The polite voice in Korean: searching for acoustic correlates of *contaymal* and *panmal*

BODO WINTER[1], SVEN GRAWUNDER[2]
[1]*University of Hawai'i at Mānoa,* [2]*Max Planck Institute for Evolutionary Anthropology*

1. Introduction

Politeness is an integral part of everyday communication (Brown & Levinson 1987). In speaking to different people, we constantly adjust our behavior, our body language, the words and sentence structures we use, and our tone of voice. In line with current trends in expressive speech research (see Tatham & Morton 2004, Erickson 2005), we suggest that the speech signal alone – independent of the choice of lexical items or grammatical constructions – conveys some of the social meaning of an utterance. While many studies in the field of expressive speech have sought to characterize the "prosodic profile of emotions" (e.g. Banse & Scherer 1996, Scherer 2003), or how emotions are expressed through a speaker's tone of voice, we set out to characterize the "prosodic profile of politeness".

We conducted a speech production task with 16 native speakers of Korean who spoke short utterances in either *contaymal* (polite or formal

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speech) or *panmal* (informal speech). In our analysis, we focus on three dimensions of phonetic differences between these politeness registers: First, we analyze aspects of speech rate, pauses and fillers. Second, we analyze aspects of pitch and pitch variability. Third, we analyze voice quality. Prior studies on phonetic aspects of politeness have each focused on only a limited amount of different phonetic measurements (e.g. Ofuka 2000, Ohara 2001, Ito 2004, Shin 2005). This study seeks to provide a more holistic perspective on the phonetic and acoustic correlates of politeness by taking several phonetic dimensions into account.

Investigating vocal aspects of politeness is important for many reasons. First, it has practical applications, such as in speech synthesis or second language teaching. If specific vocal characteristics correlate reliably with different politeness registers, one can implement these phonetic dimensions in computer speech and one can teach these phonetic dimensions in classroom contexts. The possible significance of vocal aspects of politeness in second language acquisition is highlighted by a study of Ogino and Hong (1992). These researchers found that sentences uttered by learners of Japanese with the intention of being polite were actually judged as polite by only about 50% of Japanese native speakers. Finding out what exactly the phonetic parameters of politeness are might help in improving this score and promoting intercultural understanding.

Finally, a phonetic study of politeness has the advantage of relating to concrete physiological and acoustic parameters which can be connected to biological hypotheses of voice production (e.g. Ohala 1983, 1984, 1996). Such a connection cannot be made when focusing solely on morphosyntactical and lexical differences between politeness registers. In the long run, these connections might feed back into theoretical notions of politeness.

2. Background

2.1. Phonetic aspects of politeness

The vocal parameter "fundamental frequency" (f_0, the acoustic correlate of pitch) has received most attention in phonetic studies of politeness. In a study on Japanese, Ohara (2001) found that female speakers tended to express politeness by raising average f_0, whereas male speakers avoided the use of an elevated f_0. The study suggests that this might be because a high-pitched voice is associated with femininity. Shin (2005) shows that – differently from Japanese speakers – female Korean speakers tended to lower their average f_0; male speakers showed only little to no variation in pitch.

These findings can be related to the "frequency code" as formulated by Ohala (1983, 1984, 1996), a hypothesis which states that high pitch is associated with subdominance and low pitch with dominance in all kinds of mammals, including humans. If this hypothesis can be transferred to politeness, one would expect an increase in pitch when speaking to superiors. In this regard, Japanese women behave in line with the frequency code hypothesis, Korean women do not (Shin 2005). However, the Korean data was based on only very few speakers. We therefore intend to extend this work by recording a larger number of speakers and by doing so, we hope to give patterns of pitch differences in male speech a greater chance to emerge.

Ofuka and colleagues (2000) took a different approach to vocal politeness. Instead of looking at overall f_0 differences, they looked at f_0 movement on the final vowel of Japanese utterances and found that the direction of f_0 movement was used consistently to indicate politeness registers. In yet another study, Ito (2004) notes that aspiration noise (which could be a reflection of breathiness) is perceptually associated with relatively more polite speech in Japanese. However, as noted by Ito (2004: 216) herself, "We cannot see what kind of voice quality has the most effect on changing the impression of politeness." By looking at several voice quality parameters in this study, we hope to further understanding of which voice quality parameters matter for politeness distinctions.

