Poster W15

The influence of talker variability and audiovisual speech on word learning in cochlear implant listeners

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INTRODUCTION

- Many cochlear implant (CI) listeners show word-learning deficits relative to their normal-hearing (NH) peers.[1,2,4]
- Talker variability – learning from multiple talkers – helps listeners to extract the acoustic cues that are relatively invariant, leading to robust representations of word forms.[3,5,6]
- Similarly, viewing a talker's lips move can also improve speech perception for NH and CI listeners.
- Little is known whether talker variability improves word learning in CI listeners and whether CI listeners fixate to the mouth of a talker when learning new words.

PURPOSE OF STUDY

Aim 1

To determine whether learning from multiple talkers improves word learning in adults CI listeners

Aim 2:

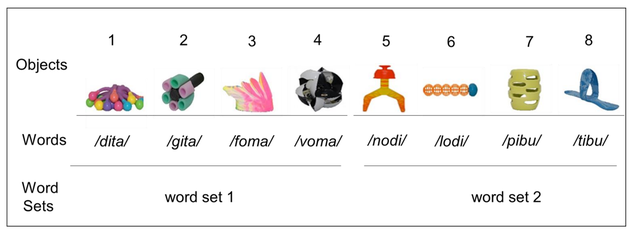
To assess whether CI listeners fixate to the mouth of a talker when learning new words

METHODS

Table 1. Demographics of CI participants
(will test age matched NH participants)

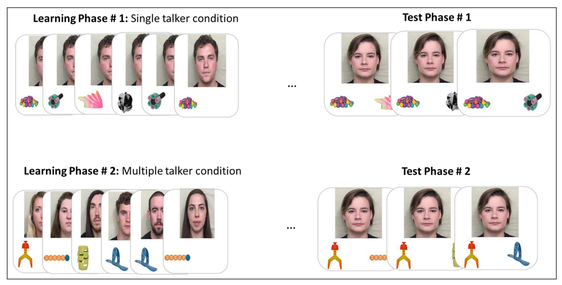
Subject	Age at testing (yrs)	Onset of deafness (age in years)	Years of BiCI experience	Years of auditory deprivation	External processor (L/R)
IAJ	73	12	16	38	Kanso/N6
IAU	70	3	14	46	N6/N6
ICM	63	25	7	29	N6/N6
ICP	56	4	7	42	N7/N7
ICY	66	N/A	4	N/A	--
IDA	52	8	5	38	N6/N6
IDD	21	0.5	11	3.5	N6/N6
IDH	20	3.5	14	1.5	N6/N6
N6	58	45	5	8	N6/N6

Stimuli: 8 English nonwords paired with novel objects



Procedure:

- **Learning phase:** Participants were taught novel word-object pairings from a single talker or from 6 different talkers (multiple talkers)
- **Test phase:** Participants were tested on ability to learn word-object pairings in a two-alternative forced-choice task
  - Trial Types
    - **Easy trials:** target and distractor object labels differed by several phonetic sounds (e.g. dita vs foma)
    - **Hard trials:** target and distractor object labels differed by a minimal pair (e.g. dita vs gita)



Measurement: High-speed eye-tracking (SR Eyelink 1000 Hz) was used to measure eye movements to target and mouth over time

AIM 1: Learning from multiple talkers

Fixation to the target = $\frac{time\ spent\ looking\ at\ target\ object}{total\ time\ spent\ looking\ at\ either\ target\ or\ distractor}$

for test trials only

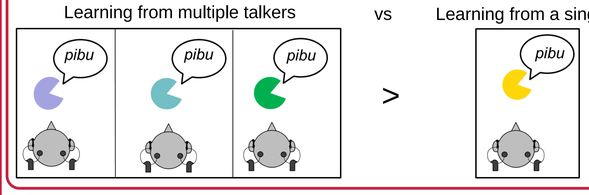
AIM 2: Gaze behavior during learning

Fixation to the mouth = $\frac{time\ spent\ looking\ at\ mouth}{total\ time\ spent\ looking\ at\ either\ mouth\ or\ eyes}$

for learning trials only

PREDICTIONS

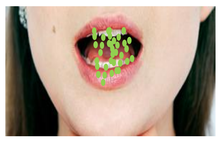
Aim 1: Learning from multiple talkers



Talker variability will allow listeners to tune into the relatively invariant acoustic cue

