



Towards the prosody of persuasion in competitive negotiation. The relationship between f0 and negotiation success in same sex sales tasks

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Abstract

Prosodic features play a key role in a speaker's persuasive power. However, previous studies on persuasion have been focused on public speaking and the signaling of leadership, while acoustic studies on negotiation have been primarily concerned with cooperative interactions. In this study we are taking a first step into investigating the role of acoustic-prosodic cues in competitive negotiation, focusing on f0 in same-sex negotiations. Specifically, we ask whether the prosodic correlates of persuasive speech are comparable for public speaking and negotiation. Sixty-two speakers (44f/18m) in 31 same-sex pairs participated in a competitive task to bargain over the selling price of a fictional company. We find a significant correlation between a speaker's f0 features and his/her interlocutor's concession range. In line with findings from public speaking, greater f0 excursions and higher f0 minima correlate with negotiation success. However, while the female speakers also show an expected elevated f0 mean, the opposite is the case for male speakers. We propose that in competitive negotiation, displaying dominance may overrule showing passion in contrast to public speaking, but only for male speakers.

Index Terms: sociophonetics, prosody, charisma, persuasion, competitive negotiation, voice profiling, f0

1. Introduction

A recent surge in studies on the acoustic features of persuasive speech shows that prosodic cues play a vital role in signaling speaker charisma and persuasiveness [cf. 1-7]. Accordingly, the contribution of vocal features to a speaker's persuasive power is equal to if not outweighing the role of the linguistic content [8-10]. However, comparable to traditional rhetorical analyses, the majority of research has been focused on persuasion in monologues, i.e. public speaking, where the interlocutor takes on a passive role as an audience [11-13]. Studies on the prosody of persuasion in dyadic interactions, i.e. negotiation, are relatively scarce.

Negotiation has been a major research topic in organizational psychology for over 50 years. However, this research has been primarily concerned with investigating the psychological elements and behavioral strategies [14] as well as personality traits [15] underlying negotiation. When it comes to the communicative behavior and hence the linguistic aspects of negotiation, research has been focusing on discourse structure, rhetoric strategies, and visual cues [16-19]. So far, vocal behavior has often been reduced to a side note.

When looking into the prosodic studies on negotiation, two major types of negotiation have to be distinguished. *Integrative negotiations* are characterized by win-win-like situations where both speakers achieve better gain from the negotiation when working together towards maximizing the potential outcome as a whole [14]. Prosody research has been largely focused on this type of negotiation mostly related to the topic of prosodic entrainment. In integrative negotiation, participants profit from engaging in cooperation and gain better results from collaboration. Higher task success in integrative negotiations has been associated with the acoustic-phonetic strategy of adapting to an interlocutor's vocal features called *prosodic entrainment* [20,21]. *Distributive or competitive negotiations* constitute the second major type of negotiations. In distributive negotiations, participants compete over a limited resource where the gain of one directly leads to the loss of the other [14]. Research for example from competitive game tasks played against the computer suggest that prosodic adaptation in the form of disentrainment might play a role in signaling dominance and hence may affect negotiation success (cf. [22]). So far, there are no known studies on the independent use of acoustic-phonetic features in competitive negotiation and their effect on persuasion.

Expectations about the acoustic features of persuasion in competitive negotiation can be derived from the effects found for public speaking. We approach the topic by initially focusing on fundamental frequency (f0). There seems to be a large general consensus on how f0 contributes to a speaker's charisma and persuasiveness. In general, persuasive speakers show a raised register which manifests itself in both an elevated f0 mean as well as a raised baseline in the form of an elevated f0 minimum [3, 23]. Both are assumed to correlate with a speaker's perceived engagement and liveliness [3, 24]. Furthermore, charismatic speakers show a larger f0 range and f0 variation [1,2,3,24]. Larger f0 ranges have been associated with expressiveness, confidence, and liveliness as well signaling a speaker's emotional involvement and passion [1,2,3,24]. Lastly, while being engaged and lively, persuasive speakers are also assumed to be assertive, convinced, and self-assured [3,25,26]. These attributes have been associated with deeper phrase final f0 movements to signal certainty and assertiveness [27,28].

