

On Lying and Being Lied To: A Linguistic Analysis of Deception in Computer-Mediated Communication

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This study investigated changes in both the liar's and the conversational partner's linguistic style across truthful and deceptive dyadic communication in a synchronous text-based setting. An analysis of 242 transcripts revealed that liars produced more words, more sense-based words (e.g., seeing, touching), and used fewer self-oriented but more other-oriented pronouns when lying than when telling the truth. In addition, motivated liars avoided causal terms when lying, whereas unmotivated liars tended to increase their use of negations. Conversational partners also changed their behavior during deceptive conversations, despite being blind to the deception manipulation. Partners asked more questions with shorter sentences when they were being deceived, and matched the liar's linguistic style along several dimensions. The linguistic patterns in both the liar and the partner's language use were not related to deception detection, suggesting that partners were unable to use this linguistic information to improve their deception detection accuracy.

Modern communication technologies have advanced both the speed and quantity of information that is shared among humans and organizations. Although these changes have created a number of advantages for society, including faster access to information and inexpensive modes of communication at a distance, they have also

created new opportunities for deception (Hancock, 2007). Deception, in general, is not an infrequent part of human communication. Indeed, it has been reported that people tell an average of one to two lies a day (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996), and recent research suggests that these everyday lies also take place in mediated communication (Hancock, Thom-Santelli, & Ritchie, 2004).

As Granhag and Strömwall (2004, p. 324) pointed out, the fact that lying occurs across different communication media has important implications for the study of deception (see also Carlson, George, Burgoon, Adkins, & White, 2004; Hancock, 2007). For example, how does deception affect language use in text-based interactions, such as e-mail and instant messaging; that is, can linguistic patterns differentiate between deceptive and truthful electronic communication? If so, can these linguistic patterns be assessed in ways that might be useful in detecting some of the potentially dangerous types of deception increasingly found in online chat rooms, such as the sexual predation of minors (Mitchell, Finkelhor, & Wolak, 2001)?

In this study, we begin to address these questions by examining the linguistic profiles of deceptive and truthful liars and their partners engaged in synchronous, text-based computer-mediated communication (CMC). Unlike previous deception research that has focused primarily on the liar's behavior, in this study we examine the linguistic behavior of both the liar and the target of the lie. We also manipulate the *motivation* of liars to succeed in their deceptions in an effort to examine how motivation affects the linguistic profile of digital deception.

AUTOMATED ANALYSIS OF LINGUISTIC CUES IN DECEPTION

Although not as well-studied as the non-verbal aspects of deception (Miller & Stiff, 1993), the language of deception has been examined with several different approaches (see Shuy, 1988), including Statement Validity Analysis (see Raskin & Esplin, 1991), Scientific Content Analysis (see Driscoll, 1994), and Reality Monitoring (see Johnson & Raye, 1998). These approaches or techniques to analyzing deceptive and truthful language are based on theoretical assumptions of how deception should be reflected in language. For example, Reality Monitoring assumes that descriptions of real memories of an event differ from imagined or fabricated memories, such that descriptions of real memories will contain more perceptual and contextual information than false memories. Coders examine transcripts of interviews and statements for evidence of these types of differences (e.g., Vrij, Edward, Roberts, & Bull, 2000).

More recently, automated linguistic techniques in which computer programs are used to analyze the linguistic properties of texts have been used to examine the linguistic profiles of deceptive language (e.g., Bond & Lee, 2005; Newman,

Pennebaker, Berry, & Richards, 2003; Zhou, Burgoon, Twitchell, Qin, & Nunamaker, 2004). In general, this research suggests that four categories of linguistic cues have been associated with deception: (a) word quantity, (b) pronoun use, (c) emotion words, and (d) markers of cognitive complexity.

Consider first the overall production of words across deceptive and truthful communication. The majority of previous research suggests that liars tend to use fewer words when lying, and tend to offer fewer details (Burgoon, Blair, Qin, & Nunamaker, 2003; DePaulo et al., 2003; Porter & Yuille, 1996; Vrij, 2000). Because liars are fabricating facts or an account, liars will often have less familiarity with what they are discussing, which makes producing extra detail cognitively more difficult.

Although some research suggests that deceptive accounts will involve fewer words than truthful accounts, a recent study examining word production in asynchronous CMC (i.e., e-mail) in which participants sent one another text messages reported that liars produced significantly *more* words when lying than when telling the truth (Zhou, Burgoon, Nunamaker, & Twitchell, 2004). Zhou, Burgoon, Nunamaker, et al. (2004) offered three factors that may lead lies being wordier. First, because the communication medium was asynchronous and text-based, deceptive participants may have taken more time to plan and edit their messages (Hancock & Dunham, 2001). Second, the majority of previous deception research has involved lies about verifiable facts (e.g., a mock theft) in which the liar may wish to speak briefly to avoid contradicting their account of the facts. In contrast, the task employed by Zhou, Burgoon, Nunamaker, et al. (2004) involved convincing a partner of a non-verifiable opinion in which the participants may have used additional discourse to provide reasons and arguments for their deceptions, and with little basis for partners to suspect duplicity. Yet a third factor is whether the communication format is monologue, such as autonomously describing an event, or dialogue in which two partners interact in conversation (Burgoon, Buller, & Floyd, 2001; Burgoon, Buller, White, Afifi, & Buslig, 1999). Liars engaged in an interactive conversation may use more words to manage information flow, to enhance mutuality with their partner, and to decrease a conversational partner's suspicion (Burgoon et al., 2001). Because we are examining non-verifiable forms of deception in our synchronous, text-based dialogues, we expect deceptive communication in this situation to be more verbose than truthful communication.

