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Role Played by Cued Speech in the Identification of Written Words Encountered for the First Time by Deaf Children: A Preliminary Report[1]

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Studies concerning word identification procedures and their role in reading acquisition in hearing children have demonstrated the importance of the alphabetic principle. The generative aspect of the alphabet provides a phonological recoding procedure which allows the identification of words encountered for the first time - autonomous reading (Gleitman, 1985; Alegria, Leybaert & Lechat, 1987; Alegria, Lechat & Leybaert, 1988).

Autonomous reading plays a dynamic role in the process of reading acquisition by means of a "self-teaching mechanism" (Jorm & Share, 1983). Each successful encounter with an unfamiliar word acts as a positive learning trial. The repetition of these trials creates an internal orthographic representation of the new item which allows direct identification of the word in subsequent encounters (Reitsma, 1983).

In deaf children, these processes are hindered by the lack of precise phonological representations of the words they know. This severely reduces the generative power of the alphabet, with consequences that can easily be derived from the model just outlined.

In the deaf, the phonological representations of the words which determine ordinary speech perception are, to an important degree, based on lipreading. Unfortunately, lipreading is intrinsically poor because the same pattern of lip configurations can represent numerous words. For example French words such as *papa, maman, bébé, bombe, marbre, propre, palme, pipe, plombier*, etc., are almost identical in lipreading, hence the internal representations of these words based on a code derived from their visual images are necessarily ambiguous (the same code represents several phonemes) and plenty of gaps (some of the phonemes are not represented). In this situation there is no reason for the deaf subjects to use phonological recoding procedures for identifying unfamiliar words.

Cued Speech, devised by Cornett (1967) and adapted into French as "Langage Parle Completé" (LPC) uses a system of visual cues produced with a hand held near the mouth while speaking. These cues, when combined with the information seen on the lips (strictly, on the mouth, since teeth and tongue are important when visible) while speaking, are aimed at producing an unambiguous phonological message:

- when different consonantal phones produce the same mouth signal, the corresponding handshapes are different: for example, /m/, /p/, and /b/ are cued with the full hand, one finger, and four fingers, respectively.
- conversely, a single handshape represents (generally) a group of three consonantal phones which are clearly different in terms of lip configuration. Thus, one finger indicates a choice of /p/, /d/, or /ʒ/The choice is made from the information seen on the mouth.

The vowels are cued similarly and simultaneously, but using hand locations instead of handshapes. When different vocalic phones produce similar lip patterns, the corresponding hand locations are different--for example /i/, /ɛ/, and /e/, which are very similar on the mouth, are cued with the most-extended finger tip at the corner of the mouth, on the tip of the chin, and at the larynx, respectively.

In the same way, a single hand location is used for a group of (generally) three vocalic phones that are clearly different in appearance on the mouth--for example, the tip of the finger which is extended most is placed on the tip of the chin for /ɔ/, /ɛ/, and /u/, each being identified within the group by its pattern on the lips.

The whole system uses eight different handshapes and (for French) five different hand locations. It has an almost syllabic structure, i.e. each combination of lips, handshape and hand location represents (usually) a CV structure. The system is relatively easy to learn, and skilled users can produce the cues in real time without any appreciable slowing down of their speech.

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It has been experimentally demonstrated that the inclusion of the cues systematically improves the perception of the speech message, both in English (Nicholls and Ling, 1982) and in French (Périer, et al, 1987). It can then be expected that Cued Speech might contribute to the elaboration of word representations in the deaf which have a structure similar to the phonological structure of those representations in hearing subjects. The main question addressed in this study is whether the representations elaborated through Cued Speech can help the deaf child to identify written words they see for the first time.

Method

Subjects

The subjects in the study were 18 children aged from 8 to 13 years, most of whom were profoundly deaf (four severe). All were at the Ecole Intégrée, in Brussels, which has adopted Cued Speech as a teaching method. The children had had at least two years of practice with Cued Speech. Their teachers were asked to judge their ability on a four-point scale, and 12 of the 18 were considered at the highest level. Only one child was judged to be at the lowest level.

Procedure

The experimental procedure included the introduction of a series of new words (experimental words) in the course of a collective small lesson using a video film especially prepared as a support. Each word was also represented by a drawing. The words were presented in Cued Speech. The experimental words were divided into three groups (related to horseback riding, underwater diving and fruits, respectively) and each subject was exposed to only one of the groups. For each experimental word a control word similar in its orthographic characteristics was included for comparison. The control words were supposed to be well known to the subjects [for example, for the experimental items *selle* (saddle), *tuba* (snorkel), and *figue* (fig), we took *balle* (ball) , *bâton* (stick), and *fille* (girl), respectively, as controls]. During the lesson the orthographic versions of the different items were never used.

