Native and Non-native Perception of Stress in Mapudungun:
Assessing Structural Maintenance in the Phonology of an Endangered Language

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Abstract: *Today, virtually all speakers of Mapudungun (formerly Araucanian), an endangered language of Chile and Argentina, are bilingual in Spanish. As a result, the firmness of native speaker intuitions – especially regarding perceptually complex issues such as word-stress – has been called into question (cf. de Lacy, 2014). Even though native intuitions are unavoidable in the investigation of stress position, efforts can be made in order to clarify what the actual source of the intuitions are, and how consistent and 'native' they remain given the language's asymmetrical contact conditions. In this article, the use of non-native speaker intuitions is proposed as a valid means for assessing the position of stress in Mapudungun, and evaluating whether it represents the unchanged, 'native' pattern. The alternative, of course, is that the patterns that present variability simply results form overlap of the bilingual speakers' phonological modules, hence displaying a contact-induced innovation. A forced decision perception task is reported on, showing that native and non-native perception of Mapudungun stress converge across speakers of six separate first languages, thus giving greater reliability to native judgements. The relative difference in the perception of Mapudungun stress given by Spanish monolinguals and Mapudungun-Spanish bilinguals is also taken to support the diachronic maintenance of the endangered language's stress system.*

Key words: Stress perception; Mapudungun; Araucanian; Non-native intuitions; Bilingual phonology

INTRODUCTION

Stress is primarily a perceptual or mental instantiation of prominence, rather than a uniform physical trait of syllables. As a result, there is no single tell-tale sign of its location within words. Inasmuch as it is possible to find acoustic and phonological correlates to the percept of stress in a given language, these are established *a posteriori*, on the basis of the fundamental experience of stress given by speaker intuition. Although the value of native intuition has sometimes been called into question as a source of phonological knowledge (e.g. Schütze, 1996; Kawahara, 2011), in the case of stress, knowing where speakers perceive stress is the condition *sine-qua-non* for pinpointing its phonetic and structural properties. What happens, however, when native speaker intuitions become suspect, due to universal, inherent bilingualism and language marginalization? Can non-native intuitions aid us in clarifying native ones? How informative can non-native speakers be about a language's stress patterns, and further, about the reliability of native intuitions on stress? Such questions are explored in relation to Mapudungun (formerly referred to as *Araucanian*), an endangered language spoken – alongside Spanish – by a fast-shrinking number of ethnic Mapuche people in Chile and Argentina.[1] The objectives of the study are twofold: to assess the value of non-native perception in establishing stress position – particularly in conditions where native data are suspect – and, in doing so, to evaluate and improve upon the available evidence for Mapudungun's stress-system.

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[1] Based on survey data (CEP, 2006), Zúñiga (2006) estimates the number of speakers at 144,000 in Chile. However, the same survey finds rural speakers use the language to address children in only 8.2% of cases, while urban speakers do so in a mere 0.8% of cases. Census numbers in Argentina are much smaller, with just over 8,400 self-reported speakers (INEC, 2008).

In languages where native stress intuitions are robust, there is an uncontroversial baseline for correlating these to variation in syllable F0, duration, intensity, spectral tilt or phonotactic constraints and allophonic alternation (cf. Gordon, 2011a, 2014). In some languages, nevertheless, intuitions are debatable, particularly for secondary stress, where prominence is not phonemic (cf. Hualde & Nadeu, 2014). In such cases, acoustic correlates may be extremely difficult to find (cf. Dogil & Williams, 1999 for Polish and Spanish; Arvaniti, 1992, 1994 for Greek) and phonological generalizations may be unreliable (cf. Hyman, 2014) or indeed over-identified (cf. Newlin-Łukowicz, 2012 for Polish secondary stress).

Further complications to the percept of stress may also arise from the conditions in which the language is spoken and the interaction of different stress-assignment and perception systems. This is particularly so for inherently bilingual speech communities where one of the languages has no contrastive stress, while the other assigns it a clear phonemic value. This is the case for Mapudungun *vis-à-vis* Spanish. In such a context, obtaining intuitions on stress is an uncertain affair, chiefly because there is such a strong prototype for its cues, position, and function put forth by the culturally dominant language.

With native intuitions suspect, and in the absence of other resources, we turn to the perceptions of non-native speakers. The data they can provide are of two sorts: the first relates to the general perceptibility of stress, regardless of native language. If there is consistency in the position of stress as identified by speakers of different native languages, there must be some reality to the percept. On the other hand, by comparing the perception of stress given by native speakers of different languages we can measure up languages

according to their correlation with stress as perceived by native speakers. In this case, looking at the accuracy of Spanish speakers in perceiving Mapudungun stress, as compared to speakers of other mother-tongues, we can infer the degree of influence of the Spanish stress system on Mapudungun-Spanish bilinguals' own perception of stress. In other words, we may attempt to disentangle the phonological modules governing each of the two languages in the bilingual speakers' grammar (cf. de Lacy, 2014).

In the case of Mapudungun and Spanish, if the Mapudungun module is alive and well, perception of its stress is expected to be distinct for bilinguals, when compared to Spanish monolinguals. It is possible, however, that the pattern is equally identifiable to native speakers of Spanish, as well as speakers of other languages. In such a case the cues to the language's prominences must be of a more general nature.

If a convergence is found between Spanish monolinguals and Mapudungun-Spanish bilinguals, we may assume there is some level of overlap in the bilinguals' phonological modules. If the results point to a convergence of all speakers' percepts, we may assume the prominences are, overall, easy to identify, and hence have a means of evaluating native speaker intuition. Finally, if there is one language – other than Spanish – which converges with the native Mapudungun data, we may be in the presence of a very similar system of stress cuing, and hence find that Mapudungun stress assignment is both consistent and independent from Spanish in the bilingual speaker's perception.