Where do we expect persuasive negotiators to deviate from the attributes of persuasive public speakers? While personality traits have been crucial in the description of persuasive public speakers [18,26,29], there has been a long standing consensus that personality plays no or only a marginal role in negotiation (cf. [30]). However, this assumption has recently been successfully challenged (cf. [15]). Accordingly, we ask where

traits of persuasive negotiation are in line with the traits of charismatic speakers outlined above as well as where they deviate from these attributes. Confidence and competence, as well as expressiveness and liveliness are features shared by both communicative settings [3,15,26,29]. Accordingly, we expect an elevated register as well as an expanded f0 range to play a role in competitive negotiation. However, a key feature to charisma is passion and emotional investment in the communicated vision. A charismatic speaker induces emotional contagion in his/her followers [31]. In contrast, distributive negotiation is negatively affected by the display of emotional investment [15]. Accordingly, smaller or even contrasting effects may be expected in competitive negotiation.

Furthermore, a key contributor to successful competitive negotiation is dominance and assertiveness [15]. While certainty is also an important feature of charisma, the concept of charisma is commonly defined through persuasion without dominance and authority [29,32,33]. Accordingly, we expect manifestations of dominance to assume a much larger role in competitive negotiations. As described above, lower values of phrase final f0 have been associated with assertiveness and certainty. Hence, we would expect this feature in persuasive negotiation as well. However, the most frequently found feature of dominance relates to a lowered register in the form of f0 mean or median [34-37]. This directly contrasts with our expectations from public speaking. Accordingly, one major question of this paper is, whether successful negotiation is more characterized by showing engagement and passion or by showing dominance and self-assurance. Furthermore, there is a possibility for a divergence in speaker sex, since the correlation of lower f0 and dominance strongly correlates with masculinity (cf. [34,35,38]). Male negotiators may use dominant negotiation strategies more often than female negotiators.

2. Method

2.1. Participants

The study was conducted with 62 speakers of German, 44 female and 18 male, between the age of 18 and 51 years (mean = 25.4 years, SD = 6.1). Participants were recruited from the participant pool of the University of Goettingen.

2.2. Procedure

The study at hand constitutes part of a larger study. In the original study, subjects participated in both mixed-sex and same-sex negotiations. Since this study constitutes a first approach to the topic of vocal features in competitive negotiation we focus on same-sex negotiations only and hence a subset of the original study to reduce previously found entrainment effects in mixed-sex conversations [39]. Accordingly, the subset of the participants reported above formed same-sex pairs, 22 female-female and 9 male-male. Each participant was assigned a role representing either the owner/seller or the buyer of a fictional pharmaceutical company. Participants received instructions about their role, the company's values and assets, the motivation and interest of the selling or buying party respectively, as well as an alternative offer to compare the negotiated value against to give each participant enough grounds for negotiation. Both participants were guided into a quiet room and seated in front of each other at a table. It was randomly chosen whether seller or buyer made the first offer. Both parties were instructed to set an initial offer preceding the negotiation but were not obligated to stick it as

the first actual offer made in the negotiation. Participants were given a time limit of five minutes which was strictly enforced. Accordingly, the negotiation was canceled if an agreement was not reached within the time limit. Furthermore, the negotiation was ended, if an agreement was reached before the time ran out. Participants were financially compensated according to their performance.

2.3. Acoustic analysis

For the acoustic analysis, the audio tracks were extracted from the video files and automatically annotated for interpausal units using the *Syllable Nuclei* script by [40] with its update by [41]. All phrases were manually labelled for speaker and corrected by hand. We extracted the f0 features mean, minimum, maximum, excursion size, and final f0 from the labelled intervals using ProsodyPro [42]. Measurements for f0 mean, minimum, maximum and final f0 were taken in Hz, measurements of range were taken in semitones to ensure comparability with contemporary research on speaker charisma and persuasion [cf. 1-7].

