



Prosodic encoding of declarative, interrogative and imperative sentences in Jaminjung, a language of Australia

Candide Simard

Department of Linguistics, School of Oriental and African Studies, London, United Kingdom

cs75@soas.ac.uk

Abstract

This paper examines the prosodic encoding of sentence types in Jaminjung, a language of Northern Australia. Analyses cover the description of the contours as well as a systematic acoustic analysis, comprising the measurements of F0, duration, pitch excursion and velocity for each syllable in datasets carefully selected from spontaneous speech. Results show that declaratives and imperatives receive a falling contour; interrogatives, either polar or *wh* questions, can have one of three contours: falling, fall-rise, marked by a rise on the last syllable, or rising. A test on the F0 measurements of each sentence type with a falling contour reveals that they are in effect distinguished by pitch register, ranging from higher to lower, from imperatives to polar questions, to *wh* questions and statements. Hence, contour shape alone is not sufficient to describe the encoding of sentence types in Jaminjung: overall pitch register is also used. We will argue for the usefulness of instrumental phonetic investigations in describing lesser-known languages and also to enhance our understanding of sentence type characterization in a typological perspective.

Index Terms: prosody, pitch register, sentence type, questions, statements, Australian language, prosodic typology

1. Introduction

In many languages, whether a sentence is a statement, a question or a command is signaled by intonational means. That intonation contours constitute an integral part of the meaning attributed to sentences (the signifier side) is widely accepted, at least since [1] who counted *modulation* as one of the four ways of arranging linguistic forms. In prosodic studies, it is assumed that the scope of the contour is the intonation unit (IU hereafter), a term often preferred to ‘sentence’ to describe a unit of speech (the two terms may be used interchangeably in this paper). However common the link between sentence type and intonation, it is important to keep in mind, particularly when describing the prosodic system of a language for the first time, that using intonational means to distinguish sentence types is only one of the possible strategies available in any given language (other means include word order variations and morphological marking).

The pattern of declaratives/statements ending in a fall and interrogatives/questions ending in a rise is so common in the world’s languages that it is sometimes suggested as one of the rare language universals. More specifically, sentences bearing the meaning of completion, termination, finality or assertion are associated with low or falling pitch, and those bearing the meaning of inquiry, uncertainty, non-finality or question with

high or rising pitch [2], [3]. There are, however, some counterexamples to this generalization about high and low endings. Examples from African languages are discussed in [4]; it is claimed for Chickasaw [5] that typical declarative utterances end with a high instead of a low boundary tone. [6] also provides evidence against the universalist position, notably from Hungarian polar questions which end in a high-low sequence of tones rather than a rise or a simple high tone.

Register is defined as a range of F0 selected out of the entire pitch range the speaker can possibly use. Register variation involves the overall raising or lowering of all target points. Few analyses have concentrated on the use of register to encode sentence types, its effect has been noted for example in some Romance languages i.e. in Peninsular Spanish [7], where sentence initial F0 peaks in exclamatives are significantly higher than in interrogatives, which in turn are higher than declaratives; in Majorcan Catalan [8], in which pitch scaling is the primary cue for distinguishing yes-no questions from *wh*-questions; and in Bari Italian [9], where it distinguishes between information and echo questions, the former seeking information new to both participants, the latter challenging an interlocutor assumption that information is shared; findings that challenges the theoretical position in the Autosegmental Metrical (AM) theory that pitch range variation (pitch scaling) is paralinguistic i.e. it carries information on prominence and emphasis.

Even though raised pitch is recognized as a marker of polar questions cross-linguistically, it often corresponds to a final rise instead of an overall raise of all pitch targets, which is how a raise in pitch register is understood here. Such a raise is attested in polar questions in Northern Sotho [10], a Bantu language.

The Australian language Jaminjung, examined here, is part of a small western branch of the geographically discontinuous Mirndi family [11], [12], a member of the diverse non-Pama-Nyungan group. The traditional country of the Jaminjung speakers is located around Timber Creek in the Northern Territory. The remaining few dozen speakers today are all elderly.

