

**T**HE CONTRIBUTION OF TONAL SCALING TO  
THE PERCEPTION OF POLITENESS IN **C**ATALAN

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# ABSTRACT

It has been proposed in the literature that prosody plays a role in the expression of politeness. The present paper attempts to explore the contribution of tonal scaling to the expression of paralinguistic meanings. More specifically, it examines the relationship between pitch height and the degree of perceived politeness in yes–no questions in Central Catalan. Studies on the biologically–determined use of pitch (Gussenhoven, 2002; Nilsenova, 2006; Ohala, 1984, 1996) claim that high or rising F0 can convey politeness. Experimental studies have found that use of a higher pitch range or use of higher peaks is typical of polite utterances (Álvarez & Blondet, 2003; Maekawa, 1999; Orozco, 2006). Yet, other studies (Culpeper, 2005) have shown that higher pitch can also be associated to impoliteness. In order to test whether pitch height correlates positively or negatively with politeness, two continua were created by gradually increasing and decreasing the final boundary tone of a rising and a falling yes–no question. 20 native speakers of Central Catalan took part in the experiment. They had to compare stimuli in pairs and also rate the degree of politeness that each stimulus conveyed in isolation. Results obtained in both tasks and for both continua point to the same direction: the degree of perceived perception gradually decreases when the pitch height of the final boundary tone is increased.

# 1. INTRODUCTION

The study of the linguistic expression of politeness has traditionally focused on lexical choice and on morphosyntactic aspects of the utterance, such as the use of indirect structures, formal forms of address, or conventionalized politeness markers (see Watts, 2003, for a classification of expressions and a discussion of their value). Even if this is a less explored area, it is widely acknowledged that prosody (intonation or use of pitch<sup>1</sup>, rate of speech, voice quality, among other elements) contributes to the perception of politeness in different languages. Although they do not dwell much in it, Brown and Levinson (1987) list exaggeration (of interest, approval, sympathy with the hearer) as a positive politeness strategy which may be implemented by means of “*exaggerated intonation, stress, and other aspects of prosodics*” (p. 104). It is unclear, though, what “exaggerated intonation” actually consists in. More broadly, Wichmann and Cauldwell (2003) refer to the belief that emotions can be revealed by certain acoustic parameters, such as pitch, loudness and speed, either globally (stretching over the utterance) or locally. Chen (2005) talks about the *paralinguistic* meaning of intonation, i.e. degrees of a given meaning can be conveyed by gradual changes in pitch range or peak alignment. Crucially, this type of meaning is gradient, not categorical.

Research conducted on the contribution of prosody to the perception of politeness is not very extensive. Studies so far have focused on peak alignment (Maekawa, 1999), choice of nuclear configuration type (Estrella-Santos, 2007; Payà, 2003), F0 movements (final rising or falling boundary tone), rate of speech (Ofuka, McKeown, Waterman, and Roach, 2000; Payà,

<sup>1</sup> Throughout the paper, terms such as "pitch", "pitch height", "pitch scaling", and "pitch range" will be used. A brief definition is provided here for those concepts. Rate of vibration of the vocal folds determines pitch, "the auditory sensation of tonal height" (Gussenhoven, 2004:1). Higher frequency of vibration of the vocal folds (higher F0 or fundamental frequency) results in higher pitch, and it is expressed in hertz (Hz). "Pitch height" is, then, determined by vocal fold vibration. "Pitch scaling" refers to changes in pitch height. "Pitch range" refers to the distance or span between the lowest and the highest F0 values (a valley and a peak, respectively) observed in an utterance. Pitch range is automatically modified when pitch height increases or decreases at one point in the utterance but remains unchanged in the rest. None of the studies reviewed in this paper manipulate "register". By varying register, a whole contour is raised or lowered in the F0 space. This will not be examined here. For more information on these concepts, see Hualde, 2005; Gussenhoven, 2004; Prieto, 2002a, 2002b.

2003), pitch range (Orozco, 2006), and pitch height together with F0 variability (Álvarez and Blondet, 2003). Some studies assess the contribution of prosody vis-à-vis lexical choice or morphological configuration (Estrella-Santos, 2007; Maekawa, 1999; Payà, 2003).

The relationship between prosodic aspects and politeness in Catalan has been studied by Payà (2003). Specifically, she examined the contribution of choice of pitch contour type and speed of delivery to the perception of politeness. She analyzed the interpretation of utterances with conflicting prosodic and non-prosodic elements (the former conveying politeness but not the latter, or vice versa). By so doing, she wanted to isolate prosodic strategies and assess their contribution to the perception of politeness. In her study, she used the two common contours for yes-no questions in Catalan: the falling contour as the most polite, and the rising one as the least polite. As regards lexical and morphological choice, one of the utterances was clearly impolite (*Vols venir d'una puta vegada?* 'Do you want to fucking come?'), while the other was clearly polite (*Que li faria res venir un momentet?* 'Would you-formal mind coming for a second?'). In her stimuli, choice of pitch contour entailed some variation in duration and intensity as well. The results showed that the appearance of any impolite cue (whether prosodic or non-prosodic) overrode the rest and, thus, biased the hearer to an impolite interpretation.

Other studies have explored the effects of intonation on politeness in another Romance language, Spanish, through both production and perception studies. In Álvarez and Blondet (2003), two Venezuelan Spanish interrogatives were compared: an informational wh-question and a "polite sentence" (indirect command). Sixteen utterances were recorded (two interrogatives repeated once by eight women) and measures were taken for each syllable in them. The comparison revealed that the polite yes-no question displayed more F0 variability (more peaks and valleys), whereas the wh-question was rather flat. Similarly, the authors argued that there was a difference in pitch height: the polite yes-no question being higher than the wh-question. Álvarez and Blondet (2003) hypothesize that differences would be found in the length of syllables too, so other prosodic elements may be having an effect. In fact, the two interrogatives examined were not directly compared because they were of a different type: the polite sentence was a yes-no question (*¿Me compras el*

*periódico?* ‘Can you buy me the newspaper?’), whereas the question was a wh-question (*¿Cómo te fue el paseo?* ‘How was your walk?’). In addition, the former contained eight syllables, while the latter was made up of nine syllables. Differences observed between the two interrogatives might be due to the linguistic material in them.

Orozco (2006) studied the prosodic realization of interrogative requests in Mexican Spanish. She asked participants to read three sentences<sup>2</sup> (printed without punctuation signs) in three different ways: in a “normal”, “dry”, and “kind” way (p. 6). She compared the neutral vs. polite realizations by gathering FO measurements at several points: initial (first syllable) and final boundary tone; beginning, mid point and end of the stressed syllable; as well as mid points of the pretonic and the posttonic syllables. As far as pitch contour is concerned, no differences between neutral vs. polite utterances were observed. However, polite requests tended to begin with a %H boundary tone (neutral ones were more often realized with a %L boundary tone). Another difference observed concerned pitch range: polite expressions were produced with an expanded pitch range. This difference became more evident when analyzing women’s speech separately: women used a wider pitch range than men in their polite requests.

