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Journal of Language and Social Psychology 2006; 25; 76
DOI: 10.1177/0261927X05284482

Journal of Language and Social Psychology
Volume 25 Number 1
March 2006 76-96

10.1177/0261927X05284482
http://jls.sagepub.com
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The Dynamic Nature of Deceptive Verbal Communication

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Past research on verbal deception has found inconsistent patterns, possibly due to failure to consider the dynamic nature of interpersonal deception. The current investigation examined temporal changes and sequencing effects in truthful and deceptive responding on 23 linguistic measures. Interviewees responded to 12 questions during which they alternated between giving blocks of truthful and blocks of deceptive answers. Results showed significant variability in verbal behavior across the course of the interview on virtually all measures. Deceptive responding differed from truthful responding depending on the truth-deception sequence and the phase of the interview. The truth-first order made it much easier for deceivers to approximate truthful discourse sooner. The existence of significant variability due to time and sequence has important implications for identifying reliable indicators of deception and for research paradigms used to investigate deceptive and truthful discourse.

Keywords: *deception; language; interpersonal communication*

Language practices have long been a staple of research interest for communication scholars. Much of the impetus for scientific inquiry in the communication field came from Jim Bradac's work on features such as verbal immediacy, lexical diversity, and language intensity and their relationship to powerful-powerless speech and message effectiveness (e.g., Bradac, 1990; Bradac & Bowers, 1979; Bradac, Hemphill, & Tardy, 1981; Bradac, Konsky, & Davies, 1976; Bradac & Mulac, 1984). The investigation to be reported is indebted to Bradac's approach of examining language features at both the molecular and the molar levels. As well, we follow his lead in considering an array of features related to powerful and powerless speech but applied in this case to the context of human deception.

Authors' Note: Portions of this research were supported by funding from the U.S. Air Force Office of Scientific Research under the U.S. Department of Defense University Research Initiative (Grant No. F49620-01-1-0394). The views, opinions, and findings in this report are those of the authors and should not be construed as an official Department of Defense position, policy, or decision. Correspondence should be addressed to the first author at jburgoon@cmi.arizona.edu.

Until recently, interpersonal deception has garnered far more attention to its nonverbal than verbal aspects. The past decade has seen rising interest in verbal deception with investigations of lexical, syntactic, and meta-content features that distinguish truthful from deceptive discourse (e.g., Chung & Pennebaker, in press; Hancock, Curry, Goorha, & Woodworth, 2005; Hancock & Dunham, 2001; Newman, Pennebaker, Berry, & Richards, 2003; Pennebaker, Mehl, & Niederhoffer, 2003; Qin, Burgoon, & Nunamaker, 2004; Vrij, Akehurst, Soukara, & Bull, 2004; Vrij, Edward, Roberts, & Bull, 2000; Vrij, Semin, & Bull, 1996; Zhou, Burgoon & Twitchell, 2003; Zhou, Burgoon, Twitchell, & Nunamaker, 2004; Zhou, Burgoon, Zhang, & Nunamaker, 2004). However, patterns have been inconsistent within and across experiments (see, e.g., Buller, Burgoon, Buslig, & Roiger, 1994, 1996), suggesting that moderating factors need to be investigated.

One such factor is time. Very little deception research has examined temporal adjustments in deceptive communication. If deceptive behavior fluctuates rather than remaining stable over the course of an interaction, then much of what has been written about verbal or nonverbal indicators of deception may be inaccurate. For example, verbal and nonverbal indicators of deception that are identified in meta-analyses of the extant literature (DePaulo et al., 2003; Zuckerman & Driver, 1985) may be accurate only in depicting the opening seconds or minutes of a deceptive episode but not the later ones. Thus, a first question addressed in the current investigation is whether deceptive behavior differs depending on time.

A related timing issue is whether an individual has the opportunity to engage in truthful communication before having to deceive. Common practice in real-world detection contexts and in many research paradigms is to establish a truthful baseline before launching into questioning where suspected deception might emerge. For example, the Behavioral Analysis Interview used by practitioners in criminal investigations (Blair & Horvath, 2005; Inbau, Reid, Buckley, & Jayne, 2001) often begins with mundane questions related to a person's place of residence and employment history. The practical significance of this method is to give deceivers opportunity to begin on safer ground and to acclimate to the task, setting, and/or interlocutor before encoding any deception. It is therefore possible that the sequencing of truthful and deceptive responding may influence the behavior that is generated. The second research question addressed in the current research was whether deceptive communication differs depending on sequence.

Theoretical Background and Hypotheses

As noted, little empirical research has examined temporal fluctuations in deception displays. Among the exceptions are experiments by Stiff, Corman, Krizek, and Snider (1994) and Granhag and Stromwall (2001, 2002). Stiff et al. documented changes in deceivers' vocal patterns over the course of being questioned about cheating on a quiz. Granhag and Stromwall (2001) investigated how judgments of deception, rather than deceptive behavior itself, changed over the course of multiple interrogations. Granhag

and Stromwall (2002) measured the verbal and nonverbal behaviors displayed by deceivers and truth tellers across the three interrogations. Results showed deception-related temporal changes in four nonverbal behaviors; of the two verbal behaviors measured, both truth tellers and deceivers showed declines in message length, and results were inconsistent on richness of details present (deceivers used the same number of details as, fewer than, and more than truth tellers, respectively, across the three interrogations).

One program of research that places temporal changes center stage is interpersonal deception theory (IDT; Buller & Burgoon, 1994, 1996). IDT is a propositional theory that explicitly considers temporal and process factors in deception. Premised on fundamental principles of interpersonal communication, IDT assumes that interpersonal deception, like other forms of interpersonal interaction, is interdependent, dynamic, and adaptive. That is, deceivers' actions are interrelated to receivers' actions. Deceivers attune to and respond to the behavior of cointeractants. As deceptive interactions progress, deceivers take in interlocutors' feedback regarding their own performance and adjust their communication accordingly (with social skills moderating the adaptation such that more skilled deceivers are better able to adapt and to present a credible performance).

