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How to Become Aware of Phonemes without Knowing the Alphabet

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To be able to speak and to understand the speech of others does not necessarily entail an awareness of language, i.e. an ability to disregard the meaning of words and to concentrate on their sound structure. That speakers of a language may not be linguistically aware has been shown in several studies, e.g. by Morais et al. 1979 who found that illiterate adults were unaware of phonemes. However, if they are given reading instruction, they develop an awareness of phonemes. On the other hand, from the ability to read does not automatically follow an awareness of phonemes as shown by the findings that readers of non-alphabetic writing systems are phonemically unaware (Mann 1986, Read et al. 1986). Such findings, as well as the observation that poor readers are often linguistically unaware has led some researchers to regard phoneme awareness as an effect of learning to read and write in an alphabetic code, while others regard phonemic awareness as a prerequisite for learning to read and write. Those who hold phoneme awareness to be a prerequisite often base their opinion on work with children, e.g. on studies where the effect of phoneme awareness on reading and writing achievements, and the training of such awareness, are studied in beginning readers (e.g. Mann and Liberman 1982, Bradley and Bryant 1985). An intermediate position is taken by those who argue that phoneme awareness is both a prerequisite and an effect of reading acquisition (e.g. Ehri and Wilce 1979, Valtin 1984).

The view that awareness of phonemes can only be developed as an effect of learning to read and write in an alphabetic writing system is counterevidenced by the fact that many non-literate pre-schoolers enjoy rhyming and other playful activities that require an awareness of phonemes. As their phonemic awareness can not be attributed to their reading ability, it is reasonable to assume that they have used other means to discover the phonemic structure of language. One

possibility that has been suggested by Mattingly 1987 is that the morphological structure of various languages serves as a more or less obvious guide to the phonemic structure.

Researchers with a psychological orientation often describe linguistic awareness as an ability to shift attention. They ascribe the establishing of this ability to a change in cognitive functioning and have a tendency to discuss linguistic awareness as if children were either linguistically aware or totally unaware. This is not in accordance with the findings in our studies of non-literate pre-school children (e.g. Magnusson and Nauclér 1987). Our results show that the same subjects appear to be more or less aware depending on the type of task they are given: e.g. more children show linguistic awareness on a rhyme recognition task than on a phoneme identification task. Furthermore, it seems to be important which type of segments they are asked to manipulate and which sequences or structures these segments are part of. Observations of this kind suggest that children gradually become linguistically aware over a period of time and that the growth of linguistic awareness is helped by phonetic (and phonological) factors. The present study was undertaken with the aim of looking into how syllabic structure and segment type (or phonetic substance) influence children who are in the process of developing phoneme awareness.

PROCEDURE

The study presented here is based on data from a longitudinal project in which we are studying groups of language disordered and normally speaking children with the aim of identifying the linguistic abilities that are most important, or even indispensable, for learning to read and write. The project started when the children were six years old, i.e. one year before they started school. In addition to testings in pre-school, testings were also done in the first and third grades and a follow-up is planned in grade four.

The data presented in this paper are data from the pre-school testings where the subjects were 114 children, 75 language disordered ones and 39 normally speaking ones. The language disordered children had been examined at the Speech Department of the ENT-clinic at Malmö General Hospital and diagnosed as having an idiopathic, or functional, language disorder, i.e. their language problems could not be attributed to impaired hearing, mental retardation, emotional disturbances, physical malformations, etc. All the subjects were six-year-old pre-schoolers who had not been subject to reading instruction. 39 of the language disordered children had had speech and language therapy.

From the various meta-linguistic tasks the children were given at the pre-school testing (Magnusson and Nauclér 1987), we have chosen two tasks that

were designed to measure the awareness of phonemes: identification and segmentation of phonemes.

Identification of phonemes

In the identification task the children were asked to identify two consonants, a fricative /s/ and a plosive /t/, and two vowels, a back vowel /u/ and a front vowel /i/, in a number of familiar words. The target sounds appeared in either initial, medial, or final position of the word – or not at all (see table 1). The children were asked to indicate whether or not the target sound – in their opinion – was part of the sound structure of a number of words said by the experimenter. This was done by asking the children questions of the following type: "Do you hear [s] in *sol*? Do you hear [s] in *apa*?" where the target sounds were given in their phonetic, and not in their alphabetic, form.

Table 1. Words used in the identification task.

Ident. of /s/	*Ident. of /t/*	*Ident. of /u/*	*Ident. of /i/*
sol	nalle	bil	Ida
Lisa	katt	Ola	mage
apa	mus	mor	docka
myra	tak	kaka	bi
hus	äta	dörr	bok
båt	nål	ko	pil

The task was introduced to the children in a number of training items and the children's attention was drawn to the fact that the target sound was found in some of the test words, but not in all of them. In order to complete the identification task successfully, the children had to recognize both the presence and the absence of the target sounds in the test words. The 24 test words were given in the order they are presented in table 1.

