# SOME THOUGHTS ON READING AND WRITING

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Linguistic proficiency and linguistic activity are taken for granted by most of us. Certainly, every parent regards the first attempts of his child to talk as most remarkable and unique but all the same as completely natural. All children are expected to start talking and, as is well known, nothing can prevent a normal child from picking up the trick how to speak and understand the language of his linguistic community. To acquire other linguistic skills such as reading and writing, however, the child has to be sent to school to get instruction. In the hands of a trained teacher the child is expected to learn to read and write, albeit not as easily as he learned to talk.

Speaking and understanding are primary linguistic activities and they are basic to reading and writing proficiency. By the age of 4, the vocabulary of the child is large, his language is fluent and his memory span for heard words is quite adequate for comprehending simple sentences (Conrad 1972). Yet he is generally not sent to school until the age of 6 or 7. What more are we waiting for to happen? According to Mattingly (1972) the primary linguistic ability alone is not sufficient, since reading is highly related to the speaker-hearer's awareness of this linguistic ability. It is not enough to be able to listen and talk, one must be aware of this activity too. The pleasure some children show in playing with words as in punning and rhyming are obvious signs of this awareness, as is also the invention of "secret" languages. Maybe this awareness is reinforced by the reading skill so that it might be more appropriate to talk about a mutual influence.

Conrad (pp. 217 ff.) argues that what the child of 4 has not yet developed is a phonological short-term memory. Such a memory is necessary to enable him to remember the segment just processed while working on the next one. Without this memory no word would emerge from the letter-to-sound processing. Conrad draws this conclusion from an experiment with adults who showed a preferred use of what he calls the phonological short-term memory (STM) code when recalling visually presented verbal items with either similar or dissimilar sounds. Although the items in one of the two lists were visually quite different, this

information was apparently ignored.

A similar paradigm was then used for young children with mental ages ranging from 3 to 11 years. Two sets of coloured pictures were used. The names of the pictures were all familiar to the subjects. One set consisted of "cat", "rat", "bat", "hat", "mat", "man", "tap", "bag" and the other of "fish", "girl", "bus", "spoon", "horse", "train", "clock" and "hand". The children had to match from memory a certain number of cards (which were turned face down after having been shown and named by the experimenter) with the cards from one of the two vocabulary sets. Up to the age of 5 there was no difference in the ability to recall either of the two sets. Beyond 5 years there was an increasing advantage for the non-rhyming set. Conrad concludes that before this crucial age it is irrelevant to STM performance whether or not the pictures have rhyming names but from the age of 5 or 6 years the subjects perform as if they were using phonological information as STM code.

Even though the child has some awareness of his linguistic activity and even if he has developed a phonological STM code, we cannot be sure that he will have no problems in mastering the language in its written form. Lots of apparently normal children fail to learn to read or learn only very slowly. One possible reason is the visual similarity of the letters. All the vowels except "i" are small and round, and yet they should be associated with very different sound qualities. Such a relation must be found illogical. During his short life the child has learnt that a picture of a cat or a dog is a cat or a dog no matter if the picture is turned on its head or to the right or the left. It must be confusing to discover that one letter turns into a new one if turned in different directions, as is the case with "b", "d", "p", and "q".

To a beginner the letters mean only form, not sound. This fact was illustrated very clearly once in a test given to the beginners in the schools of Great Britain. The instructions were to continue to place the letters of the alphabet on two rows in the following sequence:

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A     E F  H
  B C D    G
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This test became known because only beginners were able to solve the task in the intended way. Letters mean form only as long as they do not have an acoustic content. Once the letters have been given this property

it is no longer possible to perceive them as pure graphic forms. Deaf mutes tend to confuse tachistoscopically presented letters that are similar in form, while people with good hearing and deaf with articulated speech confuse letters that represent similar sounds (Conrad pp. 227 ff.).

Lindell (1964) has shown that spelling problems do not mean deficient visual perception. Pupils with spelling problems have no difficulty in detecting differences between ordinary pictures but gain a lower score than pupils without spelling difficulties when tested for differences between word pictures.

Rozin et al. (1971) report very good results from an experiment with nine American children with severely retarded reading ability who were taught to read English by using Chinese characters. Two conclusions can be drawn from this experiment. Either the Chinese characters are too different in form to be confused or "phonetic mapping" is avoided when reading logograms.

In his neuropsychological investigation of reading disabilities, Doehring (1968) has shown that reading disability was most highly correlated with visual and verbal tasks that required sequential processing of the related material.

