DOCUMENT RESUME

ED 161 266 FL 009 741

AUTHOR Barton, David
TITLE Phonemic Discrimination and the Knowledge of Words in Children under 3 Years. Papers and Reports on Child Language Development, No. 11.
INSTITUTION Stanford Univ., Calif. Committee on Linguistics.
PUB DATE May 76
NOTE 9p.

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Auditory Discrimination; *Child Language; *Cognitive Development; Distinctive Features; *Language Development; Language Learning Levels; Language Research; Language Skills; Linguistic Competence; Linguistic Performance; Perception Tests; Perceptual Development; *Phonemes; Phonology; Preschool Children; Psycholinguistics; Speech; *Verbal Development; Vocabulary Development; Word Recognition
IDENTIFIERS Minimal Pairs (Phonology)

ABSTRACT

Several studies have begun to investigate the claim that children can make most phonological discriminations when they begin to speak. This paper investigates how well children aged 2;3 to 2;11 can discriminate between pairs of minimally different real words, and it shows that the results are affected by how well the children know the words. It is argued that in some earlier studies not knowing the words well enough may have given the impression of worse discrimination abilities. The present study makes several methodological improvements on the earlier studies. Pilot work had suggested that how well children know the words interfered with the results, so this variable was made a central part of the study. Also, on the assumption that children around two-and-a-half years of age can make many of the discriminations, those discriminations least likely to be known were investigated. (Author/NCR)

PHONEMIC DISCRIMINATION AND THE KNOWLEDGE OF WORDS IN CHILDREN UNDER 3 YEARS.*

David Barton
Dept. of Phonetics & Linguistics
University College London

Several studies, including Garnica (1971, 1973) and Edwards (1974), have begun to investigate the claim of Shvachkin (1948) that children can make most phonological discriminations when they begin to speak. This paper investigates how well children aged 2;3 to 2;11 can discriminate between pairs of minimally-different real words, and it shows that the results are affected by how well the children know the words. It is argued that in some earlier studies not knowing the words well enough may have given the impression of worse discrimination abilities. The present study makes several methodological improvements on the earlier studies.

Pilot work had suggested that how well children knew the words interfered with the results and so this variable was made a central part of this study. On the assumption that children around two and a half years of age can make many of the discriminations, those discriminations least likely to be known were investigated.

Subjects and materials.

The subjects were twenty children aged from 2;3 to 2;11 (mean 2;7) who were attending various playgroups in the area.

There were twenty pairs of words to be discriminated (see Appendix). The pairs were chosen so that the two words were mono-syllables that differed from each other in only one distinctive phonological feature of one segment (and there were some 'intuitively' difficult pairs). The words were names of objects that the children were likely to know and which could be easily illustrated.

Each pairs of words was illustrated on a separate 'language-master' card. These cards are approximately 10 x 25cm. and two channels of sound track can be recorded on them. Instructions were recorded on each card: for example, one card had illustrations of the pair 'goat' and

*Some of these results were presented at the Third International Child Language Symposium, London 1975. This work was supported by a Science Research Council Research Studentship.

'coat': "point to the goat" was recorded on one track and "point to the coat" on the other track. The recordings were by an adult female speaking in a normal voice.

Procedure

The children were tested individually either at home or at their playgroup; some children were tested in two sessions of half the cards and the ones who tried more quickly were tested in a larger number of shorter sessions. Sessions varied in length from twenty to forty minutes. All sessions for any child were completed within ten days. While being tested, the subject sat on one side of the machine, a modified 'language-master', where he could see the illustrations and the experimenter sat on the other side where he could operate the controls. By using recorded stimuli in this situation the possible influence of non-linguistic cues was greatly reduced. In carrying out the task the children soon learned to feed the cards into the machine and it was this they attended to rather than the experimenter.

There were two stages in the experiment. The first stage was the identification of the words. All the cards to be used in the session were presented randomly one at a time with no soundtrack. The child was asked to identify each picture in turn. If he was unable to, he was prompted until each picture could be consistently identified. Three categories were used here. If the child named a picture before the experimenter, then the word was recorded as named; if the experimenter named it only once (usually by saying "can you see a ... anywhere?) and the child pointed it out and could later identify it, then it was recorded as prompted; lastly, if the experimenter had to name it more than once (with perhaps some explanation of its use, etc.), then it was recorded as taught.

This part of the sesison was not finished until all the words could be identitifed by the child. To check on taught words, it was accepted that a child could identify a particular word if he could consistently discriminate it when it was contrasted with monosyllables that differed from it in all segments. For example, one could check 'log' by contrasting it with 'cat' and 'head'. Identification was checked in this 'non-minimal' situation and it was not necessary for the child to produce every word.

