

Third Workshop on Second Language Prosody

Abstract Booklet



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Cues or Codes: An Investigation into ‘accent relativity’.

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Recent research shows that bilinguals’ native language affords privileged access to semantic information pertaining to the native culture. However, it is currently unknown whether language per se is the driving force in this relationship, or whether it is part of a constellation of cultural cues, any of which can form a strong link with cultural semantics. Here, the current project examined whether phonological characteristics of speech – the speaker’s accent – is one such cultural cue, which can trigger privileged semantic access on a par with language. Native Welsh-English bilinguals listened to Welsh and English sentences that were spoken in either a North Welsh accent, or in a South Eastern English accent. Sentence content was either culturally relevant or irrelevant, and true or false. (*Globally, Welsh is the oldest language / Many countries share the same language.*) Our data shows that culturally specific sentences heard in a Welsh accent led to reduced N400 compared to sentences heard in an English accent, even though the sentence content was identical and in both cases, presented in English. These data suggest that accent constitutes another cue – similar to language – that primes culturally relevant knowledge.

Judging uptalk in a native and non-native dialect.

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Non-question rises (also called uptalk, high rising intonation or high rising terminals) refers to ending a declarative sentence with high rising intonation. Popular literature has argued that uptalk can lead to confusion and suspicion, and has typically judged uptalk negatively (e.g. Psychology Today, 2015). Tyler's (2015) scientific analysis found that sentences with uptalk were perceived as less finished, less intelligent, but happier and clearer. While uptalk has been stereotypically associated with women, Armstrong et al. (2015) found that male and female college students from two dialects of US English used it at about the same rate. In this study, we compared perceptions of uptalk across two dialects to explore how two groups that differ in their native dialect as well as in terms of cultural background perceive these rises in the same speakers.

In a matched-guise study, 52 British (mean age = 27) and 44 American (mean age = 40) participants rated American English speakers with and without uptalk. Participants listed to eight brief excerpts from TED talks. Half the excerpts contained uptalk and the other half did not. There were two versions of each excerpt: the original version and a changed-gender version, where the gender of the speaker was changed from male to female or female to male using Praat (Boersma & Weenink, 2013). The original and changed-gender versions were counter-balanced across two lists. Participants listened to eight speakers in Google Forms and rated each speaker on several dimensions. They then completed a section with demographic information.

The results showed that speakers with uptalk were rated as significantly more intelligent, educated, and organized (UK only, all $p < 0.05$) than speakers without uptalk. While US participants rated female speakers as significantly more self-assured, more assertive, more self-confident, more ambitious, and stronger than male speakers, UK participants rated female speakers as significantly less self-assured, less self-confident, and weaker.

Our results do not confirm Tyler's (2015) results which suggested that speakers with uptalk sounded less intelligent. It is possible that uptalk is becoming more accepted. Surprisingly, given popular commentary on this phenomenon, speakers with uptalk were rated as more intelligent. Since we did not manipulate final rises in the brief excerpts for a fully counter-balanced design, it is possible that the speakers with uptalk talked about more scientific topics, resulting in higher intelligence ratings. We also found a clear difference in how US and UK participants rated female vs. male speakers on aspects that relate to self-confidence and strength. Thus, participants who shared the dialect of the speakers rated women higher on these aspects, whereas participants who did not share the dialect of the speakers rated women as lower on these aspects. It is not clear what drives this consistent difference between US and UK participants.

Do you hear ‘feather’ when listening to ‘rain’? Lexical tone activation during unconscious translation: Evidence from Mandarin-English bilinguals.

