

# THE PROSODY OF REPEATED MENTIONS IN YUCATECAN SPANISH

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## ABSTRACT

It has been shown that speakers generally reduce repeated words in discourse. However, most evidence comes from well-documented languages, in particular English. In the current paper we investigate to what extent repetition affects the prosody of words in Yucatecan Spanish. This is an under-researched variety originating from contact between speakers of Spanish and Yucatec Maya, which is spoken in the Yucatán Peninsula of Mexico. To this extent, an analysis of several acoustic cues was carried out. The measures were taken from content and function words occurring in a corpus of spontaneous speech. Results show that content words are shortened upon repetition, with no effects of F<sub>0</sub>, whereas function words are generally not affected. In addition, the results are better explained by taking into account that word stress affects particular word classes in this language.

**Keywords:** Yucatecan Spanish, prominence, repetition reduction, prosody, word stress.

## 1. INTRODUCTION

### 1.1. The prosody of repeated mentions

Some studies have investigated how words that are repeated in discourse become prosodically reduced (e.g., [3], [13], [17]). For example, after a speaker introduces the word *table* in speech, its subsequent mention may be less carefully articulated. Several linguistic factors can have an effect on the prosodic reduction of words, such as information redundancy [1] or lexical frequency and probability ([3], [13]).

On the basis of the Smooth Signal Redundancy Hypothesis (SSRH; [1]), we could expect second mentions to be more redundant and therefore reduced. The SSRH posits an inverse relationship between linguistic and acoustic redundancy. This relationship is taken to be universal and is conditioned by prosodic prominence. In particular, [1] tested the hypothesis for (syllable) duration in English. They suggested that the hypothesis may be equally applicable to other prosodic measures such as F<sub>0</sub>, although the specific intonation patterns of a language should be taken into account. Extrapolating these results to words, second

mentions could thus be shorter and have a lower F<sub>0</sub> than first mentions.

Most studies have focused on English (e.g., [5], [8], [17], [26]), although there is some research on other languages (e.g., Dutch [22]; Mandarin [29]; Papuan Malay [14]; Thai [28]). Studies have shown that reduction occurs more frequently within coherent stretches of discourse, where first and second mentions refer to the same concept (e.g., [8], [9], [17]). The most studied acoustic cue is duration; other acoustic cues are F<sub>0</sub>, intensity and vowel dispersion. Reduction in terms of F<sub>0</sub> yields contradictory results: some authors have not found an effect (e.g., [8], [17] for English), whereas others have, although not in the same direction (lower F<sub>0</sub> values of repeated mentions for English [12]; higher values of F<sub>0</sub> mean in repeated mentions [14] for Papuan Malay). For vowel dispersion, vowels of stressed syllables have less dispersion in second than in first mention words ([5] for English).

Additionally, most studies have concentrated on content words and have found that they are shorter when repeated ([1], [8], [29]). Some researchers have made a distinction between content and function words. For English, [3] and [26] found that content words are more reduced in terms of duration than function words, whereas [14] did not find this effect for Papuan Malay.

Given the small number of studies on repetition reduction that exists for other languages than English, this paper focuses on Yucatecan Spanish, for which no such work exists. At the same time, this study contributes to the understanding of prosody in Yucatecan Spanish, for which little research exists.

### 1.2. Yucatecan Spanish

Yucatecan Spanish is spoken alongside Yucatec Maya in the Yucatán Peninsula, Mexico. Preliminary work on this variety shows that there might be a phrase-initial high pitch in contrastive constructions ([10], [27]) and that F<sub>0</sub> peak alignment is stable in broad focus utterances [20]. Additionally, [19] compared stressed syllables in broad and contrastive foci and concluded that duration is not an acoustic cue to focus marking.

A considerable number of works about other varieties of Spanish exists. The literature discussed henceforth might therefore only partially apply to

Yucatecan Spanish. In central Mexican Spanish different focus conditions (e.g., narrow focus, contrastive focus) present the same types of pitch accents, but the frequency of occurrence of the latter differs among conditions [15]; the same pattern is observed in Peninsular European Spanish ([7]). For this variety, [21] compared the F0 mean of stressed syllables in declarative and parenthetical sentences. Their results show that F0 is lower in parenthetical information.

Duration and pitch are relevant for word stress, which is contrastive in Spanish. Stressed syllables are longer than unstressed ones (e.g., [21]). [25] studied the acoustic cues to word stress in phrase-medial position in broad focus (a context with no pitch accent) and found that duration and intensity, but not F0, could distinguish most cases of word stress in production. In isolated words, the main acoustic correlates of word stress in Spanish are F0, duration, and amplitude (see, e.g., [18]).

As for word type, content words in Spanish (i.e., nouns, verbs, adjectives, adverbs: [6]) bear word stress; function words, however, can be either stressed or unstressed. For example, the function word *en* 'in' is unstressed, whereas *un* 'a' is stressed. Nevertheless, there are pragmatic contexts in which an unstressed syllable of both content and function words can bear stress, namely in narrow and contrastive focus, under initial emphatic stress, or under rhythmic stress [11].

