

Vowel Articulations in Welsh: A Public Engagement Study Using Ultrasound Tongue Imaging

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While Welsh vowels have been thoroughly described and acoustic studies have documented the realisations of monophthongs and diphthongs in the two main varieties of Welsh, Northern and Southern Welsh (Mayr & Davies, 2011), no previous work has examined Welsh vowels using instrumental articulatory methods. Such studies are needed since the same acoustic result can be achieved by different articulatory gestures, for example F2 is based on both tongue frontness and lip aperture (Havenhill, 2024).


The present study aims to fill this gap by investigating the lingual articulations of Welsh vowels for the first time using ultrasound tongue imaging (UTI). Adding to a small number of previous studies (Nance et al. 2023), data collection occurred during a public engagement event, the National Eisteddfod 2025, held between 2 and 9 August in Wrexham, which is a large annual arts festival that celebrates Welsh language, culture and heritage. Following Nance et al.'s (2024) methodological recommendations for the use of UTI in public engagement events, we collected data in a tent on the festival premises from 45 Welsh-speaking members of the public (20-82 years; 32 female/ 13 male), with self-rated Welsh accents including northern ($n=30$), southern ($n=6$), mixed ($n=3$), central ($n=2$) and Patagonian ($n=1$) varieties, with 3 people indicating they were unsure. Using a Telemed Micrus ultrasound machine and a 20mm 4 MHz convex probe, we recorded 5 instances of 6 monosyllabic words that contain vowels with differing realisations in Northern and Southern Welsh (see word list below), elicited in a picture-naming task. The data were recorded and time-synchronized on a Windows laptop using Articulate Assistant Advanced (AAA), v. 221.3.4. Simultaneously, audio data were recorded with a lapel microphone that was attached to an Ultrafit Stabilization Headset. Subsequently, splines were fitted to the ultrasound images in AAA using Deep Lab Cut, and coordinates were extracted from the frame closest to vowel acoustic midpoint, with a bite plate recording used as a reference. Preliminary results indicate distinct tongue shapes for northern and southern Welsh realisations, as shown in the figures depicting average tongue shapes for the six contrasts below. Formal statistical analysis using Principal Component Analysis is currently underway and will be discussed at the conference.

Havenhill, J. (2024). Articulatory and acoustic dynamics of fronted back vowels in American English. *JASA* 155(4):2285-2301.

Mayr, R. & Davies, H. (2011). A cross-dialectal acoustic study of the monophthongs and diphthongs of Welsh, *JIPA*, 41 (1), 1-25.

Nance, C., et al. (2023). Acoustic and articulatory characteristics of rhoticity in the North-West of England. In Radek Skarnitzl & Jan Volín (eds.), *Proceedings of the 20th International Congress of the Phonetic Sciences*, 3573–3577. Prague: Guarant International.

Nance, C. et al. (2024). Articulatory phonetics in the market: combining public engagement with ultrasound data collection. *Linguistics Vanguard*, 10(1): 51–62



Pâr Llafariaid Vowel Pair	Gair Cymraeg Welsh Word	IPA (Gogledd/De)	English Meaning
/i:/ vs /i/	“dyn”	North /din/ South /dɪn/	“man”
/i/ vs /ɪ/	“tun”	North /tɪn/ South /tʌn/	“tin”
/a/ vs /ɔ/	“tân”	North /ta n/ South /tɔn/	“fire”
/o/ vs /ɔ/	“ton”	North /ton/ South /tɔn/	“wave”
/u/ vs /ʊ/	“twt”	North /tʊt/ South /tʊt/	“neat”
/i/ vs /ɪ/	“nid”	North /nid/ South /nɪd/	“not”

