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Thin slices of negotiation:

Predicting outcomes from conversational dynamics within the first five minutes

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Abstract

In this research we examine whether conversational dynamics occurring within the first five minutes of a negotiation can predict negotiated outcomes. In a simulated employment negotiation, micro-coding conducted by a computer showed that activity level, conversational engagement, prosodic emphasis, and vocal mirroring predicted 30% of the variance in individual outcomes. The conversational dynamics associated with individual success among high-status parties were different from those associated with individual success among low-status parties. Results are interpreted in light of theory and research exploring the predictive power of "thin slices" (Ambady & Rosenthal, 1992). Implications include the development of new technology to diagnose and improve negotiation processes.

Key words: Negotiation, thin slices, conversational dynamics, speech features, nonverbal behavior, speaking time, turn-taking, prosodic emphasis, mimicry, status differences, artificial intelligence.

Thin slices of negotiation:

Predicting outcomes from conversational dynamics within the first five minutes

Decades of research in social psychology illustrate the surprising power of first impressions. From contexts as diverse as evaluating classroom teachers, selecting job applicants, or predicting the outcomes of court cases, human judgments made on the basis of just a "thin slice" of observational data can be highly predictive of subsequent evaluations.

The term "thin slice" comes from a frequently cited article by Ambady and Rosenthal (1993; see also Allport, 1937; Funder & Colvin, 1988; Gladwell, 2005; Goffman, 1979), who had college students evaluate 30-second silent video clips of instructors teaching a class, and found high correlations between those evaluations and end-of-semester ratings of the same instructors by their respective students (r = .76). This result was replicated with high school teachers, and using even thinner slices of video (as short as six seconds for each instructor).

Earlier research found a similar pattern of results when examining decision-making behavior in the context of the employment selection interview (for a review, see Wright, 1969). That is, an interviewer's impressions are formed in the early stages of the interview, and tend to persist throughout the interaction (Webster, 1964; also see Prickett, Gada-Jain, & Bernieri, 2000). Whereas most research on employment interviews uses the dichotomous hiring decision as the primary dependent variable, Webster (1982) likened the interview process to a conflict situation, and Rosenthal (1988) has argued that expectancy effects should be evident in the context of negotiations.

The current research explores the degree to which thin slices of an employment negotiation predict subsequent economic outcomes. More specifically, our study demonstrates the degree to which four conversational dynamics, occurring within the first five minutes of a two-party, simulated employment negotiation, predict the outcomes of that negotiation. We also explore how the status of the negotiating parties interacts with these conversational dynamics.

This study extends research and theory in a number of important ways. First, whereas the majority of research demonstrating the thin slices phenomenon applies to impression formation

and person perception, the present research applies the thin slices phenomenon to the behavioral outcome of a transactional negotiation. Second, whereas most thin slices research to date has tended to focus on the accuracy of intuition or snap judgments that may take many factors into account, the present research is based on formal micro-analyses of highly specific speech features. Third, whereas past research has demonstrated the predictive validity of human observers (or judges), the present research demonstrates the predictive validity of computers. Fourth, the present research provides preliminary evidence that conversational dynamics might play a critical role in negotiation, a role that appears to vary as a function of status differences in an organizational hierarchy. Finally, by using computer algorithms to explore the operation of thin slices phenomena within a negotiation context, we hope to provide a useful diagnostic instrument that might facilitate future research on negotiation processes as well as applications for training and evaluating negotiators.

Thin Slices Research

Thin slices of behavioral data have been shown to predict a broad range of consequences, including therapist competency ratings (Blanck, Rosenthal, Vannicelli, & Lee, 1986), personalities of strangers (Borkenau, Mauer, Riemann, Spinath, & Angleitner, 2004), and even courtroom judges' expectations for criminal trial outcomes (Blanck, Rosenthal, & Cordell, 1985; for reviews, see Ambady, Bernieri, & Richeson, 2000; Ambady & Rosenthal, 1992)

One of the most impressive examples of thin slices predicting important, long-term consequences is marital research conducted by Gottman and his colleagues (for a review, see Gottman & Notarius, 2000). For example, Gottman and Levenson (1992) carried out one of the first longitudinal studies predicting divorce among married couples based solely on the interaction of the couple during a dispute and their associated physiological responses. Even more striking, Carrère and Gottman (1999) were able to predict marital outcomes over a six year period based on human micro-coding of positive and negative affect over just the first 3 minutes of a marital conflict (i.e., an even thinner slice of expressive behavior). As in the employment

interview context, the very *beginning* of the marital discussion (i.e., the "startup" phase) appears to have the most predictive power (Gottman, 1979).

