Investigating Whether 9-months Old Infants are Able to Distinguish Different Word-Endings

Yingli NA
CU Coventry University

Abstract: The aim of current study is to examine 9-months old infants’ sensitivity to the phonotactic pattern of their native language, to investigate whether they can sense the difference between word-endings with tense and lax vowel. It was predicted: since 9-months olds were assumed to be able to use phonotactic cues to segment words and most English words are ending with tense vowels, there will be a preference to words ending with tense vowels. Participants in this study are 9-month old infants, using head-turn preference system to examine their listening time to stimuli. Unfortunately, the outcomes did not agree with the hypothesis, which the difference between listening time is too small to accept.

Keywords: Infants’ Sensitivity to mother language; Phonotactic pattern; English words; Tense and lax vowels

DOI: 10.47297/wspiedWSP2516-250003.20200410

1. Introduction

For English-leaning infants, there are three primary word segmentation cues for them to use: statistic cues that used to extract statistical regularities from words they heard (Saffran et al., 1996). Johnson and Jusczyk (2001) observed that 8-months olds can parse both speech and non-speech stimuli by a single statistical cue. Hoff (2008) suggests that infants first use statistical cues to isolate words in a speech stream, and then they use the knowledge they have learned by combining it with other cues.

Prosodic pattern means the stress or rhythm of words (Thiessen & Saffran, 2003). Studies show that new-born are very sensitive to rhythm, displayed the ability of using it to distinguish their native language and other dissimilar pattern language, but failed to discriminate between similar pattern language. However, infants can detect the difference between their native language and other similar rhythm language by prosodic cues when they grew up to the end of their first year (Christophe et al., 2003). Jusczyk (1999) found that 7.5 months old infants can

About the author: Yingli NA (1986-03), CU Coventry University.
detect prosodic pattern in sentential contexts, indicated that infants can use prosodic cues to distinguish different words, and respond to whole words rather than strong syllables. Furthermore, 9-months old infants show a significant preference to words with explicit pattern, but 6-months olds did not display same choice.

It was found that English-learning infants first show their ability of words segmentation around the age of 7.5 months, but they only display a sensitivity to prosodic pattern. This ability helps infants to develop their lexical level until they get enough knowledge to use another cues, which is the third cue-phonotactic. Hoff (2008) referred that phonotactic knowledge is about the probability of certain phoneme and sound sequences in a language, for example, in English, /t/ is frequent, and /kp/ is not legal. Jusczyk (1999) found that 9-months old infants show the ability of using phonotactic cues to segment words from a speech stream, and sensitive to both phonotactic and phonetic properties of their native language, but 6-months olds did not show the same (Mattys & Jusczyk, 2001).

Researchers compared 9-month old English and Dutch infants and found out that they have already developed sensitivity to phonotactic patterns in their native language, and showed a significant preference to stimuli that contain high-probability of fitting with the pattern (Mattys, 1999). Furthermore, Gonzalez-Gomez (2013) found that 14-month French infants learned LC words quicker than CL words since LC words are more frequent in French, indicated that infants can obtain phonotactic knowledge and use it to learn words.

In current study, phonotactic cues will be discussed as the primary factor that helps 9-months olds to detect the word boundaries. However, one additional factor appears, phonological memory is the ability to remember the sound sequence of a new word, and this ability helps children to segment words from the stream of speech that related to infants’ sensitivity to phonotactic cues (Gathercole & Baddeley, 1989). May and Werker (2014) discovered that age and vocabulary size of infants would influence the efficiency of learning novel-sound words by phonotactic cues in a frame sentence. Thus, this study focused on 9-months old infants that assumed has some amount of vocabulary and they are sensitive to phonotactic pattern of their native language.

2. Methods

(1) Participants

25 9-months old healthy infants were involved in this study, none of them had auditory nor vision deficiency. The data for 7 of the infants was not usable due to crying or being too old. After all, data of 18 participants are useable to analyse, 6 participants did not complete their CDI form to record their lexicon level.
They were all recruited by email invitation that had been sent to their legal guardian after their legal guardian registered with babylab of Plymouth University. Due to the participants being under 16 years old, informed consent was gained from their parents.

