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MODERATORS OF NONVERBAL INDICATORS OF DECEPTION
A Meta-Analytic Synthesis

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In many legal proceedings, fact finders scrutinize the demeanor of a defendant or witness, particularly his or her nonverbal behavior, for indicators of deception. This meta-analysis investigated directly observable nonverbal correlates of deception as a function of different moderator variables. Although lay people and professionals alike assume that many nonverbal behaviors are displayed more frequently while lying, of 11 different behaviors observable in the head and body area, only 3 were reliably associated with deception. Nodding, foot and leg movements, and hand movements were negatively related to deception in the overall analyses weighted by sample size. Most people assume that nonverbal behaviors increase while lying; however, these behaviors decreased, whereas others showed no change. There was no evidence that people avoid eye contact while lying, although around the world, gaze aversion is deemed the most important signal of deception. Most effect sizes were found to be heterogeneous. Analyses of moderator variables revealed that many of the observed relationships varied as a function of content, motivation, preparation, sanctioning of the lie, experimental design, and operationalization. Existing theories cannot readily account for the heterogeneity in findings. Thus, practitioners are cautioned against using these indicators in assessing the truthfulness of oral reports.

Keywords: deception, nonverbal cues to deception, meta-analysis, moderator variables, lay assumptions

In many professions, it is particularly important to be skilled at detecting deception. Besides mistaken identifications, deception, perjury, and fraud by perpetrators, witnesses, and snitches are considered major contributing causes of miscarriages of justice (Huff, Rattner, & Sagarin, 1996; Scheck, Neufeld, & Dwyer, 2000). However, with few exceptions, many professionals such as police officers, customs inspectors, federal law enforcement officers, federal polygraphers, robbery investigators, judges, law enforcement personnel, parole officers, and psychiatrists are no more skilled at detecting deception than the average observer (Aamodt & Custer, 2006; Bond & DePaulo, 2006; Ekman & O'Sullivan, 1991). Even training programs specifically designed (and sold) to improve detection of deception have notoriously failed, some actually showing a detriment rather than an improvement in performance (Meissner & Kassin, 2002). Although many observers seem to rely on nonverbal cues to detect deception, either they have trouble doing so effectively in ongoing interactions or the cues they use are not valid (Vrij, 2000).

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This meta-analysis provides an integrative review of the validity of nonverbal cues as a function of different situational variations that may affect their validity. Nonverbal cues can be subdivided into two broad classes: nonverbal visual cues (e.g., facial expressions or bodily behaviors) and paraverbal cues (aspects accompanying speech, such as pitch, pauses, or speech errors). Here, the focus is on nonverbal visual cues (eye blinks, eye contact, gaze aversion, head movements, nodding, smiles, adaptors, hand movements, illustrators, foot and leg movements, postural shifts; for a recent meta-analysis of paraverbal cues, see Sporer & Schwandt, 2006).

In a recent, comprehensive meta-analysis, B. M. DePaulo et al. (2003) analyzed 158 different cues to deception, including a large variety of nonverbal, verbal, and paraverbal cues, as well as certain content features of deceptive and truthful messages.[1] The present article investigates only a small subset of 11 nonverbal visual behaviors that we consider particularly important from an applied perspective, namely, blinking, eye contact, gaze aversion, head movements, nodding, smiles, adaptors, hand movements, illustrators, foot and leg movements, and postural shifts. Lay people and professionals pay attention to these aspects of demeanor to gauge whether a person is telling the truth or lying, for example, in cross-examination or in police interviews. Of these nonverbal behaviors, none showed a reliable association with deception across studies in DePaulo et al.'s meta-analysis. In fact, the only nonverbal indicators that showed effect sizes $|d| > 0.20$ ($r = .10$)[2] were overall nervousness and tension ($d = 0.27$, $r = .13$), pupil dilation ($d = 0.39$, $r = .19$), and a raised chin ($d = 0.25$, $r = .12$). However, the latter two estimates were based on only $k = 4$ studies.[3] Across three studies, liars were perceived to be less cooperative ($d = -0.66$, $r = -.31$). However, one may critically ask, what particular aspects of nonverbal behavior should one look for to classify a behavior as cooperative (defined in that study as "the speaker seems helpful, positive and secure"; B. M. De Paulo et al., 2003)?

[1]Unfortunately, we were not aware that B. M. DePaulo et al. (2003) had embarked on this large scale meta-analysis until all our data collection, analyses, and the first draft of our write-up were completed. Therefore, we have integrated only some of their findings in our introduction and discussion.

[2]Although many meta-analysts report d as a measure of effect size, we have used the Pearson point-biserial correlation r to describe our results (see Mullen, 1989; Rosenthal, 1991, 1994). Assuming equal ns, d values can be transformed to r values by the formula $r = d/\sqrt{(d \times d + 4)}$. Conversely, any r value can be transformed into d by the formula $d = \sqrt{[(4 \times r \times r)/(1 - r \times r)]}$.

[3]Some other visual nonverbal behaviors also showed effect sizes $|d| > 0.20$ but were investigated too infrequently to be included in the main analyses. Although there was no overall association of smiling with deception in $k = 27$ studies ($d = 0.00$, $r = .00$), there was a significant decrease in genuine smiles ($d = -0.70$, $r = -.33$) in two studies, whereas another study reported a significant increase in feigned smiles ($d = 0.70$, $r = -.30$). Two studies found significant changes in foot movements ($d = 1.05$, $r = .46$) and one study in pupillary changes ($d = 0.90$, $r = .46$). Specific hand and arm movements were also observed in two studies to significantly decrease while lying ($d = -0.36$, $r = -.18$). Two studies also found that liars tended to hold their hands together less frequently ($d = -0.21$, $r = -.10$), whereas two studies observed that they held them apart less frequently ($d = -0.15$, $r = -.07$), but both trends were not significant. The specific ways some of these latter behaviors were measured in individual studies makes it difficult to draw any general conclusions for practitioners from them. We therefore have focused in our analysis on easily observable behaviors that may or may not betray a liar.

Arguably, if a behavior cannot be observed objectively, it can hardly be used as a clue to deception.

In contrast, police training packages often include nonverbal and paraverbal behaviors as important cues to deception. Ever since Freud's influential writings in 1904, lay people and professionals alike have believed that these behaviors are particularly helpful in catching a liar (e.g., Akehurst, Köhnken, Vrij, & Bull, 1996; Breuer, Sporer, & Reinhard, 2005; Vrij & Semin, 1996; for a recent review, see Stromwall, Granhag, & Hartwig, 2004). Although there seem to be no reliable cues, a closer look reveals that some studies have found reliable differences between liars and truth tellers under certain conditions, which may account for the overall inconsistency in findings. An explanation for the contradictory findings obtained across individual studies might be that studies differ regarding experimental method, the type of sample, or the operationalizations used to measure the nonverbal behaviors of interest. A host of moderator variables may blur the association between nonverbal cues and deception. Some researchers gave their participants the opportunity to prepare deceptive messages; others did not. Also, it is quite difficult to motivate participants to lie in a laboratory setting where the consequences appear minimal compared with real-life situations, especially in criminal proceedings and before courts of law. Therefore, motivation and opportunity to prepare an account may be important moderator variables regarding the ecological validity of deception cues.

In this article, we present a new, theory-driven meta-analysis focusing on a variety of practically relevant moderator variables to account for differences in findings. We focus on those aspects that may be particularly relevant in a legal context. The choice of nonverbal behaviors investigated here was dictated by particularly strong beliefs regarding the diagnostic value of these behaviors in detecting lies. In contrast, the comprehensive meta-analysis by B. M. DePaulo et al. (2003) centered on self-presentation and lies in everyday life and investigated all nonverbal, paraverbal, and verbal cues ever studied. In the present meta-analysis, in addition to motivation and preparation (i.e., planning and rehearsal), the following variables were investigated as potential moderators: content features of the deceptive message, sanctioning of lies, degree of interaction between experimenter and participant, type of experimental design, and operationalizations of the variables. In the following section, we outline several theories that have been suggested to account for behavioral differences when lying in contrast to telling the truth.

Theories to Predict Nonverbal Correlates of Deception

Many researchers (e.g., Köhnken, 1990; Sporer & Schwandt, 2006; Vrij, 2000) have followed the four-factor model of behavioral cues to deception proposed by Zuckerman, DePaulo, and Rosenthal (1981) and Zuckerman and Driver (1985). According to Zuckerman and his colleagues, deception involves various processes or factors that can influence behavior. As the authors freely acknowledged, the behavioral correlates of deception may be determined by more than one factor (they are multidetermined), and it is not possible to isolate any of these factors as causally responsible. Nevertheless, it is illuminating to note that these different theories lead to contradictory predictions with respect to different

Table 1
Predictions Derived From Different Theories and Lay Assumptions About Changes in Nonverbal and Paraverbal Behaviors When Lying

<table>
<tr><th rowspan="2">Behavior</th><th rowspan="2">Arousal</th><th colspan="2">Emotion/ affect</th><th rowspan="2">Attempted control</th><th rowspan="2">Cognitive load/ working memory</th><th rowspan="2">Lay assumptions</th></tr>
<tr><th>Fear</th><th>Guilt</th></tr>
<tr><td colspan="7">Nonverbal behaviors visible in the head area</td></tr>
<tr><td>Blinks</td><td>></td><td>></td><td>?</td><td>?</td><td>?</td><td>></td></tr>
<tr><td>Eye contact</td><td>?</td><td><</td><td><</td><td>></td><td><</td><td><</td></tr>
<tr><td>Gaze aversion</td><td>?</td><td>></td><td>></td><td><</td><td>></td><td>></td></tr>
<tr><td>Head movements</td><td>></td><td>></td><td><</td><td><</td><td><</td><td>></td></tr>
<tr><td>Nodding</td><td>></td><td><</td><td><|></td><td>?|></td><td>?</td><td>></td></tr>
<tr><td>Smiles</td><td>?</td><td><</td><td><|></td><td>?|></td><td><</td><td>?</td></tr>
<tr><td colspan="7">Nonverbal behaviors visible in the body area</td></tr>
<tr><td>Adaptors</td><td>></td><td>></td><td>?</td><td><</td><td><</td><td>></td></tr>
<tr><td>Hand movements</td><td>></td><td>></td><td>?</td><td><</td><td><</td><td>></td></tr>
<tr><td>Illustrators</td><td>?</td><td><</td><td><</td><td><|></td><td><</td><td>></td></tr>
<tr><td>Foot and leg movements</td><td>></td><td>></td><td>?</td><td><</td><td><</td><td>></td></tr>
<tr><td>Postural shifts</td><td>></td><td>?</td><td>?</td><td><</td><td>?</td><td>></td></tr>
</table>