### 1.3. Research questions

The current study researches prosodic reduction of repeated mentions of both content and function words in Yucatecan Spanish. Three acoustic measures: raw word duration, F0 range, and F0 mean are considered.

In line with previous research, we expect repeated mentions to be shorter than first mentions, both for content and function words. Furthermore, content words may show larger differences in duration between first mention and repetition than function words, as only the latter might be realized without word stress.

The SSRH [1] suggests that F0 reduction may also occur. However, measures of F0 have yielded contradictory results in studies of prosodic reduction. Also, several languages present a compressed F0 range in post-focal positions [30], which could have an effect in second mentions having a smaller F0 range. In the case of F0 mean for Spanish, if the parenthetical information in [21] is interpreted as redundant and thus subject to more reduction, we expect that second mentions have a lower F0. On the other hand, there are no clear-cut differences in F0 to mark focus in Spanish, which could rule out F0 as a

relevant cue to repetition, as repeated words often constitute given information.

## 2. METHODOLOGY

To investigate repetition reduction in the prosody of Yucatecan Spanish, an oral interview was carried out and recorded. The recordings were then annotated and acoustically analyzed as described below.

### 2.1. Design and procedure

The recordings took place in the city of Felipe Carrillo Puerto, Quintana Roo state, Mexico. Participants were interviewed by two speakers of Spanish (the first author, a native speaker of Peninsular European Spanish, and a second-language speaker). In the interview, participants were asked questions about culture and language in their region. The beginning of the interview was selected for the present study to make sure that first mentions of words were indeed first mentions in a coherent part of discourse. Crucially, the general topic of conversation was the same throughout the selected parts. In some cases, interviewers briefly questioned the participants about something that the latter had already introduced in the discourse. This happened twice to three times on average per conversation. In the interviews of three participants, one to two new questions were introduced.

Recordings (44.1 kHz, 16 bit, wav) were made in a silent room with an AKG C 544 L head-mounted microphone connected to a Presonus AudioBox USB. The average duration of the recordings was 5 minutes.

### 2.2. Participants

All 10 participants ( $M_{age} = 54$ , age range = 34–72) were male speakers of Yucatecan Spanish; 5 of them were bilingual speakers of Yucatec Maya and Spanish.

### 2.3. Data selection and acoustic analysis

A native speaker of Yucatecan Spanish orthographically transcribed the recordings. They were then automatically aligned with BAS Pipeline online service [16] and manually corrected by two labelers in Praat [4]. Further corrections were made by the first author, a native speaker of Peninsular European Spanish.

For the analysis, words were excluded when they contained: hesitations, slips of the tongue, truncations, false starts, stretches difficult or impossible to identify, overlapping speech in dialogue, filled pauses, stretches with background

noise, and proper names. Words whose reduced form is somehow lexicalized (*pa* instead of *para* ‘for’, *to(n)ces* instead of *entonces* ‘then’) were excluded because the choice of the full/reduced forms may depend on other factors—such as individual and stylistic variation—rather than on repetition reduction. Words in utterance-final position were left out to control for final lengthening effects. Words that were introduced by the interviewers and subsequently used by the participants were not taken into account in the analysis to avoid any possible influence that they could have had on the participants’ realizations.

Only first and second mentions were considered; third or later mentions were excluded. This decision was taken because few words were repeated more than twice. Words were further labeled as content or function words. The final subset consisted of 469 words (121 function words) for which at least one repetition could be found. Content words had 1 to 5 syllables, whereas function words had 1 to 3 syllables. The number of words per speaker ranged from 27 to 64. Three acoustic measures of words were taken following [14]: raw duration, F0 range (the difference between the maximum F0 and minimum F0 of a given word), and F0 mean.

#### 2.4. Statistical analysis

Linear mixed model analyses (using Satterthwaite approximations to degrees of freedom to calculate *p* values) were fitted using the `lme4` package ([2]) in R ([24]). A model was fitted for each dependent variable (duration, F0 range, and F0 mean), with mention (first/second) and word type (function/content) as fixed factors, and with speakers and items (words) as random factors.

### 3. RESULTS

Means and standard deviations are presented in Table 1. For duration, content words were significantly longer than function words (176.99, *SE* = 24.69, *t* value = 7.17, *p* value < 0.001). Results show an interaction effect for word type and mention (-26.49, *SE* = 10.43, *t* value = -2.54, *p* value < 0.05), which indicates that content words had a significantly shorter duration in their second mention than function words.

For F0 range, second mentions did not show significantly higher values compared to first mentions; also, there was no interaction effect for word type and mention. Content words had a greater F0 range than function words (6.52, *SE* = 2.46, *t* value = 2.65, *p* value < 0.01).

As for F0 mean, there were no significant effects of any of the (interactions of) factors.

**Table 1:** Mean (and *SD*) duration (ms), F0 range (Hz), and F0 mean (Hz) of first and second mentioned content and function words.