Consider next the patterns of pronoun usage associated with deception. Liars tend to be more non-immediate than truth tellers and refer to themselves less often in their deceptive statements. In a series of studies in which participants either lied or told the truth, Newman et al. (2003) observed that individuals consistently used first-person singular pronouns less frequently when lying than when telling the truth. Using first-person singular pronouns (also referred to as self-oriented references), such as "I," "me," or "my," involves taking ownership

of a statement; and deceivers may refrain from using these first-person pronouns due to either a lack of personal experience or a desire to dissociate themselves from the lie being told.

The data concerned with other-oriented pronouns, including second (“you”) and third-person pronouns (“she,” “their,” “they”), suggest that liars are more likely to use third-person pronouns in their deceptive interactions than in truthful ones (DePaulo et al., 2003). According to Ickes, Reidhead, & Patterson (1986), liars who are careful about constructing deceptive messages will exhibit an increased other-focus in an effort to distance themselves from the lie.

Research examining emotional terms that occur during deception suggests that there are slight but consistent elevations of disparaging statements and negative emotion words (e.g., “hate,” “worthless,” “enemy”) during deception compared with telling the truth (Knapp & Comadena, 1979; Newman et al., 2003; Vrij, 2000; Zhou, Burgoon, Nunamaker et al., 2004), which are assumed to reflect the fact that the deceiver feels guilty about the act. These observations are generally consistent with work by Burgoon et al. (2003), who found that deceivers tend to use more emotional expressiveness (both negative and positive verbal tokens of emotion, such as happy and sad) compared to truth tellers.

Finally, previous research also suggests that liars may be particularly wary of using distinction markers that delimit what is in their story *and* what is not (Newman et al., 2003). For example, exclusive words (e.g., “but,” “except,” “without,” and “exclude”) and negations (e.g., “no,” “never,” “not”) require a deceiver to be more specific and precise, which may increase the likelihood that a deceiver will be caught in a contradiction. Similarly, from a cognitive perspective, truth tellers should be able to discuss exactly what did and did not happen because they were actually there to witness the event being discussed. Liars, on the other hand, would be forced to keep track of what they have previously said to avoid contradicting themselves later. As such, deceptive conversation should contain fewer distinction markers, such as exclusive terms and negations.

Although the literature on linguistic analysis of deception suggests that changes in word quantity, pronouns, emotional terms, and distinction markers may reflect deception, previous research is limited in two important ways. First, as a number of researchers have noted (Buller & Burgoon, 1996; Miller & Stiff, 1993), previous deception research has been limited primarily to analyses of deception in the context of monologues rather than in conversational contexts. For example, Newman et al. (2003) conducted five studies in which participants discussed a given topic by writing about it, talking about it to a video camera, or by typing their views on it. Given that lies tend to occur during conversations with others (DePaulo et al., 1996; Hancock et al., 2004), and given the fact that language use in conversation differs in important ways from language use in monologues (Burgoon et al., 2001; Clark, 1996), the focus of previous research on monologue-based deception may limit its applicability to conversation.

A second, and related, weakness is that previous research on linguistic predictors of deception has focused almost exclusively on the liar (i.e., the teller of the deception or the truth). For example, recall Newman et al.'s (2003) examination of liar's handwriting, videotapes, and typed transcripts. The reactions of the targets of deceptive messages (e.g., interviewers, conversational partners, etc.) were not considered. However, research from a range of disciplines, from psychology, linguistics, and communication, suggests that participants engaged in conversation tend to adjust their behavior in relation to their partner, from their use of language to their nonverbal behaviors (for a review, see Burgoon, Stern, & Dillman, 1995). For example, Communication Accommodation Theory suggests that when participants are trying to persuade or gain the approval of their partner, they tend to match a variety of behaviors, including accent, loudness, vocabulary, grammar, and gestures (Giles & Coupland, 1991). At the psycholinguistic and pragmatic levels, partners in conversation tend to align their linguistic representations (Pickering & Garrod, 2004) and coordinate their use of referents (e.g., Brennan & Clark, 1996).

Given that interlocutors tend to match one another's language use, and given that speakers appear to alter their behavior in systematic ways when lying versus when they are telling the truth, an important question that remains to be addressed is whether the conversational partners also behave differently linguistically when lied to than when they are told the truth. One possibility is that the language produced by partners will match changes in the language of the liar. As noted above, conversational partners tend to use language in similar ways, such as matching their levels of verbosity and their use of articles and prepositions, regardless of the topic matter being discussed. One recent formulation of this phenomenon is the Linguistic Style Matching (LSM) model (Niederhoffer & Pennebaker, 2002), which proposes that two people in conversation adjust their own speaking behavior or style, at a turn-by-turn level, to match their partner's behavior; this matching is assumed to reflect the coordination processes inherent in natural conversations. If, as LSM and other models suggest, people in conversation adjust their linguistic behavior to that of their partners, then any differences in linguistic behavior by liars across deceptive and truthful communication should also be observed in the partner's behavior. As such, the LSM perspective predicts that during deceptive interactions, partners, like liars, should produce different quantities of words, a greater focus on other-references (e.g., fewer first-person singular pronouns, more second- and third-person pronouns), more negative emotion terms, and more exclusive words.

A second possibility is that partners may not simply mirror the liar's linguistic style but may instead adjust their language according to their own goals and conversational constraints. Interpersonal Deception Theory (IDT), for example, models deception as an interactive and ongoing transaction between a liar and conversational partner in which both participants are assumed to produce strategic adjustments during communication to relate to one another (Buller & Burgoon,

1996; Burgoon et al., 1999). Although this model assumes reciprocity between the liar and partner that is similar to the LSM model, IDT argues that reciprocity processes may be a strategic communication behavior used by the deceiver to facilitate their deception (e.g., to enhance mutuality).

