

Annotated Bibliography of Research on Cued Speech

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The summaries included in this bibliography were prepared from research articles in refereed journals, conference proceedings and project reports, reports of sponsored research, master's degree theses, and doctoral dissertations. Also included are a few theoretical papers judged to be particularly valuable in interpreting experimental results.

Alegría, J., Dejean, C., Capouillez, J. M., & Leybaert, J. (1989, May). **Role played by the Cued Speech in the identification of written words encountered for the first time by deaf children.** Presented at the annual meeting of the Belgian Psychological Society, Louvain-la-Neuve. (Reprinted in **The Cued Speech Journal**, 4, 1990).

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 these words from their orthographic representation when encountered for the first time. In their introduction, the authors stress the importance of the "alphabetic principle," by which the alphabet provides a phonological recoding which allows the identification of words encountered for the first time, if they are in the lexicon of spoken words already known to the reader. They stress that deaf subjects in general do not have access to this technique, since their phonological representations are, for an important part, based on lipreading, and are ambiguous. Cued Speech is aimed at reproducing an unambiguous phonological message, leading to an unambiguous internal phonological system. For the study, 18 children from L'Ecole Intégrée, aged 6 to 12 years, were selected. Fourteen were profoundly deaf, and four had a severe hearing loss. The subjects each had at least two years practice with the use of Cued Speech. They were taught "experimental words", new to them, with Cued Speech and pairing with video pictures. For each a control word, similar in orthographic characteristics, and familiar to the subjects, was also used, for comparison of results. Each test presented a picture, to associate with one of four written words, the correct word and three distractors: a word similar in appearance on the lips, a pseudo-word also visually similar on the mouth, and an unrelated word. Included were a pretest, a first posttest within 24 hours, and a posttest 18 to 25 days later. RESULTS: (1) For all three groups of subjects, there was an important increase in the percentage of correct responses (more than a doubling) from the pretest to the posttests, for the experimental words. There was no significant increase for the control words. (2) Two of the groups performed at a higher level than the third, apparently as an effect of age of the subjects. (3) In all the groups there was also a significant increase between the pretest and post-test 2. (4) There was not a decrease of performance from posttest 1 to posttest 2. The author, concluded, "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 hearing subjects. In both cases the internal representations of the words are compatible with their orthographic representation. This allows the use of phonological coding to identify unfamiliar words and, as said before, can prime the whole process of reading acquisition."

Alegría, J., Lechat, J., & Leybaert, J. (1988). Rôle du LPC dans L'Identification de Mots chez L'Enfant Sourd: Théorie et données préliminaires [Role of Cued Speech in the identification of words in the deaf child: Theory and preliminary data]. **Glossa**, 9, 36-44. (Reprinted in **The Cued Speech Journal**, 4, 1990).

This experiment attempts to evaluate the extent to which children in a school in which Cued Speech is used have a tendency, when exposed to orthographic material, to translate that material into Cued Speech. The rationale for expecting such a tendency is that the children use Cued Speech habitually in the receptive domain for understanding oral language. Through the phonologic structure perhaps internalized in the use of Cued Speech, the children might be able to relate to new orthographic material. The experiment utilizes a process called "priming", in which the subject is exposed to a pair of items, in sequence, and is expected to decide, as rapidly as possible, whether the second item is a word or a pseudo-word. The first item, which does not require a response, may have a semantic relation to the second item. If it does, the classification of the second item will tend to be made more rapidly. For example, the item *butter* will be identified as a word more rapidly if it is preceded by *bread* than if it is preceded by *bath*. The hearing-impaired subjects numbered 16, of which 14 were profoundly deaf from birth, and two severely deaf from birth. A control group of 16 hearing subjects was also selected. The experiment utilized two series of trials, one in which the second item was

always a word, and one in which the second item was a pseudo-word. Three conditions were present for each series, for the word series: Semantic, Cued Speech, and Control; and for the Pseudo-word series: Orthographic, Cued Speech, and Control. The condition refers to the relationship, if any, between the first item and the second. Results: For both the deaf group and the hearing group, in the Word series, the time of reaction was much smaller in the Semantic condition, that is, when the priming word had a semantic relation to the item to be identified as a word or a non-word. The time of reaction obtained in the Cued Speech condition, when the priming word was chosen to have the same cueing as the target word was less than for the Control condition, for both deaf and hearing subjects. The results of the experiment suggest that deaf children accommodated academically in an environment where Cued Speech was used in class, utilized in the capacity of an intermediary in the activity of reading.

Beaupré, W. J. (1976). Cued Speech as a training strategy in phonetics courses (Abstract). *Folia Phoniatica*, 28, 203.

Beaupré, W. J. (1977). Cued Speech as a training strategy in phonetics courses. *International Association of Logopedics and Phoniatics Congress Proceedings*, 2, 35-41. (Abstract by Beaupré)

The paper presented before the 17th International Congress of Logopedics and Phoniatics, August 15-18, 1977, in Copenhagen, Denmark, reported on the results of the Tate study (see below) with interpretations of research findings in the light of further experience using Cued Speech as a strategy to teach phonemic transcription. Approximately 100 additional students in three classes since 1975 had been exposed to Cued Speech as a transcription learning aid. These students could also elect to demonstrate proficiency in Cued Speech expressive skills for extra credit. About a third of the students elected this option.

The effects of the Cued Speech regimen were subtle but substantial. Through videotapes of Cued Speech in action, students were introduced to clinical applications with hearing-impaired children which had heretofore not been a part of the study of phonetics. Phonetics was seen as having a practical application. Less class time was necessary to review the common student difficulties (i.e., perceiving certain phoneme variations). Therefore, more class time was available to introduce elements of acoustic phonetics and analyses of defective articulation. Final transcription projects utilizing narrow transcription were in many instances far more sophisticated.

The author concludes his observations with the following statement: "The future competency of our practicing clinicians in Speech Pathology and Audiology with hearing-impaired clients will be determined in part by the variety of strategies they have at their disposal. It is comforting for this educator to know that at least one of these clinical strategies--Cued Speech--is directly compatible with the learning of phonetics."