Aim 2: Eye gaze behavior during learning

CI listeners



The visual domain provides more reliable and salient cues for CI listeners than the auditory domain

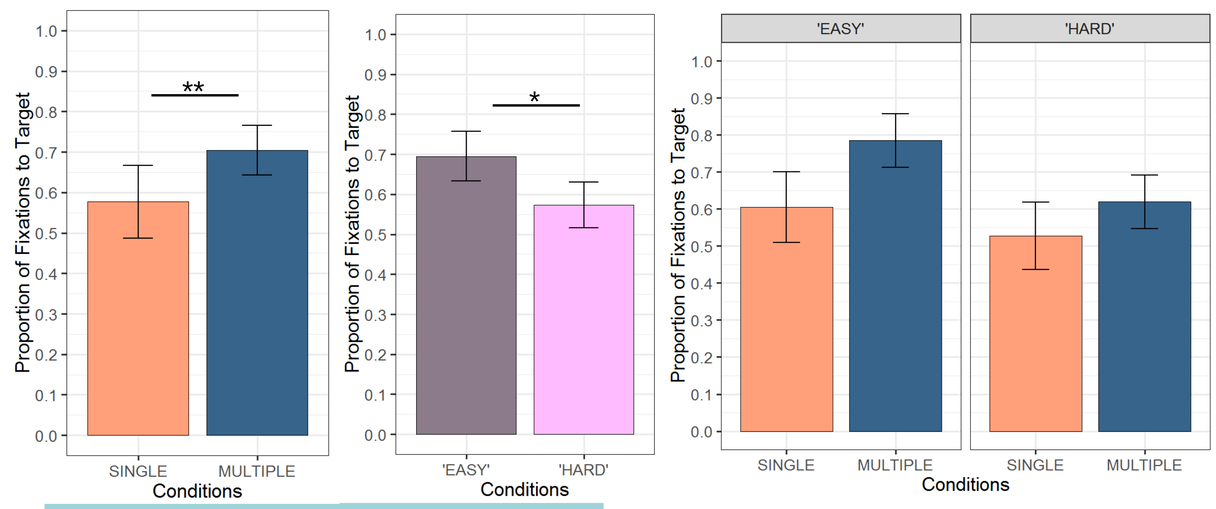
RESULTS

Effects of learning from multiple talkers

a) **Overall mean accuracy**

b) **Mean accuracy: Test difficulty**

c) **Mean accuracy: Learning condition X Test difficulty**

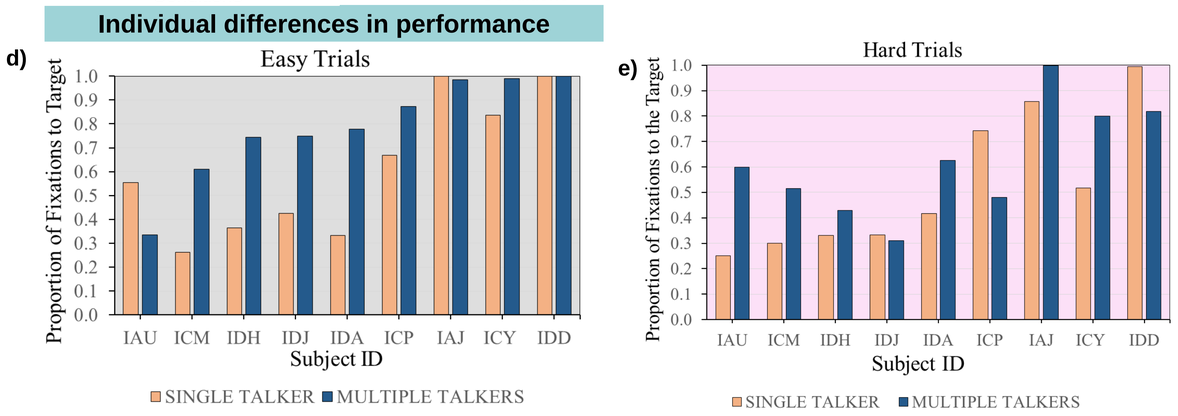


- Significantly better performance in learning from multiple talkers than a single talker
- Significantly better performance on easy trials vs hard trials
- Larger discrepancy in performance between learning conditions for easy trials compared to hard trials

Individual differences in performance

d) Easy Trials

e) Hard Trials



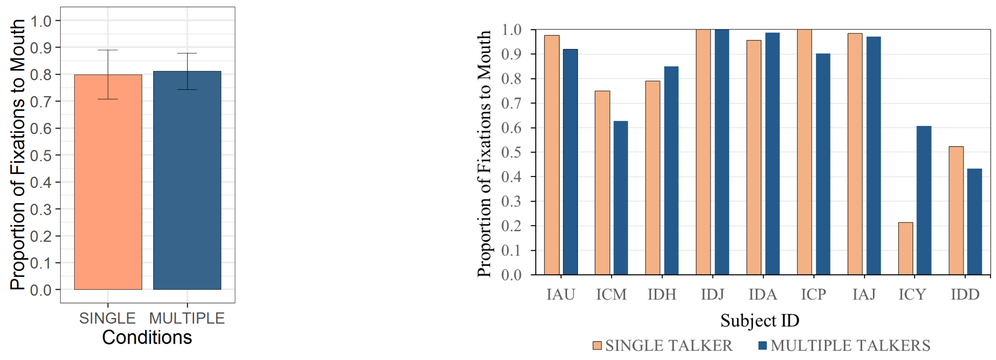
- Individual variation in performance for easy vs hard trials
- Easy trials: 5 out of 9 CI listeners benefited in learning from multiple talkers
- Hard Trials: 6 out of 9 CI listeners benefited in learning from multiple talkers

Fig 1. Proportion of fixations to target (accuracy) for test trials. Plotted as a function of **a)** learning condition, **b)** test difficulty, and **c)** interaction between learning condition and test difficulty. Subject data plotted as a function of **d)** easy trials and **e)** hard trials. Asterisk denotes significant difference (** p < .01, * p < .05). Error bars represent standard error.

Gaze behavior during learning

a) **Mean fixation to the mouth**

b) **Individual differences in fixations to mouth**



- Majority of fixations were to the mouth
- Individual variation in fixations to the mouth

Fig 2. Proportion of fixations to mouth for training trials. Plotted as a function of **a)** learning condition. Subject data plotted as a function of **b**) learning conditions. Error bars represent standard error.

CONCLUSIONS

- Overall, CI listeners learned words significantly better when taught by multiple talkers than by a single talker. Future studies are aimed at collecting more data to determine if this significance persists.
- Overall, CI listeners performed significantly better on easy trials than on hard trials. Learning from multiple talkers improved performance for the easy trials more than the hard trials. Such findings suggest that talker variability might be more useful for helping CI listeners learn words that differ by several phonetic features than by a single phonetic feature.
- For easy trials, 5 out of 9 CI listeners benefited in learning from multiple talkers while for the hard trials, 6 CI listeners showed a benefit from talker variability. Future studies will assess whether demographic factors, such as onset of deafness or year of auditory deprivation, predict outcomes on word-learning.
- Overall, the majority of fixations (>80%) were to the mouth, suggesting that CI listeners rely heavily on visual domain to extract relevant linguistic information. Future studies will determine whether increased fixation to the mouth correlates to word-learning outcomes.

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