IDT also suggests that liars and their partners may have different goals that may lead to different behaviors. Liars, for instance, must convince their partner about something that the liar believes to be false, which is not the case for partners. One strategy that liars may use to achieve this goal and appear more credible is to increase the interactivity of the conversation, perhaps by increasing their verbosity or by asking questions to engage their partner (Burgoon et al., 2001). Partners, on the other hand, do not face this issue; however, they may become suspicious of their partner, which may lead to behaviors related to obtaining more information regarding their partner's truthfulness such as asking questions about the narrative or information content (Burgoon, Buller, Dillman, & Walther, 1995; Burgoon et al., 1999; Burgoon et al., 2001). As such, partners may ask more questions of the speaker when they are being lied to than when they are being told the truth; and, because IDT assumes that deception is an ongoing, interactive process, changes in either partner's behavior may prompt changes in the other partner's behavior.

HYPOTHESES

This research examined both the liars' and their conversational partners' behavior in conversations during truthful and deceptive conversations that took place in text-based, synchronous CMC. Participants discussed four opinion-based topics (e.g., "Who is the most important person in your life") by sending short text messages to one another in a synchronous interaction. One half of the participants were assigned to the liar role and were instructed to lie to their partner on two of the topics and tell the truth on the other two topics. One half of the liars were motivated by the experimenter to succeed in their lie, whereas the other liars were not. The participants assigned to the partner role were blind to the deception and motivation manipulations.

In Hancock, Woodworth, and Goorha (in press), we report on the partner's ability to detect the liars' deception in this experiment. Overall, partners performed at chance levels in these text-based deceptions (53.5%). However, partners were *less* accurate at detecting deception when the liars were motivated to lie (42.6%) than when they were not (55.6%). In this study, we were concerned with the language used to enact these truthful and deceptive conversations.

The first hypothesis was derived from previous data suggesting that in asynchronous CMC (e.g., e-mail) conversations, deceptive messages about opinion-based topics involved more words than truthful messages (Zhou, Burgoon,

Nunamaker et al., 2004). We predicted that this increase would also be observed for synchronous CMC:

H1: Liars will produce more words during deceptive conversations than during truthful conversations.

The second hypothesis was derived from IDT's interactivity principle, which states that liars should attempt to engage the partner and increase the perceived interactivity of the communication in an effort to increase believability, such as asking questions. Thus, in deceptive interactions, liars were expected to ask more questions than during truthful interactions:

H2: Liars will ask more questions during deceptive conversations as compared to truthful conversations.

Theoretical and empirical observations suggest that liars attempt to distance themselves from their deception by using fewer first-person singular pronouns (Newman et al., 2003; Zhou, Burgoon, Nunamaker et al., 2004) and more other-focused pronouns, such as second-person and third-person pronouns (DePaulo et al., 2003; Ickes et al., 1986; Vrij, 2000; Zhou, Burgoon, Nunamaker et al., 2004):

H3: Liars will use fewer first-person singular but more other-directed pronouns in deceptive conversations than in truthful conversations.

Previous research suggests that increased levels of negative emotion terms are observed during deceptive communication (Newman et al., 2003; Vrij, 2000; Zhou, Burgoon, Nunamaker, 2004). Therefore, liars in this study were expected to produce more negative words during deception:

H4: Liars will use more negative emotion words during deceptive conversations than during truthful conversations.

Based on Newman et al.'s (2003) findings regarding the liars' decreased use of exclusive words during deceptive conversations, the liars in this study were also expected to produce a lower rate of distinction markers, including exclusive words and negation terms, during deceptive communication in comparison to truthful communication:

H5: Liars will use fewer exclusive words and negation terms during deceptive conversations as compared to truthful conversations.

Causation words (e.g., “because,” “effect,” “hence”) may be similar to distinction markers because they add specificity and detail to a story and increase the possibility of self-contradiction. If a liar not only lies about *X* but also lies about why and how *X*, the liar may be more at risk of detection. As such, liars should avoid using causal terms and phrases when lying:

H6: Liars will avoid causation phrases during deceptive interactions relative to truthful interactions.

The last linguistic variable of interest was sense terms (e.g., “see,” “touch,” “listen”), which add detail and specifics to narrative. Although providing these types of sensory details may be more difficult for a person who is fabricating an opinion or memory (e.g., Johnson & Raye, 1998; Vrij, 2000), a deceiver may attempt to create a detailed story in an effort to enhance the credibility of the story and avoid eliciting skepticism from the deceiver (Burgoon et al., 2001). Given that this context (i.e., mediated interaction, dialogic format, opinion-based deception) may shift liars into a persuasive mode, liars should be more likely to use sense words to flesh out their deception and demonstrate involvement in what they are discussing:

H7: Liars will use more sense terms during deceptive interactions as compared to truthful interactions.

The linguistic behavior of the partner was also of primary interest in this study. As noted earlier, previous research suggests at least two possibilities with regard to the conversational partner’s language production during deception. According to the LSM perspective, changes in the partner’s language across deceptive and truthful conversations should match changes in liar language production. If this is case, then we should see few differences in liar and partner language, and there output along the various dimensions described in the previous hypotheses should be correlated. A second possibility, according to IDT, is that although liar and partner behavior should be somewhat reciprocal, because liars and partners have different goals in the conversation, some differences in their language output should be observed. For example, partners may ask more questions during deceptive conversation if they become suspicious about their partner’s veracity:

RQ1: Will partners change their linguistic style during deceptive conversations?; if so, how will those changes relate to changes in the liar’s linguistic style?

