ISOLATED WORDS IN INPUT TO INFANTS: A CRITICAL WEDGE?

Marilyn Vihman,
Tamar Keren-Portnoy and
Robin Lindop Fisher

University of York

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

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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?

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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)

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How much is 'enough'?
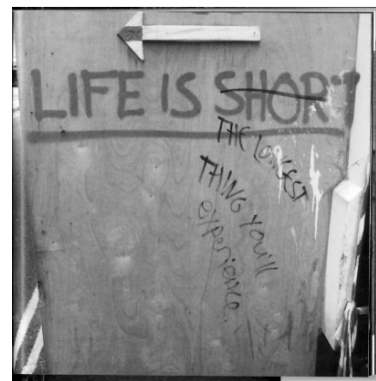
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APPROACH II: PRESENT WORDS IN ISOLATION VS. RUNNING SPEECH IN LAB

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.

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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*)

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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)

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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.

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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?

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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

Look at this lovely dugong.   Look at this lovely pet. Dassie.

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METHOD

Note: Learning conditions not optimal!

- noisy
- lack of consistency in presentation
- no marking of learning context as special
- parents unaware of aim of study

This models everyday exposure and learning.

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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).

Let's look at this furry bilby   Let's look at this even furrier bilby   12

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.

Set 1	Set 2	Set 3
pudu	puku	pika
fennec	civet	ferret
zebra	sambar	vulture
beaver	**dassie**	cavy
condor	petrel	bilby
gibbon	bettong	**dugong**
dunlin	dolphin	desman
bongo	gundi	panther

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RESULTS, EXPERIMENT 1

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

(N = 18)

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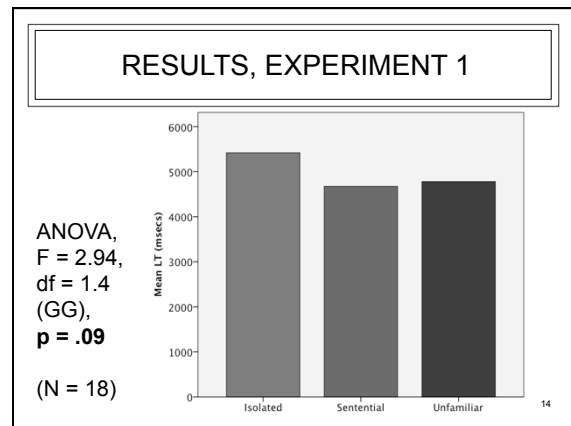
EXPERIMENT 2

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

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EXPERIMENT 2: RESULTS

t = 3.49, df = 15, **p = .003**   t = .04, df = 15, p = .72

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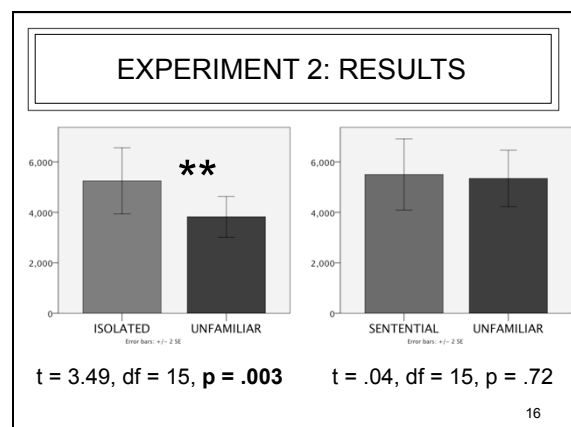
EXPERIMENT 2: DISCUSSION

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?

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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

Set 1	Set 3
pudu	pika
fennec	ferret
zebra	vulture
beaver	cavy
condor	bilby
gibbon	dugong
dunlin	desman
bongo	panther

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EXPERIMENT 3: RESULTS

t = 0.46, df = 14, p = .65   t = -1.79, df = 15, **p = .09**

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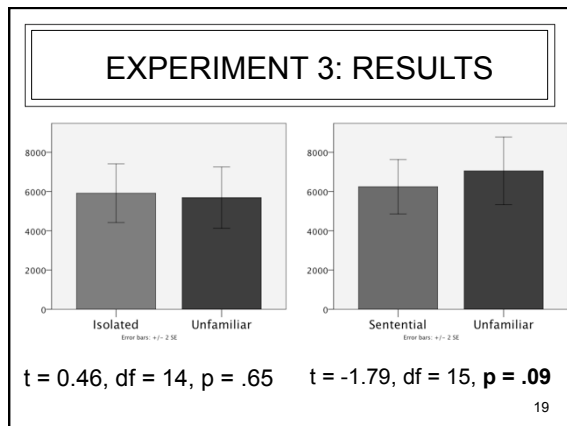
EXPERIMENT 3: DISCUSSION

'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.

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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

(**French:** Hallé & Boysson-Bardies, 1994, **UK English:** Vihman et al., 2004, **Dutch:** Swingley, 2005, **Italian:** Majorano et al., 2014, **US English:** DePaolis et al., 2012, **Hebrew:** Segal et al., in prep.).

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GENERAL DISCUSSION

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

DePaolis et al., 2014

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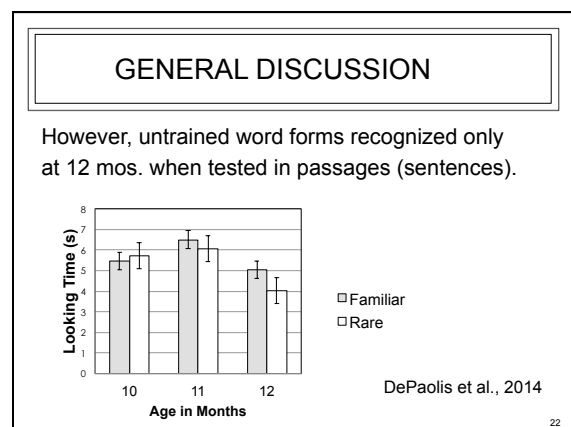
GENERAL DISCUSSION

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.

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CONCLUSION

- When presented in natural parent-child interaction, word forms heard in isolation are better remembered.
- Isolated words may be infrequent, but they must play a disproportionate role early on:
  - They support segmentation of other words (Bortfeld et al., 2005)
  - They seem critical for *first word production* (Vihman et al., 2008)*;*

This is thus the form of exposure most likely to *initiate* word learning.

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