Addendum: Thirteen years later URI students in phonetics classes are still learning phonemics via Cued Speech, only now expressive skills with Cued Speech are a course requirement at least to the "Borderline" level of proficiency on the Beaupré test of cueing proficiency. Many students demonstrate skills to the "Mini-proficient" level.

Beaupré, W. J. (1984). **Gaining Cued Speech Proficiency: A Manual for Parents, Teachers, and Clinicians.** (Available from the Cued Speech Team, Audiology Department, Gallaudet University, Washington, D.C.)

Based upon data from the preliminary testing of Cued Speech practitioners, the author has identified proficiency goals and error factors which influence cueing skills. The resulting error factors become the basis for specific practice sessions to correct cueing deficiencies. In addition to the five chapters addressing proficiency goals, the manual offers strategies for overcoming the tendency to cue words as spelled rather than as spoken, some phonological rules about /s/-/z/ cueing, an essay on Cued Speech and amplification, some cue tips with nursery rhymes, and practice with the most common spoken English words. The "Cued Speech Guide to American Pronunciation of Common Words", included in the manual, provides many alternative pronunciations (and therefore, cues) which occur within and among regional dialects. The manual is probably most helpful to those who have already learned the basics of Cued Speech in workshops, from audio/video taped lessons, or through personal instruction from a qualified professional.

Beaupré, W. J. (1985). A test for Cued Speech proficiency. **Cued Speech Annual**, 1, 38-45.

The author describes the principles, methodology, and procedures he followed in developing and validating his "Test for Cued Speech Proficiency", which, as of early 1990, is used almost universally in the United States for evaluation of cueing proficiency.

Beaupré, W. J. (1987). The Cued Speechreading Test: An Analysis of the Results. **Cued Speech Annual**, 3, 32-40.

The Cued Speechreading Test (CSRT) was standardized on a population of 86 cueing volunteers at a Cued Speech Family Workshop in August, 1986, at Gallaudet University. Subjects ranged from novices to experienced cuers, small children to senior citizens, profoundly deaf to normal hearing. Cueing experience of the subjects averaged 36 months, varying from one day to eighteen years. Test sentences for evaluation of both lipreading skills and Cued Speechreading were administered without auditory input. The lipreading skills of the subjects were assessed by administering the "Post-Test" form of the Sargent Lipreading Test (developed by Beaupré in 1977) to the 19 men, the 67 women, and the 10 hearing-impaired subjects, whose mean scores were 44.9%, 44.0%, and 44.6%, respectively. The overall mean for the 86 subjects was 44.3%.

When the Cued Speechreading Test was administered, using the sentences of an equivalent form of the Sargent Lipreading Test, but with cues, the group mean scores were 62.5% for the 19 men, 69.7% for the 67 women, and 79.2% for the 10 hearing-impaired subjects. If one hearing-impaired subject who took the test the same day he began to learn Cued Speech had been omitted, the mean for nine hearing-impaired subjects would have been 84%. The mean for the 86 participating subjects was 68.42%. The range of performance on the SLT was so great that some subjects who scored only a few percent on the SLT demonstrated astronomical percentages of improvement with the CSRT, such as 2000%. As a result the average percent of improvement for the total population (n=86) was 108%, and for the hearing-impaired (n=10) the average improvement was 240%.

The author established a "Pass" score by specifying that a subject who either scores 75% or more on the CSRT, or scores 50% more than his SLT (Sargent Lipreading Test) score, is rated "Pass." Thus, a subject who scores 28% on the SLT and fails the first criterion by scoring only 44% on the CSRT can still qualify as a "Pass," since his improvement was 57%. Of the 27 subjects who did not score a "Pass," 17 had been cueing for less than three months, and 11 for less than five days.

The performance of subjects taking the test who were known to be skilled at reverse interpreting with Cued Speech were examined for scores reflecting formal, clinical proficiency. A minimum of 85% on the CSRT was specified as a reasonable minimum standard for reverse interpreting. A total of 22 subjects (26%) met this requirement.

The full article includes additional information on frequency distribution of scores on the SLT and the CSRT, on performance on the CSRT as a function of age and cueing experience, on correlations among factors, and a very useful analysis of substitution errors due to confusions between handshapes or hand locations.

Chapman, I. M. (1984). **The Effects of Cued Speech on the Auditory Discrimination of English Vowels by Hearing Chinese Speakers**. Unpublished master's thesis, University of Mississippi.

The purpose of this study was to measure the effects of Cued Speech on the ability of normal-hearing Chinese listeners to discriminate the spoken vowel and diphthong sounds of English. Subjects were four Chinese adults with normal hearing, and with 7 to 10 years of training in the English language. Pretraining behavior baselines were obtained in a one-week period. Then followed the Cued Speech training phase, conducted over 10 consecutive school days, one hour per day. After a break of one week, post-training behavior baselines were assessed in a one-week period. The instruments used to assess improvement of auditory skills were *The Vowel Test*, a subtest of the *Minimal Auditory Capabilities Battery* (Owens et al, 1981) and the *Aural Comprehension Examination*, a subtest of the *English Achievement Series* (Pillsbury et al, 1963). Results: All vowels and diphthongs were correctly discriminated when both visual and auditory modalities were employed. With audition only, after Cued Speech training the subjects demonstrated improved ability to discriminate all vowels except /ɛ/ and /I/ in the words *check* and *chick*, and between /u/ and /U/. Diphthongs were rarely in error after the training in Cued Speech. All of the subjects showed improvement in the *Aural Comprehension Test*. Autocorrelations for serial dependency were performed, and all proved to be non-significant at the .05 level of probability, indicating that the subjects improvement in auditory abilities was due to the training in Cued Speech.

Charlier, B. L. & Paulissen, D. (1986). *Audiometrie Vocale et Langage Parlé Complété (L.P.C.)* [Speech audiometry and Cued Speech]. *Otica, 10* (19).