Across a wide range of studies, Ambady and Rosenthal (1992) found that observations lasting up to five minutes in duration predicted their criterion for accuracy with an average effect size of $r = .39$. This effect size corresponds to 70% accuracy in a binary decision task (Rosenthal & Rubin, 1982). It is astounding that observation of such a thin slice of behavior can predict important behavioral outcomes such as professional competence, criminal conviction, and divorce, when the predicted outcome is sometimes months or years in the future. The key to success lies is in understanding social signaling which is often nonverbal in nature (Blanck & Rosenthal, 1982; Blanck et al., 1985). We turn next to a brief review of that literature.

Social Signaling and Conversational Dynamics

Animals communicate and negotiate their position within a social hierarchy in many ways, including dominance displays, relative positioning, and access to resources. Humans add to that repertoire a wide variety of cultural mechanisms such as clothing, seating arrangements, and name-dropping (Dunbar, 1998). Most of these culture-specific social communications are conscious and easily manipulated.

However, in many situations, non-linguistic social signals (e.g., body language, facial expressions, and tone of voice) are as important as linguistic content in predicting behavioral outcomes (Ambady & Rosenthal, 1992; Nass & Brave, 2004). Indeed, some have argued that such vocal signaling originally evolved as grooming and dominance displays, and continues to exist today as a complement to human language (Dunbar, 1998; Provine, 2001).

While the human ability to judge outcomes from thin slices of behavior has been well documented, there is no complete theory of which signals participants might be employing to make those judgments. One method of building toward such a theory is to compare candidate signal features that have already been suggested in the literature with behavioral outcomes, to determine which signals (if any) have predictive power similar to that of human judges. Finally,

we can examine how these predictive social signals relate to existing theories of mental function and social interaction.

Toward this end, Pentland (2004) constructed four measures of vocal quality and conversational interaction which could possibly serve as predictive social signals. These four measures, which are designated activity, engagement, emphasis, and mirroring, were extrapolated from a broad reading of the voice analysis and social science literature in an attempt to find plausible candidates for predictive social signals. Below, we review these four general measures of conversational dynamics (or speech features), and hypothesize the relationship between each dynamic and its potential for influencing negotiation outcomes.[1] Within the Methods section, we describe the mathematical processes used to calculate each of the four measures.

Activity

Our simplest measure is activity, which is the fraction of time a person is speaking. Some individuals speak profusely and are quite animated in negotiations, whereas others adopt a more passive approach. Percentage of speaking time is known to be correlated with interest level (Dunbar, 1998) and extraversion (Nass & Brave, 2004). In the domain of negotiation, Barry and Friedman (1998) found a trend whereby extraversion correlated positively with individual outcomes in an integrative bargaining task similar to the one used in the present study.

In a recent meta-analysis, Schmid Mast (2002) found a high correlation between speaking time and individual dominance, particularly among same-sex groups and when dominance was operationalized as a function of role assignments (as opposed to personality traits). Indeed, in studies involving competitive settings similar to a negotiation, speaking time is positively correlated with dominance over the outcome (e.g., Bottger, 1984; Littlepage, Schmidt, Whisler, & Frost, 1995). Thus, more speaking time during the first five minutes should be correlated with better individual outcomes.

Hypothesis 1: An individual's activity level during the first five minutes of the negotiation will be positively correlated with his or her own individual outcome.

Engagement

Engagement is measured by the influence that one person has on the other's conversational turn-talking. When two people are interacting, their individual turn-taking patterns influence one another, and the whole can be modeled as a Markov process (Jaffe, Feldstein, & Cassotta, 1967; also see Thomas & Malone, 1979). By quantifying the conditional probability of person A's current state (speaking versus not speaking) given person B's previous state, we obtain a measure of person B's engagement (i.e., person B's influence over the turn-taking behavior). If two individuals are practically talking over one another, then both will have high engagement scores, whereas long pauses between speakers would lead to low engagement scores. One-sided engagement is when one person is energetically questioning another, and the other begins speaking only after the questioner ceases speaking.