In a perception study, Estrella-Santos (2007) addressed the relationship between pitch contour type and politeness in a variety of Spanish in contact with Quechua. Estrella-Santos noted that Ecuadorian Andean Spanish speakers used both morphological and prosodic cues to determine the degree of politeness of requests. The variety of Spanish she studied exhibits a polite request structure which is actually a calque of a Quechua structure containing a benefactive verb (*dar* ‘to give’). Both the morphological and the prosodic Quechua configuration made their way into Spanish. In her experiment, she used Spanish imperatives (with their specific prosody and also with the Quechua intonational configuration) and Quechua-borrowed request structures (with their own prosody and with the Spanish imperatives’). When

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<sup>2</sup> The sentences were: *Podrías apagar tu cigarro* (‘Could put out your cigarette?’), *Te molesta si fumo* (‘Do you mind if I smoke?’), *Échame una mano en la cocina* (‘Help me out in the kitchen’). The first two sentences have been rendered as questions in English but, strictly speaking, since they did not include punctuation marks in Spanish, they could be interpreted as either interrogative or declarative sentences.

comparing the Quechua calque (e.g. *Deme pasando la sal* 'Benefactive give + passing me the salt') to the Spanish imperative (e.g. *Páseme la sal* 'Pass me the salt'), Ecuadorian speakers preferred the former over the latter in all cases. When intonation was held constant (that of the Spanish imperative), the Quechua structure with the benefactive verb was always preferred over the Spanish imperative. When the Quechua intonation was superimposed on both types of morphological structures, the Quechua structure was preferred over the latter (69% vs. 31%). Finally, when structures exchanged their intonation (the Spanish imperative was presented with the Quechua intonation and the Quechua structure with the Spanish intonation), intonation seemed to yield better results than morphology (53.5% vs. 46.5% respectively). In general, then, the Quechua-borrowed intonational contour seems to play a crucial role in the perception of politeness in Ecuadorian Andean Spanish.

In the Japanese culture, politeness expressed both linguistically and attitudinally is considered of utmost importance (see, for example, Ide, 1982), and its expression has been studied extensively. As regards the contribution of prosody to it, Ofuka et al. (2000) explored the relationship between speech rate and use of high vs. low pitch, and the perception of politeness. The authors recorded several speakers interpreting a short scene with varying interlocutors, which compelled them to use three different speaking styles: "polite", "casual" and "authoritative". In the variety of Japanese investigated in this study, pitch pattern is very constricted, allowing variation only at the end of the sentence. The analyses of the utterances revealed that slower speech rate and total duration of utterances correlated positively with politeness; however, there was no consistency across speakers in the use of higher vs. lower pitch to signal polite vs. casual speech. Only F0 movements at the end of the utterance (but not F0 level, F0 range or F0 rate of change) were used consistently to mark different speaking styles. The two features that were used consistently in production (F0 movements at the end of the utterance and speech rate) were further examined in two separate perception experiments. The first perception test included three variables: speaking style (polite vs. casual), final vowel duration (short vs. long), and F0 movement type (rise vs. fall). Final vowel duration was found to play a crucial role (short vowels being perceived as more polite), whereas F0 movement remained less influential. Final rises were evaluated more positively than final falls, but the difference

failed to reach significance. The second perception test manipulated overall speech rate and it was observed that politeness ratings depended on participants' own speech rate.

Maekawa (1999) examined the effect of pitch peak alignment and question particle choice in another variety of Japanese, *Kumamoto* Japanese, characterized by a 'wandering H(igh)' tone (any of the syllables in an accentual phrase can receive the high pitch peak). In addition, Kumamoto Japanese allows two different final boundary tones in questions, either falling or rising. This freedom of alignment, as well as the different options of the final boundary tone, results in a variety of contours which are equally grammatical, but which vary as to the degree of politeness they convey. In a perception experiment, Maekawa found that contours displaying a later peak (in the last syllables of the utterance) or a rising boundary tone received higher politeness scores than those with an early peak (toward the beginning of the utterance) or ending in a falling cadence. The effects of peak alignment were statistically significant, independently of the use of the particles compared. With this study, Maekawa confirmed a model of the way in which politeness is affected by intonation which he had proposed in previous works: the position of the last intonational peak, together with its magnitude, determines the degree of politeness expressed by the utterance. The later the peak and the larger its prominence, the higher the degree of politeness perceived.

In a nutshell, the studies summarized above do explore the prosody-politeness interface, and they tend to focus on intonational contour choice, speech rate, pitch height, pitch range, pitch variation, and pitch peak alignment. The same is true of studies on impoliteness.

Culpeper, Bousfield, and Wichmann (2003) analyzed impolite utterances which aimed specifically at attacking the hearer's face<sup>3</sup>. They observed that prosody was involved in the expression of impoliteness in different ways: by choosing a specific nuclear contour (which determines the illocutionary force of the utterance), by allowing the conversation to continue or blocking it (by

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<sup>3</sup> It is important to understand that impoliteness is not simply absent or failed politeness. Impoliteness constitutes a deliberate attempt to damage the hearer's face, according to Culpeper (2005) and Culpeper et al. (2003).

using rising or falling contours respectively), or by using extreme loudness or pitch in order to invade the hearer's auditory space. In a study of (theoretically fake) impoliteness as entertainment (as exhibited in the quiz show *The weakest link*), Culpeper (2005) confirmed that prosody plays an important role. In his example, the expression of what is considered a polite farewell (“*goodbye*”) is perceived as rude by virtue of its being accompanied by means of “*faster tempo, tense articulation and [...] much higher pitch average*” (p. 53). In addition, the intonation contour comprises a fall from a very high starting point, which, he claims, indicates closure to the hearer and therefore appears as impolite as the hearer is not given the choice to add anything else.

Some of the studies summarized above (Álvarez and Bondet, 2003; Culpeper, 2005; Culpeper et al., 2003, and Orozco, 2006) mention pitch height or range as a means to convey a higher or lower degree of politeness. Interestingly, a biological basis of the use of pitch variation has been posited in the literature. Some authors have endorsed the biological nature of (at least, part of) intonational meaning. Ohala (1984, 1996) suggested the existence of a cross-species phylogenetic use of F0, which he labeled the *frequency code*. According to this view, the current use of pitch in human languages has evolved from a primitive code which relates high or rising F0 and low or falling F0 to basic meanings of “smallness” and “bigness” respectively and to secondary social meanings of “subordination, submission, lack of threat or confidence, politeness” and “dominance, threat, authority, aggression, assertiveness” respectively. Nilsenova (2006) adds the question of age in relation to the frequency code: higher pitch signals that the speaker is either very young or very old, hinting again at a situation of unequal power relations. Similarly, Culpeper et al. (2003) claim that the meanings conveyed by prosody can be “iconic or physiological in origin”. They associate high pitch to “small, young” whereas low pitch is linked to “big, old”. This dichotomy can be extended such that high pitch is associated with deference (“behaving in a ‘small’ way”).

The present study aims at pursuing a line of research that has not received much attention yet. The goal behind it is to explore the pragmatic contribution of pitch scaling. Specifically, we seek to determine how differences in pitch height affect the perception of politeness of interrogative requests in the

Central variety of Catalan in a perceptual experiment, given that some studies have proposed that pitch can be used to convey nuances (other than emphasis) such as politeness or submission. In fact, the study described here is (to our knowledge) the only perception study where pitch height of the final boundary tone of the interrogative stimuli is manipulated in order to assess its contribution to the perception of politeness. Two different hypotheses can be proposed based on the studies just reviewed. Pitch height of the final boundary tone is expected to correlate positively with degree of politeness, based on the claims sustained both in studies on the biological use of pitch and also in some experimental studies reviewed above (Álvarez and Blondet, 2003; Maekawa, 1999; Orozco, 2006). Nevertheless, Culpeper's (2005) study associated higher pitch with impoliteness, so pitch height can also be predicted to correlate negatively with perception of politeness according to that article.

In order to test which of the two hypotheses holds true, 18 synthetic stimuli were created by increasing and decreasing the final boundary tone of two yes–no questions in equidistant steps. Each of the two base questions displayed one of the two possible contours in Catalan: one of the questions ended in a rising boundary tone, whereas the other one ended in a falling boundary tone. Speakers of Central Catalan were asked to judge which of two modified stimuli presented one after the other was more polite in a given situation in a comparison task, as well as to rate the degree to which individual stimuli seemed polite or appropriate to a specific situation on a five–point scale of politeness. A fully–fledged description of the experiment can be found in section 2.