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Although lexical tone is a highly prevalent phonetic cue in human languages, its role in bilingual spoken word recognition is not well understood. The present study investigates whether and how adult bilinguals, who use pitch contours to disambiguate lexical items in one language but not the other, access a tonal L1 when exclusively processing a non-tonal L2. Using the visual world paradigm, we show that Mandarin-English listeners automatically activated Mandarin translation equivalents of English target words such as ‘rain’ (Mandarin ‘yu3’), and consequently were distracted by competitors whose segments and tones overlapped with the translations of English target words (‘feather’, also ‘yu3’ in Mandarin). Importantly, listeners were not distracted by competitors that overlapped with the translations of target words in all segments but not tone (‘fish’; Mandarin ‘yu2’), nor were they distracted by competitors that overlapped with the translations of target words in rime and tone (‘wheat’, Mandarin ‘gu3’). These novel results demonstrate implicit access to L1 lexical representations through automatic/unconscious translation, as a result of cross-language top-down and/or lateral influence, and highlight the critical role of lexical tone activation in bilingual lexical access. This work is the first demonstration of lexical tone activation through unconscious (recently published in *Cognition*); while earlier work (e.g., Shook & Marian, 2016) triggered lexical tone activation in L1 through superimposing Mandarin pitch contours onto L2 English syllables. In other words, tonal information was available in their L2 input, while absent in our current study in L2 input. Thus, lexical access through tonal information is operated by completely different mechanisms in the current study, compared to previous work.

Production and comprehension of contrastive pitch accents in the L1 and the L2.

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Contrastive pitch accents convey a contrast, such that the accented word is contrasted with an upcoming or preceding word in the discourse. Adult native speakers of English and German can use contrastive pitch accents to predict upcoming referents (cf. Ito & Speer, 2008; Weber et al., 2016). For example, when hearing *Click on the blue book. Click on the RED...* (where CAPS indicate a contrastive accent), adult native speakers will predict that the noun *book* will be repeated. Such prediction does not occur when hearing the same sequence without a contrastive pitch accent, as in *Click on the blue book. Click on the red....* Children show the same sensitivity to contrastive pitch accents, but are generally slower in their processing (cf. Ito et al., 2014). The current study investigates how bilingual adult participants process and produce contrastive pitch accents in their L1 and they L2, with the following research questions:

- (1) Can L2 learners use contrastive pitch accents to predict upcoming referents?
- (2) Does predictive processing depend on recent exposure?
- (3) Does exposure to contrastive pitch accents influence the production of lexical contrasts?

Eighteen native-German intermediate to advanced L2 learners of English participated in the study. For the comprehension task, participants eye movements were monitored as they followed a speaker's instructions to click on two successive objects. For the production task, participants produced instructions to click on two successive objects. All instructions were of the form *Click on the [COLOR] [OBJECT]*. During comprehension, the speaker always produced the first instruction with neutral prosody, and the second instruction with neutral prosody or with a contrastive accent either on the color adjective or the noun. The experiment contained 48 production trials, followed by 48 comprehension trials, an exposure phase, another 48 comprehension trials, and 48 additional production trials. During the exposure phase, but not during comprehension trials, a contrastive pitch accent on the adjective of the second instruction was always followed by a repeated noun, whereas a neutral second instruction had a new noun.

The comprehension results before exposure revealed a main effect of language ($p < 0.001$) with reliably earlier looks to the target object in the L1 compared to the L2 as well as a language by prosody interaction ($p < 0.01$), which showed that contrastive pitch accents only facilitated reference resolution for repeated nouns in the L1, but not the L2. After exposure, a main effect of language ($p < 0.001$) and a main effect of prosody ($p < 0.05$) revealed reliably earlier looks to the target object in the L1 compared to the L2 as well as contrastive pitch accents facilitating reference resolution for repeated nouns in both the L1 and the L2. Production results suggest that a majority of contrastive pitch accents are produced felicitously, but there us no influence of exposure on productions. Overall, the results suggest that recent exposure to a consistent speaker plays a role in processing contrastive accents in the L2, such that L2 learners only use contrastive pitch accents to predict upcoming referents after recent exposure to a consistent speaker, but not before.

Declination patterns of native and nonnative English.