2.2. Politeness in Korean

The Korean language is widely known for its extremely elaborate system of honorification:

> "No doubt in all societies, people have some awareness that different ways of speaking can convey different social messages. In the Korean case, however, this kind of awareness is obviously more explicit and more specific than in most other societies." (Yoon 2004: 204)

The grammatical system forces speakers of Korean to make choices for every single sentence depending on the relationship with their interlocutors (Yoon 2004: 194). The large variety of differentiated linguistic forms means that in Korean, one can hardly say anything without choosing between options regarding different levels of politeness. This was one of the main reasons why we chose Korean as the language for our phonetic analyses: we thought politeness distinctions would be easier to elicit and expressed more readily in a language and culture where politeness is so entrenched.

Also, Korean provided us with an easy way to operationalize politeness for the purposes of this study: We decided to define politeness as the

distinction between formal speech to superiors (*contaymal*) and informal speech to inferiors and peers (*panmal*) (for a discussion of the lexical and morphosyntactic differences between these speech styles see also Sohn 2001: 407-417). By sticking to this culturally recognized distinction rather than theoretical notions such as "positive" or "negative" politeness (Brown & Levinson 1987), we avoid the long-lasting controversy surrounding politeness theory (see e.g. Xie et al. 2005) and we investigate categories which are known and meaningful to our Korean participants.

3. Methodology

3.1. Participants

Nine female and seven male speakers (age: 21-31, median: 23.5) were recruited via internet forums and a local Korean church community located in Cologne, Germany. The speakers volunteered to be recorded and received ten euros for a thirty minute session. Of the sixteen speakers, all but three were from Seoul metropolitan area and reported to speak standard Korean. At the time of the recording, all participants had resided in Germany for a mean time of four years and all but one reported to use Korean on a daily basis.

3.2. Procedure and materials

Participants were seated in a sound-proof booth at the Institute of Phonetics, University of Cologne and were informed about the procedure by a native speaker of Korean. Instructions were also presented in written form (Hangul) on a computer screen. After reading out a newspaper extract to make them acquainted with speaking into the microphone, each participant performed two different tasks. First, a Mailbox Task was performed in which the participants were given a note in paper format. They had to use the main points of this note (e.g. "meeting at 10.30 am, in front of Starbucks") to formulate a coherent message which they had to leave on an imaginary cellphone mailbox (cf. the task in Shin 2005). Second, a verbal version of the Discourse Completion Task (cf. Byon 2006 for a written version) was performed in which speakers were given contexts which served as a basis for initiating role-played dialogues.

All contexts and written materials except the note in the Mailbox Task were presented on a computer screen using Microsoft PowerPoint. Through a window in the booth, the researchers maintained eye-contact with the participants who were free to ask clarification questions at any time. As soon as the participants read and understood a context passage, they gave a visual signal through the window and a picture of the imagined interlocutor appeared on the screen inside the booth. 2200ms after display of the picture,

participants heard a beep which served as a signal for participants to deliver their response.

Each context appeared in slightly different versions in a *panmal* and a *contaymal* condition. In the Mailbox Task, there were two contexts. One involved leaving a message on a mailbox about an appointment, the other involved leaving a recipe on a mailbox. In the Discourse Completion Task, there were five different contexts: requesting a letter of recommendation (*contaymal* condition) from a professor or a language textbook from a friend (*panmal* condition); giving an excuse for coming too late; giving directions; correcting a mistake; congratulating someone on a music performance.

The Discourse Completion Task has often been criticized with respect to its ecological validity (Bodman & Eisenstein 1988, Bardovi-Harlig & Hartfold 1993, Yuan 2001). It has been argued that the results do not reflect real language patterns and heavily depend on the participants' role-playing abilities. The pictures presented after each context passage served to counteract these methodological confounds. These pictures depicted either elderly and authoritative-looking or else young and casual-looking male interlocutors, i.e. people with whom a Korean speaker would unambiguously use either *contaymal* or *panmal*. This made it easier for our participants to switch between politeness registers.

3.3. Recordings

All recordings were done via a head-set microphone AKG C420 (linear characteristic) with 48kHz/16bit sampling. The distance and orientation of the actors to the microphone, as well as the input level of the sound recording, was held constant. For each participant, a whole session was recorded continuously but we excluded material before restarts from subsequent analysis.

4. Results and analysis

In general, participants accustomed to the task easily and used all morphosyntactic markers of *contaymal* and *panmal* appropriately. In total, we collected 2.6 hours of spoken material. All phonetic analyses were conducted with Praat (Boersma 2001); statistical analyses with SPSS 16.0.0. Analyses are based on both tasks (Discourse Completion and Mailbox) for the acoustic analysis but only on the Discourse Completion Task for the analyses of pauses, fillers and speech rate[1]. Data were analyzed using analysis of variance (ANOVA) across participants (F_1) and items (F_2) with gender as between-participants factor.

