

Real-time MRI of Speech Movements at ETH Zürich

Jeffrey Tsao¹, Christof Barmet¹, Robert Sader^{2,3}, Phil Hoole⁴, Mathias Vogel⁵, Ralf Peters⁴

¹Institute for Biomedical Engineering, ETH Zurich

²Hightech-Forschungs-Zentrum (HFZ), Center of advanced studies in cranio-maxillo-facial surgery, Klinikum rechts der Isar, Technical University Munich

³Universitätsklinik für Wiederherstellende Chirurgie, Abteilung für Kiefer- und Gesichtschirurgie, Kantonsspital Basel - Universitätskliniken

⁴Phonetics Institute, Munich University

⁵Klinik München-Bogenhausen, Munich

Main acquisition parameters

MRI

2D spiral gradient echo sequence

Pixel resolution 1.88mm x 1.88mm

Slice thickness 6mm

Spiral parameters: Acq. window = 2.70ms, 5 segments, 6 interleaves/segment

TE / TR /flip angle 1.33ms / 6.2ms / 20deg

Reconstruction with sliding rectangular window, total window length 186ms

Output frame rate 26.9 frames/s (= 186/5 or 6.2*6 ms/frame)

Audio

Phon-Or optical microphone with noise suppression

Audio aligned with images using synchronization pulses from MRI machine

Additional noise suppression off-line using combined subtraction and inverse filtering

Useful references:

Narayanan, Nayak, Lee, Sethy, Byrd (2004), "An approach to real-time magnetic resonance imaging for speech production". JASA 115(4), 1771-1776

NessAiver, Stone, Parthasarathy, Kahana, Paritsky (in press), "Recording high-quality speech during tagged cine MRI studies using a fiber optic microphone", JMRI.

**VCV sequences
(iCi aCa uCu oCo)**

VCV midline	VCV midline (2 nd set)	VCV 1cm left of midline
t	t	t
s	s	s
l	l	l
sh	sh	sh
k	k	k
p	p	p

Words
(“Lese ____ wie ____ bitte”)

teste wie Thesaurus

Tüte wie huschen

Vase wie Tiegel

Pfütze wie Hufe

schieben wie Tische

Püterich wie hüpfen

These wie Testament

Zypern wie Chile

Schübe wie Diele

fühle wie lüften