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First investigated in the 1960's and having been under study for decades, declination was first realized as a result of physiological constraints [1]. Possible causes include tracheal pull [2], downtrend of subglottal pressure [3, 4], and the activity of laryngeal muscles [5]. In addition to these physiological factors, speaker-controlled planning is also believed to be involved as the linguistic share of declination [6]. The down drift trend is commonly observed in speech production, whereas in speech perception, listeners tend to automatically compensate for such a downtrend [7].

Declination in L2 speech has been a relatively new realm. In this study, declination patterns of native and nonnative English production were investigated. Materials were two text passages (165 words in total) used in a national standardized English test; all the sentences were descriptive ones. Two groups of eight Mandarin learners of English were randomly selected from the test takers in accordance of their oral scores: Those who obtained the highest score were categorized as High L2, while those who barely passed the test as Low L2. A group of eight native speakers was also recruited as a control. Intonation phrases (IPs) and pitch accents were labelled for each recording following the ToBI convention [8].

Preliminary results showed that the extent of declination worked as a function of IP duration only for the Low L2 group. Duration seemed not to be a major contributor for declination in the other two groups. In addition, the number of pitch accents within each IP was negatively correlated with the speakers' proficiency levels. The Low L2 group had the largest number of accents per IP, followed by the High L2 and the native groups, respectively. Furthermore, for the Low L2 group, the more the number of accents per IP, the greater the declination extent was observed; this positive correlation held true when the extent of declination was replaced by the pitch value of the first accent of any given IP. Data from the L2 groups' Mandarin production will be collected to examine whether this is due to L1 transfer or merely immature L2 prosodic development.

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The long-term effect of training in the learning of Spanish stress contrasts by French-speaking listeners.

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French-speaking listeners –who are said to be 'deaf to stress'– tend to experience difficulties in perceiving stress contrasts in a second language like Spanish (0). Nevertheless, as showed by our recent research (0), they are able to improve their stress detection ability after a 4-hour training.

Researchers have examined the durability of the training effect for segmental and tone contrasts (e.g., 0, 0), and found that the contrasts were maintained long after training (i.e., three to six months). However, to our knowledge, the long-term retention of stress contrasts has not been studied yet. The aim of the present research is thus to test the durability of the training effect in the learning of Spanish accentual contrasts by French-speaking listeners.

For this, we developed an experimental design composed of 4 phases: 1) Pre-tests; 2) Two-week training (8 x 30-minute sessions); 3) Immediate post-tests: 2 days after the training period; 4) Delayed post-tests: 1 year after the training period.

In the pre-tests, immediate and delayed post-tests, the participants performed two tasks involving different processing levels: a stress identification task ('ID') and an Odd-One-Out task ('OOO') (0). In the training phase that focused on Spanish accentuation, half of the participants received an explicit training and the other half an implicit training (see 0 for the details). The participants were French-speaking listeners without knowledge of Spanish. Among the 49 participants who took part in Phases 1-3, only 23 were able to participate in Phase 4. Twelve performed the explicit training, and 11 performed the implicit training. We also included a control group of 23 French-speaking listeners, who did not receive any training and performed twice the identification and Odd-One-out tasks at a 2-week interval.

As can be seen in Table 1, the accuracy in the delayed and immediate post-tests were similar, both higher than in the pre-tests, which reveals that the improvement was maintained one year after training. The absence of the effect of test in the control group (with no training) confirms that the improvement we observed with explicit and implicit training methods was caused by the training phase and not by the repetition of the task.

Task	Training	Pre-test	Immediate post-test	Delayed post-test	Statistics
Identification	No training	52.43	52.46	---	No effect of test
	Explicit	60.56	74.31	76.46	Effect of test
	Implicit	56.14	68.48	70.91	No effect of training No interaction
Odd-One-Out	No training	45.56	46.41	---	No effect of test
	Explicit	52.26	62.27	62.94	Effect of test
	Implicit	51.20	59.53	59.79	No effect of training No interaction

Table 1. Accuracy (%) as a function of task, training method and test.