Deception is also assumed to be more cognitively burdensome than truth telling. Although this greater cognitive load is posited to result in initial impairments of communicative performance and to temporarily interfere with one's ability to adapt, IDT postulates that deceivers have the capacity to repair their performances and will make adaptations over time. Specifically, deceivers are expected to respond to signs of suspicion by modifying their verbal and nonverbal behavior so as to increase credibility and evade detection. Thus, initial impairments in performance are expected to subside over time so that deceivers' verbal and nonverbal behavior converges on the patterns exhibited by truth tellers.

Confirmation that deception is more challenging than truth telling has come from a variety of contexts, including thermal and fMRI scans of brain activity and observed behaviors during interrogations (e.g., Ganis, Kosslyn, Stose, Thompson, & Yurgelun-Todd, 2003; Granhag & Stromwall, 2002; Spence et al., 2001; Spence et al., 2004). The greater difficulty of deception than truth has also been evidenced by such observed impairments as longer response latencies and nonfluent speech (e.g., Anolli, Balconi, & Ciceri, 2003; Burgoon, Blair, & Moyer, 2003; Gilbert, Pelham, & Krull, 1988).

However, other research has shown that nonverbal deceptive displays are changeable over the course of a conversation or interview (e.g., Buller & Aune, 1987; Buller, Strzyzewski, & Comstock, 1991; Burgoon & Buller, 1994), with deceivers adapting their behavior to more closely approximate that of truth tellers (Burgoon, Buller, White, Afifi, & Buslig, 1999; White & Burgoon, 2001). This adaptation is attributable in part to communicators viewing the communication style of interlocutors as feedback regarding their own performance (White & Burgoon, 2001). A positive demeanor from cointeractants implies acceptance, leading deceivers to believe they are succeed-

ing with their deception, whereas negativity connotes suspicion and skepticism, which motivates deceivers to alter their behavior so as to win targets' acceptance. The result is that in later phases of an interaction, deceptive behavior becomes indistinguishable from truthful behavior.

To date, adaptation processes have been tested on only a few measures, most of which were nonverbal rather than verbal. The current investigation tested whether deceivers' verbal behavior shows the same initial impairment and later convergence toward truthful verbal behavior.

Hypothesis 1: Verbal indicators of truth and deception (a) show different temporal patterns such that (b) they are more divergent at the outset of an interaction than at its conclusion.

As regards sequence effects, two factors argue for differential behavior patterns. The first is the aforementioned cognitive difficulty associated with deceit. Individuals who begin an interaction on the familiar turf of truth should feel more at ease, and exhibit more "normal" and unimpaired communication patterns, than those who begin with lies. The general pattern is for interactants, whether truthful or deceptive, to become more comfortable and relaxed over time (Granhag & Stromwall, 2002). But it is arguably easier to move into a comfort zone sooner when one is speaking from the relative ease of talking about that which is known than that which is being fabricated, concealed, or ambiguated. Second, relative to beginning immediately with deceptive responses, a truthful start should elicit more favorable responses from interlocutors, making it easier for communicators to shift from truth to deception than the reverse pattern of shifting from deception to truth. Put another way, once on a roll, truth tellers should be able to segue into deception on the sure footing of having already established a communication pattern that is comfortable, familiar, and in sync with their interlocutor. Comparatively, deception-first communicators may feel more off balance and fail to settle into a comfortable and smooth interaction style.

IDT posits, and research has confirmed, that deceptive behavior is seen as unexpected, anomalous, and "fishy looking" and evokes suspicion (Bond et al., 1992; Buller & Burgoon, 1994; Burgoon & Buller, 1994). A deceptive start should therefore elicit more skepticism and negative reactions than a truthful start. Although deceivers may recover over time, and Hypothesis 1 predicts efforts to increasingly emulate a more normal communication performance, unknown is whether the different start value for interaction will produce a persistent drag on performance by deception-first communicators or lead to greater variability in performance than that shown by truth-first communicators. Hypothesis 2, therefore, predicts that the communication patterns would differ according to sequence while leaving as an empirical question the actual shape of those patterns.

Hypothesis 2: Verbal behavior differs according to the sequence of truth telling and deception.

Method

Overview

Data for the current investigation come from an experiment reported in Burgoon et al. (1999) in which interviewees alternated between truthful and deceptive responding to a series of 12 interview questions. Truth or deception occurred in alternating blocks of three questions and followed one of two orders: truth-deception-truth-deception (hereafter "truth-first") or deception-truth-deception-truth (hereafter "deception-first"). Each block included all truthful or all deceptive responding so that three deception questions followed three truth questions or vice versa. The current study entailed transcribing all the videotaped interviews and subjecting them to automated analysis of the linguistic and meta-content features.

Sample

Participants (n = 122) were (a) community members recruited from the county courthouse in a large southwestern metropolitan area and (b) nontraditional undergraduate students (older than 25) enrolled in a communication course for business majors at the university. Demographically, 27 of the participants were male and 34 were female; 37% were age 19 to 30, 30% were age 30 to 40, and 33% were older than 40; 90% were Caucasian and 10% were either African American, Hispanic, or Other; 5% had high school education or less, 81% had (some) college education, and 14% had graduate-level education. Participants were paid or received extra credit for their participation. Participants were paired randomly to create 61 dyads (32 cross-gender dyads and 29 same-gender dyads, 15 of which were female-female).

Procedure and Independent Variables

Upon arrival at the apartment-like research site, participants signed consent forms, were randomly assigned the role of interviewee (hereafter referred to as senders) or interviewer (hereafter referred to as receivers), and then separated. Senders reviewed a list of 12 questions (as shown in the appendix) that they would be answering during the interview and then received the deception induction: They were told that past research has shown that complete honesty is often not in one's best interests and that the ability to manage information is an important skill, one that senders would be asked to test in the upcoming interview by contradicting or misrepresenting their true response on some questions. Specifically, they were instructed to alternate between telling the truth and deceiving in blocks of three questions, resulting in two blocks of truthful questions and two blocks of deceptive responses. The sequence was counterbalanced so that half of the interviewees followed a truth-first and the remainder followed a deception-first order.