As for many other Australian languages, Jaminjung has ‘free word order’ in the sense that word order is not used to distinguish the grammatical roles of arguments, but is rather conditioned by information structure at the discourse pragmatic level [13]. This leads to lexical arguments being freely omitted – argument roles are indicated by bound pronominals which attach to the verbs as prefixes and by case markers suffixed to constituents of noun phrases. Like many other languages of the area [14], [15], [16], Jaminjung also has two distinct categories of verbs: the inflecting verbs, which form a closed class of around thirty members, and a non-inflecting category, referred to as ‘coverbs’.

The model of prosodic analysis adopted here, the Parallel Encoding and Target Approximation (PENTA) model [17] considers that different communicative functions are

simultaneously encoded in a single prosodic contour. Quantitative and statistical investigations of prosodic patterns linked to independently identified functions make it possible to uncover the language-specific prosodic parameters which serve to encode individual linguistic functions, and eventually to distinguish them from paralinguistic functions.

This study reports on the analysis of the prosodic cues that characterize the most researched sentence-types, namely, statements, questions, and commands.

2. Methodology

2.1. Datasets

All tokens are extracted from a corpus of spontaneous or at least unread speech, resulting from fieldwork conducted between 1993 and 2009. It includes narratives consisting of personal anecdotes and mythological stories; picture-prompt narratives based on more widely used materials, such as the Frog Story [18], and some of the tasks from the Questionnaire for Information Structure (QUIS) materials developed as part of the SFB 632 Information Structure research project [19]. It also includes small discourses elicited by means of presenting a verbal or non-verbal context, and also data recorded in the course of the documentation of the ethnobiological knowledge of the speakers. Recordings usually involved more than one speaker. Tokens from 9 speakers are used in this analysis.

Audio recordings made during fieldwork, usually out of doors, are not always of optimal quality for acoustic analysis, which explains why our datasets are limited in number. We had to disregard measurements of intensity as it was impossible to control the distance between speaker and microphone during recording sessions. Nonetheless, we contend that the analysis of spontaneous speech is worthwhile: patterns must be identifiable, otherwise speakers would not use them in their interactions.

The sentence types tested include declaratives, imperatives and interrogatives, of which we tested two subtypes: *wh*-questions which contain a question word (WHI) where a speaker requests new information, and polar questions or yes/no-questions (YNI) where a speaker inquires about the truth of a proposition [20].

2.1.1. Simple declaratives

There are 69 tokens in the dataset, from 9 different speakers, all topic-comment or comment-only constructions. They are verbal clauses, except for one token that consists of a nominal predicate. Prosodically, the tokens consist of a succession of phrases, each of which is marked with a slight pitch reset; the phrase corresponding to the comment contains a prominent syllable, usually in initial position, functionally associated with the focused element.

Example 1 Figure 1 shows an example of an IU consisting of a simple declarative with an explicit topic-comment structure. It displays a falling contour punctuated by the pitch target associated with the first syllables of the focus (on the first syllable of *GAniwirim*). This contour is the unmarked contour in statements.

(1)

[bulany-ni]_{Top} [gani-wiri-m]_{Com}
snake-ERG/INST 3sg:3sg-bite-PRS
'A snake bit him'. [IP:ES08_16_02]

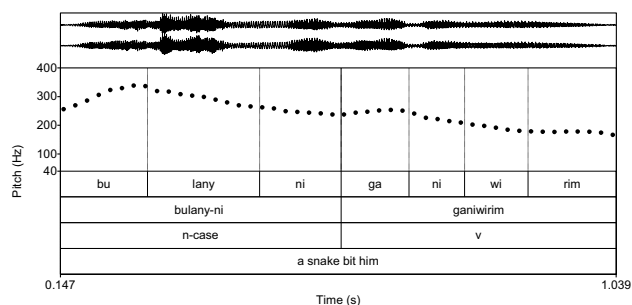


Figure 1 IU corresponding to a simple declarative, with an explicit topic and a comment.

2.1.2. Interrogatives

The analysis of WHI is based on 58 tokens. These questions usually contain one of the following nominal interrogatives: *nanggayin* 'who/someone', *nganthan* 'what/something' and its variants *nganthanug* 'why' (reason, objective), *nganthan-ngunya* 'why' (reason/cause, lit/ 'what from'), *ngajang* 'how many', *warnang* 'where', and *nyangulang* 'when'. Jaminjung also has an interrogative coverb, *warndug* 'how, do what'. The clitic =*warra*, glossed as 'DOUBT', is associated with interrogatives: it conveys ignorance about the intended referent ('I don't know wh-').