In conclusion, the training effect, independently of the training method and task appears to be robust, especially given that the participants were not exposed to Spanish between the training and the delayed post-test. These findings suggest that, as for segmental and tone contrasts, French-speaking listeners are able to create novel stress contrasts that remain stable over time.

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Acoustic correlates of L2 prosodic boundaries by German learners of French.

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Deviations in L2 intonation affect a number of prosodic characteristics including pitch range, declination line (Mennen, 2007), or the rises of non-final IPs (Santiago et al. 2015), and might lead to misunderstandings or contribute to the perception of foreign-accent (Jilka, 2007). This study investigates the characteristics of non-native speech at the boundary between prosodic constituents. We analyzed a French sentence, extracted from the IFCASL corpus (www.ifcasl.org), made up of four constituents: a subject, a verb phrase, a direct object and an adverbial phrase. Each constituent has three syllables and the sentence is realized typically by French speakers with four accentual –prosodic groups, corresponding to the four constituents. Forty German learners of French (beginners, and advanced speakers) and fifty four French speakers read the sentence once. We used the software ProsodyPro from Yi Xu for the prosodic analysis.

We determined the presence of pauses and evaluated for each prosodic group: the (normalized) F0 maximum on the last syllable; the F0 excursion (max-min) of the final contour, and its maximum of velocity. In order to analyze the temporal course of F0 on the final contour, we also compared the values of the F0 excursion on the vowel and before it.

As expected, German speakers realized more pauses than French speakers (four times more). These pauses occurred in general after the first and the third groups (the subject and the object). Despite large individual variations, results, submitted to the Kruskal-Wallis non-parametric statistical analysis, showed highly significant differences between French and German realizations, especially for the first group. These differences were observed in presence and in absence of a following pause. For the first group, the F0 max, the F0 excursion as well as the velocity were more important for non-native speakers, especially beginners. Moreover, whatever the amplitude of the overall excursion, the F0 rise was more important before the vowel than on it for most French speakers, contrary to what happens for most German speakers, especially beginners. Similar differences were found for the third group, except for F0 max and velocity. On the basis of acoustic cues, non-native speakers, especially beginners, appear to realize higher prosodic boundaries (e.g. higher F0 maxima, more pauses) than French does, whereas French speakers appears to show more anticipation (see F0 course). Data will be submitted to models (in particular INTSINT and PENTA) for further interpretation.

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Organization of L2 prosodic features as evidence for prosodic typology.

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In the studies on the acquisition of phonological skills in a second/foreign language (L2), first language (L1) phonological influence has never really been called into question and plays a major role in most theoretical models of phonological acquisition (Rasier & Hilingsmann 2007). Works on either contrastive phonology, L2 error analysis, or later on interlanguage all assume that a learning language at any stage of acquisition possesses grammar as any other natural language, and that a phonological system within its grammar is independent of both L1 and L2 (Selinker 1972, Corder 1981).

Although prosodic errors are reported to have at least as much detrimental effect to the degree of foreign accentedness of L2 speech as segmental ones (Jilka 2000, Boula de & Vieru-Dimulescu 2006, Kang 2010 etc.), focus was traditionally placed on the phonemic level while rather little research has so far been done on the interference effects upon the acquisition of L2 prosodic characteristics. This especially holds true for typologically distinct languages (Lai 2003, Hirano & Kawai 2005, Rasier & Hilingsman 2007, Choi et al. 2017), and among those Japanese and Slovene in particular (Golob 2008).

Based on the idea that prosodic properties and their same vs. different exploitations among languages play an important role in prosodic typology (Grabe 2002, Hyman 2011), this study examines lexical and post-lexical properties in pitch-accent Japanese, stress-accent Slovene, and L2 Japanese spoken by Slovene natives at the beginners and intermediate level. Acoustic analysis was conducted on a controlled spoken discourse in a way to allow extraction and evaluation of fundamental frequency (F0) with lexical (accent), post-lexical (intonation), and paralinguistic (focus) functions, focusing on the behaviour of F0, intensity and duration on accent locus.