Finally, the last objective of this study was to explore the impact of motivation on the linguistic patterns of deception. Motivation of the deceiver is an important factor in the detection of deception, and previous research suggests that

motivation operates via a dual process, impairing nonverbal performance during deception but facilitating verbal performance (DePaulo & Kirkendol, 1989; DePaulo, Lanier, & Davis, 1983; Vrij, 2000). Although there is some controversy about the exact role of motivation in deception, empirical research to date suggests that higher levels of motivation facilitate the liar's ability to deceive their partner when only verbal information is available (see Burgoon & Floyd, 2000; DePaulo & Morris, 2004). For example, when nonverbal cues are not available and judges must rely only on the transcribed verbal content of a deception, motivated deceivers tend to be more difficult to detect (e.g., DePaulo et al., 1983), which suggests some underlying linguistic differences between the language of motivated and unmotivated liars. This study examined how motivation would affect the linguistic behavior of unmotivated and motivated liars and their conversational partners in a communicative environment in which nonverbal communication is not possible:

RQ2: How will motivation to deceive a partner affect the linguistic style of liars and partners across deceptive and truthful communication in text-based communication?

METHOD

Participants

Participants ($N = 70$) were upper level students at a northeastern American university, and they participated for credit in various courses. Participants were randomly paired to form 35 same-sex (19 women, 16 men), unacquainted dyads. Participants communicated via CMC from separate rooms and did not meet the person with whom they interacted until after their session was completed. Participants were recruited for a "study of how unacquainted people interact on various conversation topics in CMC." Two dyads (1 woman and 1 man) had to be excluded from the study because the transcripts of the conversations were not saved.

Procedure

On reporting to the laboratory, participants were led separately to remote rooms where they completed an initial set of forms, including an informed consent form and two additional questionnaires not relevant to this study.

The procedure was adapted from Burgoon et al. (2001). In this study, all participants were told that they would be having a conversation with an unknown partner. They were instructed that they would discuss five topics, which were then provided to the participants on a sheet of paper. The first topic was always, "When I am in a

large group, I” This initial topic was designed to allow the participants to become comfortable interacting with their partner, and was not included in any analyses. After this topic, participants began a discussion of the four experimental topics that included the following: “Discuss the most significant person in your life,” “Talk about a mistake you made recently,” “Describe the most unpleasant job you have ever had to do,” and “Talk about responsibility.” Note that the topics were selected based on the protocol developed by Burgoon et al. (2001). There was no time limit, and participants were asked to discuss each topic until they had exhausted it and understood each other’s responses.

One of the two participants was randomly assigned to the role of liar, and the other to the role of partner. Liars were asked to deceive their partners. In particular, they were instructed “to NOT tell ‘the truth, the whole truth, and nothing but the truth’” on two topics, and to be truthful on the other two topics (Burgoon et al., 2001). The two topics in which the whole truth was not to be told were marked with an asterisk on the sheet of paper given to the liar. Liars had approximately 5 min to plan their stories. Partners were blind to the deception manipulation and were told that they were going to have a conversation with another person and that their role was to keep the conversation going. The same list of topics in the same order was given to the partners but without any asterisks marking topics.

The sequence in which the topics were discussed, and the order in which the liar lied, was counterbalanced across 16 orders. After the initial ice-breaking topics, liars were instructed to lie on either the next two topics or on the last two topics. One half of the liars followed a truth-first, deception-second order. The remainder followed a reverse order. Because topics followed a diagram-balanced Latin square order within truth and within deception, all topics appeared within a given time period.

Participants performed the task at isolated computer terminals. Participants used one of two desktop computer stations while the experimenter monitored and recorded the interaction from a third station. Once participants were seated at their terminals, the experimenter briefly demonstrated the use of the computer interface, Netmeeting, in which participants typed their message in a private composition window and hit enter to send their message to a shared window. Note that participants could edit their messages before transmitting them to their partners.

Once participants finished the discussion task, they were asked to complete a series of questionnaires based on their conversation, which included items assessing how truthful the liar had been and how truthful the partner believed the liar had been. The data from these questionnaires are reported in Hancock et al. (in press). After completing the post-interaction questionnaires, each member of the dyad was brought to a common room and introduced to his or her partner, and they were fully debriefed.

Motivation Manipulation

Liars were randomly assigned to one of two motivation conditions: “low motivation to lie” or “high motivation to lie.” The motivation manipulation was based on previous research procedures used to manipulate motivational levels of liars (see DePaulo et al., 1983; Forrest & Feldman, 2000). In the case of the high-motivation condition, liars were falsely informed that they had to make sure that they were able to convince their partner on the topics that they were lying about, as it was a very important skill to be able to deceive others in daily interactions. They were also told:

Research clearly shows that the ability to lie to others successfully is a good predictor of their future success in social settings, various jobs like consulting and counseling and for the maintenance of friendships, and that it was therefore important that they could make their partner believe their lies.

After the interaction, participants were asked to rate on a Likert scale ranging from 1 (*not at all important*) to 7 (*very important*) how important it was for them to deceive their partner. Motivated liars rated deceiving their partner as more important ($M = 5.22$, $SE = 0.29$) than unmotivated liars ($M = 4.24$, $SE = 0.29$), $F(1, 65) = 5.73$, $p < .05$, suggesting that the motivation manipulation was effective. During debriefing the liars were informed that, in fact, no relation between lying ability and future success has actually been documented. Low motivation liars were only told to try to deceive their partners.

Automated Linguistic Analyses

Liar and partner transcripts were converted into separate text files for each topic. As such, each dyad produced eight different transcript files: two deception discussions and two truthful discussions for each liar, and two deception discussions and two truthful discussions for each partner, which produced a total of 264 transcripts. Before conducting the linguistic analyses on the transcripts, the transcripts were subjected to pre-processing, which involved three aspects. First, given that CMC participants often omit punctuation, periods were placed at the end of all turns. Similarly, if a question mark was omitted after a question, a question mark was inserted, and if multiple question marks ended a question they were reduced to one question mark. Last, any misspellings were corrected, unless the participant explicitly corrected the spelling error.