An individual's engagement measure may be an indication of attention paid by the other participant. In one of the first studies to formalize the measure of conversational turn-taking, Jaffe, Beebe, Feldstein, Crown, & Jasnow (2001) found that timing of vocalizations between 4-month-old infants and their caregivers was predictive of infants' cognitive and social development as measured at 12 months. Choudhury and Pentland (2004) recorded all interactions among 24 individuals within their place of work for a period of 2 weeks (approximately 1,600 hours of audio data), and found a very strong correlation ($r = 0.90$) between a person's measured engagement and his or her betweenness centrality (Freeman, 1977; 1979)—i.e., the extent to which he or she played the role of a "connector" in the workplace social network (Gladwell, 2000). Indeed, influence over conversational turn-taking is popularly associated with good social skills or higher social status (Dunbar, 1998).

Recent evidence from research on competitive allocation tasks suggests that both power and status are linked to individual outcomes, and that this relationship is mediated by partner's attention (Proell, Thomas-Hunt, & Fragale, 2006; see also Solnick & Schweizer, 1999). In a study on negotiation, individuals who were primed with the recollection of a time when they felt dominant or powerful tended to wield more influence over the early stages of the negotiation

process (e.g., making the first offer to gain an anchoring advantage, Galinsky & Mussweiler, 2001), and in so doing, they achieved superior individual outcomes (Magee, Galinsky, & Gruenfeld, 2006). Influence over conversational turn-taking during the early stages of a negotiation could signal control over influential factors such as the agenda, which could yield a strategic advantage (Pendergast, 1990). Thus, influence over conversational turn-taking during the first five minutes of a negotiation should be associated with influence over the outcome.

Hypothesis 2: An individual's level of engagement during the first five minutes of the negotiation will be positively correlated with his or her own individual outcome.

Emphasis

Emphasis is measured by variation in speech prosody—specifically, variation in pitch and volume. Prosody refers to speech features that are longer than one phonetic segment and are perceived as stress, intonation, or rhythm (Werner & Keller, 1994; also see Handel, 1989). If an individual's voice has a large dynamic range (e.g., from a whisper to a shout), this results in a high emphasis score.

The concept of prosodic emphasis has appeared in research on child development. For instance, Fernald and Mazzie (1991) argued that mothers' use of exaggerated pitch peaks to mark focused words may aid infants in their speech processing. As speech prosody often is used to communicate emotions (Frick, 1985; Thompson, Schellenberg, & Husain, 2004), our emphasis measure may therefore be an indication of the importance a speaker attaches to the interaction.

In a negotiation, emotionality can be a sign of desperation. One of the primary reasons people use negotiation agents is because agents tend to be more emotionally detached (Thompson, 2005). Cohen (2003) argues that one of the greatest liabilities in negotiation is conveying to the other side that you "care too much" about the outcome. Indeed, a negotiator's level of influence is negatively correlated with one's own feeling of dependence (Giebels, De Dreu, Van de Vliert, 2000), and positively correlated with one's perception of the counterpart's dependence (Rinehart & Page, 1992; also see Emerson, 1962). Thus, vocal stress during the first

five minutes, because it might signal emotionality or dependence on the other side, should represent a liability in negotiation.

Hypothesis 3: An individual's level of emphasis during the first five minutes of the negotiation will be negatively correlated with his or her own individual outcome, but positively correlated with the counterpart's individual outcome.

Mirroring

When the observable behavior of one individual is mimicked or "mirrored" by another, this could signal empathy, and has been shown to positively influence the smoothness of an interaction as well as mutual liking (Chartrand & Bargh, 1999). The nonconscious mimicry of others' overt behaviors (e.g., body movements, facial expressions, or speech) seems to serve an adaptive social function (for a review, see Chartrand, Maddux, & Lakin, 2005). For example, Van Baaren, Holland, Steenaert and Van Knippenberg (2003) found that when waitresses mimicked the speech of their customers, they received higher tips than when they did not mimic their customers' speech. In our study, the distribution of utterance length was bimodal. That is, sentences and sentence fragments typically occurred at several-second and longer time scales, whereas time scales less than one second tended to be short interjections (e.g., "uh-huh"), but also back-and-forth exchanges typically consisting of single words (e.g., "OK?", "OK!", "done?", "yup."). We treated the occurrence of short back-and-forth exchanges (i.e., reciprocated short utterances) as a proxy for vocal mimicry, which we call "Mirroring."[2] Based on the results of Van Baaren et al. (2003), mirroring behavior during the first five minutes of a negotiation should be associated with improved individual outcomes.

Hypothesis 4: An individual's frequency of mirroring during the first five minutes of the negotiation will be positively correlated with his or her own individual outcome.