This study addresses a question raised at the Cued Speech Workshop (Paris; April, 1984). The specific problem raised was concerning the utilization of residual hearing by children regularly supported by Cued Speech. Dabout and Descourtieux called attention to the possible danger that the extent to which the child has the benefit of a superior visual way of understanding may lead the child to fail to use his residual hearing spontaneously or to neglect that contribution to information.

The authors theorize that the grouping of the phonemes in Cued Speech tends to arrange them so that their acoustic and articulatory characteristics, within groups, are as far separated as possible. This, they postulate, may facilitate auditory discrimination among the members of a group, when the cue is present. They tested this hypothesis experimentally.

Nine prelingually and profoundly hearing-impaired subjects were used, five whose impairment was of the second degree of profoundness, and four of the third degree. They had experienced 52 months of exposure to Cued Speech. Mean age was 13 years 11 months for the first group and 13 years 5 months for the second. The material presented included five lists of phonemically balanced words, covering the 50 phonemes of French (21 vowels and 29 consonants). The five conditions of presentation were: audition alone, audition plus cues without lipreading, audition plus lipreading plus cues, audition plus lipreading without cues, and lipreading alone.

The authors were surprised at the high level of performance on lipreading alone, and raised a question as to whether lipreading is easier in French than in English which they identified as a question needing further investigation.

Authors' Conclusion: "The subjects of this research were effectively able to utilize the support of the cues to improve their auditory recognition. And far from diverting the auditory attention of the children, the presence of the cues of L.P.C. was able to support in them a better phonetic discrimination through audition."

Authors' Abstract: "Cued Speech (Langage Parlé Complété in French) is a helping tool for receiving speech, facilitating the lipreading process. By design, it offers the possibility of exercising the audition of hearing-impaired children. In fact, the hypothesis of a carelessness for the residual hearing, by deaf children using this method, is discussed and disproved through research with deaf children, using a vocal test of logatomes jointly presented with complementary manual cues."

Chilson, R. F. (1979). **Effects of Cued Speech on Lipreading Ability.** Unpublished master's thesis, University of Rhode Island.

The purpose of this study was to explore whether the learning of Cued Speech significantly improved the speechreading skills of normal-hearing college students enrolled in phonetics courses. Students who qualified as subjects in this study had normal hearing, normal or corrected-to-normal vision, and no previous instruction in either lipreading or sign language. Since the study was designed to comply with the objectives of the phonetics course instruction, the 16 students included in the experimental population were enrolled in the course during the Fall semester, 1978; and the sixteen subjects included in the control population were enrolled in the course during the Fall semester, 1979. Both populations were taught by the same professor, received the same amount of phonetic instruction in the same manner, and practiced transcribing the same sequences of highly structured lessons. The students in the experimental population were instructed to listen to each Cued Speech instructional tape four times, to transcribe the auditory stimuli two times, and to cue it to a mirror or partner two times. The students in the control population were instructed to listen to the identical auditory stimuli of the Cued Speech instructional tapes, minus the Cued Speech instructions, four times, and to transcribe it four times. The only variable was the simultaneous practice of cueing and saying by the experimental population during the transcription activities. The videotaped Sargent Lipreading Pretest was administered to all the students during their first class session. The results on this test established baseline scores of lip reading ability, and subjects were matched into the control and experimental populations. After all the phonemes were presented in the phonetics course, the videotaped Sargent Lipreading Posttest was administered. A *t*-test was used to determine whether the difference between the speechreading scores of the experimental and control populations was significant. Sandler's A was also used to verify if the difference was significant. The results of compared group means after instructional transcription practice indicated that the group mean score of the experimental population

was significantly higher than that of the control population, at the .01 level of significance. The results of Sandler's A also indicated a significant difference.

Chilson, R. (1985). Effects of Cued Speech instruction on speechreading skills. **Cued Speech Annual**, 1, 60-68. (For summary, see thesis abstract above).

Christopher, S. E. (1984). **Cued Speech: A Single Case Study**. Unpublished master's thesis, Texas Woman's University, Denton.

This study recounts and documents extensively one family's attempts to secure a free and appropriate education utilizing Cued Speech for their profoundly deaf daughter. It also evaluates the effect of Cued Speech as a factor in the academic progress of the child.

Clarke, B., & Ling, D. (1976). The effects of using Cued Speech: A follow-up study. **The Volta Review**, 78, 23-34.

Cued and non-cued phrases and sentences were presented in a live situation, at normal and slow rates, with and without hearing aids, to eight profoundly deaf 8-to-12-year-old subjects who had been tested the previous year. Written responses were analyzed in relation to the number of complete phrases, sentences and words correct, and the type of phoneme errors made. Scores were significantly superior when the material was presented with cues, but no differences were observed with rate of presentation. For sentences, the accuracy for the same group of eight subjects rose from 12.0% the year before to 62.8% with cues, and from 5.8% to 19.4% without cues. For words within sentences, accuracy rose from 59.0% to 85.6% percent with cues, and from 45.4% to 57.5% without cues.

Cornett, R. O. (1972). A study of the readability of Cued Speech. **Cued Speech Parent Training and Follow-up Program**, 45-52. Project report to U.S. Office of Education, Department of Health, Education and Welfare, Washington, D.C.

This study evaluated the accuracy with which videotaped, isolated consonant-vowel syllables, and single, short words were recognized by two subjects, without any auditory input. Subject A was a profoundly deaf 15-year-old girl, with several years of experience with Cued Speech. Subject B was an 8-year-old hearing sibling of another deaf child, a skillful user of Cued Speech. Subject A correctly transcribed 96% of the syllables, with 98% accuracy on the phonemes in the syllables, and 90% of the words, with 96% accuracy on the phonemes. Without cues, she scored 42% on syllables and 53% on words. Subject B scored 88% on cued syllables and 96% on cued words. Without cues, she scored 27% on syllables and 13% on words. Listeners with normal hearing score between 80% and 96% on a similar test, with high-fidelity sound input on CV syllables.

Cornett, R. O. (1987). Progress Report on the Autocuer: Vibrotactile, Electrocutaneous and Visual Automatic Support of Lipreading. In I. G. Taylor (Ed.), **The Education of the Deaf-Current Perspectives, Vol. 1, 1985 International Congress on the Education of the Deaf**. Beckenham, Kent, UK: Croon Helm Ltd.

