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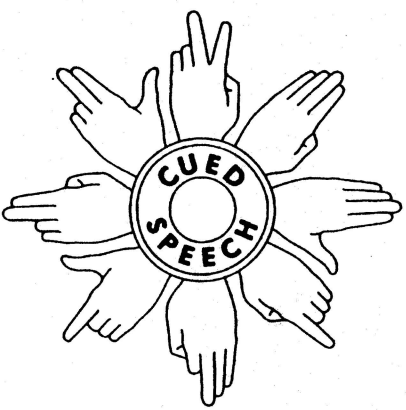

Journal of the National Cued Speech Association

CUED SPEECH JOURNAL

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The Importance of Thinking Words

R. Orin Cornett

This paper is based on a single, simple assertion: Only if in face-to-face communication, as a result of that communication, a child consistently thinks English words, will that child learn English rapidly and efficiently. This is true whether the child has an auditory deficit or not.

Auditorially deficient children can be taught English words. They cannot be taught words through signs, but in signing programs they can be taught English words by stopping the signing momentarily and fingerspelling or writing the word corresponding to the related sign. Efficiency is lowered because of the interruption of communication that is necessary, but this is not the most important point. To recognize the crucially important point, it is necessary to consider how the brain works, what it forgets and what it can recall.

Forgetting

A very important ability of the brain is its capacity to forget. Without the ability to forget most unimportant or trivial information, without conscious effort, the brain would become overloaded and unable to assimilate new information, within a few days. This is exactly what happens in a computer which has a hard disc capable of storing 200,000,000 bytes of information if new information is added each day in large quantities and nothing is erased. But our wonderful brains forget, in a day or so, all the unneeded or temporary information that is bombarding us ceaselessly, through our senses. Thus, we are consistently ready to take in new information and use it.

Remembering

A child's learning new language is not a simple matter of teaching him or her new words. New words, once learned, will be forgotten if not encountered repeatedly, while they are still remembered, so that they become permanent in the mind. With a hearing child, or a child exposed consistently to Cued Speech, all communication provides repeated exposures

of words already known, pushing them further into the core memory, the permanent vocabulary.

If a person has occasion to call a telephone number he has not seen before, he may or may not be able to retain the entire number while dialing it. Most people, in order to remember it in one piece while dialing, must concentrate for a bit and visualize it clearly. If it is visualized clearly enough to dial it without stopping to look at it during the process, it is quite likely that the next day one can recall the number; but it is not likely to be recalled after two or three days, or a week. If, however, the number is recalled the next day, one is likely to be able to recall it a week after that. Four or five uses of the number on successive days will make possible recall of it for months. This visual refreshing of an image can expedite retention of anything: dates of historical events, formulas in chemistry, or words in a foreign language.

I have taught hundreds of college students to use a simple daily procedure to ensure that they will remember indefinitely all important material they learn. On a small slip of paper they write each stimulus, say, the words *sulfuric acid.* The student associates visually with those words all that he wants to remember about sulfuric acid: its formula, H_2SO_4, the specific gravity of a normal solution of sulfuric acid, etc. All this information can be captured and visualized by the brain in less than one minute. For most persons, it will all be retained if checked the next day, but not after two or three days. The key is that if one looks at the stimulus words *sulfuric acid* the next day, and again a day later, and so on for a total of four or five days, revisualizing the associated material from memory, all the information will be retained indefinitely. A college student who jots down the key words associated with each important item he learns during a day, and reviews all of them at intervals of about 24 hours for four days, can practically dare the teacher to stump him or her regarding facts.

I have often compared this method of memorizing permanently to applying a solid one-fourth-inch-thick coat of paint to a small section of a wall. One cannot do it all at once. But, a two-inch-square patch on a wall can be coated with paint to a depth of one-fourth inch in less than a minute of *painting* time, if that minute is used in five-second pieces, each to apply a thin coat of paint to the surface, waiting 24 hours between coats. Visual memory operates analogously.

Learning of English in a Total Communication Program

Now let me apply the above to the learning of English by a child with a profound hearing deficit (PTA threshold 90 dB or more), in a TC program. In a TC program new English words are taught to the child specifically through the written or fingerspelled form. This process is slow, because it interrupts the flow of communication, taking extra time and damaging enjoyment. However, this is not the principal reason that the acquisition of English is so slow. The problem is that subsequent communication in signs, using the specific signs associated with English words the child has been taught, **does not bring those English words to the child's mind again!** Once a new word is learned, if subsequently it does not come to the mind again for several days, it will be forgotten, and must be relearned. Thus, teachers in a TC program must be sure to review in writing all new words taught, each day for several days, to produce extended recall. Even if that is done, the process will not be as efficient as the normal one in which every subsequent encounter with a word newly learned makes it increasing familiar and easy to handle.

During the first two years I served at Gallaudet as Vice President for Long Range Planning (1965-75), I obtained the evidence that encountering signs in communication does not bring English words into the mind of a child whose usual mode of communication is an English-based sign system. I could see no reason why teachers should speak when they signed, because I could not believe that simultaneous speech would accomplish anything.

In my travels to schools for the deaf I took occasion to interview 400 signing children, in groups of 10 to 50 or so. In each case I signed and spoke to them, saying first, "I want to communicate with you, and then ask you what happened in your minds—okay?" They were always willing, so I proceeded to make quote signs in the air and continued signing and speaking, as follows: "I want you to work on your *notebook* now." I signed and spoke all the words except one, notebook, which I spoke and fingerspelled, for a reason that will become clear.

Next, I asked, "Did you understand me?" All answered yes. "As I communicated to you, **in your mind** did you hear the words?" All answered negatively. "Did you say the words in your mind?" All said no. "Did you see the words in your mind?" Seven said yes, 393 said no. "Which words?" All seven identified notebook, which I had delivered in a code for written English. "Did you write the words in your mind?" All answered negatively.

My final question was: "Do you know the words for all the signs I used?" All 400 children answered that they knew the words. I submit that I covered all the ways in which it is possible to think an English word as a result of receiving it in communication, unless one counts unrelated modes such as Morse code.

My conclusion was that receiving signed communication, even accompanied by speech, does not bring English words to the mind of a child who communicates primarily in signs, even if the child already knows the words. This is not a weakness of signs. Languages such as Spanish and French, likewise, do not bring English words to the mind of a skilled user of those languages. Only if one knows those languages so poorly that he/she must translate them literally into English words in order to guess what is meant is there any tendency to think English words.

The profound implication of the preceding can be stated as a question: "If signs, even accompanied by speech, do not cause the corresponding words to come to the mind, just when is a deaf child going to get enough exposure to English words to produce the degree of familiarity and ease of recognition and use that is necessary for reading, writing, and oral communication?"

Now consider what will happen if hearing parents of children in signing programs use Cued Speech consistently at home, for everything they say. The first advantage is that the parents already know all the language they need to use with or teach to the child. Second, the parents can make any word clear to their child. For example, a trip to the zoo is no challenge because the parent can identify such animals as an alpaca, an otter, a baboon, a giraffe, any kind of bird or reptile—anything and everything—from the names on the cages or enclosures. But, the third point is the most important: If there is discussion of the trip to the zoo the next day (and there should be), every mention of every animal encountered on the visit will renew the memory of that animal and its name. The process of making new vocabulary permanent is easy, natural and enjoyable, if the parents simply take the opportunity to relive the interesting activities they have shared with their child, as any good parent should do.

In 1978 I wrote to 15 deaf teenagers who had grown up with Cued Speech, asking them to tell me what happened in their minds when they think. Thirteen replied. Eleven wrote back using the identical words: "I hear myself talking." Another, who has little or no measurable hearing, wrote: "I feel myself talking." The other one, the most oral of the group, replied: "I see the words." All were reported by their parents to talk in

their sleep. All confirmed that in their dreams they could lipread everyone perfectly, and everyone could understand their speech. These young people all think in the spoken language and use it as their base for reading. They have all grown up in the mainstream, with Cued Speech transliterators, receiving and digesting the same raw English received by their hearing classmates, and developing the same level of sophistication in English.

For many years, in every workshop on CS I have conducted that was attended by TC teachers, I have asked them to tell me why they speak and sign at the same time. Not one has told me the principal reason. They have given answers such as: "So the children will learn to lipread." "So the children will use their hearing." "So they will learn spoken words." The best answer they gave was, "Because we are instructed to do so." After I noted in each case that they had given a possible reason, but not the principal one, I explained that they speak with their signing because they want the children to do the same, and they could not expect the children to do it if they didn't. I then explained that they wanted the children to speak when they signed because only when the children speak can the teacher be sure they know and are thinking English words. Every time I gave the explanation the teachers agreed that I was right about the principal reason for speaking and signing simultaneously.

What About Aural/Oral Programs?

In an aural/oral or auditory/oral program (with or without a cochlear implant), if a child can acquire English rapidly enough to become a good reader on schedule, without so much pressure on child and parents as to damage either the child or the parents or rob the child or them of too many of the important things of life, that child does not need Cued Speech. Only a minority of children with a prelingual and profound auditory deficit are able to do this. For the majority of children who are prelingually and profoundly deaf, the traditional oral approaches are inadequate unless Cued Speech is incorporated into both the school program and the home. Let us examine the facts that support this conclusion.

With traditional oral methods alone, the learning of new language is too slow and laborious for most children with a profound auditory deficit. For such children oral programs do the same thing the TC programs do, revert to teaching English through the written form. The simple truth is that new language cannot be either learned or refreshed efficiently through a defective input.

In June, 1888, Dr. Alexander Graham Bell (Gordon, 1892) made the following statement to the Royal Commission of the United Kingdom on the Condition of the Blind, the Deaf and Dumb:

> I think that with the congenitally deaf to commence their education by speech reading, to commence to have the child read words from the mouth, before he knows the language, interferes with his mental development, retards progress in the acquisition of language, and thus defeats its own end, and retards the acquisition of speech reading itself.
>
> So far as my observation has gone, if a pupil is taught to rely upon the mouth for communication, before the language is acquired, it interferes with the acquisition of language; but if he is taught the language before he relies upon the mouth, then that knowledge of the language enables him to acquire the art of speech reading.