Method

Overview

Participants engaged in a scored, multi-issue employment negotiation task. All negotiations were digitally recorded, with conversational speech features extracted from the first five minutes of dialogue using a computer. Dependent variables were the number of points earned by each participant and the sum of points earned by each dyad.

Participants

One hundred and twelve first year graduate students who were enrolled in a required MBA course on organizational behavior participated in the research study on a volunteer basis.[3] Participants were informed that their negotiations would be audio taped and that the purpose of the study was to examine correlations between negotiation processes and outcomes. Forty-four participants (39%) were female.[4] The population had 1-16 years of work experience (M = 4.8 years) and was comprised primarily of U.S. Citizens (54%) as well as citizens of countries in Asia (18%), Europe (12%) and Latin America (11%). The average age was 28.7 years.

Procedure

This study was conducted in the context of a standard classroom negotiation simulation that has been used in previous research (Pinkley, Neale, & Bennett, 1994). The task was an employment negotiation between a candidate (Middle Manager) and a recruiter (Vice President) concerning the candidate's compensation package. Participants were randomly formed into 56 same-sex dyads, with one member of each dyad randomly assigned the role of Middle Manager and the other assigned the role of Vice President. One week prior to the negotiation, each participant received a set of written confidential instructions indicating his or her role and the various issues to be negotiated. Both parties were informed that the Middle Manager was seeking a transfer from one division of the company to another and, although the Middle Manager's application had met all the basic criteria, it was up to the Vice President to authorize the transfer, provided that specific terms of the compensation package could be mutually agreed upon.

The compensation package included a total of eight issues, with each offering five possible options for resolution. Each option was associated with a specific number of "points" for each party (see Table 1), although each party only saw his or her own payoff matrix. Two of the eight issues (starting date and salary) were *distributive* or "fixed-sum" issues such that the parties' interests were diametrically opposed. Two of the issues (job assignment and company car) were *compatible* issues such that both parties received the same number of points for a given option, and thus the parties' interests were best served by the same option (Thompson & Hrebec, 1996). The remaining four issues (signing bonus, vacation days, moving expense reimbursement, and insurance provider) were *integrative* or potential logrolling issues such that the differences in point totals among options for a given issue enabled potential trade-offs which would increase the joint value of the agreement for both parties (Pruitt, 1983). All participants were instructed that their goal was to maximize their own personal gain—i.e., to "reach an agreement with the other person on all eight issues that is best for you. The more points you earn, the better for you." To provide an incentive for maximizing individual performance, participants were informed that one dyad would be selected at random and its members would receive payment in accord with the individual point totals they had earned in their negotiation.

Upon arriving at the laboratory, participants were greeted by an experimenter, escorted into a small (10' X 12') room, and seated face-to-face in two chairs located approximately four feet from one another. After obtaining participants' consent to be audio taped, the experimenter started the recording equipment, and instructed the participants to begin their negotiation. Participants were given no specific guidance as to how to start their negotiations. Rather, participants were free to offer whatever information, arguments, and proposals they wished, but prohibited from physically exchanging their confidential instructions. The experimenter monitored the process for up to 45 minutes through a two-way glass window on one side of the room. Immediately after the negotiation, participants completed an online questionnaire in which they reported their negotiation outcomes.

A measured called *Individual Points* was the number of points earned by each participant (i.e., the total number of points earned across all eight issues). Although our hypotheses concerned only individual outcomes (i.e., "value claiming"), another dependent variable was included to assess "value creation" (Lax & Sebenius, 1986): *Joint Points* was the sum of points earned by each dyad (i.e., Middle Manager's total points plus Vice President's total points).

Measurement of Speech Features

Four conversational speech features were extracted from the first five minutes of each negotiation recording.[5] Following the mathematical procedures described below, we constructed measures of activity, engagement, emphasis, and mirroring.

Activity. Calculation of the activity measure begins by using a two-level Hidden Markov Model (HMM) to segment the speech stream of each person into voiced and non-voiced segments, and then grouping the voiced segments into speaking versus non-speaking (Handel 1989, Basu 2002). We measure conversational activity level by the proportion of speaking time relative to the entire five minute period. Note that the activity measures in a dyadic interaction do not sum to one, since there are silent periods and/or periods in which both participants are speaking simultaneously.

