



## Research Article

# Second language acquisition of intonation: Peak alignment in American English



Calbert Graham\*, Brechtje Post

Phonetics Laboratory, DTAL, University of Cambridge, Cambridge CB3 9DA, UK

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## ABSTRACT

The objective of the present study was to investigate (1) whether, and to what degree, late bilinguals of different L1 backgrounds are comparable to native speakers in the phonetic implementation of tonal targets in their L2, (2) whether they exhibit general patterns of acquisition irrespective of the typological closeness of their L1 to their L2, and (3) whether learners' choice of accent contours and the alignment of the high tone ( $H^*$ ) proceeds in parallel with proficiency in the L2. More specifically, we examined the acquisition of the nuclear contour composition and the  $H^*$  alignment of the American English (L) $H^*$ L- (i.e. pitch accent and boundary tone combination) in initial-stressed and final-stressed words by Japanese and Spanish late bilingual speakers at varying proficiency levels in American English. Our results show that the L1 Spanish speakers were more comparable than the L1 Japanese speakers to the native English speakers in the phonological aspect of intonation (choice of pitch accent contour). In terms of peak alignment, we found that the late bilinguals generally tended to realise significantly later alignment than the native speakers, although the precise manifestation of this varied according to the L1 background of speakers and the stress pattern of words.

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## 1. Introduction

It has long been established that the acquisition of a second language (L2) can entail some degree of interaction between the native (L1) and target language phonological systems of late bilinguals, often through the transfer of L1 properties to the L2. The vast majority of studies that have addressed this issue have examined the acquisition of segmental features, although within the past two decades or so there has been a growing body of literature on the acquisition of prosodic phenomena by late bilinguals (see [Gut, 2009](#) for a review).

Prosody poses a particular challenge for second language acquisition (SLA) theories because of the difficulty in isolating the categorical or phonological sources of influences from gradient or phonetic sources. The relatively few existing studies of L2 prosody suggest that different aspects of prosody develop in different ways. That is, the acquisition of, for instance, lexical stress ([Archibald, 1994](#)), accent distribution ([Rasier & Hiligsmann, 2007](#)), accentual lengthening ([Barry, 2007](#)) and variability in the timing of vowels ([Li & Post, 2014](#)) follow general or universal developmental paths. In general, the findings suggest

that learners produce what are often referred to as 'default' or 'unmarked' values in their interlanguage irrespective of their L1, and progressing in the direction of the L2 as their proficiency increases. By contrast, intonational aspects like pitch range, register, and direction (falling or rising) show transfer effects ([Backman, 1979](#)), progressing from L1-like values towards L2 values as proficiency increases. Research also suggests that imitation as a strategy may play a role in the acquisition of second language intonation. For example, [Cavone and D'Imperio \(2006\)](#) show that both accentual and pre-boundary lengthening in L2 French by Italian learners are modified as a consequence of imitation, and are very different in the baseline. This finding shows the effects of rote learning in the acquisition process and serves to somewhat modulate the universalist claim. Intonational features are by no means easy to define and characterise, not least because of the different assumptions researchers make and, consequently, the different frameworks they employ (e.g. see the debate on prosodic typology between [Beckman & Venditti, 2010, 2011](#) versus [Hyman, 2001, 2006, 2011](#)). It might be agreed, however, that the advent of the autosegmental-metrical framework has made it more feasible to compare the intonation of different language systems (e.g. [Ladd, 2001](#)).

\* Corresponding author.

E-mail address: [org29@cam.ac.uk](mailto:org29@cam.ac.uk) (C. Graham).

The autosegmental-metrical (AM) approach was originally developed as a descriptive analysis of English intonation by Pierrehumbert (1980) and others (on intuitions implicit in earlier works such as Bruce, 1977; Goldsmith, 1976; Liberman, 1975). The AM approach has subsequently been extended to other languages (Japanese by Beckman & Pierrehumbert, 1986; Pierrehumbert & Beckman, 1988; Venditti, 1995; Korean by Jun, 1993; Dutch by Gussenhoven, 1984; Gussenhoven, 2004; French by Post, 2000 and Jun & Fougeron, 1995; Greek by Arvaniti & Baltazani, 2005; among many others). The AM framework is the most widely used phonological framework for analysing intonation in various systems partly because of its simplicity, versatility and conceptual elegance.