(1) Goals for a non-native stress-perception assessment

    a. Is the position of stress as perceived by native speakers of Mapudungun generally or consistently perceived in the same way by speakers of other languages?

b. Are Spanish speakers better than speakers of other languages at perceiving the position of stress in Mapudungun?

MAPUDUNGUN STRESS

Under the exonym 'Araucanian', the nature of Mapudungun stress has been the object of substantial debate in broader typological work.[2] Nearly all of these accounts can be traced back to a single article by Echeverría and Contreras (1965), which places stress on every even syllable of the word, from the left edge.

(1)   Left-right version of Mapudungun stress (Echeverría & Contreras, 1965:134):

a. [wuˈle]   b. [tʂiˈpanto]   c. [eˈlumuˌju]
   'tomorrow'   'year'   'give us'

d. [eˈluaˌenew]   e. [kiˈmufaˌluwuˌlaj]
   'he will give me'   'he pretended not to know'

Such a pattern could be construed as a quantity-insensitive iamb, a foot-type which is explicitly ruled out by versions of the iambic-trochaic law (Hayes, 1985) and is excluded from major contemporary foot typologies (such as McCarthy & Prince, 1986 or Hayes, 1995). A recent article by de Lacy (2014) takes a closer look at the data-source for this debate, finding it suspect (or invalid for current theories) on a number of counts.

Paradoxically, Echeverría and Contrera's paper – although the most widely cited work on Mapudungun stress – is the odd one out in terms of its account of the

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[2] Among others: Hyman, 1977, p.41-2; Kager, 1993, p.409, 2007, p.205-6; Hung, 1994; Kenstowicz, 1994, p.556; Hayes, 1995, p.266; Gordon, 2002, p.522, 2011b, p.143; Hyde, 2002; McGarrity, 2003; p.59-61, Tesar, 2004, p.220-21; Hermans, 2011, p.982-984, Noel, 2013.

phenomenon. In Mapudungun-specific literature we find grammars available from the early 17th century onwards (Valdivia, 1606; Febrés, 1765; Havestadt, 1777; Lenz, 1897; Augusta, 1903; Salas 2006; Zúñiga, 2006; Smeets, 2008) all of which include some remarks on stress. Although details vary concerning secondary stress, as well as the placement of main stress in multi-suffix verbs and compounds; the general rule for main stress seems consistent: stress the last vowel before a consonant. In other words, while Echeverría and Contreras (1965) describe a system that may be construed as a quantity insensitive iamb parsed iteratively from left to right; most other literature – before and after Echeverría and Contreras – describe what may be seen as a quantity sensitive (moraic) trochee, parsed as a single foot from right to left. In sum, every single parameter is reversed.

(2) Penultimate mora stress in Mapudungun (Salas, 2006, p.73-4)
     a. [ʈʂuf.ˈken]   b. [ma.ˈwi.θa] c. [a.tʃa.ˈwaʎ] d. [we.jul.kɨ.ˈlej]
     ‘ash’   ‘woodland’   ‘chicken’   ‘(s)he is swimming’

     This said, descriptions of Mapudungun stress (including Echeverría and Contreras’) also provide the caveat that disyllables ending in a vowel often do not follow the general rule. This is either attributed to lexical stress (Smeets, 2008), or to free alternation (Echeverría, 1964; Salas, 2006; Zúñiga, 2006; Sadowsky, Paniqueo, Salamanca & Avelino, 2013), with the common suggestions that phrase-level phenomena might be exerting an influence (Echeverría, 1964: 48; Zúñiga, 2006: 65; Smeets, 2008: 49).

(3) Stress alternation in disyllables (Salas, 2006, p.73)
     [ˈɻu.ka] ~ [ɻu.ˈka]   ‘house’

The potential for such widespread misrepresentation of a supposedly rare phonological pattern provides reason enough for a more fine-grained examination of the basic data for Mapudungun stress.[3] To begin, from a phonological standpoint, there seems to be no distinction between the segmental inventories of syllables reported as stressed vs. those reported not to be stressed. In an acoustic study, Sadowsky et al. (2013) report a consistently higher F1 for stressed vowels,[4] although this has no major implications for their phonological distribution. In a previous study (Molineaux 2014) I compare pitch, duration and intensity measures in Mapudungun vowels, finding that the percept of stress in words in isolation (as self-reported by native speakers) had pitch maxima alone as a significant correlate when compared to stresslessness.

Given this strong apparent reliance on pitch for Mapudungun word-stress, the same study evaluated the extent to which intonation may interact with the cueing and position of stress (Molineaux 2014, 103-9). Somewhat reassuringly, it was found that, in 595 nouns in a variety of phrasal contexts, the position of pitch maxima was consistent with the last pre-consonantal vowel. As in the case of words in isolation, disyllables ending in a vowel were the only exceptions. Nevertheless, the distribution of final and penultimate stress in these forms showed no particular preference for specific phrase positions. This can be taken to mean that stress-position is not conditioned by phrasal phenomena and that, until more conclusive evidence for the conditioning of disyllabic

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[3] It is puzzling that Echeverrría and Contreras (1965) reach the conclusions they do, seeing as how Echeverría (1964) gives evidence that contradicts the very pattern they put forth the following year. The root of the new proposal may emerge from the prosodic structure of longer words, which are, by and large, suffixed words. The fact that most roots in the language are disyllabic, and that – where there is no clash – the root-final syllable bears stress, must have led to the percept of an initial quantity-insensitive iamb (cf. Molineaux, 2014 for details).