Note. > = increase with deception; < = decrease with deception; ? = no prediction available or prediction not clear; | = rival predictions depending on certain aspects of an approach.

nonverbal behaviors. We summarize these predictions in Table 1.[4] Table 1 also contains lay persons' and professional lie catchers' assumptions about changes in these nonverbal behaviors when people are lying (based on studies by Akehurst et al., 1996; Breuer et al., 2005; Granhag & Stromwall, 2001; Stromwall et al., 2004; Vrij & Semin, 1996). It is worth noting that there seem to be few if any differences in beliefs between studies conducted with students, the general public (potential jurors), police officers, and various legal professionals (lawyers, prosecutors, and judges), or across countries and cultures (Global Deception Research Team, 2006). In the following section, we describe these theories and the predictions that can be derived from them.

Arousal

The notion that lying is associated with physiological arousal can be traced back to ancient times (Kleinmuntz & Szucko, 1982; Trovillo, 1939) and is also at the heart of any psychophysiological approach to detecting deception (e.g., with a polygraph, or lie detector; see Lykken, 1998). Although there seems to be agreement that lies are accompanied by autonomic responses, explanations for this phenomenon are disputed (Zuckerman & Driver, 1985). There is the general

[4]Although some researchers may disagree with some of these predictions, which were not always spelled out by the authors cited, we have ventured to make them explicit to allow for a test of rival theories. We are grateful to Guenter Köhnken and Maike M. Breuer for insightful discussions of some of these predictions.

notion that whenever faced with an unusual, threatening, or complex situation, individuals experience a greater degree of arousal (Kahneman, 1973). The assumption is that physiological responses associated with arousal are rarely subject to control and therefore may provide relatively consistent cues to deception (Zuckerman, DePaulo, & Rosenthal, 1981). As a consequence, one would expect to see an increase in frequency of signs of autonomic activity (e.g., eye blinks) and also of various types of movements, particularly in the extremities (although this was not explicitly stated by Zuckerman, DePaulo, & Rosenthal, 1981). These movements seem to be carried out semiautomatically without much conscious control (like driving a car). Illustrators, which—unlike other hand movements—are used deliberately by communicators to underscore or explain what is being said (as in giving directions), are a possible exception.

Perhaps partially as a consequence of the widespread absorption of Freud's writings, his claim that these nonverbal behaviors betray a liar (Freud, 1904) is a common assumption among many intellectuals. Worldwide cross-cultural comparisons have confirmed that beliefs about these indicators of deception are universally shared (Global Deception Research Team, 2006). One of the problems with this assumption is that there may be large interindividual differences, perhaps due to personality differences, in the amount of movement displayed irrespective of deception. Also, the relationship between arousal and the production of these behaviors may not be linear, that is, these behaviors may not increase as stress increases. The relationship may be curvilinear, such that under extreme stress (e.g., when accused of a murder by a police investigator), interviewees may freeze like a soldier in combat.[5]

The question always remains whether this kind of sympathetic activation is different from arousal attributable to a source other than deception (deTurck & Miller, 1985). There is also the question whether it is a general form of arousal that may be responsible for some of the behavioral reactions observed when lying or whether these behaviors may be a function of specific emotions[6] experienced while lying (Ekman, 1992).

Affects and Emotions

The affective approach refers to the emotional state emerging when someone is lying. On the one hand, a liar might feel fear of being caught. On the other hand, he or she might feel guilty about lying, especially if he or she "respects the target, when the target is not collusively aiding the lie and does not benefit from the lie, and when the lie is in no way authorized by any social group or institution" (Ekman, 1988, p. 166). Ekman (1988) argued that the fear of being caught is highest when the liar expects the punishment in the case of being caught to be very severe, when the liar has not practiced the lie before, and when the target is expected to be suspicious. Other authors have postulated withdrawal by liars

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[5]We are indebted to an anonymous reviewer for pointing out this analogy.

[6]Although we are aware that emotion researchers distinguish between emotion and affect, we use these terms interchangeably as many deception researchers have done (e.g., Zuckerman, DePaulo, & Rosenthal, 1981, referred to this as the *affective approach* while citing Ekman's work, which referred to specific emotions and feelings; e.g., Ekman, 1992).

(Miller & Burgoon, 1982), which should result in an orientation away from the receiver and in fewer illustrators. Ekman (1988, 1992) also mentioned another possible emotion he called *duping delight.* This pleasure of cheating is enhanced, for example, when others who are allies of the liar observe the liar's actions (Ekman, 1988). Fear and guilt should be associated with a reduction in eye contact and smiles and an increase in bodily nonverbal behaviors. However, when smiles occur because of embarrassment or as a sign of duping delight, they may increase. As can be seen in Table 1, the assumption of different accompanying emotions (fear vs. guilt) leads to contradictory predictions regarding changes in nonverbal behaviors, and even for a given emotion, rival predictions are conceivable depending on specific situations.

Attempted Control

The third theory refers to the supposition that liars try to control the different communication channels to create a credible demeanor (Ekman, 1981; Ekman & Friesen, 1969). This notion presupposes that the sender of the deceptive message has an idea of the behavioral displays presumably raising skepticism about his or her own credibility in the receiver (see also Köhnken, 1990). As the studies on beliefs about deception have indicated, there seems to be worldwide agreement on what constitute cues to deception in others, behaviors one should oneself avoid to escape detection. Consequently, liars will try to display behaviors opposite to those that people believe give a lie away (see Table 1). Contrary to beliefs about nonverbal behavior held several decades ago, social psychologists today believe that nonverbal behavior is more regulated (not necessarily consciously) by self-presentational goals (B. M. DePaulo & Friedman, 1998).

Specifically, individuals often associate deception solely with increasing (not decreasing) intensity or frequency of certain behaviors (Akehurst et al., 1996; Breuer et al., 2005; Granhag & Stromwall, 2001; Stromwall et al., 2004; Vrij & Semin, 1996) and therefore try to inhibit these behaviors. Consequently, deceivers' attempts to inhibit their behavior (e.g., head movements) actually serve as cues to deception because their performance appears rigid and lacking in spontaneity (B. M. DePaulo & Kirkendol, 1989; Zuckerman, DePaulo, & Rosenthal, 1981). On the other hand, skilled liars may attempt to appear credible by deliberately using illustrators and gestures.

Furthermore, Ekman and Friesen (1969) postulated that some nonverbal channels are more controllable than others. This is referred to as the *leakage hierarchy hypothesis.* Specifically, these researchers postulated that relative to the face, the body is less controllable and therefore a better source of leakage (nonverbal acts that give away a message the sender wishes to hide) as well as of deception cues (nonverbal acts indicating that deception is occurring without revealing the hidden message). Additionally, deception sometimes becomes evident because of so-called channel discrepancies (behaviors are reduced in one channel but not in others).

The Cognitive Approach/Working Memory Model

Some researchers have argued that encoding a deceptive message requires a greater cognitive effort than telling the truth because of higher processing capacity demands (Köhnken, 1990; Miller & Stiff, 1993; Sporer & Schwandt, 2006; Sporer & Zander, 2001; Vrij, 2000; Zuckerman, DePaulo, & Rosenthal, 1981). This may be particularly relevant in an interrogation or under cross-examination where a respondent (suspect, defendant, or witness) is confronted with an unexpected question. Here, a respondent may have to decide whether or not to lie in response to the particular question (presumably depending on whether or not the information sought can be verified independently). This decision process may lead to a delay in responding (Walczyk, Roper, Seemann, & Humphrey, 2003; Walczyk et al., 2005) and an increase in pauses. These paraverbal cues are beyond the scope of the present review (see meta-analyses by B. M. DePaulo et al., 2003; Sporer & Schwandt, 2006).

We (Sporer & Schwandt, 2006) have revised the cognitive load approach proposed by Zuckerman, DePaulo, and Rosenthal (1981) and Vrij (2000) in terms of a working memory model. For example, the construction of complex lies taxes working memory when coming up with a sound alibi. Liars have to simultaneously plan what they are saying, attempt not to contradict themselves or the knowledge of the listener (Cody, Marston, & Foster, 1984), and observe the listener's reactions while at the same time attempting to control their nonverbal behavior. Considering these multiple demands, it should be no surprise that liars appear to think hard, which may actually give them away (Vrij, Edward, & Bull, 2001). One nonverbal corollary of thinking hard may be that people look away when constructing a (complex) lie (Vrij, 2000).

Although psycholinguistic theories (Goldman-Eisler, 1968) may provide a sound basis for predicting some paraverbal correlates of deception (Vrij, 2000; Walczyk et al., 2003, 2005), the link with nonverbal indicators is less clear. Alternatively, our model for constructing lies (Sporer & Schwandt, 2006), which is derived from a working memory model (Baddeley, 1986, 2000a, 2000b), may be more appropriate today, as it is better grounded in contemporary cognitive theory. The central executive in the working memory model not only is thought to be involved in dual-task paradigms frequently used within working memory research but also is considered important for monitoring response output. Thus, this model can serve as a basis for understanding (complex) lies and the accompanying nonverbal and paraverbal reactions. From a self-presentational perspective (B. M. DePaulo, 1992; B. M. DePaulo & Friedman, 1998), attempting to regulate one's behavior is also assumed to usurp cognitive resources (Baumeister, 1998). Again, there may be interindividual differences in working memory capacity (Baddeley, 2000b), verbal ability, and strategic communication skills that may affect liars' ability to control their nonverbal and paraverbal responses.

