A Microgenetic Analysis of Word Learning in Infants with and without Language Delay using a Preferential Looking Paradigm

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Abstract

The purpose of this study was to investigate novel word learning using a microgenetic, preferential looking paradigm, in a 20 month-old infant with history of language delay and a 20 month-old infant with normal language development to determine if infants with language delay require more exposure to novel label/object pairings before they evidence word learning. Using a fixed trial training phase, we examined learning over time in a habituation learning paradigm. Preliminary results suggest there are qualitative differences between the at-risk compared to the typical participant in the ability to attach meaning to novel words and degree of learning. Findings may provide information regarding how children are identified at-risk for language delay.

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Purpose

Our prior work shows that LTs require same number of trials as NL controls to habituate in Object-Label Association tasks, but show no evidence of learning at test. Using a microgenetic design to examine in detail the time course of novel word learning, we ask if, similar to children with SLI, a 20 mos. late talking toddler at risk for SLI (LT) requires more exposure trials than a 20 mos. typically developing normal language control (NL) to map novel word labels to novel objects.

Word Learning in SLI

Children with SLI have difficulty learning new words

1. They require more exposures to learn a lexical label as compared to typically developing controls *(Gray, 2004; Rice, et al., 1994)*

2. They have difficulty have difficulty encoding the semantic features of novel objects *(Alt & Plante, 2006)*

They are less accurate in linking nonverbal semantic features to novel lexical labels *(Alt et al., 2004)*

Novel Word Learning in Late Talkers

Late Talkers (24-36 mos) have difficulty learning novel labels & building conceptual representations of novel object

1. LT's required the same number of trials to criterion as NL controls to comprehend novel words, but do not show the same *Shape Bias*, and instead appear to have a *Texture Bias* *(Jones, 2003)*

2. LT's do not acquire lexical categories as "deeply" as CA peers and can not identify familiar objects from abstract caricatures (Jones & Smith, 2005)

Novel Word Learning in LT 18 month olds

Late Talkers (18 mos) have difficulty mapping novel labels to novel objects.

1.In label-object association tasks, using 50% reduction look time over three trials a criteria, LT (18 mos) have same number of trials to habituation as NL controls. *(Ellis & Evans, 2009)*

2.At test, unlike NL controls, LT show no evidence of mapping labels to objects. LT's show a Familiarity preference -- look longer at object-label pairs from Habituation; NLs show a Novelty Preference -- looking longer at new object-label combinations. *(Ellis & Evans, 2009)*

Method

Participants. Two full-term infants (20 mos) with normal hearing, fewer than 3 ear infections, normal nonverbal IQ, no significant birth history or head injury per parental report, and evidence of N400 to known words at 18 mos *(Travis et al., SRCLD, 2010).*

Method (cont.)

	Age (months)	Bayley MDI[1]	MDI[1] Nonverbal	MB-CDI[2] WG %		MB-CDI[3] WS %
				Prod	Comp	Prod
LT	20	86	6	12	26	9
TYP	20	116	7	60	36	38

[1]Mental Developmental Index (MDI) score on Bayley Scales of Infant Development-II (BSID-II)
[2]MacCarthur-Bates Communicative Developmental Inventory (MB-CDI) Words and Gestures (WG)
[3]MacCarthur-Bates Communicative Developmental Inventory (MB-CDI) Words and Sentences (WS)

Procedure

- Toddlers came for three consecutive days at same time of day.
- Each visit, toddlers first heard Exposure Language then completed an Object-Label Association task (*Graf Estes et al. (2007).*
- Timing of object label pair presentations controlled via Habit 2000 (*Cohen, Atkinson, & Chaput, 2000).*

Exposure Language

To insure equal familiarity with novel labels, toddlers listened to a 2.5 minute syllable sequence of the novel words spoken without pauses between syllables (*nomaygabutimaydobu).*

Object-Label Association Task

Habituation Phase. Toddlers heard one of two sets of object-label pairs while watching a video of 3D novel objects moving side to side on monitor.
- Total 10 trials each session (5 trials per pair)
- Each trial 20 sec. total duration
- During each trial, label spoken 15 times via loudspeakers every 0.7 sec.
- Between trials, cartoon guided toddlers attention back to screen
- Different random order each session

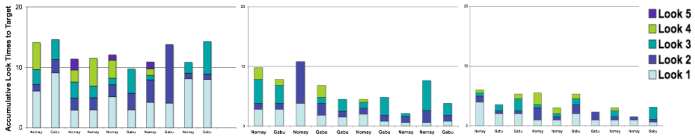
Test Trials. Following Habituation, Toddlers presented with Test Trials
- Total 8 trials each session (4 Same, 4 Switch)
- **Same trials:** same object-label pair from Habituation Phase
- **Switch trials:** novel object-label combinations not in Habituation trials
- Different random order each session

Stimuli.

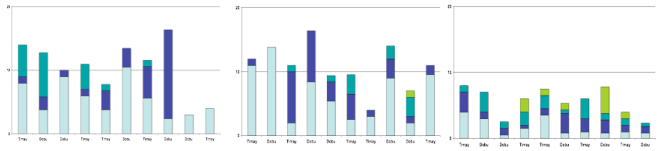
- Novel word labels
  - Words toddlers heard in the Exposure Language
    Late Talker (Nomay, Gabu), NL (Timay, Dobu)
- 3D object videos

Results

Habituation



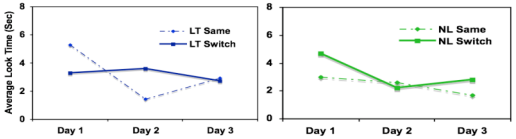
LT



NL

- Duration of First Look at Target[1]
  - Main effect of Day ($p < .007$), significantly *shorter* over three days
  - Main effect of Group ($p < .02$), significantly *shorter* for LT than NL all 3 days
- Total Look Time: Significant Day X Subject interaction (Day 2, LT < NL. $p < .03$).
- Total Number of Looks at Target. Significant Day X Subject interaction (LT > NL Day 1, $p > 004$, Day 2, $p < 04$).

Test



- NL shows novelty preference at Day 1
- LT appears to require a second day of exposure to showing Novelty preference at Day 2.

Conclusions

- In our previous study, LT habituated to novel object/label stimuli at same rate at NL using 50% decrease on look time over 3 trials; but showed no evidence of Novelty preference, looking longer at Familiar trials at test *(Ellis & Evans, 2009)*
- This study shows quantitative and qualitative differences in pattern of novel word for LT & NL toddlers:
  1. LT required X2 exposure as NL before Novelty preference (Day 2)
  2. Novelty preference fluctuates with increased exposure for both NL/LT
  3. Microgenetic analysis of Habituation trials suggest differences in learning styles for LT and NL toddlers.
- Studies using object-label tasks (e.g, Werker & Staeger, 1997) to investigate word learning in LT and NL toddlers need to carefully examine:
  1. Habituation criteria and role of decreased attention and/or fatigue
  2. Stability of Novelty preference with increased learning

[1]Mixed model used that assumed dependence among trials, with different covariance structure used to assess look time patterns during Habituation trials (Total Look Time, Number of Looks per trial, Length of First Look)