The same problem applies to learning new language through audition alone. For most profoundly deaf children it is an ambiguous and incomplete message, inadequate for rapid and efficient acquisition of new language. Both speechreading and audition furnish fractions of the speech message. For some children the combination, speechreading with the aid of audition, can eventually result in efficient learning, but for the majority the combination is inadequate. The bottom line is whether the child is acquiring English fast enough and handling it easily enough. With the aid of Cued Speech, especially at home, many more children in oral programs can learn language rapidly and efficiently. Then, for some, their skills at speechreading with audition can be developed to a point at which they can perform well aural/orally with familiar language.

It should be recognized that the difficulty of learning new language orally or auditorially is not the only problem. A second problem is that after a child learns a new word laboriously through traditional oral methods, his/her ability to speechread (with audition) that new language may not be good enough that when he encounters a newly learned word in oral communication he/she does not recognize it, and therefore the all-important refreshing of the newly learned word fails to happen. So the problems, and the results, for a majority of profoundly deaf children in both oral and TC programs, are much the same. Both need Cued Speech as a supplementary tool for use with the majority of profoundly deaf children.

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An Acoustic Study of the Speech Skills of Profoundly Hearing-Impaired Children Who Use Cued Speech

John Ryalls, Dominique Auger and Catherine Hage

Cued Speech is a method of completing the linguistic information available to those with profound hearing loss from speech-reading, by visual cues which accompany speech production. This method of supplementing speechreading was developed by Cornett (1967). Cued Speech has been reported to improve the speech reception abilities of profoundly hearing-impaired children (Nicholls & Ling, 1982). More recently these results have been extended to demonstrate more complete phonologies on the part of children who consistently receive Cued Speech (Charlier, Hage, Alegria & Perier, 1990; Alegria, Lechat & Leybaert, 1990; Hage, Alegria & Perier, 1991; Alegria, Leybaert, Charlier & Hage, 1992).

While there is now rather ample evidence that Cued Speech can result in improved speech reception and subsequent phonological development, it is not presently known whether Cued Speech also has a carry-over beneficial effect on speech production. That is, while it is known that Cued Speech has a phonological consequence, does it also have an effect at the phonetic level? If Cued Speech does succeed in delivering more complete information on speech contrasts, one might reasonably expect improved speech production as well. This issue of the speech production skills of children who use Cued Speech was the focus of the present study.

Specifically, we hypothesized that profoundly hearing-impaired children who consistently received Cued Speech would have better speech skills as reflected in voice onset time (VOT) production, syllable duration and fundamental frequency than their profoundly hearing-impaired peers who do not use Cued Speech. These speech skills were chosen because they have been previously shown to be compromised in the speech of profoundly hearing-impaired children (Osberger & McGarr, 1981, & references therein for the English language; Ryalls, Larouche & Giroux, 1993, for French). That is, hearing-impaired children have been shown to have less difference

in VOT between voiced and voiceless consonants, abnormally long durations, and higher average fundamental frequencies. It was expected that these acoustic parameters would be less affected in the speech of hearing-impaired children using Cued Speech.

Method

Subjects

Three groups of children were established for the present study: (1) A group of 10 normally-hearing children (5 boys, 5 girls) between 7 and 10 years; (2) A group of 10 children (5 boys, 5 girls) with profound hearing impairment (i.e., at least 90 dBHL for each ear) of similar age who do **not**

Table 1

Subject Characteristics - Normally Hearing

Males		Females	
Subject	Age	Subject	Age
NO1	7:9	NO6	7:10
NO2	9:3	NO7	10:9
NO3	9:11	NO8	9:6
NO4	8:6	NO9	9:7
NO5	7:6	NO10	7:9

Average-- 8 years: 10 months

use Cued Speech; and (3) A group of 10 children (5 boys, 5 girls) with profound hearing impairment of similar age who **have** used Cued Speech consistently for at least five years. Subject characteristics for each group are presented in Tables 1 - 3.

While the first two groups of subjects were recruited in Quebec, Cued Speech is too recent to find the third group of children in Canada. Consequently, these children were recruited from Belgium from a center and school known for its application of Cued Speech. It should be pointed out that Belgian French and Canadian French are very similar in regard to their

VOT production (Serniclaes, D'Alimonte & Alegria, 1984; Jacques, 1982; Ryalls, Larouche, Dupont & Fournier, 1990).

Table 2

Subject Characteristics
Profoundly Hearing-Impaired Subjects - Non-Cued Speech (Non-CS)

Males				Females			
		Hearing-Loss (dB HL)				Hearing-Loss (dB HL)	
Subject	Age	LE:	RE:	Subject	Age	LE:	RE:
PO1	10:6	120	118	PO6	9:1	115	115
PO2	10:9	120	116	PO7	9:9	105	105
PO3	10:9	115	118	PO8	9:4	115	117
PO4	7:11	110	125	PO9	8:3	108	108
PO5	8:4	113	120	PO10	8:8	120	120

Average Age = 9 years: 4 months
Average Hearing Loss = 114 (LE), 116 (RE)

Stimuli

The stop consonants /p/, /t/, /k/ and /b/, /d/, /g/ were combined with the extreme vowels /i/, /a/ and /u/ to form 18 basic syllables. These stimuli were presented in non-word form (i.e., an orthography that did not constitute a real word) in order to avoid differences in familiarity to the children. The children were all capable of reading these syllables. Five productions of each of the 18 syllables were recorded on high quality tape for subsequent analysis. Children in the Cued Speech (CS) group were also given appropriate CS cues by their usual speech-language pathologists during testing.

Only productions which preserved the correct place-of-articulation were retained (i.e., a production of [pa] for a target /ta/ was eliminated). These productions were then digitized onto disk with 12 bits of resolution at a sampling rate of 20 kHz, after low-pass filtering at 10 kHz to avoid aliasing, using the BLISS (Mertus, 1989) software package implemented on an AT-

compatible personal computer equipped with a Data Translation DT-2801-A digital conversion board.

VOT was measured on the basis of both the oscillographic display and the audio signal in accord with standard procedures. Sample VOT measures for voiced and voiceless consonants are provided in Figure 1.

Table 3

Subject Characteristics
Profoundly Hearing-Impaired Subjects - Cued Speech (CS)

Subject	Sex	Age	Years of CS	Hearing Loss (dB HL) LE:	RE:
CS01	M	11:11	10	94	99
CS02	M	12:7	+9	88	96
CS03	M	8:9	+8	103	104
CS04	M	12:6	+11	94	99
CS05	M	7:3	+6	101	110
CS06	F	7:11	+4	100	96
CS07	F	7:9	+6	101	93
CS08	F	10:11	+8	99	99
CS09	F	8:1	+7	111	109
CS10	F	8:10	+7	103	108

Average Age = 9 years: 8 months
Average Hearing Loss = 99 (LE); 101 (RE)

Total syllable duration was measured from the burst (in the case of initial voiceless consonants) or the onset of phonation (in the case of initial voiced consonants) to the point of zero amplitude after the vowel. In cases where phonation resumed again after a fall to zero amplitude, the first fall to zero was used to determine the total duration (i.e., voicing "tails" were eliminated for the most conservative measure of duration). Fundamental frequency was determined on the basis of an average of ten pitch periods taken from the middle of the vowel portion of the production.

differentiation than non-CS children for both bilabial and alveo-dental places of articulation. For the velars, the VOT slopes are parallel in Figure 2, indicating that the two groups were not different.

A two-way analysis of variance (ANOVA) was completed on the VOT measures with group and voicing as factors. Results revealed a significant effect of group [F (2,23) = 4.44,.023], an expected highly significant effect for voicing [F (1,23) = 51.72, p = .000 1), and a significant group by voicing interaction [F (2,23) = 28.15, p = .0001). Newman-Keuls post hoc analyses holding voicing constant, revealed that both CS and non-CS profoundly hearing-impaired children were significantly different from normally-hearing children, but that non-CS and CS hearing-impaired children were not significantly different from one another.

Table 4

Average VOTs (in milliseconds)

	Voiceless			Voiced		
Subjects	p	t	k	b	d	g
Normal	32	60	65	-91	-91	-88
Non-CS	17	18	12	16	17	-14
CS	24	27	52	- 2	- 3	5

	Differences (voiceless - voiced)		
	Bilabial	Alveo-dental	Velar
Normal	123	151	153
Non-CS	1	1	26
CS	26	30	47

The lack of significance between subject groups is surely due to the considerable variation between subjects in the hearing-impaired groups. One means of reducing this variation would be to look only at VOT differences by place of articulation for each subject (instead of all six VOT measured for each consonant). Therefore, a similar ANOVA was also performed on the individual VOT differences for each place of articulation. The analysis revealed a significant effect for group [F (2,23) = 28.15, p = .0001), a

Table 5

Total Syllable Duration (in milliseconds)

Subjects	Voiceless Initial C	Voiced Initial C	Average
Normals	257	342	300
Non-CS	659	665	663
CS	440	462	451

longer (since they include the voicing lead portion) than those that begin with a voiceless consonant. Overall average durations for CS children were longer than for normally-hearing children, but shorter than for non-CS children. An ANOVA with group and voicing as factors revealed a significant effect for group [$F(2,19) = 12.88$, $p = .0003$], an effect for voicing [$F(1,19) = 16.40$, $p = .0007$), and a significant group by voicing interaction [$F(2,19) = 9.05$, $p = .0017$]. Newman-Keuls post hoc analyses revealed that all three groups were significantly different from the other for duration.