However, within the cognitive theoretical framework, it is very difficult to establish simple hypotheses or predictions because the behavioral displays are strongly influenced by the nature of the response itself. In some situations, a lie may require a simple yes–no response, whereas a truthful communication may require a narrative response. Of course, in such cases, the cognitive effort should be higher with the truthful response (Greene, O'Hair, Cody, & Yen, 1985). Additionally, the time within which an untruthful answer must be given is important. If someone is prepared to lie on a certain issue and, between the preparation and the deceptive response, the person is busy with other tasks, he or she is distracted from the deceptive task, which limits his or her resources to construe the lie and to control his or her behavior. While cognitively occupied in constructing a lie (i.e., "cognitively busy"), eye contact as well as other nonverbal behaviors should decrease (as when one asks somebody where he or she had been on the first Saturday last December). Another prediction from this theoretical framework is a reduction in illustrators (nonverbal gestures) accompanying lies (Ekman & Friesen, 1972; Zuckerman, DePaulo, & Rosenthal, 1981).

These four theories considered by Zuckerman, DePaulo, and Rosenthal (1981) are complementary rather than rival theories. Nonetheless, we believe that these theories provide a basis for deriving predictions, which we tested in our meta-analysis (see Table 1 above). As is evident in Table 1, for some behaviors, the different positions make similar predictions, in particular, the arousal and affective theories on the one hand and the attempted control and cognitive load/working memory model on the other hand. For certain behaviors investigated in this study, however, no specific predictions can be derived from any of the theories. For other behaviors, the theories make contrary predictions, which can be tested against each other.

Moderator Variables and the Purpose of the Present Study

The purpose of the present meta-analysis was (a) to obtain combined effect sizes, along with significance levels, for each of the specified variables associated with lying; (b) to gain information on the appropriateness of each of the theories to account for behavioral differences when lying versus truth telling; and (c) to find out how strong the influence of a series of moderator variables is on nonverbal behavior when lying versus truth telling. Finally, (d) we wanted to contrast the effect sizes obtained with effect sizes of beliefs of various groups (including police) about changes in these behaviors.

In the present meta-analysis, motivation and preparation (i.e., planning, including rehearsal), content of the deceptive message, degree of interaction between experimenter and participant, sanctioned versus unsanctioned lying, and within- or between-subjects design and operationalization of the measured variables were investigated as potential moderators. The respective categories of these moderator variables were coded from the respective method sections of the original studies.

With respect to motivation, we assumed that deception under highly motivating conditions should be associated with less eye contact, blinking, head movements, illustrators, hand movements, adaptors, foot and leg movements, and postural shifts when compared with low-motivating conditions. This hypothesis is based on the assumption that the arousal and the attempted control approaches interact. Highly motivated deceivers should experience a higher degree of arousal compared with low-motivated deceivers and at the same time should try harder to control behaviors that could give their lies away. Thus, for highly motivated liars, trying harder to control their nonverbal behavior should lead to a decrease in these behaviors. However, when control of nonverbal behaviors is taken to the extreme because participants are highly motivated, this may lead to a rigidity in behavior that in itself is a cue to deception (the motivational impairment effect; B. M. DePaulo & Kirkendol, 1989).

Compared with short preparation, deception under long preparation conditions should be associated with more eye contact, head movements, adaptors, foot and leg movements, hand movements, and illustrators. This hypothesis was derived from the assumption that planning lies should demand fewer cognitive resources during talking. Therefore, poorly prepared liars should experience higher cognitive demands than well-prepared deceivers, resulting in more obvious changes in the frequency or intensity of certain behaviors. Thus, for low preparation and planning, the predictions made from the various approaches should simply be more extreme (see Table 1). A person confronted unexpectedly should show more signs of nervousness than somebody having ample opportunity to prepare what he or she wants to say. Originally, we planned to consider rehearsal as a separate moderator variable but found too few studies that had manipulated this variable to allow meaningful comparisons.

Many studies have investigated lies about attitudes and feelings toward an object or person, compared with lies about facts. The former types of lies play an important role in everyday lives and interpersonal relationships (B. M. DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996; Kashy & DePaulo, 1996). However, when applying deception research to areas such as police interrogations, evaluating witnesses before courts of law, and business or insurance contexts, lies about facts are of central interest. Therefore, we studied the content of a lie, coded on the basis of descriptions provided by researchers in the method sections, as a potentially important moderator variable. We expected deception about feelings to entail more changes in nonverbal behavior than lies about facts.

Finally, we included several methodological variables as potential moderators, viz., experimental design (between- vs. within-subjects), type of operationalization (duration vs. frequency), whether or not participants interacted with an interviewer (or were simply recorded), and whether or not the lie was sanctioned by the experimenter (cf. Miller & Stiff, 1993). We expected within-subjects designs to be more sensitive to changes in nonverbal behavior. We did not, however, venture any hypothesis about the operationalizations used. Because Buller and Burgoon (1996) argued that the interaction between sender and receiver is crucial for understanding interpersonal deception, we categorized studies by the amount of interaction involved. Differences between liars and truth tellers should be larger in two-sided interactions. Similar to our hypotheses about motivation, unsanctioned lies would be more likely to be accompanied by changes in nonverbal behavior than would sanctioned lies.

Method

Retrieval of Studies

First, an online search with the Social Sciences Citation Index for the period 1981 onward (until 2001) was conducted using keywords such as *deception, deceptive, lie,* and the like. Due to homographs (*lie, lies,* etc.) with multiple meanings, this search led to a very large database (over 5,000 entries) that was carefully sifted on the basis of titles and abstracts. Reference sections of recently published articles were searched, and potentially relevant earlier studies were located. Furthermore, letters and e-mails requesting published and unpublished articles were sent to authors.[7] Altogether, 41 articles provided sufficient statistical data to be included in this meta-analytic synthesis. Results of different experimental conditions were considered separately when these conditions differed from one another with respect to the moderator variables and provided sufficient detail for separate coding. This resulted in a total of $k = 54$ hypothesis tests (or studies). For example, if an experiment reported separate comparisons between liars and truth tellers under two conditions, for example, under low and under high motivation, two hypothesis tests were used as separate units of analyses.

Almost all of the studies retrieved had investigated differences between lies and truths on a series of dependent variables. For the present meta-analysis, only the behavioral changes visible in the head (six behaviors) and body area (five behaviors) were investigated. Only one effect size for any one of the behaviors investigated was retrieved per study. Thus, from 54 studies, 153 effect sizes were retrieved, an average of 2.8 effect sizes per study. The fact that virtually all studies contained multiple dependent variables and, therefore, multiple hypothesis tests is important for assessing whether or not a publication bias or availability bias exists within this meta-analytic database (Hunter & Schmidt, 2004; Rosenthal, 1979; Schmidt, Hunter, Pearlman, & Hirsh, 1985).

Behavioral Correlates of Truth and Deception

In a typical paradigm for studying deceptive communication, two groups of communicators are formed (by random assignment). One group of individuals is instructed to answer truthfully; the second group receives instructions to falsify its answers. To reduce between-subjects variability, sometimes a within-subjects design is chosen, that is, the same participants are observed repeatedly. Behaviors are measured in both groups, and the mean values for truthful and deceptive messages are compared. For the purposes of this meta-analysis, it was necessary to reduce the large number of previously examined behaviors and classify them into groups of equivalent measures. We established several rules for including or excluding measures in our analysis.

One can distinguish between single measures, such as blinks or foot and leg movements, and composite measures. In the present meta-analysis, only single measures were taken into account because several composite measures were too rarely used to compute an overall value as a result. For the most part, experimenters used standard definitions of the dependent variables. Frequently, when different operationalizations for a single dependent variable were encountered, these variables were collapsed together. At other times, we established subcategories and conducted separate analyses (e.g., for eye contact and gaze aversion). Both alternatives have their pros and cons (see Mullen, 1989). Variables were grouped into nonverbal behaviors that were visible in the head and body area and that could be coded by watching video sequences (independent of tone of voice).

The predominant operationalizations for the variables included in this meta-

[7]Many of the unpublished studies cited by Zuckerman, DePaulo, and Rosenthal (1981) and Zuckerman and Driver (1985) were no longer available. Although we could have included some of these studies on the basis of the *d* values reported in those earlier reviews, we included only studies we could code ourselves.

analysis were as follows: In the head area, we defined (a) *blinks* as frequency of both eyes being briefly closed at the same time, (b) *eye contact/gazing* as duration of time looking at the eye area of the interviewer, (c) *gaze aversion* as duration or frequency of time looking away from the interviewer, (d) *head movements* as frequency of up-and-down movements and side-to-side movements of the head, (e) *nodding* as frequency of clearly perceptible forward–backward motions of the head suggesting affirmation, and (f) *smile/facial pleasantness* as duration or frequency of smiles.

In the body area, we defined (g) *adaptors/self-manipulations* as duration or frequency of movements in which one hand is in contact with the other hand or other parts of the body or face, such as by rubbing or scratching (unlike illustrators, adaptors are not related to what is being said verbally); (h) *hand movements* as frequency of hand movements without the arm being moved; (i) *illustrators/gestures* as frequency of hand movements that accompany speech and accent, emphasize or trace the rhythm of speech, or show visually what is being said; (j) *foot and leg movements* as duration or frequency of foot and leg movements, such as changes in posture, crossing and uncrossing of legs, and rapid twitching of the feet; and (k) *postural shifts* as frequency of movements made to change the sitting position.

