Word Learning and Habituation in 18-Month Olds

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Abstract

The purpose of this study was to investigate the relationship between word learning abilities and vocabulary levels in young children. The ability to habituate and attach meaning to newly segmented words was examined in typical and low-vocabulary groups. Preliminary results suggest there are qualitative differences between groups 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.

References:

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Background and Purpose

Novel word learning in SLI
➢ Children with Specific Language Impairment (SLI) have difficulty learning language despite normal nonverbal IQ.
➢ Children with SLI have lower vocabularies than typical peers
➢ Late Talkers and children with SLI are poor at novel word learning tasks (Ellis Weismer & Evans, 2002).

Typical 18 Month old word learning
➢ 17 mos. typical infants easily discover word boundaries that can subsequently map to novel meanings (Graf Estes, Evans, Alibali, & Saffran, 2007).

Late Talkers
➢ Typically developing children acquire language rapidly and effortlessly, but some children do not. These children, often referred to as Late Talkers, are usually identified at about 24 months of age by parent report questionnaires.
➢ In past research Late Talkers have been identified many different ways, for example, by being below the 10th percentile in language abilities; having less than a 50 word productive vocabulary; very few, if any, word combinations; and are at risk for continued language impairment (Ellis & Thal, 2008).
➢ To date the best predictors of SLI are composite measures of: (1) family history of language impairment, (2) delay in comprehension *and* production, and (3) little use of gestures (Ellis & Thal, 2008).
➢ Are learning patterns delayed in children at risk for SLI?

Familiarity/Novelty Continuum
➢ Infants receiving repeated presentations of a stimulus should show a familiarity preference prior to a novelty preference (Hunter & Ames, 1988)
➢ Preferences can be dependent on the infants age, complexity of task or stimulus and processing time.
➢ Infants more likely to show familiarity preference when task is difficult (Thiessan & Saffran, 2003)
➢ Do all young children show the novelty preference when expected?

Fast Mapping and Looking Paradigm
➢ The current study will investigate the earliest part on word learning -- linking the meaning to the object
➢ To compare groups, we controlled the prior expereince by exposing the groups to a novel statistical language.

Question

➢ Using the same paradigm as Graf Estes, et al., (2007), do 18 mos. infants with low vocabulary -- after the same exposure to the target novel words in statistical learning stimuli -- perform the same as typically developing age and nonverbal matched controls on a novel word learning task?
➢ Do they require the same number of trials to habituation?
➢ Do they look longer on "switch" as compared to "same" trials during testing?
➢ Do they show particular patterns (novelty preferences) during testing? Are there differences in preferences by group?

Methods

Participants
Two groups of 18 month-old toddlers (N = 48) *
1. Low Vocabulary (Low Vocab)
   • 1-19th percentile on all three measures (gestures, comprehension and production) in the CDI:WG and CDI:WS
2. Typical age- and nonverbal IQ-matched controls (Typical)
   • 14th to 99th percentile on all three measures (gestures, comprehension and production) in the CDI:WG and CDI:WS

Inclusion/Exclusion Criteria:

• Full-term
• Passed infant hearing screenings at birth
• Passed tympanometry screening in at least one ear at testing
• Fewer than 3 ear infections.
• Normal Mental Developmental Index (MDI) score on Bayley Scales of Infant Development-II (BSID-II) (MDI,17-19 month range)
• Normal nonverbal abilities (6 of 11 items)
• No neurological damage or significant birth history based on parent report

•Fourteen participants excluded due to low MDI (2), did not pass tympanometry screening (3), not full term (5) and missing CDI or inconsistent CDI profiles (4).

Table 1. Mean and Standard Deviations for the Low Vocabulary and Typical groups for the Bayley MDI, nonverbal items, MB-CDI:WS words produced and percentile.

	All subjects N=34	Low Vocab N=14	Typical N=20	p value
Bayley MDI: 17-19 mos.	104 (9.67)	99.28 (10.01)	107.3 (8.13)	p=.015
Nonverbal items	8.08 (1.67)	7.28 (1.77)	8.65 (1.38)	p=.017
MB-CDI: WS Words produced	93.82 (94.86)	18.5 (10.3)	146.55 (91.9)	p <.001
MB-CDI: WS percentile	39.73 (29.38)	10 (6.82)	60.5 (18.96)	p <.001
MB-CDI: WG words comprehended	242.02 (82.32)	194.85 (90.56)	275.05 (58.07)	p=.004
MB-CDI: WG comprehension percentile	45.05 (29.5)	31.2 (29.6)	54.75 (26.1)	p=.02
MB-CDI: WG gestures	46.3 (8.76)	41.42 (9.4)	49.8 (6.5)	p=.004
MB-CDI: WG gestures percentile	39.67 (27.9)	26.71 (25.0)	48.75 (26.7)	p=.02

Methods

Procedures
➢ MacArthur Bates CDI:Words & Gestures (MB-CDI:WG) and Words & Sentences (MB-CDI:WS).
   • Prior to the visit, parents were sent the MB-CDI: WG & WS forms. Parents brought completed forms to the lab visit.
   • Forms were scored and child language percentiles were calculated after the testing.

