Background

Previous studies have revealed the effects of word characteristics such as neighborhood density and phonotactic probability on word learning.

- Neighborhood density: the number of similar sounding words
- Phonotactic probability: the likelihood of occurrence of a sound sequence

Storkel, Armbruster, and Hogan (2006) found that adults learned high density words and low probability words more accurately.

However, little is known about how background noise encountered in our daily lives influences these effects of word characteristics on word learning.

Purpose

To investigate how neighborhood density and phonotactic probability influence adults’ word learning in two noise conditions (i.e., typical vs. challenging)

Methodology

- Participants: 58 college students
- Materials:
  - the same materials as used in Storkel et al. (2006)
  - 16 CVC nonwords varying in neighborhood density and phonotactic probability
  - 16 novel objects created or taken from children’s stories paired with 16 nonwords
- SNRs: Nonword stimuli were digitally mixed with broadband white noise at +8 and 0 dB SNR using Matlab*
- Procedures:
  - Participants were exposed to the nonword-object pairs in a story context at either + 8 dB SNR (typical noise) or 0 dB SNR (challenging noise).
  - Learning was measured with a picture-naming task after 1 exposure, 4 cumulative exposures, and 7 cumulative exposures to the nonwords.
  - The responses were phonetically transcribed and scored as correct when a participant’s response matched 2 or 3 phonemes to the target word.
  - DV: proportion of correct responses
- IVs: noise, neighborhood density, phonotactic probability, time
- Analysis: repeated measures ANOVA for response: 2 noise group (+8 dB SNR vs. 0dB SNR) x 2 neighborhood density (low vs. high) x 2 phonotactic probability (low vs. high) x 3 time (1 vs. 4 vs. 7 exposures)

Results

<table>
<thead>
<tr>
<th></th>
<th>0dB &amp; 8dB SNR</th>
<th>8dB SNR (typical noise)</th>
<th>0dB SNR (challenging noise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>*</td>
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</tr>
<tr>
<td>D*PP</td>
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<td>D*PPxG</td>
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<tr>
<td>D*PPxE</td>
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</tbody>
</table>

* Significant Effect (p< .05)
E: Exposure; D: Neighborhood Density; PP: Phonotactic Probability; G: Group

D effect at 8 dB SNR

Proportion Correct

D effect at 0 dB SNR

Proportion Correct

PP effect at 8 dB SNR

Proportion Correct

PP effect at 0 dB SNR

Proportion Correct

Discussion and Implication

- Noise alters the effect of neighborhood density and phonotactic probability.
- Noise dampens the effects of density and probability in a typical noise condition (i.e., +8 dB SNR).
- Adults require a convergence of density and probability in a challenging noise condition (i.e., 0 dB SNR).
- Noise may heavily tax cognitive processes (e.g., working memory). Specifically, under a taxing condition, adults may require a convergence of cues similar to that observed for children (Hoover, Storkel, & Hogan, 2010).
- The influence of acoustic parameters is not well captured by current word learning models.
- This may be particularly important in understanding word learning by children and adults with hearing impairment.

References


Acknowledgments

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