Selection of Dependent Variables

Every single dependent variable, along with its operational definition, was originally recorded. At the end, if a dependent variable was used three times or less, it was dropped from further analysis. This kind of selection was difficult at times because, in some cases, identical or at least similar operationalizations were hidden under dissimilar variable names. This was, for instance, the case with the smile variable. The variable name smile was chosen by most researchers (e.g., McClintock & Hunt, 1975), but the same behavior was named facial pleasantness by Mehrabian (1971). In the meta-analysis conducted by Zuckerman and Driver (1985), these two measures were collapsed, as was done in the present study, whereas B. M. DePaulo et al. (2003) coded these variables separately. Some studies coded in the latter meta-analysis as shifting eyes were coded as eye contact or gaze aversion and vice versa in the present study. Given these differences in coding, some differences in results can be expected.

It is obvious that not every variable investigated is completely independent. First, with respect to nonverbal variables associated with the deceiver's head, the variables nodding and nodding plus shaking one's head (called head movements) were included in this analysis as the operationalizations of these two variables, which were not similar enough to collapse into a single variable. Of six studies using the nodding plus shaking variant, three were conducted by Vrij and his colleagues (Vrij, 1999; Vrij & Winkel, 1991, 1993). Mullen (1989) addressed the problem of nonindependence arising from multiple studies conducted by one particular research team. Sometimes, it has been found that specific teams produce patterns of results different from those of other independent researchers. Nevertheless, Vrij and his colleagues obviously chose operational definitions derived from a different theoretical angle compared with that of the other researchers (seven studies utilized only the nodding variable). It is important to compare results on the basis of this difference. In this case, unfortunately, the research team was confounded with the choice of operationalization for head movements.

Coding Procedures

Two coders completed all coding necessary for this analysis independent of each other. Codes included statistical information on mean values; *F, t,* or *r* values; sample sizes; degrees of freedom; significance levels; and directions of effect, as well as category assignments of moderator variables. Whenever possible, we attempted to obtain precise estimates of effect sizes from the available indices. Sometimes, the respective test statistics had to be reconstructed from other values reported (e.g., means, cell sizes, and *MSE* values; see Winer, Brown, & Michels, 1991, p. 426). Effect sizes *r* were calculated according to Rosenthal (1991, Equation 2.17; see also Mullen, 1989). In some cases, test statistics were not reported in the primary studies, whereas significance levels were. In these cases, we attempted to reconstruct the test statistics from the tables of common statistics textbooks (or using inverse functions in Microsoft Excel spreadsheets), which led to conservative, lower estimates of effect sizes (Rosenthal, 1994).[8] In cases where no statistical tests were reported but the results were described as nonsignificant, *r*s and *d*s were set at zero.

The coding of moderator variables involved intricate coding operationalizations that were established in advance (cf. Stock, 1994). For most moderator variables, two categories were established (e.g., design: between- vs. within-subjects design). For motivation and preparation, we first created finer distinctions with four and three coding categories, respectively. However, because of small cell sizes, these finer categories had to be abolished by combining categories. For all coding of these study descriptors, intercoder reliabilities were highly satisfactory, with all coefficients either indicating perfect agreement or being equal to or higher than $r = .94$ (motivation: $r = .94$; preparation/planning: .96; rehearsal: 1.00; interaction: .94; content: 1.00; sanctioning: 1.00; experimental design: 1.00). In the few cases of disagreements, the two coders addressed the differences in codings and discussed their decisions until reaching agreement.

Results

Preliminary Analyses: Vote Counting and Funnel Plots

Before the main quantitative analyses, we used vote-counting procedures. For the majority of tests (126 of a total of 154 tests), no significant differences between lying and truth telling were obtained. Only in 13 studies were significant increases in nonverbal correlates between deceptive versus truthful statements observed. Additionally, only 15 studies showed significant decreases in these nonverbal correlates. Given these few significant findings, one might wonder why these studies were published at all. However, almost all studies reviewed reported multiple nonverbal behaviors, only some of which

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[8]Note that this more laborious procedure differs from the method utilized by B. M. DePaulo et al. (2003), who used an even more conservative estimate of $|d| = 0.01$ for statistically reliable effects when details of test statistics were missing.

obtained significant results. Thus, it is very unlikely that the meta-analysis presented here is subject to a publication bias due to an exclusive reliance on significant findings. To further check on this potential problem, we also drew funnel plots (sample sizes on the *y*-axis and the Fischer's *Z* values of the respective effect sizes on the *x*-axis) for each behavior examined. This was used as an eyeballing method for the homogeneity of results across studies (Begg, 1994; Light & Pillemer, 1984; Mullen, 1989). A publication bias is said to exist when there are no studies with small effect sizes associated with small sample sizes or when there are only studies with large positive and large negative effect sizes but no reports of studies with small effect sizes. Inspection of these funnel plots[9] revealed that no such biases were present. A null-results publication bias, if anything, was present, because null or small results associated with small sample sizes were missing, only for two variables (head movements and illustrators). We conducted both unweighted and weighted analyses of effect sizes for nonverbal behaviors visible in the head and in the body area. In unweighted analyses, each study is given equal weight irrespective of sample size (see Mullen, 1989), whereas, in weighted analyses, each effect size is weighted by sample size (more precisely, by its inverse variance weight). As both unweighted and weighted analyses produced very similar results, we present only the weighted analyses here in detail. The calculation of combined effect sizes and variabilities was completed using the meta-analysis programs of Schwarzer (1989). We used Pearson's *r* as an effect size estimate, as recommended by Rosenthal (1991, 1994) and Mullen (1989), but in addition, we report Cohen's (1988) *d* for the main analyses.

Weighted Analyses

For the analyses of weighted *r* effect sizes, we used two different meta-analytical approaches, namely, the approach of Hedges and Olkin (1985) and the method of Schmidt-Hunter. Although the latter was introduced mainly by Hunter, Schmidt, and Jackson (1982), it became widely known as the Schmidt-Hunter method (Schwarzer, 1989). To derive mean effect sizes, both approaches weight each effect size by its sample size. However, Hedges and Olkin's approach uses Fisher's *z* transformations of study effect sizes in an attempt to outweigh the nonlinear bias of *r* values, whereas the Schmidt-Hunter method does not. Therefore, the latter method should slightly underestimate *r* (Johnson, Mullen, & Salas, 1995). Although we calculated all analyses both ways, we report only the results obtained using the approach of Hedges and Olkin as the Schmidt-Hunter method yielded virtually identical results (with mean effect sizes differing only at the third decimal). As a cross-check on accuracy, some analyses were run using self-designed programs that produced identical outcomes.

Only one behavior in the head area was significantly associated with deception (see Table 2). Liars nodded less than truth tellers (Hedges and Olkin approach: $r = -.091$). Contrary to common beliefs, there was no association between eye contact ($r = -.007$), gaze aversion ($r = .027$), or the combined

[9]Copies of these funnel plots are available from Siegfried L. Sporer.

Table 2
Integration of Weighted Effect Sizes for Nonverbal Indicators of Deception Visible in the Head and Body Areas

Dependent variable	*k*	*N*	Fisher's *Z*	Mean *r*	*p*	*Q*	Observed variance	95% CI	Cohen's *d*
Changes visible in the head area									
Blinks	11	769	.004	**.004**	.456	0.47	.000	−.068 to .077	0.008
Eye contact[a]	15	791	−.007	**−.007**	.422	25.45*	.032	−.079 to .065	−0.014
Gaze aversion[a,b]	5	303	.027	**.027**	.324	0.64	.002	−.089 to .141	0.054
Eye contact combined[a,b]	20	1,094	−.011	**−.011**	.359	23.24	.023	−.072 to .050	−0.022
Head movements	7	362	.059	**.059**	.131	9.20	.026	−.048 to .163	0.118
Nodding	9	590	−.091	**−.091**	**.014**	26.02**	.042	−.170 to −.007	−0.183
Smile	20	1,134	−.032	**−.032**	.141	24.39	.022	−.093 to .026	−0.064
Changes visible in the body area									
Adaptors	27	1,539	.018	**.018**	.240	50.25**	.031	−.030 to .072	0.036
Hand movements	5	308	−.188	**−.186**	**.001**	8.80	.028	−.293 to −.073	−0.379
Illustrators	21	1,355	.016	**.016**	.278	124.39**	.043	−.039 to .070	0.032
Foot and leg movements	15	799	−.067	**−.067**	**.029**	11.10	.015	−.136 to .006	−0.134
Postural shifts	17	872	.011	**.011**	.373	5.82	.007	−.056 to .080	0.022

Note. *k* represents the number of tests included. Positive *r* values indicate that an increase in the behavior was associated with deception. CI = confidence interval. The values in boldface indicate the mean estimated effect size as well as the significance associated with it (when significant).
[a] Eye contact = looking at the eye vs. gaze aversion = looking away from the interviewer. [b] Two hypothesis tests were removed.
* $p < .05$. ** $p < .01$.

measure with deception ($r = -.001$).[10] In the body area, the reduction of hand movements ($r = -.186$) and foot and leg movements ($r = -.067$) was significantly related to deception. In contrast to the unweighted method, the association of adaptors with deception was not reliable ($r = .018$).

As a prerequisite to further analyses of moderator variables, the homogeneity statistics are particularly important (see Table 2). According to the *Q* and chi-square statistics, the effect sizes for eye contact, nodding, adaptors, and illustrators were heterogeneous, indicating that the search for moderator variables is worthwhile. Although our search for moderator variables was primarily theory driven, we also inspected the estimated error and residual (true) variances relative to the observed variance. If a large proportion of the observed variance in correlations is accounted for by artefacts such as sampling error, moderators are not likely to explain any additional variation (see Hunter & Schmidt, 1990, 2004, for a thorough discussion of these issues). Finally, the raw residual amount of variability may also indicate whether or not a search for moderators might be fruitful. This was the case for smiling, head movements, and hand movements (residual standard deviations were .064, .080, and .113, respectively). Thus, moderator variable analyses were conducted when sufficient hypothesis tests were available in the respective subgroups. For the head area, this applied to eye contact, head movements, nodding, and smiles. For the body area, this applied to adaptors, illustrators, and hand movements.