Experimental Design and Statistical Analysis

To decompose the four blocks into separate effects for deception and for time, each dependent variable was analyzed in a 2 (order: truth-first vs. deception-first) × 2 (deception: truth vs. deception) × 2 (block: first half of the interview vs. second half) doubly repeated measures general linear model (GLM) analysis of variance, with the latter two factors repeated. (Note that in the repeated measures analysis *block* now combines the first two and second two question blocks, with truth and deception repeated within each.)[1]

Automated Linguistic Analysis

Research suggests that we can learn a great deal about peoples' underlying thoughts, emotions, and motives by counting and categorizing the words they use to communicate. For example, deceivers tend to give briefer responses (fewer words and sentences) than truth tellers. By disclosing less information, they decrease the chances of being detected. Meanwhile, deceivers' messages also typically lack vivid and specific details because they do not have corresponding experiences that give rise to such details. In previous research (Qin et al., 2004; Zhou et al., 2004), clusters of potential indicators, all of which could be automatically calculated with a shallow parser (Grok or Iskim) or could use a look-up dictionary, were considered. These included some of the same measures that Bradac and colleagues had investigated in the context of powerful-powerless speech (Bradac & Bowers, 1979; Bradac, Hemphill, & Tardy, 1981; Bradac & Mulac, 1984) and were thought to be relevant especially to verbal expressions of dominance and certainty. In the current investigation, we analyzed the same clusters of indicators but used the General Architecture for Text Extraction for parsing (Bontcheva, Cunningham, Tablan, Maynard, & Hamza, 2002) and used the Whissell dictionary of more than 7,000 words with scaled values for affect-related indicators (Cunningham, 2002; Whissell, Fournier, Pelland, Weir, & Makarec, 1986). The classes of cues and respective indicators were as follows:

1. *Quantity* (number of words, number of verbs, number of sentences)
2. *Complexity* (syntactic complexity, measured as average sentence length [ASL]; lexical complexity, measured as average word length [AWL]; pausality, measured as amount of punctuation)
3. *Diversity* (lexical diversity; content word diversity; redundancy, measured as repetitive words)
4. *Specificity* (number of sensory details, ratio of sensory terms to total terms, modifiers, first-person singular and plural pronouns, second-person pronouns, and third-person pronouns)
5. *Affect* (affect, pleasantness, imagery, all scaled in the dictionary)
6. *Uncertainty* (modal verbs)
7. *Activation* (emotiveness, measured as the number of adjectives and adverbs divided by the number of nouns and verbs; activation, measured as scores assigned from the dictionary)
8. *Verbal nonimmediacy* (passive voice)

Results

Hypothesis 1: Temporal Differences Between Truth and Deception

All measures were tested with GLM repeated measures analyses of variance. Testing Hypothesis 1 required inspecting and decomposing the block by deception by order interaction to determine whether deceptive behavior differs over time relative to truthful behavior. Testing Hypothesis 2 required further examining differences specifically due to order. Means for all measures are displayed in Table 1. The main effects and interactions among all three independent variables are presented in Table 2, where summary descriptions of the results are also given.

Before considering the interaction effects, it should be noted that virtually every measure showed main effects for block (see Table 3). Quantity, specificity, activation, and nonimmediacy increased over time, whereas complexity declined. Diversity and affect measures showed mixed results. These findings indicate that separate from any effects of deception, linguistic behaviors themselves are changing as an interaction unfolds and should not be treated as constants.[2]

Turning next to interactions, Table 2 reveals a large number of interactions between block and deception or among block, order, and deception. We describe each cluster of verbal measures in turn.

Because the three cues of quantity (number of words, verbs, and sentences) were highly correlated (average $r > 0.60$, $p < .0001$), we will report only the results for number of words; the other results are quite similar. The main effect for block was significant, $F(1, 51) = 26.99$, $p < .0001$, Wilk's $\Lambda = .654$, partial $\eta^2 = .346$, with quantity increasing from Block 1 ($M = 1899.10$, $SD = 30.47$) to Block 2 ($M = 2002.11$, $SD = 34.49$). The interaction of block by deception was also significant, $F(1, 52) = 7.22$, $p = .01$, Wilk's $\Lambda = .88$, partial $\eta^2 = .12$. On average, deceivers tended to utter fewer words than did truth tellers, which conforms to previous literature and would support the conclusion that deceivers were less verbose than truth tellers. But simple effect tests showed that the difference between truth and deception varied by order and time. For those beginning with truth, deceptive messages in Block 1 were more verbose than truthful ones ($p < .0001$), but in Block 2, truthful messages were more verbose than deceptive ones ($p = .009$). For those beginning with deception, their truthful messages in Block 1 had more words than their deceptive messages ($p < .0001$); in Block 2, their messages did not differ. Thus, the deception-first order conformed to the pattern of deceivers showing initial brevity but eventually matching their own truth-telling in quantity, whereas the truth-first order evinced a completely contrary pattern.