The rest of the article is organized as follows. Section 2 describes the two Catalan contours used in this paper and provides information on the methodology. Section 3 presents and discusses the results obtained. Finally, section 4 summarizes the conclusions.

## 2. METHODOLOGY

### 2.1 Goals of the study

As has been exposed before, this paper deals with the prosody-politeness (phonology-pragmatics) interface. Following studies on the biologically-determined use of pitch and its signification (Gussenhoven, 2002; Nilsenova, 2006; Ohala, 1984, 1996; among others) and studies on the effects of prosody on the perception of politeness (Álvarez and Blondet, 2003; Culpeper, 2005; Culpeper et al., 2003; Estrella-Santos, 2007; Maekawa, 1999; Ofuka et al., 2000; Orozco, 2006; Payà, 2003), the research question is whether pitch scaling modifies the degree of politeness perceived in both falling and rising request interrogatives in Central Catalan. According to studies on the biological codes, it is to be expected that higher final boundary tones elicit higher politeness ratings, and that decrease of the final boundary tone be perceived as a decrease in politeness. Following Álvarez and Blondet (2003) and Orozco (2006), use of a higher pitch range (which is the result of manipulating the final boundary tone while keeping the rest constant) is also expected to correlate positively with politeness. However, studies on impoliteness (Culpeper, 2005) have also shown that higher pitch can be associated to impoliteness. Hence, another possibility is that higher pitch can be associated with impoliteness, rather than politeness.

### 2.2 Catalan yes-no questions

The use of interrogative sentences with the force of requests or commands has been extensively noted in the literature on politeness and speech acts. In her PhD dissertation, Escandell (1988) offered a comprehensive approach to the syntax, semantics and pragmatics of Spanish interrogatives, of which she also described the intonational contours. Escandell claims that “*interrogation functions, then, as a ‘syntactic euphemism’ to avoid the use of closed forms [i.e. forms which do not let the hearer opt out] and the impoliteness associated with them*” (p. 582, my translation). In other words, interrogative

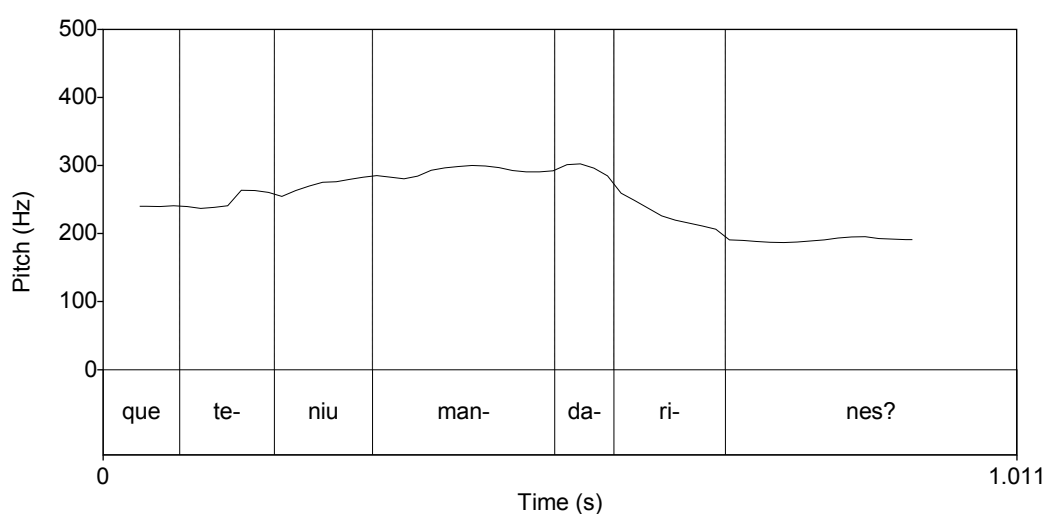
forms can be used whenever the speaker wants to compel the hearer to do something without imposing on him/her. She assumes that interrogative requests are “*intrinsically polite*” (p. 580) by virtue of letting the hearer accept or deject the proposal. Escandell goes on to say that a polite request entails the creation of a fictional situation in which the speaker assumes an inferior position, thus conferring (fictional) authority to the hearer. By so doing, the hearer does not consider the request an imposition, although, through his or her knowledge of the world, s/he knows s/he does not have the authority attributed to him/her and thus interprets the utterance as a polite request (p. 572–573). She then offers a summary of the conditions required for an interrogative to be interpreted as a request (or what she calls an “*impositive directive interrogative*”).

As Bonet (1984), Payà (2003), and Prieto (2001, 2002b) pointed out, yes–no questions in Central Catalan allow two different intonational realizations: the falling (figure 1) and rising (figure 2) contours. Prieto (2001) considers both contours to be unmarked and describes them in the following terms. The falling contour (figure 1) initiates at a relatively high pitch and maintains this height up to the beginning of the last stressed syllable, where the pitch starts to decline and reaches the speaker’s minimum F0 values. Typically, a slight increase in pitch is observable in the syllable prior to the beginning of the decline (Prieto, 2001, 2002a). In Central Catalan, this type of yes–no questions may be introduced by the question particle *que* (Prieto, 2001; Prieto and Rigau, 2007). Following the notation described for Cat\_ToBI (Prieto, Aguilar, Mascaró, Torres–Tamarit, and Vanrell, 2009; for an introduction in English, see Prieto, in press), the falling pattern is transcribed as H+L\* L%.

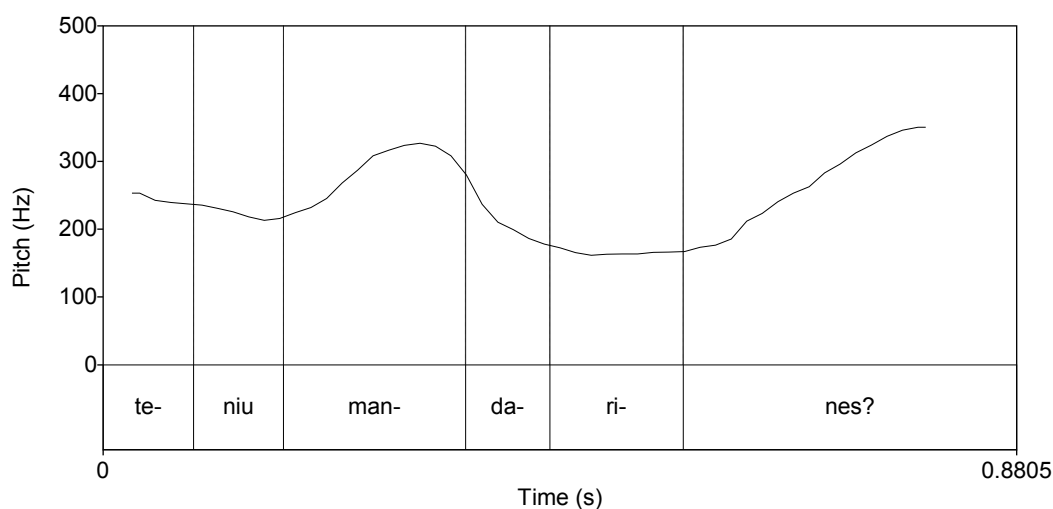
The other class of yes–no questions exhibits a rising contour (figure 2). This contour initiates at a mid tone that decreases mildly over the first unstressed syllables. A low pitch accent is anchored in the first stressed syllable. A rising movement is associated with the following syllable, after which there is a gradual pitch decrease up to the last stressed syllable, where another low pitch accent is anchored. Finally, the contour concludes in a rising melody. This contour, transcribed as L\* HH%, is incompatible with the presence of *que*. For a more comprehensive approach to interrogatives, see Prieto, 2001 (a

dialectological approach to interrogatives), 2002a, 2002b, in press; and Prieto et al., 2009.