Fundamental Frequency

Averages for fundamental frequency by group and gender are presented in Table 6. Again, results for CS children are in between normally-hearing children and non-CS children. A two-way ANOVA with group and gender as factors revealed a significant effect for group [$F(2,23) = 4.56$, $p = .0215$], a non-significant effect for gender [$F(1,23) = .116$, $p > .73$], and a non-significant group by gender interaction [$F(2,23) = .048$, $p > .95$]. Newman-Keuls post hoc analyses with voicing held constant revealed only that non-CS children were significantly different from the normally hearing children. CS children were neither significantly different from non-CS children, nor were they significantly different from the normally-hearing controls.

Discussion

Acoustic results from this study suggest that Cued Speech provides somewhat better speech skills for hearing-impaired children than for their hearing-impaired peers who do not use Cued Speech. CS children had better

VOT distinctions for bilabials and alveo-dentals, shorter syllable durations and lower fundamental frequencies than their peers who do not use Cued Speech. Results for the CS group were always between that of the normally-hearing and the non-CS hearing-impaired group for all three acoustic measures of this study (VOT, duration and F0).

Table 6

Average Fundamental Frequencies (in Hertz)

Sex / Subjects	Male	Female
Normals	264	269
Non-CS	362	363
CS	285	306

While it is obvious that a better internal concept of voiced and voiceless phonemes would naturally lead to a better VOT distinction in production, it is not as obvious why Cued Speech should allow for shorter syllables and a lower fundamental frequency. At the present there are not satisfactory explanations why these speech parameters are affected by hearing-impairment. It has been suggested that longer syllable durations on the part of hearing-impaired speakers are produced in order to gain more kinaesthetic feedback to compensate for the reduced auditory feedback (Ryalls, Larouche & Giroux, 1993). Higher fundamental frequencies may result from greater vocal effort on the part of hearing-impaired speakers. Thus, lower fundamental frequencies in children with profound hearing impairment who used Cued Speech, may reflect less vocal effort on their part.

Since speech skills are still developing in children of this age, it is also possible that this study did not yet capture the full beneficial effects of Cued Speech on speech production, and that subject groups may turn out to be even more distinct at a later stage of development.

These are only preliminary results from somewhat imperfect subject groups. Further studies should explore these issue in greater depth. These results should also be replicated for the English language. It would also be desirable to have more perfectly-matched subject groups, not only to have

larger and more homogenous subject groups, but to have more perfectly-matched hearing-impaired groups. Unfortunately, it is quite difficult to find a subject group which uses Cued Speech in the same geographical location as an equivalent subject group which does not use Cued Speech--and still retain all other factors such as hearing and age equal.

All of this notwithstanding, the potential benefit to hearing-impaired children of more research in this area certainly warrants the necessary investment in research.

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Adapting Cued Speech to Additional Languages

R. Orin Cornett

As of October, 1993, Cued Speech had been adapted to 56 languages and major dialects. In most of these adaptations, the writer had the assistance of one or more native speakers of the target language. In a few cases, he had advice from experts on the phonetic and phonological aspects of the language in question. Other persons produced five of the adaptations (Alu, Malagasy, Maltese, Korean and Polish) with little or no guidance from the writer.

Persons other than the writer will likely produce increasing numbers of adaptations to other languages. This article is intended to provide guidance and suggestions that will facilitate such adaptations. It aims to furnish the benefit of experience gained in the original design of Cued Speech and its adaptation to 50 languages by the writer. It will summarize the following:

1) the basic theory of Cued Speech
2) procedures followed in grouping the phonemes of American English in the basic version of Cued Speech
3) recommended procedures for adapting Cued Speech to additional languages
4) the timing movements of Cued Speech
5) special problems encountered in adapting CS to various languages

Basic Theory of Cued Speech

Cued Speech is based upon this simple principle: If all the sounds of a spoken language were clearly different from each other as they appear on the mouth, the deaf child could learn the spoken language through vision, just as the child with normal hearing learns it through hearing. In most languages CS utilizes eight handshapes, in three or four locations near the mouth. These cues supplement the information visible on the mouth so that all the phonemes of a specific spoken language look different from each

other, either on the mouth or on the hand. Sounds which look the same on the mouth look different on the hand, and sounds which look the same on the hand look different on the mouth. Thus, the spoken language is clear, through vision alone, at the levels of phonemes, syllables, stress, and duration. If needed, approximate intonation can be indicated by the angle of inclination of the hand from the horizontal, with 45 degrees for middle pitch, near 90 degrees for high pitch, and near the horizontal for low intonation.

The preparation I made for developing Cued Speech included four steps.

1) From basic physics I decided that the hand is too massive to make movements equivalent to those of the vocal organs at the speed of normal speech. This means that no manual system (such as phonemic fingerspelling) can convey the equivalent of the speech message at a normal rate.

2) I determined that slightly more than half the information in the speech message, in mathematical terms, is visible on the mouth. This does not mean that half the message can be perceived by seeing the mouth. It is analogous to the fact that the longitude of a location on the earth is half of the information needed to locate it.

3) I concluded that if I could design a system in which the hand provides the half of the information that is not available from the mouth, it might work. My calculations showed that the hand could carry that amount of information.

4) I decided that the information conveyed by the hand must be in a mathematical relationship to the information on the mouth making the combination equivalent to a double, two-dimensional matrix. In nonmathematical terms, the idea is that the identification of a group of look-alike consonants by the mouth, and the simultaneous identification of a group of consonants by the handshape, result in the identification of a single consonant, at the intersection of the two elements of the two-dimensional consonant matrix. Also, the identification of a group of look-alike vowels from the mouth, with simultaneous identification of a group of vowels by the hand location identifies a single vowel, as the intersection of the two elements of the two-dimensional vowel matrix. Thus, the combination of hand

shape and hand location, with the information visible on the mouth, identifies a single consonant-vowel syllable, the normal unit of speech.

Procedures Followed in Assigning Phonemes to Cue Groups in the Development of Cued Speech in its Original Form

The development of Cued Speech in its initial form was primarily for General American English, though phonemes used in various other dialects of American English were included. Subsequently, additional phonemes were added to accommodate Standard Southern British, Australian, Cockney, Scottish, Irish, Australian and New Zealand dialects of English, in the one system. Adaptation to other languages followed swiftly, among the earliest being Spanish, French and German, bringing the total to 48 languages and major dialects as of September 1989, and to 53 as of September 1992.

Compatibility among languages was an objective in all the adaptations, to the extent possible without diminishing the accuracy and effectiveness of the system in each specific language. For English, priority was given to accuracy of discrimination provided by maximum visual contrast on the mouth between phonemes grouped by a single cue, balance of frequencies of appearance of groups, assignment of most-used groups to the handshapes easiest to make, ease of change from one handshape to another in frequent consonant clusters, and other considerations. In the adaptations to other languages, the additional factor of compatibility among languages (for bilingual use) had to be considered along with the other factors listed. Accurate information on phoneme frequencies in some languages was not as readily available as in English. For this reason, and because there is a high degree of correlation in phoneme frequencies across languages (at least for the most frequent phonemes in western languages), compatibility was given a higher priority than phoneme frequency in languages other than English.

The primary factor in assignment of phonemes to groups associated with a single handshape or hand location was visual contrast on the mouth, within groups. Use was made of the data of Woodward and Barber (1960) on visual contrasts of initial consonants in English. The frequency data of Denes (1963) was used for balancing the groups as to frequency, and assigning the easiest and least tiring hand configurations to the most frequent groups of phonemes. Woodward and Barber computed an "index of contrast" between the members of each pair of consonants, ranging from 2.00 to -2.00. They rated those pairs in the range 2.00 through 1.44 as contrastive, 1.33 through .06 as similar, and .02 through -2.00 as equiva-

lent. In the original design, for English, I was able to arrange all the English consonants in groups in which the contrasts by pairs were all in the range 2.00 through 1.44, or contrastive, except one. Only one pair, /y/ vs. /ch/, has a contrast on the limit of the similar range. Later studies have confirmed that this pair is sufficiently contrastive for the vast majority of speakers, suggesting that the single speaker used in the Woodward and Barber study was atypical on this specific pair.

As reported in published studies (Nicholls, 1979; Nicholls and Ling, 1982), the basic Cued Speech system provides enough visual contrast (through the combination of the cues and the visual manifestations of speech on the mouth) to make it possible to read spoken language (through vision alone) at an accuracy comparable with that possible through normal hearing.

In my first attempt at design of Cued Speech, I grouped the phonemes by acoustic properties as well as visual contrast. The purpose was to make the system more useful in speech therapy by putting phonemes with a common phonetic characteristic (such as voice or plosion) together. Thus, I put /p/ /t/ /k/ (unvoiced stops) in one group, and /b/ /d/ /g/ (voiced stops) in another. The visual contrasts within these groups are not nearly as good as those achieved when I disregarded acoustic properties. As a result, my first design resulted in only 70% to 75% accuracy in the discrimination of consonant-vowel syllables. Incidentally, this pattern is essentially that followed in the AKA system developed in Belgium (for French) in an effort to make Cued Speech a better speech tool, which is the same idea I had in the beginning. At any rate, I found it necessary to give up grouping by acoustic properties to achieve the needed level of accuracy.

After assembling the consonants into groups designed for maximum average visual contrast within groups, I assigned each group to a handshape, choosing for the highest-frequency groups the handshapes that require least energy to execute. I then considered the frequency of appearance of consonant clusters, and the difficulties these might present in changing quickly from one hand configuration to another. For example, I deviated from the frequency/energy order of the groups in order to make it very easy to change from the handshape for /s/ and /r/ to that for /t/ (and the reverse). This made it easy to execute the /st/, /rt/, /rm/, /sm/, /tr/, and /ts/ clusters, some of which occur very frequently.

The grouping of the vowels was worked out similarly. However, I developed my own data on visual contrast for the vowels, and gave high priority to ease of cueing of the diphthongs.

The distribution finally chosen for English produces very high accuracy in recognition of CV syllables (Cornett, 1972), words (Nicholls, 1979; Nicholls and Ling, 1982), in discourse (Musgrove, 1985), and as reported universally by users of Cued Speech. Researchers on and users of Cued Speech in other languages have reported similarly (Périer, et al, 1987).