[4] The actual position of stress, upon which the acoustics were based, was established impressionistically by the researchers (Sadowsky, Scott: personal communication).

alternation is provided, words in isolation are appropriate loci for examining the position of stress in Mapudungun words.[5]

Another issue, given that F0 is taken as the key cue for Mapudungun stress, is whether we are dealing with a stress language at all, or rather with a language whose prosody falls in with so-called 'pitch-accent' systems. Here we follow Hyman (2009) in characterising Mapudungun within a property-driven prosodic typology. Crucially, Mapudungun prominence is *obligatory* (i.e. every lexical word must have at least one stressed syllable) and, as can be seen in the multi-morphemic words in (4), it is assigned at the level of the output lexical word, and not at the input morpheme level. These two key traits place Mapudungun firmly within the spectrum of stressed languages.

(4) Main stress on the penultimate mora of polymorphemic Mapudungun words:

a. [kon. -pu.-tu.   -ˈa -j]
   enter-CIS -RESTOR-FUT-IND.3
   's/he will go back into x'

b. [ʈʂi.pa.-ke.   -ˈla -n]
   exit   -HABIT-NEG-IND.1S
   'I don't usually go out'

c. [ɨ.ʈʂɨf.-tu.ku.-ˈla -j. -m-i]
   throw-put.in-NEG-IND-2 -S
   'you don't throw in'

d. [ko.ˈn-i. -j-u]
   enter-IND-1-D
   'you (two) enter'

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[5] In this earlier study (Molineaux 2014), however, I conducted no close analysis for the acoustics of words in context, and did not specifically control for focus, so, although the *position* of stress does not appear to be conditioned by phrasal factors, the *cues* might potentially be conflated with accentual patterns (see Gordon, 2014 for a review of this topic). This is particularly true since the question of the relative weight of pitch excursions was not calculated for accented vs. non-accented positions in relation to other potential stress cues.

FIELDWORK

The stimuli for the non-native perception task, as well as the native speaker stress judgements are taken from a broader set of recordings, belonging to original fieldwork in Mapudungun-speaking communities from Chile's Araucanía Region. Interviews were conducted with seven subjects, all native speakers of Mapudungun, though fluent in Spanish. All speakers learned the language in the home and, in most cases, only began speaking Spanish upon entering school some time between the ages of 6 and 10. Subjects were aged 55-83, and reported no hearing or speech disorders. They all continued to use the language often, when speaking to members of the community of their approximate age.[6] Data for words in isolation were elicited by the principal investigator and one main informant using a picture-naming task.

Native Speaker Intuitions

With the background of Spanish phonemic stress, all speakers were aware of differences in stress patterns, and quite informative as to its position in Mapudungun.[7] After elicitation, speakers were asked if a word could have an alternate stress pattern. The main informant (or interviewer) demonstrated the possible patterns:

(4) Sample native speaker stress discrimination (following picture-naming task):
   Interviewer*: ¿Usted dijo* [ˈɻ̝uka] *o* [ɻ̝uˈka]*?* (Did you say [ˈɻ̝uka] or [ɻ̝uˈka]?)
   Response: [ˈɻ̝uka].   ([ˈɻ̝uka].)

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[6] Subjects were asked a series of questions on their linguistic background including: 1) Is Mapudungun your native language? 2) In what context do you speak Mapudungun at present? 3) Where and when did you learn to speak Mapudungun? 4) Where and when did you learn Spanish? 5) What language do you use most often? The reported data come exclusively from speakers who answered 1) Yes, 2) At least with some members of their immediate community/family, 3) At home during childhood, 4) Upon entering school (age 6-8), or before in the home/community, 5) Spanish more often or both languages equally.
[7] The facilitating role of Spanish in fostering awareness of stress among bilingual speakers of other native languages of South America has been noted by Hintz (2006) for Conchucos Quecha.

Interviewer: *¿Y es posible decir* [ɻuˈka]*?*   (And is it possible to say [ɻuˈka]?)
Response: *También se dice* [ɻuˈka].   ([ɻuˈka] is also used.)

Interviewees were able to decide between the options given, always accepting at least one of the versions. They did often disagree, however, with regards to disyllables ending in a vowel. In such words, a single informant routinely gave both initial and final stress as acceptable. The speaker's first stated intuition is recorded hereafter.

Table 1: Native speaker perception of stress – monomorphemic di- and trisyllables

Syllable structure	Examples	Penult Stress	Final Stress
CV.CV	[ˈθo.mo] ~ [θo.ˈmo] *'woman'*	62%	38%
(C)VC.CV	[ˈwiŋ.ka] ~ [wiŋ.ˈka] *'foreigner'*	60%	40%
CV.ˈCVC	[kɨ.ˈɻɨf] *'wind'*	0%	100%
(C)VC.ˈCVC	[aj.ˈwiɲ] *'shadow'*	0%	100%
(C)V(C).CV.ˈCVC	[a.tʃa.ˈwaʎ] *'chicken'*	0%	100%
(C)V(C).ˈCV.CV	[ma.ˈwi.θa] *'woodland'*	100%	0%

With the native speaker data alone, we have some preliminary evidence for intra-speaker variation in disyallables, going against the claim that differences are due to lexical specification of stress (Smeets, 2008, p. 49-50) or regional and idiolectal variation (Sadowsky, et al. 2013, p. 94). There was also a tendency for speakers to give the stress-initial form when asked expressly for the 'correct' stress pattern of vowel-final disyllables. Both di- and trisyllables with final closed syllables were invariably considered stress-final, with no alternative given. Finally, trisyllables ending in a vowel always stressed the penult.