Isabelle Liberman (1973) is seeking the causes of reading errors in an unawareness of the phonemes of the spoken words. In her opinion, a child of 5-6 years cannot segment a word into phonemes, but has no problems when asked to count the syllables of the word. This argument is consistent with data from Japan. According to Makita (1968), fewer than 1 % of the Japanese pupils have reading difficulties. In the West the corresponding percentage is between 10 and 20. As the difference cannot be physiological it must be related to the different writing systems. The Japanese have two different types of characters, viz. "kanjis" (ideograms) and "kanas" (phonograms). The kanas represent 46 sound units, mostly the consonant-vowel type syllable. The kanji characters number about 1,800 and have inherent meaning as well as phonological form. In school, the children are first taught to recognize and reproduce the kanas, and then to represent the lexical items by the kanjis. It is a common observation that when a person forgets how to write the kanji for infrequent words (there are such a large number of characters to be mastered), he often

represents such words with the kana equivalents (Sasanuma & Fujimura 1971).

Many skilled readers claim they go directly from the graphic picture of the word to its semantic representation without using any kind of "inner speech" or "latent articulation". There have been numerous discussions about such neuromotor activity during silent reading. Edfeldt (1960) in an investigation regarding EMG activity in laryngeal muscles during silent reading found less activity in good readers than in poor. He also found that an easy text resulted in less silent speech activity than did a difficult one. Smith (1973) asks how the maning of a sentence that is not available during unvocalized silent reading will suddenly appear when words are subvocalized. Conrad maintains the opinion "that articulation almost always occurs, that it is probably task-relevant, but that sound evidence that it is necessary is lacking" (p. 211). In some recent articles Klapp et al. (1973) and Pynte (1974) discuss a mechanism of readiness for pronunciation during the reading process.

In order to find out whether there was any kind of phonetic activity when reading non-alphabetical written words, Erickson et al. (1973) conducted an experiment on the visual, phonetic and semantic confusability of the Japanese kanji characters. The subjects, all native Japanese, reported not being aware of using any kind of silent speech or acoustic memory, which of course must be considered as redundant in connexion with non-alphabetical text. The subjects were shown a series of characters and then asked to name a subsequent character. Confusion turned out to be much greater when the words represented by the series of characters were phonetically similar. In spite of the nature of the kanji characters, the subjects used a "phonetic" code. In the discussion of their results, Erickson et al. bring up the investigations carried out among Japanese aphasic patients by Sasanuma & Fujimura (1971 and 1972). A group of aphasics with apraxia of speech made a significantly greater number of errors in kana processings than in kanji processings, especially in writing tasks. The aphasics without apraxia exhibited no such clear difference. It was assumed by Sasanuma & Fujimura that the kana transcriptions can by-pass the phonological processor and have direct access to the lexical items. The conclusion that the kana and the kanji transcriptions were to be processed in different modes is in-

consistent with the way the normal Japanese acted in the experiment reported by Erickson et al. If the phonological processor was damaged then there should be a notable difference in perception too, they argue. Such a difference was not reported. They prefer to regard the behaviour of the aphasic patients as an indication of different levels of linguistic awareness.

Everything reported so far seems to ignore visual perception in reading and yet the graphic picture of the words is what is most important to the skilled reader. He does not code words into sounds before grasping their meaning. If that was his strategy, he would not hesitate when confronted with a sentence like: "The bouy and the none tolled hymn they had scene and herd a pear of bear feet in the haul" so long as the words are familiar to him (LaBerge 1972). Smith (pp. 73 ff.) emphasizes that meaning can be extracted from sequences of written words independently of their sounds, and that meaning must be comprehended if sounds are to be appropriately produced.

An active reading process like the analysis-by-synthesis procedure in speech perception is proposed by many investigators. Bower (1970) has shown that a fast reader picks up the structure of the sentence before recognizing the individual constituents of the sentences. This means that the appearance of a word is more important than its sound for reading (pp. 143 ff.). Kolers (1972) comes to a similar conclusion in a very interesting reading experiment where he rotated the lines of the text in various ways. Such texts preserve all the normal features but in a somewhat unfamiliar pattern. The subjects developed considerable skill at reading the rotated lines. It was discovered that in misreading a word the subjects usually substituted for it a word of approximately the same length. This seems to be the same phenomenon as Liberman (1972) refers to as "shortcuts" in the linguistic processing, indicating that familiar material does not receive complete linguistic processing. An active reading strategy must imply exactly this sort of guessing-game.

It is generally agreed that only a small part of a text is focused by the eye, which moves "in saccades" and makes only 3 or 4 fixations per second. Slow and fast readers make the same number of fixations. Malmquist (quoted by Platzack 1974, p. 26) reports that a skilled reader can take in 2.5 words per fixation at most, a slow reader not more than 0.5 words per fixation.

It can thus be assumed that becoming a skilled reader implies a lot more than just processing rapidly the letters put together into words and sentences. The reader's awareness of the phonotactical and grammatical structure of his language is a pre-requisite as is his knowledge of the phonology and the morphology of the words. This knowledge increases the redundancy of the visual information and a larger part of the text can be processed at the same time (Platzack, op.cit.). Spelling errors might reveal something about the development of this knowledge and about the reading process itself. I have therefore collected all the misspellings from about 200 compositions written by about 100 Swedish pupils during their fourth and sixth year in school. Since it is known from e.g. Lindell (op.cit.) that the difference between a good and a poor speller is the number, not the kind of misspellings, the errors collected from a 'normal' class can be regarded as representative.