Recommended Resources and Procedures for Adapting Cued Speech to Additional Languages and Dialects

Resources

The following resources are needed for adaptation of Cued Speech to an additional language:

1) A good knowledge of the basic principles of phonetics, preferably including their application to two or more languages.

2) Access to an authoritative book (preferably several) on the phonetics and phonology of the target language.

3) The assistance of several native speakers of the target language, preferably with different dialects and degrees of sophistication.

4) A good cassette tape deck, for recording and studying speech samples, and for making audiocassette lessons, if their production is part of the project.

5) Ability to use Cued Speech accurately (not necessarily rapidly or fluently) in one language is desirable.

6) The application of several hours per day for several weeks, for completion of a trial adaptation, a like amount of time for writing and editing the lessons, and a similar period for recording and correcting the lessons. Additional time is required for evaluating and testing each trial version.

Procedures

The first step is to study the phonetics of the target language. It is not necessary to learn the language, but a modest degree of familiarity with common words is desirable. The ability to make all the sounds and accurately imitate the pronunciation of words is essential. Generally, this

will result in the ability to read the language aloud, slowly, with good pronunciation. Of course, being a native speaker of the language is a great advantage, though a native speaker must guard against thinking of his/her own dialect as preeminent.

The second step is to compile a complete list of phonemes of the target language. For the purposes of adaptation of Cued Speech the following simple definition of a phoneme can be used, though it lacks the rigorousness of formal (and very elaborate) definitions used by phoneticists: "A phoneme is a family of closely related sounds ordinarily thought of by native speakers as only one, and necessary as a distinct group in order to perceive differences in the meanings of words and phrases. For example, the various shades of the short **a** vowel in the English word **fat**, from that used by most Englishmen to the flat short **a** of southern Mississippi are all thought of as "short **a**," even though one is aware of the differences among them. Whether one uses the sound as made by an Englishman, or that used in the southern United States, the meaning of the word is the same. Thus, all the various shades of the sound of short **a** belong to the one phoneme, short **a**, and are the **allophones** that belong to the family of that phoneme. Cued Speech is a phonemic system. It does not distinguish between allophones within a phoneme, except in special cases that will be explained later. The test for determining whether two specific sounds belong to different phonemes is the existence of a **minimal pair**, a pair of words with different meanings that are identical except for the two sounds in question. For example, the existence of **fat** and **fit** affirms that short **a** and short **i** are different phonemes. Remember that we are considering only **sounds**, not spelling. Another example: In many languages the two vowel sounds in **pull** and **pool** are allophones, that is, they can be used interchangeably without changing meaning. In English they are separate phonemes, as is indicated by the different meanings of **pull** and **pool**. In English and German, the short **i**, as in **fit**, the sound of long **e**, as in **feet** in English, and **ie** in German (biegen) are separate phonemes. In most languages (Spanish, French) they are allophones, members of a single phoneme ranging in acoustic quality from short **i** to English long **e**, but all spelled as **i**.

A complete list of the phonemes of the target language can usually be obtained from a book on the phonetics of the language. However, it is necessary also to take note of allophones of various phonemes, in cases in which there may be reason for Cued Speech to distinguish between certain allophones. For example, in the 21 countries in which Spanish is the major language, there is great variation in the pronunciation of the word **yo**, which means I. In Castilian, the most prestigious dialect of Spanish, used widely in Spain itself and by some speakers in several of the countries of South

America (such as Columbia), the usual pronunciation of the consonant is that of **y** in **yes**. But, in Argentina and several other South American countries, and even by many speakers throughout Spain, the pronunciation is like **s** in **pleasure** and **vision**. In Puerto Rico, the prevalent pronunciation is like **j** in **Joe**, and many Spaniards use this pronunciation also. These three sounds are allophones; they can be used interchangeably without changing the meaning, and without causing confusion anywhere. There are two reasons for cueing these allophones differently in Spanish. The first is that their use is so much a matter of culture and pride in some countries that parents will want their deaf children to be able to distinguish and use the pronunciation preferred in that country. The second reason is that two of the three allophones (**zh** and **dzh**) are the same on the mouth, but the other one (**y**) is different. Thus, I designed the Spanish adaptation (on the advice of a committee of Spanish-speaking persons from six different countries) to provide for distinction among these three allophones. In most languages it will not be necessary to distinguish among allophones.

After a complete list of phonemes has been assembled, the next step is to group the vowels into groups assigned to the several hand locations, and the consonants according to the eight or so hand configurations. They must be grouped so that no group contains two phonemes that are too similar in appearance on the mouth. Usually, one begins by arranging the phonemes essentially as they are in English, and then making changes as needed. If in the target language the vowel **i** represents only a single phoneme (not **i** and **ee** as in English), the vowel arrangement of Spanish may be a better starting point.

When the list of phonemes is complete, and a trial arrangement is in place, three things should be checked. First, each group of vowels or consonants should contain at least two phonemes (preferably three), so as to follow the basic principle that the reader must use the information seen on the mouth separate the sounds within a group designated by a specific cue. Second, if there are only two phonemes in a group, one of them should not be a low-frequency phoneme, in order to prevent the cue being interpreted as a "sign" for a specific sound. Finally, a series of trial drafts of the arrangement should be made and tested. For example, in the writer's work with Dr. Anna Metlyuk and Dr. Nadezhda Evtchik, of Minsk, the goal was to produce a workable adaptation that accommodated both Standard Russian and Byelorussian. It was necessary to work through four successive trial drafts, over a period of months, to arrive at one that was as nearly satisfactory as possible.

The Timing Movements of Cued Speech

Cued Speech is a time-locked system; that is, the cues must be synchronized with the spoken sounds. Every cue is essentially a hand movement that is timed relative to the sound. The movements used include: 1) a movement from one location to another; 2) a change from one handshape to another; 3) a forward movement of no more than one inch in the side location, for syllables containing **ah** or **oe**; 4) a backward movement (in the case above) to the original location, but *only* when the next cue is also in the side location; 5) a downward movement in the side location, for the schwa (**uh**), ½ inch when it is unstressed, and up to one inch when stressed, 6) a return (upward) of the hand to the original location in 5), but *only* if the next cue is also in the side location; and 7) the *flick*, a small, ¼-inch movement forward and back, required in specific situations.

Movement of the hand from one location to another, and changes from one handshape to another, clearly indicate the timing of the voice-hand synchronized pattern. The time of arrival of the hand at a given location indicates the instant at which the next sound is to begin. The time the hand reaches a new configuration likewise indicates accurately when the associated sound begins.

The third type of movement listed, a forward movement of about an inch in the side location, to accompany the vowel sounds made in that location (with the exception of the schwa), is necessary to help indicate when the sound begins and how long it is continued. The fourth movement, the return to the original location after the forward movement, is required only when there is to be another cue in the same location.

The fifth movement, a very short movement downward in the side location, to accompany the neutral vowel (the schwa), is necessary if the schwa is used in the target language (and if it is placed in the side location, as it is in all the languages adapted to Cued Speech to date). The sixth movement, the return (upward) following the fifth movement, occurs if the next cue is in the side location.

The seventh movement, the flick, is used whenever the same cue is used twice or more in succession in the same location. For example, if one says and cues the word **meter**, cued 5 mouth, 5 mouth, it is necessary to move the tips of the fingers away from the corner of the mouth a very small distance (¼ in.) and replace it, between the two syllables. Thus, the hand touches at the corner of the mouth as one says **mee**, is moved away and

quickly back, and touches again as one says **tur**. The same movement occurs in the side location when the same cue is used twice consecutively, as in the word left, 6 chin, 5 side, 5 side flick. In the side location the flick movement is forward and backward. For a more detailed explanation of the timing movements, refer to Chapter 29, "The Fine Points of Cueing," in *The Cued Speech Resource Book for Parents of Deaf Children* (Cornett & Daisey, 1992).

Special Problems That May Be Encountered

In some languages certain acoustical characteristics of sounds, such as palatization, nasality (in languages having many nasal sounds), and aspiration, need to be indicated by supplementary aspects of the cues. For example, in the Czech language, the softening (palatization) of consonants is indicated by a tiny pronation (rotation forward on its axis) of the wrist as part of the cue. In the languages of India there are many cases in which two consonant phonemes differ only in that one of them is more strongly aspirated than the other. To keep from having more hand configurations than are feasible with a single hand, one can indicate aspiration in such cases by pronation of the wrist as part of the cue. In a language in which the difference between long and short forms of the same vowel is phonemic (changes the meaning), pronation can be used to distinguish the long form of the vowel from the short counterpart. There are other movements that can be used for similar distinctions.

In Standard Russian the existence of both palatized (softened) and unpalatized forms of many of the consonants caused the number of consonant phonemes to be so large that there had to be a choice between growing more fingers and finding a way to differentiate palatized consonants from their unpalatized counterparts without putting them in different groups. The solution, as in Hungarian, was to use pronation of the wrist (rolling it just slightly forward on its own axis) to indicate palatization.

If a language is tonal, that is, if changes in pitch can of themselves change the meaning of a word, variation in the angle of the hand (near vertical for high pitch, near horizontal for low pitch) can be used to indicate the tonal dimension in the phonemic structure of the language. This works very well in Thai, Igbo, Mandarin, Cantonese and other tonal languages.

Adaptations for Use in Two Languages

In many situations, there will be a need for an adaptation which will permit use of Cued Speech in two languages, the primary language of the

family, and a second language which parents wish to teach to their deaf child to some extent. This may be because of a heritage in the second language, because of relatives, because the family's immigration has placed them in an environment where another language is dominant, or for some other combination of reasons.

It is best to make special adaptations to meet such needs by starting with the basic adaptation for the primary language, and trying to add any phonemes of the second language not found in the first language, in cue groups in which they will be different on the mouth from those already included. Such adaptations will tend to be less efficient in the secondary language, but will serve the purpose for which they are intended.