The second stage of the experiment was the discrimination of the pairs. In this stage the cards were presented with the sound track on. They were presented one at a time and the child responded by picking out one of the pair of illustrations. When all the cards had been presented once, the procedure was repeated. This continued for five presentations of each pair; which track was heard was random with the provise that by the end there were at least two instances of each track for each card. If the child failed to respond at any point the same card was repeated until the child responded. He was not told whether or not his responses were correct. If a child got all five presentations of a card correct, then it was assumed that he could discriminate that pair; otherwise,

there were further trials to give a total of twenty trials. This was to establish whether the errors were just chance errors or whether the discrimination was not being made. The criterion used was 15 correct trials out of 20 ($p < 3\%$). (For statistical rationale, see Barton 1975).

Results

Of the twenty subjects, thirteen completed all twenty cards; the remaining seven subjects did only ten cards each (a random ten). These seven subjects did not complete for various practical reasons, but it should be stressed that none of them dropped out because of difficulty with any part of the experiment.

Overall about half the words were named by the children, 30% were prompted and the remaining 20% taught. Some errors were made with named words, more were made with prompted words and even more with taught words. (The details are given in figure 1). Most of the failures to discriminate that occurred did so where at least one of the pair was a taught word. (This was despite the fact that these taught words could be identified correctly in the non-minimal situation.) In these cases it was not possible to know whether the difficulty was with the discrimination or whether it lay in not knowing these taught words adequately. To avoid the interfering effects of taught words, the results are first considered excluding any pair containing a taught word.

Figure 1.

Error rates for named, prompted and taught words.
(in first five presentations of each pair)

	no. errors	no. presentations	error rate %
named words	86	794	10.8
prompted words	94	487	19.3
taught words	156	369	42.3
overall	336	1650	20.4

The results have been scored into four categories (see figure 2 on next page). The first category (✓) indicates how often all the first five presentations were discriminated correctly. This occurred

on over 80% of instances. The children could make these discriminations unequivocally; there even appeared to be a faster reaction time for these discriminations, although it was not measured in this experiment. The second category (-) represents those instances when at least 15 trials out of 20 trials were correct; in this category the children made the discrimination but not perfectly. This accounted for a further 14% of instances. Together these two categories, where an ability to discriminate was demonstrated, account for nearly all the results. In the remaining instances there appeared to be two distinct patterns of response: there was random responding, where the child chose randomly between the pair of pictures, and there was biased responding, where he or she consistently chose one of the pictures and ignored the other. Different interpretations can probably be put on random responding and biased responding. For pairs falling in these two categories it has not been demonstrated that the children could under no circumstances discriminate them, but only that they failed to in this situation.

Figure 2.

Results excluding pairs containing taught words.

Card number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Total subjects tested		13	18	19	16	15	19	16	14	16	20	16	17	17	19	17	15	15	19	15	14
Untaught subjects*		3	18	16	15	0	17	13	8	12	14	11	15	7	3	4	13	11	17	10	6
Results (no. of subjects)	✓	1	13	10	14		8	9	7	10	12	10	15	6	2	4	12	10	16	9	5
	-	2	2	5	1		9	2	1	1	2	1		1	1		1	1		1	
	X		1	1				1		1									1		1
	B		2					1													

Totals			
	✓	173	81.3%
	-	31	14.5%
	X	6	2.8%
	B	3	1.4%

* i.e. those whom neither member of pair was taught.

Key: ✓ consistently correct
- some errors but better than chance responding
X random responding
B consistent bias to one of the pair

For list of pairs, see appendix.

In interpreting these results, one wants to know if this ability to discriminate is limited to pairs of words known by the children. With pairs where one or both of the words had to be taught, the subjects did less well at the discrimination task; nevertheless, in most instances the pairs were discriminated. The results for these pairs are displayed in figure 3.

Figure 3.

Results where one or both words of a pair was a taught word.

RESULTS																				
	✓	6		2		4		1	3		5	4	2	3	9	6	2	2		4	2
	-	3				3	2	1		1	1			3	5	3		2	2		3
	X	1		1		4			3					2						1	1
	B				1	4		1		3		1		2	2	4					2

Totals			
	✓	55	47.0%
	-	29	24.8%
	X	13	11.1%
	B	20	17.1%

Discussion

i) These results show a general ability to make the phonological discriminations that were tested. Overall, the children could do most of the discriminations. Individually, they ranged from those who could make only some of the discriminations to four children who did them all perfectly. The procedure used seemed simple enough for there to be a high level of unequivocal responding and task difficulty did not seem to interfere with the results. The pairs tested covered a wide range of phonological distinctions and it should be recalled that at the beginning pairs were chosen that were thought to be most likely to give difficulties. (The results of individual children and the relative difficulty of different pairs will be dealt with elsewhere; briefly, no statistically significant 'order of acquisition' was apparent).