All transcripts were analyzed using the Linguistic Inquiry and Word Count (LIWC) program (Pennebaker, Francis, & Booth, 2001). This text analysis program was used to create empirically derived statistical profiles of deceptive and

truthful communications (Pennebaker, Mehl, & Niederhoffer, 2003), and it has been used in studies to predict outcome measures like social judgments, personality, psychological adjustment, and health. LIWC analyzes transcripts with a dictionary-based approach in which each word is compared against a file of words divided into 74 linguistic dimensions. Each word may be counted in multiple categories. For the purpose of this study, only variables relevant to the hypotheses and research questions were included, which left 11 variables to analyze: word counts, words per sentence, question marks, first-person singular pronouns, second-person pronouns, third-person pronouns, negative emotion words, exclusive words, negations, causation words, and words pertaining to the senses. The standard LIWC dictionary was employed for each of these variables. LIWC produces the percentage of each variable type by dividing the frequency of the observed variable by the total number of words in the sample, with the exception of word counts, words per sentence, and question marks, which are reported frequencies.

RESULTS

The following reported findings reveal that deception affected both the liar and the conversational partner's patterns of language use. In addition, an increased motivation to succeed in lying impacted the liar's linguistic style. The findings are organized along the 12 primary linguistic variables of interest, followed by an analysis of the LSM between liar and conversation partner. An example transcript of a dyad engaged in a deception topic and a truthful topic is displayed in the Appendix.

The model used to analyze each of the linguistic variables involved both between and within-subjects factors. In particular, a 2 (discussion type: truthful vs. deceptive) x 2 (role: liar vs. partner) x 2 (topic: first vs. second) x 2 (motivation: high vs. low) mixed general linear model procedure was conducted on each dependent variable. The discussion type, role, and topic factors were entered as within-subjects factors; the motivation factor was entered as a between-subject factor. No effects of the topic factor were observed, and it is not discussed further. Table 1 contains the descriptive statistics for each variable.

Word Quantity

Consistent with H1, more words were produced during deceptive discussions ($M = 156.53$, $SE = 13.73$) than during truthful discussions ($M = 122.32$, $SE = 10.45$), $F(1, 31) = 6.86$, $p < .05$. The increase in word count for deception was equivalent for both liars' ($M = 138.40$, $SE = 12.13$) and partners' ($M = 140.45$, $SE = 9.67$) interaction, $F(1, 31) < 1$, *ns*, suggesting that both liars and partners used more words when the liar was lying. No effect of motivation was observed.

TABLE 1
Means and Standard Errors of the Linguistic Categories
by Truth Condition and Role

Variable	Liar				Partner			
	Lie		Truth		Lie		Truth	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Word count	155.79	11.89	125.12	11.38	157.27	16.83	119.53	11.13
Questions	15.90	2.30	16.42	2.35	15.38	1.53	10.78	1.31
Words per sentence	10.20	0.99	9.02	0.53	8.22	0.43	9.04	0.60
First-person singular (%)	7.08	0.36	7.85	0.37	7.36	0.42	8.39	0.42
Second person (%)	2.43	0.28	2.81	0.31	2.65	0.33	2.25	0.22
Third person (%)	3.29	0.33	2.43	0.19	2.57	0.31	2.41	0.27
Negative affect (%)	2.00	0.21	1.72	0.22	2.16	0.23	1.67	0.21
Negations (%)	2.21	0.19	1.77	0.17	2.28	0.19	2.19	0.21
Exclusive words (%)	3.99	0.27	4.17	0.33	3.63	0.23	3.87	0.31
Causation (%)	.94	0.11	1.19	0.13	.99	0.10	1.14	0.17
Senses (%)	2.48	0.16	2.09	0.20	2.49	0.19	2.18	0.22

An analysis of the number of words used per sentence revealed that liars ($M = 9.03$, $SE = 0.53$) and partners ($M = 9.04$, $SE = 0.59$) produced the same number of words per sentence during truthful discussion, $F(1, 31) < 1$, *ns*; but during deceptive communication, partners used marginally fewer words per sentence ($M = 8.21$, $SE = 0.42$) than liars ($M = 10.20$, $SE = 0.97$), $F(1, 31) = 3.81$, $p = .06$.

Question Frequency

H2 predicted that liars would use more questions during deceptive communication. Consistent with this hypothesis, more questions were observed during deceptive communication ($M = 15.64$, $SE = 1.29$) than during truthful discussions ($M = 13.60$, $SE = 1.41$), $F(1, 31) = 4.59$, $p < .05$. This effect, however, was moderated by a significant three-way interaction between the discussion type, role, and motivation factors, $F(1, 32) = 4.23$, $p < .05$. Simple effects analyses revealed that this interaction reflected the fact that partners asked more questions when unmotivated liars were lying ($M = 17.07$, $SE = 2.26$) than when they were telling the truth ($M = 8.78$, $SE = 1.60$), $F(1, 15) = 9.58$, $p < .01$, but asked the same number of questions of motivated liars regardless of whether the liar was lying ($M = 13.69$, $SE = 2.13$) or telling the truth ($M = 12.78$, $SE = 1.83$), $F(1, 16) < 1$, *ns*. Furthermore, the number of questions produced by liars did not differ across truthful and deceptive conversations in either of the motivation conditions, suggesting that liars used the same number of questions regardless of their truthfulness or motivation level.

Pronouns

H3 predicted that liars would use fewer first-person singular pronouns and more second- and third-person pronouns when they were lying. Consistent with this hypothesis, participants used marginally fewer first-person singular pronouns when lying ($M = 7.22$, $SE = 0.33$) than when telling the truth ($M = 8.12$, $SE = 0.30$), $F(1, 31) = 3.78$, $p = .06$. No effects were observed for role or motivation, suggesting that both liars and partners decreased their use of first-person singular pronouns to the same degree during deceptive communication, regardless of whether or not the liar was motivated.