The complexity cues show a general pattern of decreasing over time. Illustrative is syntactic complexity (ASL), which declined from Block 1 ($M = 38.99$, $SD = 1.274$) to Block 2 ($M = 35.84$, $SD = 1.154$), $F(1, 52) = 18.12$, $p < .0001$, Wilk's $\Lambda = .74$, partial $\eta^2 = .26$. This implies that sentence structure will become more simplified as a conversation progresses and communicators presumably become more comfortable. Pausality (number of punctuation-related pauses, such as with dependent clauses) showed a significant interaction between block and deception, $F(1, 52) = 4.15$, $p = .047$, Wilk's

Table 1
Means for Verbal Categories and Cues, by Truth (T) or Deceptiveness (D) of Responding and Block

Category	Indicator	Block 1				Block 2			
Quantity	Words	T	1,843.37	D	2,057.19	T	2,179.41	D	1,986.33
		D	1,781.95	T	1,913.88	D	1,930.03	T	1,912.65
	Verbs	T	81.33	D	116.44	T	149.04	D	116.22
		D	72.53	T	95.32	D	104.16	T	107.27
	Sentences	T	54.96	D	65.85	T	72.89	D	64.59
		D	45.93	T	54.60	D	54.56	T	57.00
Complexity	Syntactic (ASL)	T	37.02	D	36.09	T	32.95	D	34.23
		D	43.50	T	39.76	D	39.56	T	37.00
	Lexical (AWL)	T	4.08	D	4.02	T	4.01	D	4.01
		D	4.11	T	4.11	D	4.09	T	4.08
	Pausality (punctuation)	T	7.03	D	6.69	T	6.00	D	6.2
		3							
		D	7.92	T	7.31	D	7.38	T	6.41
Diversity	Lexical	T	0.297	D	0.302	T	0.316	D	0.311
		D	0.287	T	0.296	D	0.293	T	0.307
	Content words	T	0.332	D	0.336	T	0.353	D	0.344
		D	0.320	T	0.331	D	0.327	T	0.340
	Redundancy	T	9.58	D	9.46	T	9.36	D	9.12
		D	11.38	T	10.79	D	10.74	T	10.02
Specificity	Total specificity	T	0.015	D	0.023	T	0.024	D	0.019
		D	0.013	T	0.020	D	0.016	T	0.019
	Sensory ratio	T	0.016	D	0.026	T	0.020	D	0.019
		D	0.014	T	0.022	D	0.014	T	0.019
	Modifiers	T	38.444	D	67.704	T	81.074	D	72.074
		D	37.330	T	52.670	D	54.203	T	69.958
	1st person singular pronouns	T	0.029	D	0.025	T	0.029	D	0.033
		D	0.025	T	0.021	D	0.024	T	0.031
	2nd person pronouns	T	0.004	D	0.014	T	0.011	D	0.010
		D	0.004	T	0.007	D	0.007	T	0.007
	1st person plural pronouns	T	0.0002	D	0.0013	T	0.0019	D	0.0015
		D	0.0001	T	0.0014	D	0.0010	T	0.0021
	3rd person pronouns	T	0.0008	D	0.0039	T	0.0067	D	0.0039
		D	0.0005	T	0.0042	D	0.0056	T	0.0040
Affect	Affect ratio	T	0.0015	D	0.0020	T	0.0026	D	0.0049
		D	0.0015	T	0.0013	D	0.0017	T	0.0060
	Pleasantness	T	1.949	D	1.925	T	1.897	D	1.940
		D	1.967	T	1.929	D	1.932	T	1.957
	Imagery	T	1.392	D	1.397	T	1.374	D	1.382
		D	1.371	T	1.403	D	1.337	T	1.394
Uncertainty	Modal verbs	T	0.0727	D	0.0262	T	0.0586	D	0.0481
		D	0.0616	T	0.0283	D	0.0552	T	0.0326
Activation	Emotiveness	T	0.0218	D	0.0339	T	0.0407	D	0.0390
		D	0.0217	T	0.0293	D	0.0301	T	0.0403
	Activation	T	1.6307	D	1.6315	T	1.6487	D	1.6576
		D	1.6265	T	1.6306	D	1.6472	T	1.6713
Verbal immediacy	Passive voice	T	0.0036	D	0.0044	T	0.0085	D	0.0048
		D	0.0018	T	0.0060	D	0.0063	T	0.0034

Table 2
Summary of Block Effects and Description

Category	Cues	Block Main Effect	Block and/or Order by Deception	Difference Between Deception and Truth	
				Block 1	Block 2
Quantity	Words	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D
	Verbs	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D
	Sentences	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D
Complexity	Syntactic (ASL)	↓	—		D > T[a]
	Lexical (AWL)	↓	—	—	
	Pausality	↓	Yes	D > T[a]	D > T[a]
Diversity	Lexical	↑	Yes	T > D[a]	T > D[a]
	Content words	↑	Yes	T > D[a]	T > D[a]
	Redundancy	↓	—		D > T[a]
Specificity	Specificity	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D[a]
	Sensory ratio	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D[a]
	Modifiers	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D[a]
	1st person singular pronouns	↑	—	—	
	2nd person pronouns	—	Yes	D > T	—
	1st person plural pronouns	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D[a]
	3rd person pronouns	↑	—	T > D[a]	
Affect	Affect ratio	↑	Yes	—	D > T if telling truth first; T > D if telling deception first
	Pleasantness	↓	—	—	
	Imagery	↓	—	T > D[a]	
Uncertainty	Modal verbs	—	—	—	
Activation	Emotiveness	↑	Yes	D > T if telling truth first; T > D if telling deception first	T > D[a]
	Activation	↑	—	T > D[a]	
Verbal nonimmediacy	Passive voice	↑	—	—	

Note: T = Truth; D = Deception.
a. For these relationships, the pattern applies only to the D-first condition.

Table 3
Means, Standard Deviations, and Analysis of Variance for Main Effects of Block