Analysis of the L2 Japanese in comparison to L1 Japanese and L1 Slovene shows two types of prosodic transfer: 1) inter-level; stress-accent interference, and 2) intra-level; post-lexical and paralinguistic implementation order interference. The latter type of transfer points out the differences in prosodic organization of the two languages as well as in the ranking of their prosodic constraints, and suggests that interlanguage prosody may be a valuable source for discussions on the general structure and organization of prosodic features in a human spoken language.

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Question intonation in the first and second dialect of a bi-dialectal child.

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There is abundant evidence that interlocutors adapt to each other's speech in terms of pronunciation, lexical choice, syntactic structures etc. Similarly, the language of the environment may influence people's pronunciation (cf. Sancier & Fowler, 1997). This study investigates dialect change in a bidialectal child. Most of the literature on children's dialects concerns the acquisition of non-standard dialects and often relates to school performance. In contrast, few studies explore dialect change in children who move to a new dialect area. The current case study aims to start filling this gap and has the following research questions:

- (1) How does a child's pronunciation change when moving into a new dialect area?

The focus of the current analysis is on yes-no question intonation in a bidialectal child, who grew up with American English and moved to the UK at the age of five. Following the move, the child's question intonation seemed to be affected by exposure to the new dialect. Yes-no questions are said to end in high-rising intonation in US English and in low-rising intonation in British English (but see Lewis, 1999). The child was recorded 3, 6, 15 and 18 months after moving to the UK. During each session, the child played a bingo game with two adults, one who speaks American English and one who speaks British English. The Bingo game elicited yes-no questions, such as *Does Mary have a blue banana?* The results suggest clear changes in the child's yes-no question intonation over time. In particular, the child is adapting to the final rises of the American English interlocutor in the first two sessions, but to the flatter intonation contours of British English interlocutor in the last two sessions. Overall, the results suggest a change in the child's yes-no question intonation within the first year of moving to a new dialect area.

The role of phonetic aptitude and language use in L2 prosodic acquisition.

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Few studies have investigated the impact of bilinguals' individual differences on second language (L2) acquisition of prosody. Here, we explore whether late L2 learners' phonetic aptitude and language use influence how target-like they are in the prosody of Arabic and English wh-question words. Wh-question words are characterised by a steep rise in pitch on the wh-word in Arabic, but not in English (Defense Language Inst, 1974).

15 monolingual native Arabic speakers from Saudi Arabia, 15 monolingual native English speakers from the UK, 14 native English learners of Arabic (E-A bilinguals), and 15 native Arabic learners of English (A-E bilinguals) participated. The bilinguals had been living in the L2 environment for about 20 years. All participants read brief dialogues of wh-question/answer pairs. Bilinguals read the dialogues in both Arabic and English, and completed a proficiency test, a phonetic aptitude (talent) test, and a language-background questionnaire. They were grouped by language use as either high or low L2 use, and by aptitude as either high or low phonetic aptitude. We analysed the pitch contour of the wh-question words. Time was normalised and pitch measurements were converted into the percentage of each individuals' pitch range to facilitate the comparison of tokens. Growth curve analysis was used to capture differences in slope steepness and amount of curvature.

Comparing the monolingual groups revealed that the wh-question words in Arabic show a steep rise in pitch, followed by a peak around the middle of the word, followed by a steep fall in pitch (i.e., a symmetric, inverse U-shaped curve). In contrast, the prosody of wh-question words in English shows reliably less curvature i.e. is rather flat. A-E and E-A bilinguals' curves are similar to, but differ significantly from, native speakers, suggesting that both are approximating the prosody of the L2. Language use, but not phonetic aptitude, modulates how target-like participants' prosody is: E-A bilinguals with high L2 use show significantly more curvature in their wh-question words than those with low L2 use ($p < 0.01$). A-E bilinguals with high L2 use show a significantly less curvature in their wh-question words than those with low L2 use ($p < 0.001$).