Two types of other focused pronouns were analyzed: second- (i.e., “you”) and third-person pronouns (i.e., “he,” “she,” “they”). No effects were observed for second-person pronouns. An analysis of third-person pronouns revealed that liars used third-person pronouns more frequently overall ($M = 2.86$, $SE = 0.17$) than partners ($M = 2.49$, $SE = 0.23$), $F(1, 31) = 4.68$, $p < .05$. This effect, however, was moderated by a reliable interaction between discussion type and role, $F(1, 31) = 4.31$, $p < .05$. Consistent with H3, liars were significantly more likely to use third-person pronouns when lying as compared to when they were telling the truth, $F(1, 31) = 4.57$, $p < .05$. In contrast, no effect of discussion type was observed for the partner, $F(1, 31) < 1$, *ns*.

Negative Affect Terms

In contrast to H4, the frequency of negative emotion terms did not increase during deceptive conversations. No effects or interactions for negative emotion terms were observed, suggesting that deception, role, and motivation did not affect the liar or partner’s production of negative emotion words.

Distinction Markers

The next set of analyses examined use of distinction markers, including exclusive terms and negations. Contrary to H5, no effects were observed for exclusive terms. However, a marginal interaction between discussion type and motivation was observed for negation terms, $F(1, 31) = 3.44$, $p = .07$. When liars were motivated to deceive their partner, no difference in the frequency of negation words was observed across deceptive ($M = 1.88$, $SE = 0.18$) and truthful discussions ($M = 2.06$, $SE = 0.19$), $F(1, 16) < 1$, *ns*. In contrast, when liars were not motivated, liars produced marginally more negation words during deceptive discussions ($M = 2.61$, $SE = 0.25$) than between truthful discussions ($M = 1.90$, $SE = 0.21$), $F(1, 15) = 3.45$, $p = .07$. Considered together, these data do not support the assumption that liars avoid distinction markers. Indeed, they suggest that unmotivated liars may actually increase their use of simple negation terms during deception.

Causal Terms

An analysis of causation words (e.g., “because,” “effect,” “hence”) revealed a significant three-way interaction between discussion type, role, and motivation, $F(1, 31) = 4.03, p < .05$. Although no effects were observed for the partner role, motivated liars used reliably fewer causation terms when they were lying ($M = 0.86, SE = 0.15$) than when they were telling the truth ($M = 1.44, SE = 0.17$), $F(1, 16) = 5.58, p < .05$. This difference was not observed for unmotivated liars, $F(1, 15), < 1, ns$, suggesting that only motivated liars modified their use of causal terms during deception.

Sense Terms

Participants were significantly more likely to use words that pertained to the senses (e.g., “see,” “touch,” “listen”) when lying ($M = 2.47, SE = 0.16$) than when they were telling the truth ($M = 2.10, SE = 0.19$), $F(1, 31) = 5.25, p < .05$. No other effects for the senses variable were observed, suggesting that both liars and partners increased their use of sense terms, and that motivation did not affect the production of this linguistic category. Analyses of the individual sense subcategories produced by LIWC (seeing, touching, and feeling categories) revealed that the pattern of increased sense terms during deception was consistent across the individual sense subcategories.

Linguistic Correlations Between Liar and Partner

To examine the LSM between liars and partners, a series of correlations were calculated between the liars’ and partners’ linguistic output across conditions. As Table 2 describes, across conditions and linguistic categories, liar and partner language use was positively correlated ($r = .26, p < .05$). Specifically, word counts, pronouns, and the use of negative emotion terms were all significantly correlated between liar and partner. LSM was more evident during deceptive conversations ($r = .33$) than during truthful ones ($r = .19$), although this difference did not achieve significance, $z = 1.19, ns$. Nonetheless, more correlations in the high motivation-deception condition achieved significance than in any other condition, including word count, second- and third-person pronouns, negative emotion terms, and negations, suggesting that liars and partners matched their language production most closely when the liar was motivated to lie.

DISCUSSION

The primary objective of this study was to examine the linguistic behaviors of both liars and partners during synchronous CMC that involved both deceptive and truth-

TABLE 2
Correlations of the Linguistic Categories Between Liar and Partner Across
Low and High Motivation

Variable	Low		High		Overall
	Lie	Truth	Lie	Truth	
Word count	.84***	.63**	.80***	.85***	.78***
Questions	-.17	.03	.44	.59*	.14
Words per sentence	.14	.17	-.15	.11	-.03
First-person singular	.42	.04	.45	.27	.32*
Second person	.29	-.02	.58*	.24	.27*
Third person	.68*	-.08	.73**	.13	.46**
Negative affect	.40	.69**	.52*	.53	.58**
Negations	.17	-.37	.55*	-.18	-.05
Exclusive words	.22	.31	.43	-.07	.22
Causation	-.10	.51*	-.16	-.10	.06
Senses	.17	-.18	.08	.10	.06
Average correlation	.28	.15	.38	.23	.26

* $p < .05$. ** $p < .01$. *** $p < .001$.

ful discussions. The first question of interest was determining whether the liars' linguistic behavior changed when the liar was being deceptive relative to when the liar was being truthful. The data suggest that, overall, when liars were lying to their partners, they produced more words, used fewer first-person singular pronouns but more third-person pronouns, and used more terms that described the senses (e.g., "see," "hear," "feel") than when they were telling the truth.

These observations are consistent with a number of the hypotheses described earlier. As predicted by H1, liars produced approximately 28% more words when lying than when telling the truth. This is consistent with recent research examining dyadic asynchronous CMC conversations (i.e., Zhou, Burgoon, Nunamaker et al., 2004) and extends the observation to synchronous CMC in which participants exchanged messages in real time.