The spelling errors were grouped conventionally into insertions, omissions, substitutions and transpositions. Only errors not due to ignorance of spelling rules are discussed here. As in the investigations by Lindell, the omissions and the substitutions turned out to be by far the most frequent errors. Lots of substitutions are purely graphic, defined as errors that would be discovered by the author if he was to read the text aloud himself. The "genuine" substitutions would probably not be detected by the writer since they are equivalent to his acoustic or articulatory idea of the word. About 3/4 of the omissions are consonants and almost 2/3 of the omitted consonants belong to clusters. A great deal of the substitutions and the omitted consonants can be explained by reference to the coarticulation and assimilation tendencies of the spoken language. Gårding (1974) has given rules for assimilation and reduction in spoken Swedish. One type of reduction rule concerns the assimilation of consonants. This is a very common phenomenon in the written compositions too. There seems to be an even stronger tendency in the misspellings than in spoken language for two adjacent consonants to share the same contact surface, since several omissions in the written material of consonants in clusters with the same or almost the same place of articulation are never omitted in speech. Gårding also mentions the fact that initial clusters are never reduced, only final ones. This seems to be true for the written

material in general. Many omissions are found in final position, very few initially. Almost 100 % of the single consonants are omitted in final position. This goes even for words where such an omission is impossible in the spoken language. As is well known and as was mentioned also by Gårding, the information value is low at the end of a word. It would be an interesting task to compare the causes of the spelling errors with the origin of the reduction rules of the spoken language.

There was a certain tendency among the substitution errors for a target phoneme to be replaced by a phoneme with the same distinctive features except one. This observation has been reported in the literature many times. Wickelgren (1966) concluded that a consonant is coded in the short-term memory not as a unit but as a set of distinctive features. Sasanuma & Fujimura (1972) and Trost & Canter (1974) found that the substitution errors made by aphasic patients were approximations for the target phonemes. It has also been suggested that certain graphic errors found in compositions written by students at the age of 19 or 20 show a similar pattern (Hultman, personal communication).

If the tendency to confuse phonemes with the same or almost the same place of articulation and to omit consonants in clusters under similar conditions can be proved to occur more generally in misspellings, then we might assume that we use an articulatory memory during writing tasks. Maybe this hypothesis can also explain why the aphasics with apraxia had greater difficulty in writing the kanas than the kanjis. It might be that they could not evoke their articulatory memory just as they cannot evoke the memory of other movements. The articulatory memory would only be necessary for the sequential processing of the quasi-phonological kana symbols, but not for the ideograms. If this is true there must be another explanation for the phonological activity shown when the 'normal' Japanese confused the rhyming kanjis. This was a memory task and it is plausible, as is emphazised by LaBerge, that the phonological code is the strategy we use when the task is to store and retrieve directly from the short-term memory. This strategy cannot simply be generalized to comprehension tasks (p. 243).

## Summary

The child who has not yet learnt to read and write has an undivided

acoustic-articulatory image of a word. To be able to read and write, he must link this acoustic-articulatory unit with a sequence of letters.[1] This can only be achieved if the acoustic-articulatory image is first divided into sound segments corresponding to the letters, a task which involves segmentation of a continuous acoustic signal and overlapping articulatory gestures and relating the segments to neatly defined letters. Little by little the sound segments and the sequence of letters are integrated and perceived as a unit. There is no longer one acoustic and one visual picture of the word but a picture that is simultaneously and indivisibly acoustic-articulatory and visual. When this integration has been accomplished, the reading process can develop in an analysis-by-synthesis manner like the auditory perception. The strategy used by a skilled reader is neither a letter-by-letter nor a word-by-word processing. If the child has difficultes in managing the sequential processing when starting to read there will be no integrated word picture and the child will fail to learn to read, or learn only very slowly.

Learning to read and write logograms does not require awareness of the segments of the acoustic word image since the visual word picture is not a sequence of symbols. No sequential processing is thus necessary for reading logograms.

The completely integrated word picture cannot be dissolved. Alexia and agraphia are fictitious exceptions, since it is the performance and not the competence that is damaged (Weigl & Bierwisch 1970). With an integrated word picture it is no longer possible to perceive the letters as pure forms. Consequently, it is not possible to use only visual processing in silent reading or writing. If this was the case, then a poor reader would not have more problems in separating word pictures than other pictures. Some sort of silent speech is no doubt involved in silent reading and writing as well as in other mental activities. The task is to find out what kind, how and when.

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1. This is the way reading is frequently taught. Only recently have attempts been made to teach reading by presenting the whole written word as a unit (e.g. Söderbergh, 1972).

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