Segmentation of phonemes

In the segmentation task, the children were instructed to indicate the number of phonemes in a word pronounced by the experimenter by selecting the correct number of markers of some kind, e.g. buttons, stones, or pieces of paper. The words used in the task varied as to the number of phonemes as well as to syllabic structure, e.g. VC, CV, VCC, CVC, CCVC, CVCC (see table 4 below). Both

monosyllabic and bisyllabic words were included. The 18 test words were presented to the children in a randomized order.

The segmentation task was introduced to the children in the following way: "Now we are going to put out a stone for each sound in a word. When we say *i* ['in'] we only have to put out one stone." One stone is picked out. The experimenter says the word *i* and points to the stone. "But when we say *is* ['ice'] one stone is not enough. We have to put out one more stone." A second stone is placed beside the first one. The experimenter says the word slowly while pointing to the two stones, "*i-* [pointing to the first stone] *-s* [pointing to the second stone]". "When we say *ris* ['rice'] two stones are not enough. We have to put out one more." The experimenter says the word slowly and both the experimenter and the child point to each of the three stones in succession. The children were encouraged to listen to and to think about the words (without saying them) and to pick out and to point to the correct number of stones.

RESULTS

The first observation to be made about the results concerns the difficulty of the identification and the segmentation tasks. Even if both the tasks were designed to measure the awareness of phonemes, the identification task turned out to be easier than the segmentation. Some of the 114 children whom we tried to test could not be made to understand the tasks. They employed a consistent strategy and responded "yes" (or "no") to all the questions in the identification task, irrespective of the presence or absence of the target sound in the test words, or they made patterns out of the markers instead of using them to indicate the number of phonemes in the test words in the segmentation task. These children were excluded from the analysis as we are mainly interested in factors that influence children who are in the process of developing phoneme awareness. Children who did not complete the tasks were also excluded from the analysis. In the following, we will present results on the identification task from 92 children, 57 language disordered ones and 35 normally speaking ones, who completed the task. The segmentation task was completed by 81 children, 50 language disordered ones and 31 normally speaking children. Thus, more children understood the task and suggested a solution for each of the test items in the identification task than in the segmentation task. This was the case, even though the identification task contained more test items (24) than the segmentation task (18).

Identification

Both segment type and position of the segment in the word influenced the children's ability to identify phonemes. As regards segment type, vowels were easier to identify than consonants (see table 2). There was no difference as to how well the children identified the two vowels, /i/ and /u/, but there was a difference between the consonants so that the fricative /s/ was more often correctly identified than the plosive /t/ and almost as often as the vowels.

Table 2. 92 subjects' correct identifications of phonemes.
( ) number of possible identifications.

Type of phoneme				Position		
C (1104)		V (1104)		Initial (368)	Medial (368)	Final (368)
	834		916	306	263	262
/s/	447	/i/	463			
/t/	387	/u/	453			

If position is considered irrespective of segment type, we find that more phonemes were correctly identified in initial than in either medial or final position. If segment type is taken into consideration as well as position (see table 4), this is so for /i/, /u/, and /s/. For /u/ and /s/ we also find more correct identifications in medial than in final position. An exception to this pattern is /t/ which was equally well identified in both initial and final position. /t/ was the most difficult phoneme to identify, causing most problems in medial position.

Table 3. Correct identification of four phonemes in initial, medial and final position.

	Initial	Medial	Final
/i/	83	66	73
/u/	84	75	64
/s/	80	75	69
/t/	55	47	57

Segmentation

The length of the word seemed to influence children's ability to segment words into phonemes so that words with four phonemes were more difficult to segment than words with three phonemes (see table 4). However, such a difference was not found between words with two and three phonemes. The number of syllables does not seem to be important, since mono- and bisyllabic words with the same number of phonemes are segmented equally well (e.g. *katt, åka*).

In words with two phonemes, syllabic structure was important so that CV syllables were easier to segment than VC syllables (e.g. *se, gå*). Segment type, whether a fricative or a plosive, did not influence the children's ability to carry out the task, as in the identification task.

Table 4. 81 subjects' correct segmentations.

CV		VC					
se	62	ös	51				
gå	60	ek	55				
CVC		VCV		VCC		CCV	
katt	49	apa	56	ost	59	stå	43
sol	52	åka	50	arm	43	bra	38
		CVCV		CVCC		CCVC	
		bada	28	dans	22	glas	30
		titta	16	mask	24	spik	14

In words with three phonemes, the segmentation was influenced by whether or not there were consonant clusters, by the position of the cluster, and, to some extent, by the type of cluster. Words with clusters (e.g. *stå, bra*) were more difficult to segment than words with only singletons (e.g. *sol, apa*), and words with initial clusters (e.g. *stå*) were more difficult than words with final clusters (e.g. *ost*).