(2) Materials

In this study, the head turn preference system vision 1.8 was used to record infants’ preference to different word-endings by analysing their looking time to either the left or right side in experimental booth. During the experiment, investigator can simultaneous observe participants’ action.

The stimuli used in this study contained two lists, each list composed by 12 groups, there are totally 24 groups of monosyllable non-words that contain 12 groups of tense word-endings and 12 groups of lax word-endings.

Each participant was tested by different condition, each condition contain 6 groups lax non-words and tense non-words, a random counterpart would be added into trials when inattention occurred during experiment. Conditions are same audio length in experimental sound recording, duration between two stimulating was adjusted according to the length of stimuli.

A CDI (communicative development inventory) form were filled in by parents to probe into infants’ lexical level, parents chose which words they think their infants could understand or both understand and speak.

The length of the child’s head turn time was recorded using a recording box. Infants’ head direction was detected by a camera located in front of them in the booth. Their actions were recorded by computer system called IP Camera Wizard. Speakers are located in both at left and right side of the booth to play stimuli. 2 red flashing lights and 1 green light were in the booth to track infants’ attention. The green light was in front of the booth, infant and parent were sit forward it and on the chair in the central of booth, two red lights were in their left and right side, were able to be seen when either one of them were light up.

(3) Design and Procedure

This experiment is a between subject design with two conditions for each trial.

The investigator make sure the booth and computer were ready before the parent and child arrived. After the baby and guardian arrived, introduce the purpose and procedure of this study, answer any of the guardian’s questions, ask them to sign the consent form when they felt satisfied. After the guardian and baby felt ready, they followed the investigator into the experimental booth.
During the experiment, Participant sat on guardian’s lap facing forward towards the camera. The experimenter placed headphones on the guardian and played music, so that he/she could not hear the stimuli and bias infant’s reaction. Investigator start the experiment after parent and infant were ready.

After press the ‘start experiment’ button on computer, the investigator pressed the left green button on the keypad. At first, the green light in the middle of the front wall flashed to gather infant’s attention. Once the infant looked at the green light, the investigator pressed the middle red button on the keypad, either left or right red light would flash randomly, once infant looked at the flashing light, the investigator pressed and held the right blue button as long as the infant was looking at the red light to record their looking time.

There were 14 trials total, included 2 habituation trials and 12 test trials (some participants was tested for 13, 14 test trials, due to inattention occurred, system automatically refill the inattention trials to make sure the data integrity). 2 habituation trials will be played at first to help infant to learn the head turn system, once the child looked at the red light, music followed until the end of the trial, or unless they looked away more than 2 seconds. The test trial started after habituation trials, In the 12 test trials, non-sense words followed once the child made a correct head turn until the end of the trial or unless they looked away more than 2 seconds.

3. Result

(1) Correlation Analysis for tense and lax vowel

Table 1 shows the outcome indicated that the mean difference between ‘Tense’ and ‘Lax’ is not different from 0, means that null hypothesis was accepted.

|       | Number | t    | sig.(2-tailed) |
|-------|--------|------|---------------|
| Tense & Lax | 18    | -.064| .950          |

(2) The Paired Samples Test among infants who completed CDI form:

Table 2 shows that the different listening time between tense vowel and lax vowel ending stimuli is still not different from 0, indicate a rejected hypothesis.
|                          | Number | t    | sig. (2-tailed) |
|--------------------------|--------|------|-----------------|
| CDItense & CDIlax        | 12     | 1.290| .223            |

4. Discussion & Conclusion

Consonants and vowels have different functional roles in language acquisition, which consonants mainly concern about lexical size and involve in word processing, while vowels help learners to detect the grammatical properties in a rhythmic and syntactic system, and are normally used for extracting and generalising structural relations (Nespor Pena & Mehler, 2003; Hochmann et al., 2011). Furthermore, consonants and vowels carried different information, that consonants are more about word identification, vowels are tied to syntactic and prosodic information, language learners prefer to use consonants to segment words in continuous speech (Bonatti et al., 2007). English words are usually not ending with lax vowel, therefore, current study tends to investigate whether 9-months old infants have sensitivity to English words with tense or lax vowel.