Persons interested in use of cueing with a child in two languages should check with the writer, on the possibility that an arrangement for combined use in the two languages in question may have already been made.

Conclusion

With some languages the solutions of some of the special problems listed above may be very difficult to work out. The adaptation to Arabic was particularly challenging. Accordingly, persons who are attempting to adapt Cued Speech to an additional language may wish to seek assistance from the writer, who will be glad to be of help. The charts of phoneme/cue arrangements for several languages, illustrating some of the problems solved, may also be useful.

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Cued Speech and the Ling Speech Model: Building Blocks for Intelligible Speech

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Intelligible speech for profoundly hearing-impaired children has been shown to be a desirable and attainable goal (Ling, 1976). Levels of speech skills among profoundly and totally hearing-impaired children have been historically poor, even though totally deaf children can be taught to talk (Ling, Perigoe & Gruenwald, 1981). Cued Speech, a visible speech code system (Cornett, 1967), takes the guessing out of speech reading. Cued Speech can be used in conjunction with the Ling approach (Ling, 1976) as an aid to developing speech skills in profoundly and totally hearing-impaired children.

Cued Speech and the Ling Speech Model

Cued Speech and Ling's model for speech development are both organized and systematic. They are both ideal for use with profoundly hearing-impaired children. The goal of Cued Speech is to give the hearing-impaired child clear and precise spoken language **input**. The goal of the Ling speech method is to give the hearing-impaired child clear and intelligible spoken language **output**. Therefore, they are two sides of the same coin. One must concentrate on making the spoken language **output** of the hearing-impaired child as clear as his/her spoken language **input**. This concept is the true meaning of communication.

It is critical to remember that Cued Speech is not a speech teaching system. It merely provides visual cues that make it easier for the child with little or no hearing to speechread. It operates receptively to enable the child to "fill-in" the sounds and parts of words that are difficult to speechread. Examples of sounds difficult to speechread are: sounds made with the tongue tip right behind the teeth, such as /t, d, l, n/; sounds made at the back of the mouth, such as /k, g, ng/; blends and abutting consonant clusters within words and between words, such as /st, nd, dz/, etc.; and voiced/voiceless distinctions, such as /b/p, s/z/, etc. Cued Speech also

helps the child to distinguish between many vowels that can look alike on the lips or get lost in connected speech. Examples of vowels which can look alike on the lips are: long /ee/ vs. short /i/ or short /a/ vs. /ah/.

Children who use Cued Speech need a systematic approach, such as the Ling method, for learning speech because: (1) They usually have little usable residual hearing; (2) The use of Cued Speech can slow down both receptive and expressive speech, so there is a need to focus on natural speech production; (3) Teachers and parents tend to read the child's cues for expressive communication and tend not to listen to the speech production of the child.

Speech Development

The clarity of input provided by Cued Speech to the hearing-impaired child will have more value if the child's expressive spoken language is intelligible. It is difficult to tell a child he is incorrect when expressively both his language and cues may be perfect, yet the speech is unintelligible. It is for this reason that a speech program be instituted as soon as the child is diagnosed as hearing-impaired.

If the child is still an infant, there are many informal speech strategies (Ling, 1989; Ling & North, 1990) which can be used successfully along with Cued Speech. As the child gets older, more formal speech strategies can be used (Ling, 1976; Ling & North, 1990). Usually, by school age it is necessary to use a structured approach with formal teaching strategies. Many children at this late stage have already developed poor speech habits (i.e., poor voice patterns, poor voice quality, incorrectly produced consonants and/or inaccurate vowel production, etc.).

It is important for the child who has been identified late or who starts the Ling program after he/she enters school, to be trained to use Cued Speech accurately as soon as speech therapy is started. Cued Speech will aid the student in receiving accurate input and, if the system is known, can also be used initially by the student expressively.

The Ling model represents seven stages of development at both the phonetic (syllable) level and the phonologic (spoken language) level. Ling's order of teaching vowels and consonants is not designed to be developmental stages, though many are, but are designed specifically with the hearing-impaired child in mind.

Ling has written a structured set of subskills for the development of each voice pattern and speech sound (Ling, 1976). While Ling stresses the use of auditory input, he also provides many visual and tactile strategies which are appropriate for children with little or no hearing (Ling & North, 1990). These visual and tactile prompts are removed as the child learns to rely more on auditory and kinesthetic feedback.

Ling's seven stages of development can be divided into four major areas: (1) Voice patterns; (2) Vowels and Diphthongs; (3) Consonants; (4) Blends.

Voice Patterns

Variations in vocal duration, intensity (loudness) and pitch are the "personality" of spoken language. Prosodic and voice features are stressed initially and must continue to be practiced at every stage of development. Cued Speech can be used to communicate the importance of voice patterns.

Vowels and Diphthongs

Vowel development precedes consonant development and is ongoing as more difficult consonants emerge. The voice patterns "ride on" the vowels and diphthongs. It is impossible to produce adequate differences in duration, loudness and pitch without vocal manipulation of vowels (except with some unique consonants such as /m/ and /n/).

Three main vowels are taught first: /ee/ - front; /ah/ - mid; and /oo/ - back. They are then combined to produce the first two diphthongs: /ah-oo/ for /ow/ (as in cow); and, /ah-ee/ for /ai/ (as in pie). The same three vowels serve as the cornerstones from which all other vowels and diphthongs may be taught. In addition, vowels serve as the basis for the development of semivowels /w/ and /y/. Alternation of /oo-ah/ - /oo-ah/ will produce /wah/ and /oo-ee/ - /oo-ee/ will produce /wee/. Alternation of /ee-ah/-/ee-ah/ will produce /yah/ and /ee-oo/-/ee-oo/ will produce /yoo/. Cued Speech provides accurate input of the individual vowels, plus it visually illustrates the blending of the two vowels to form the diphthong or the semivowel.

Consonants

The Ling method is ideal for Cued Speech users who are first learning to distinguish consonant sounds on the lips. For the school-age child who may be learning Cued Speech late and has unintelligible speech, the use of

Cued Speech in speech training will be helpful. If the teaching of cues can be coordinated with the order of teaching speech sounds, it will be very beneficial. As Ling introduces consonants that are progressively more difficult to produce and less visible on the lips, Cued Speech will help hearing-impaired children to distinguish and identify these sounds accurately. It is important that the Cued Speech instructor teach the Cued Speech system accurately and quickly to these late comers to speech therapy, for optimal benefit of the two approaches.

Ling has demonstrated that simple consonants can be learned more easily if they are taught in a particular order. Consonants are divided into several steps. Step 1 consonant sounds are the most visible on the lips (except /h/). Step 1 consonant sounds /b/p, f/v, th, h, w, m, and final p/b/ teach **manner** of articulation. These visible consonants lay the foundation for correct consonant articulation and act as building blocks for later developing sounds. For example,

Step 1 --> --> -->	Step 2 --> --> -->	Step 3
b/p	d/t	g/k
f/v & th	s/z	sh/zh
m	n	ng

Steps 2 and 3 consonants teach **place** of articulation. Most Step 2 sounds are dental, (d/t, s/z, sh/zh, y, l, n, and final t/d). They are important in spoken language because many of these consonants, which appear frequently in English, are used in many morphological markers, such as verb endings and plurals. Step 3 consonants include back sounds that are difficult to see, (g/k, ng, final k/g) and sounds that are more difficult to pronounce (/r/ and /ch/). Step 4 consonants concentrate on teaching **voiced/voiceless** distinctions.

Blends

Once basic consonants are established in words, initial and final blends can be introduced as the student progresses to two or more syllable words and phrases. A coarticulation approach can be used at this point in the speech program to encourage naturally produced speech (Hudson, 1980). Cued Speech provides clear input for blends and for abutting consonants (when consonants are next to each other within a word or between words). Cued Speech help to avoid confusion and omissions of consonants in clusters and blends.

Carry-Over

To achieve carry-over the hearing-impaired child must transfer what has been learned in the classroom and speech sessions into real-life situations. Carry-over of learned speech skills into spoken language can be facilitated by Cued Speech because it is a total representation of the phonological system. The advantage of Cued Speech above other visual systems, such as fingerspelling or sign language, is that it presents intact to the hearing-impaired child both the grammar of English and its phonology (how speech sounds are distinct from one another and combine to make words). Unlike the printed word, used in many oral programs, Cued Speech represents the sounds of English, not the written symbols. This helps to eliminate some typical "deaf speech" mispronunciations such as "thumbuh" for "thumb." It also helps with the pronunciation of many irregular spellings in words, such as "ough" in:

through - long /oo/
though - long /o/
bought, thought - /ah/ or /aw/ (depending on the dialect)
enough - /uf/
plough - /ow/

To increase carry-over to spontaneous speech, structured carry-over activities should include a coarticulation approach for teaching phrases and sentences. Speech should be presented in natural phrases of at least two or more syllables rather than in isolated words. Speech and language goals should be combined so that practice can be more effective. This can be done by using morphological markers, such as "-s", "-ing" and "-ed;" function words, such as articles and prepositions (Perigoe & Ling, 1986); and common phrases used in the classroom and at home.

Daily practice of speech and oral language goals are important. The teacher or speech therapist should provide parents with follow-up activities for daily home practice which will reinforce learned skills. Carry-over activities can be designed to be fun as well as effective. Activities should be designed to practice learned skills and to provide more opportunities to use the new speech skills. Good speech production on the part of the hearing-impaired child must be reinforced by the listener, not merely with phrases such as "Good speech!" or "You said that correctly!" Instead, natural, real-life consequences of the child's verbal production should be the main reinforcer.

Because hearing-impaired children who use Cued Speech expressively can communicate effectively with parents, teachers and others who can read cues, their perception of their own speech may be over-rated. The student needs to take greater responsibility for his/her own speech and work on improving poor speech habits. Teachers and speech pathologists can help by using remediation strategies for speech errors common to profoundly hearing-impaired children (Calvert & Silverman, 1975; Ling, 1976, 1989; Ling & North, 1990; Perigoe, in press).