[1] These phonetic dimensions are highly susceptible to differences in "reading fluency" and are therefore likely to be influenced by the note in the Mailbox Task.

4.1. Pauses, fillers and speech rate

We used a pause detection script by Mietta Lennes (http://www.helsinki.fi/~lennes/praat-scripts/) which automatically labelled all silent pauses which are longer than 200ms. It is common practice to take 100ms as the minimum threshold for pauses (e.g. Butcher, 1981; Trouvain, 1999; Trouvain & Grice, 1999) but we decided to go with comparatively large 200ms in order to avoid interpreting the closure durations of Korean tensed stops as pauses. All results of the script were checked manually.

In addition to silent pauses, we analyzed filled pauses. These were further classified into fillers (such as *ahh* and *ohh*), "hissing sounds" and the discourse particle *yey*[2]. All our analyses are based on pause and filler *rates*: for the participants analysis, we divided the sums of pauses and fillers through each speaker's average speaking duration. For the items analysis, we divided the sums through the average speaking duration of each item. We measured speech rate by sentences per second, words per second and syllables per second. We measured articulation rate by syllables per second, excluding pauses.

There was no relevant difference in respect of silent pauses between *contaymal* and *panmal*, either by participants ($F_1(1,14)=1.529$, $p=0.237$) or by items ($F_2(1,8)=2.376$, $p=0.162$). However, there was a significant difference in respect of filled pauses between the politeness registers ($F_1(1,14)=6.825$, $p=0.02$; $F_2(1,8)=7.907$, $p=0.023$): the rate of fillers is almost twice as high in the *contaymal* (0.09±0.026 fillers/second[3]) as in the *panmal* condition (0.05±0.028 fillers/second).

There also was a significant difference in regard to hissing sounds; these were more than twice as likely to occur in *contaymal* speech (0.034±0.012 hissing sounds/second) as in *panmal* speech (0.013±0.018 hissing sounds/second); both by participants ($F_1(1,14)=7.556$, $p=0.016$) and by items ($F_2(1,8)=15.096$, $p=0.005$)[4]. These sibilant-like hissing sounds have a large amount of energy in the higher frequency range and are produced with an ingressive airstream. This airstream is often sucked in laterally (to the side of the tongue).

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[2] We are aware of the fact that *yey* and the pauses and fillers can occur in different contexts and serve different pragmatic functions. However, our quantitative approach does not look into these differences and treats *yey*, fillers and pauses alike.

[3] All results will be reported with ± 2 standard errors.

[4] Interestingly, there was a near-significant interaction between gender and attitude by items ($F_2(1,8)=5.076$, $p=0.054$) but not by participants ($F_1(1,14)=2.886$, $p=0.111$). Across items, the hissing sounds were more used by men in the *contaymal* context than by women. Separate paired t-tests reveal that the hissing sounds are more reliably used by men than by women to indicate politeness (for men: $t_1(6)=2.291$, $p=0.062$; for women: $t_1(8)=1.130$, $p=0.291$).

The discourse particle *yey* was used only in the *contaymal* condition ($F_1(1,14)=4.897$, $p=0.044$, $F_2(1,8)=53.055$, $p<0.001$). Also, it was only used by men, as shown by an interaction between the factors gender and attitude ($F_1(1,14)=4.897$, $p=0.044$, $F_2(1,8)=53.055$, $p<0.001$). It seems to be the case that the use of *yey* to indicate politeness registers is a gender-specific strategy.

Speech rate as measured by words per second is significantly slower in the *contaymal* than in the *panmal* condition ($F_1(1,14)=18.048$, $p=0.001$; $F_2(1,8)=56.709$, $p<0.001$). However, when one looks at speech rate as measured by syllables per second as well as articulation rate (syllables per second without pause time), this difference disappears (speech rate: $F_1(1,14)=0.333$, $p=0.573$; $F_2(1,8)=1.540$, $p=0.25$; articulation rate: $F_1(1,14)=0.013$, $p=0.91$; $F_2(1,8)=0.699$, $p=0.427$). Therefore, participants utter more words in a given amount of time when speaking *contaymal* as compared to *panmal*, but they do not utter relatively more syllables.