In Payà's article (2003), the falling contour is described as the most polite. However, Payrató (2002) claims that both patterns are adequate when the speaker's attitudes are neutral and when the aim of the interrogative is simply to elicit unknown information. However, when the action conveyed in the utterance implies a high benefit for the speaker and a high cost for the hearer, the falling pattern is perceived as less polite or formal than the other. The rising contour is preferred in those cases (Prieto, 2001; Payrató, 2002).



**Figure 1.** Falling yes–no question (*Que teniu mandarines?* ‘Do you have tangerines?’). Note the falling movement (H+L\*) starting in the pretonic “da-” and the final low cadence (L%).



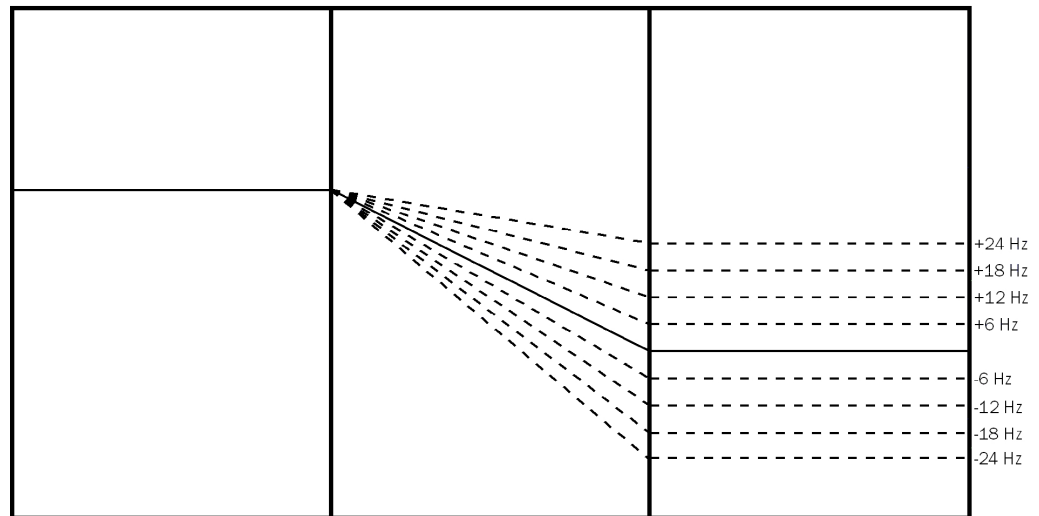
**Figure 2.** Rising yes–no question (*Teniu mandarines?* ‘Do you have tangerines?’). Note the L\* in the stressed syllable “ri-” and the HH% boundary tone.

## 2.3 Stimulus preparation

Two interrogative utterances, one with the falling and the other with the rising contour, were uttered by a young female native speaker of Central Catalan. They were recorded in a sound-proof booth. The content of the sentence was *Tens hora?* ('Do you have the time?') and it was selected so that it remained semantically neutral (following Ofuka et al., 2000): at least in a Catalan environment, asking what time it is is a frequent situation and is not perceived as imposing a high cost on the hearer. This was done in order to prevent the form of the text from biasing participants' responses. For the same reason, no "politeness markers" (such as *please*) or polite forms of address were included.

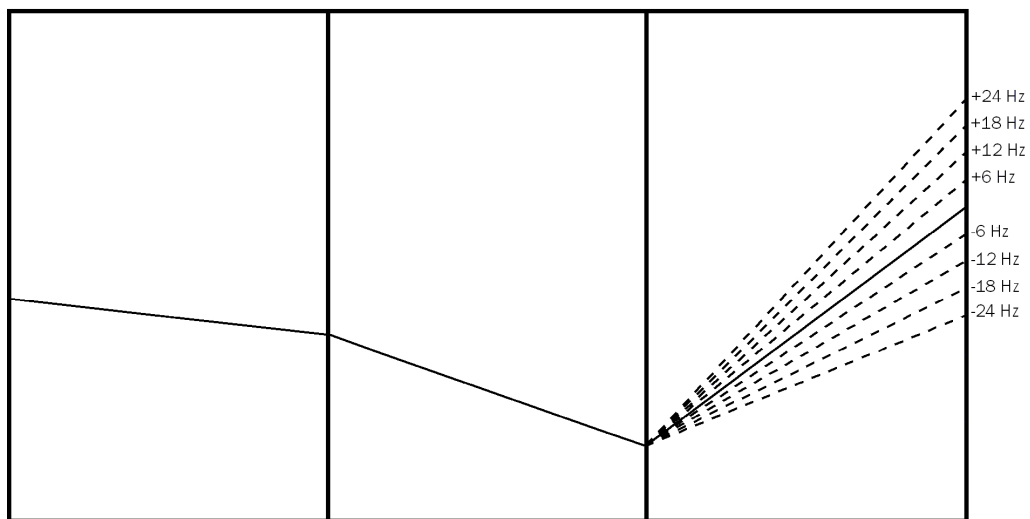
Both interrogatives were manipulated and synthesized using the PSOLA technique in the Praat software (Boersma and Weenink, 2005). Each original utterance was modified so that eight different new versions of each were produced by increasing or decreasing the boundary tone by 6 Hz each time. For the falling interrogative, the modification of the boundary tone affected the pitch accent in order to avoid altering the contour. In the falling contour, the boundary tone typically stays at the same level as the L\* valley reached by the pitch accent. Modifying only the boundary tone would result in a complex contour which is not typical of Catalan falling yes-no questions. The total number of stimuli was 18 (16 new modified ones and the two original ones, which were also synthesized). Figures 3 and 4 show schematic representations of the different stimuli created.

## Falling stimulus continuum



**Figure 3.** Falling yes–no question stimuli.

## Rising stimulus continuum



**Figure 4.** Rising yes–no question stimuli.

## 2.4 Test administration

The test was administered by means of the DmDx Display Software (Forster, 2007). Participants were seated at a laptop wearing headphones. All the instructions were printed on the screen in Catalan and participants were allowed to read them at their own pace. The test consisted of four parts: two comparison tasks and two rating tasks. Each task contained only rising or

falling stimuli. Rising and falling stimuli were not mixed in any task. In the comparison tasks, participants were presented with two stimuli separated by a 1.2 second pause. They had to decide which of the two was the most polite by pressing a key in the keyboard (“1” if the first stimulus was perceived as the most polite; “2” if the second one was the most polite). Each pair was formed by combining every other stimulus in the continuum (e.g. stimulus 1 and stimulus 3; stimulus 2 and stimulus 4, and so on). Contiguous stimuli were not presented together. This yielded 14 pairs of stimuli (seven groupings x two orders), presented five times each ( $14 \times 5 = 70$  pairs in each comparison task). The order of presentation of pairs was randomized for each participant.

The rating task consisted in the presentation of isolated stimuli, whose degree of politeness participants had to rate on a five-point scale (“1” meant “not very polite”, “3” was “adequate”, and “5” corresponded to “very polite”). In Watts’s (2003) terms, “3” would correspond to *politic behavior*, i.e. behavior that is adequate to the ongoing social interaction. There were nine stimuli presented five times each ( $9 \times 5 = 45$  stimuli in each rating task). As in the comparison tasks, stimuli were presented in a randomized order for each speaker.

Before completing these tasks, participants were asked to sign a consent form and fill in a questionnaire. They were asked to briefly define “polite” and “impolite”. The test was administered so that participants first completed the comparison task for a set of stimuli before undertaking the rating task with the same set. The two other tasks were presented in the same order after a short break. Some participants were exposed to falling stimuli first, while others heard rising items first. The total duration of the testing session was approximately 45 minutes.

