THE UTILITY OF TURNING-POINT ANALYSIS METHODS FOR WELSH AND IRISH INTONATION

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ABSTRACT

Two turning-point transcription systems (INTSINT and PoLaR) were used to examine intonation data from Southern Welsh and Munster Irish. Each study required a turning point approach to avoid issues of stress identification complicated by long-term contact with majority English. The particular choice of system was informed by study-specific aims. The Welsh investigation employed an INTSINT analysis of L2 learner data to focus on contour shape. The Irish investigation focussed on timing relationships by use of a PoLaR analysis of L1 speech. Welsh findings reveal significant differences in L2 intonation for learners of differing L1 backgrounds. Irish findings reveal regional variation and diachronic change in the relationship between high pitch and intensity prominence.

This summary comparison of the two studies illustrates the utility of turning point analyses as an intermediate step in addressing ambiguous intonation data while avoiding premature claims about phonological representation.

Keywords: Intonation, turning points, minority, Celtic

1. INTRODUCTION

Autosegmental-metrical (AM) approaches to the description of intonation such as Tones and Breaks Indices (ToBI; [23]) analyse pitch contours as strings of discrete tonal targets. The implementation of these strings is described with reference to metrical structure, e.g. H*+L referring to a falling pitch-accent in which the high target is associated with a metrically prominent syllable. Crucially, however, such analyses require the reliable identification of such metrical prominence, whether in terms of lexical stress (in, e.g., English) or predictable phrasal prominence (in, e.g., French).

The issue of lexical- and phrasal-prominence identification is far from trivial. There is growing cross-linguistic evidence of (i) diversity in the phonological relevance of lexical-level prominence marking [7, 12, 15], (ii) robust differences in phonetic implementation of phonological prominence [6, 27], and (iii) so-called 'stress deafness' in evaluating prominence as an L2 listener [8-10, 32-35].

This paper summarises two studies in which such identifications cannot be confidently or unambiguously made, dealing with two Celtic languages: Welsh and Irish. In each case, complicated contact with English and ambiguity surrounding lexical stress necessitated the use of a phonetic system of intonation analysis that did not force premature judgments about phonological structure, although this may be of interest for future work. Two systems based on turning points (TPs) in F0 were selected for this purpose: the International Transcription System for Intonation (INTSINT) [14] and Points, Levels and Ranges (PoLaR) [1]. The choice of each was determined by the respective focuses of the Welsh and Irish studies.

The case of Southern Welsh is first examined in Section 2, followed by Munster Irish in Section 3. The paper concludes with summary remarks in Section 4.

2. SOUTHERN WELSH

Examinations of sentence-level intonation in Welsh are almost exclusively based on perceptual studies employing several idiosyncratic and largely incomparable systems of analysis and notation [18, 19, 25, 31]. The only substantial work which draws on AM-style analysis is Cooper's 2015 investigation of Anglesey Welsh [5].

The study described here employs the first turning points analysis of Welsh by use of the International Transcription System for Intonation (INTSINT) [14]. The application of INTSINT described here facilitated an initial examination of L2 Welsh intonation amongst learners with L1 Welsh-substrate influenced English (Welsh English) and L1 Standard Southern British English (SSBE).

Conducting a cross-linguistic investigation of intonation in Welsh and English is complicated by the presence of differing acoustic realisations of lexical stress in the two languages. Welsh and English speakers have traditionally been held to produce lexical stress by drawing on different acoustic resources [26: 445, 34]. Previous investigations of Welsh stressed syllables find them to have relatively shorter duration, lower intensity and lower pitch compared to post-stress syllables [32-35]. The difference between

Welsh and English stressed syllables can lead speakers of L1 English to make erroneous stress-placement judgments on Welsh words by relying on English-style lexical stress pitch cues [33]. Such findings have led to a functional separation between stress and pitch in Welsh being posited [2: 90].

The situations of synchronic and post-shift (i.e. Welsh to English) language contact in which the two languages exist have resulted in the presence of a Welsh prosodic substrate in some varieties of Welsh English [28-30]. In communities where Welsh retains community-level functions, the presence of cross-linguistic influence has been found in the realisation of lexical stress by bilingual Welsh speakers and monolingual speakers of Welsh English [17].