Describes the work of the author, in collaboration with Robert Beadles, on delivery of vibrotactile, electrocutaneous, and visual cues patterned after the manual cues of Cued Speech, for support of lipreading, and the progress toward a wearable device. Despite highly accurate results obtained with keyboard delivery of vibrotactile cues, this avenue was rejected because of power and size requirements. Electrocutaneous delivery was also rejected because of difficulties experienced by subjects in perception. Keyboard delivery of visual cues to nine Gallaudet University students in 1974, after 13.5 hours of training on CV syllables, resulted in mean scores of 88% accuracy with cues, and 33% without cues. After 35 hours of training on 1000 common English words, mean scores on words from a 200-word closed set were 92% with cues, 29% without. The remainder of the paper describes the word-accuracies obtained with computer-delivered, error-free visual cues (85%), and with cues produced from voice input with the speech-analysis program, using zero crossings (62%) and other attributes, such as elements of linear prediction and possible error reduction. These yielded subject performances as high as 82%. Only theoretically attainable figures are represented, however, since the actual cue outputs were artificially modified. Also included in the paper is a description of the speech-analysis program, the optical system for cue delivery, and the wearable unit, as of 1985. Substantial modifications have been made since that time.

Hage, C., Alegría, J., & Périer, O. (1989, July). **Cued Speech and Language Acquisition**. Paper presented at the Second International Symposium on Cognition, Education and Deafness Washington, D.C. (Reprinted in **The Cued Speech Journal**, 4, 1990).

This paper describes and presents the results of two studies. The first, which used 55 subjects, compares the improvement in reception of spoken language when presented in Cued Speech, for

children who have received Cued Speech both at home and at school, with that of children who have received Cued Speech only at school and that of children who have received Cued Speech only at home. Performance was highest for children who received Cued Speech both at home and at school, somewhat lower for children who received only at home, and very much lower for children who received Cued Speech only at school. This study also reported correlations between speechreading and degree of hearing loss (negative), between degree of hearing loss and improvement through CS (positive), between duration of CS exposure and improvement through CS, and age at first exposure to CS and improvement through CS. (Compiler's note: These correlations, as well as the findings on the importance of use of CS at home, are all in exact accord with the assertions of Cornett, though his opinions were based on subjective and theoretical impressions, rather than empirical data).

The second project reported in this paper evaluated the perception and knowledge of grammatical gender (in French) by nine prelingually, profoundly deaf children with intensive Cued Speech experience. The rationale for the study is that, whereas normally hearing children three years old are aware of grammatical gender differences indicated by certain word endings, it is taken for granted that grammatical gender is a feature to which deaf children have limited access through traditional oral methods. Sixty nouns were used in the test given the subjects. Each was represented on a card which the tester presented while naming the item in Cued Speech, without the article. The child was to answer by saying the article, which specified the corresponding gender. The 60 nouns were distributed symmetrically among familiar and unfamiliar, masculine and feminine, and marked (by endings) and unmarked. For unfamiliar words, the subjects scored essentially at chance (50%) on the unmarked words, but nearly 80% on the marked words, showing that they had absorbed the gender rules related to word endings. On the familiar words they scored about 90% on the unmarked words and close to 100% on the marked words, showing that on familiar words they had learned the respective genders by heart, through the association of the nouns with the gender-related forms of the article.

Juillerat, C. (1978), & Mantelet, E. (1978). Jointly published theses with the title: *Le Cued Speech, un Complement Visible du Langage Parler*. Combined master's theses, Academie de Paris - Université de Paris. Première Partie (partie commune): *La Méthode*. Deuxième Partie (Juillerat): *Le Cas de Stasie*. Troisième Partie (Mantelet): *Le Cas d'Isabelle*.

These are detailed case studies of two profoundly deaf children, Stasie and Isabelle. Each provides a wealth of detail on background, family efforts, learning and use of Cued Speech, language development, speech, and behavior. (Compiler's note: Stasie was the first child in France to be exposed to Cued Speech. She is now (1990) sixteen years old, has attended only French schools, always mainstreamed, and without an interpreter. She is fluent in both spoken and written English and French, with excellent speech in both, has studied German for several years, and is now taking Russian in school).

Kaplan, H. (1974). *The Effects of Cued Speech on the Speechreading Ability of the Deaf*. **Dissertation Abstracts International**, 36(2), 645B. (University Microfilms No. 75-17,726).

The primary purpose of this study was to evaluate whether the presence of manual cues along with spoken stimuli significantly improved the ability of prelingually deaf individuals to lipread those stimuli. A second purpose was to determine whether significant relationships existed between improvement as a function of Cued Speech and such factors as: (1) intelligence; (2) receptive vocabulary; (3) reading level; (4) lipreading ability; and (5) proficiency in reading Cued Speech. Still another purpose was to determine whether consonants assigned to the same cue group were visually distinctive on the lips and whether the manual cues themselves were visually distinctive. Eighteen severely and profoundly deaf adolescents were evaluated with cued and comparable non-cued versions of nonsense syllables, words, unrelated sentences, and related sentences. Differences were assessed using a *t*-test of significance. Correlations were run between differences in speechreading scores from cued to non-cued material and tests designed to measure: (1) intelligence; (2) receptive vocabulary; (3) reading level; (4) lipreading ability; and (5) proficiency in reading Cued Speech. In order to evaluate the distinctiveness of cued consonants, confusion matrices were constructed from the responses of the subjects to cued and non-cued consonant-vowel syllables. These matrices were analyzed for patterns of consonant error. Results indicated that: (1) the presence of manual cues significantly improved speechreading scores for all types of material used; (2) correlations between improvement as a function of Cued Speech and IQ, receptive vocabulary, reading level, and lipreading ability were insignificant; (3) significant correlations were obtained between proficiency in reading Cued Speech and improvement in speechreading for words and unrelated sentences but not

for related sentences; and (4) the members of several consonant pairs were found not visually distinctive enough to be assigned to the same cue group, and two manual cues appeared to have limited visual distinctiveness.