The observation that liars produced more words when lying, however, is inconsistent with some previous research that suggests that liars are less forthcoming and provide less detail than truth tellers (for a review, see DePaulo et al., 2003; Porter & Yuille, 1996; Vrij, 2000). As previously noted, in this study the communication task for the liars was to describe false opinions, which were generally non-verifiable and unlikely to arouse suspicion (e.g., "Who is the most significant person in your life?"). It may be the case that when it is safe to do so, deceivers will pepper their lies with more detail; but when they are at risk of being discovered, they will be more hesitant to provide details. For example, consistent with H7, liars used more sense words (e.g., "see," "touch," and "listen"). As Anolli and Ciceri

(1997) noted, sometimes eloquent, detailed, and lengthy responses provided by liars are indicative of their effort to provide persuasive and credible statements that try and move the listener's attention from any false or untrue information.

The decrease in the liars' use of first-person singular pronouns (e.g., "I," "me," "my") and increase in their use of third-person pronouns (e.g., "he," "she," "they") during deception is consistent with H3 and with previous research suggesting that participants modify their use of pronouns so that their language is more other-focused (Burgoon et al., 2003; Knapp & Comadena, 1979; Newman et al., 2003; Vrij, 2000; Zhou, Burgoon, Nunamaker et al., 2004). Considered together, these findings suggest that pronoun usage may be an important indicator of deception across various contexts.

Although the data suggest important overall differences in liar linguistic patterns across deceptive and truthful discussion, not all of the linguistic variables changed as a function of deception. Contrary to H4, which predicted that liars would use more negative emotion words when they were lying than when they were telling the truth (Newman et al., 2003), liars used negative emotion words with the same frequency, regardless of discussion type. Similarly, liars did not reduce the frequency of exclusive words during deceptive interactions, as predicted by H5.

The motivation of the liar affected several dimensions of the liar's linguistic output. First, motivated liars tended to produce fewer negations and causal terms (e.g., "because," "hence," "effect") when lying, whereas the discourse of unmotivated liars did not differ on these linguistic dimensions, suggesting that only motivated liars may have been attempting to avoid some of the traps associated with the specificity of negations and causal explanations. It is important to note, however, that the relatively weak motivation manipulation in this study limits the conclusions we can draw about the impact of motivation on verbal performance during deception. Frank and Ekman (1997), for instance, highlighted the importance of using "high-stakes" deception, which include potential for serious negative consequences if detected, for drawing out the impact of motivation on deception. Nonetheless, motivation levels did affect language use across deceptive and truthful conversations, and, as discussed later, motivated participants were more successful in their deceptions than unmotivated participants. Considered together, the data support a facilitative effect of motivation on verbal performance during deception (Burgoon et al., 2000; DePaulo & Kashy, 1989; DePaulo et al., 1983)

The second question of interest in this study was whether the linguistic style of the conversational partner changed systematically according to whether or not the liar was lying. The data suggest that, in fact, partners did behave differently linguistically when they were being lied to. In particular, when they were being lied to, partners used more words, although they generated fewer words per sentence, suggesting that their communication was characterized by frequent but shorter

utterances. They also used fewer first-person pronouns, more sense words and asked more questions.

Perhaps the most interesting observation is that, despite being blind to the deception manipulation, partners asked more questions of the liars during deceptive communication than during truthful communication, which is consistent with some previous face-to-face research suggesting that liars tend to encounter more probing questions from partners when they are being deceptive (Burgoon et al., 1995; Knapp and Comadena, 1979). The fact that partners tended to use shorter utterances during deception also suggests that partners were using probing questions. Given that partners asked more questions of liars when they were being deceived despite being unaware of the deception manipulation suggests at least two intriguing possibilities. The first is that partners may have been suspicious and were using the questions to probe the liar, an observation that corresponds with the predicted behavior for partners in Buller and Burgoon's (1996) explanation of IDT. In particular, IDT assumes that partners become suspicious of deception and will use indirect means (such as question-asking) to obtain more information from the liars. The liars, in turn, pick up on the partners' skepticism and seek to alleviate it, perhaps by describing things in more detail. The second possibility is that liars were intentionally opening themselves up to questions from the partner in an effort to increase the mutuality and involvement of the interaction. As Burgoon et al. (1999) observed, participants that increase involvement in conversation tend to arouse less suspicion in their conversational partner. Additional research is required to tease apart the causal relation between the increased word production and question-asking during deception observed in this study.

The increase in question asking during deception, however, was more pronounced in the partners interacting with an unmotivated liar than those interacting with a motivated liar. If the increased question asking represents increased probing behavior, as suggested earlier, then these data suggest that unmotivated liars may have been less successful than motivated liars in portraying their statements as honest. This would be consistent with the results reported in Hancock et al. (in press) in which partners were more accurate at detecting unmotivated liars (55.6% accuracy) than motivated liars (42.6% accuracy). In the next section, we explore the specific relations between linguistic cues and deception detection.

Linguistic Features and Deception Detection

Did the changes in the liars' or partners' linguistic behavior affect the partners' ability to deceive their partners? That is, did these linguistic changes help the liar or give the liar away? To explore this question, we examined the correlation between the linguistic categories and the partners' deception detection accuracy rates reported in Hancock et al. (in press; see Table 3). Positive correlations indicate more accurate deception detection when a linguistic category was produced more

frequently during truthful messages. As Table 3 reveals, the correlations between the linguistic dimensions and a partner's ability to detect the truth were uniformly low, for both liars and partners. Taken together, these data suggest that although liars and partner's produced different linguistic profiles during deception, partners were unable to use these linguistic changes to improve their ability to detect deception.