ii) Far more difficulty was experienced when the children did not previously know the words. With the biased results it tended to be the case that one word was named (or prompted) and the other taught, and that the bias was towards the named word. With some subjects, in the middle of testing it seemed that they did not know certain words and that a mistake had been made in the first part of the experiment; however, on retesting non-minimally in the middle of the experiment they were able to identify these taught words. (It is possible that in the non-minimal situation they were dividing the known/taught pair into known/unknown, and that they were responding on this basis. This seems unlikely, however: in Vincent-Smith et al (1974) children were taught unknown words by pairing them with known words; the children could later correctly choose the words when unknown/unknown pairs were tested.)

These taught words were spread throughout the pairs and they did not seem to be similar phonologically. There was no evidence that children at this age avoided and did not know certain phonologically difficult words. Where words were not known by many children, the reason was

probably that they were uncommon words. Age was important here; there was some correlation of age with overall performance, but the main problem for the younger children was that they knew fewer of the words.

iii) These results highlight a problem that arises in studies that make use of invented words, which are all taught. This is the problem that errors may come from not knowing the words well, rather than from an inability to discriminate. This may affect the results of such studies and it may explain results that claim that older children cannot make these discriminations. To give one example, all of the children in this study could do some of the discriminations where the pairs differed in the phonological feature of voicing and there are very few cases where a discrimination was not made; in Garnica (1971) none of the three children tested on the initial p/b discrimination (aged 2;9, 2;10 and 3;5) suceeded, and in Koenigsknecht & Lee (1968) an error-rate of 36% is reported for voicing in three year olds. This may affect studies using invented words and it also needs to be taken into account when the stimuli are real words. In one study (Locke (1971)), one pair of words was excluded from the analysis because the more familiar word of the two was constantly chosen; however, the interfering effects of how well the words were known may have been more widespread.

Using real words is, of course, a constraint in that not all the possible minimal pairs of English can be tested. To test certain discriminations, invented words have to be used (and they have the advantage that at the beginning they are all equally unknown). One, therefore, has to be sure that they are taught adequately. In an experiment with younger children, using real words that they may not know, I have tried to overcome this by never testing non-minimally on the same session that they are taught the words. In this way the children have to remember the words for at least a day.

iv). In demonstrating that children can make these discriminations, I am not suggesting that the features represent perceptual dimensions; rather, this study is concerned with the acquisition of these features as classificatory dimensions. In some studies, for example those using the Shvachkin-Garnica technique, both words for comparison are presented together in the testing situation and there can be some auditory comparison by the child; on the other hand, in the situation described here the two words are never presented together and any comparison is internal. (In this respect the Shvachkin-Garnica technique gives a simpler task.) The first paradigm is testing a surface perceptual contrast (and it may not tap the minimal phonological comparisons in use), while in the second paradigm the subject has to refer to some internal representation before making a judgement. Hopefully, this process is mediated by the phonological classifications used by the subject.

References

Barton, D. (1975). Statistical significance in phonemic perception experiments. Journal of Child Language. 2, 297-298.

Edwards, M.L. (1974). Perception and production in child phonology: the testing of four hypotheses. Journal of CHild Language. 1, 205-219.

Garnica, O.K. (1971). The development of the perception of phonemic differences in initial consonants by English-speaking children: a pilot study. PRCLD 3, 1-29.

Garnica, O.K. (1973). The development of phonemic speech perception. In T.E. Moore (ed.), Cognitive Development and The Acquisition of Language. New York: Academic Press.

Koenigsknecht, R.A. & Lee, L.L. (1968). Distinctive feature analysis of speech sound discrimination in children. ASHA.

Locke, J.L. (1971). Phoneme perception in 2- and 3-year old children. Perceptual and Motor Skills 32, 215-217.

Shvachkin, N. Kh. (1948). The development of phonemic speech perception in early childhood. Reprinted in C.A. Ferguson & D.I. Slobin (1973), Studies of Child Language Development. New York: Holt, Rinehart & Winston.

Vincent-Smith, L., Bricker, D. & Bricker, W. (1974). The acquisition of receptive vocabulary in toddler-age children. Child Development 45, 189-193.

Appendix

List of minimal pairs used.

1. log lock
2. grass glass
3. wing ring
4. back bag
5. frock frog
6. mouth mouse
7. coat goat
8. lock rock
9. curl girl
10. seat feet
11. mat bat
12. goat boat
13. clown crown
14. cat cap
15. train chain
16. pie tie
17. head hen
18. bear pear
19. guard card
20. cloud clown