2.4. Statistical analysis

For the statistical analysis, we conducted linear mixed effects models using *R* [43], the *lme4*-package [44], and the *lmerTest*-package [45]. Model fit was determined by maximum likelihood ratio tests. *P*-values were calculated using the Satterthwaite approximation. As fixed factors we used SPEAKER SEX, the five f0 measurements MAX, MIN, RANGE (5th-95th percentile), MEAN, and FINAL F0, as well as the two-way-interactions between the f0 features and SPEAKER SEX. As the dependent variable, we used the respective interlocutor's concession range measured as the difference between the interlocutor's first offer and the agreed upon selling price, if an agreement is reached, or the last offer made, if no agreement is reached. As random factor we used *conversation*.

3. Results

Table 1: *Statistical results for the effects of a speaker's f0 features on an interlocutor's concession range.*

	<i>b</i>	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
SEX	0.29	3.90	50.05	0.08	n.s.
MAX	-0.02	0.00	1266.00	-3.18	<.01
MIN	0.09	0.02	1265.00	5.42	<.001
RANGE	0.19	0.08	1266.00	2.43	<.05
MEAN	-0.01	0.01	1266.00	-1.68	n.s.
SEX X MIN	-0.06	0.01	1267.00	-4.99	<.001
SEX X MEAN	0.03	0.01	1269.00	3.03	<.05

As shown in table 1, we find no main effects for SPEAKER SEX, meaning that *concession range* in general did not differ between male and female speakers. We find significant main effects for the F0 MAXIMUM with lower maxima correlating with greater *concession ranges*, as well as for the F0 RANGE with larger f0 ranges correlating with greater *concession ranges*. The F0 MINIMUM correlates positively with *concession range* as a main effect but interacts significantly with SPEAKER SEX. Figure 1 shows that the interaction affects the magnitude of the effects but not the direction. Both sexes show a positive correlation of F0 MINIMUM and *concession range* but with shallower slopes for male speakers. Lastly, the F0 MEAN shows no main effects but a

significant interaction with SPEAKER SEX. Figure 2 illustrates that the F0 MEAN shows the opposite effects for both sexes. While female speakers show a positive correlation, male speakers show a negative correlation for *concession range*.

Figure 1: Interaction of speaker f0 minimum and speaker sex on an interlocutor's concession range.

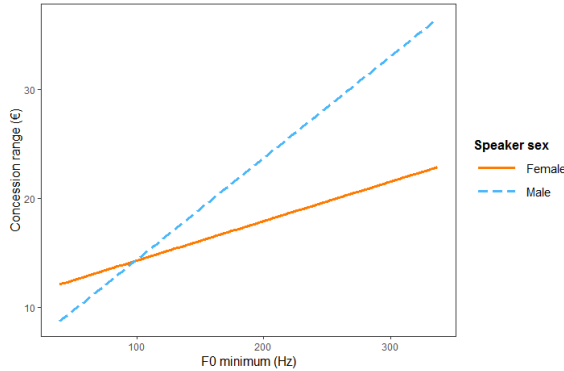


Figure 2: Interaction of speaker f0 mean and speaker sex on an interlocutor's concession range.