The question word usually receives the encoding associated with a focused argument. WHI mostly have a falling contour (55% of tokens), but a rising contour can also occur (12%), where the rising movement starts with the focused question word and continues until the end of the IU, as well as a contour called the fall-rise (33%), where the rising movement occurs only in the final syllables of the IU. At this stage of our research no functional motivation has been found for the three different contours. An example of a falling contour is given in example 2 (and accompanying Figure where the clause is non-verbal).

(2)

nganjan janyungbari
what other-QUAL
'What is the other one?' [BH:CS07_72_01]

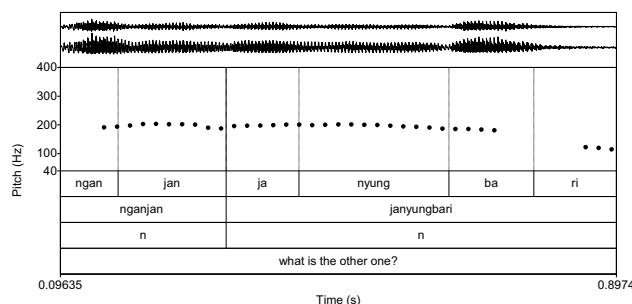


Figure 2 WHI, displaying a falling contour.

The dataset for YNI contains 22 tokens. Polar questions have the same structure as declarative sentences in Jaminjung. The clitic = *ja*, glossed as 'QUESTION' may be used as a polar interrogative marker, but it is not frequent. Given the relative formal similarity of declaratives and polar questions, the interpretation of an IU as a polar question rests on contextual cues. The following properties were used to identify polar

questions, originally developed for English and French [21]: they must be turn-final, and be followed by a reply from the addressee that contextually entails ‘yes’, ‘no’, or ‘I don’t know’. YNI also vary in the shape of their overall contours; 59% questions have falling contours, 32% have a fall-rise and 9% a rising contour. Example 3 (Figure 3) shows a polar question with a falling contour.

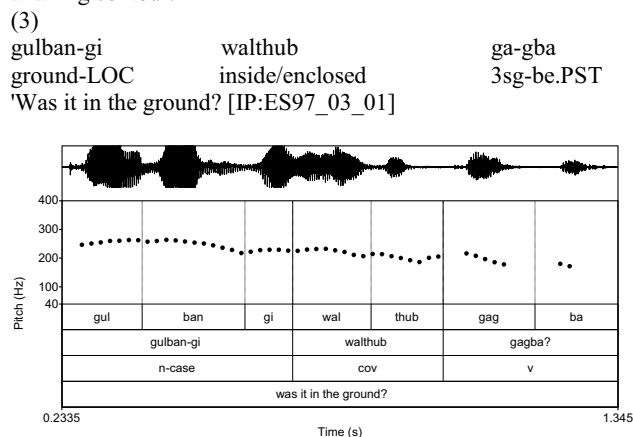


Figure 3 YNI with a falling contour.

2.1.3. Imperatives

When listening to Jaminjung speakers, it is fairly clear that imperatives are uttered with greater intensity, a correlate which we decided not to include within the parameters of this study.

The basic criterion used in the selection of the 23 IUs in this dataset is the presence of an inflected verb in the imperative form. This verb may occur in any position in the IU. Imperatives all have an overall falling contour. An example is shown in (4) Figure 4.

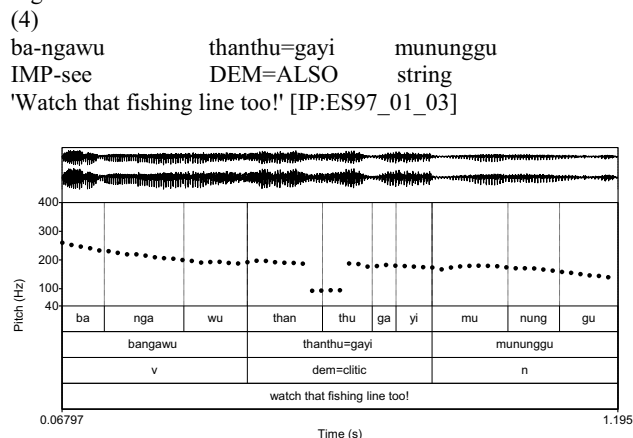


Figure 4 An imperative sentence with a verb in the imperative form.

