Expectancy Learning and Later Vocabulary

Erica M. Ellis and Gedeon O. Deák[1]
San Diego State University and [1]University of California, San Diego
Joint Doctoral Program in Language and Communicative Disorders

ABSTRACT

We investigated the relation between expectancy learning and later vocabulary in infants. Very young infants can learn statistical regularities in sequences of events. To learn words, however, infants must find regularities, or contingencies, between heard speech and possible referents. Little is known about how infants' contingency learning supports their language acquisition. We used the visual expectancy paradigm (VExP) to test infants' ability to learn novel predictable sequences of events. Speed of learning was measured in terms of infants' saccades to the location of the next event. Results suggest that the ability to learn to predict novel event sequences at 6 and 7 months of age relates to some measures of vocabulary at 12 months. This indicates that infant's sequence-learning ability might contribute to later word learning.

BACKGROUND

Learning Contingencies

From a young age infants learn contingencies and expect sequences of information in "noisy" social settings (Kaye, 1982).

- **Relationship to IQ**

  Infants' ability to learn simple event sequences predicts later IQ (Doughterty & Haith, 1997). However, it is not known how contingency learning contributes to later language learning.

- **Relationship to Word Learning**

  Infants learn contingencies between patterns of sounds and events in the social environment, utilizing temporal event synchrony for word learning (Gogate et al, 2000).

- **The Task**

  Haith (1993) tested contingency learning using a Visual Expectancy Paradigm to show the development of forming expectations in young infants.

QUESTIONS

1) **Is contingency learning itself stable in infancy?**

2) **Does it relate to general cognitive milestones?**

3) **Does contingency learning at 6 and 7 months predict later vocabulary (12-22 months)?**

METHOD

Participants

Session	N	Male	Female	Age in Days
6 mths	32	17	15	188
7 mths	29	14	15	218

Demographics

- Healthy typically developing infants with no reported perceptual or medical difficulties.
- Participants were from primarily English speaking middle-SES homes in the San Diego area.
- Average Bayley Cognitive score was 109 (12.5).

Procedure: Visual Expectancy Paradigm

- Infants sat on mother's laps facing a projection screen (Figure 1). Mother could not see or hear the events.

Each Trial (Figure 2)

- Center Cues: two novel shapes A or B (700 ms)
- Rewards: two distinct moving shapes, A (left) or B (right), paired with unique sounds (1 sec)
- ISI: 1 sec central orientation stimulus

Predictable Block

- Cue A always preceded Reward A. Cue B always preceded Reward B. (Cues were in random order.)

Learning the Contingency

- Infants must learn that each center cue predicts a different visual reward on the left or right.
- Infants who learn the cue/reward associations will shift to the correct location, gradually faster, and sometimes even before the reward begins (anticipatory).
- Infants complete a random block to assess baseline responses to the reward videos' onset.

Figure 1   **Figure 2**
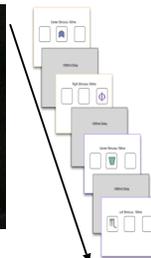
VExP MEASURES

Infant looking was coded offline frame by frame (30 fps) using Mangold Interact 8.0.

Infant looking codes for location and saccade times were synched to the online event log times.

Infant Looking Behavior

- **Anticipatory look:** Correct saccade to reward location after the center cue but <u>before</u> the reward onset
- **Reactive look**: Correct saccade to reward location after the reward onset

Dependent Measures:

- **Percent of Anticipatory Looks** out of all valid trials
- **Average RT**: Time from cue onset to the initiation of a reward-directed saccade
- **Learning Speed:** RT change from early to late trials

VOCABULARY/COGNITIVE MEASURES

MacArthur Bates CDI: Short-Form: Infant (Level I, Infant)	89-word vocabulary checklist (production/comprehension)
MacArthur Bates CDI: Short-Form (Level II, Infant)	100-word checklist (production)
Bayley Scales of Infant Development (BSID-III, 2005)	Cognitive Sub-scale

RESULTS: DESCRIPTIVE STATISTICS

Table 1. Mean and *SD* for infants at 6 and 7 months for Percent of Correct Anticipatory Looks and mean RT.

	6 mth session	7 mth session
% Anticipatory Looks	23.4% (12%)	25.7% (16%)
RT Anticipatory Looks	1.44 (1.22)	1.28 (1.11)

Table 2. Means and *SDs*: BSID-III Cognitive; MBCDI at 12, 16 (*n* = 21), and 22 mths (*n* = 19).

Dependent Variable	Means
BSID (Bayley) 12 mth Cognitive	110.3 (12.9)
12 mth MB-CDI: Comprehension	23.9 (17.7)
12 mth MB-CDI: Production	3.77 (4.5)
16 mth MB-CDI: Production	13.6 (16.2)
22 mth MB-CDI: Production	40.2 (19.3)

RESULTS: CONTINGENCY LEARNING

Stability across months: RT on correct anticipatory trials is correlated at 6 mths and 7 mths r (17) =.58, p = .015.

Contingency Learning and Vocabulary: Overall RT (6 and 7 mths) predicts 12 mth MBCDI comprehension, r (27) = -.42, p = .03.
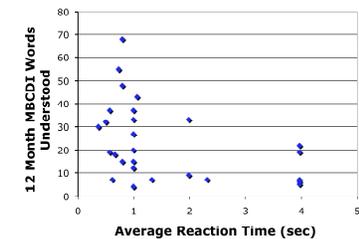
Contingency Learning Speed

Cognition: BSID-III Cognitive is correlated with 7-month learning speed (i.e.,decrease in RT), r (28) = .452, p = .016. VExP relates to general cognitive skills.

Vocabulary: Partial correlation of 6-month learning speed and 12-mth MCDI production, controlling maternal education, approaches significance, r (22)= -.361, p =.08

SUMMARY

1. Early infancy measures of learning may reveal new relations to later language development
   - Predictive validity was highest at 12 months
2. Ability to learn and anticipate event sequences might be a critical factor in word learning
   - Visual contingency learning shows moderate individual stability from 6 to 9 months (Canfield et al, 1997).
3. Infant learning speed (i.e., RT decline over trials) might be another useful (and previously unexplored) measure of infants' contingency-learning ability.

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