The findings of the experiment show that there is no significant difference between listening time to non-words ending with tense and lax vowel. Further analysis shows that lexicon level did not significantly effect infants’ sensitivity to the different none-word. Even previous studies suggested that 9-months olds (or even younger) can detect the illegal phonotactic pattern in their native language, and recognised the vowel changes in their familiar words (Mattys et al., 1999; Bouchan et al., 2014). The stimuli used in this study were all of high-probability which exists in real world, and according to the audio measurement of stimuli, non-words were all in similar audio length and stress. However, even infants can segment words by various cues, when other cues were against with prosodic cues, they detected word boundary more rely on it than others (Johnson & Jusczyk, 2001). Thus, this outcome is possible due to the rhythm of stimuli.

The age of 9-months is in the middle of between ‘very sensitive to vowel’ and ‘developed sense to consonants’, it is possible that the development of participants’ brain, cognition and experience that might affect their sensitivity. Thus, expanding the age range would contribute to detecting the age boundary between sensitivity to the vowel only and to both vowels and consonants. In addition, the head-turn system merely detected infants’ attention, but do not show exactly what infants’ opinion about the stimuli. As Cubelli (1991) discovered that different status of graphemes of consonants/vowels is differentially in brain process, employing a brain analysing machine would provide more accurate data and evidence about
infants’ sensitivity to phonological pattern.

Current study examined infants’ sensitivity to the language based on previous studies, focus on 9-months olds that assumed as in the age of being able to recognise words by both prosodic and phonotactic cues, also being able to detect changes of vowels in their native language. Even outcomes do not support the hypothesis; it still provides valuable data and implication for further study.

Works Cited

[1] Bonatti, L. L., Pena, M., Nespor, M., & Mehler, J. (2007). On Consonants, Vowels, Chickens, and Eggs. Psychological Science, 18(10), 924–25.
[2] Christophe, A., Nespor, M., Guasti, M. T., & Van Ooyen, B. (2003). Prosodic structure and syntactic acquisition: the case of the head-direction parameter. Developmental Science, 6(2), 211–20.
[3] Gathercole, S. E., & Baddeley, A. D. (1989). Evaluation of the role of phonological STM in the development of vocabulary in children: A longitudinal study. Journal of Memory and Language, 28(2), 200–13.
[4] Hochmann, J.-R., Benavides-Varela, S., Nespor, M., & Mehler, J. (2011). Consonants and vowels: different roles in early language acquisition. Developmental Science, 14(6), 1445–58.
[5] Hoff, E. (2008). ISE for Language development (4e 4th E di ti on.). United Kingdom: Wadsworth Publishing Co Inc.
[6] Johnson, E. K., & Jusczyk, P. W. (2001). Word Segmentation by 8-Month-Olds: When Speech Cues Count More Than Statistics. Journal of Memory and Language, 44(4), 548–67.
[7] Jusczyk, P. W. (1999). How infants begin to extract words from speech. Trends in Cognitive Sciences, 3(9), 323–28.
[8] Mattys, S. L., Jusczyk, P. W., Luce, P. A., & Morgan, J. L. (1999). Phonotactic and Prosodic Effects on Word Segmentation in Infants. Cognitive Psychology, 38(4), 465–94.
[9] Mattys, S. L., & Jusczyk, P. W. (2001). Phonotactic cues for segmentation of fluent speech by infants. Cognition, 78(2), 91–121.
[10] May, L., & Werker, J. F. (2014). Can a Click be a Word?: Infants’ Learning of Non- Native Words. Infancy, 19(3), 281–300.
[11] Nespor, M., Peña, M., & Mehler, J. (2003). On the different roles of vowels and consonants in speech processing and language acquisition. Lingue e linguaggio, 2(2), 203-30.
[12] Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical Learning by 8-Month- Old Infants. Science, 274(5294), 1926–28.
[13] Thiessen, E. D., & Saffran, J. R. (2003). When cues collide: Use of stress and statistical cues to word boundaries by 7- to 9-month-old infants. Developmental Psychology, 39(4), 706–16.