4.2. Pitch

We analyzed the fundamental frequency means and standard deviations of each trial with Praat's automatic pitch-tracking algorithm (with standard autocorrelation settings of Praat version 5.1.23). The mean f_0 and median f_0 were lower in the *contaymal* condition by about two to three semitones. This difference was significant by participants ($F_1(1,14)=33.515$, $p<0.001$) and items ($F_2(1,12)=9.863$, $p=0.009$). The f_0 standard deviations were also lower in the *contaymal* condition than in the *panmal* condition , however only for participants ($F_1(1,14)=14.344$, $p=0.002$; $F_2(1,12)=0.001$, $p=0.98$).

4.3. Intensity

Intensity is the acoustic correlate of perceived loudness. Mean intensities were lower in *contaymal* speech than in *panmal* speech, both by participants ($F_1(1,14)=17.220$, $p=0.001$) and items ($F_2(1,12)=5.032$, $p=0.045$). This difference was statistically significant but extremely small in magnitude: in our data set, *panmal* speech was only 1dB ± 0.235dB louder than *contaymal* speech. This difference is therefore unlikely to play a great role for the impression of politeness on the part of the listener.

4.4. Voice Quality

Voice quality refers to "the quality of a sound by which a listener can tell that two sounds of the same loudness and pitch are dissimilar" (ANSI 1973). We measured perturbation by amplitude (shimmer), perturbation by fundamental frequency period (jitter), and the differential energy of the first harmonic to the second harmonic (H1-H2).

We found a significant decrease in shimmer ($F_1(1,14)=23.928$, $p<0.001$; $F_2(1,12)=11.313$, $p=0.006$) and jitter ($F_1(1,14)=16.375$, $p=0.001$;

$F_2(1,12)=6.332$, $p=0.027$) in the *contaymal* condition. In this condition, there also was a significant increase in H1-H2 ($F_1(1,14)=15.444$, $p=0.002$; $F_2(1,12)=16.143$, $p=0.002$). This difference in H1-H2 is the only acoustic parameter where a significant interaction effect between gender and politeness register occurred ($F_1(1,14)=16.38$, $p=0.001$; $F_2(1,12)=17.176$, $p=0.001$). Whereas women clearly increased H1-H2 when speaking *contaymal*, the H1-H2 values of men did not change to the same extent, as can be seen in figure 1.

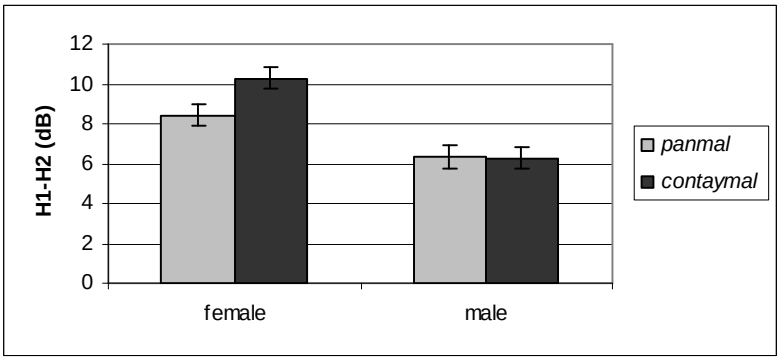

Figure 1: H1-H2 values for female and male participants in relation to politeness condition

5. Discussion

5.1. Pauses, fillers and speech rate

The fact that fillers but not silent pauses differed consistently between the politeness registers suggests that for Korean, audible fillers are more likely to acquire social meaning than non-audible speech pauses. The hypothesis that in Korean, audible fillers are more relevant for politeness than silent pauses generates predictions which can be tested in subsequent perceptual experiments. In general, we interpret the increase in fillers as a stylized way of marking insecurity.

Our speech rate analyses suggest that words per second, which is sometimes used as a measure of speech rate, might not be an apt reflection of relevant rate differences. In Korean, words have consistently more syllables in *contaymal* than in *panmal* speech[5] (for participants: $F_1(1,14)=30.164$, $p<0.0001$; for items: $F_2(1,8)=35.083$, $p<0.0001$). This

[5] To our knowledge nobody has yet investigated whether differences in word length have an effect on the perception of speech rate.

results in speech rate differences when words per second are measured which disappear when syllables per second are measured.

5.2. Pitch

The lowering of fundamental frequency in Korean polite speech has also been recognized by Shin (2005). This study confirms that f_0 in *contaymal* speech is lower than in *panmal* speech. This is a different pattern from Japanese (e.g. Ohara 2001). If Ohala's frequency code (1983, 1984, 1996) applies to human politeness distinctions (as is suggested by e.g. Shin 2005), it would predict speech to superiors (as is the case with *contaymal* speech) to be higher in average pitch than speech to peers. Korean does not follow this prediction. This might show that the frequency code cannot be directly applied to politeness phenomena.