Our analysis revealed that, in the case of prosody, amount of L2 language use seems to have a bigger effect on sounding target-like than participants' phonetic talent. Implications of these findings for theories of L2 acquisition will be discussed.

Prosodic features and pragmatic functions of *I think* in learners' speech.

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This study investigated the highly-frequent, multifunctional phrase *I think* in the speech of Arabic-native speaking learners of English. Previous research ascribes to *I think* several meanings which are distinguished by varying prosodic realizations. In second language (L2) speech research, studies of this phrase and other multifunctional particles, or *discourse markers*, have largely ignored prosodic features, or analyzed them as confirming pre-conceived categories of meaning. In contrast, this study sought to identify associations between meanings and prosodic features of *I think* in L2 speech, and compare them to native speaker (L1) norms. Based on qualitative analysis of discourse context and instrumental analysis of pitch, intensity, and duration, it appears likely that participants produced one distinction, between pragmatically-sensitive and pragmatically-trivial meanings, with prosodic realizations that were consistent with L1 norms. Evidence for a prosodic distinction between *deliberative* and *tentative* meanings of *I think* was inconclusive, and inconsistent with L1 norms. Implications for L2 research, pedagogy, and accounts of L2 development are discussed.

L1 attrition and L2 acquisition of pitch in Japanese-English bilinguals as a function of gender.

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Acquiring a second language has largely been seen as acquiring a homogeneous system, despite research in variationist sociolinguistics providing evidence that languages are comprised of numerous varieties which monolinguals learn and manipulate (Cheshire, 2008; Labov, 1991).

This research aims to examine how bilinguals learn and manipulate variation in their respective languages, looking at how differently gendered varieties of an L1 and L2 influence one another with regard to L2 acquisition and L1 attrition.

Previous research has provided evidence that different cultural and social norms influence pitch perception and production (Deutsch, Le, Shen, & Henthorn, 2009; Dolson, 1994; Ordin & Mennen, 2016; Pemberton, McCormack, & Russell, 1998; Van Bezooijen, 1995). For example, Ordin & Mennen (2016) reported a gender effect on Welsh-English bilinguals pitch production: only females were found to switch their pitch range across languages. They attributed this behaviour to a learned cultural pattern. This study sets out to examine cross-language pitch perception and production in Japanese-English late sequential bilinguals. Japanese females have been reported to use a pitch approximately 40 Hz higher than Caucasian (American, Northern and Western European) females (Loveday, 1981; Ohara, 1992, 1999; Yamazawa & Hollien, 1992). Such high pitch would be chosen by Japanese females, probably subconsciously, as to approximate a particular vocal image reflecting socio-culturally desired persona attributes and social roles (Ohara, 1992). This project aims to shed light (1) on whether and how Japanese-English late sequential bilinguals index gender in their L2 (e.g. do the Japanese-English females acquire the lower pitch of the female English monolinguals?) and (2) whether and how the acquisition of English affects pitch production of their native language (e.g. if Japanese-English female acquire such lower pitch, is this reflected through a lower pitch in their Japanese?). The experimental design marries methods used in research on bilingualism (one perception task and two production tasks, to elicit speech in different contexts) and sociolinguistics (questionnaires to investigate social variables and gender stereotype endorsement) to produce a fine grained-analysis of the potential individual variation found in the data. Standard predictor variables, such as amount of L1/L2 use, L1/L2 proficiency, LoR, AoA, will also be examined. Using innovative gender neutral elicitation procedures, speech will be elicited in both languages separately (Grosjean, 2001) to determine how different varieties in languages are expressed in the processes of L2 acquisition and L1 attrition in late sequential Japanese-English bilinguals. Preliminary results of the pilot study will be presented.