In all the tasks, the same context was printed on screen and made clear to participants. The context was the following: “Imagine you are taking a walk in the street. A stranger approaches you and after greeting you, s/he asks: ‘do you have the time?’”. In previous studies, context has been found to affect the perception of politeness. Wichmann and Cauldwell (2003) asked students to use their own labels to describe the attitudinal or affective meanings conveyed by a series of sentences, first out of context and later in context. Participants’

perception changed drastically when sentences were embedded in their context. Crucially, sentences in isolation were typically regarded as negative, whereas, when inserted in a context, they received more positive ratings. In another study by the same authors, it was observed that more polite interpretations of utterances emerged in context; thus confirming Watts's (2003) claims that the context is crucial in order to assess the politeness of a particular interaction.

## **2.5 Participants**

20 participants took part in this experiment (7 men, 13 women). All participants were native speakers of Central Catalan living in Central-Catalan-speaking areas, aged 18-44 (mean age: 30). None reported any known hearing impairment.

## **2.6 Statistical analyses**

Non-parametric statistical tests were used to analyze the data. This choice was motivated by the fact that the data sample was small (20 participants) and that responses represented a rank which did not have any clear numerical interpretation (a nominal scale was used).

# 3. RESULTS AND DISCUSSION

## 3.1 Rating Tasks

As described in section 2, participants completed two rating tasks: one with stimuli created from the rising question, and another one with stimuli created from the falling question. They had to judge the degree of politeness of each stimulus presented in isolation by assigning them a number, from 1 to 5.

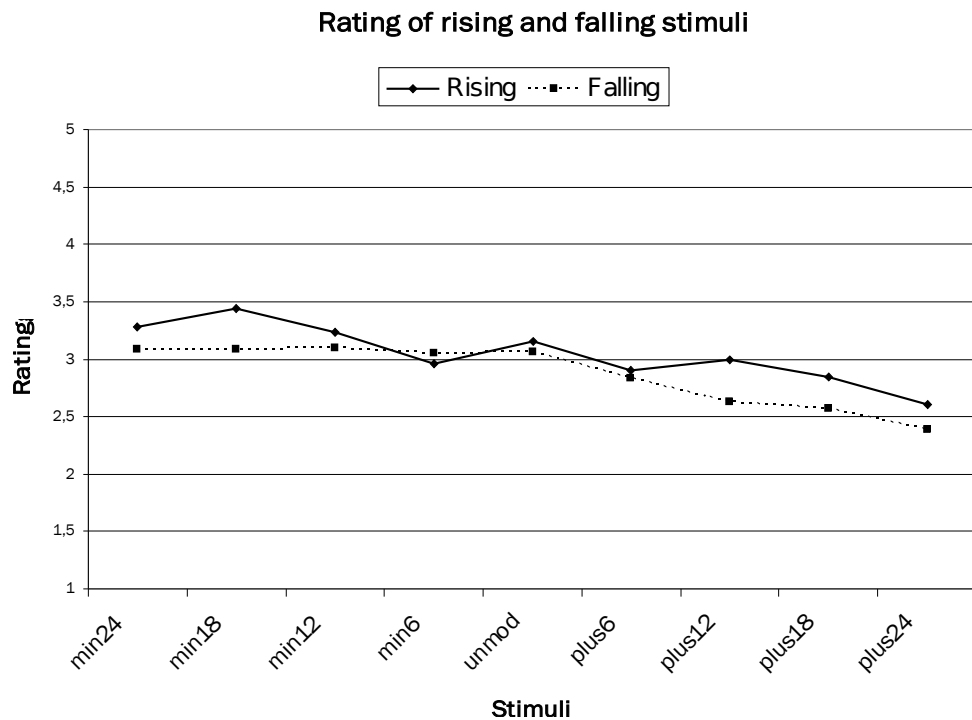
Figure 5 presents the results of the two rating tasks. The graph reflects the mean rating for each of the stimuli in the two continua. The solid line shows the results obtained by the rising stimuli, whereas the dotted one represents those obtained by the falling stimuli. The plot does not resemble the S-shaped function usually expected in identification tasks because the contrast being tested here is not categorical, but gradual.

First of all, note that the average ratings obtained by stimuli from both continua (rising vs. falling) are very similar, suggesting that there may not be differences in the degree of politeness conveyed by the two interrogative contours available in Catalan and that both type of questions (rising and falling) are equally suitable in terms of politeness for a context such as the one presented in the experiment, i.e. a context of low cost for the hearer.

For the falling stimuli, note the flat line from stimulus -24 Hz to the unmodified one, which indicates that participants failed to appreciate differences in politeness among these stimuli. A slight gradual decrease in perceived politeness is observed for the stimuli created by increasing the pitch height of the boundary tone.

As for the line representing the ratings of the rising stimuli, it presents more variation. The general tendency displayed is again a decline in politeness as the pitch height of the final boundary tone rises. Notice that that seems to contradict studies which suggest that rising or high pitch is associated to secondary meanings such as subservience, politeness, etc.

The decline in politeness just described is the general pattern that emerges when all participants are considered together, but there is variation across participants. Some participants did indeed consider lower stimuli as more polite, but some others showed the opposite tendency (politeness increased as pitch height increased). Table 1 provides the mean rating and standard deviation for each stimulus. As seen in figure 5, the difference between the mean ratings for each of the stimuli is small, and the standard deviation is generally high, suggesting variation across responses.



**Figure 5.** Mean ratings for each of the stimuli in the rising and falling continua.

| Stimulus   | RISING STIMULI |                    | FALLING STIMULI |                    |
|------------|----------------|--------------------|-----------------|--------------------|
|            | Mean           | Standard deviation | Mean            | Standard deviation |
| min24 Hz   | 3.28           | 1.15               | 3.09            | 1.32               |
| min18 Hz   | 3.44           | 1.06               | 3.08            | 1.08               |
| min12 Hz   | 3.23           | 1.08               | 3.09            | 1.02               |
| min6 Hz    | 2.96           | 1.10               | 3.05            | 1.05               |
| unmodified | 3.15           | 1.09               | 3.06            | 1.10               |
| plus6 Hz   | 2.90           | 1.15               | 2.84            | 1.09               |
| plus12 Hz  | 2.99           | 1.21               | 2.63            | 1.05               |
| plus18 Hz  | 2.84           | 1.24               | 2.58            | 1.17               |
| plus24 Hz  | 2.60           | 1.26               | 2.39            | 1.22               |

**Table 1.** Mean ratings and standard deviation for each of the stimuli in the continua.

Despite the small differences observable, the statistical analyses carried out revealed some of them to be significant. Two multiple-sample Friedman tests were performed for each set of stimuli and showed significant differences in both continua (for rising stimuli: chi-square = 51.439;  $p < 0.000$ ; for falling stimuli: chi-square = 64.186;  $p < 0.000$ ). To locate the differences along the continuum, Wilcoxon two-sample tests were performed taking two contiguous stimuli in the continuum. The difference between the extremes, and that between the unmodified stimulus and each of the extremes was also submitted to statistical analyses. Results are shown in Table 2. Columns two and four present the p value obtained in the Wilcoxon test for rising and falling stimuli respectively.

| Pair                 | RISING STIMULI |                   | FALLING STIMULI |                   |
|----------------------|----------------|-------------------|-----------------|-------------------|
|                      | p value        | Corrected p value | p value         | Corrected p value |
| min24 - min 18       | 0.206          | n.s.              | 0.924           | n.s.              |
| min18 - min12        | 0.121          | n.s.              | 0.680           | n.s.              |
| min12 - min6         | 0.027          | n.s.              | 0.708           | n.s.              |
| min 6 - unmodified   | 0.152          | n.s.              | 0.934           | n.s.              |
| unmodified - +6      | 0.040          | n.s.              | 0.058           | n.s.              |
| plus6 - plus12       | 0.395          | n.s.              | 0.076           | n.s.              |
| plus12 - plus18      | 0.150          | n.s.              | 0.507           | n.s.              |
| plus18 - plus24      | 0.159          | n.s.              | 0.057           | n.s.              |
| min24 - plus24       | 0.000          | *                 | 0.003           | *                 |
| min24 - unmodified   | 0.334          | n.s.              | 0.890           | n.s.              |
| plus 24 - unmodified | 0.000          | *                 | 0.000           | *                 |

**Table 2.** Results of the Wilcoxon tests carried out on the ratings of contiguous stimuli in each of the continua, the extremes and the mid-point, and the extremes. The new alpha level is 0.0045.

