1 in 15 UK Children have a Speech Sound Disorder (SSD) - difficulty producing one or more native language speech sounds (e.g. ‘k’, ‘g’, ‘r’)

SSDs affect...
• confidence
• communication
• education

“Ultrax” project aims to develop a tool to visualize inner mouth movements for speech therapy

Imaging technology - articolgraphy challenge

Two techniques may be used to (safely!) image vocal tract:

Ultrasound: standard ultrasound probe placed submentally can image the tongue, though with some complications
• grainy + noisy
• extra edges
• disappearing parts
• distracting clutter
*no passive articulators* (context)

MRI:
• fuller detail (though not teeth...)
• slow acquisition
• spatial/temporal resolution trade-off
• uncomfortable
• relatively expensive

Ultrax approach

Combine the strengths of MRI and ultrasound:
• Diagrammatic visual display
  - anatomical context from MRI
  - ultrasound for tongue tracking

• Diagram animation requires:
  1. vocal tract/head modelling
  2. realtime tongue tracking

Imaging data

- MRI: 12 phoneticians, 52 sound shapes each
- Siemens Verio 3T (8 x 1.7 x 1.7mm voxels, 52ms echo time, 400ms repetition time(=2.5fps), FOMRI-III optical microphone)

- Ultrasound for 12 adults, to match MRI
- ~100 children, (90 TD, 9 SSD) - range of tasks
- Ultrasonix RP system (B mode, raw scanline data, 10mm microconvex probe at 5MHz)

Beyond speech therapy

Imaging technology already makes valuable contributions to speech technology and production research.

But, there are still limits to address:
• Robust extraction of articulatory features from raw image data
• Faster frame rates (esp. MRI)
• Co-registration of multiple data sets (articulator land mark points)
• 3D acquisition highly desirable

All MRI + Ultrasound data collected will be made publicly available, free for research use.

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