Moderator Variables: Focused Comparisons of Effect Sizes

To test the effects of moderator variables, we chose the technique of classification (or blocking; Mullen, 1989; Rosenthal, 1991). Blocking means that we conducted hypothesis tests within subgroups, determined by the levels of the predictor under consideration, which resulted in a mean *r* and its associated 95% confidence interval for each behavior within each category (block) of a predictor. If the confidence interval around an effect size within a given block did not include zero, it was considered significant for this set of studies. To compare the extent to which study outcomes differed between blocks of studies, the difference was tested as the *Z* (normal distribution) for the difference between effect sizes in each block (Mullen, 1989; Rosenthal, 1991). For each block, we report the number of studies *k,* the total *N,* the effect size *r,* and the associated *p* value within

[10]Originally, we had included a study by Miller, deTurck, and Kalbfleisch (1983), who obtained differences corresponding to $r = .43$ and .51 for gaze aversion. With this study included, gaze aversion would also have been somewhat more strongly (but not significantly) associated with deception ($r = .067$). Although Miller et al.'s hypothesis tests were not necessarily outliers as calculated in analogy to an algorithm suggested by Hedges and Olkin (1985) for the detection of outliers among *d* values, we nonetheless dropped the study from our analyses on eye contact for methodological reasons. In this study, participants were watching either pleasant (landscapes) or unpleasant slides (pictures of heavy burns) and had to either tell the truth or lie about them. Looking away from either the interviewer or the slides was coded as eyeshifts. Thus, it is not clear whether participants averted their gaze because of deception or because of the unpleasantness of the slides, rendering the conclusions equivocal. We are indebted to an anonymous reviewer for pointing out this interpretational ambiguity.

Table 3
Mean Weighted r Effect Sizes as a Function of Content of the Lie

Variable	Content of the lie	k	N	r	Z	95% CI for r
Eye contact	Feelings and facts	4	194	$-.127^{*}$	1.92^{*}	±.137
	Facts only	11	597	.032		±.084
Head movements	Feelings and facts	3	86	$.255^{**}$	2.08^{*}	±.182
	Facts only	4	276	.000		±.118
Nodding	Feelings and facts	3	300	$-.223^{**}$	3.41^{**}	±.111
	Facts only	6	290	.055		±.116
Smile	Feelings and facts	7	343	$-.099^{*}$	1.48	±.105
	Facts only	13	791	−.003		±.071
Adaptors	Feelings and facts	8	284	$.104^{*}$	1.60	±.128
	Facts only	19	1,255	−.001		±.057
Illustrators	Feelings and facts	6	269	−.095	2.01^{*}	±.116
	Facts only	15	1,088	.042		±.063

Note. k represents the number of tests included. Positive r values indicate that an increase in the behavior was associated with deception. Z indicates the significance of the difference between the two correlations (normal distribution). CI = confidence interval. $^{*}p < .05$. $^{**}p < .01$.

each block, as well as the significance test Z for the difference between the effect sizes in the blocks.[11]

Content of the lie. From an applied perspective, the content of a lie is probably the moderator variable of most central interest. Originally, we classified lies into three types: lies about feelings (and attitudes), lies about facts only, and lies about feelings and facts. To obtain sufficient block sizes, the categories of feelings and both feelings and facts had to be collapsed. Thus, two categories remained: (a) feelings and facts and (b) facts only. For four behaviors, effect sizes were reliably larger when lies involved both feelings and facts than when they involved facts only (see Table 3).

Participants displayed less eye contact with the interviewer when lying about feelings and facts ($r = -.127$, $p = .038$, $k = 4$, $N = 194$) as compared with facts only ($r = .032$, $p = .217$, $k = 11$, $N = 597$; $Z = 1.92$, $p = .027$). Head movements and deception were positively associated when participants talked about feelings and facts ($r = .255$, $p = .009$, $k = 3$, $N = 86$) but not when they talked about facts only ($r = .000$, $p = .500$, $k = 4$, $N = 276$; $Z = 2.08$, $p = .019$). At the same time, individuals nodded less when lying about feelings and facts ($r = -.223$, $p < .001$, $k = 3$, $N = 300$) compared with facts only ($r = .055$, $p = .174$, $k = 6$, $N = 290$; $Z = 3.41$, $p < .001$). Participants also displayed significantly fewer illustrators when lying about feelings and facts ($r = -.095$, $p = .060$, $k = 6$, $N = 269$) than when lying about facts only ($r = .042$, $p = .083$, $k = 15$, $N = 1{,}088$; $Z = 2.01$, $p = .022$).

Participants tended to smile less when lying about feelings and facts ($r = -.099$, $p = .033$, $k = 7$, $N = 343$) compared with facts only ($r = -.003$, $p = .466$, $k = 13$, $N = 791$) and tended to display more adaptors (feelings and facts:

[11]The results of all the remaining moderator analyses performed are available from Siegfried L. Sporer in tabular form, including all the 95% confidence intervals within each block.

$r = .104$, $p = .040$, $k = 8$, $N = 284$; facts only: $r = -.001$, $p = .489$, $k = 19$, $N = 1{,}255$), although the differences between the groups did not reach statistical significance ($Z = 1.48$, $p = .069$, and $Z = 1.60$, $p = .055$, respectively).

Motivation. With respect to motivation, the original fine category distinctions between four levels of motivation had to be aggregated into two broader categories to obtain sufficiently large block sizes. Therefore, Levels 1 and 2 were collapsed (low motivation, operationalized as a small monetary incentive or enlisting the participant as a confederate), as well as Levels 3 and 4 (high motivation, i.e., stressing the importance of lying for one's professional development). Note that these categorizations are quite different from those used in the meta-analysis based on self-presentation theory (B. M. DePaulo et al., 2003).

Compared with the high-motivation condition ($r = .033$, $p = .216$, $k = 11$, $N = 566$), deception under low motivation was associated with less smiling ($r = -.075$, $p = .037$, $k = 9$, $N = 568$; $Z = 1.82$, $p = .035$). For the other dependent variables, significant associations were observed in only one or the other subgroup, without the Z test indicating a significant difference: Hand movements decreased particularly under high levels of motivation ($r = -.204$, $p < .01$, $k = 3$, $N = 196$), whereas increases in head movements ($r = .116$, $p < .05$, $k = 4$, $N = 218$) and decreases in nodding ($r = -.111$, $p < .05$, $k = 6$, $N = 478$) and smiling ($r = -.075$, $p < .05$, $k = 9$, $N = 568$) were observed only under lower levels of motivation.

Preparation. None of the studies involved very long preparation times, so we compared only behaviors after short (i.e., minimum preparation) and medium preparation (see Table 4). Nodding was negatively associated with deception under short preparation time ($r = -.158$, $p < .001$, $k = 7$, $N = 452$) but somewhat positively associated with deception under medium preparation time ($r = .113$, $p = .059$, $k = 2$, $N = 138$; $Z = 2.99$, $p = .001$). Head movements were

Table 4
Mean Weighted r Effect Sizes as a Function of Level of Preparation

Variable	Preparation	k	N	r	Z	95% CI for r
Eye contact	Short	10	543	.017	0.97	±.088
	Medium	5	248	−.058		±.121
Head movements	Short	4	230	.009	1.25	±.135
	Medium	3	132	.146*		±.160
Nodding	Short	7	452	−.158**	2.99**	±.095
	Medium	2	138	.133		±.162
Smile	Short	14	816	−.022	0.54	±.068
	Medium	6	318	−.058		±.114
Adaptors	Short	17	847	−.016	1.46	±.073
	Medium	10	692	.059		±.078
Hand movements	Short	4	252	−.226**	1.52	±.123
	Medium	1	56	.000		±.263
Illustrators	Short	12	697	.044	1.07	±.077
	Medium	9	660	−.014		±.076

Note. k represents the number of tests included. Positive r values indicate that an increase in the behavior was associated with deception. Z indicates the significance of the difference between the two correlations (normal distribution). CI = confidence interval.
* $p < .05$. ** $p < .01$.

more frequent when lying after medium preparation ($r = .146$, $p < .05$, $k = 3$, $N = 132$). There was also a significant reduction in hand movements with short preparation ($r = -.226$, $p < .01$, $k = 4$, $N = 252$).

Sanctioned versus unsanctioned lies. From a practical point of view, studies involving unsanctioned lies would seem very important. However, we could find very few studies to generate sufficiently large blocks for focused comparisons. Smiles tended to increase when lies were unsanctioned ($r = .120$, $p = .082$, $k = 3$, $N = 136$) but not when sanctioned ($r = -.052$, $p = .050$, $k = 17$, $N = 998$; $Z = 1.87$, $p = .031$).

Interaction. Interaction was coded at three levels: no interaction between sender and receiver (talking into a video camera), one-sided (communication toward a receiver without questions), and two-sided (with questions and answers by receiver and communicator). Most studies involved two-sided communications. For none of the nonverbal behaviors did the blocking result in significant differences as a function of type of interaction. Only the frequency of nodding seemed to be significantly reduced in two-sided communications ($k = 6$, $N = 408$, $r = -.101$, $p = .021$). Therefore, type of interaction does not seem to moderate the association of deception with nonverbal behaviors.