Kipila, B. (1985). Analysis of an oral language sample from prelingually deaf child's Cued Speech: A Case Study. **Cued Speech Annual**, 1, 46-59.

This study is an evaluation of oral expressive language in a child whose speech is unintelligible. Since the child and the researcher have both expressive and receptive skills in Cued Speech videotaped samples of their communication furnish the material for accurate analysis of the child's expressive spoken language, independently of speech quality. The child's pure-tone hearing thresholds averaged 110 dB in the right ear and 110 dB also in the left ear. He was exposed consistently to Cued Speech in the home from before the age of 18 months, and in nursery school from the age of two years. He has cued expressively since age 2 ½. Before the age of four years he was fitted with a cochlear implant at the House Institute, causing him to have speech awareness at 50 dB, and to begin to vocalize more consistently. The child's videotaped conversations with a former teacher and with another cueing adult were made at age 5 yrs, 4 months. To conduct an analysis of the first 14 morphemes typically acquired by a normal child learning language, the author chose 111 utterances, not selecting single-word responses. The 111 utterances produced a total of 459 morphemes, 124 of which were examples of the first 14 morphemes typically acquired. The mean length of utterance was 4.5 morphemes. Of the 124 morphemes used in the analysis, 109 were correct. The results showed 100% accuracy on seven of the morphemes: contractible auxiliary, past irregular, past regular, plural, possessive, third person irregular, and uncontractible copula. The articles were 90% correct (38 of 42), which is rated as mastery at the minimum level, and the 4 not correct were omissions. Performance on the remaining six morphemes was as follows: the contractible copula (80%, 11 of 14), the uncontractible auxiliary (2 of 3), the present progressive (3 of 5), "in" (2 of 4), 3rd person regular (1 of 2), "on" (0 of 2). Of the 15 errors, 10 were omissions, 5 were errors of usage. There were no errors of "overuse".

Leybaert, J., & Alegría, J. (1988, May). **Cued Speech and the Acquisition of Reading by Deaf Children**. Paper presented at "De Zevende Sociolinguistiedagen", Brussels, Belgium. (Reprinted in **The Cued Speech Journal**, 4, 1990).

This paper delineates clearly and logically the rationale for the probable need of prelingually deaf children for access to the phonological code of the language they learn, in the process of acquiring it as a base for reading. The possible roles of phonological, sign, and orthographic codes in deaf children's reading are analyzed, and the primary question about the relationship of Cued Speech to reading in deaf children is identified as whether it enables them to develop addressed and assembled phonological codes. If so, the conclusion is that Cued Speech might help to overcome the reading difficulties generally encountered by deaf subjects. (Compiler's Note: The value of this paper lies in the perspective it provides on the prior and subsequent highly revealing experiments conducted by the authors and their associates on the relationship of Cued Speech to reading).

Ling, D., & Clarke, B. R. (1975). Cued Speech: An evaluative study. **American Annals of the Deaf**, 120, 480-488.

In this study cued and non-cued sentences and phrases were presented in a live situation at normal and at slow rates to 12 hearing-impaired subjects aged 7-11 years old who had been exposed to Cued Speech one-to-two hours a day for one school year. Written responses were analyzed in relation to the number of complete sentences and words written correctly and the type of phoneme errors made. Scores were generally superior when the material was presented with cues, but overall performance was poor, particularly so for sentence material, which yielded only 9 percent correct responses. The number of correct responses and the advantages of cueing were greater for phrases than for sentences, and for words than for phrases. Results suggested that subjects tended to process the material in units not exceeding word length, and that they had not yet developed adequate strategies to meet the demands imposed on perception and memory in processing speech sequences. (Compiler's note: For evidence that these subjects were in the early stages of acquiring skill at decoding Cued Speech, refer to the follow-up study made one year later by Clarke and Ling (1976), described above).

Mohay, H. (1983). The effects of Cued Speech on the language development of three deaf children. **Sign Language Studies**, 38, 25-49. (Abstract by Mohay.)

The language development of three prelingually deaf children was studied in videotapes made monthly from the time of their enrollment in a Cued Speech program. Each child's communication

was analyzed in terms of the frequency of use of gestures, cues, and speech. Length and structure of multi-unit utterances and lexical development were also documented. The data were compared with data previously obtained from the same children while enrolled in an oral education school [Mohay (1982), *Sign Language Studies*, 34, 73-90). With the introduction of Cued Speech the frequency with which the children used communicative gestures dropped dramatically without a corresponding increase in speech production. There was however a slight shift towards the production of longer spoken utterances. Spoken vocabulary showed a significant increase only in the child whose rapid vocabulary acquisition had commenced before her introduction to Cued Speech. The results suggest that the introduction of Cued Speech at an early age does not materially aid the spoken language development of profoundly deaf children. (Compiler's note: The evaluations were of only expressive language. The lengths of time the children spent in a Cued Speech program, up to the last evaluation, were five months, nine months, and 25 months, respectively.)

Musgrove, G. N. (1985). **Discourse comprehension by hearing-impaired children who use Cued Speech**. Doctoral dissertation, McGill University, Montreal. (Abstract by Barbara Anderson, April, 1987).