EXPERIMENTAL DESIGN

A forced-decision auditory task was designed, exploring the percept of stress in Mapudungun disyllables as assessed by native speakers of five different languages

(Spanish, English, French, German, and Japanese). Subjects were played individual disyllabic Mapudungun nouns taken from the picture naming task (words in isolation), and asked to click one of two buttons within 1.5 seconds in order to indicate where they perceived main stress. The words had the structures (C)V.CV; (C)V.(C)VC; (C)VC.CV and (C)VC.(C)VC. Sample waveforms and pitch-tracks for each structure are provided in Figure 1.
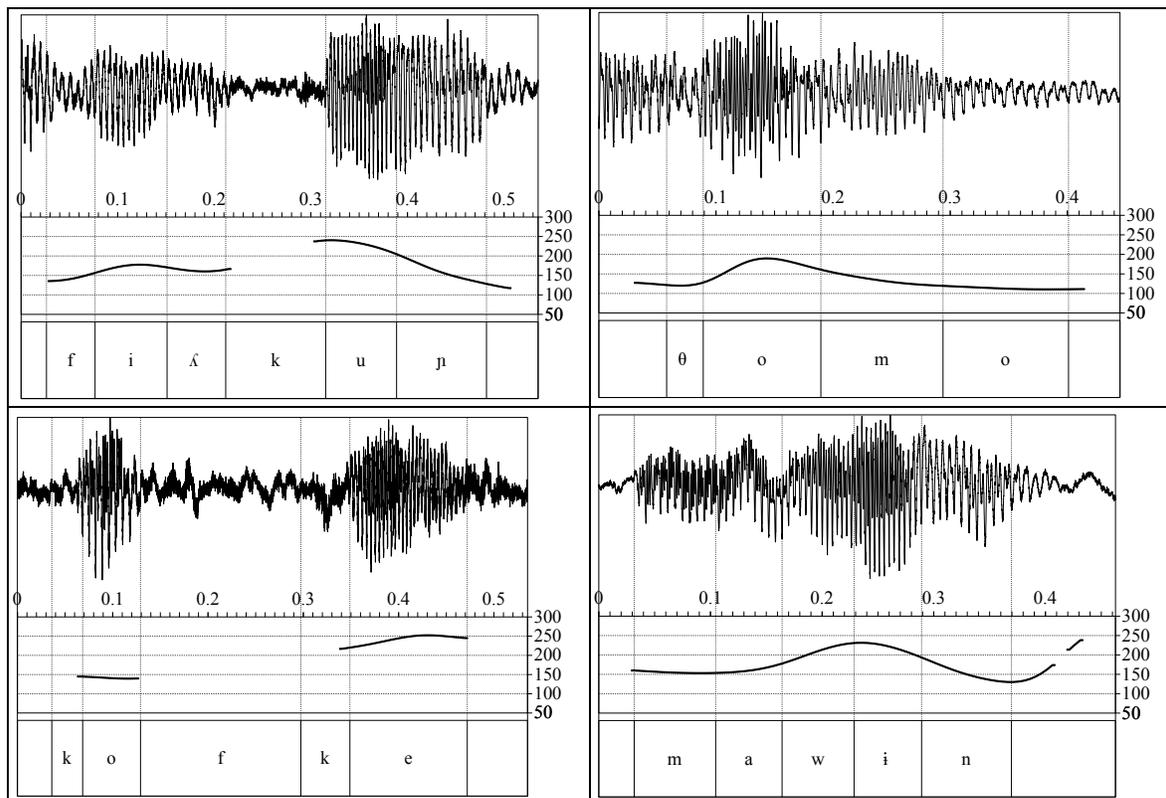

Figure 1: Sample waveforms and F0 (Hz) tracks for stimuli taken from a single male subject. Items: [fiʎ.ˈkuɲ] 'lizard', [ˈθo.mo] 'woman', [kof.ˈke] 'bread', [ma.ˈwɨn] 'tree' – stress is marked according to the position self-reported by the speaker.

Fourteen participants – eight female, six male – were recruited for the task, with a mean age of 28.5. Each language was represented by two participants, with the exception of Chilean Spanish, which was represented by six native speakers, since it is the closest

contact language for Mapudungun and was being examined more closely as regards its influence on the stress of the target language.[8]

The selection of languages was made in order to provide a relatively broad sampling of native stress/accentual patterns and cues, and to establish whether speakers' language background had an effect on the perceptibility of the Mapudungun patterns.

Table 2: Simplified stress/accent patterns and cues for subjects' native languages

Language	Stress/accent pattern; cues	References
French	Phrase final accent (excluding schwa) – alternatively, rising tone at the left and right edges of the accentual phrase	Dell (1984); Jun & Fougeron (2000)
German	Rightmost heavy stressed; cued by F0, duration and, to an extent, intensity	A summary in Jessen (2008); Dogil (1995)
Japanese	Lexical pitch accent; cued by F0	Haraguchi (1999)
English	Quantity sensitive, left-right stress, with word-category-specific extrametricality; cued by vowel quality, spectral balance, duration and F0	A summary in Trommelen & Zonneveld (2008); Sluijter & van Heuven (1996)
Spanish	Penultimate mora in nouns, penultimate syllable in verbs / morphologically conditioned; cued by duration and intensity in non-accented vowels, though dependent on vowel quality as well	Harris (1996); Roca (2005); Ortega-Llebaria & Prieto (2009)

Subjects were required to judge the position of stress in 110 disyllabic noun tokens. These stimuli, given in Table 3, were made up of 22 lexical items (types) presented five times each (5x22=110). The five individual tokens within each type corresponded to the

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[8] All subjects were postgraduate students at Oxford University, so had a working L2 command of English. Aside from the Chilean Spanish speakers, all other subjects had some linguistics training, enough so to require little clarification as to the meaning of the term "stress". Spanish speakers, of course, were aware of stress and its potential alternations as part of the language's orthographic system. None of the subjects had special training in the identification of stress position.

recordings of different Mapudungun speakers interviewed in the fieldwork.[9] Importantly, even though each lexical item was repeated five times, the stress pattern of the words varied amongst the vowel-final forms. This variation, however, was neither lexically specific nor dependent on ~~the presence~~ the structure of the first syllable: about a third of both CVC and CV initial syllables were reported by native speakers as stress-final.