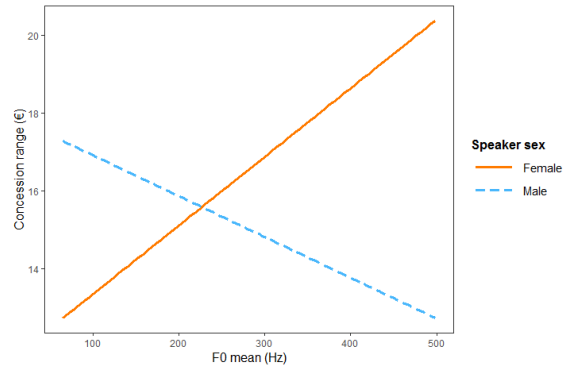


Table 2 and 3 present the post-hoc results separated by speaker sex to investigate the interactions for the F0 MINIMUM and the F0 MEAN. Table 2 shows that for the female speakers the effects for MAXIMUM, MINIMUM, and MEAN are in line with the main model. However, the RANGE does not reach statistical significance. Table 3 shows that for the male speakers the effects for MAXIMUM, MINIMUM, and RANGE are compatible with the main model supporting the assumption that the effects for F0 MINIMUM vary in magnitude but not in significance and direction. However, the F0 MEAN does not reach statistical significance for the subset of male speakers. Furthermore, we find a significant effect for FINAL F0 not present in the main model. FINAL F0 is negatively correlated with *concession range*.

Table 2: Post-hoc analysis of the effects of f0 concession range for female speakers.

	<i>b</i>	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
MAX	-0.01	0.00	916.94	-2.09	<.05
MIN	0.01	0.00	918.25	2.27	<.05
MEAN	0.02	0.01	918.50	2.46	<.05

Table 3: Post-hoc analysis of the effects of f0 concession range for male speakers.

	<i>b</i>	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
MAX	-0.03	0.01	348.54	-3.26	<.01
MIN	0.12	0.02	348.10	5.25	<.001
RANGE	0.34	0.12	348.62	2.82	<.01
FINALF0	-0.01	0.01	347.95	-2.47	<.05

4. Discussion

The results show that a speaker's f0 features correlate with his/her interlocutor's concession range in competitive sales negotiations. Furthermore, the effects are mostly in line with our expectations from persuasive speech in public speaking, cf. [1-7].

We find that a larger excursion size and thus a greater f0 range correlates with the degree to which an interlocutor deviates from his/her initial offer towards the speaker within a competitive negotiation. Comparable to public speaking, we can assume that a larger f0 range signals expressiveness and liveliness [1,2,3,24] and hence higher confidence and competence in the negotiator which may contribute to his/her persuasive power. Furthermore, a larger f0 range can be associated with extraversion [1] which positively contributes to successful negotiation in both integrative and distributive settings [15]. However, we note that although excursion size reaches statistical significance as a main effect and shows no interaction with speaker sex, we do not find effects for excursion size in the post-hoc analysis for the female speakers.

The effects for the f0 maximum seem to contradict the effects found for excursion size. Although we expect a larger f0 range to correlate with more pronounced maxima, we find the exact opposite with lower f0 maxima correlating with more interlocutor concession. Accordingly, a wider f0 range may increase persuasive power [46] while excessive f0 peaks are detrimental to it. We suggest that a wider f0 range signals a different kind of expressiveness than pronounced f0 peaks. One possibility is that the generally expanded f0 range corresponds to the facet of liveliness and expressiveness of the extraversion quality, while sharper f0 maxima contribute to the openness and emotional involvement facet [47]. This is where persuasion in public speaking and negotiation may deviate. While charismatic speakers are assumed to be lively and expressive and at the same time encouraged to be passionate and emotionally involved for followers to subscribe to their view [3,29,31,32], emotional involvement in competitive negotiation may pose a liability. Emotional involvement signals vulnerability which may result in a more aggressive and less compromising negotiation behavior by the interlocutor [15].

With respect to the register, the results for the f0 minimum are again in line with our expectations. The f0 minimum can be interpreted as the baseline of the register [3,23]. For both female and male speakers an elevated f0 register correlates with stronger concessions by the interlocutor. Since elevated registers correspond to sounding livelier, more engaged, convincing, and competent in public speaking [3,24], this could be regarded as a general property of persuasiveness. The differences in magnitude found by speaker sex are also expectable since the register of average female speakers is already close to the charismatic optimum while male speakers usually have to raise their register by a larger amount [33,48].

