depicted in Figure 1, participants were unable to discriminate male and female faces at above-chance accuracy (M = 48.35%, SD = 15.14), which suggests that the faces were presented below conscious perception, $t(65) = -0.88$, $p = .38$.

3. Unlike in Experiment 1, no gender differences were evident, $t(64) = 1.67$, $p = .10$.

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