Category	Cues	Block Main Effect	Block 1		Block 2		$F(1, 52)$	p Value	Wilk's Λ	Partial η^2
			M	*SD*	*M*	*SD*				
Quantity	Words	↑	1,899.10	30.47	2,002.11	34.42	26.99	< .0001	0.65	0.35
	Verbs	↑	91.41	4.61	119.17	5.9	50.17	< .0001	0.51	0.49
	Sentences	↑	55.34	2.56	62.26	2.61	23.249	< .0001	0.69	0.31
Complexity	Syntactic (ASL)	↓	38.99	1.27	35.84	1.15	18.12	< .0001	0.74	0.26
	Lexical (AWL)	↓	4.08	.02	4.04	.02	4.98	0.03	0.91	0.09
	Pausality	↓	7.24	0.2	6.51	0.19	39.45	< .0001	0.57	0.43
Diversity	Lexical	↑	0.30	0.002	0.31	0.002	35.19	< .0001	0.67	0.4
	Content words	↑	0.33	0.002	0.34	0.002	29.35	< .0001	0.64	0.36
	Redundancy	↓	10.25	0.45	9.76	0.41	5.05	0.03	0.91	0.09
Specificity	Specificity	↑	1.78E-02	0.001	1.96E-02	0.001	4.7	0.04	0.92	0.08
	Sensory ratio	↑	1.93E-02	0.001	1.78E-02	0.001	4.32	0.04	0.92	0.08
	Modifiers	↑	49.04	3.40	69.33	4.47	48.21	< .0001	0.52	0.48
	1st person singular pronouns	↑	7.57E-02	0.004	8.8E-02	0.004	18.23	< .0001	0.74	0.26
	2nd person pronouns	—	7.42E-03	0.001	8.93E-03	0.001	2.54	0.12	0.95	0.05
	1st person plural pronouns	↑	2.17E-03	< 0.0001	4.73E-03	0.001	24.89	< .0001	0.68	0.32
	3rd person pronouns	↑	6.97E-03	0.001	1.5E-02	0.001	54.16	< .0001	0.49	0.51
Affect	Affect ratio	↑	1.58E-03	< 0.0001	3.81E-03	< 0.0001	134.84	< .0001	0.28	0.72
	Pleasantness	↓	1.94	0.003	1.93	0.004	8.18	0.006	0.86	0.14
	Imagery	↓	1.39	0.01	1.37	0.01	12.04	0.001	0.81	0.19
Uncertainty	Modal verbs	—	4.71E-02	0.003	4.89E-02	0.003	0.25	0.62	0.99	0.01
Activation	Emotiveness	↑	2.62E-02	0.002	3.71E-02	0.002	59.65	< .0001	0.47	0.53
	Activation	↑	1.63	0.003	1.66	0.002	80.8	< .0001	0.39	0.61
Verbal nonimmediacy	Passive voice	↑	0.012	0.001	0.017	0.001	3.23	0.078	0.94	0.06

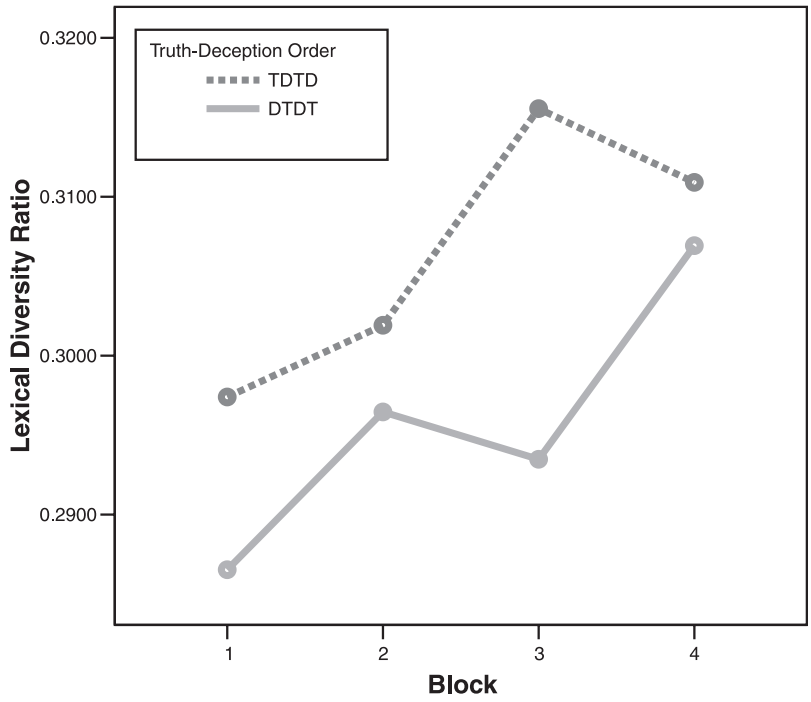
$\Lambda = .93$, partial $\eta^2 = .07$. Those who started with deception had more punctuation (a sign of more complex syntax) in both blocks when they were telling lies than when telling the truth ($p < .005$), whereas for those who started with truth-first, no difference was found. ASL, another indicator of syntactic complexity, was generally shorter when one was telling the truth than deception and significantly so in the deception-first case (deception: $M = 41.34$, $SD = 1.65$; truth: $M = 38.17$, $SD = 1.64$; $p = .001$) but not the truth-first case. Lexical complexity (AWL) showed no interaction between block and deception and no deception effects.

For language diversity, lexical diversity and content words performed similarly, with main effects for block and a block by deception interaction. For example, lexical diversity was lower in Block 1 ($M = .29$, $SD = .002$) than in Block 2 ($M = .31$, $SD = .002$), $F(1, 52) = 35.19$, $p < .0001$, Wilk's $\Lambda = .59$, partial $\eta^2 = .4$. Like pausality, lexical diversity and content words showed significant deception effects in the deception-first situation, with truth greater than deception ($p < .05$). Figure 1 presents a graphical demonstration of how deceit and truth changed across the four blocks of questions. It shows that within each sequence, truth exceeded deception, but the diversity of deceptive responses also increased over time to the point that at the end of the interaction, deceivers were actually using more diverse vocabulary than were truth tellers. Here again, measurements taken at the beginning of the interaction told a different story than did measures taken at the end; truth tellers initially exceeded deceivers on diversity, but at the end, it was deceivers whose lexical choices and context words were more varied.

Redundancy decreased from Block 1 ($M = 10.247$, $SD = .45$) to Block 2 ($M = 9.76$, $SD = .41$), $F(1, 52) = 5.05$, $p < .029$, Wilk's $\Lambda = .91$, partial $\eta^2 = .88$; and deception was more redundant than truth but only in the deception-first case. Put differently, deceivers were more repetitive than were truth tellers when they had to start with deception than when they started with truth, but everyone generally became less repetitious over time.

