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ISOLATED WORDS IN INPUT TO INFANTS: A CRITICAL WEDGE?

HOW DO INFANTS BEGIN TO LEARN WORDS?

Do infants learn from hearing isolated words (or short phrases) in the input?
Or is learning based entirely on segmenting words from running speech, from the start? This has been the implication of segmentation studies: 'The ability to segment words from fluent speech is a necessary precursor to the mapping of sounds to meanings' (Gerken & Aslin, 2005).
How can we test this issue?

APPROACH I: INTUITIVE ASSUMPTIONS ABOUT WHAT IS ‘ENOUGH’

• “[… Even when] mothers were explicitly encouraged to teach new words to their infants, […] words were presented in isolation only 28% of the time.” (Jusczyk & Aslin, 1995, p.2; see Aslin et al., 1995)
• “…Unlikely that attention to words in isolation is sufficient for infants to parse the input accurately. Most infant-directed utterances contain more than one word.” (Johnson & Jusczyk, 2001, p. 549)

APPROACH II: TESTING IN THE LAB

Highly constrained and artificial situation:
• Quiet, no distractions
• Distinct situational context (new place, unknown voice)
• Typically, training on a few words, immediate testing
• Focus on how infants can learn rather than on how they actually learn.
Under such conditions, infants can segment speech (e.g., Jusczyk, Houston & Newsome, 1999) – but results are not reliably replicable (cf. Nazzi et al., 2013: Parisian vs. Canadian French; Floccia et al., under review: UK vs. US English)

APPROACH II: PRESENT WORDS IN ISOLATION VS. RUNNING SPEECH IN LAB

This is an empirical approach, but it addresses a narrower question:
Which type of presentation do infants
• respond to better / faster in the lab?
• leads to better learning in the short term?
This does not test learning as speech occurs in the infants’ everyday experience.

APPROACH II: PRESENT WORDS IN ISOLATION VS. RUNNING SPEECH IN LAB

How much is ‘enough’?
WORDS IN ISOLATION VS. RUNNING SPEECH IN LAB

- Advantage for running speech: Infants respond more quickly and accurately to correct picture after Look at the doggie! than after Look. Doggie! (Fernald & Hurtado, 2006)
- Advantage in recognition, after single exposure, for words in isolation (Junge et al., 2012)
- Advantage for combined presentation of words in isolation and running speech (Lew-Williams, Pelucchi, & Saffran, 2011)

APPROACH III: STUDYING INFANT LONG-TERM LEARNING

- Input frequency of word in isolation is a significant predictor of production at 15 mos., total input frequency is not. (Brent & Siskind, 2001)
- Reanalysis of Brent & Siskind data reveals additional factors (concreteness, duration) – but isolated words remain significant predictor (Swingley, 2013)
- Review of US CDI shows categories Sounds and Social words to be the most often reported (Swingley, 2015)...all words typically produced in isolation.

CURRENT STUDY: VARIANT ON APPROACH III

If we alternatively expose infants to novel words in isolation or in running speech, with the same input frequency, in their natural home environment, which type of exposure will more reliably lead to word form recognition?

METHOD

- 11-month-olds
- parents read book to child, twice a day, over 3 weeks
- Rare animal names, half produced in isolation, half sentence-finally
- testing in lab with Head Turn procedure

BOOK

Each animal presented (in same condition) on 2 consecutive pages, with different preceding words and with text that encourages contrastive stress, reported to aid segmentation (Bortfeld & Morgan 2010).
EXPERIMENT I: 
BOOK AND HEAD TURN

Each book contains two sets of animal names. Sets rotated between infants: each set was Isolated, Sentential or Unheard for one-third of the infants.

In Head Turn infants heard words as lists of isolated words, each repeated 6 times.

<table>
<thead>
<tr>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>pudu</td>
<td>puku</td>
<td>pikua</td>
</tr>
<tr>
<td>fennec</td>
<td>civet</td>
<td>ferret</td>
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<tr>
<td>zebra</td>
<td>sambar</td>
<td>vulture</td>
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<td>dassie</td>
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<td>patarel</td>
<td>billy</td>
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<tr>
<td>dunlin</td>
<td>dolphin</td>
<td>desman</td>
</tr>
<tr>
<td>bongo</td>
<td>guindi</td>
<td>panther</td>
</tr>
</tbody>
</table>

RESULTS, EXPERIMENT 1

ANOVA, $F = 2.94$, $df = 1.4$ (GG), $p = .09$ (N = 18)

EXPERIMENT 2

Two groups (N = 16 each), presented with only two types of word lists at test:

Group 1: Isolated vs. Unheard words
Group 2: Sentential vs. Unheard words

- books rotated between infants – so different words are again Isolated, Sentential, Unheard for each infant group.
- All infants hear same lists at test: Reduces risk of experimenter error or bias

EXPERIMENT 2: RESULTS

$t = 3.49, df = 15, p = .003$

$t = .04, df = 15, p = .72$

EXPERIMENT 2: DISCUSSION

Word forms with identical input frequencies easier to remember when heard in isolation than when heard sentence-finally.

Confounding variable?

In Exps. I and II testing used lists of isolated words.

Effect due to matching conditions at ‘training’ and test?

EXPERIMENT 3

To control for possibility that Exp. 2 findings affected by matching of conditions between ‘training’ and test:

In Exp. 3, as in Exp. 2:

- books rotated across infants
- all infants hear same stimuli at test
- test stimuli presented in passages => recognition requires segmentation
EXPERIMENT 3: RESULTS

\[ t = 0.46, \text{df} = 14, \text{p} = .65 \]
\[ t = -1.79, \text{df} = 15, \text{p} = .09 \]

EXPERIMENT 3: DISCUSSION

‘Training’ several words at a time (through book reading) does not lead to good enough learning for recognition when words embedded in passage – whether exposure was to isolated words or sentences.

Exp. 2 effect unlikely to have been due to matching conditions between exposure and test.

GENERAL DISCUSSION

Previous studies of untrained word form recognition:
Words known from home (e.g., thank-you, grandma) reliably recognized at 11 mos. when tested using lists of isolated words with phonotactically matched rare word foils


However, untrained word forms recognized only at 12 mos. when tested in passages (sentences).

Our study suggests that segmentation does not necessarily lead to later word recognition.

Isolated words are more readily remembered at ‘training’ stage and more readily recognized at test.

In daily life no distinction between training and test:

Each additional exposure is both a ‘training trial’ – a reminder, an opportunity for reactivation of something familiar – and a ‘test’; only items that have already left a representation in memory will be reactivated and potentially recognized.

CONCLUSION

\begin{itemize}
  \item When presented in natural parent-child interaction, word forms heard in isolation are better remembered.
  \item Isolated words may be infrequent, but they must play a disproportionate role early on:
    \begin{itemize}
      \item They support segmentation of other words (Bortfeld et al., 2005)
      \item They seem critical for first word production (Vihman et al., 2008)
    \end{itemize}
  \item This is thus the form of exposure most likely to initiate word learning.
\end{itemize}
THANK YOU

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