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

Stimuli: 8 English nonwords paired with novel objects

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

| Subject | Age at testing (yr) | Age at outcomes (age in years) | Years of NICU experience | Years of auditory deprivation | External processor (ALXI)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IU9</td>
<td>30</td>
<td>12</td>
<td>18</td>
<td>55</td>
<td>N/A/ALXI</td>
</tr>
<tr>
<td>IU10</td>
<td>20</td>
<td>3</td>
<td>14</td>
<td>46</td>
<td>N/A/ALXI</td>
</tr>
<tr>
<td>ICU</td>
<td>30</td>
<td>25</td>
<td>27</td>
<td>29</td>
<td>ALXI/ALXI</td>
</tr>
<tr>
<td>ICP</td>
<td>30</td>
<td>27</td>
<td>17</td>
<td>12</td>
<td>ALXI/ALXI</td>
</tr>
<tr>
<td>ICH</td>
<td>30</td>
<td>25</td>
<td>27</td>
<td>29</td>
<td>ALXI/ALXI</td>
</tr>
<tr>
<td>IDA</td>
<td>20</td>
<td>8</td>
<td>5</td>
<td>30</td>
<td>N/A/ALXI</td>
</tr>
<tr>
<td>IDB</td>
<td>20</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>N/A/ALXI</td>
</tr>
<tr>
<td>IDM</td>
<td>20</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>N/A/ALXI</td>
</tr>
<tr>
<td>IDN</td>
<td>20</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>N/A/ALXI</td>
</tr>
</tbody>
</table>

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 features (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 = time spent looking at target object for test trials only

AIM 2: Gaze behavior during learning

Fixation to the mouth = time spent looking at either mouth or eyes for learning trials only

RESULTS

Table 1. Demographics of CI participants

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.

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.

ACKNOWLEDGEMENTS

This work was supported by grants from the National Institute on Deafness and Other Communication Disorders (R01 DC 008393, R01 DC 016807, R01 DC 008393, R01 DC 008393), and Helen H. B. F. Foundation (1556485). We would like to thank Dr. Mark Liberman for sharing data analysis scripts.