Because multiple comparisons were tested using the same set of data, Bonferroni correction was applied to the p values resulting from the Wilcoxon tests to reduce falsely significant results. This type of correction consists in dividing the alpha level (set at 0.05) by the number of comparisons carried out with the same data set ( $0.05/11 = 0.0045$ ). The new alpha level is 0.0045. Columns three and five indicate the significant results after correction for rising and falling stimuli respectively. Significant results are marked with an asterisk (\*). As shown in the table, the ratings received by stimuli at the ends of the continua (those which had been modified by decreasing or increasing the boundary tone by 24 Hz) were significantly different. Similarly, the comparison between the ratings obtained by the unmodified stimulus and the

one with the highest boundary tone turned out to be clearly significant. Differences in ratings for these two pairs were significant in both continua.

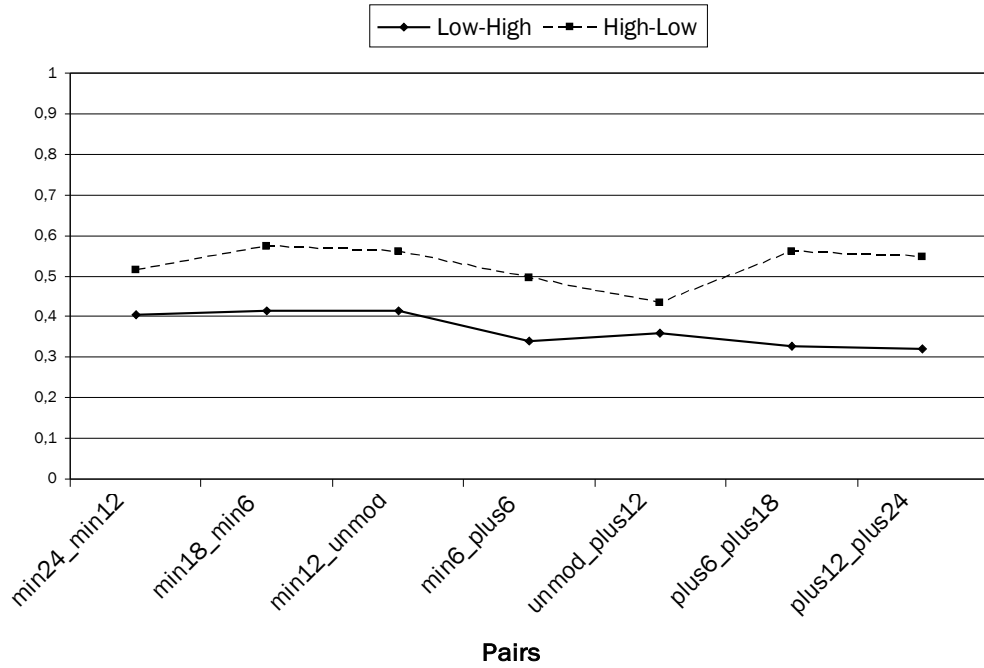
For both continua, significant differences are found between the unmodified stimulus and the stimulus with the highest pitch values in the boundary tone, and between the two extremes of the continua. Other comparisons did not reach significance, neither for the falling stimuli nor for the rising ones. These results confirmed what was ventured above: the higher the pitch in the final boundary tone is, the less polite it is perceived to be. This is consistent with some participants' comments at the end of the perception test session reporting that some of the highest stimuli sounded "irritating, impertinent". This effect is found to be clearly significant when we compare the extremes, and the highest extreme and the mid-point of the continuum.

## 3.2 Comparison tasks

The experiment included two comparison tasks, in which stimuli were presented in pairs (in the two possible orders: the lowest one followed by the highest one, and vice versa). Participants had to determine which of the two stimuli was perceived as the most polite and press a key accordingly. Stimuli from the two different continua were presented separately in different tasks.

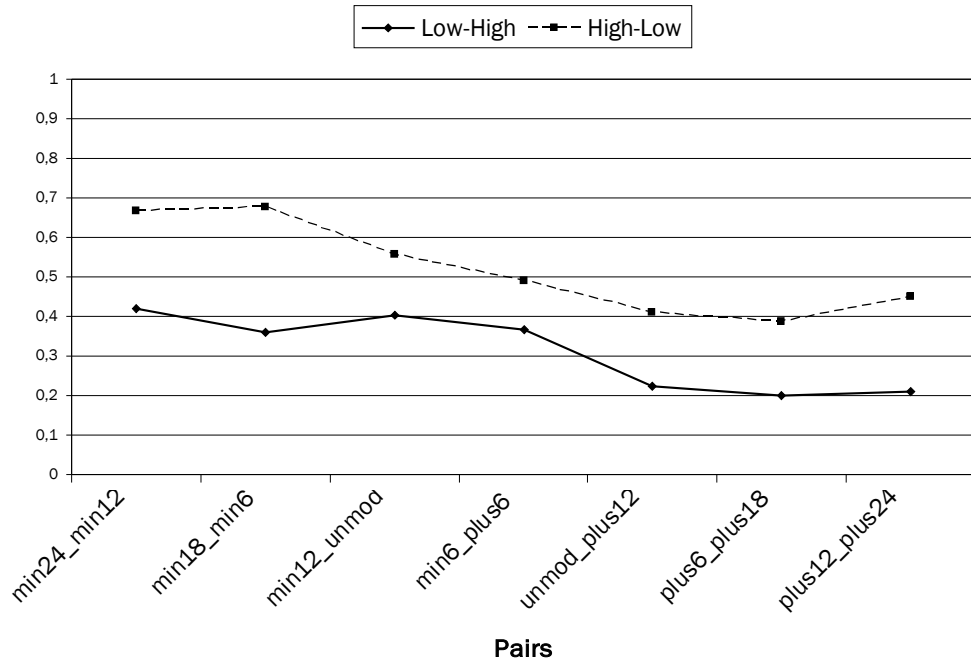
Figures 6 and 7 show the results of the comparison tasks separately for rising and falling stimuli. The solid line represents the answers obtained by pairs formed by the lowest stimulus followed by the highest one (LH order); the dotted line represents the same stimuli in the reverse order (the highest stimulus first, HL order). Responses were coded so that "0" means that the lowest stimulus in the pair was considered the most polite, whereas "1" means the opposite (i.e. the highest stimulus was regarded as the most polite).

### Comparison of pairs of rising stimuli



**Figure 6.** Mean results of the comparison task for rising stimuli (0 = the lowest stimulus is more polite; 1 = the highest stimulus is more polite).

### Comparison of pairs of falling stimuli



**Figure 7.** Mean results of the comparison task for falling stimuli (0 = the lowest stimulus is more polite; 1 = the highest stimulus is more polite).