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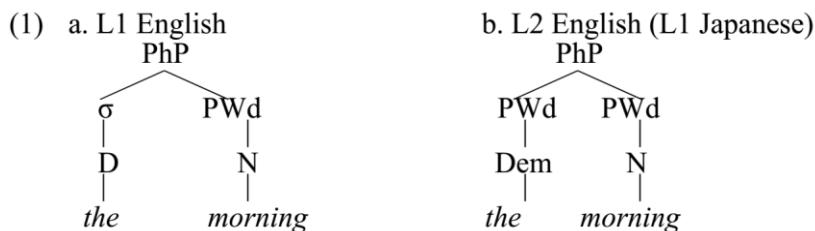
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Prosodification of articles by Japanese EFL learners.

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This study investigates how Japanese-speaking learners of English prosodically realize a function word of an article. According to Match Theory (Selkirk 2011), syntactic constituency is mirrored in the form of prosodic constituency. In the determiner phrase (DP) of English, a determiner (D) and a noun (N) correspond to different prosodic categories, namely, an unstressed syllable (σ) and a prosodic word (PWD), to constitute a phonological phrase (PhP), as in (1a). σ linked to D is assumed to be phonetically low in pitch and short in duration, while PWD is high in pitch and long in duration.



Japanese has no articles and uses demonstratives instead which are analyzed as lexical words (Fukui 1986). It is hypothesized that lexical transfer occurs from Japanese to English and articles are treated as lexical demonstratives (Dem) in L2 English. It is predicted then that articles will be phonologically realized as PWD, as in (1b). That is, phonetically speaking, the duration ratio of the article to the entire DP will be higher in L2 English than that in L1 English, and the pitch rise from the article to the immediately following stressed syllable will not be anticipated in L2 English. These predictions were examined in this study.

A read aloud task was employed in the experiment with 10 English speakers and 11 Japanese university students whose English proficiency was at Intermediate-Low level. They were asked to read aloud the following English narrative which contained four target DPs.

- (1) Some years ago, Mr. Sato had [DP₁ **a very kind student**] in his class. She had [DP₂ **a pretty name**], Aika. Her classmates liked her very much. Sometimes Mr. Sato saw her at school early in [DP₃ **the morning**]. In her hands she always had very pretty flowers. She picked them from her garden. Everyone in her class loved [DP₄ **the colorful flowers**].

An analysis of the results by a one-way ANOVA shows that there was a significant difference in the duration ratio of the article to the entire DP between the two groups (L2: 0.116, SE=0.007; L1: 0.074, SE=0.007; $F(1,19)=16.589$, $p<.01$). Pairwise-comparisons also show that the ratio of the L2 learners was significantly higher than that of the English speakers in three out of four DPs, namely, DP₁, DP₂ and DP₃ ($p<.05$). The L2 learners demonstrated the pitch rise from the article to the immediately following stressed syllable while the English speakers did not (L2: 9.602Hz, SE=2.979; L1: -5.819Hz, SE=3.184; $F(1,13)=12.508$, $p<.01$). These results partly support our prediction: L2 English articles were realized as PWD with a longer duration than L1 English counterparts. However, the findings on L1 English pitch were unexpected, although they are compatible with Adam and Munro (1978) and Tajima et al. (1997) who point out that English speakers utilize duration more frequently than pitch as an acoustic cue in production.

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Using Smoothing Spline ANOVAs and Growth Curve Analysis to analyze prosody.

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Much research on prosody involves measurements of intonational or tonal patterns. These patterns are curves, so rigorous statistical methods to analyse curves are needed. Two such methods are Smoothing Spline ANOVA analyses (Gu, 2013) and Growth Curve Analysis (Mirman, 2014; Winter & Wieling, 2016). Smoothing Spline ANOVAs can determine whether two or more curves diverge from each other to a statistically significant extent and where these differences occur. To do this, the analysis fits smoothing splines, which balance goodness-of-fit and smoothness of the original curve, to the curves being compared. Bayesian confidence intervals then determine which sections of the curves diverge statistically significantly. Growth Curve Analysis uses time polynomials to determine whether two or more curves differ significantly in terms of slope or amount of curvature. Both analysis treat changes over time in a rigorous manner and can model both fixed and random effects. Both analyses approaches will be introduced using example data and providing relevant R code.