

The Role of Syllable Stress and Position in Young Infants' Retention of Speech Information

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Syllables are important units of speech processing for infants. Bertoncini & Mehler (1981) found that infants discriminate stimuli with syllabic (CVC) structures better than nonsyllabic (CCC) patterns. More recently, Jusczyk et al. (1995) found that the availability of a common syllable structure improved 2-month-olds' memory for speech information. Infants familiarized with a set of 4 bisyllables that included a common initial stressed syllable (e.g., [baD remembered the items well enough to detect the addition of a new item after a 2-minute delay. In contrast, infants familiarized with a set of 4 bisyllables, that shared two phonetic segments from different syllables, did not detect the addition of a new item after the delay period. Jusczyk et al. concluded that the presence of the common syllable facilitated infants' encoding of the speech sounds. The common syllables used by Jusczyk et al. were *stressed* and always occurred in *utterance-initial position*. Consequently, it is not clear whether infants gain advantage from the presence of any common syllable, or only ones with particular stress and utterance-position properties. The present studies were designed to explore this issue.

Experiment 1

This first study addressed whether infants gain advantage only from the presence of common *stressed* syllables. To investigate this, we devised a set of 4 bisyllables, similar to those used by Jusczyk et al. except that all 4 bisyllables began with the same *unstressed* syllable: [b_lo _], [b_zi _], [b_m_t _], [b_d_s _]. If stress is not critical for an advantage in encoding the items, the infants should be able to detect the presence of a new bisyllable after the delay period.

Methods

Subjects

Thirty-six (17 female, 19 male) 2-month-olds (mean age = 10 weeks, range = 8 weeks to 15 weeks) completed the study (12 subjects in each of 3 test conditions). An additional 44 infants were tested, but failed to complete the procedure due to crying (23), falling asleep (17), failure to habituate (4), and not sucking on the pacifier (6).

Design and Procedure

The infants were tested with a modified version of the HAS procedure, in which a 2-minute delay period was interposed between the pre- and post-shift periods. In the pre-shift period, each criterion suck produced one occurrence of one bisyllable, randomly chosen from the 4 in the stimulus set. During the post-shift period, a new bisyllable was added to the pre-shift set for subjects in the experimental conditions. In one instance, the new item contained the same common initial-syllable ([b_nal _]); in the other, the new item contained a new initial-syllable ([s_nal _]). Subjects in the control condition heard the same 4 bisyllables as in the pre-shift period.

Results and Discussion

To assess detection of the new bisyllables, we computed difference scores by subtracting the average number of sucks in the first 2 post-shift minutes from the average in the last 2 pre-shift minutes. The average change in post-shift sucking responses of infants in each of the

Experiment 2

The overall pattern of findings in Experiment 1 replicates that of Jusczyk et al. (1995). Hence, it appears that infants' encoding of speech is facilitated by the ' presence of common initial-syllables --even unstressed ones. It is possible that infants were sensitive to the occurrence of the common syllable -stressed or unstressed -because it occurred in the utterance-initial position. To explore whether utterance-position affects the likelihood that infants detect the presence of a common syllable and whether it affects their retention of speech information, we created a new set of bisyllables which contained the *same stressed second syllable*. Thus, the pre-shift stimuli set was composed of the following bisyllables: [s_ bad _], [w_ bad _], [m_ bad _], [k_ bad _].

An indication that infants detected the common syllable among the pre-shift stimuli would be if they displayed smaller increases in post-shift sucking to a new bisyllable containing the same stressed second syllable ([l_ bad _]) than to one containing a new stressed second syllable ([l_ pa _]). Also, if the presence of the common stressed second syllable facilitates memory encoding, then the group of infants who have [l_ pa _] added to the post-shift stimulus set should show significant increases in sucking as compared to the control group.

Method

Subjects

Thirty-six (13 female, 23 male) 2-month-olds (mean age = 9.2 weeks, range = 7 weeks to 14 weeks) completed the study (12 subjects in each of 3 test conditions). An additional 30 infants were tested, but failed to complete the procedure due to crying (10), falling asleep (8), failure to habituate (3), experimental failure (2), and not sucking on the pacifier (7).

Design and Procedure

All infants were tested with the modified version of HAS used in Experiment 1. During the pre-shift period, infants in all three test conditions heard the same 4 bisyllables. In the post-shift period, a new bisyllable (either [l_ bad _] or [l_ pa _]) was added to the pre-shift set for infants in the two experimental conditions. No new stimulus was added to the pre-shift set for infants in the control condition.

Results and Discussion

Difference scores were computed, as in Experiment 1, for each test condition. Relative to the control condition, infants displayed significant increases in post-shift sucking when [l_ pa _] was added ($t(22) = 4.94, P < .001$), but not when [l_ bad _] was added ($t(22) = 0.57, P > .57$). Thus, it appeared that infants detected the presence of the common syllable in the pre-shift stimulus set, and once again, this facilitated their encoding of the speech sounds. Clearly, it is not essential that the common syllable appear in the initial position of the utterances. The presence of a common *stressed* second syllable yielded a comparable facilitation effect.

Experiment 3

The findings from Experiment 1 and 2 suggest that infants are able to detect the presence of a common syllable when it is stressed but in the non-salient utterance-final position or if it is unstressed and utterance-initial. The final experiment tested 2-month-olds' ability to detect a common syllable that is both unstressed and in utterance final position. The pre-shift stimuli set was composed of the following bisyllables: [d_s _b_], [m_t _b_], [lov _b_], [zi _b_]. If infants can detect the common syllable, they should exhibit a greater increase in post-shift sucking when presented with a novel bisyllable containing a different final syllable ([nal _s_]) than

infants were tested, but failed to complete the procedure due to crying (25), falling asleep (10), failure to habituate (6), and not sucking on the pacifier (9).

Design and Procedure

All infants were tested with the modified version of HAS used in Experiments 1 and 2. During the pre-shift period, infants in all three test conditions heard the same 4 bisyllables. In the post-shift period, a new bisyllable (either [nal _b_] or [nal _s_]) was added to the pre-shift set for infants in the two experimental conditions. No new stimulus was added to the pre-shift set for infants in the control condition.

Results and Discussion

Difference scores were computed for each test condition. Relative to the control condition, infants displayed significant increases in post-shift sucking when [nal _s_] was added ($t_{22} = 5.00$, $P < .0001$), but not when [nal _b_] was added ($t_{22} = 0.61$, $P > .50$). As in the previous two experiments, infants detected the presence of the common syllable in the pre-shift stimulus set, and this facilitated their encoding of the speech sounds.

General Discussion

The present results extend those of Jusczyk et al. (1995) in several ways. In particular, they demonstrate that infants are sensitive to the presence of common syllabic elements, whether they are in utterance-initial or utterance-final positions or whether they are stressed or unstressed. Moreover, the fact that the presence of common syllables appears to facilitate infants' encoding of speech information suggests that, even at this early age, such units do play a role in on-line processing. Attention to syllables and, in particular, to syllable-types may be helpful in discovering certain aspects of native language sound organization, such as those relating to its phonotactics and its word structure. For instance, which types of sound sequences can appear in syllabic units reflect the phonotactic structure of the language. In turn, identifying which kinds of sequences do and do not occur within such units can provide clues for segmenting words from fluent speech.

References

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