This study was done to investigate the discourse comprehension abilities of a group of profoundly deaf children who had used Cued Speech at least four years. Prior studies regarding the language of hearing-impaired children had focused on semantics and pragmatics, with relatively little attention to discourse comprehension. This study was done because of the previous study at the school by the same author showing a high proficiency (95%) in speech reception of key words in sentences when using Cued Speech. The question asked in this second study was: "What effect does this level of information reception have on language processing in the context of understanding and recalling connected discourse?" It was noted that the "critical period" for language learning peaks at age four, and the majority (17 of 20) of these children were introduced to Cued Speech between ages five and nine. Through Cued Speech these children receive English as it is spoken in the community. Subjects were 20 profoundly deaf children between 10 and 18 years of age, all with normally hearing parents, and at least four years of being taught with Cued Speech. All entered the Cued Speech program with delayed or deviant language. The two control groups were normally hearing children: Group 2 was matched to the hearing impaired group by reading level (therefore, younger chronologically), and Group 3 was matched by chronological age. Three texts were presented to the children on videotape: a story in dialogue form involving a problem and a solution, a folktale in narrative form, and an explanatory, descriptive passage. These were done orally for the hearing students, and orally with cues for the hearing-impaired students. Every effort was made to keep the presentations otherwise similar. The subjects viewed a videotape and then reported what they had seen. The hearing subjects' responses were audiotaped, and the hearing impaired subjects' were videotaped. The hearing-impaired students were found to be more competent at understanding conversationally organized text than narrative or explanatory text. ("Profoundly, totally, and near-totally deaf children have not previously been reported as having such advanced skills in conversational discourse.") With conversationally organized text their results were similar to those of the reading-matched group, but significantly lower than those of the age-matched group. For the other types of text, the hearing-impaired group scored significantly below both hearing groups. The recall and inferential operations used in comprehension, and the number of inferences processed by the hearing-impaired I group, were appropriate for their level of reading ability and similar to those of the reading-matched hearing group. The hearing-impaired subjects' comprehension of narrative text was qualitatively different from that of either control group. The hearing students focused on the story's problem when retelling it, while the hearing-impaired group focused instead on events leading up to the problem and on dialogue. In the explanatory passages the hearing-impaired group was similar to the reading-matched group, and scored lower than the age-matched group.

Mußmann, Roswitha Winker (1974). **Cued Speech im Vergleich zum Mund-Hand-System nach Forchhammer**. Unpublished master's thesis, Pädagogischen Hochschule Rheinland, Abteilung für Heilpädagogik, Köln.

The purpose of this study was to compare the Danish Mund-Hand-System (M-H-S), devised by G. Forchhammer (1923), with Cued Speech, developed by R. Orin Cornett (1967). Since the purpose of both systems is to clarify the ambiguous message of the visual manifestations of speech, the basic question posed in this study is: "Are the systems, in view of their purpose, equally valuable, or which is more performance capable (leistungs-fähiger)?" Detailed descriptions of the two systems are presented and discussed, and available evidence of their effectiveness is given and analyzed with respect to production of visual differences between phonemes, relation to articulation, ease of

learning, usability with young children, weaknesses of kinemes, completeness of support to lipreading, and other factors. Cued Speech was judged the better on almost all counts, and equal on the others. The final sentence reads: "In conclusion, Cued Speech, in comparison with M-H-S, is of greater effectiveness in relation to spoken language and for spoken communication, and the adaptation (of Cued Speech) to German is most highly desirable for use in spoken German."

Nash, J.E. (1973). Cues or signs: a case study in language acquisition. **Sign Language studies**, 3, 80-91.

Compiler's Note: Though this case history is not research-oriented, it is included because it is one of only two studies located for which the conclusions are unfavorable to Cued Speech.

This case history reports on a prelingually, profoundly deaf child whose parents began Cued Speech with him before the age of one year, and who by then were "cueing to him in consistently well-formed sentences." At age three years 'Marc's receptive competency (what he seemed to understand and was capable of acting on) was not much, if any, below that of a normal hearing child." However, Marc's expressive language output ".. was a different story." Before the introduction of signs, at age 3, his parents reported three words recognizable by adults, seven more easily recognizable by parents, fifteen others recognizable in context, and six words habitually cued. At this point the parents set out to shift to signs, and expressive signing developed rapidly. Conclusions: "This case seems to illustrate that cueing is indeed an oral technique; whereas signed English and fingerspelling are sufficiently similar to speech-generating languages to be acquired in a natural fashion ...The early and extensive use of cues represents a conscientious attempt to provide a visual communicative environment. Unfortunately, the sufficient structural properties for "normal" acquisition appear not to be present in the cues." (Compiler's note: The same issue of **Sign Language Studies** includes, immediately following the Nash article, a response by Cornett entitled *Comments on the Nash Case Study*. He pointed out the dangers of generalization from a single child, particularly when the parents had received no guidance on how to stimulate expressive cueing in the child, needed because of the slow development of speech. He cited the case of Janette, the only other child (at that time) known to have received Cued Speech consistently before the age of one year. After 14 ½ months of exposure to Cued Speech (at age 22 ½ months) she had a spontaneous spoken vocabulary of 210 words and phrases and a much larger receptive vocabulary, according to the parents [personal correspondence]. Cornett quotes the conclusion reached by the father of this prelingually, profoundly hearing-impaired child: "There is evidence to suggest that the use of Cued Speech with a very young child permits the maintenance of a normal sequence of development of speech and language despite the existence of a significant hearing impairment." Cornett cites Nash's observation that Marc attempted to say 29 words at age 16 months, whereas Janette at 17 months "said" only "8 or 9" words, none clearly. He indicates that this suggests that if he had the opportunity to give guidance to Marc's parents, as he gave Janette's parents through correspondence, perhaps Marc might have also progressed satisfactorily.)

Nicholls, G. (1979). **Cued Speech and the Reception of Spoken Language**. Unpublished master's thesis, McGill University, Montreal. (Available from Gallaudet University).

This study was designed to investigate the effect of Cued Speech on profoundly hearing-impaired children's speech reception abilities under seven conditions of presentation: audition; lipreading; audition and lipreading; audition and cues; lipreading and cues; and audition, lipreading and cues. The 18 subjects had been taught through the use of Cued Speech for at least four years. They were presented with specially designed speech tests (syllables and key words in sentences) which had been recorded in color videotape, and they responded in writing. Speech reception scores of over 95% with the key word in sentence materials and over 80% with the syllables were obtained with lipreading plus cues, and audition, lipreading plus cues. Equally high levels of reception by such children have not previously been reported. The subjects also demonstrated the ability to use audition with the sentence material, both in combination with lipreading and with cues, though there were large individual differences under these conditions. Speech reception abilities in the lipreading plus audition condition were highly correlated with scores for speech production; while language attainments were correlated with reception through Cued Speech. The implication of these findings to the field of aural rehabilitation are discussed.