In addition, parents and teachers need to have high expectations of the child's speech. They should demand this high standard of speech and focus on the actual speech production and less on expressive cues as the student progresses through the Ling speech program. Instructors and parents should provide opportunities for the child to express himself without using Cued Speech expressively. Over time, the dependence on Cued Speech as expressive output can be diminished as the student's speech production improves. This can be part of the planned therapy session, the class lesson (i.e., answering questions, reading aloud, etc.), or the everyday interactions at home (i.e., at mealtimes, playtime, etc.).

Conclusions

Cued Speech can be a valuable speech teaching tool when working with profoundly and totally deaf children. It can be a facilitator in communicating speech objectives to profoundly hearing-impaired students. When properly implemented, Cued Speech can facilitate speech training, but it does not replace speech therapy. It is not a substitute for good speech teaching. An organized and systematic approach to speech teaching, such as the one provided by Ling, can be implemented with success with hearing-impaired children. The pairing of the Ling approach and Cued Speech can be a natural complement to the overall speech training program. In this way the Ling method and Cued Speech can work well together as the building blocks of intelligible spoken language.

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Accelerating English Acquisition and Reading Development In Total Communication and Aural/Oral Programs

R. Orin Cornett

It is a sad commentary on the education of children with hearing deficiencies that after more than two and one-half centuries of organized effort educators still worship at the altars of separate methods, when no one method is sufficient to meet all the needs of a single deaf child, much less the needs of all deaf children. I am using the term "deaf" to mean persons with a prelingual PTA threshold of 90 dB or more.

In 1888 Alexander Graham Bell (Gordon, 1892) lamented the fact that of the then-existing three broad varieties of methods of instruction—the oral, the manual (fingerspelling), and the sign methods—each aimed primarily at remedying only one of the misfortunes of the congenitally deaf child. These he identified as lack of speech, lack of knowledge of written language, and lack of mental development which comes from intercourse with others. He affirmed the effectiveness of each of the approaches in remedying one of these misfortunes, but recommended taking what he called the *resultant* path, striving to solve all three problems through combinations of tools used within a single program.

Today the situation remains the same. Oral educators are now further divided into advocates of aural/oral, auditory-verbal, and cochlear-implant camps. Those who use the slogan Total Communication give lip service to speech and hearing, and include fingerspelling and the teaching of written language. The tragedy is that the results have not changed significantly in the last century.

The fact that both Total Communication and aural/oral methods have failed to produce acceptable levels of proficiency in English and reading is amply documented (Geers, Moog and Schick, 1984; Commission on Education of the Deaf, 1988). In fact, if one drops the designations Total Communication and aural/oral, and refers only to the manual, oral and combined methods dating back to the nineteenth century, the available data

are appalling. Pintner and Patterson (1916) reported that the median scores of deaf students at any age never reached the median for hearing children eight years old. Studies 70 years later (Allen, 1986) showed the level of performance to be essentially the same.

The dismal results cited above do not imply that the basic concepts of either Total Communication or aural/oral methods are necessarily wrong, or that either should be replaced. They do suggest that something is missing in each of them. The basic strength of Total Communication lies in the easy, clear communication it produces among deaf children, between them and deaf people generally, and with hearing persons who learn enough signs to use English-pattern signing with deaf people who know both signs and basic English. The weaknesses of Total Communication lie in its failure to produce adequate English acquisition and reading development. The basic strength of aural/oral methods is that they teach and use language in the form known and used by hearing persons, including most parents of deaf children. Their weaknesses also lie in failure to produce adequate rates of English acquisition and reading development in profoundly deaf children.

Bell (Gordon, 1892) stressed four things: 1) the learning of language through an input clear to the child's senses; 2) leading the child to think in the language being learned; 3) the learning of language by using it for communication, without translation into any other language; and 4) the deferring of speechreading until a solid base of verbal language has been acquired. He stressed that these things can be accomplished only by using a combination of instructional tools and methods. He recommended that a deaf child learn English through written language, but only because no method of making spoken English clear, face-to-face and in real time, existed in his time.

What both Total Communication and aural/oral methods need is an additional tool that will make it possible to produce acceptable levels of competence in English and reading in most prelingually, profoundly deaf children. This paper suggests the addition of Cued Speech to the conventional methods, and asserts that it is capable of accelerating English acquisition by presenting English in a visually clear form, useable face-to-face for natural communication. Cued Speech can be used within the context of either a Total Communication philosophy or an aural/oral philosophy, without detracting from the advantages of the methods that presently characterize them.

Dr. Edward C. Merrill, Jr. president of Gallaudet College from 1969 through 1983, wrote as follows in the *Deaf American* monograph, *Perspectives on Deafness:*

> Twenty years later, Cued Speech has substantial data showing that it enables deaf children to attain competency in English at the level of hearing students grade by grade. I know of no other system that enables this to happen—not oral, not combined, not ASL (although the argument here will be that it has not been tried consistently)....I do not predict often, but in this case I predict that the success of this system will present a "moment of truth" for the deaf community. As more and more young deaf persons achieve academically because of this system, deaf leaders will need to re-examine their options. (1991, 95-97).

I shall first describe a model for utilizing Cued Speech within the context of a Total Communication philosophy, then a model for its use within the context of an aural/oral philosophy. I will present the results of research that supports the conclusion that Cued Speech can, within either philosophy, secure the results in English acquisition and reading development that have thus far eluded both Total Communication and aural/oral programs, for the majority of children with a congenital or prelingual severe-to-profound hearing deficiency. I prefer the term *hearing deficiency* or *hearing deficit* because the terms *hearing impairment* and *hearing impaired* suggest that hearing existed and was impaired, which may not be the case. My awareness of this weakness in our terminology dates from being commissioned to make several presentations at a 1986 international symposium in Cartagena, Spain, sponsored by the Congreso Hispanoamericano de Associaciones de Padres de Deficientes Auditivos, that is, the Hispanoamerican Association of Parents of Auditory Deficients, or children with auditory deficiencies. It struck me that their terminology is much more appropriate than our use of terms such as *hearing impaired* and *hearing loss* in referring to children with congenital hearing deficiencies rather than acquired hearing deficits.

Cued Speech Within the Context of Total Communication

Reasons for Total Communication Problems

There are at least three reasons why Total Communication programs do not produce adequate rates of English acquisition and reading development. First, signs do not, of themselves, teach English words. In fact, it is impossible to teach an English word to a child through signs. Suppose

the mother of a deaf child gives him or her, each morning at breakfast, a glass of that wonderful white liquid that comes from a cow, and identifies it with the appropriate sign. The child quickly learns to associate the sign with the substance. He/she can soon indicate that it is good, and ask for more. At this point, however, the child does not associate either the written word or the spoken word with the liquid. In order to teach the word, the mother or teacher must stop signing and either write or fingerspell m-i-l-k, or must teach the spoken word laboriously through many repetitions of the aural/oral input.

The implication of this situation is not that English words cannot be taught in Total Communication programs, but only that every word *must* be taught, through an interruption in communication. Children using signs learn signs easily through communication, without interruption in the communication. Hearing children, and deaf children with whom Cued Speech is used, learn *words and phrases* through uninterrupted communication. This makes English acquisition much faster and more natural.

The second problem in conventional Total Communication programs is that hearing parents of deaf children in those programs typically do not keep up with their children in signing. Fewer than five percent of such parents keep up with their signing children to the age of seven. My conversations with administrators of large Total Communication programs reveal that the majority of them agree that most hearing parents are unable to contribute significantly to their children's language acquisition or their knowledge of the world. Thus, the most under-used potential in Total Communication programs is probably that of the hearing parents. This is tragic, since abundant research results are available to show that the home is the best language development laboratory for young children.

The third problem in conventional Total Communication programs is that signed communication, though clear and satisfying, does not cause English words to happen in the mind. Thus, though the time spent in communication can be enjoyable and mind-expanding, it does not develop the ability to think in English. This being true, when are English words to become familiar and easy to use?

Before I went to Gallaudet as Vice President for Long-Range Planning in 1965, I was puzzled by three questions about signing programs: Why do most of the deaf children not become good readers? How are the deaf children expected to learn English? Why do the teachers sign and speak at the same time? By the time I reached Gallaudet I had, in my opinion, found the answers to the first two questions, but not to the third. One of the first

things I did during my first two years was to visit many schools for the deaf. During those visits I interviewed 400 children in Total Communication programs, in groups of 10 to 50, in an effort to find out what happened in their minds when I signed and spoke to them simultaneously. To each group I explained that I wanted to communicate with them and ask them what happened in their minds. Then I made quote signs in the air, and signed and said: "I want you to work on your *notebook* now." I first asked: "Did you understand me?" All did. Then I asked: "As I communicated to you, in your mind did you hear the words I said?" All answered in the negative. "In your mind, did you say the words?" All replied negatively. "Did you see the words?" Seven said yes, 393 said no. "Which words did you see in your mind?" All seven said: "notebook." That was the only word I did not sign. I had fingerspelled it, delivering a clear code for the written word. My final question was: "Did you write the words in your mind? All replied negatively. What did I learn from all this? I had identified all four of the ways in which a person can think English words in response to receiving them: by hearing them mentally, saying them mentally, seeing them mentally, and writing them mentally. My conclusion was that speaking while signing does not cause the English words to happen in the mind. Then why do signing teachers speak when they sign? What is accomplished by doing it? The reason they do it is that they want the children to speak as they sign, that being the only opportunity the teacher has to learn whether the child is progressing in ability to speak.

In 1978 I wrote to 13 deaf teenagers who had grown up with Cued Speech, asking them to tell me what happened in their minds when they think. Eleven wrote back, using the identical words: "I hear myself talking." Another, who has no measurable hearing, wrote: "I feel myself talking." The other one, the most oral of the group, replied: "I see the words." All were reported by their parents to talk in their sleep. All confirmed that in their dreams they could lipread everyone perfectly, and everyone could understand their speech. These young people all think in the spoken language and use it as their base for reading.