Most of the specificity cues showed block effects, one exception being second-person pronouns. The overall specificity of details, as well as sensory ratio, modifiers, and first-person plural pronouns, shared the same patterns. Take the example of overall specificity. Details increased from Block 1 ($M = .018$, $SD = .001$) to Block 2 ($M = .020$, $SD = .001$), $F(1, 52) = 4.704$, $p = .035$, Wilk's $\Lambda = .917$, partial $\eta^2 = .083$. In Block 1, as with quantity cues, if communicators began with truth, their subsequent deceptive utterances showed more specificity than truthful ones ($p < .0001$), but if communicators began with deception, then their truthful utterances had greater specificity ($p < .0001$). In Block 2, truthful utterances were likewise more specific than deceptive ones ($p < .06$). The first-person pronouns were more evident under truth telling than deception in all but truth-first Block 1. The second-person pronouns were more frequent under deception in the first block but did not differ from truth in the second block. Third-person pronouns did not show interactions of block and deception. For those who began with deception, they referred to others more often in their true comments than deceptive ones ($p = .039$); no differences were found in truth-first situation.

Figure 1
Changes in Lexical Diversity When Truth Telling and Deceiving Across Blocks of Questions



The ratio of affective terms showed a block effect, $F(1, 52) = 134.80$, $p < .0001$, Wilk's $\Lambda = .28$, partial $\eta^2 = .72$, with increases in use of such terms over time (in Block 1, $M = .002$, $SD < .0001$; in Block 2, $M = .004$, $SD < .0001$). Deception effects changed with time. In Block 1, there was no significant difference between deception and truth; in Block 2, deceptive utterances had more affective terms than truthful ones in the truth-first order, but the reverse was true in the deception-first order ($p < .0001$ for both). Pleasantness terms failed to produce deception effects. Imagery terms showed a pattern of greater imagery under truth ($p < .0001$) that was only significant in the deception-first situation. Imagery did not produce an interaction of block by deception.

Modal verbs, which were the only cue representing uncertainty of language, did not show any effects. This is at odds with previous research showing that modal verbs were often a good discriminator.

Activation increased over time. Specifically, emotiveness had a significant block effect, increasing from Block 1 ($M = .027$, $SD = .002$) to Block 2 ($M = .037$, $SD =$

.002), $F(1, 52) = 59.65$, $p < .0001$, Wilk's $\Lambda = .47$, partial $\eta^2 = .53$. Similar to quantity and some specificity cues, the difference between truth and deception did not become clear until Block 2 in the deception-first order ($p = .008$). Truthful utterances had greater activation.

Passive voice did not show any effects other than increasing block effects—in Block 1, $M = .012$, $SD = .001$; in Block 2, $M = .017$, $SD = .001$, $F(1, 52) = 3.23$, $p = .078$, Wilk's $\Lambda = .94$, partial $\eta^2 = .06$.

In sum, deception and truth showed different patterns across time for most of the linguistic measures. Results were consistent with Part a of Hypothesis 1 but did not support Part b; there was not consistent convergence between deceptive and verbal behaviors from Block 1 to Block 2, and in many cases, there was divergence.

Hypothesis 2: Sequence Effects

As reported above, the analyses for Hypothesis 1 demonstrated many order effects. A large number of cues showed different patterns according to sequence such that significant differences between truth and deception appeared only in the deception-first situation. Cues fitting this pattern (mainly in Block 2; see Table 2) included words, verbs, sentences, pausality, lexical diversity, content words, redundancy, specificity, sensory ratio, modifiers, first-person plural pronouns, affect ratio, imagery ratio, emotiveness, and activation ratio. All these measures, therefore, would be diagnostic of deceit only if a speaker were forced into being deceptive at the outset of an interaction; these indicators would be declared nonsignificant in cases where deceivers had a chance to respond truthfully first. Table 4 presents results expressly for the interactions between deception and order. Complexity (ASL, pausality), diversity (lexical diversity, content word diversity), and affect (pleasantness, imagery) all produced significant interaction effects. Illustrative of the magnitude of the effects is ASL, $F(1, 52) = 18.12$, $p < .0001$, Wilk's $\Lambda = .74$, partial $\eta^2 = .26$. Five cues (ASL, pausality, lexical diversity, content word diversity, and imagery) had a greater difference between deception and truth ($|T\text{-}D|$), in the deception-first than the truth-first condition. Put differently, the truth-first order greatly attenuated differences between truth and deception. Simple effect tests showed that the difference between deceptive and truthful language from the same person was significant ($p < .05$, two-tailed) for these cues (see Table 5). For pleasantness, although there was a trend toward $|T\text{-}D|$ in truth-first being greater than in deception-first, the difference was not significant.

Figure 2 provides further demonstration of how sequence affected the difference between truth and deception, $|T\text{-}D|$, for ASL in Block 2. $|T\text{-}D|$ was much higher in the deception-first than in the truth-first order, indicating that starting with truth favored deceivers, whereas starting with deception favored detection of deceit.

Discussion

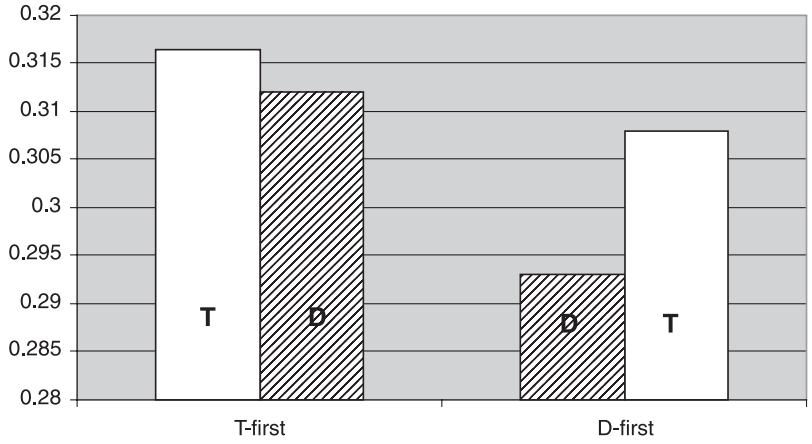
James Bradac pioneered research on the role of language in interpersonal interaction. The current investigation resonates with his analytic approach in decomposing