2.2. Measurements

Tonal contours of each utterance type are determined by careful auditory analysis. All data is analysed and annotated using the Praat software [22] and labeled according to their subtypes. They are then segmented into syllables. The number of words in each token and their positions in the IU are indicated, as well as the number of syllables and the position of each syllable in a word.

Given the conditions of our data collection, it was not possible to control the segmental composition of syllables. For each syllable, the following measurements were made (using Xu's script [23]):

- Mean F0 — Average of all F0 values in a syllable, in Hz.
- Excursion size — Difference between the max F0 and min F0 expressed in semitones for each syllable.
- Final velocity—Velocity is a measure of the instantaneous rates of F0 change expressed in semitones per second, taken at a point earlier than the interval offset (here 30ms). It is an indicator of the slope of the underlying target of the interval.
- Duration — Time interval between the onset and offset of the syllable, in ms.

The quantitative analysis consists of a comparison of the values found in the datasets for each sentence type. A statistical analysis is conducted to validate the results. Preliminary tests assess the impact of speaker difference and IU length on the analyses. Then the different contours of WHI and YNI are examined. Finally an overall comparison between declaratives, interrogatives and imperatives is conducted.

3. Results

3.1. Preliminary tests

To ensure uniform treatment of all data, which consists of IUs with differing lengths by different speakers, tests are conducted to assess whether the factors ‘speaker’ and ‘IU length’ affect the analysis of our datasets. Multifactor ANOVA tests show that the interaction between sentence type and ‘IU length’ is not significant for any of the correlates; neither is the factor ‘speaker’. Only the first and final syllables are shown in the subsequent graphs, for ease of presentation.

3.2. Interrogatives

A first test is conducted on the interrogatives which show variation on the overall shape of the contours. ANOVA tests with mean F0, excursion size, final velocity and duration as dependent variable(s) and ‘syllable position’ and ‘subtype of question/contour’ as factors reveal no significant differences between the fall-rise and rising contours in WHI and YNI. The falling contours, however, differ significantly for the measurements of final velocity and duration ($F(1, 176) = 5.206, p = .024$ and $F(1, 180) = 14.818, p = .000$), but not for mean F0 and excursion size.

The results are shown graphically in Figure 5. The mean F0 values are indeed very close: YNI (dotted line) have slightly higher values at the left boundary and lower values in the final syllables than WHI. For excursion size, the values vary mostly in the penultimate syllables where the YNI average 3.89st and the WHI have much lower values at 2.43st.

The final velocity values point to similar underlying targets on the initial syllables, but not at the right edge where the penultimate and final syllables of YNI have values of -36.53st/s and -13.19st/s, respectively, suggesting a [fall] target. For WHI, the values in the same syllables are -11.01st/s and .11st/s, a pattern suggesting a [low] target.

The differences in the values for duration are also significant. YNI have shorter durations than WHI in all syllables but the first.

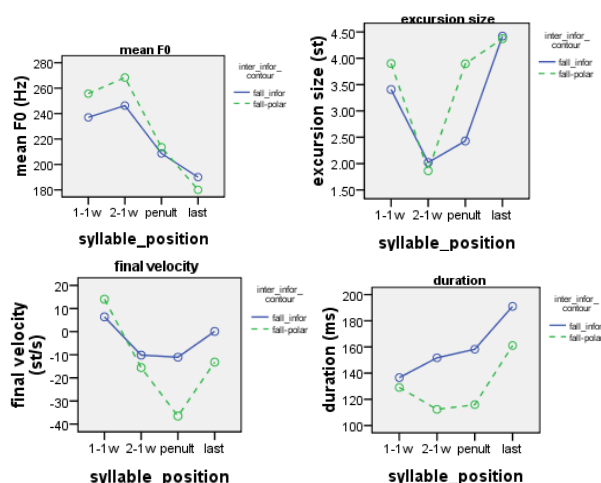


Figure 5 Comparison of the correlates of YNI (dotted line) and WHI (unbroken line) with a falling contour.