Bell quoted Delgarno's suggestion "...that a deaf person should be taught to read and write in as nearly as possible the same way that young ones are taught to speak and understand their mother tongue" (Gordon, 1892, p. 38). He described Delgarno's idea as being "...that we should talk to the deaf child just as we do to the hearing child, with the exception that our words are to be addressed to his eye instead of to his ear." Of course, Delgarno was talking about conveying the written language through his manual-alphabet code. Cued Speech conveys the *spoken* message through vision, making Delgarno's idea apply to spoken language.

Advantages of Using Cued Speech in the Home

I claim three significant advantages for the use of Cued Speech in the home by hearing parents, and limited use of it in school for speech-and-hearing instruction, for introduction of new vocabulary and language patterns, and even in teaching high-verbal subjects, as confidence in its benefits grows.

First, the consistent use of Cued Speech by hearing parents in the home, as specified in the model, typically results in English acquisition rates and ultimate reading levels far superior to those achieved with other methods and, indeed, comparable to those of hearing children. As we look at research evidence, consider first the evidence that use of Cued Speech at home is much more important than its use at school, as users of Cued Speech have observed.

Hage, Alegría, and Périer (July, 1989) presented a study showing that children who receive Cued Speech both at home and in school demonstrate the greatest gain in performance over lipreading alone; that those who have Cued Speech only at home perform only slightly lower; and those who have Cued Speech only at school perform much lower. Use of Cued Speech at home is much more important than use at school.

Next, let us examine some of the evidence that profoundly deaf children can really learn and understand English through Cued Speech. Nicholls (1979) revealed that 18 prelingually deaf (ranging from 97 dB PTA to 122 dB) children at St. Gabriel's School (NSW), aged 9 to 16 years, scored 96% on key words in cued sentences, without sound. Thus, she demonstrated that Cued Speech is clearly and accurately readable to deaf children who have had at least three years of Cued Speech experience. Nicholls' study was the only important research evidence at the disposal of Cued Speech advocates until about 1985. It was summarized in a journal article by Nicholls & Ling (1982).

Perhaps the most striking evidence of the ease with which deaf children learn new language through Cued Speech is contained in a study of 11 children carried out by teachers and parents in 1991 in several states, following my design. The results are summarized in *The Cued Speech Resource Book For Parents of Deaf Children* (Cornett and Daisey, 1992). The eleven subjects, all of whom had received Cued Speech for several years in the home, were given a baseline test on 20 unfamiliar words in Spanish. They were tested first on auditory recognition, then on lipreading with sound, and then with Cued Speech. In the test they were asked to

identify the correct picture from a group of four of the pictures. They scored slightly below the chance level of 25%, since the words were totally unknown to them, and some of them were reluctant to guess. Then, they were taught the 20 Spanish words in 45 seconds each, with Cued Speech. There were three exposures of 15 seconds each, distributed over a period of 8 days. Each word was spoken and cued, and the associated picture was presented. Next, the test was repeated to determine the effect of learning the words through Cued Speech. The second test was identical with the baseline test administered before the words were taught. Each word was spoken with mouth covered, and the subject was asked to select the correct picture from a group of four of the pictures that had been used in the teaching process. Then each word was tested with mouth visible, and finally with Cued Speech. The results are given in Table 1. They show the dramatic effect of being taught the words with Cued Speech on their ability to recognize the Spanish words through audition alone, through lipreading with sound, and through Cued Speech, after learning the words in three short exposures to each.

Analysis of Data

The data presented in Table 1 indicate the levels of confidence with which the null hypothesis can be rejected, for the differences of the means on the two administrations of the same test, for audition, lipreading, and Cued Speech. The probabilities that the improvements were the result of chance, rather than of having learned the words through Cued Speech, were less than 0.005 for audition, 0.001 for lipreading, and 0.001 for Cued Speech. The confidence levels were derived from repeated-measures, paired-sample t-tests.

The scores on the second test (labelled the pretest) show that the process of learning the Spanish words through Cued Speech prepared the subjects for unisensory auditory and aural/oral identification to a very significant degree, increasing performance over the baseline test by 74% and 162%, respectively. The scores on the Cued Speech presentation suggest that the time spent teaching the Spanish words should be increased to one minute instead of 45 seconds, with four exposures rather than only three, in order to secure Cued Speech recognition scores near 100%. This will be done in the next study, which will include more cochlear-implant recipients. Two of the 11 subjects in this study, A and G, use cochlear implants. PTA thresholds for the other nine ranged from 86 to 113 in the better ear, averaging 99.7 dB. Note that of the 11 subjects one of the two implant

Table 1

Scores on 20 Spanish Words
Auditory, Aural/Oral and Cued Speech Inputs

Subjects PTA	Baseline	Pretest	Posttest
A Implant	5-4-5	9-6-13	13-15-17
B 98	5-3-1	4-11-18	10-13-16
C 105	6-2-5	11-14-15	14-14-17
D 95	6-5-3	8-9-15	12-16-19
E 105	4-4-4	8-11-13	12-17-18
F 103	5-5-9	11-14-16	8-18-20
G Implant	4-8-4	14-18-20	18-20-20
H 113	3-5-4	7-9-10	9-19-20
I 87	6-4-3	9-15-15	14-17-20
J 86	2-2-3	5-5-3	14-19-20
K 105	5-3-4	3-6-6	6-20-20
Means 99.7	4.64-4.09-4.09	8.09-10.72-13.09	11.82-17.09-18.82
Δ		3.45-6.64-9.00	3.73-6.80-6.36
s.d.		3.24-3.59-5.25	2.90-4.94-6.28
t		3.54-6.14-5.68	4.26-4.35-3.36
P<		.005 .001 .001	.005 .005 .005

users showed the greatest improvement in use of audition from the Cued Speech exposure, though his intellectual ability tests within the average range.

English Acquisition

We will now examine the additional evidence that exposure to Cued Speech produces rapid learning of English. Berendt, Krupnik-Goldman and Rupp (1990) reported that on the Rhode Island Test of Language Structure, their 36 Cued Speech subjects ages 5 to 16 years averaged at the 92nd percentile of the hearing-impaired children their age on whom the RITLS was normed. On the Developmental Sentence Score, the expressive measure, Berendt et al. found that the Cued Speech children produced correctly an average of 36.5 out of 50 sentences, a result comparable to that of hearing children.

Peterson (1991), on the basis of data on 36 children, 5 to 11 years old, evaluated at the Houston Ear Foundation, reported that the children receiving Cued Speech surpassed the majority of signing and oral children in verbal language skills. Peterson's 11-year background was in Total Communication.

Table 2

Verbal Language Skill Performance

Communication Method	Question Test	EOWPVT	MSEI
Cued Speech	6/7 (86%)	4/5 (80%)	5/7 (71%)
Oral/aural	1/8 (13%)	2/9 (22%)	1/9 (11%)
Signed English	3/18 (17%)	2/20 (10%)	1/20 (5%)

The data collected were from three tests: an informal question test, the Maryland Syntax Evaluation Instrument (MSEI), and the Expressive One Word Picture Vocabulary Test (EOWPVT). Of the 36 children scored, 20 customarily received some form of signed English (most SEE-2), seven Cued Speech, and nine the speechreading (oral/aural) approach. Since the EOWPVT was normalized on children through 11 years old, older children

were not included in this study. Table 2 presents the results tabulated for those children who met the following criteria on at least one of the three measures:

1. Answered the question forms with at least 85% accuracy;
2. Formulated at least six perfect sentences (of 10) on the MSEI; and
3. Achieved at least the 20th percentile on the EOWPVT.

Reading Development

Wandel (1989) reported that, on the 1982 reading sub-test of the Stanford Achievement Test, carefully matched groups of profoundly deaf Cued Speech children and hearing children scored at statistically equivalent levels. Oral and Total Communication groups scored much lower. She used four groups of 30 subjects each, carefully matched.

Alegría, Dejean, Capouillez and Leybaert (1990) on the basis of sophisticated research procedures, reported that Cued Speech develops in a deaf child an internal phonological model of the spoken language equivalent to that of hearing children. They concluded that:

> 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 representations. This allows the use of phonological coding to identify unfamiliar words and, as said before, can prime the whole process of reading acquisition. (p. 8)

Their conclusion implies that the child who can identify written words the first time he sees them (if they are in his internal phonological lexicon) can quickly become an *autonomous* reader.

In the same paper the authors reported on the first of a series of studies they have planned on the effects of Cued Speech on mastery of grammar. This report was on the effects of Cued Speech on mastery of grammatical gender in the French language, which the Cued Speech subjects had mastered. They point out that it is generally conceded that this is a feature to which deaf children have limited access through traditional oral methods.

The presently under-utilized potential of hearing parents can become a major aid to success of Total Communication programs in English and

reading acquisition through their use of Cued Speech at home. In addition, their use of Cued Speech in the home can produce a normal, communicating atmosphere, with resultant family relationships similar to those in families in which the parents are deaf. Such a situation can be in direct contrast to the presently typical pattern of simplistic communication with the deaf child in an otherwise hearing family.

Freedom for Increased Benefits from Signed Communication

Through this model for use of Cued Speech within Total Communication programs, signed communication is freed from the burden it typically carries inappropriately and unsuccessfully, that of teaching English. Signing can then be used most effectively and naturally for what it is best for: communication, explanation, stimulation, social development, and general learning. After the model has been followed for two or three years, if English acquisition and reading are showing hoped-for gains, educators in a Total Communication program can make an unhurried decision as to whether they wish to move into ASL/English bilingualism, phasing out Signed English, or whether they prefer to continue with what they have. If the decision is to move to ASL, this can be carried out with relative ease, without abrupt changes. They can also give careful consideration to the advisability of increasing use of Cued Speech at school to include instruction in high-verbal subjects such as language arts and social studies.