To test the knowledge each subject acquired during the lesson, he was presented each drawing accompanied by four written items. His task was to choose the one which represented the drawing. One of the items was the correct response and the three others were the distractors--a word similar from a lipreading point of view, a pseudo-word also similar in lipreading, and an unrelated word. The related items--a word and a pseudo-word--were chosen in order to ascertain that the subject had stored the new word exploiting the information given by the Cued Speech presentation.

The whole experiment consisted of a pretest, a first posttest administered during the 24 hours following the "lesson," and a second posttest administered between 15 and 18 days after the first one.

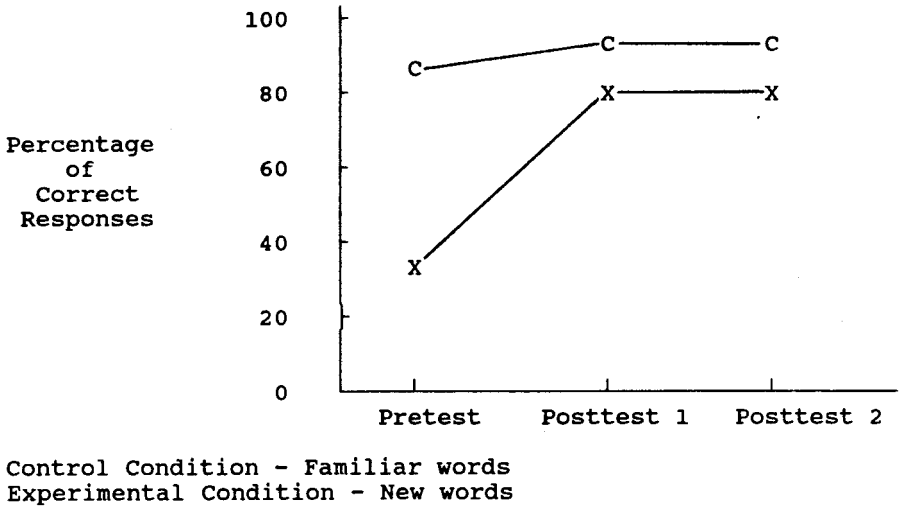

Figure 1 Percentage of Correct Responses per Condition at Each Testing Session

Results

The mean percentage of correct responses for each group of children, for the three testing sessions, appears in Figure 1. The main points to be noted are:

1. An important increase in correct responses from the pretest to posttest I occurred for the experimental words, but not for the control words. The increase was similar for all of the groups.
2. A difference between groups appears, with groups I and II performing at a higher level than group III. It must be said that the subjects of groups I and II were older than those of group III (the corresponding mean ages were 10;9, 10;9 and 7;3). While the conclusion that the difference was an effect of age is not guaranteed because age and materials were confounded (strictly speaking, we cannot be sure that the words used with group III were not harder than those used with the other two groups), it seems reasonable to suppose that it was.
3. Comparison of the results of the pretest with those of posttest II shows a significant increase in performance in all three groups.
4. There was no decrease of performance level between posttest I and posttest II.

Discussion

This experiment was aimed at establishing whether the internal representations of the words derived from Cued Speech have properties that allow for the identification of those words from their orthographic representations encountered for the first time. The answer to this question is clearly positive.

The strongest evidence lies in the very high level of correct responses obtained in the identification of critical items in the posttests. This indicates that during the presentation of the test items in the lesson, the children elaborated representations of them which drastically reduced the number of possible spellings.

It is important to point out that two of the distractors were potentially correct responses under the assumption that the representations elaborated by the subjects were based exclusively on lipreading. The fact that they rejected these responses demonstrates the role played by Cued Speech in the task.

All the groups performed better in the second posttest than in the pretest. This indicates that the representations elaborated in the training phase were not short-termed, but lasted long enough to be potentially useful for reading acquisition.

It is surprising that the performance reached by the subjects about three weeks after the presentation of the material was equivalent to the performance in the posttest which immediately followed the training. This was impossible to predict on the grounds of any standard model of memory trace. It is possible that this result reveals an effect of the first posttest on the fixation of the representation of the words. It is at this moment, indeed, that the subject for the first time can integrate the representation of the word coming from the "oral" (Cued Speech) representation with the orthographic version of the same word. This encounter could be responsible for an increase in the strength of the word representation. More work is needed to clarify this important point.

To come back to our initial point, the present work strongly suggests that the lexicon developed by the deaf with Cued Speech has properties which are equivalent to the phonology of the hearing subjects. In both cases the internal representations of the words are compatible with their orthographic representations. This allows the use of phonologic coding to identify unfamiliar written words and, as said before, can prime the whole process of reading acquisition.

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