Examining the relationship between speech rhythm, fluency measures and comprehensibility/accentedness ratings in L2 English speech

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The relationships between speech rhythm measures, fluency measures and listener ratings of speaking proficiency, including comprehensibility, fluency and accentedness, are currently under-researched. For language pairs such as English and Spanish, which typify stress-timed and syllable-timed rhythm patterns respectively, the acquisition of L2 rhythm may enhance learners' speech processing and comprehensibility (Ordin & Polyanskaya, 2015). However, previous studies examining the relationship between speech rhythm and listener ratings of comprehensibility and accentedness have shown inconsistent results. Trofimovich and Isaacs (2012) observed that speech rhythm was a stronger predictor of accentedness than comprehensibility; conversely, in a study by van Maastricht et al. (2021), speech rhythm on its own failed to demonstrate significant predictive power for either accentedness or comprehensibility. Quesada Vasquez (2019) identified a ceiling effect among more proficient learners, while Uchihara (2022) found that appropriate speech rhythm paradoxically predicted decreased comprehensibility and increased accentedness. Furthermore, little is known about how speech rhythm relates to the development of L2 fluency, although there is some evidence that listener perceptions of fluency can be predicted by appropriateness of speech rhythm (Prefontaine & Kormos, 2016). This study therefore examines the relationship between speech rhythm measures (vowel reduction ratios and vocalic variability measures) and fluency measures (speed and breakdown) in their ability to predict native listener perceptions of comprehensibility, accentedness and fluency.

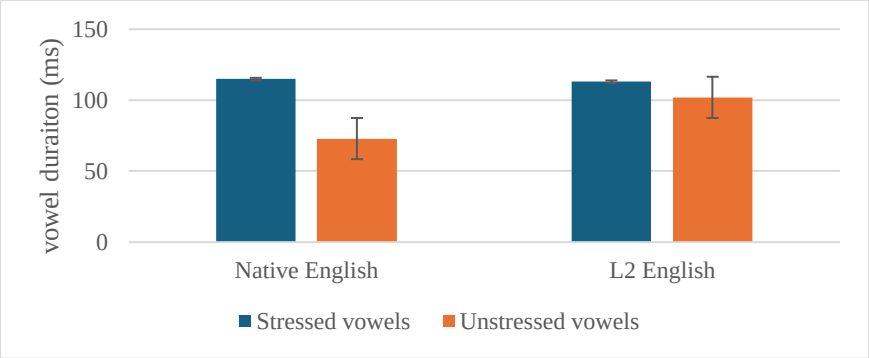
Spontaneous speech samples were elicited from advanced Spanish-Catalan learners of English (N=82) and native speaker controls of the RP variety of English (N=8). Speech rhythm of the samples was measured through durational variability metrics (Varco-V, nPVI-V and %V) along with a vowel reduction ratio measure (VRR) examining the ratio of stressed to unstressed vowels. Fluency was assessed through speed (speaking rate, mean syllable duration and mean length of run) and breakdown (pause frequency and pause duration) measures. Comprehensibility and accentedness were rated by 10 English native speakers, while collection of fluency ratings is ongoing.

Fluency and rhythm measures were found to be mostly unrelated to one another (see Table 1). For speech rhythm alone, durational variability metrics (Varco-V, nPVI-V) did not differentiate the learner group from the native group, nor did they correlate significantly with listener ratings of comprehensibility and accentedness, except for %V. In contrast, VRR measures showed moderate, significant correlations with both accentedness and comprehensibility. These measures also effectively differentiated between the L2 speaker group and native English speakers, with the latter exhibiting much greater durational reduction of unstressed vowels (see Figure 1). For fluency, significant relationships were observed between speed and breakdown measures and listener ratings of comprehensibility and, to a lesser extent, accentedness. These findings suggest that the development of target-like speech rhythm, including durational reduction of unstressed vowels, likely progresses independently from fluency development. Additionally, ongoing collection of listener ratings of speaking fluency, as well as multiple regression analyses, aim to provide further insights into the relationship between speaking fluency measures, listener perceptions and speech rhythm. Future work involving speech rhythm training methods will be discussed, as well as including other aspects of vowel reduction such a qualitative changes and intensity for a more complete model.

Table 1. Pearson-r correlations between vowel reduction ratio (VRR = *Mdur* stressed syll. / *Mdur* unstressed syll.), speaking fluency measures, and comprehensibility and accentedness.

	SR	MSD	MLoR	PF	PD	Comp	Acc
VRR	.075	-.084	.158	-.104	.108	.384**	-.494**
%V	-.187	-.148	.166	-.056	-.102	-.450**	.403**
Varco-V	-.126	-.107	.010	.034	-.071	-.009	.011
nPVI-V	-.317**	-.298**	.210	-.072	-.129	-.166	.063

Figure 1. Average vowel duration for Native English and L2 English speech



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