Engagement. We measure engagement by modeling each participant's individual turn-taking using an HMM and then calculating the conditional probabilities that connect these two HMMs to estimate the influence each participant has on the others' turn-taking dynamics (Choudhury and Pentland, 2004). This conditional probability is used as the measure of engagement. Our method is similar to the classic method used by of Jaffe et al. (2001), but with a simpler parameterization that permits the direction of influence to be calculated, and permits analysis of conversations involving many participants.

Emphasis. To measure emphasis, we begin by extracting the speaking energy and the frequency of the fundamental format for each voiced segment, and then calculate the standard deviation of the energy and frequency measures, each scaled by their respective means. We measure each speaker's emphasis by the sum of these scaled standard deviations.

Mirroring. We measure mirroring by the frequency of reciprocated sub-one-second utterances. For example, a back-and-forth exchange of short utterances, such as “OK?”, “OK!”, “done?”, “yup” is counted as two utterances per participant. However, a single short utterance, such as “uh-huh,” if not reciprocated by the counterpart, is not counted. Although this measure does not capture the full richness of mimicry behavior, we hoped that it would capture a core element, such that the frequency of these short interchanges would be proportional to the overall amount of mimicry.

Results

Four dyads were dropped because they failed to reach agreement within the specified bargaining zone (cf. Barry & Friedman, 1998; De Dreu, Koole, & Steinel, 2000; Kray, Thompson, & Galinsky, 2001). In addition, two dyads were dropped from the analysis due to problems with the recording quality. The remaining 100 participants comprising 50 dyads were retained for the analyses that follow.

Table 2 indicates the inter-correlations among all speech features within and between roles. The high level of interdependence within dyads means that analyzing the data as though it were derived from individuals would result in biased significance tests (Kenny, 1995). However, treating the dyad as the unit of analysis (i.e., averaging each dependent variable to create a dyad-level score) prevents the statistical comparison of effects between roles (Campbell & Kashy, 2002). Thus, we employed the Actor Partner Interdependence Model (APIM; Kashy & Kenny, 2000) to obtain actor and partner effects as predictors of individual points through hierarchical linear modeling. The secondary dependent variable, joint points, was a between dyads variable and thus analyzed at the dyad-level using regular regression. Because mirroring was so highly correlated within dyads, partner mirroring was excluded from the APIM analyses so as to minimize multicollinearity. In the regular regression, a joint mirroring score (i.e., the average mirroring score within each dyad) was used instead of the individual scores for each role. Sex and role also were included as covariates.

The results of both models are presented in Table 3. The regular regression predicting to joint points showed no significant effect of speech features. However, the APIM analyses predicting to individual points yielded a number of significant effects.[6] Using the method prescribed by Raudenbush and Bryk (2002), we compared the residual variance in the "unconditional" model (i.e., with no predictor variables) versus the "conditional" model (i.e., including predictor variables) to obtain relevant measures of *R*-squared (also known as "pseudo R^2"). Including all four speech features, the model predicted a total of 30% of the variance in individual points (R^2 for Middle Managers = .36, R^2 for Vice Presidents = .23). The effect of each speech feature on individual points is discussed below.

Activity. Hypothesis 1 proposed that activity level would be positively correlated with individual outcomes. This effect was confirmed for Vice Presidents ($\beta = .32$, $p < .05$), but not for Middle Managers ($\beta = -.20$, *ns*). The relevant role by activity interaction was significant ($\beta = .52$, $p < .05$), indicating that speaking time during the first five minutes was related to individual outcomes differentially for Middle Managers and Vice Presidents. Middle Managers who spoke more tended to have Vice President counterparts who earned better individual outcomes, as illustrated by the Vice President partner effect ($\beta = .36$, $p < .05$). However, the activity level of Vice Presidents was not associated with Middle Manager individual outcomes ($\beta = -.11$, *ns*). The relevant role by activity interaction was significant ($\beta = .47$, $p < .05$), indicating that *counterpart's* speaking time during the first five minutes also was related to individual outcomes differentially for Middle Managers and Vice Presidents.

Engagement. Hypothesis 2 proposed that engagement (i.e., influencing the other side's conversational turn-taking) would be positively correlated with individual outcomes. This hypothesis was not supported for Vice Presidents ($\beta = .13$, *ns*) or for Middle Managers ($\beta = -.28$, $p < .10$), yet the relevant effects suggest what might be, if there were sufficient power, a role interaction similar to that seen with activity level—i.e., one in which engagement is related to individual outcomes differentially for Middle Managers and Vice Presidents. Nevertheless, the relevant role by engagement interaction was not statistically significant ($\beta = .42$, $p < .10$).