Nicholls, G., & Ling, D. (1982). Cued Speech and the reception of spoken language. **Journal of Speech and Hearing Research**, 25, 262-269. (For summary, see thesis abstract above).

Périer, O., Charlier, B., Hage, C., & Alegría, J. (1987). Evaluation of the effects of prolonged Cued Speech practice upon the reception of spoken language. In I. G. Taylor (Ed.), **The Education of the Deaf-Current Perspectives, Vol. 1, 1985 International Congress on the Education of the Deaf**. Beckenham, Kent, UK: Croom Helm Ltd. (Reprinted in **The Cued Speech Journal**, 4, 1990)

This paper summarizes the reasons for the adoption (in 1980) of both Cued Speech and Signed French in the programs of the Centre Comprendre et Parler and the Ecole Intégrée, both in Brussels. It also delineates the ways in which the two systems are used. It describes the research project carried out to evaluate the effectiveness with which spoken French can be received through Cued Speech, the effects upon speechreading capabilities without sound, and to investigate whether the phonological information made available by Cued Speech is stored and utilized in activities involving inner speech, such as reading and writing. Method: Videotaped sentences, simple grammatically, were presented twice, and then a group of four pictures was shown to the subjects, who were expected to identify the picture which most closely represented the sentence. Three groups of sentences were used, representing easy, medium difficulty, and high difficulty. The difficulty was neither lexical nor grammatical, but related to the greater or lesser degree of similarity of the visual pattern available for speechreading. The study revealed that (1) there are wide differences in the degree of benefit different subjects derive from Cued Speech; (2) most children derived substantial benefit from Cued Speech, in reception of spoken language; and (3) the results confirm Cornett's assertion that consistent use of Cued Speech at home is more beneficial than its use at school. Children with whom Cued Speech was used both at home and at school performed best; children with whom it was used only at home performed somewhat less well; and those with whom it was used only at school performed substantially less well. Statistical analyses supported the conclusions reached.

Périer, O., Bochner-Wuidar, A., Everarts, B., & Michiels, J., (1986). The combination of Cued Speech and Signed French to improve spoken language acquisition by young deaf children. In B. Tervoort (Ed.), **Signs of Life: Proceedings of the Second European congress on Sign Language Research** (pp. 194-199). Amsterdam. (Reprinted in **The Cued Speech Journal**, 4, 1990)

This paper describes in some detail the initial rationale, methodology, and results associated with the very innovative experimental use of both manual communication and Cued Speech in a preschool program. Highly revealing are the speech language samples of Sacha, at four years two months and at five years, two months of age, and the experience of his parents as their ability with signs was outdistanced by his linguistic progress, causing them to shift gradually to almost exclusive use of Cued Speech.

Périer, O. (1987, October). **The psycholinguistic integration of signed French and Cued Speech: How can speech components be triggered?** Paper presented at the Symposium on Oral Skills and Total Communication, Gent, Belgium. (Reprinted in **The Cued Speech Journal**, 4, 1990)

This paper consists of two parts. First is a presentation of anecdotal evidence that use of both Cued Speech and Signed French by deaf children leads to psycholinguistic integration. The second part presents arguments supporting the idea that the combination can support the development of expressive speech.

Power, D. J. (1985). **Teacher-pupil interaction in oral and Cued Speech classes in England and Australia**. Paper presented at the International Congress on Education of the Deaf, Manchester, England.

This study evaluated levels of teacher dominance in oral and Cued Speech classes in England and Australia, using such indicators as: (1) percent of cases in which communication was initiated by the teacher; (2) percent in which communication was initiated by pupils; and (3) percent of pupil expression that was spontaneous, or resulted from a teacher's command or leading comment. The author reported that teacher dominance was highest in oral classes in England, next in oral classes in Australia, and much lower in Cued Speech classes in England and Australia. He reported a marked superiority for Cued Speech classes in pupil initiative and pupil initiation of communication.

Sneed, N. A. (1972). The effects of training in Cued Speech on syllable lipreading scores of normally hearing subjects. **Cued Speech Parent Training and Follow-up Program**, 38-44. Project report to U.S. Office of Education, Department of Health, Education and Welfare, Washington, D.C.

This study was designed to investigate the effects of training in the reading of Cued Speech upon performance on a filmed syllable-lipreading test of normally hearing subjects. Ten normally-hearing college students, ages 18 to 23, were trained in phonetic notation in an average of four hours, reaching

an accuracy of 85% to 95% in transcription of consonant-vowel syllables. They were then given the filmed syllable lipreading test. Over a period of six weeks the subjects were given an average of fifteen hours of instruction and practice in Cued Speech, all reaching a level of 75% to 95% accuracy in reading CV syllables without sound. They were then given the same syllable lipreading test (twelve films with 29 syllables each), with the films in a different order from that used in the pretest. One of the films was used as a practice film before the posttest in order to test for learning effects. Mean accuracy on the pretest was 11.0% (range 6.6% to 14.4%) and on the posttest 14.9% (8.662% to 18.4%). A syllable was scored as correct only if both phonemes were transcribed correctly. The difference between pretest and posttest means was significant at the .01 level of confidence. One subject scored slightly higher on the pretest than on the posttest. Mean performance on consonants was 24.4% for the pretest and 27.4% on the posttest. Mean performance on the vowel phonemes was 42.0% for the pretest and 54.0% for the posttest. The differences were significant at the .01 confidence level.

Tammaasaeng, M. C. (1987). The effects of Cued Speech upon tonal perception of the Thai language by hearing-impaired children. In I. G. Taylor (Ed.), **The Education of the Deaf-Current Perspectives, Vol. 1, 1985 International Congress on the Education of the Deaf**. Beckenham, Kent, UK: Croom Helm Ltd.

Tammaasaeng, M. C. (1985). The effects of Cued Speech upon tonal reception of the Thai language by hearing-impaired children. *Dissertation Abstracts International*, 47(01), 150A. (University Microfilms No. DA8606013).