Although the partner's accuracy was not related to the observed language profiles, a second question is whether the linguistic properties of the messages alone can be used to classify the messages as deceptive or truthful. For example, Newman et al. (2003) used the LIWC variables examined in that study to classify 61% of the messages accurately as deceptive or truthful, a rate that was significantly better than chance. Following Newman et al., the linguistic categories that demonstrated a significant difference across deceptive and truthful messages in this study were entered into a simultaneous logistic regression model predicting the deceptiveness of a message. Two models were created, one for the liar and one for the partner; and the coefficients for each model are presented in Table 4. The model using the liars' linguistic profile to predict deception was significant, $\chi^2(6)$

TABLE 3
Correlations Between Liar and Partner Linguistic Categories
and Partners' Deception Detection Accuracy

Variable	Word Count	Words Per Sentence	Questions	First Person	Third Person	Negations	Causality	Senses
Liar	0.21	0.04	-0.02	-0.21	-0.13	-0.11	-0.13	-0.10
Partner	0.20	-0.04	0.01	-0.06	-0.13	-0.18	-0.18	-0.04

Note. The difference between truthful and deceptive messages was calculated by subtracting deceptive linguistic output from truthful output for each category. Positive correlations indicate more accurate deception detection when a linguistic category was produced more frequently during truthful messages. No correlations achieved significance at the .05 level.

TABLE 4
Logistic Regression Coefficients for Liar and Partner Linguistic Categories
Predicting Message Veracity (Truthful vs. Deceptive)

<i>Linguistic Category: Liar</i>	β	<i>Linguistic Category: Partner</i>	β
Words	.005	Words	.005
First-person singular	-.205*	Words per sentence	-.102
Third-person singular	.287*	Questions	.061
Causal terms	.211	First-person singular	-.100*
Negations	-.538*	Senses	.256*
Senses	.346*		

* $p < .05$.

= 13.74, $p < .05$, and correctly classified 66.7% of the messages (truthful: 66.7%; deceptive: 66.7%). The model for the partners was also significant, $\chi^2(6) = 11.06$, $p = .05$, and classified 66.7% of the messages (truthful: 63.6%; deceptive: 69.7%). Both classification rates are significantly above chance ($p < .01$) and similar to those observed by Newman et al.

These results have important implications for the automatic detection of deception in texts (for a review, see Zhou, Burgoon, Twitchell, Qin, & Nunamaker, 2004), namely that the language features of the partner should also be considered when building classification models for deception detection.

LSM

Another important question was how the liar and partner's linguistic behaviors related to one another across deceptive and truthful communication. Recall that the LSM model assumes that participants match their linguistic styles during conversation (Niederhoffer & Pennebaker, 2002), and predicts that changes in the liar's linguistic profile should be matched by changes in the partner's linguistic profile. Consistent with this perspective, liars' and partners' overall language production was correlated on word count; first-, second-, and third-person pronouns; and use of negative affect terms. Perhaps more important, liars and partners appeared to match their language production most closely when liars were engaging in deception, especially when the liar was motivated (see Table 2). When motivated liars were lying, liars and partners matched their rates of generation for words, second- and third-person pronouns, negative affect, and negations.

Research examining communication accommodation has demonstrated that converging language styles lead to increased similarity and attraction perceptions and enhanced persuasiveness (Burgoon et al., 1995; Giles & Coupland, 1991). The data in this study suggest that motivated liars may have used LSM as a strategy to appear more credible to their partner. The possibility that liars may use collaborative or alignment processes that have been observed in non-deceptive language use (Brennan & Clark, 1996; Pickering & Garrod, 2004) as a resource for accomplishing deception is consistent with the assumption in IDT that deceivers engage in strategic communication processes (Buller & Burgoon, 1996). Additional research is required to determine whether liars were, in fact, strategically leveraging linguistic style-matching as a resource in their deceptions. Nonetheless, the systematic relation between liar and partner highlight once again the importance of examining the verbal behavior of both the liar and the target of the lie.

CONCLUSION

This research advances our understanding of how linguistic behavior changes in synchronous CMC according to the truthfulness of the discussion and whether the

liar is motivated to lie. Understanding deception in these mediated contexts becomes increasingly important as more and more concerns surfaces regarding a wide range of deceptive practices that may be carried out online, from sexual predation to financial fraud. The findings from this study support views of deception as an interactive process and improve our understanding of not only the linguistic profiles of motivated and unmotivated liars, but also the linguistic behavior of those who are lied to.

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APPENDIX

Example of Deceptive and Truthful Conversations in a High Motivation Dyad

<i>Deceptive Topic</i>	<i>Truthful Topic</i>
P: the most recent mistake i made was oversleeping for class yesterday.	P: who's your most sig. person?
P: what about you?	L: my best friend, and ex boyfriend, [male name]
L: oh. i forgot i had to work yesterday.	L: you?
L: what class did you miss?	P: haha same!
P: i missed my thai class.	L: same name too?
L: thai? language class?	P: oh no, his name's [male name].
P: and there's only five people in it, so my professor definitely knew i missed class	P: but we've been friends since third grade.
P: yea thai language.	L: oh. does he go to school with you now?
P: where do u work?	P: no, he goes to [school name] college.
L: I work at [library name] library.	P: does [male name] go to school w/ u?
L: Why does your class only have 5 people in it?	L: oh. thats good its close to [school name]. No, [male name] is working on a tv show out in LP.
P: um i don't know.	P: wow, which tv show?
P: there aren't a lot of thai people at this school.	L: He is on the art staff for that show [show name] on comedy central.
P: so what do you do at [library name]?	P: ohh cool.
L: i shelve books. it gets pretty boring.	P: so you're from la?
L: but i only work 2 days a week so its not bad.	L: no. i am from New Jersey, but he went out to LP last year.
P: are you allowed to listen to music?	L: i have gone to visit him though.
L: yeah my headphones.	L: its really nice in los angeles.

Note. L = liar role; P = partner role.