Table 4
Means, Standard Deviations, and Analysis of Variance for Interaction Effects of Order by Deception and Simple Effect Tests for |T-D|

	Order by Deception				Difference Between T and D: |T-D| (*p* Value)			
Cue	$F(1, 52)$	*p* Value	Wilk's Λ	Partial η^2	D First		T First	
Syntactic (ASL)	6.60	0.01	0.89	0.11	3.17	(.001)	.18	(.85)
Pausality	12.36	0.00	0.81	0.19	0.79	(< .0001)	0.051	(.74)
Lexical diversity	7.65	0.01	0.87	0.13	0.012	(< .0001)	0.00006	(.98)
Content words	12.68	0.00	0.80	0.20	0.012	(< .0001)	0.0028	(.37)
Pleasantness	4.07	0.05	0.93	0.07	0.008	(.17)	0.009	(.15)
Imagery	13.44	0.00	0.79	0.21	0.04	(< .0001)	0.007	(.36)

Note: T = Truth; D = Deception.

Figure 2
Order Effect on |T-D| for Average Sentence Length



T = Truth; D = Deception.

molar verbal constructs into their molecular constituents. It stands as testament to his leadership in drawing scholarly attention to what is an extraordinarily significant, if complex, aspect of social life.

Nowhere is the attention to language more warranted than in the context of interpersonal deception, where the amount of empirical work devoted to verbal behavior has been spotty until lately and where results that have been obtained have been perplexing in their inconsistencies.

The current investigation pursued one reason for inconsistencies, namely, the lack of stability of deception displays across time and sequence. The current findings affirm the supposition that verbal behavior—lexical choices, syntax, and metacontent—shows substantial variability across the course of an interaction. Apart from any effects of deception, 21 of the 23 verbal indicators that were measured showed changes from the first half to the second half of the interaction. Messages became longer, more specific, more diverse, more "active" (i.e., incorporating more terms scaled as high activation), simpler, less redundant, and less immediate (i.e., using more passive voice) over time. Affect measures showed mixed patterns. Only second-person pronouns and modal verbs failed to show a main effect for block, suggesting either that those two measures remained fairly stable across the interaction or that their infrequency of use resulted in measurement error. Thus, change rather than constancy was, and is likely to be, the norm. Any analysis of truthful and deceptive discourse must be understood against this backdrop of change.

Although both truth and deception fluctuated throughout the interaction, the fluctuations were not the same. As tests of Hypotheses 1 and 2 demonstrated, temporal

patterns associated with verbal deception differed from those for truth, both in terms of when in the interview they emerged and under which sequence. Virtually all dependent measures showed sequence effects. Differences between truth and deception were more prominent in the deception-first order. For example, contrary to previous research, deceivers used more complex syntax than did truth tellers but only in the deception-first order. Comparatively, beginning with truth made it easier for deceivers to approximate truthful verbal behavior and to lessen the difference between truth and deception.

One implication of these results is that inconsistencies across past investigations may have been due to capturing deception at what is essentially different junctures in the stream of conversation. Consider the profile of deceit that would have emerged from measurements taken at the beginning of the interview. Compared with truth tellers, deceivers had briefer and repetitive but more complex responses that were lacking in affect-laden language. Their discourse had the earmarks of being under some degree of cognitive load and resorting to obfuscation and avoidance as a way to get through the interaction. But if measurements were taken only at the end of the interview, deceivers' discourse would be characterized as more verbose, diverse, emotionally expressive, and nonredundant than that of truth tellers. Our conclusions about how deceivers behave verbally would thus be a function of when we observe them. In short, the temporal variability in deceptive practices means that brief "snapshots" of deception taken in the opening seconds of an interaction may bear little resemblance to deception in ongoing interaction.

These findings point to one reason why the investigations that have considered verbal deception have produced such a mix of results. If utterances at the beginning of a conversation have a different complexion than those appearing at later junctures, then we would expect a high degree of heterogeneity in results across experiments depending on whether a single utterance, a full turn, a series of turns, a written statement, or an entire conversation was measured. Failure of specific linguistic indices to yield large effect sizes in meta-analyses, for example, might be more attributable to testing them with inappropriate measurement or research designs than to their inconsequentiality. It is not that language is a poor source of clues about deceit but rather that its ephemeral character requires a different methodological approach.

One option for achieving more homogeneous and accurate estimates would be to standardize the size of observational "windows" and the timing of measurements across interactions, although such a recommendation strikes us as rather impractical. Another option would be to employ within-group (or within-dyad) designs instead of, or in addition to, between-subject ones. The design used in the current experiment permitted both between-groups and within-groups analyses, and each type of analysis yielded different information. For example, the between-group comparisons revealed differences between a truthful start and a deceptive one. The within-group analyses revealed how the same individuals adjusted their behavior as they moved from one type of response to another.

This paradigm shift would, in itself, also encourage collecting more naturalistic samples of discourse. The preponderance of research on interpersonal deception has

employed paradigms in which deceivers and truth tellers generate very brief samples of discourse, sometimes as brief as single-word or single-sentence utterances and often no more than 30 seconds in duration. Real-world deception is not limited to a single utterance or turn at talk. It is embedded in ongoing conversation and frequently entails mixing truth with deception or incorporating a variety of deception strategies (e.g., Bavelas, Black, Chovil, & Mullett, 1990; Burgoon, Buller, Guerrero, Afifi, & Feldman, 1996). Use of time-series and longitudinal research designs would have the benefit of necessitating longer utterances and more turns at talk so that multiple measurements could be made. This methodological turn in itself would permit a fuller, more representative sampling of the gamut of utterances that real people produce under normally evolving conversation.