This suggests that, although the WHI and the YNI with falling contours have superficially very similar contours, they vary in their encodings. The YNI have steeper falls, evidenced by the higher values in the excursion size of their penultimate syllables, the lower values in their final velocity which signals a different target, a [fall], and their shorter durations.

3.3. Comparison of the sentence types

This test compares the contours in all sentence types including simple declaratives which all have falling contours; interrogatives, for which YNI and WHI with falling contours are given a distinct category while those with rising and fall-rise contours are grouped together; and imperatives, which also only have falling contours.

Quite predictably, the measures of final velocity as indicators of pitch targets vary significantly between the sentences types/contours ($F(5, 577) = 3.999, p = .001$). Declaratives and WHI are surprisingly alike, the first syllable has a [high] or a [fall] (depending of the information structure (IS) of the IU). It is followed by a sequence of [mid] targets, and demarcated by a final [low] target. The pattern for the imperatives differs at the left boundary with much lower values in the second syllables which suggest a [fall] target, again an encoding of the IS category of focus. YNI are distinguished by their lower values at the right boundary suggesting a [fall], as observed earlier. Of particular interest are the significant differences found in the mean F0 values between the sentence types, as shown by a multifactor ANOVA test with mean F0 as dependent variable and sentence type and contour shape as factors ($F(5, 584) = 39.691, p = .000$). The results show that declaratives and imperatives which both have solely falling contours differ from each other significantly, while the interrogatives form a subgroup with averages between the declaratives and imperatives. The averages are shown in Figure 6.

The examination of the results of the falling contours in all 3 sentence types show that they are distinguished by differences in pitch register, from the least marked declaratives, closer to the lower reaches of the baseline, to the WHI followed by YNI, and finally to imperatives which have the highest overall values. Hence, the gradation in prosodic marking is related to the

markedness of the speech acts expressed in the different sentence types.

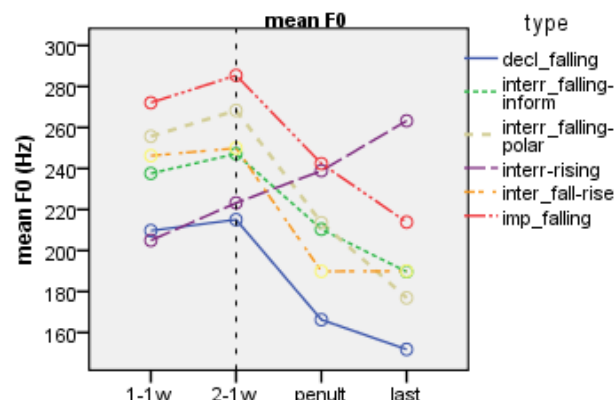


Figure 6 A comparison of the mean F0 values of the syllables at the left and right boundaries of declarative, interrogative, and imperative sentences, distinguished according to their contours.

4. Conclusion

This paper examined the encoding of sentence types in Jaminjung and yielded two major findings. While all sentence types in Jaminjung have predominantly falling contours, interrogatives vary in their contour shapes. A finer analysis of the information structure of interrogatives, as conducted for Italian in [24], could possibly help to explain the different contours. One important result concerns the superficially similar falling contours of polar questions (YNI) and information questions (WHI). YNI have steeper contours, ending with a [fall] pitch target, as shown by their wider excursions and final velocity values at the right boundary, while the measurements for WHI suggest pitch targets reminiscent of those of declaratives.

The second important finding is revealed by the comparison of the prosodic correlates of all three sentence types: they are differentiated by pitch register – declaratives are closer to the lower baseline, imperatives have the highest overall values, and interrogatives lie somewhere in between.

The raising of pitch register has been discussed in the literature to distinguish between declaratives and interrogatives, but to our knowledge, it is the first time that differences in overall pitch register are found to distinguish between the three most often studied sentence types.

This study illustrates the usefulness of instrumental phonetic investigations in describing lesser-known languages, so that their patterns can be fully described, and also bring fresh contributions to the typological investigation of sentence types in the world's languages.

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