The central idea behind the approach is that categorical phonological representations should be distinguished from gradiently varying phonetic realisation in the description. Phonologically, there are high (H) and low (L) tones that are associated either with metrically prominent syllables (indicated by an asterisk, e.g. H\* or L\* – often called ‘starred’ tones or pitch accents), or with phrase boundaries (H- and L- are associated with the edges of intermediate phrases, whilst H% and L% mark intonation phrase boundaries). The inventory of pitch accents and boundary tones varies between languages, as do the phonotactics that constrain how they can be combined within utterances. Languages exhibit significant contrasts in their intonational phonology not only in terms of distribution and realisation of pitch accents but also in the number of tonal primitives they allow and the way in which they can be combined. The phonetic component controls the language-specific implementation of the underlying tones as tonal targets, determining their timing (alignment) and pitch height (scaling) relative to the segmental string. The present study will focus on pitch accent production and the alignment aspect of their phonetic implementation.

Previous studies (e.g. D’Imperio & House, 1997; Dilley & Brown, 2007; Pierrehumbert & Steele, 1989; Rietveld & Gussenhoven, 1995) report findings which suggest that listeners tend to process certain phonetic details of tonal targets categorically (see Ladd, 2008 for a further discussion), although an alignment distinction cueing two different categories in one language may not represent distinct categories in another language. For example, L\*+H and L+H\* are distinct categories in American English, but are not in Parisian French (in prenuclear position), although the timing of a rising movement does vary in French. For more on this, see Post, 2011; but also D’Imperio, Bertrand, Di Cristo, and Portes, 2007 for claims for the existence of contrastive alignment of non-final rises in French. Furthermore, there is evidence that this category (i.e. inventory of pitch accents) vs. gradience (i.e. the phonetic realisation of pitch accents) distinction may even vary across different dialects of the same language, for example, L+H\* and H\* in American English are manifested as the same category in some dialects (e.g. Minnesotan dialect), and as distinct categories in others (e.g. Southern California dialect) – (Arvaniti & Garding, 2007). Moreover, research (e.g. Niebuhr, D’Imperio, Gili Fivela, & Cangemi, 2011) suggests that individual differences in alignment can also be found within the same language variety.

A key assumption of the original AM framework is that tonal association to segments is determined by phonetic alignment,

though this view has been challenged by some researchers who argue that peak alignment may also be phonologised without any evident phonetic motivation. Note, for example, a study by Arvaniti, Ladd, and Mennen (2000) that challenges the concept of starredness based on phonetic alignment by showing that neither the L nor the H tone is consistently aligned with the accented syllable in Greek rising bitonal pitch accents in prenuclear position. More generally, the available evidence from this line of research suggests that tonal alignment in pitch accents is not only phonetic but can also be phonologically specified (see Prieto, D’Imperio, & Gili Fivela, 2005 and D’imperio, 2006 for insightful discussions of this point<sup>1</sup>).

Second language learners may have difficulties not only in producing context-appropriate intonation patterns, but also in their implementation of the phonetic details of their production. We know very little about how the phonological and the phonetic component of intonation develop in L2 learners. Mennen (2015) introduced a new model – the L2 Intonation Learning Theory (LILt) – as a first step to standardise variables relevant to intonation learning. The model is based on the premise that cross-language differences in intonation can occur in a number of dimensions, including the inventory of pitch accents and their phonetic realisation. This opens the possibility for research on how these various dimensions are acquired by learners of different proficiency levels and typologically different L1s. This could shed light on a number of outstanding issues, including the following.

1. How learners acquire the phonological and the phonetic aspects of intonation. The findings in the area of L2 segmental acquisition (e.g. L2 acquisition of vowels) generally show that even when learners have acquired a specific category of sound (i.e. a phoneme) their manipulation of individual acoustic cues may still not be native-like.
2. How the various aspects of intonation develop with proficiency in a target L2. The experimental evidence for segmental processing, and indeed the limited research that has been done on L2 prosodic acquisition, suggest that experience with the target language typically plays a role in the degree to which L2 speech is perceived as natural or intelligible.
3. What the role of L1 typology is in L2 intonation. Studies in segmental acquisition and the limited research on L2 intonation suggest that L1 background plays a crucial role in L2 speech production.

The study reported in this paper examines the acquisition of pitch accent contour shape and alignment of the high tone in the (L+)H\*<sup>2</sup> pitch accent in American English in the final falling (L+)H\* L-L% contour by L1 Japanese and L1 Spanish speakers who are late bilingual speakers of American English. More specifically, the study compares the choice of pitch accent contour shape and tonal alignment (location of tones in relation to the segmental string) of the H\* peak in the (L+)H\* L-L% pitch contour in L1 and L2 American English within the autosegmental-metrical approach.

<sup>1</sup> It may be worth indicating here that the notion of starredness is less controversial in the formalisation of American English intonation within the AM framework, and for this reason this point will not be discussed in further detail in the present study.

<sup>2</sup> Please note that (L+)H\* is used in this paper to signify either one or the other of the following two pitch accents: H\* and L+H\*. As will be discussed later, L+H\* can be treated as a minor variant of H\*.

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