Employing AM analyses of intonation which require pitch events to be related to stressed syllables is problematic given the differing acoustic realisations of lexical stress and the situations of language contact and acquisition in which this study is situated. Separate language- and variety-specific criteria for identifying stressed syllables against which pitch events could be anchored would need to be established. Generating such acoustically defined criteria, whilst perfectly possible, would not lead to systematically comparable data. This methodological problem is compounded by the lack of previous acoustically-informed studies of Welsh intonation.

2.1. Data

This study employed the first turning-points-style analysis of Welsh intonation, also providing one of the first examinations of L2 Welsh sentential intonation. Data were collected from 8 speakers of L1 SSBE and 8 Speakers of Welsh English (4 from North Pembrokeshire in south-west Wales and 4 from south-east Wales). The former group were designated 'non-native learners' and the second group 'native learners'. All were following formal online Welsh courses at CEFR level B1. Realisation of sentence-level pitch contours was compared with localised native speaker baselines.

Samples of controlled, laboratory-style speech were collected from participants in two remote recording sessions via Zoom (one in Welsh and one in English). Participants read aloud a total of 36 sentences (18 in Welsh and 18 in English). Using recording freeware, participants recorded themselves producing a declarative, a yes/no question and a declarative question of each sentence in both languages. An effort was made to ensure as few voiceless segments were included in the sentences as possible, whilst also ensuring that each sentence had a meaningfully equivalent version in each language. A total of 405 sentences were extracted from the recording process and annotated using INTSINT labels in Praat textgrids [4].

2.2. Analysis

INTSINT allows for the equivalent of a narrow phonetic transcription of intonation (14: 14). It allows for 2 broad types of turning points to be recorded. They can be defined in relative terms to the previously occurring pitch movement as Higher (↑), Lower (↓), the same, slightly Downstepped (>) or slightly Upstepped (<). The second option for the transcriber is to record more global pitch movements to the extreme Top (⇑) or Bottom (⇓) of the individual speaker's range within an utterance. Relative scaling is not marked as the analysis focuses instead on the relative height of each successive turning point. TPs in brackets denote utterance-final pitch movements. Unlike AM-style analyses, or the PoLaR analysis considered in Section 3 below, INTSINT does not anchor pitch events to phonological percepts such as stressed or prominent syllables. Figure 1 below shows an example of an annotated Welsh declarative (*Mae William yn gyrru i Wynedd* 'William is driving to Gwynedd') as produced by an L1 Welsh English speaker from the Rhondda in south-east Wales.

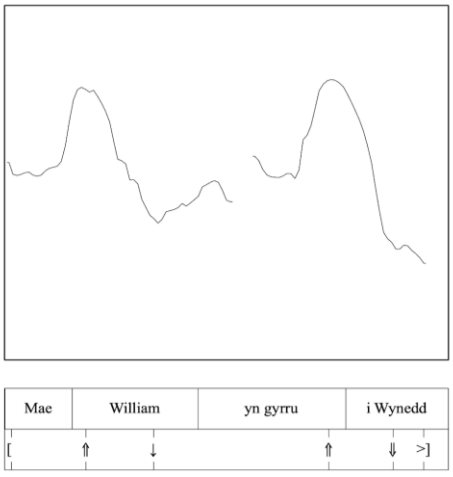

Figure 1: INTSINT annotation of the Welsh sentence *Mae William yn gyrru i Wynedd* ('William is driving to Gwynedd') spoken by a south-eastern Welsh learner (L1 Welsh English).

This study intended to provide an initial overview of utterance-level intonation in L2 Welsh and consider effects of transfer [11] from Welsh substrate-influenced L1 Welsh English. In order to make broad cross-linguistic comparisons, the INTSINT transcriptions for each utterance were converted into a series of 7 schematic pitch contours. The use of such schematic contours have been previously used in situations of synchronic and diachronic language contact between minority and majority languages [21].

Each schematic pattern was defined by the presence of a certain combination of TPs up to and including the pre-final TP. 'Sawtooth' patterns included an initial ↑/⇑ with a following ↓/⇓; a combination which repeated across the utterance in the case of double or triple sawtooths. Figure 1 shows an example of a double sawtooth pattern. Sequences of ↑/⇑-↓/⇓ have been described as a Welsh substrate-influenced feature of Welsh English sentential intonation [30].

