TELLING THE TIME WITH AUDIOVISUAL SPEECH AND NON-SPEECH: DOES THE BRAIN USE MULTIPLE CLOCKS?

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Aim & Introduction

- ‘Unity assumption’: mutual dependence between perceived cross-modal synchrony and integration (Vroomen & Keetels, 2010; Welch & Warren, 1980).
- Subjective audiovisual synchrony (Point of Subjective Synchrony, PSS) can vary widely between subjects (Stone, 2001) and paradigms (van Eijk, 2008). But unclear whether AV integration depends on PSS.
- We concurrently measured PSS and optimal timing for AV integration (tAVI) in a dual task paradigm.

→ Unity assumption predicts: PSS should correlate positively with tAVI

Expt. 1 Method: McGurk

- Subjects: ## experienced but naïve adults, age ##
- Stimuli: typical McGurk AV stimuli (McGurk & MacDonald, 1976):
  - Congruent and incongruent combinations: movie of lip-movements [ba], [ga] paired with audio /ba/, /da/.
- Variable auditory lag: 9 levels, range ±500ms, randomised.
- Dual task: Timing judgement and phoneme identification
- Timing judgements, two types: Temporal Order Judgement (TOJ) or Simultaneity Judgement (SJ). Blocked and counterbalanced

Expt. 1 Results: McGurk

- Asynchrony for maximum illusion significant and positively correlated with PSS derived from SJ, following the unity assumption.
- The analogous correlation with PSS derived from TOJ was significantly negative.

Expt. 2 Results: Stream-Bounce

- Non-speech stimuli, stream-bounce paradigm (Sekuler, Sekuler, & Lau, 1997).
- Other methods details unchanged

Expt. 2 Method: Stream-Bounce

- DUAL TASK MCGURK PARADIGM

Discoard

- Relationship is not restricted to speech stimuli.
- Relationship apparent when visual information alters auditory perception as well as in instances where auditory information alters visual perception.

The temporal mechanisms for the TOJ pairing seem neither unitary nor fully independent, but apparently antagonistic.

A tentative temporal renormalisation mechanism explains these paradoxical results as follows:
1) subjective timing in our different tasks can depend on independent mechanisms subject to their own neural delays;
2) inter-modal synchronization is achieved by first discounting the mean neural delay within each modality;
3) apparent antagonism between estimates of subjective timing emerges as the mean for each modality is attracted towards deviants in the unimodal temporal distribution.

References