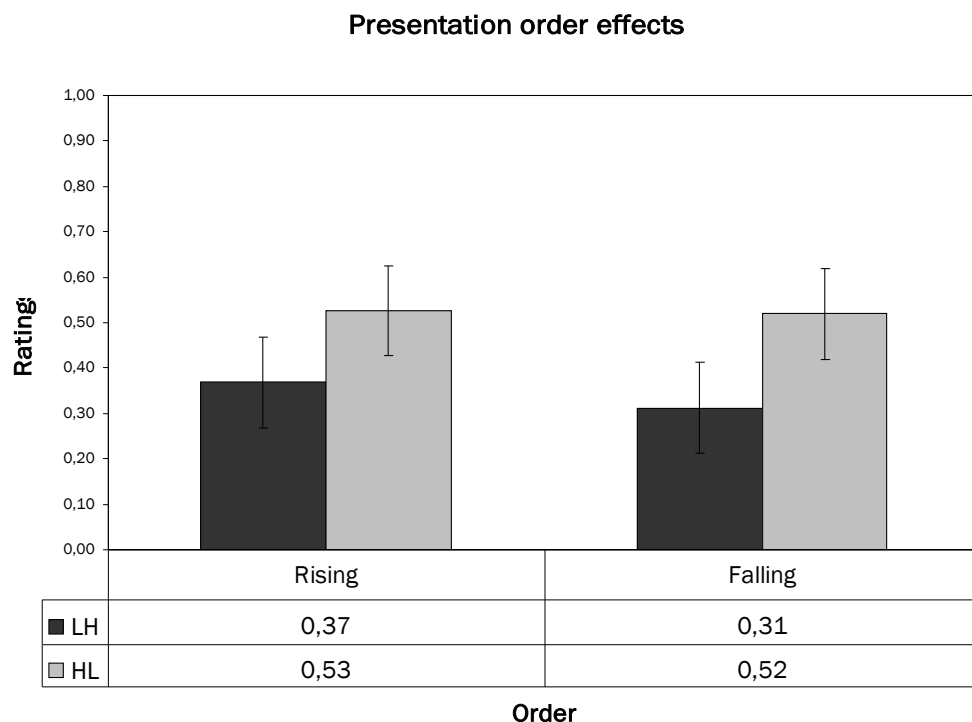
The curves in both graphs indicate that the lowest stimulus in the pair was generally preferred when the two stimuli were presented in LH order (that is, when the first one was lower than the second). The HL order of presentation (the highest one first) seemed to elicit more ambiguous responses. For the rising stimuli, average answers are mostly situated around 0.5, showing that there was no clear preference for one of the stimuli over the other when presented in the HL order. For the falling stimuli, a similar tendency is observed. However, note that in the HL order, the highest stimulus is preferred in the first three pairs, whereas the lowest stimulus is preferred in the last three pairs (i.e. pairs formed by combining stimulus whose final boundary tone has been increased).

These differences across orders of presentation were submitted to statistical analysis to verify whether participants were consistent in identifying one of the two stimuli as more polite than the other regardless of the order of presentation. Analyses were also carried out to determine whether there were significant differences between the mean ratings of different pairs.

As done for the rating task results, an initial multiple-sample Friedman test was performed: no significant differences were observed for pairs of rising stimuli presented in the LH order (chi-square = 8.525,  $p = 0.202$ ) nor in the HL order (chi-square = 7.508,  $p = 0.276$ ). Wilcoxon two-sample tests carried out for each two contiguous pairs of stimuli were consistent with the first analyses: no significant differences were observed.

Even if both continua patterned similarly in the rating task, differences emerge here. Both Friedman tests for the comparison of pairs of falling stimuli in the LH order and in the HL order returned significant differences (LH order: chi-square = 31.083,  $p < 0.000$ ; HL order: chi-square = 38.690,  $p < 0.000$ ). Contiguous pairs of stimuli were submitted to Wilcoxon tests. Significant differences were found between two pairs: pairs four and five (min6-plus6 and unmod-plus12) when the stimuli were presented in the LH order and pairs two and three (min18-min6 and min12-unmod) in the HL order. However, the significance disappeared after applying Bonferroni correction (corrected alpha level =  $0.05/6 = 0.008$ ; pair four-five:  $p = 0.016$ ; pair two-three:  $p = 0.046$ ).

Because the nature of the contrast being tested in this experiment is gradual, the inexistence of a category–shift boundary should come as no surprise. This is precisely what is expected given the characteristics of the stimuli being tested. Let’s turn to compare the responses obtained by the very same pair of stimuli across the two orders. Order of presentation of stimuli was tested by means of a two–sample (LH vs. HL) Wilcoxon analysis testing general differences for all stimulus pairs. Figure 8 plots the means for pairs of rising and falling stimuli presented in both orders (LH and HL). As can be seen, participants were more inclined to evaluate the lowest stimuli in the pair as the most polite when they were presented in LH order. In the HL order, average responses are close to 0.5, suggesting less ability to classify which element was the most polite. These differences are significant (pairs of rising stimuli:  $p < 0.000$ ; pairs of falling stimuli:  $p < 0.000$ ). Thus, the order of presentation of stimulus in a pair did affect participants’ judgments. Further Wilcoxon tests were used to compare the pairings of the same stimuli in the two different orders of presentation. Table 3 shows the results of the tests.



**Figure 8.** Comparison of the mean responses of pairs of stimuli in the two orders of presentation (LH = the lowest one first; HL = the highest one first; 0 = the lowest stimuli was perceived as the most polite).

| Pair          | RISING STIMULI |                   | FALLING STIMULI |                   |
|---------------|----------------|-------------------|-----------------|-------------------|
|               | p value        | Corrected p value | p value         | Corrected p value |
| min24_min12   | 0.115          | n.s.              | 0.000           | *                 |
| min18_min6    | 0.036          | n.s.              | 0.000           | *                 |
| min12_unmod   | 0.053          | n.s.              | 0.052           | n.s.              |
| min6_plus6    | 0.058          | n.s.              | 0.034           | n.s.              |
| unmod_plus12  | 0.423          | n.s.              | 0.005           | *                 |
| plus6_plus18  | 0.005          | *                 | 0.004           | *                 |
| plus12_plus24 | 0.004          | *                 | 0.000           | *                 |

**Table 3.** Results of the Wilcoxon tests carried out on the ratings of the same pairs of stimuli in different orders. The new alpha level is 0.008.

Indeed, the means obtained by the same pair of stimuli when presented in the different orders are significantly different for certain pairs. As was anticipated by looking at the graph, the results obtained for each of the continua do not pattern together as they did in the rating tasks. After Bonferroni correction was applied, two pairs in the rising continuum received significantly different ratings in the two orders, namely those formed by stimuli plus6 and plus18, and plus12 and plus24. The falling continuum behaves differently. It presents more differences: the pairs min24–min12, min18–min6, unmod–plus12, plus6–plus18 and plus12–plus24 were rated differently depending on whether they were heard in the HL vs. LH order.

Asymmetries derived from the order of presentation of the members in a pair have been reported in the literature. Whether stimuli are presented in a rising order (LH) or a falling order (HL) interferes with participants' ability to discriminate or compare the stimuli in the pair (see Vanrell, 2007). Apparently, this is related to “declination”, a phenomenon consisting in the progressive fall in fundamental frequency as the utterance progresses. Peaks that should be equivalent may be realized at a lower pitch height toward the end of the utterance (Gussenhoven, 2004). Several experiments have revealed that listeners are able to compensate for this declination, or that they “use an abstract declination line when judging the height of the contour” (Gussenhoven, 2004:118; see also Gussenhoven and Rietveld, 1988; Pierrehumbert, 1979; Vanrell, 2007).

This compensation or reference declination line can explain why results are more ambiguous when the stimuli to be compared are presented in

descending order (i.e. when the second one is lower than the first, HL). Compensation of later peaks may make it difficult for participants to perceive a difference between the two. In the reverse order (LH), compensation effects may emphasize the second peak so that it becomes more salient and more distinguishable from the first one (Vanrell, 2007). Thus, asymmetries derived by the order of presentation can stem from the effects of this compensation mechanism.

