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Articulatory perturbation due to ultrasound imaging: an acoustic analysis

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A safe, non-invasive imaging technique which captures articulatory movements in real time is the Holy Grail of articulatory analysis. Ultrasound imaging of the tongue seems suitable, albeit for a single articulator. However, ultrasound requires positioning a probe under the chin which may inhibit jaw movement. It is well-known that speakers compensate rapidly for similar articulatory perturbations such as bite-blocks. Consequently, the images obtained by ultrasound may show compensatory articulations due to jaw inhibition, rather than natural articulations. This study assesses the effects of articulatory compensation during ultrasound imaging using acoustic analysis. The experiment compares acoustic data from three speech conditions: probe-free, probe held manually, probe fixed non-manually. It is hypothesised that sounds requiring a low jaw position, such as low vowels, velars, and velarised laterals, will be worst affected. High jaw sounds such as /s/ and /i/ are also assessed. Any differences between conditions are assumed to be due to compensation for jaw immobility rather than learnt segment-specific register effects and are therefore unlikely to diminish as the subjects relax. Variability may diminish, however, as compensatory strategies become more practised. We expect to find some effects on certain segments, but that manual probe holding allows for more natural speech.