2.2. Results

A binomial variable was established in which sawtooth patterns were compared against all other schematic contours (i.e. those which didn't include ↑/⇑-↓/⇓ TPs). Results from linear mixed effects modelling found a significantly higher number of sawtooth patterns in Welsh compared to English in addition to varying degrees of the presence of a Welsh substrate between the two areas. Native learners (i.e. those with L1 Welsh English) in north Pembrokeshire, where Welsh retains community level functions, were found to use significantly more sawtooth patterns in Welsh than native speakers. However, contrary to the study's expectations, statistical modelling revealed that this significantly higher usage was not a transfer effect from the local L1 Welsh English variety. In the south-eastern region, on the other hand, the frequency of sawtooth patterns were unaffected by both the learners' L1 background. There were additionally no more general significant effect of speaker/learner on the use of sawtooth contours.

The analysis of utterance final TPs revealed that the use of <], ↑] and ⇑] was controlled by sentence type (Y/N question, declarative question and declarative) instead of by speaker or variety/language-based predictor variables. This finding runs contrary to previous work on Welsh English declaratives and interrogatives which has found high final pitch movements on both sentence types [28-29].

The INTSINT analysis employed presents an initial sketch of L2 Welsh intonation. Through facilitating inter-speaker/learner, intra-learner and inter-variety comparisons of sentential pitch shapes, this analysis also provides new intonational evidence of the potential weakening of the Welsh language substrate within Welsh varieties of English [24]. Through focussing on pitch movements without reference to stressed syllables, the study provides a starting out point for more-fine grained phonetic investigations of Welsh and Welsh English intonation.

3. MUNSTER IRISH

The Points, Levels, and Ranges (PoLaR) turning-point transcription system [1] was used to examine Munster Irish intonation, the first TP analysis of any Irish variety. This variety is said to exhibit a complex system of lexical stress assignment, in contrast to initial stress in other Irish varieties. Based on statistical findings for phonetic prominences at the lexical-level [16: 106-206], and suggestions in the literature that the rightward 'stress shift' in Munster Irish derived historically from high pitch occurring one or more syllables after lexical stress [3], it was decided to analyse the timing of high F0 relative to nearby heightened intensity as a starting point for the evaluation of such a misalignment hypothesis.

The distinctive character of Welsh lexical-stress marking noted in Section 2 was influential in encouraging scepticism of casual identification of stress in this related Celtic language. A TP analysis was therefore pursued to focus on the phonetic identification of regions of relatively high F0 in a contour without direct comment on the phonological status of the local metrically strong syllable (i.e. without explicitly diagnosing formal lexical 'stress' per se), and without categorising contour shapes.

3.1. Data

Naturalistic storytelling data from L1 MI speakers from two eras were used for this analysis.

The first dataset dates to 1928 – wax cylinder recordings, digitised by the Royal Irish Academy [22] and freely available online. Story (re)tellings from 20 male L1 MI speakers with age range 36-82 were selected. Modern (2020-21) data came from Zoom interviews in which story readings and retellings comparable to the 1928 data were collected from 14 L1 MI speakers, 11 female and 3 male, with age range 20-79.

All participants came from the Munster *Gaeltachtaí* (traditional Irish-speaking regions) of Counties Kerry, Cork, Waterford, Clare, and Tipperary. The latter two varieties went extinct by the end of the 20th century, and are only included in the 1928 data.

It was hypothesised that high pitch would frequently occur one or more syllables after metrical strength, especially in more conservative speech (i.e. less English-influenced) speech.

3.2. Analysis

PoLaR was selected for its modular structure, and for its flexible implementation. In contrast to INTSINT, used above with reference to Welsh, a PoLaR transcription includes the identification of 'strong' (if not

necessarily lexically 'stressed') syllables within utterances. This was crucial for the MI investigation's focus on timing. Analysis was carried out in Praat [4].

The system was adapted and operationalised for analysis of the selected storytelling recordings. Metrically strong syllables (PrStr/<*> in PoLaR notation) were identified primarily using maximum syllable intensity, supplemented by functional/lexical considerations. Content words were prioritised over adjacent function words for metrical strength. Strong syllables were labelled at the midpoint of the vowel, as suggested in the basic PoLaR conventions [1].