Table 3: Target words for perception experiment:

(C)VC.CVC	[aj.wiɲ] 'shadow'	[fiʎ.kuɲ] 'lizard'	[il.wen] 'dew'	[l̝af.ken̝] 'ocean'	[man.sun] 'ox'	[meʃ.ken] 'chili'	[mɨʎ.pun] 'soot'	7
CVC.CV	[kof.ke] 'bread'	[piw.ke] 'heart'	[wen.ʈʂu] 'man'	[wiŋ.ka] 'foreigner'				4
(C)V.CVC	[e.kuʎ] 'shawl'	[kɨ.ʈɨf] 'wind'	[ma.wɨn] 'tree'	[pu.ʈʂem] 'tobacco'	[ɨ.ʈʂar] 'seed'			5
CV.CV	[tʃa.ʎa] 'pot'	[θo.mo] 'woman'	[ku.ɻa] 'stone'	[ma.pu] 'land'	[ɻu.ka] 'house'	[ʈʂe.wa] 'dog'		6
						Total	22

The tokens were randomised for presentation, with each subject being asked to perform the entire task twice, with two different presentation orders. Thus, each subject was ultimately presented with a total of 220 words for evaluation (110x2=220). A five to ten minute pause separated the two blocks. Participants were given 1500 ms per word to press one of two buttons: left for initial stress, right for final. Figure 2 shows the presentation procedure. A beep, followed by 200 ms of silence preceded every new stimulus. After every ten items, a 5000 ms break was given, marked by three beeps.

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[9] Although for each noun-type there are five tokens – each one a recording of a separate native informant – the task actually contained a total of seven voices. Only the clearest five tokens of each word were used in the task.

Figure 2: Presentation of stimuli
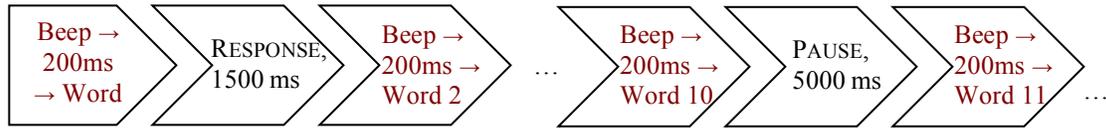
RESULTS

After preliminary analysis, ten of the target tokens were eliminated,[10] either due to a large percentage of omissions (> 25%) or contradictory responses across randomizations in a single participant (in four or more subjects). An even 100 tokens remained.

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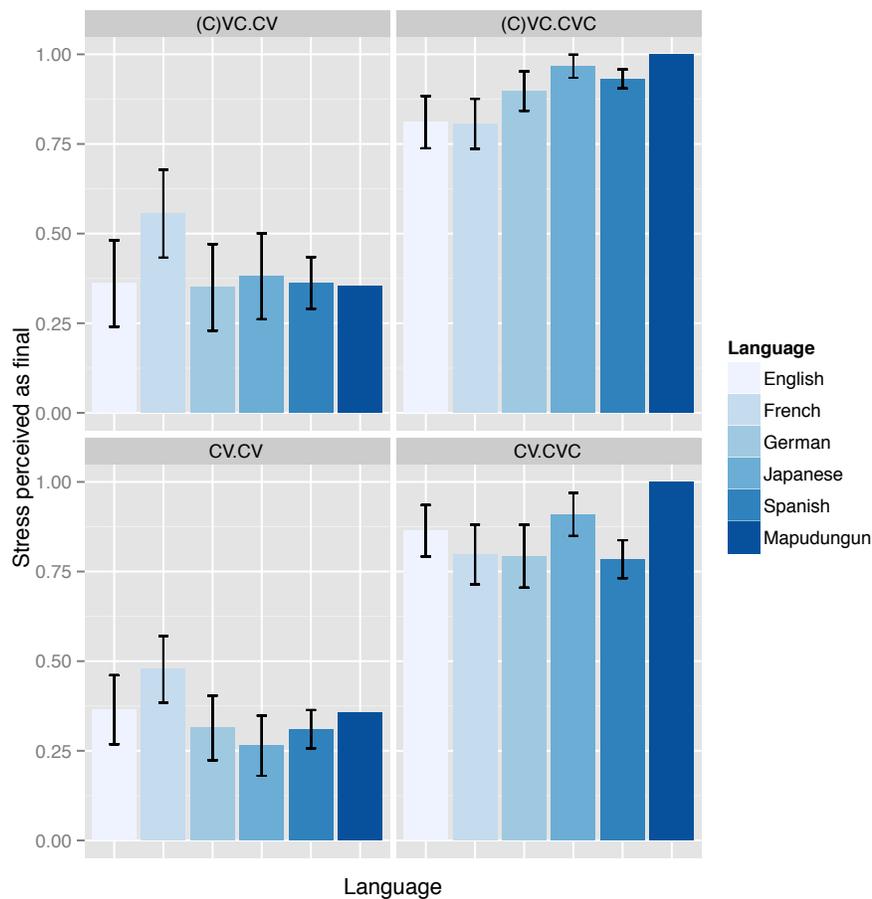
[10] In most cases, the original sound file had either ambient noise or atypical intonation.

Figure 3: Perception of stress-position as final in disyllables by syllable structure and subject's native language

A first approximation assessed the data according to syllable structure and native language. As is evident in Figure 3, there is a clear-cut distinction between final open and closed syllables, stress being identified overwhelmingly on a final closed syllable, irrespective of subjects' native language. These impressionistic findings are borne out by applying further inferential power via a mixed effects logistic regression. The model was set up with the result of the perception tasks as the outcome variable (final/penult),[11] while predictors were subject L1 (English, German, French, Japanese, Spanish and Mapudungun), final syllable structure (closed/open), and penultimate syllable structure (closed/open). The subject, lexical item, and repetition of the task were included as random variables. Finally, individual ANOVAs compared the contribution of the fixed effects to the overall model fit.

