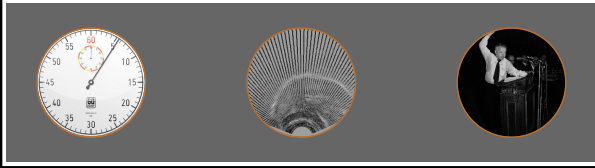
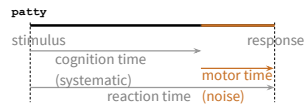


# the problem with reaction times



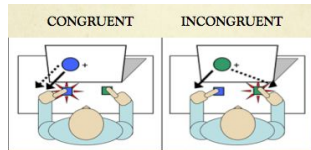
# some psycholinguistic assumptions

interested in how the mind/brain processes language  
 only observables are behaviour and its consequences  
 (detection of) button press is a *consequence* of behaviour



# systematically variable motor time

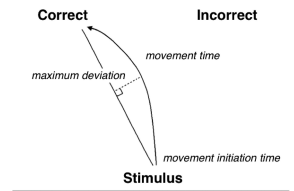
reaction time contains both pre-motor time and motor time  
 these can differ independently by condition



(Boulinguez et al., 2008; Tandonnet et al., 2004; Klapp, 1996)

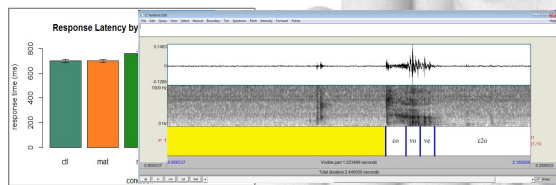
# systematically variable movement

mouse tracking



(Hendy et al., 2009)

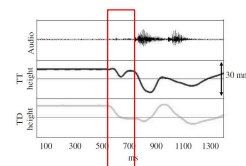
# what about language production?



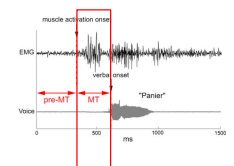
(Drake & Corley, 2015a)

# articulation during response latency

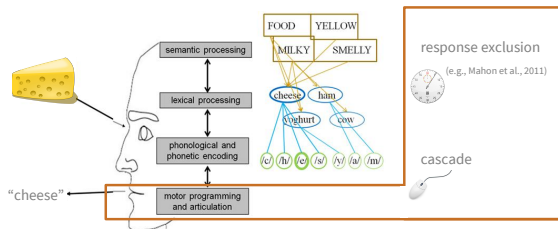
Pouplier (2007) EMA



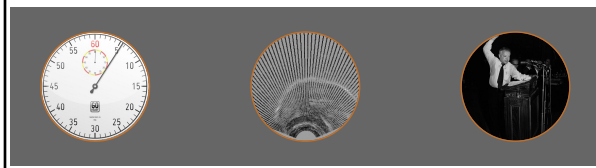
Riès et al. (2012) EMG



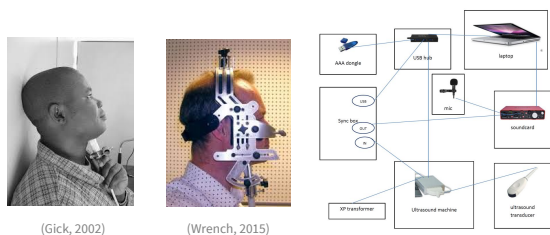
## unconventional psycholinguistic approach