Measure	Word type	1 <sup>st</sup> mention	2 <sup>nd</sup> mention
Duration	Content	320.95 (143.80)	300.97 (142.87)
	Function	161.76 (91.92)	168.28 (101.98)
F0 range	Content	31.87 (20.51)	30.14 (20.75)
	Function	24.20 (19.84)	24.13 (22.62)
F0 mean	Content	114.34 (18.14)	115.57 (20.08)
	Function	109.72 (17.68)	109.19 (16.09)

## 4. DISCUSSION

In this study, only the duration of content words was reduced upon repetition. This finding partially confirms earlier results for other languages.

#### 4.1. Duration

We have shown that upon repetition, content words have shorter duration. This effect is in line with studies reported for other languages (e.g., [1], [8], [28]) and with our predictions. This effect, however, does not hold for function words. [3] report that the effect of repetition is larger for content words than for function words. Nevertheless, in our study function words are longer in their second mention. This result is further analyzed in Section 4.3.

Content words were significantly longer than function words. This result is to be expected as the former consisted of more syllables than the latter.

#### 4.2. F0 range and F0 mean

Neither F0 range nor F0 mean show significantly reduced values for second mentions, which indicates that F0 is not a relevant cue to repetition reduction processes in Yucatecan Spanish. This result is in line with research on this variety that indicate that F0 may not be a cue to mark information status (Section 1.2). Nevertheless, the role of F0 to mark information status on Spanish needs further research. Previous studies for other languages have yielded different results, either finding no effect of repetition or finding lower/higher F0 values. Finally, the reduction in terms of F0 that the SSRH [1] hypothesized is not found in the data. The results thus corroborate the idea that (repetition) reduction of F0 is language dependent [1].

Content words have a greater F0 range than function words. This result can be explained by the fact that content words are longer than function words and stressed in all cases, which allows for a greater tonal excursion. F0 mean differences between word classes are not observed. The larger standard

deviation of content words compared to that of function words may account for this result.

### 4.3. Post hoc analysis: Stress and function words

In this study, function words are longer upon repetition, a result that seemed counter to the reduction hypothesis. Importantly, function words in Spanish can be either stressed or unstressed. Therefore, we conducted a post hoc analysis on the subset of function words for the effect of repetition and the role of word stress.

#### 4.3.1. Statistical analysis

The subset comprised 12 stressed and 109 unstressed words subject to repetition. Linear mixed model analyses were fitted following the procedure indicated in Section 2.4. A model was fitted for each dependent variable (duration, F0 range, and F0 mean), with mention (first/second) and word stress (stressed/unstressed) as fixed factors, and with speakers and items (words) as random factors.

#### 4.3.2. Results

Results are given in Table 2. As for duration, there was an interaction effect for mention and word stress ( $55.73$ ,  $SE = 23.86$ ,  $t$  value =  $2.33$ ,  $p$  value <  $0.05$ ), which indicates that stressed function words have a significantly longer duration in their second mention. Stressed function words were significantly longer than unstressed function ones ( $108.69$ ,  $SE = 41.54$ ,  $t$  value =  $2.614$ ,  $p$  value <  $0.05$ ).

**Table 2:** Mean (and *SD*) duration (ms), F0 range (Hz), and F0 mean (Hz) of stressed and unstressed function words.

Measure	Stress	1 <sup>st</sup> mention	2 <sup>nd</sup> mention
Duration	Stressed	270.85 (155.87)	327.57 (188.33)
	Unstressed	149.75 (73.80)	150.74 (69.38)
F0 range	Stressed	39.3 (23.48)	43.67 (36.18)
	Unstressed	22.49 (18.75)	21.97 (19.70)
F0 mean	Stressed	118.96 (24.01)	118.23 (20.72)
	Unstressed	108.67 (16.64)	108.2 (15.29)

F0 range results show that stressed words had a significantly higher F0 range than unstressed ones ( $14.04$ ,  $SE = 6.97$ ,  $t$  value =  $2.01$ ,  $p$  value <  $0.05$ ). There were no significant (interaction) effects. For F0 mean, there were no significant effects of any of the (interactions of) factors.

#### 4.3.3. Discussion

The post hoc analysis confirmed the expectation that stress plays a role in the duration of repeated

mentions. Stressed function words are longer in their second mention, whereas unstressed function words are not. This seems to explain the duration differences observed between content and function words in Section 3. The effect of mention for stressed function words seems counterintuitive. However, stressed function words are only 12 instances. For unstressed function words, of which there is a larger number, no such effect is observed.

Overall, the acoustic cues showed that it is important to distinguish stressed and unstressed function words. The former generally showed larger acoustic values than the latter in this study.

### 4.4. Conclusions

This study provides new data about an under-researched variety of Spanish. It also contributes to cross-linguistic research on repetition reduction. We have shown that content words are shortened upon repetition, whereas the same effect is not observed for function words. Finally, F0 is not a relevant cue to reduction processes in Yucatecan Spanish, but it is for word stress, in line with research on Spanish.

F0 range results for content/function words and stressed/unstressed function words indicate that not only duration but also word stress may explain the differences between the word types. In addition, the role of word stress, especially within the class of function words, needs further exploration to assess to what degree it interferes with phrase-level prosody. Further research may help clarify whether repetition reduction in Yucatecan Spanish is in accordance with previous research on other languages or whether function words do indeed show a different pattern.

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