The ability to segment the cluster /st/ in final position as in *ost* did not ensure that the children were able to segment the same cluster in initial position as in e.g. *stå*. Nor did the ability to segment /st/ in *ost* and *stå* guarantee the segmentation of sC-clusters in words like *mask* and *spik* with one additional segment. These longer words make larger demands on short-term memory, and may for some children exceed their short-term memory capacity. When tested for short-term memory, it was found that some of the children had a memory span of only two or three items.

The type of cluster made the task more or less difficult. Clusters with /s/ were easier to segment than clusters with /r/ (*stå* and *ost* were easier than *bra* and *arm*), although we cannot argue that clusters with /s/ were easier than all clusters containing liquids, since e.g. *glas* was segmented correctly by more children than *spik*.

DISCUSSION

The first remark that should be made is that our study was undertaken with non-literate children who performed a phoneme identification and a phoneme segmentation task. This gives further support to the view that it is not necessary to be able to read in order to develop an awareness of phonemes. Even if the children had not had reading instruction, we cannot argue that they had no knowledge at all about the alphabetic writing system, as it is not possible to live in an urban Western society without being surrounded by written messages. Consequently, most of our subjects showed an interest in letters, recognized a few letters or words, and could "draw" their names more or less accurately from memory.

Another conclusion that can be drawn is that both type of segment (or phonetic substance) and syllabic structure seem to be important for the achievements of children who are in the process of developing an awareness of phonemes. The importance of each factor is partly dependent on the type of task the children are given.

For the children's results on the identification task, segment type is important. This is consistent with the way the task was presented; the children were given a sound as a model and their task could be described as finding a perceptual match to the target sound in a number of words. In order to do this, the children have to be able to disregard the meaning of the words and to concentrate on their sound structure. Furthermore, they have to perceive words not just as entities but have to have gained at least some insight into the possibility of segmenting words into smaller units, even if the demands on their knowledge about the segmental structure are not as heavy as in the segmentation task.

Position in the word also influences the children's identifications so that segments in initial position are the easiest to identify, except for /t/. These results fit in well with the assumption that the identification task is largely performed at a perceptual level. /t/ is the phoneme of the four tested ones for which the phonetic realization differs most in different positions of the word. The model given was the aspirated variant used in initial and final position, while the variant

in medial position is an unaspirated stop. The children had most difficulties in identifying /t/ in medial position, i.e. in identifying the phonetic variant that differs most markedly from the variant given as a model. Perceptual and phonetic factors such as perceptual saliency and the higher degree of acoustic energy in vowels than in consonants may be used to explain why initial sounds are most often correctly identified and the fact that vowels are easier to identify than consonants.

In order to carry out the segmentation task, the children cannot rely on perceptual strategies but have to make abstractions as there are no cues in the continuous acoustic signal as to the discontinuous nature of the segmental structure. Higher demands are made on both memory and linguistic awareness than in the identification task as the whole word and all the parts it has been segmented into have to be stored in the working memory while the operations are performed. In order to make identifications, the children only have to look for and recognize the target sound.

In the segmentation task, segment type does not seem to be as important as in the identification task, while word length and syllabic structure play a more important role. Provided that the number of phonemes in the word does not exceed the short-term memory limit (which we have reason to assume in a number of cases) syllabic structure is important, whether it is a CV or VC syllable, whether or not there are clusters, and whether the clusters are word initial or word final.

Some of our results support the hypothesis put forward by Fudge 1969 about the hierarchial structure of the syllable. According to Fudge, a syllable is divisible into onset and rhyme, and the rhyme is further divisible into peak and coda. Empirical data as e.g. in Treiman 1983 show that it is much easier to segment between the onset and the rhyme of the syllable than between the peak and the coda of the rhyme. The same result is found in our data, since CV is easier to segment than VC, but when there is a consonant cluster instead of a single consonant, CCV is not more easily segmented than VCC. At present we cannot suggest any explanation.

That words with clusters are more difficult to segment than words with only singletons is not surprising, as data about children's phonological acquisition suggest that clusters are often treated as one unit. The type of cluster seems to be important and when children begin to be able to segment within consonantal clusters, their progression mirrors the order of acquisition reported in studies of child phonology.

The conclusion we can draw from this study is that children who cannot read are influenced by both phonetic and syllabic factors in their attempts to develop

an awareness of phonemes. In order to further explore the relevance of these phonetic and syllabic factors for phonemic awareness a more systematic investigation with a sufficient number of test words is called for.

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