Experimental design. For most of the behaviors examined (with the exception of illustrators), effect sizes were larger for within-subjects designs compared with between-subjects designs, which appeared to be less sensitive. However, for only two variables did effect sizes differ significantly as a function of the experimental designs used (nodding: $Z = 3.33$, $p < .001$; illustrators: $Z = 2.05$, $p = .020$). Participants nodded less while lying in within-subjects designs ($r = -.216$, $p < .001$, $k = 4$, $N = 314$) compared with between-subjects designs ($r = .057$, $p = .172$, $k = 5$, $N = 276$). Contrary to expectations, however, they displayed more illustrators while lying in between-subjects designs ($r = .082$, $p = .027$, $k = 9$, $N = 556$) compared with within-subjects designs ($r = -.031$, $p = .190$, $k = 12$, $N = 801$). When measured in within-subjects designs, hand movements reliably decreased ($r = -.240$, $p < .01$, $k = 3$, $N = 176$; between-subjects design: $r = -.113$, *ns,* $k = 2$, $N = 132$), but the blocking comparison was not significant ($Z = 1.13$, *ns,* respectively).

Operationalization of dependent variables. As shown in Table 5, measurement as frequency compared with duration yielded significant differences in results for four behaviors. Frequencies of hand movements decreased with deception. In contrast, adaptors and illustrators showed significant increases with deception only when measured as durations. Illustrators are often part of continuous movements, which make such behaviors difficult to count, which in turn may explain why duration measures produced reliable results for this behavior, whereas frequency counts did not. These findings indicate that operationalization of the behaviors observed is an important consideration.

Discussion

This meta-analysis sought to present a quantitative summary of the evidence of nonverbal indicators of deception that may be particularly relevant in forensic settings when evaluating defendants' or witnesses' statements in police interviews or before courts of law. Of course, the results are also important for other legal settings, for example, in tort law, in family courts, or with insurance claims, as well as outside the law, in business settings and negotiations and in interpersonal relationships.

Table 5
Mean Weighted r Effect Sizes as a Function of Operationalization of Dependent Variables

Variable	Design	*k*	*N*	*r*	*Z*	95% CI for *r*
Eye contact	Duration	14	725	.014	0.11	±.077
	Frequency	1	66	.000		±.242
Head movements	Duration	1	60	.370**	2.74**	±.200
	Frequency	6	302	−.007		±.116
Smile	Duration	9	550	−.048	0.52	±.083
	Frequency	11	584	−.017		±.082
Adaptors	Duration	12	554	.105**	2.54**	±.086
	Frequency	15	985	−.030		±.066
Hand movements	Duration	1	59	.050	1.99*	±.252
	Frequency	4	249	−.240**		±.124
Illustrators	Duration	5	251	.241**	4.01**	±.119
	Frequency	16	1,106	−.036		±.059

Note. *k* represents the number of tests included. Positive *r* values indicate that an increase in the behavior was associated with deception. *Z* (normal distribution) indicates the significance of the difference between the two effect sizes. CI = confidence interval.
* $p < .05$. ** $p < .01$.

Only a dozen indicators were selected that can be observed online by interaction partners without any technical aid. We conducted a meta-analytic quantitative summary guided by predictions derived from major theoretical approaches summarized by Zuckerman, DePaulo, and Rosenthal (1981; see also B. M. DePaulo et al., 2003; Köhnken, 1990; Sporer & Schwandt, 2006; Vrij, 2000; Zuckerman & Driver, 1985). As these indicators showed only small associations with deception and as most of the results were heterogeneous, we also tested the impact of a series of moderator variables, most of which are also likely to be operative in practical settings.

First, we summarize the major findings by contrasting them with those of past meta-analyses, drawing conclusions regarding the theoretical approaches and outlining their practical implications. To gauge the practical importance of our findings, we contrast the results of this meta-analysis of observed correlates of deception with the results of several prior studies that have investigated beliefs about these behaviors held by students thinking about a specific crime situation (Breuer et al., 2005; see Table 6), police officers and lay people (Akehurst et al., 1996; see Table 6), and lay people versus professionals (Köhnken, 1988; Zuckerman, Koestner, & Driver, 1981; see Figure 1). We discuss these differences before we turn to some of the practical implications of our findings. At the end, we address some methodological issues that have implications for future research.

Overall Effects and Support for Theoretical Approaches

Overall analyses weighted by sample size indicated that out of 12 behaviors investigated, only 3 were reliably associated with deception: Nodding ($r = -.091$), hand movements ($r = -.186$), and foot and leg movements ($r = -.067$) were negatively associated with deception. With the unweighted analyses, there was also a significant decrease in smiles ($r = -.066$) and an increase in adaptors ($r = .069$). The effect sizes of these behaviors, however, were small except for

Table 6
Mean Effect Sizes of Nonverbal Correlates of Deception in Meta-Analyses and Cues Associated With Deception by the General Public, the Police, and Students

Variable	Zuckerman & Driver (1985)	B. M. DePaulo et al. (2003)	Present meta-analysis: Weighted mean r	Present meta-analysis: Unweighted mean r	Beliefs: Public/police	Beliefs: Students
Nonverbal behaviors visible in the head area						
Blinks	$.24^{*}$	.03	.00	.00	.62	$.23^{**}$
Eye contact	−.01	.00	−.01	−.02	−.58	$-.36^{**}$
Gaze aversion	[a]	.01/.03[b]	.03	.02	.58	$.36^{**}$
Head movements	−.09	−.01	.06	.05	.53	[a]
Nodding	[a]	.00	$-.09^{*}$	−.05	[a]	$.27^{**}$
Smile	−.04	.00	−.03	−.07*	.17	$-.15/.44^{c**}$
Nonverbal behaviors visible in the body area						
Adaptors	$.17^{**}$	$.08^{*}$	.02	$.07^{**}$	.86	$.53^{**}$
Hand movements	[a]	.00	$-.19^{**}$	$-.18^{**}$	.66	$.46^{**}$
Illustrators	−.06	$-.07^{*}$	.02	.02	.48	$.44^{**}$
Foot and leg movements	−.01	−.04	$-.07^{*}$	−.05	.64	$.41^{**}$
Postural shifts	−.01	.02	.01	.03	.78	$.38^{**}$

Note. In Zuckerman and Driver (1985), B. M. DePaulo et al. (2003), Akehurst et al. (1996), and Breuer et al. (2005), effect sizes d were presented that were transformed into rs for better comparison. Akehurst et al. used general public and police, Breuer et al. students as participants. Positive values of r indicate an increase in the behavior associated with deception.
[a] Not investigated. [b] Gaze aversion and eyeshifts were coded separately. [c] Feigned smile.
$^{*} p < .05$. $^{**} p < .01$.

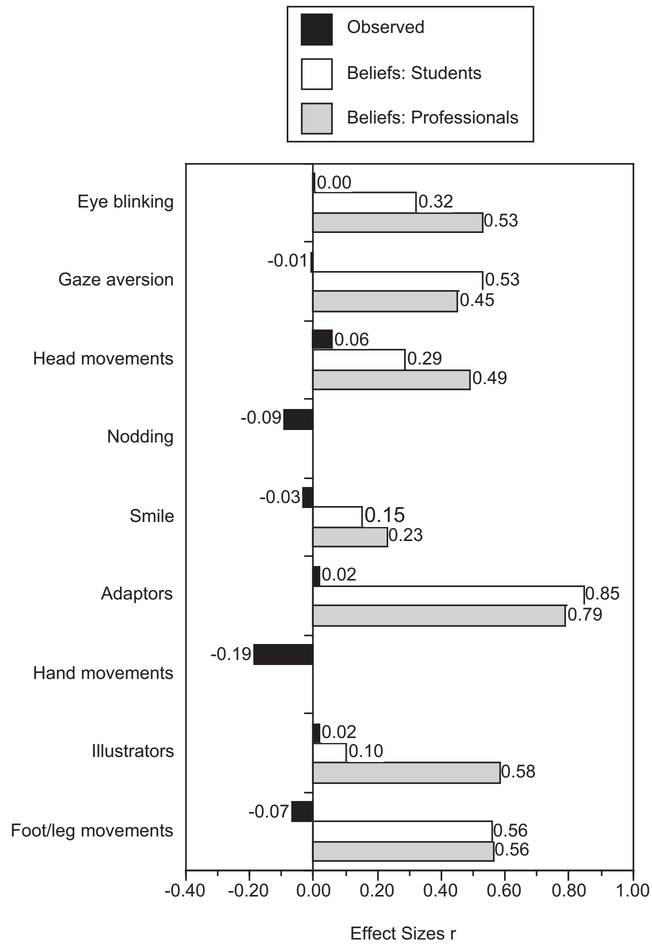

Figure 1. Effect sizes in studies of students' (Zuckerman, Koestner, & Driver, 1981) and professionals' (Köhnken, 1988) beliefs about changes in nonverbal behaviors versus effect sizes observed in this meta-analysis.

hand and finger movements, which were small to medium according to Cohen's (1988) guidelines for interpreting effect sizes.

Of the predictions provided by the arousal approach, only the findings of the unweighted (but not the weighted) analyses for adaptors were corroborated by the present data.[12] However, this effect size was quite small and was investigated most extensively in our database. The moderator analyses performed as a function

[12]Zuckerman, DePaulo, and Rosenthal (1981) and Zuckerman and Driver (1985) also found a significant increase in adaptors by using procedures that combine effect sizes without weighting them by sample size. B. M. DePaulo et al. (2003) reported the results of weighted analyses but differentiated between different types of fidgeting, which resulted in estimates similar to ours depending on which operationalization is used (undifferentiated fidgeting: $r = .08$, $p < .05$; self-fidgeting: $r = -.00$, *ns*; facial fidgeting: $r = .04$, *ns*). As we had collapsed these three variables under the category of adaptors, the results converge to a similar value.

of motivation revealed no increase but rather a decrease in adaptors under high motivation ($r = -.033$, $k = 13$, $N = 551$). As all the other behaviors investigated pointed to a decrease rather than an increase in the behaviors observed while lying, there appears to be little evidence in support of the notion that arousal results in an increase in directly observable nervous behavior such as arm, hand, and leg movements. In contrast with the research findings, the behavior that both lay people and police alike believe to be most strongly associated with deception is an increase in adaptors (see Table 6 and Figure 1).