The comparisons showed a final closed syllable to be the only statistically significant predictor for the perception of stress position ($\chi^2(1)=36.7$, $p<.0001$). The structure of the penultimate syllable, in contrast, did not reach significance as a predictor ($\chi^2(1)=2.66$, $p<.1$). This was also the case for the overall effect of subject L1 ($\chi^2(5)=4.35$, $p<.5$).

The second step in the analysis involved grouping results according to language background and comparing them directly to native speaker intuitions. Individual Mapudungun speakers' judgement of a token word's stress position was compared to the

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[11] Recall, however, that the data for native speaker stress-position judgements was not obtained via the same task as non-native speakers, bur rather, via the procedure described in (4).

perception given for that token by each individual subject within the non-native perception task. The proportions of matches vs. non-matches were grouped by native language and syllable structure in Figure 4.
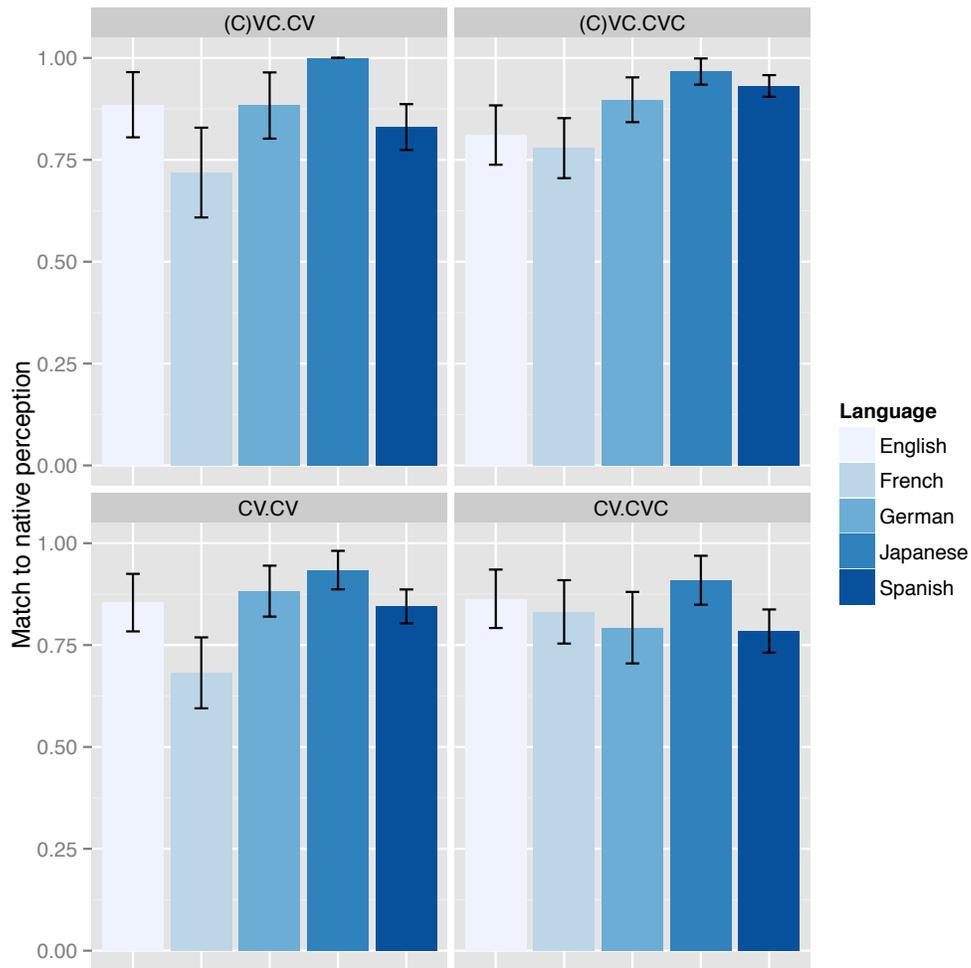

Figure 4: Percentage match of native to non-native speaker stress perception, by L1 and syllable structure

A second mixed-effect logistic regression was conducted to assess the extent to which the match between native and non-native speaker perception (match/no-match) – the

dependant variable – was predicted by the same fixed and random variables as those used in the previous model. Again, individual ANOVAs were calculated for the goodness of fit of the model with and without the fixed variables. In this case, although the overall intercept of the fixed effects was statistically significant (SE=0.53, z =2.8, p<.0051) none of the variables contributed significantly to said fit (structure of final syllable: $\chi^2(1)$=1.26, p<.26; structure of penult syllable: $\chi^2(1)$=2.25, p<.13; L1: $\chi^2(4)$=4.07, p<.4). Although Figure 4, appears to show important differences between the subjects' perceptions according to L1, the model shows no clear relation to this effect. This is particularly important for Spanish (SE=.59, z=.2, p<.84), as we have argued that it might have influenced the Mapudungun phonological module for bilingual speakers.

Although the one-to-one correspondence of native to non-native speaker stress intuitions (Fig. 4) places Japanese speakers as having the highest proportion of matches, and French speakers the lowest, this is not borne out in the model (Japanese: SE=.71, z=1.7, p<.09; French: SE=.69, z=-.25, p<.80). The regression ultimately confirms that the difference in native language appears not to be relevant to the perception of Mapudungun stress, as intuitions overwhelmingly match those of native speakers.[12]

DISCUSSION

Overall, the results of the non-native speaker perception experiment give relatively clear answers to the questions proposed in (1). It appears that the cues for Mapudungun

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[12] Although there is no direct bearing on the discussion below, it is worth noting that in a version of the native-non-native matches model where either the *subject* or *lexical item* random effects were excluded, the effect of Japanese as L1 does become significant. Ultimately, the non-significance of this effect in the full model may be a result of the limited number of subjects for each language, as well as the array of words tested.

prominence are salient enough to be perceived by speakers of languages with different stress/accent systems, and that they all converge on the weight of the final syllable as being a key factor coinciding with the perceived position of stress. Furthermore, non-native speakers are generally capable of perceiving the position of prominences in Mapudungun in the same manner as native speakers, with Spanish speakers not being significantly better in this respect. As a result, we may claim that the Mapudungun stress system remains somewhat independent from Spanish, at least as regards its perceptual cues.