Language Exposure Phase
• Same as Graf Estes et al., 2007
• Infants were exposed to one of two artificial languages.
• Each language was 2.5 minutes
• Natural speech
• Only reliable cue to the word boundaries was transitional probability

Habituation (Training) Phase
• Immediately following exposure phase
• Infants participated in a novel object-label habituation task.
• Two novel 3D objects were paired with two words from the exposure language using Habit 2000 Software (Cohen, Atkinson, & Chaput, 2000).
• Infants saw/heard two different label-object pairs, one at a time as novel objects moved side to side across screen
• Order of object-label pairings randomly presented
• Habituation criteria was met once looking time across three consecutive trials decreased 50% from looking time for the first three trials or max. of 25 trials.

"Timay"   "Dobu"

Methods

Test Phase
• Immediately following habituation phase, infants learning of object-label pairs was examined using a *Same/Switch* trial paradigm
• Children presented with two types of pairings, one at a time in random order

1. **Same** -Trials where the original object-word pairing from the habituation phase was maintained (N = 4 trials)

   "dobu"   "timay"

2. **Switch** -Trials where original object-word pairings from habituation phase were switched. (N = 4 trials)

   "dobu"   "timay"

Results

Habituation Phase

• The two groups did not differ in the number to trials to reach habituation $F(3,33) = .00$, $p = .994$ (Figure 1a) or duration of habituation $F(1, 33) = .374$, $p = .545$ (Figure 1b).
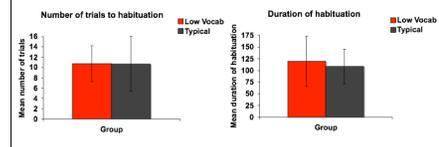
Figure 1a. Number of trials to habituation   Figure 1b. Duration of habituation

Test Phase
• Typical group is approaching a significant difference between the switch trials and same trials, in the direction of the switch trials $t(1,19) = -1.96$, $p = .06$
• No difference in looking times between same and switch trials for Low Vocab group $t(1,13) = .679$, $p = .509$
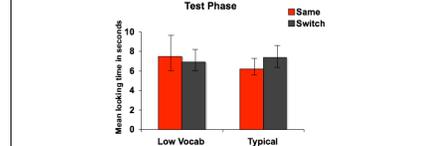
Figure 2. Looking time in seconds to same and switch trials during test phase

Familiarity versus Novelty

• Familiarity preference during testing phase:
   • infants looked longer at the same trials during testing phase -- those test trials having same object-word pairing during habituation phase.
      • Low Vocabulary group N = 7
      • Typical group N = 8
• Novelty preference:
   • infants looked longer at the switch trials during testing phase -- those test trials where object-word pairing switched from habituation phase.
      • Low Vocabulary group N = 7
      • Typical group N = 11
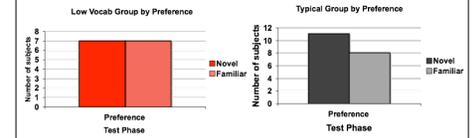
• No difference in look times to **Same** trials for Low Vocab and TD children showing Familiarity preference (Figure 4a).
• No difference in look times to **Switch** trials for Low Vocab and TD children showing Novelty preference (Figure 4b).

Figure 4a.   Figure 4b.
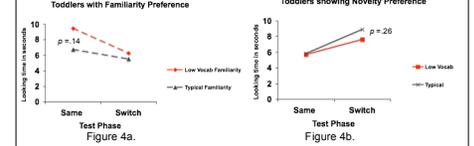
• Significant difference in Comprehension and Gesture CDI scores for Low Vocab Novelty group as compared to Low Vocab Familiarity group.
• No difference in Comprehension and Gesture CDI scores for TD Novelty or Familiarity groups (Figure 5).

Figure 5
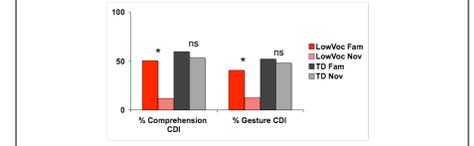
Summary

• Typically developing 18-month olds data replicate prior work of Graf Estes et al., (2007).

• As a group, Low Vocab infants showed different pattern of learning
   • Same number of trials to habituation as Typical infants
   • No difference between look times to *same* versus *switch* trials

• Low Vocab - Familiarity preference infants similar CDI Comprehension and Gestures scores as TD infants
• Low Vocab - Novelty preference infants significantly lower CDI Comprehension and Gestures scores

• Future research needs to examine these qualitative differences in "Novelty" preference infants at risk for SLI.