Even though it was not our intention to analyze the data in regard to Politeness Theory, it is also interesting to relate our pitch results to a comment made by Brown & Levinson (1987: 267-268):

> "We predict (...) that a sustained high pitch (maintained over a number of utterances) will be a feature of negative-politeness usage, and creaky voice a feature of positive-politeness usage, and that a reversal of these associations will not occur in any culture."

To the extent that politeness usage in Korean can be analyzed as reflecting mainly negative politeness (or "politeness-as-deference", cf. Pinker 2007) rather than positive politeness ("politeness-as-sympathy"), our data seem to contradict Brown & Levinson's prediction[6].

5.3. Voice Quality

Voice quality measures are notoriously difficult to directly relate to differences in perception and physiological settings. Our clearest results are exhibited by the harmonics-to-noise ratio which has been taken as an indicator of breathiness (Klatt & Klatt 1990): women use a relatively more breathy-sounding voice when speaking *contaymal* than when speaking *panmal*. Men do not seem to employ breathiness in a similar way; they do not exhibit consistent differences between the two politeness registers.

This is interesting because in other languages, a breathy voice quality has been found to be associated with "femaleness" or "effeminacy". In American English (Klatt & Klatt 1990) and Spanish (Mendoza et al. 1996),

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[6] However, one should note that at the time this prediction was made, the necessary exploratory work of looking at a number of different languages and their respective vocal patterns of politeness had not been conducted. One has to look at more languages before universalist hypotheses like these can be made.

it has been found that female voices are relatively more breathy than male voices. Sulter and Peters (1996) found that this difference in "breathiness" can be a reliable cue for gender discrimination. For Dutch, van Borsel and colleagues (2009) found that breathy vowels are perceived as being more feminine than modal vowels uttered by the same speaker.

We currently think that because breathiness has been repeatedly found to be associated with femaleness, it is a politeness strategy that is not available to male speakers who probably do not want to sound "effeminate". This is similar to the Japanese men in Ohara's (2001) study who did not employ a high-pitched voice in polite speech. It might be the case that breathiness, by virtue of being associated with femininity, gains a kind of taboo status for men[7].

Finally, it should be noted that in Johnstone & Scherer (1999), a decrease in jitter was perceptually associated with an increase in perceived tension of the speaker. It might be that the decreased jitter values in *contaymal* (and possibly the decreased shimmer values as well) are perceived as indicating 'tensedness' or insecurity of the speaker.

6. Conclusions

When one takes a broader perspective on the different phonetic parameters we measured, one realizes a certain pattern: a number of measures which are taken to indicate perturbation of the speech signal are decreased. Perturbation by period (jitter), perturbation by amplitude (shimmer) and pitch variability are all decreased. Together with the slight decrease in loudness, we think that this creates the impression of "dampness", a speech style which is more subdued and monotonous than modal voice.

This characterization is related to the finding that the variability of an acoustic signal leads to differences in the perception of loudness. Moore et al. (1998) and Neuhoff et al. (1999) point out that pitch changes and changes in loudness can influence each other and musicians report that one of the functions of vibrato, which is a relatively slow (3 to 8 Hz) modulation of the fundamental frequency of a voice or an instrument, is to make a sound appear more expressive or loud (see also Fletcher & Munson, 1933). A decrease in pitch variability leads to a decrease in perceived loudness and perceived expressiveness (see e.g. Traunmüller & Eriksson 1995). The same could apply to differences in voice quality; however, we currently do not know of any studies which investigate possible relationships between perceived loudness and differences in perturbation measures.

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[7] However, one would need to test the way breathiness is produced and perceived in Korean to substantiate this claim.

To summarize, our data show that politeness affects many phonetic parameters, ranging from intensity and pitch to speech rate and voice quality. Taken together, these parameters and the differences in speech pauses and fillers produce audible phonetic differences between the politeness registers. Subsequent studies can test the perceptual relevance of these phonetic differences and they can investigate how much each parameter contributes to the auditory impression of politeness.

Traditionally, the field of politeness studies has focused on lexical and morphosyntactic aspects of politeness. These studies are very important to demonstrate how politeness is realized in everyday interactions; however, by not studying "vocal politeness" we miss a certain part of what politeness is. Instead of relying solely on hedging constructions, honorific markers and lexical items, politeness is simultaneously and redundantly expressed in the voice. Phonetics is thus an aspect of politeness which deserves more attention to arrive at a richer understanding of politeness and how it is realized in different cultures.

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