Intonation contours were then defined using a maximum of six TPs, with no more than one preceding the metrically strong syllable's vowel midpoint. Contours complex enough to initially require more than six TPs were scrutinised and either (i) divided into two contours, or (ii) filtered for superfluous TPs associated with, e.g., microperturbations in the F0 trace. Contours were identified as *nuclear* (phrase-final) or *prenuclear* (non-final) to allow for consideration of positional impact on high pitch timing. 8,487 contours were described in this way, using a total of 35,557 hand-placed TPs.

3.3. Results

A custom Praat script [20] was used to automatically extract described contours as strings of TPs with associated PoLaR levels, F0 value in Hertz (subsequently converted to semitones), and timing of the highest F0 point (or high plateau onset) relative to the local metrically strong syllable's vowel midpoint.

The latter revealed diversity in timing across eras and regions. An apparently conservative pattern of 100+ ms delays between strong-syllable vowel midpoints and the achievement of high pitch stood out in 1928 Cork (45% of prenuclear [PN] cases, 37% of nuclear [N] cases) and Kerry (45% PN, 38% N), and has been retained as a substantial minority pattern in 2020-21 (Cork: 35% PN, 34% N; Kerry: 21% PN, 16% N). This contrasts with a preference for closer alignment (+/-50 ms) between high pitch and metrical strength in 1928 Clare, Tipperary, and Waterford. This is retained in modern Waterford, and matches or outnumbers cases of large 100+ ms delays in modern Cork (36% PN, 34% N) and Kerry (56% PN, 51% N).

By divorcing the identification of metrical strength from the description of pitch-contour shape, the PoLaR analysis highlighted ambiguity in using F0 activity as a primary marker of lexical stress. In Figure 2, the light-heavy disyllable *troidín* 'fight.DIM' has intensity prominence on the initial syllable – the stressed syllable for this item in other Irish varieties – but excursion to a high pitch peak aligned with the end of the final heavy syllable predicted to receive lexical stress under typically-described MI conditions. This suggests that lexical stress in MI should not be uncritically diagnosed by F0 excursion, and further highlights problems that may arise in basing AM pitch-accent labels on presumed and/or prescribed stress location. Labelling for Figure 2's 1-1-5(-1) contour would likely vary (e.g. IViE L*+H versus H*+L [13]) if the initial or final syllable of *troidín* were identified as stressed.

These ambiguities would not be satisfactorily addressed by simply changing to impressionistic judgements of stress location, especially for an L1 English analyst. Results of the PoLaR approach to MI intonation data therefore demonstrate the utility of a decompositional phonetic approach to ambiguous intonation data.

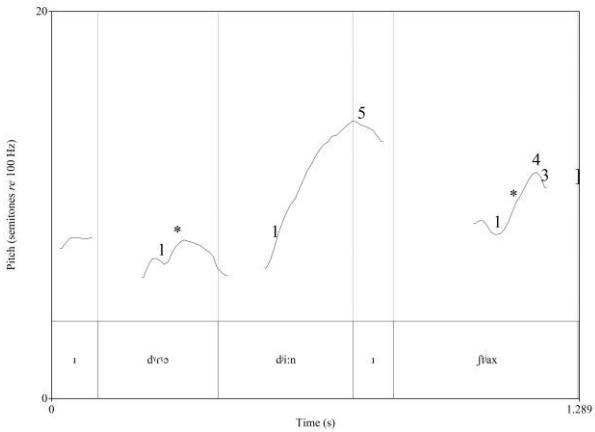

Figure 2: PoLaR annotation of 1928 Kerry utterance *i dtroidín isteach* from a monolingual MI speaker (b.1853). The initial light syllable /dˠrˠə/ of *dtroidín* 'fight.DIM' is identified as 'strong' (<*>) based on intensity prominence, while high pitch (<5>) occurs just after the following heavy syllable /dʲiːnʲ/.

4. CONCLUSION

The use of PoLaR and INTSINT analyses sought to resolve the theoretical problems posed by the relationship between stress and pitch-contours. In the case of Southern Welsh, a shapes-based analysis was facilitated by INTSINT annotations which identified the presence of cross-linguistic influence in a language acquisition context. In the case of Munster Irish, a PoLaR analysis which adopted an ambiguous stance in the identification of lexical stress was nevertheless able to facilitate a timings-focussed analysis and shed light on the role of F0 excursion in this variety's realisation of lexical stress. Both studies illustrate the potential utility of turning-point analyses in initial phonetic investigations of the intonation of lesser studied languages in which AM pitch accent-labels cannot be easily applied.

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