Time-series designs in turn raise questions about the frequency of measurements and the size of observational windows that are needed to accurately gauge interaction dynamics. The most laborious approach is to annotate everything that is said. Such an approach guarantees that all behavior is available for analysis, that all temporal adjustments can be examined, and that true adaptation can be studied through examination of contingent responding, coherence mechanisms, and the like, between interlocutors. Analyzing entire interactions is far more manageable when the utterance length is, say, 2 minutes than 2 hours, but opting for briefing utterances is opting for masking dynamics and variability. Analyzing entire interactions will also become more manageable when speech-to-text tools and parsers are available to automatically generate and analyze transcripts. That not being the current state of the art, it is worth pondering whether a sampling methodology could yield accurate results and, if so, how one might be deployed. Might taking intermittent "snap judgments" or "thin slices" at regular intervals suffice? If so, at what intervals? Time-series designs work best with a larger number of time periods represented. This tack might argue for a very molecular approach. Alternatively, might less granularity be preferable to more? Might it be better to choose much larger analysis windows to smooth over all the "noise" created by dynamic adjustments? Macroscopic measures, which are typically more subjective in nature, might have the virtue of better glossing over anomalies so that more stable trend lines become detectable. If, however, the most telling information comes from major deviations from the norm, then a research strategy must find a way to pick up these anomalies.

These alternative measurement and analysis strategies are all eminently researchable as we move to adopting methodologies that yield the most ecologically valid and informative results. As more speech-processing tools become available, of course, these "second-best" choices will no longer be necessary, and the full stream of conversation will be available for analysis.

Another methodological change warranted by the current results is the need to take sequencing effects into account. How starting points in conversation influence interactional trajectories may unlock understanding of how communicators are able to adapt their verbal and nonverbal behavior to meet internal needs and to adjust to the communication of interlocutors. As regards adaptation, two dynamic components need to be considered: self-oriented adaptation and target-oriented adjustments. The

former happens in all communication (Bernieri & Rosenthal, 1991; Burgoon, Stern, & Dillman, 1995) and refers to the individual's process of settling into a comfortable interaction pattern. For example, as people acclimate to the setting, topic, and interlocutor, they generally increase the length of their utterances. This form of adjustment should be more related to finding one's own comfort zone than directed toward or contingent on the behavior of the interaction partner. Put in terms of a social-relations model (Kenny, 1994), it reflects an actor rather than a partner or relationship effect. Target-oriented adjustments refer to the fact that deceivers adjust their communication in response to feedback from their interlocutor so as to maintain an innocent appearance and avoid detection of their deceit. Target-oriented adjustments represent interpersonal adaptation.

The self-adapting process may be more evident in the early phase of communication and may overshadow or confound deception effects (difference between truth and deception) as both truth tellers and deceivers attempt to find a homeostasis. In the later phases of interaction, when the self-adapting process tends to stabilize, it may become easier to identify deception if deceivers do not adjust their behavior sufficiently. This was true in the case of the deception-first sequence. Where participants were forced to start with deception, there were numerous statistically significant differences between their own deceptive and truthful responding. However, in the case of the truth-first sequence, deceptions in the latter half of the interview were difficult to identify. Given that it is common practice in professional circles to begin interviews on "safe" ground, such as starting with trivial questions intended to put respondents at ease and to obtain a truthful baseline, the current results call this practice into question. It may actually backfire, making it easier for deceivers to evade detection.

The current sequence effects beg for replication and application to other forms of discourse. As well, the patterns of self- and target adaptation are sorely understudied. This aspect of interactive deception is rich with possibilities for enlightening how deceptive episodes are enacted both verbally and nonverbally.

From both a theoretical and an applied standpoint, some might regard the current results as a death knell for accurate lie detection by humans because observation at any one point in time could be highly misleading. However, we do not regard the problem as intractable, only more complex than originally imagined. We remain convinced that temporal trends and sequencing effects will exhibit regularities that can be modeled as long as the right antecedent conditions and moderators are specified. For example, how receiver feedback is framed and how it influences deceivers' attempts to repair their performance should depend on when negative feedback is received. If it occurs while a speaker is being truthful and continues when the speaker responds with deceit, the fact that it is not contingent on what the speaker is saying may lead the speaker to discount it, whereas if a speaker is deceptive from the start, then negative feedback from an interlocutor is likely to be seen as suspicion and to prompt greater efforts to increase credulity. In this regard, interpersonal deception should shed light on other domains of interactive discourse and how people generally respond to the apparent feedback of others. It is our hope that the present investigation thus adds to the larger corpus of knowledge regarding language and its functions in human communication.

Appendix
Interview Questions

1. Please describe your educational background.
2. If you found a wallet containing $1,000 and no identification, what would you do with it? Why?
3. Describe the kind of student you were in high school.
4. Please describe your current or last occupation.
5. What types of people tend to rub you the "wrong way"?
6. How do you usually spend your weekends?
7. What political issues do you feel strongly about and why?
8. If your best friend was cheating on his or her spouse, what would you do? Why?
9. How thoroughly do you investigate the qualifications of candidates before you vote?
10. How ambitious are you?
11. Describe the last argument or fight you had with a close friend or family member.
12. What do you hope to be doing in five years?

Notes

1. Not reported here is an additional between-subjects factor in the design: interviewer immediacy. Inasmuch as this factor was not the focus of the current report, and given the complexity of the other results, this factor is not reported here.

2. Although there were no interactions among interviewer immediacy, block, and deception, except on modal verbs, it is worth noting that the interviewer's immediacy affected many linguistic cues, regardless of deception. For example, on quantity measures (number of words, verbs, and sentences), the interviewee's quantity increased with corresponding greater levels of interviewer immediacy. Sensory details, affect terms, and modifiers showed similar patterns. Interactions between time and interviewer immediacy were also significant for many cues. For instance, the interviewer's immediacy affected the interviewee's message quantity but only during the latter block of questions. It appears that interviewees responded to partners' higher enthusiasm and adjusted verbal output in a reciprocal fashion.

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