The role of tapping in improving connected speech comprehension of a non-native variety of English

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Introduction
Comprehension of Glaswegian English is difficult for speakers of other varieties of English (Adank et al., 2009; Smith et al., 2014). In fast casual speech, weak syllables get particularly reduced, which increases the chances of miscomprehension even further. Tapping, or engaging in a synchronized motor task while listening to an external stimulus, can be a means of entrainment with speech (Lidji et al., 2011).

Research question
Can tapping to the beat in rhythmically regular speech help listeners to adapt to an unfamiliar variety of English?

Hypothesis
Performing a tapping task with unfamiliar Glaswegian-accented speech will lead to stronger entrainment than a control (click identification) task. Assumption: greater entrainment will lead to greater improvement on a speech comprehension task focused on weak syllables.

Therefore: Participants who perform a tapping task will improve comprehension more than controls.

Method
Participants
40 native speakers of Canadian or US English; living in Montreal, Canada; 22 F, mean age 22.5, 11 were bilingual, all English dominant.

Experiment Structure
Pre-test: Hear sentences and fill in gaps, e.g.: But it sat ______ path ______ duck.
Answer: But it sat on the path of the duck.

Training Phase
Hear sentences, and either:
- Tapping: Tap to the beat heard in speech
- Click identification: Tap upon hearing a click

Post-test: Same task as pre-test with new sentences

Materials
- Simple sentences with a regular metrical structure (e.g. But it sat on the path of the duck.)
- Weak syllables were function words that undergo reduction (Hagen 2000); designed so that there could be ambiguity as far as the meaning is concerned
- Produced by a male speaker of Glasgow English, at 2 rates (slow=80, fast=160 bpm), cued by a metronome.

Procedure
Training Phase: Listeners heard sets of 4 repetitions of 38 sentences, 1 x slow + 3 x fast rate. They performed task (tapping/click ID) on the last two fast tokens.
Pre-/Post-test: 20 sentences in each test (different sentences in pre-, post- and training). 1 token of each sentence, spoken at a fast rate.

Analysis of Pre- and Post-Test
Each missing word cued as correct or incorrect. Logistic regression in R, starting with all main effects, incrementally removing n.s. variables and testing interactions (looking for significance and low BIC). Dependent Variable: Score (0 or 1)

Fixed Effects: bold - retained in final model:
- Test (Pre/Post)
- Type of function word: Self-reported ability to tap to a beat – scale 1-5 (correlated with other variables e.g. years of musical training); Training condition (Tapping vs Click ID); Languages known; Interaction of Test x Self-reported ability to tap on beat

Random effects: Participant, Trial Number

Results – Pre-Test & Post-Test
1. Trend for improvement from pre- to post-test:

<table>
<thead>
<tr>
<th>% correct</th>
<th>Tapping Pre-test</th>
<th>Post-test</th>
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2. Significant main effect of type of function word: some types less intelligible than others (p < 0.05)

3. Significant effect of self-reported tapping ability (p < 0.0005); i.e. better scores overall if better tapping ability

4. Marginally significant interaction (p = 0.08) between Test (Pre/Post) and Self-reported tapping ability: Poor self-reported tappers get worse at task, while good tappers tend to improve.

Conclusions & future work
1. Training involving tapping did not improve listeners’ comprehension more than control training involving click identification. Indeed, there was limited evidence of improvement in either training condition.

   However...

2. Musical ability, as represented by the self-reported tapping ability variable, had a positive effect on the Canadian/US listeners’ comprehension of function words produced by a Glaswegian English speaker.

3. Musical ability was weakly linked to improvement in comprehension from pre- to post-test.

4. Subjects who tapped more regularly in the tapping condition tended to have higher comprehension scores.

Therefore:
Musical ability is linked to ability to entrain to the beat in speech. Musical ability is also linked to comprehension of a non-native variety of English, and (weakly) to improvement in comprehension after hearing rhythmic speech.

Although short-term training involving tapping did not provide a direct benefit (compared to control training), the tapping task revealed relationships between speech comprehension and music which merit further investigation.

Maybe training involving tapping be more beneficial to comprehension for those subjects who are more musically able?

We are exploring relationships between recorded tap timings & key events in speech signal (Syll-stressed syllable onset, SVO-stressed vowel onset, fd=00 peak).

Even regular tappers seem to vary in which events they align with (compare Ps 16, 15, 12).

Ongoing work: correlating taps & speech

This experiment is a part of a bigger project. It will be conducted on more two listener groups: EFL learners and native Glaswegians. The broader aim is to develop a method of teaching English connected speech to EFL learners using rhythmic methods, e.g. tapping.