The affective approach correctly predicted only nodding behavior ($r = -.091$). The attempted control approach correctly predicted a decrease in foot and leg, as well as hand, movements. In light of the meta-analyses on paraverbal indicators of deception (B. M. DePaulo et al., 2003; Sporer & Schwandt, 2006), this finding could be construed as support for the leakage hierarchy hypothesis (Ekman & Friesen, 1969), which holds that some communication channels are more controllable than others. If the control approach is correct, one must assume that participants were successful in controlling their bodily behavior by reducing the movements of their extremities but were not as successful in controlling vocal aspects of their speech (pitch: B. M. DePaulo et al., 2003; Sporer & Schwandt, 2006; Zuckerman, DePaulo, and Rosenthal, 1981).

The cognitive approach/working memory model correctly predicted the decrease in hand, foot, and leg movements during deception. With hindsight, a decrease in nodding, for which we had not made a specific prediction, can be reconciled with this model. Once again, although the aforementioned behaviors were significantly associated with deception, their effect sizes were small. The working memory model makes more successful predictions with respect to verbal and paraverbal behaviors that were not investigated here (B. M. DePaulo et al., 2003; Sporer & Schwandt, 2006). Perhaps one needs to pay closer attention to some paraverbal cues in more complex deception situations. Although recent paraverbal studies have found additional support for the working memory model from a psycholinguistic perspective, they have done so only with relatively simple content issues and in situations of low ecological validity (e.g., answering questions presented on a computer monitor; Walczyk et al., 2003).

Although the overall results are largely comparable to those obtained previously (B. M. DePaulo et al., 2003; Zuckerman et al., 1981; Zuckerman & Driver, 1985), there are also some differences (see Table 6). For instance, Zuckerman and Driver (1985) did not distinguish nodding from head movements, and at that time, there were no studies available measuring gaze aversion. Hand movements were not considered either. From the comprehensive meta-analysis by B. M. DePaulo et al. (2003), Table 6 includes only those behaviors that were also investigated in this study, although their and our definitions differ for some of the behaviors (particularly for nodding and hand movements). They also differentiated eye contact, gaze aversion, and eye shifting, which may account for some of the minor discrepancies.

At first glance, there seems to be little concordance between results obtained by Zuckerman, DePaulo, and Rosenthal (1981) and Zuckerman and Driver (1985) and those revealed by the present study. Nodding and hand movements, which reached significance in the present study, were not measured in those earlier meta-analyses. Presumably, during the intervening years of research, the variable hand (and finger) movements were thought of and investigated successfully (mostly by Vrij and his colleagues in the Netherlands and Great Britain) in an attempt to find sensitive behaviors that change during deception (Vrij, 1999; Vrij, Edward, Roberts, & Bull, 2000).

Other differences between the studies that may have resulted from different definitions relate to the divergence between the effect size estimates for hand movements and illustrators in our study versus that by B. M. DePaulo et al. (2003). For example, DePaulo et al. included gestures among hand movements, whereas we classified gestures among illustrators (which tend to be positively related to deception). Thus, their estimates ought to differ from ours precisely in the direction observed. Future researchers should pay close attention to operational definitions of hand (and finger) movements and illustrators, respectively, as opposite predictions for these behaviors derive from the different theoretical underpinning and models.

A null finding, like many of the others in the present synthesis, confirms conclusions illustrated in previous reviews regarding the eye contact variables, although we separated the studies somewhat differently. In the analyses by Zuckerman and Driver (1985) and B. M. DePaulo et al. (2003), as in the present study, eye contact bore virtually no relation to deception. We coded eye contact and gaze aversion as complementary in that the presence of one behavior implied the absence of the other. However, this distinction seems to make no difference. Nonetheless, such a null finding can be important when compared with the prevalent belief that averting one's gaze is a cue to deception (Global Deception Research Team, 2006).

Moderator Variables

Next, we compare our results regarding the impact of moderator variables with the results obtained by Zuckerman and Driver (1985) and B. M. DePaulo et al. (2003), who also considered motivation and planning in their analyses. We suggested that, compared with low-motivating conditions, deception under highly motivating conditions should be associated with less eye contact, blinking, head movements, adaptors, hand movements, illustrators, foot and leg movements, and postural shifts and with more smiling. This hypothesis was corroborated only with respect to smiling behavior (unlike the analysis by B. M. DePaulo et al., 2003). In the high-motivation condition, there was a very small nonsignificant positive relationship between deception and smiling ($r = .033$), whereas there was a small negative significant relationship ($r = -.075$) in the low-motivation condition. That is, highly motivated liars tended to smile more in contrast to low-motivated liars. There were no other significant differences between both conditions with respect to the dependent variables visible in the head and body area. Although highly motivated liars tended to display fewer head movements, adaptors, and hand movements, as was suggested by the attempted control and the working memory models, the contrast analyses failed to reach significance.

Results obtained by Zuckerman and Driver (1985) with respect to low- versus high-motivation conditions are similar to the present results as pertains to smiling behavior, although mean effect sizes for smiling did not differ significantly in their analysis. Smiling significantly decreased under deception only in the low-motivation condition, and the effect size was only $r = -.07$. Results by B. M. DePaulo et al. (2003) converge with ours, except for eye contact, which they found to be reduced when liars were highly motivated. Practitioners need to be aware that situational variations such as this may affect the occurrence of nonverbal behaviors.

Similar to the moderating role of motivation, we expected that telling lies that were not sanctioned by the experimenter would be associated with high motivation to lie successfully (Miller & Stiff, 1993). Sanctioning was a reliable moderator for smiles, hand movements, and illustrators. Smiles when lying were observed more frequently in studies without sanctioning compared with studies with sanctioning. The results on sanctioned versus unsanctioned lying must be interpreted with caution because in the database for the unsanctioned lying condition, there were often only $k = 1$ or 2 tests and never more than $k = 4$ tests. Nonetheless, one should keep in mind that in applied settings, sanctioning is likely to be the exception, especially in police interviews or before courts of law.

We suggested that, compared with poorly prepared liars, well-prepared liars should exhibit more eye contact, head movements, adaptors, foot and leg movements, hand movements, and illustrators. Although individuals increased their head movements while lying, especially when better prepared, the difference between both groups failed to reach significance. On the contrary, there was a substantial difference in nodding behavior. Parallel to the moderator analyses by B. M. DePaulo et al. (2003),[13] we found that deception was negatively associated with nodding when participants were poorly prepared ($r = -.158$). Under medium preparation time, nodding increased during deception ($r = .133$). That is, the prediction held by our hypothesis may apply more to nodding than to head movements, indicating that perhaps head movements are too roughly operationalized to capture behavioral adaptations accurately. Perhaps the effects of preparation and planning will be more apparent when verbal and paraverbal indicators of deception are analyzed.

Consumers of research on nonverbal indicators of deception should pay close attention to how the behaviors observed are measured. Overall, frequency counts compared with duration measures appear to be more sensitive and to have stronger predictive validity (except for illustrators). Another advantage of frequency counts is that they can be measured more easily (and, likely, with higher interrater reliability) than duration, and time samples from longer interactions can be taken.

Practical Implications: Beliefs Versus Observed Behavior

From an applied perspective, it is important to know whether lay people and professional lie detectors hold beliefs about cues to deception that correspond with those cues that are objectively associated with deception as documented in the available studies. Researchers have repeatedly summarized some of the differences between actual cues and beliefs about deception (e.g., Vrij, 2000). We

[13]Unfortunately, B. M. DePaulo et al. (2003) did not report the mean estimated effect sizes for lies with and without planning, only the *d*s for the difference between those conditions. Thus, no direct comparison of their findings with ours is possible.

summarize some of these findings only to contrast them to the results of the meta-analyses.

In a study by Akehurst et al. (1996), police officers and lay people were asked which behaviors they thought would increase or decrease while lying. Although there were almost no differences between the two participant groups, participants believed that these behavioral changes would occur more frequently in other people's behaviors than in their own when they themselves were lying. In another study, by Vrij and Semin (1996), professional lie catchers (customs officers, police detectives, prison guards, and patrol police officers), prisoners, and college students were asked which behaviors they thought would increase or decrease while lying. There were almost no differences between the professional and student participant groups: Both groups believed these behavioral changes would occur more frequently in other people's behaviors than when they themselves were lying. Only the prisoners' beliefs corresponded more closely with cues to deception found in the empirical literature. Similar results have been reported in Sweden, with prison inmates holding more accurate stereotypes about indicators of deception (Stromwall et al., 2004).

One of the problems with questionnaire studies is that people would not have spontaneously thought of these behaviors when evaluating the truthfulness of a statement had they not been prompted by the questionnaire regarding the specific behaviors. Another problem is that different groups of respondents may think about different types of situations when they answer the respective questions (e.g., police officers tend to think about suspects, students think about personal relationships or relatives, judges think about defendants or witnesses, and inmates think about other conwise inmates). To address this issue more directly, Breuer et al. (2005) had different groups of participants imagine different scenarios (an everyday lie, lying about an affair, a murderer trying to come up with an alibi, and a no-information control group). Half of the participants in the three specified situations were told that the liars had some time to prepare their lie; for the other half, there was no opportunity for planning and rehearsal. Although some differences between these situations emerged, participants were relatively insensitive to the situational determinants of the respective nonverbal and paraverbal determinants. In Table 6, we have contrasted the results of this and previous meta-analyses with the effect sizes for the presumed changes in nonverbal behaviors in the crime situation.

The comparison between beliefs and actual indicators of deception makes it very clear that lay people and professionals alike assume much stronger associations between certain behaviors and deception than have been found in the studies reviewed. To illustrate these differences between beliefs and actually observed cues to deception, we have contrasted them in Table 6 and Figure 1, which display the respective effect sizes of this meta-analysis and those of the respective beliefs. Across these studies, it is quite striking that irrespective of their professions, people assume the existence of much stronger cues to deception than are found in empirical studies.