Engagement by one's counterpart was not related to one's own individual points (Middle Manager β = .04, *ns*; Vice President β = .19, *ns*), and this result did not vary by role (β = .14, *ns*).

Emphasis. As predicted by Hypothesis 3, prosodic emphasis during the first five minutes was negatively correlated with one's own individual outcomes (β = -.28, $p < .05$), and positively correlated with the individual outcomes of one's counterpart (β = .42, $p < .01$). Neither of these effects interacted with status (β = .19, *ns* and β = -.02, *ns*, respectively).

Mirroring. Hypothesis 4 proposed that mirroring would be positively correlated with individual outcomes. Indeed, Middle Managers earned better individual outcomes when vocal mirroring was high (at the dyad level) in the first five minutes (β = .30, $p < .05$). However, Vice Presidents' individual outcomes were not related to mirroring (β = -.08, *ns*). The role by activity interaction was not statistically significant (β = -.38, $p < .10$), yet once again the relevant effect sizes suggest what might be, if there were sufficient power, a role interaction. Because of the multicollinearity issue (mentioned above), partner effects could not be calculated for this feature.

Sex and Role Effects. Although not the primary focus of the current investigation, sex (male = 0, female = 1) and role (Middle Manager = 0, Vice President = 1) were included as control variables in our analyses. Table 4 presents economic outcomes as a function of sex and role. No sex differences were found in individual or joint points (β = -.02, *ns* and β = .05, *ns*, respectively).[7] However, we did find a considerable role effect whereby Vice Presidents generally outperformed Middle Managers (β = .64, $p < .01$).

Discussion

Four conversational dynamics (or speech features) occurring within the first five minutes of a negotiation were highly predictive of subsequent individual outcomes. In fact, the overall effect sizes demonstrated in this study ($r = .60$ for Middle Managers and $r = .48$ for Vice Presidents) were considerably higher than the average effect size from past thin slices research ($r = .39$, Ambady & Rosenthal, 1992). Moreover, most past studies relied on human intuition to generate predictions, whereas the present study used exclusively computer algorithms. As a

result, the present study identified specific features of thin slices which correlated with subsequent behavioral outcomes.

Perhaps the most striking finding was that conversational dynamics associated with individual success among high-status parties tended to be different from those associated with individual success among low-status parties. For example, proportion of speaking time was associated with individual outcomes for Vice Presidents but not for Middle Managers. Conversely, vocal mirroring during the first five minutes benefited Middle Managers, yet not Vice Presidents.

The only speech feature for which such an interaction did not emerge (at $p < .10$) was prosodic emphasis. Indeed, prosodic style is among the most powerful of social signals, even though (and perhaps because) people are usually unaware of it (Nass & Brave, 2004). The use of prosodic emphasis during the first five minutes appears to be a liability in negotiation, as it was associated with worse outcomes for oneself and better outcomes for one's counterpart.

Although we did not expect to find status differences in the effects of conversational dynamics, such differences can be explained theoretically on the basis of previous research. For example, Tiedens and Fragale (2003) found complementarity between dominant and submissive nonverbal behaviors within dyads, and argued that such behaviors contribute to hierarchical differentiation. Gregory and Webster (1996) found that the low-frequency band of the voice communicates differences in perceived social status. Regarding the present study, with respect to activity level, previous research has found positive correlations between verbal participation rates and emergent leadership (for a review, see Stein & Heller, 1979). Thus, in the organizational context of the present study, it might have been less normative, and hence less efficacious, for low-status parties to speak too much. Similarly, previous researchers have suggested that influence over conversational turn-taking might be more efficacious among those who have high social status (Choudhury & Pentland, 2004; Dunbar, 1998). With regard to mirroring, since mimicry behaviors tend to be used by those who seek to affiliate (Lakin & Chartrand, 2003), mirroring might be more efficacious among lower status job seekers than

among higher status recruiters. Unfortunately, because we did not design this experiment specifically to test power or status differences, we did not include a manipulation check to confirm that participants perceived status differences, nor can we be certain that status differences were in fact responsible for differences in results by role.

We found no significant effect of conversational dynamics on joint outcomes. This may have been due to the nature of the negotiation task, which was relatively egoistic in terms of its instructions for participants (i.e., "Reach an agreement…that is best for you. The more points you earn, the better for you."). In a recent meta-analysis, De Dreu, Weingart, and Kwon (2000) found that negotiators with an egoistic motive used more contentious tactics and reached lower joint outcomes than negotiators with a prosocial motive. Thus, if the present study had utilized a more prosocial (or cooperative) negotiation task, we might have seen more problem-solving, higher joint outcomes, and perhaps different effects involving conversational dynamics.