Non-native Intuitions

The observed convergence between native and non-native stress perception suggest, firstly, that cues for stress are relatively robust. Of course, we assume here that words in isolation such as our stimuli may present a fair amount of overlap with accentual patterns, though the evidence presented in our previous study (Molineaux, 2014 pp. 103-9), argues for the fact that this does not interfere with the position of stress. Crucially, from a methodological standpoint, convergence of native and non-native perception of stress position implies that native speaker intuitions are reliable indicators for prominence position. Furthermore, it means that – at least for Mapudungun – non-native speakers can be fairly good judges of the position of stress, and their assessments cannot therefore be brushed aside lightly.

The first major consequence of this finding relates more generally to data sources for the study of stress. It is by no means rare that researchers establish the position of prominence in languages on the basis of their own impressionistic non-native auditory analysis. Whether this is an oversight or an inevitable consequence of the particular

conditions of data gathering for the language, we are often faced with non-native speakers' assessment of stress position, with all the risks this implies (see de Lacy, 2014 for an extensive list). Nevertheless, our data shows that non-native speakers also get it right, and that multiple, different observations may provide us with a relatively sound understanding of the overall system. This, of course, should not be read as *carte blanche* to dispense with native intuitions where these are obtainable.

The second outcome concerns Mapudungun itself and the accounts of its history. It is fair to say that, if non-native speakers today are able to give an accurate assessment of Mapudungun prominence position only 1.5 seconds after hearing a word, we can put greater faith in the grammarians who, in the past four centuries, spent decades in Mapuche communities, usually as missionaries, coming to grips with the language and its stress system. Ultimately, these new data provide greater support for the claims made concerning the diachrony of the language's stress system, for which we have only written, non-native accounts.

The third issue stemming from the consistency of non-native perception of stress concerns the assessment of the proficiency of speakers of Mapudungun today. It was discovered during fieldwork that the single subject who learned the language only in his late-teens, displayed no alternation in disyllabic stress.[13] The subject assigned final stress to disyllables across the board, in a pattern that, of course, differed from Spanish, but which also failed to capture the subtleties of the native Mapudungun system as it emerges from the data presented above.

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[13] Data for this subject are not included as part of the analyses, examples or stimuli elsewhere in this study.

Finally, the experimental data can help ascertain the language's overall stress assignment system. They provide further corroboration of Mapudungun nominal stress as clearly weight sensitive, especially with regards to the final syllable, which is without exception stressed when closed. The data for disyllables, however, are insufficient: both a right-left moraic trochee or a left-right iamb could explain the non-alternating forms (cf. Table 4 c,d) as well as a part of the alternating ones (Table 4 a,b).[14]

Table 4: Moraic trochee vs. iamb in disyllabic nouns (L=Light; H=Heavy)[15]

	Moraic-trochee right-left, ER: right	Iamb left-right, ER: right	Example and gloss
a.	(L̲L)	(L̲L)	[ˈku.ɻa] ~ [ku.ˈɻa] 'stone'
b.	(H̲)(L)	(H̲)(L)	[ˈpiw.ke] ~ [piw.ˈke] 'heart'
c.	L(H̲)	(LH̲)	[kɨ.ˈɻɨf] 'wind'
d.	(H)(H̲)	(H)(H̲)	[l̥af.ˈken̪] 'sea'

The alternating forms (Table 4 a,b) remain difficult to explain in a parametric system. One reason for the alternation might be to do with how the language deals with degenerate feet. Mapudungun has no minimal word conditions, accepting a single light syllable as a content word (cf. [we] 'young/new'), a fact explicitly mentioned by Hayes (1995, p.88) and related to a weak restriction on degenerate feet. In such a case, words of the type HL (Table 4 b) may sometimes be parsed as two independent feet, with the end rule assigning stress to the rightmost. This does not, however, account for the LL-type words (Table 4 a). Alternatively, a requirement for final stress could be proposed to override the parsing of feet, however, this would still only apply sporadically in disyllables and never in trisyllables ending in a vowel. A further possibility is that light-

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[14] A look at trisyllabic nouns and the right-edge of verbs, however, ultimately supports the trochaic analysis (see Example 2 and Table 1, as well as Molineaux, 2014).
[15] Following Hayes, 1995: Moraic Trochee: (L̲ L) or (H̲) and sometimes (L̲). Iamb: (L H̲) (H̲) (L L̲) and sometimes (L̲). Where L=(C)V and H=(C)VC. ER=End Rule.

final disyllables are particularly susceptible to the effects of register, or to higher level prosodic processes.[16]

Independence of Mapudungun stress

The experimental results do not initially appear to support the idea that Mapudungun stress system is independent from that of Spanish in the bilingual speaker's prosodic grammar. This is due to the fact that Spanish and Mapudungun speaker intuitions match up in 85.4% of tokens. This could be a very high proportion, suggesting an influence of the dominant language over the contextually restricted one, if not for the fact that it only shows an average level of correspondence as compared to other sampled languages. Furthermore, Spanish data do not contribute significantly to the general match of non-native to native perceptions of stress position.