Recently, a worldwide survey in over 40 countries indicated high consensus on deception beliefs (Global Deception Research Team, 2006). Unanimously, gaze aversion was the number one cue thought to betray a liar. Our results show that there is no evidence for this assumption but that when both feelings and facts are related (as opposed to facts only), eye contact may decrease. Nonetheless, the universally held strong belief (*r*s = .36 and .56 for students and police, respectively; see Table 6) that gaze aversion is the cue to detecting a liar is clearly wrong. Regarding eye contact, it is also important to consider situational and cross-cultural factors together (Sporer, 2001; Vrij, 2000; Vrij & Winkel, 1993). In some cultures, it may simply be a norm of politeness not to look at the questioner's face when responding. This may be particularly true with respect to authority figures such as police officers, attorneys, or judges. Moreover, people do not seem to be aware that their own behavior may affect their counterpart's behavior. If an interrogator who is him- or herself under stress is fidgeting, his or her nervousness may be transmitted to the interviewee, whose behavior in turn may then be misinterpreted as a sign of deception (Akehurst & Vrij, 1999).

Furthermore, nervous behavior, incoherence, body movements, and facial expressions are among the top five cues listed by the Global Deception Research Team (2006, Study 1). More than 50% of the worldwide sample believed that specific nonverbal behaviors such as gaze aversion, posture shifts, self-manipulations (self-touch), and hand gestures increased while lying (Global Deception Research Team, 2006, Study 2). These same universally held beliefs were also endorsed by police officers and the general public (Akehurst et al., 1996), various professionals including lawyers (Köhnken, 1988), and students thinking about a crime situation (Breuer et al., 2005; see Table 6 and Figure 1), but the objective data speak quite a different language.

Not only do lay people believe that certain nonverbal behaviors are strongly associated with deception but also, for some of the behaviors, these beliefs are actually diametrically opposed to those observed to be indicators of deception in experimental studies. For example, although people generally believe that deception is accompanied by an increase in hand movements as well as in foot and leg movements and nodding, these behaviors actually decrease when people are lying. For many other behaviors where people also assume an increase, there is no reliable relationship across studies. For example, people assume that blinks, illustrators, and postural shifts increase when people are lying, whereas there seems to be no association with these behaviors in this meta-analysis. Only for some behaviors do beliefs match the direction of the associations observed—perhaps a decrease in (genuine) smiles. Nonetheless, even with these behaviors, the magnitude of the association is assumed to be much stronger than it actually is (e.g., for adaptors). Consequently, practitioners need to be taught that nonverbal behaviors in general are not reliable cues to deception, despite beliefs to the contrary.

Moreover, although this study, as well as the meta-analysis by B. M. DePaulo et al. (2003), suggests that the association between cues to deception and lies depends on a series of moderators (in particular, the motivation of the liar not to get caught and the opportunity for preparation), beliefs about cues associated with deception almost never take these situational variations into account (Breuer et al., 2005; Taylor & Vrij, 2000; Vrij & Taylor, 2003). For example, hand movements and nodding may decrease, particularly when liars have had no opportunity to prepare their lie. Consequently, fact finders need to be taught to analyze situational determinants first to determine whether or not some cues may be considered to indicate the presence of deception in a given situation.

So, what are the alternatives if nonverbal behaviors are unlikely to help one differentiate truth from deception? In recent years, some investigators have developed new technologies, such as the voice stress analyzer or analysis of thermal reactions in the eye, which supposedly provide more foolproof methods of detecting deception. Closer scrutiny of these approaches is beyond the scope of this review. Some researchers also believe (as does the first author) that verbal content analysis may provide better tools to discriminate truthful from falsified statements (Sporer, 1997, 2004; Vrij, 2005). However, applying these content-oriented techniques properly requires intensive training and may not be applicable to all forms of deception. In the meta-analysis by B. M. DePaulo et al. (2003), results from some studies showed relatively large effect sizes compared with most nonverbal and paraverbal cues. Yet be warned: The promulgators of these new truth/lie detection techniques are likely to oversell their validity. Until research from independent research teams is in, policy changes should be made with great caution.

Conclusions

In sum, the four theories or models used to predict differences between deceptive and truthful statements all yield some accurate elements, but these need to be combined to accurately predict and account for behavioral changes during deception (Zuckerman & Driver, 1985). However, simply combining these ideas is not adequate. Our hypothesis on the impact of motivation on deceptive behavior represents a synthesis of the arousal and the attempted control theories but has been corroborated only to a small extent. Some new ideas and some more thoughtful consideration are needed, rather than simple variations on these themes. B. M. DePaulo et al. (2003) have presented a more encompassing framework that appears particularly fruitful when trying to understand lies in everyday life. Complementarily, we favor a working memory model, which may be particularly useful in assessing lies about complex events. Notably, largely similar predictions are yielded by both DePaulo et al.'s self-presentational perspective and our working memory model.

The present analyses of moderator variables indicate that there are considerable differences in behavior when individuals lie with or without permission and whether or not they are motivated to deceive successfully. If researchers start collecting data regarding lies in different contexts or situations and their properties, they should be able to predict behavior during deception more correctly. For example, there is the well-known white lie directed at a host about how nice and amusing a party has been (although it was not). This represents a lie for reasons of politeness, which usually fades from the memory of both communicator and recipient only a few minutes later. A white lie is, in a way, sanctioned by society. It affords moderate cognitive effort and does not usurp working memory resources, and its purpose is the attempt to maintain positive relationships with others. B. M. DePaulo, Kashy, Kirkendol, Wyer, and Epstein (1996) assumed that everyday lies represent the claiming of desired identities and, additionally, the support of other people's claims of desired identities. This perspective is closely related to social psychological research on the self and its presentation to others (B. M. DePaulo, 1992; B. M. DePaulo et al., 1996).

These harmless lies should differ in their properties compared with attempts to deceive others when stakes are high, be this for high monetary rewards or in the courtroom. Therefore, it is plausible that different types of lies will result in different behavioral adaptations when liars perform high-stakes lies. It is a challenge to create experimental situations in which different conditions of lying are present. For example, only very few researchers were successful in or even thought about creating unsanctioned lie conditions (Buller, Burgoon, Buslig, & Roiger, 1994; deTurck & Miller, 1985; Exline, Thibaut, Hickey, & Gumpert, 1970; Feeley & deTurck, 1998; Mehrabian, 1971; Stiff & Miller, 1986). In legal contexts, there are likely to be not only rewards for responding truthfully but also (severe) punishments for lying (e.g., perjury charges). Although punishment is almost impossible to implement in laboratory research for obvious ethical and legal reasons, psycholegal research should pay and has been paying closer attention to ecological validity in studies.

Of all investigated moderator variables, the content of the lie and the operationalizations of the dependent variables had a strong impact on the relationship between the behaviors and deception (see Tables 3 and 5). Interestingly, the impact of the content of the lie was predominantly reduced to the dependent variables visible in the head area (see Table 3), but adaptors may also increase when not only facts but also feelings are discussed. Experimental design made a difference, especially with respect to several variables. Causal explanations for the differences in effect sizes in between- versus within-subjects designs or for any other moderator variable cannot be derived from meta-analytic data, but this variable can apparently yield different directions of effect in experimental studies.

Recent research, however, has gone beyond investigating deceptive behavior in laboratory studies only. Vrij and Mann (2001) investigated the behavior of a real suspect while he was interviewed by the police in a murder case. Davis and Hadiks (1995) analyzed an interview with Saddam Hussein by an American journalist. That is, they chose a nonexperimental paradigm with a post hoc assessment of the truthful versus deceptive utterances of Saddam Hussein. Davis and Hadiks argued that in past research, there was too much emphasis on "general categories and simplistic coding tasks" (Davis & Hadiks, 1995, p. 6). They also assumed that cues to deception must be context bound, as described above.

Possibly, the general and simplistic rules of counting or rating behaviors established in deception experiments are the reason why the majority of behaviors fail to distinguish between liars and truth tellers. In the present analysis, for instance, smiling behavior was examined, but there was no overall effect with smiling in the combination of weighted effect sizes. Usually, smiling was coded using very simple descriptions, with no differentiations between types of smiles. Only the Ekman group (e.g., Ekman, Davidson, & Friesen, 1990; Ekman & Friesen, 1982) considered that smiling can take various forms. These researchers attended to smiling behavior by observing muscular activity in the face rather than relying on gross impressions. They elaborated the Facial Action Coding System (FACS; Ekman & Friesen, 1982) and specified, for example, which facial muscles can produce an upward tilt of the lips. A smile is considered a true expression of positive emotion only if an eye muscle, the orbicularis oculi, is active (Ekman & Friesen, 1982). Using FACS, a very thorough assessment of facial expressions is possible. However, the careful distinctions made by Ekman and his coworkers did not leave their mark on the present analysis because none of the other researchers used similar sensitive categories of smiling. Therefore, only the *felt smile,* as defined by Ekman and Friesen (1982), was considered.

Similar to the FACS is the microanalysis of nonverbal behavior completed by Davis and Hadiks (1995). This multistage system is designed to reveal complicated patterns of behavior. However, the movement toward such sophisticated methods represents a dilemma within deception and detection of deception research. Although the thorough analysis of an individual's behavior seems to be a challenging step within the arena of deception research, these methods do not seem applicable in face-to-face interactions when an individual wishes to assess credibility of his or her counterpart immediately. These microanalyses are only possible by using sophisticated technical equipment and investing very much time before coming to a conclusion. Therefore, they are less suitable to meeting the goal of identifying reliable deception cues to train professionals whose work depends on assessing credibility on the spot. Perhaps the renewed emphasis on analyzing the very content of lies with more objective methods may be more promising in the long run. Research consumers should be warned, however, to pay attention only to those studies that demonstrate that their methods can be applied objectively. There is no simple direct route on the many stony paths to truth.

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