This study was designed to investigate the effects of Cued Speech on the tonal perception of Thai hearing-impaired children. The subjects were 36 profoundly hearing-impaired fifth-grade students enrolled in the Sethsatian School for the Deaf in Bangkok, Thailand. They ranged in age from 12 to 16 years old. Nine subjects were enrolled in the speech program which uses speech with signs, and 27 were enrolled in the regular program using signs and fingerspelling only. Lipreading skills and Cued Speech were taught to all subjects for one semester. The Tone Perception Test, which was composed of 25 pairs of words differing only by tones, was presented to all the children without sound, using speech alone and speech with cues. Repeated measures analysis of variance showed no significant difference between the performances of children due to type of program. A significant difference in performance was obtained for mode of presentation, $p < .0001$. The mean tone perception score obtained by children from both programs, for the speech alone mode of presentation, was 49.5% (50% = chance), while the mean score for speech with cues was 86.2 percent. The presence of a significant interaction indicated that, when program was considered along with mode of presentation, the children from the speech program achieved significantly higher mean scores (96.9%) on speech with cues than did those from the regular program (82.6%), $p = .0024$. On lipreading alone, both groups scored near 50%, which equaled chance. The results show that Cued Speech helped clarify the tonal characteristics of the Thai language for profoundly hearing-impaired Thai students. Since perception of the tonal characteristics is essential to understanding of the language, the results suggest use of Cued Speech.

Tate, M. B. (1976). **Effects of Cued Speech Instruction on the Mastery of Certain Phonetic Transcription Skills**. Unpublished master's thesis, University of Rhode Island.

The primary purpose of this study was to evaluate whether training in Cued Speech, a phonemic system, significantly affected the ability of normal-hearing college students enrolled in a phonetics course to phonetically transcribe the vowel and diphthong phonemes of English. A second purpose was to evaluate the effects of different phonetic learning sequences (Cued Speech instruction followed by phonetics instruction and traditional phonetics instruction followed by Cued Speech instruction). As an extension of this research, data obtained after administering separate instruction techniques was analyzed, phoneme by phoneme, to ascertain any significant differences in transcription skills of the two research groups. With a specially-designed preinstruction examination, 48 subjects were objectively divided into two groups of 24 members to produce control and experimental groups. The control group received traditional phonetic instruction in a classroom using workbooks, while the experimental group received independent Cued Speech instruction in a language laboratory with an experimental workbook and recorded Cued Speech materials. A behavioral measure of transcription skills was administered to both groups. Research proceeded in latin-square presentation and culminated with the last behavioral measurement. F-tests were run to determine whether significant differences existed between Cued Speech instruction as opposed to traditional instruction and traditional instruction followed by Cued Speech instruction. From results of phoneme matrices, F-tests were also run on percentage conversions of each phoneme that consistently occurred in all

three behavioral measurements. Results of compared group means after instruction sequences indicated that the experimental population had obtained higher group means than the control population. Results of F-tests evaluating contrasted learning techniques and contrasted sequences of learning indicated that differences were not significant at the .05 level. When the same data were used in a *t*-test, using the formula for matched populations (since the groups were carefully matched on the basis of alternate assignment in the order of scores on the pretest), the difference between the means of the experimental population and the control population was significant at the .05 level of confidence. Results of F-tests evaluating each research phoneme indicated that differences in performance across phonemes were not significant.

Wandel, Jean E. (1989). **Use of Internal Speech in Reading by Hearing and Hearing Impaired Students in Oral, Total Communication, and Cued Speech Programs.** Unpublished doctoral dissertation, Teacher's College, Columbia University, New York.

This study investigated the relationship of recall in short-term memory (STM), use of internal speech (IS) as a STM coding strategy, and reading comprehension. It compared reading achievement of hearing-impaired students in Oral, Total Communication (TC), and Cued Speech (CS) communication modes with that of students with normal hearing. The study replicated parts of a study by Conrad (1979), using his materials, procedures, and lists of acoustically similar and visually similar words.

The design utilized three communication modes (oral, TC, CS) and two levels (severe, profound) of hearing impairment. A hearing group was used for comparison. In all 213 students were tested in order to select 30 hearing students, 30 from Oral programs, 30 from TC programs, and 30 from CS programs. Each group of 30 hearing-impaired students included 15 in the profound-loss category (PTA 90 dB or more in the better ear) and 15 in the severe-loss category (65 to 89 dB).

Each subgroup (communication mode/decibel level) was balanced for decibel loss, general cognitive ability, years in communication mode, sex, and parent education level. Additional factors were racial/ethnic origin, educational placement, communication support at home, and hand preference for writing. The hearing-impaired students were randomly selected from several public school districts throughout the country that offered all three (Oral, TC, CS) communication modes, had offered those tracks for at least three years, and administered the Stanford Achievement Tests (SAT). All potential subjects had to meet the criteria of no secondary disability, ability to read the stimuli words, and English as the primary language spoken at home. In addition, all hearing-impaired potential subjects had to have a prelingual bilateral hearing loss and to have used the relevant communication mode for at least three years.

The Raven Standard Progressive Matrices (RSPM), the 1982 SAT reading comprehension test, and the Conrad tests were administered to all subjects. The Conrad task was to read a series of one-word cards and write each word in order, from memory.

Results indicated that the 90 hearing-impaired students, as a single group, attained significantly lower scores on the Raven, more errors on the Conrad test, lower SAT reading comprehension scaled scores, and lower internal speech ratios than did the 30 hearing age-mates. The performance of the TC group was significantly lower on all these measures than the Oral and CS groups. No significant differences were noted between the two combined decibel-category groups (45 profoundly and 45 severely hearing impaired). It was noteworthy, however, that there was no statistically significant difference in reading achievement between the Hearing and Cued Speech-profound groups; that is, the two groups attained essentially the same mean scores on the reading comprehension sub-test of the SAT. Subjects in the Cued Speech-severe group did not attain reading scores comparable to the hearing and Cued Speech-profound groups.

The STM span was correlated with: 1) IS ratio in all hearing-impaired groups, and 2) reading in all four groups. Reading was correlated with IS ratio for the Oral and TC groups, but not for the Cued Speech or hearing groups, possibly because the hearing and Cued Speech groups employ processing strategies in reading that are different from those of the Oral and TC groups.

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