In addition to Mapudungun stress perception not being cued in a particularly 'Spanish' manner, the position of stress differs between the two languages in an important way: where Spanish nouns are almost invariably stressed on the penultimate mora[17] (cf. e.g. Harris, 1996, p.871), Mapudungun clearly allows variation in vowel-final disyllables. Neither perceptual cues, nor the position of stress in the dominant language, then, provide clear evidence for the superimposition of Spanish stress on Mapudungun.

The alternation of stress in Mapudungun disyllables, furthermore, cannot be viewed as a contact phenomenon, as it is attested well before the period of intense contact between

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[16] Both of these aspects may be precisely what was suggested by Febrés (1765: 8), with regards to phrase final syllables being pronounced 'long' in formal contexts (see fn. 18), however the current state of the language seems not to limit final stress to phrase edges, though the idea of 'formality' has been claimed to have a role (cf. Molineaux, 2014).

[17] Exceptions to this rule are mostly in borrowed nouns ([ra.ˈβi] 'rabbi'; [me.ˈnu] 'menu') and very few reduplicative 'baby-talk' words ([ma.ˈma] 'mum'; [pa.ˈpa] 'dad'; [be.ˈbe] 'baby').

the languages, from the end of the nineteenth century onwards. Although the first explicit claims regarding disyllabic alternation surface only half a century ago (Echeverría, 1964), the textual evidence points to its existence earlier in the history of the language.

Early grammars all mention the existence of exceptions in their stated stress assignment system. Particularly in Febrés' 1765 grammar we find mention of stress shifting to a final open syllable, where it would normally fall on the penultimate mora.[18] The alternation is restricted to words before pauses in formal speech. His examples, interestingly, are all disyllables: [maˈpu] 'land', [weˈnu] 'good', [miˈta] 'again' (1765: 8). Moreover, in the first texts with 'exceptional' stress marked in writing (cf. Lenz 1897; Augusta 1910, 1916[19]), nouns mostly surface with stress on the ultima of vowel-final disyllables.[20]

Loanword stress provides additional evidence for the independence of present day Mapudungun stress assignment: just as Mapudungun borrowings into Chilean Spanish are reliably stressed on the penultimate mora (cf. Table 5), the fieldwork shows that Spanish disyllables are borrowed into Mapudungun with the alternation described here for native Mapudungun nouns (cf. Table 6). In other words, lexical items are not borrowed wholesale, but fit into an independent prosodic system.

Table 5: Chilean Spanish loanword stress:

Original Mapudungun	In Spanish
[ˈɻ̝uka] ~ [ɻ̝uˈka] 'house'	[ˈruka] 'Mapuche house'

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[18] "Quando [los mapuche] hablan en tono de sermón, que llaman *Coyaghtun*, todas las palabras en que hacen pausa, las pronuncian largas." When the Mapuche speak as befits a sermon, which they call *coyaghtun*, every word where a pause is made is pronounced long [i.e. with final stress] (Febrés 1765:8).
[19] Both consider 'non-exceptional' main stress to fall on the last vowel before a consonant.
[20] The tendency to alternate is noted by Lenz and exemplified by contrasting position of stress in the word [ɻ̝uka] 'house' in the sentences: [təˈfamu məθi ɲi ˈɻ̝uka] 'here is my house' and [ɲi ɻ̝uˈka mo kəpˈan] 'I come from my house'.

[ˈkilʈʂo] ~ [kilˈʈʂo] 'dog'	[ˈkiltro] 'stray dog'
[kaˈwiɲ] 'celebration'	[kaˈwin] 'gossip'

Table 6: Mapudungun loanword stress

Original Spanish	In Mapudungun
[ˈtaβla] 'board'	[ˈtafla] ~ [tafˈla] 'board'
[ˈtʃantʃo] 'pig'	[ˈsanʃu] ~ [sanˈʃu] 'pig'
[aˈrao] 'plough'	[aˈɻaw] 'plough'

New fieldwork, coupled with contemporary and historical accounts, allows us to say with some certainty that penultimate mora stress in Mapudungun monomorphemic nouns has remained unchanged for at least two hundred and fifty years.[21] The major exception to this rule is the alternation in vowel-final disyllables, for which we have evidence for a similar period of time. The experimental evidence given here shows that the alternation is not superimposed by centuries of contact, but has long been an independent, native feature.

Conclusions

Although non-native and even native intuitions have been considered suspect diagnostics for phonological knowledge (cf. Werker & Tees, 1984; Dupoux *et al*. 1997, 2008), when it comes to stress, the essential fact is that no single defining factor can be isolated without the input of speaker intuitions. De Lacy (2014:177) makes an important point: 'Even if intuitions are a delusion, in some cases they are a shared and consistent delusion, and the source of the delusion might provide insight into phonological knowledge'. This

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[21] The case of verbs, where suffixation is both abundant and complex, requires additional inspection, such as that presented in Molineaux, 2014 §3.4, §4.3.

is precisely the case for Mapudungun: whatever the reason behind the alternation in disyllable prominence placement, this alternation is consistently perceived by both native and non-native speakers and is clearly restricted to words with final light syllables.

Using data from non-native speakers to assess native speaker intuitions is useful in this context insofar as it gives further support to what at first blush appears to be rampant alternation. It can therefore provide us with an additional means of evaluating unexpected patterns which may otherwise be naïvely attributed to contact-induced attrition. It also allows us to extrapolate and give greater reliability to accounts of bygone eras for which we have no native subjects or recordings to rely on directly. Finally, it is crucial in informing our understanding of stress-pattern and cue preservation, both at the level of the individual and of the language as a whole.

Beyond its Mapudungun-specific results, this study provides grounds for giving greater credence to the assessment of stress position put forth by non-native speakers in much of the primary literature. This is especially the case for languages where true native intuitions are hard or impossible to come by. Although, where native intuitions may be probed, this is undoubtedly the path to follow, the triangulation of evidence based on as many possible sources of non-native intuition as are available may – and should – be given due attention in order to inform work on stress typology.

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