To sum up, in the rising continuum, participants rated stimuli plus6, plus18, plus12, and plus24 differently depending on the order in which they were presented. The lower stimuli (plus6 and plus12) were considered more polite when presented first, and the same is true for stimuli plus18 and plus24. In the falling continuum, most of the pairs were rated differently in the two orders. For pairs min24–min12 and min18–min6, again, the difference lay in the fact that the first stimulus of the pair was rated as more polite than the other, regardless of whether it was higher or lower than the other one. However, in the pairs unmod–plus12, plus6–plus18, and plus12–plus24, the lowest stimulus was always preferred, although this effect was more evident in the LH order. It is precisely among stimuli with increased boundary tone that the lowest one is more clearly preferred, regardless of order.

### 3.3 Discussion

Following the trend opened by studies examining the effects of prosody on the perception of politeness, the aim of this paper was to explore whether changes in the pitch height (i.e. pitch scaling) of the final boundary tone in questions in Central Catalan would result in different degrees of perceived politeness. Whether a higher or lower pitch would lead to a higher degree of perceived politeness was unclear, based on the different studies on the biological use of pitch and the studies on impoliteness described in section 1.

Contrary to predictions based on the cross–species use of F0, politeness does not seem to correlate with higher pitch in Central Catalan. Results of the two rating tasks reveal the opposite effect: a tendency to evaluate higher final boundary tones as less polite is observed and, most importantly, reaches

statistical significance in both continua. When comparing the two continua, both unmodified stimuli receive higher politeness ratings than the stimulus whose boundary tone was increased by 24 Hz. Note that no difference is observed between unmodified stimuli and stimuli whose boundary tone was decreased. Participants do not rate lower stimuli as being more or less polite. It is only when there is an increase in pitch height that the degree of perceived politeness diminishes. In the rating tasks, significant differences were observed when comparing the ends of the continua as well as the unmodified stimulus and the highest one for both continua. Comparisons of contiguous stimuli did not reach significance at any point, although a gradual decline in the degree of politeness as pitch of the final boundary tone increases is observed.

It is interesting to observe that stimuli in both continua received similar ratings. This may indicate that both types of questions (rising and falling) are interchangeable in interactions that imply a low cost for the hearer. As described above, Payà (2003) considered the falling contour as more polite than the rising one. Payrató (2002) and Prieto (1998) also venture that the choice of one contour over the other may be determined by the degree of politeness that the speaker wants to convey. Further experiments targeting the two types of questions are necessary in order to assess whether they are indeed interchangeable and, if so, in what contexts.

The results of the comparison tasks support those obtained in the rating tasks. Stimuli with lower final boundary tone are always preferred in the LH order, and in some cases in the HL order. Interestingly, it is in cases where the boundary tone was increased (in the falling interrogatives) that the lower one is always preferred, no matter what the order of presentation was. Therefore, the same effect is found in both the rating and the comparison tasks: participants tend to consider stimuli with increased boundary tones as less polite than the unmodified ones or those with a decreased boundary tone.

As described in the introduction, several studies have explored the biological exploitation of pitch (Culpeper et al., 1993; Gussenhoven, 2002; Nilsenova, 2006; Ohala, 1984, 1996) and conclude that high or rising F0 is primarily associated with being small. From this first association, secondary social

meanings stem: a high pitch is viewed as conveying submission, subordination, and politeness, among other meanings. Apart from these theoretically-based studies, experimental evidence for the relationship between high pitch and higher degree of politeness has been found for Spanish and Japanese. For Venezuelan Spanish, Álvarez and Blondet's (2003) production experiment revealed that participants uttered polite sentences with a higher pitch height and higher F0 variability. In Orozco (2006), polite utterances were seen to begin with a high boundary tone in Mexican Spanish, whereas neutral utterances initiated with a lower boundary tone. A broader use of pitch range (more peaks and valleys) was also evinced in that variety. In Kumamoto Japanese, the presence of a late peak in the utterance or a final rising boundary tone was perceived to be more polite than utterances with an early peak or a falling final cadence, according to Maekawa (1999). In an analysis of impolite speech, Culpeper et al. (2003) claim that a rising contour may be more considered more polite because it keeps the conversation going, whereas a falling contour tends to put an end to it. However, in the same study they propose that extreme pitch may be disruptive to interlocutors, and thus be regarded as impolite. Finally, Culpeper (2005) described a particular example in which higher pitch average, among other prosodic cues, conveyed impoliteness.

As shown above, higher pitch is not associated with higher degree of politeness in this experiment. As a matter of fact, the opposite tendency is revealed here: stimuli whose final boundary tone had been modified by increasing the pitch were rated as less polite than the ones whose final boundary tone had been decreased in pitch. Apparently, these results would conflict with most of the studies described above. Considering the more empirical studies, it is evident that their results are hardly comparable to the ones exposed here. Both studies focusing on Spanish are production experiments, and they actually make no claim about final boundary tone and the role of its height. In these experiments, it is an initial high boundary tone that is associated with politeness as well as F0 variability. These results are not, then, directly comparable to the ones described here.

Maekawa's (1999) study does focus on final cadence or boundary tone, but the emphasis is on choice of F0 direction (rising vs. falling final boundary

tone). However, the author does say that the larger the prominence of the rising boundary tone, the higher the degree of politeness perceived. These results are in contradiction to the ones described here. This might be due to differences in the pragmatic use of pitch height in Catalan and Kumamoto Japanese. However, it should also be borne in mind that this variety of Japanese has an idiosyncratic intonation that differs from that of Catalan (see section 1). Finally, Culpeper (2005) noticed that higher pitch could also convey impoliteness, but that was in combination with other prosodic cues. Again, it was not focusing on pitch height of the final boundary tone, which makes a comparison difficult.

To sum up, even if the results of this experiment seem to contradict those of the studies described above, the experiment reported here aimed at isolating the contribution of pitch height, whereas most of the other studies examined the role of pitch in combination with other prosodic (or even lexical and morphological) elements, such as duration, peak alignment, etc. The role of pitch height might be different when exploited in conjunction with duration or access to speaker's face. Follow-up experiments may determine whether this is really the case. It is important to note, however, that lower stimuli were not perceived as more polite than the unmodified one either. There was simply no difference between them. That is, the contrary tendency (i.e. the lower the pitch, the higher the degree of perceived politeness) does not hold.

## 4. CONCLUSIONS

The goal of this experiment was to assess the contribution of pitch height of the final boundary tone to the perception of politeness in two types of interrogative contours in Central Catalan: the rising and the falling questions. It was predicted that the degree of perceived politeness conveyed by the question would be influenced by changes in pitch height.

To determine whether pitch scaling did have an effect on the perception of politeness, 20 participants completed two rating and two comparison tasks. The results obtained in the four tasks confirmed the initial hypothesis that changes in pitch height interfere with the degree of politeness conveyed by questions. Both types of tasks successfully captured the fact that participants were sensitive to differences in pitch height and showed a preference for unmodified or lower stimuli over stimuli with increased pitch in the boundary tone. The higher the pitch in the final boundary tone, the lower the degree of politeness it was thought to convey. Some participants felt that politeness correlated positively with pitch. Further studies including duration and visual access to the face of the speaker may shed more light on the role of prosody in the perception of politeness.

Based on the results obtained in the rating and comparison tasks, it can be preliminarily concluded that pitch height does play a role in the perception of politeness. Stimuli with higher pitch are not considered to be as polite as others with lower pitch. This seems to contradict a tendency for higher pitch to correlate with politeness observed in some studies, but it may be a consequence of examining the contribution of pitch in isolation or focusing on different aspects of the utterance. It is possible that the contribution of pitch height is different when combined with duration or other visual and acoustic cues, and it is also possible that languages exploit pitch differently in order to convey paralinguistic meanings. As other studies have demonstrated before, a description of politeness (whether of an abstract, theoretical, and universal

nature or not) may benefit from the incorporation of prosody as a decisive element in the encoding of politeness.

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