The results for f0 mean again seem to contradict the effects for f0 minimum. With respect to persuasive public speaking we

would expect the mean to be elevated together with the minimum since the mean is usually used to measure the general register [23]. However, this is only found for the female speakers. For female speakers, a higher f0 mean correlates with a larger concession range compatible with the interpretation we described above. However, we find a significant interaction for f0 mean with speaker sex. This indicates that male speakers show a negative correlation between f0 mean and concession range and hence a lowered register with greater interlocutor concession. First of all, we note that the post-hoc test shows no effect of f0 mean for the male speakers in either direction. Hence, the effects deduced from the interaction plot in figure 2 may not be relevant. However, this absence of significance may be caused by the much smaller sample size for the male speakers. Accordingly, we want to give an explanation for the effects. As suggested above, another deviation from persuasive public speaking may be found in the role of dominance and assertiveness. While the modern concept of charisma is explicitly defined through persuasion without dominance and authority [29,32,33], dominating a negotiation may still be a viable strategy to win in competitive scenarios. While a higher f0 mean is associated with confidence and passion, a lower f0 mean is associated with dominance and self-assurance [27,28,34-37]. Accordingly, male speakers showing a lower f0 mean may yield greater concession from the interlocutor through dominance. Furthermore, this finding suggests that male and female negotiators not only differ in the f0 features they use for successful negotiations but also in the general persuasive strategies with male speakers relying more on dominance and female speakers relying more on charisma. However, since we neither find positive nor negative effects in the post-hoc test, another explanation may be that even within the subset of the male speakers there are individual preferences for choosing dominance over charisma as a negotiation strategy. These individual preferences could be related to either difference in natural register or in personality which requires further research.

Lastly, investigating the post-hoc results we find that male speakers show lower final f0 values correlating with higher interlocutor concession. Although this effect is absent from the main model and only found for the male speakers, it is in line with our expectations. There are two explanations for lower final f0 values. Firstly, differences in final f0 can reflect differences in final contour preferences [27,28]. Accordingly, this could mean that speakers for whom we find a high concession from the interlocutor use more final falling than final rising contours. The paralinguistic use of final rising contours has frequently been linked to uncertainty and less self-assurance [34,27,28]. Thus, speakers using more frequent falls may appear more assertive, which may facilitate negotiation success. Secondly, final f0 indicates a lower fall when using a falling contour. This too has been associated with more assertiveness, especially in contexts of charismatic public speaking [32]. Accordingly, while the exact explanation calls for an additional tonal analysis, both assumptions suggest higher degrees of certainty and assertiveness to correlate with larger concessions by the interlocutor.

In conclusion, we assume that prosodic cues in terms of fundamental frequency contribute to a speaker's persuasive power in distributive negotiation by affecting the degree to which a competitor deviates from his/her initial offer towards that of the speaker. Since the relationship is symmetrical, we may also assume that a lack of the features found in this study is associated with less persuasive power. For future research,

our first objective would be to investigate mixed-sex dialogues, especially when it comes to the different effects found for f0 mean and final f0 and the differences in signaling dominance versus charisma. Furthermore, the analysis of f0 features should be complemented by a tonal analysis to test the hypotheses regarding the final f0 values, as well as by incorporating additional measurements of register and range. Lastly, the feature set should be extended to rhythmic as well as voice quality features to get a more comprehensive comparison with the acoustic features found for persuasive public speaking and charisma [7,49].

As the study in this paper serves as a pilot we want to point out some drawbacks that should be considered in future research on the topic. Firstly, we did not consider sexual orientation of the participants hence potentially compromising the effects by interferences of visual attractiveness as found by [39] for mixed sex conversations. Secondly, the generalizability of the study is restricted since it focused on German speakers and has to be extended to other languages with deviating intonation and even tonal systems. Thirdly, future analyses should take additional prosodic parameters and potentially multimodal cues such as body gestures and facial gestures into account to assess a broader range of vocal and communicative behaviors.

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