One limitation of the methodology used is that we have no measure of construct validity. Because all micro-coding of speech features was conducted by a computer, there were no human observers to verify that our measures of speech features appropriately operationalized the intended conversational dynamics. For a straightforward speech feature, such as activity level, the problem of not having a means to assess construct validity is mitigated by high face validity (i.e., having used such a simple measure of speaking time). However, for the other more complicated speech features, the link between specific measures and their respective conversational dynamics is more tenuous. Notwithstanding this potential shortcoming, one advantage of micro-coding using a computer is that it ensures high test-retest reliability. Since the computer measures an objective, physical property of the audio signal, not a subjective or psychological property, the measures are 100% consistent over repeated runs using the same audio data. Moreover, because calculations are instantaneously generated, this technology could be used to provide negotiators with real-time feedback so as to diagnose and improve their negotiation skills. Of course, one would want to ascertain first (1) whether manipulating speech

features would result in improved negotiation outcomes, and (2) whether negotiators could alter their own speech features consciously.

However, even without answers to these questions, technology based on the algorithms used in the present research could offer early predictions about the likely outcome of a negotiation. One of the central questions facing individuals at any point in a negotiation is whether to persist or whether to give in. Persisting for too long at a failing course of action is a common psychological trap (also known as "escalation of commitment" or "the sunk cost fallacy"; Arkes & Blumer, 1985; Brockner, Shaw, & Rubin, 1979; Staw, 1976) which could result in wasted time or damaged relationships. Conversely, giving up too early might forfeit a potential opportunity. Thus, having a reliable yet early indicator of performance could save negotiators time and energy.

Finally, our findings have implications for research on Artificial Intelligence. The Artificial Intelligence community has studied human communication at many levels, such as phonemes, words, phrases, and dialogs. While semantic structure and prosodic structure have been analyzed, longer-term, multi-utterance structure associated with social signaling has received relatively less attention (Handel, 1989). The present investigation suggests that such systematic analysis of social signaling, even when applied to a "thin slice" of behavior, can lead to remarkable predictive validity.

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Footnotes

[1] In this report, we use two terms—"conversational dynamics" and "speech features"—which have a similar meaning. Speech features are measures that allow us to make estimates of the conversational dynamics.

[2] The terms "mirroring" and "mimicry" both have been used in previous research. However, "mimicry" is the term most frequently used in the social sciences literature, whereas "mirroring" tends to be more commonly used in the signal processing and neuroscience literatures—e.g., Bailenson & Yee, 2005; Chartrand & Bargh, 1999; Giles, Coupland, & Coupland, 1991.

[3] Out of 200 students randomly selected to be eligible to participate, 56% volunteered to do so.

[4] Same-sex pairings were undertaken so as to control for any potential confounds between gender differences and status differences.

[5] We selected five minutes as the duration for the "thin slice" in the current research for three reasons. First, we wanted the "slice" to include some of the content of the negotiation itself, as opposed to just "small talk." Second, from a signal processing standpoint, certain measurements (e.g., "engagement") become more accurate as the time slice becomes longer. Finally, in their definition of "thin slices," Ambady, Bernieri, and Richeson (2000) specify that the behavioral stream must last no longer than five minutes.

[6] Because this was an exploratory study, we wanted to provide the reader with as much information as possible. Thus, we selected $p < .10$ as the threshold for reporting levels of statistical significance as well as the threshold for separating out effects by role in Table 3.

[7] Sex differences were found in two of the speech features, collapsing across role. Emphasis was higher among male dyads ($M = 0.87$) than among female dyads ($M = 0.70$), $t(98) = 7.22$, $p < .01$. Mirroring also was higher among male dyads ($M = 8.37$) than among female dyads ($M = 6.29$), $t(98) = 2.37$, $p < .05$. However, no sex differences were found for

activity (Male $M = 0.43$, Female $M = 0.45$, $t(98) = -0.84$, *ns*) or engagement (Male $M = 0.065$, Female $M = 0.057$, $t(98) = 1.26$, *ns*).