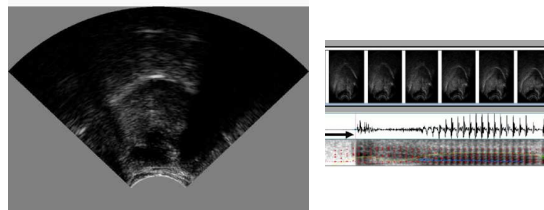
## measuring articulation



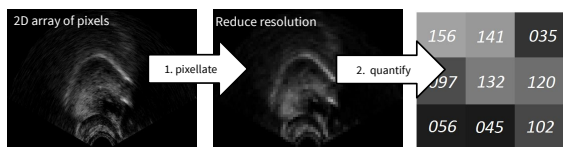
## measuring tongue movements



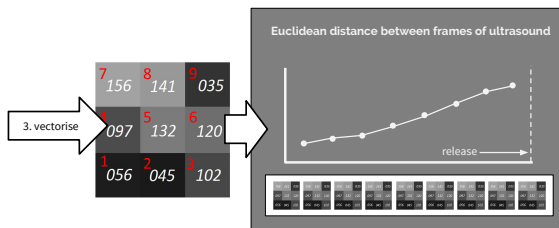
## measuring tongue movements



## ultrasound analysis

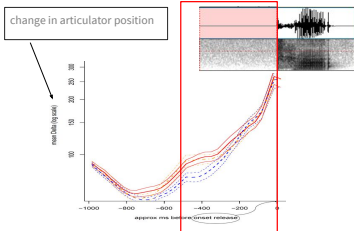


## ultrasound analysis

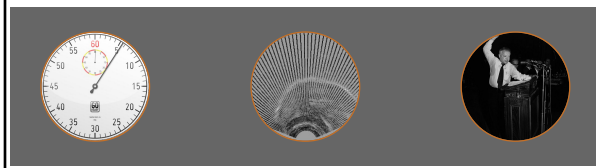


## articulation differs by condition

Drake & Corley (2015b)  
ultrasound



## human speech: 2 examples



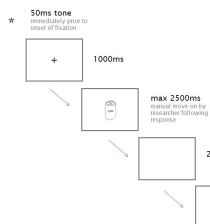
## Experiment 1



Picture-Word Interference  
does *explicit* conflicting information  
affect articulation?

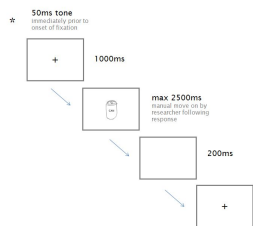
(Drake, Kanwal, Seidler, & Corley, in prep)

## Picture-Word Interference: procedure



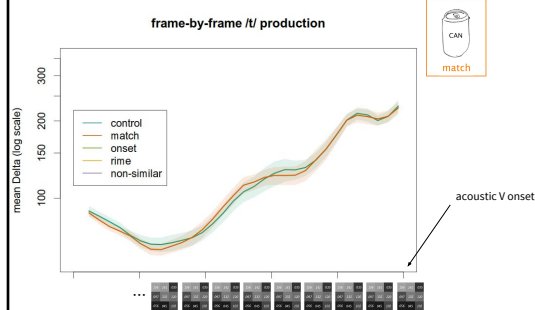
9 participants  
Ultrasonix RP ultrasound  
60 items, 5 conditions

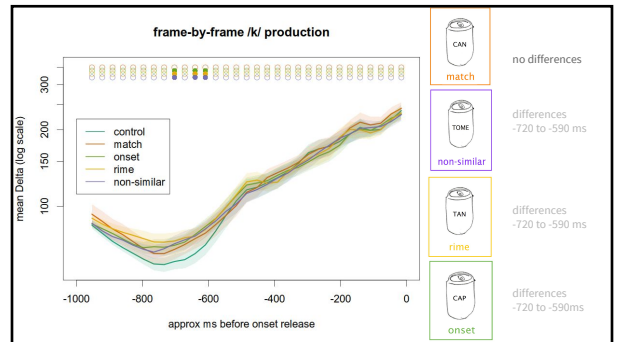
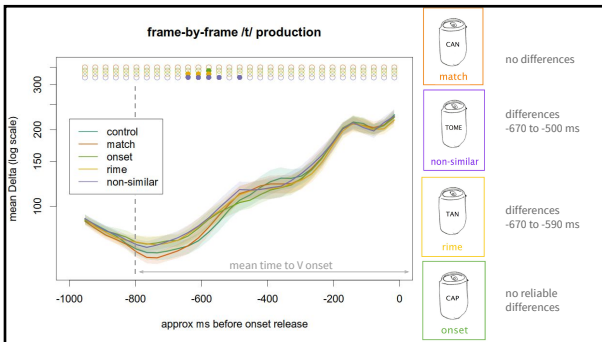
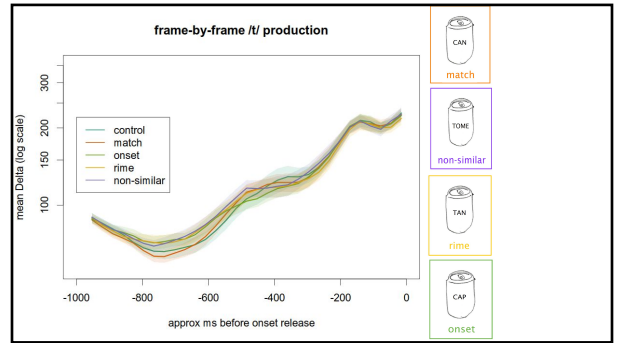
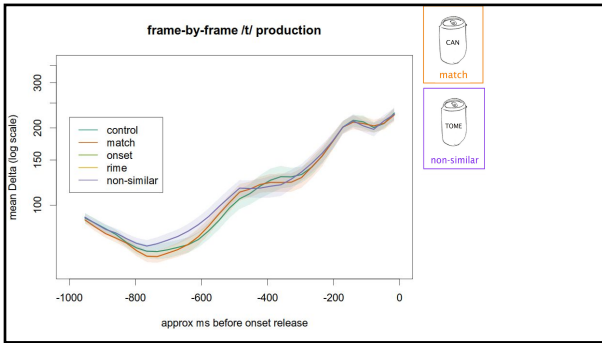
## Picture-Word Interference: procedure



