

## 3D ultrasound on a budget: Reconstruction of 3D tongue shapes from multiple coronal planes

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The tongue is a complex three-dimensional structure. However, speech researchers usually only have access to two-dimensional B-mode imaging technology. A quick and cost-effective method of acquiring 3D tongue surfaces of static speech sounds from multiple coronal ultrasound scans is presented. A head anchor with a halo was used to stabilize the head of the participants. A pivoting transducer cradle allowed swiveling the transducer to different preset angles in order to collect a sequence of coronal images in  $5^\circ$  intervals without changing the coupling spot of the transducer on the neck. In the current study, we present data from three speakers. The sustained speech sounds /a, i, u, n, ŋ/ were captured three times each. The analysis of head movement during the examination showed a mean horizontal movement of 1.41 mm (SD = 0.39 mm) and a mean vertical movement of 3.6 mm (SD = 1.14 mm), measured over a period of 9 minutes. For all speech sounds, the 3D coronal-based tongue surface reconstructions had a mean overall inter-trial error of 2.1 mm (SD = 1.22 mm), with a maximum error of 5.63 mm and a minimum error of 0.79 mm. The ease and speed of the data collection and the good quality of the data indicate that this method could be a useful and practical research tool for the acquisition of 3D tongue surface data in normal speakers as well as different patient groups.