Table 1

Points Schedule for the Negotiation Simulation

	Points			Points	
Issues and Potential Options	Vice President (Recruiter)	Middle Manager (Candidate)	Issues and Potential Options	Vice President (Recruiter)	Middle Manager (Candidate)
Signing Bonus			Moving Expenses Reimb.		
10%	0	4,000	100%	0	3,200
8%	400	3,000	90%	200	2,400
6%	800	2,000	80%	400	1,600
4%	1,200	1,000	70%	600	800
2%	1,600	0	60%	800	0
Job Assignment			Insurance Provider		
Division A	0	0	Allen Ins.	0	800
Division B	-600	-600	ABC Ins.	800	600
Division C	-1,200	-1,200	Good Health	1,600	400
Division D	-1,800	-1,800	Best Ins. Co.	2,400	200
Division E	-2,400	-2,400	Insure Alba	3,200	0
Vacation Days			Salary		
30 days	0	1,600	$90,000	-6,000	0
25 days	1,000	1,200	$88,000	-4,500	-1,500
20 days	2,000	800	$86,000	-3,000	-3,000
15 days	3,000	400	$84,000	-1,500	-4,500
10 days	4,000	0	$82,000	0	-6,000
Starting Date			Company Car		
June 1	0	2,400	LUX EX2	1200	1200
June 15	600	1,800	MOD 250	900	900
July 1	1,200	1,200	RAND XTR	600	600
July 15	1,800	600	DE PAS 450	300	300
Aug 1	2,400	0	PALO LSR	0	0

Note. Participants saw only their own points schedule.

Table 2

Descriptive statistics and Pearson correlations among speech features

	MM Speech Features				VP Speech Features			
Variable	1	2	3	4	5	6	7	8
MM Speech Features								
1. Activity	---	-.22	.08	-.22	-.40**	-.27~	-.20	-.24~
2. Engagement		---	-.06	-.34*	-.07	.72**	.16	-.31*
3. Emphasis			---	.11	-.26~	-.15	.53**	.09
4. Mirroring				---	.14	-.38**	.11	.96**
VP Speech Features								
5. Activity					---	-.18	-.08	.15
6. Engagement						---	.12	-.33*
7. Emphasis							---	.08
8. Mirroring								---
M	0.440	0.0619	0.794	7.520	0.441	0.0621	0.813	7.640
SD	0.111	0.0357	0.135	4.215	0.094	0.0321	0.138	4.552
Minimum	0.252	0.0000	0.529	0.000	0.226	0.0000	0.596	0.000
Maximum	0.840	0.1576	1.043	20.000	0.615	0.1312	1.111	22.000

Note. MM = Middle Manager; VP = Vice President.

~ $p<.10$, * $p<.05$, ** $p<.01$, two-tailed.

Table 3
Effects of speech features from the first five minutes on subsequent economic outcomes (N =100)

	Economic Outcomes	
	Indiv. Points	Joint Points
Sex (female)	-.02	-.05
Role (Vice President)	.64**	---
Activity		
Actor Effects		
Middle Managers	-.20	.18
Vice Presidents	.32*	.20
Partner Effects		
Middle Managers	-.11	---
Vice Presidents	.36*	---
Engagement		
Actor Effects		
Middle Managers	-.28~	-.12
Vice Presidents	.13	.16
Partner Effects		
Middle Managers	*.11*	---
Vice Presidents		---
Emphasis		
Actor Effects		
Middle Managers	*-.28**	.02
Vice Presidents		.26
Partner Effects		
Middle Managers	*.42***	---
Vice Presidents		---
Mirroring		
Actor Effects		
Middle Managers	.30*	*.19*
Vice Presidents	-.08	
Total R^2	.30	.00
R^2 for Middle Managers	.36	---
R^2 for Vice Presidents	.23	---

Note. All terms except model diagnostics are standardized regression coefficients (betas). For the analysis predicting to individual points, actor and partner effects were obtained through hierarchical linear modeling. Separate coefficients for Middle Managers and Vice Presidents are presented when a role interaction emerged at $p<.10$. Pooled coefficients are italicized and are presented when role interactions were not present. For the analysis predicting to joint points, multiple regression was conducted at the level of the dyad and mirroring was averaged across roles. ~ $p<.10$, * $p<.05$, ** $p<.01$, two-tailed.

Table 4
Economic outcomes as a function of sex and role

	Economic Outcomes			
	Males		Females	
	M	*SD*	*M*	*SD*
Middle Manager Points	4,319	2,248	3,926	1,958
Vice President Points	5,600	1,983	4,979	2,281
Joint Points	9,919	1,765	8,905	2,563