tone to enable synchronisation  
long fixation due to tone  
PWI composite (SOA = 0ms)  
manual move on, 2500ms timeout  
200ms blank screen  
manual start of next trial  
(all manual activity by researcher not participant)

## frame-by-frame /t/ production





### Experiment 1 - summary

articulator movement observed from ~200ms after stimulus presentation

reliable differences observed when target onset differed from that of distractor (i.e., in rime and no-overlap conditions)

distractor word is represented at an articulatory level? (and suppressed?)

additional movement → additional time

### Experiment 2

Bilingual Picture-Naming

does *implicit* conflicting information affect articulation?

(Knight, Drake, & Corley, in prep)

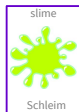
## English/German picture names



shared onset



voice change

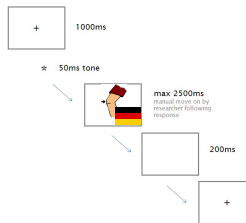


place change



both

## English/German picture names: procedure

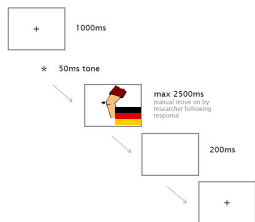


12 participants

Telem EchoBlaster 128

2 x 36 items, 3 conditions x 2 languages

## English/German picture names: procedure



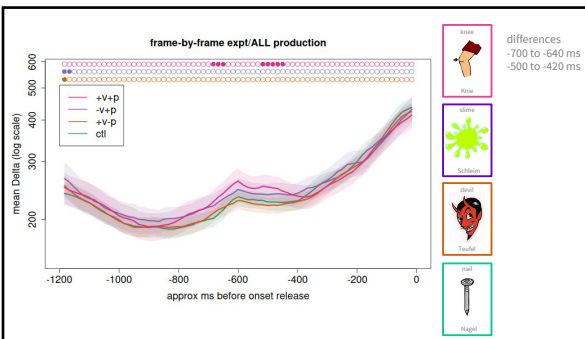
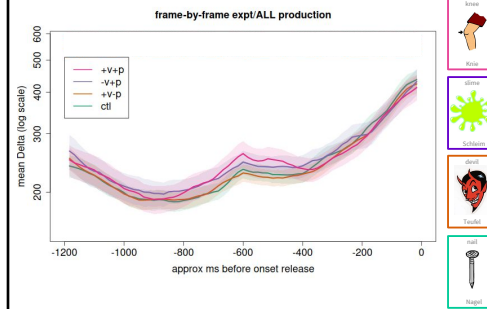
tone to enable synchronisation

PWI composite (SOA = 0ms)

manual move on, 2500ms timeout

200ms blank screen

manual start of next trial  
(all manual activity by researcher not participant)



## Experiment 2 - summary

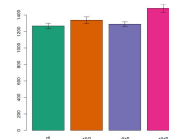
articulator movement observed from ~400ms after stimulus presentation

reliable differences observed when there was competition from the name in L1/L2 (i.e., when place and voice differed)

competing language is represented at articulation?

(and suppressed?)

additional movement → additional time



## summary

we must measure articulation to gain a full understanding of speech production

- articulation occurs before acoustics (and we should take note of this)
- speech motor movement occurs within ~200-400ms of stimulus presentation
- articulatory *differences* are observable at an early stage

## summary

speaking is a highly interactive, cascading, process

- *explicit* conflict in PWI affects speech articulation
- *implicit* conflict in bilingual naming affects articulation

## Thank You

Jasmeen Kanwal, Lene Seidler

Korin Richmond

Alan Wrench, Articulate Instruments

PPLS Pilot Fund, University of Edinburgh