The practicability of a move to ASL/English bilingualism is supported by 13 years of experience in achieving BSL/French bilingualism in L'Ecole Integrée and Centre Comprendre et Parler, in Brussels, Belgium. This program was described in a paper delivered by Olivier Périer at the International Congress on Education of the Deaf in 1985 (paper published in 1987) in Manchester, England. In the preschool of the Centre Comprendre et Parler, everything is taught in both Cued Speech and Signed French. As the children approach first grade, in L'Ecole Intégrée, the teachers stop using Signed French and begin providing exposure to deaf role models in Belgian Sign Language. They conduct class work in Cued Speech in French and instruct the parents to use only Cued Speech at home. The authors reported no serious problems in making the children bilingual in Belgian Sign Language and spoken/written French. They also showed that Cued Speech in French is clearly readable, as Nicholls did for English. When the students reach the age of 12, they are taught a third language, Flemish, through Cued Speech.

The Role of Hearing Parents in the Total Communication Model

In this model the role of hearing parents is to do what they can do best, and what comes naturally to them. They can use the language they already know and can deliver it in a form that is clear to their deaf children. The child then learns English the way hearing children learn it, through natural communication in the course of living, with a maximum of interaction and a minimum of teaching. Consequently, the problem is only for hearing parents and siblings to spend enough time with the deaf child, allowing and encouraging the child to participate fully in the activities and communication of the home. Participating fully is possible only through knowing what is happening, and being able to interject one's own personality. Only one simple tool is needed to assure this—Cued Speech. Most hearing parents can learn the basics in a one-week workshop, and then continue to practice each day after they start using it with their child. Even while they are slow at cueing, parents can express anything they know in English.

After learning the basic system in 10 to 20 hours, parents have no more lessons to take. They can profit by taking advantage of intermediate and advanced instructional opportunities, but many proceed to proficiency on their own. As they continue increasing their cueing skill, their primary task is to use this means of communicating consistently with their child, making extensive use of new experiences and situations that bring up new language, without limit.

Recommended also for use by hearing parents of children in Total Communication programs is the Auditory/Visual Model for maximum enhancement of skill in use of audition. It is described below. There is no reason why a Total Communication program should not live up to its name and produce persons capable of communicating orally, or through signed communication, at will.

Use of Cued Speech in Oral Programs

The most significant advantages of Cued Speech can be obtained with only minor changes in procedures followed at school in an aural/oral program, an auditory/verbal program, or with children using cochlear implants. Consistent use of Cued Speech at home by hearing parents is the most important feature, designed to accelerate English acquisition. At school, new language should be taught initially with Cued Speech. In addition, both parents and therapists should make use of the Auditory/Visual model for enhancement of auditory skills.

The Auditory/Visual Model

The Auditory/Visual Model was designed by Cornett and Walker in 1989 to increase development of skill in use of audition. The rationale for it is based on two basic assertions. First, English acquisition is very inefficient and slow, for most profoundly deaf children, if the children are expected to learn new words and patterns through aural/oral input. A good command of spoken language is essential for maximum use of audition in communication. Second, skill at auditory and auditory/oral recognition of new language is developed most rapidly when the child knows the target, that is, when the new word or pattern is either introduced in Cued Speech before auditory/oral exposure to it, or it is clarified through Cued Speech immediately after the exposure. Auditory and aural/oral practice should, insofar as possible, be carried out with familiar language, already learned through Cued Speech. In the recommended model, this practice is followed both at home and in therapy at school.

The experiment involving the teaching of 20 Spanish words to 11 deaf subjects was conceived and carried out to evaluate the auditory/visual model recommended for aural/oral programs. The baseline and pretest data presented earlier were relevant to the Total Communication model, since they demonstrate the effects of learning new language through Cued Speech, on ability to recognize that material through auditory and aural/oral inputs, without any actual training other than the learning of the words through Cued Speech. The final step in the experiment was to evaluate the effects of the auditory/oral training procedure recommended in the model, for use by hearing parents at home. The training protocol involved a total of about 5½ minutes per word over a period of eight days. After the training the post-test was administered, following exactly the same procedures as in the baseline test and the pre-training tests. In summary, the baseline test was to establish that the children had no familiarity with the 20 Spanish words; the pre-training test was to evaluate the effect of learning Cued Speech on ability to recognize the words through audition, aural/input, and Cued Speech, respectively; and the identical post-training test was to evaluate the effect of the coordinated training procedure on ability to recognize the words through each of the inputs.

Training Procedure A of the experimental study involved first presenting each picture and giving the word in Cued Speech, then asking the child to repeat it. Next, the same word is repeated aural/orally without cues, the picture is shown again, and the child is again asked to repeat it. Finally, the word is presented through audition alone, the picture is shown and child is asked to say the word again. This procedure, Training

Procedure A, is repeated for each of four words. Notice that the progression is from easy to difficult: Cued Speech, then lipreading with audition, then auditory-only.

Training Procedure B is carried out on the same four words. In Procedure B the first word is presented through audition alone. The child is then instructed: "Show me _____." and is allowed to choose from four pictures, one of which is the correct one. If he selects the correct picture he is directed: "Say _____." If he selects the wrong picture, the word is presented with the mouth visible, and the child is then asked again to identify and say the word. Finally, the word is presented in Cued Speech and the child is asked to identify the word and say it. Notice that the progression in Training Procedure B is from difficult (unisensory) to intermediate (aural/oral) to easy (Cued Speech).

The training phase of the project was carried out in a total of 108 minutes (under 5½ minutes per word) spread over a period of eight days. The children were then given a post-test identical with the baseline and pre-training tests. This test reflected their progress in unisensory and aural/oral identification of the 20 Spanish words as a result of the training procedures. The results of the three tests appear in Table 1.

Discussion of Results

The data in the last line of Table 1 indicate the levels of confidence with which the null hypothesis can be rejected, for the differences of the means on the pretest results versus the corresponding baseline test results, and on the means of the post-test results versus those of the pretest. The probabilities that the mean pretest gains in unisensory, aural/oral and Cued Speech decoding are due to chance, rather than being taught the Spanish words, are less than 0.005, 0.001, and 0.001, respectively. The probabilities that the further gains in unisensory, aural/oral and Cued Speech decoding on the post-test were due to chance, rather than to the training protocol, are all less than 0.005. Confidence levels were derived from repeated-measures, paired-sample *t*-tests.

The scores on the pretest show that the process of learning the Spanish words through Cued Speech prepared the subjects for unisensory and aural/oral identification to a very significant degree, increasing performance over the baseline test by 74% and 162%, respectively. The effectiveness of the training procedure is shown by further improvements in unisensory and aural/oral identification of the words on the post-test, of 46% and 59.4%, respectively, in comparison with the pretest performances. Unisensory

performance on the post-test could probably be increased by increasing the amount of coordinated training to somewhat more than 5½ minutes per word.

The room for gain in Cued Speech performance on the post-test was not anticipated. It was expected that performance with Cued Speech would be near perfect on the pretest, since all four subjects in a 1989 pilot study scored 100% with Cued Speech on the pretraining test on both aural/oral and Cued Speech decoding, and 79% with unisensory input. However, the four subjects in the pilot experiment were all accustomed to auditory training with Cued Speech. The results with 11 subjects suggest that the time spent teaching the Spanish words should be increased to one minute instead of 45 seconds, with four exposures rather than only three. This will be done in the next study, which will be on cochlear-implant recipients. Two of the subjects in this study, A and G, use cochlear implants. PTA thresholds for the other nine ranged from 86 to 113 in the better ear, averaging 99.7 dB.

We know of only one published study on the effects of Cued Speech on use of residual hearing. Charlier and Paulissen (1986) summarized:

> 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 Cued Speech was able to support in them a better phonetic discrimination through audition. (as quoted in Cornett, 1990, p. 83)

Summary

No single method—Total Communication, auditory/verbal, aural/oral, or Cued Speech, is adequate to meet all the needs of a deaf child, much less of all deaf children. Their needs should be meet through the use of a combination of instructional and communication tools that complement each other and address all his/her needs.

Both Total Communication and oral methods are inefficient in producing acquisition of verbal language and in reading development, for a majority of profoundly deaf children. Verbal language and reading comprehension levels have not improved significantly in the last 100 years. Both Total Communication and oral programs need to include appropriate use of Cued Speech to meet these crucial needs.

The potential of hearing parents of children in Total Communication programs is sadly underused. Their contribution to the development of their

deaf children is woefully less than it could be if they used Cued Speech at home.

Development of skill in use of audition and in speech production can be enhanced substantially, in both Total Communication and oral programs, through the appropriate use of Cued Speech, as outlined in the training procedures of the aural/oral model.

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An earlier version of the previous paper was presented at the convention of the Texas chapter of the Alexander Graham Bell Association for the Deaf, Austin, Texas, October 2, 1993.

Why Johnny Can Read

Barbara Caldwell

Research indicates that profoundly deaf students with experience in Cued Speech read on the same level as their hearing peers (Wandel, 1989); and speak correct sentences as often as hearing children (Berendet, Krupnik-Goldman & Rupp, 1990). Deaf users of Cued Speech also surpass the majority of other deaf children in tests of language comprehension and expression (Peterson, 1991).

Language comprehension and expression precede reading in normally hearing children; and both infer a prereading base of linguistic, experiential, and cognitive skills which are typically lacking in the deaf child (King & Quigley, 1985). Most deaf students graduate from high school reading on the fourth or fifth grade level, in spite of consistent evidence and agreement among educators and psychologists that deaf and hearing people have equal cognitive and intellectual ability (Furth, 1966; Moores, 1978; Quigley & Kretchmer, 1982).

Given this situation, two questions emerge. First, why should the majority of students exposed to Cued Speech reach English reading and writing skills levels attained by relatively few profoundly deaf students? And, second, does Cued Speech provide access to information necessary for reading according to current reading theory and research? These questions can be addressed in the research literature of a number of education-related disciplines.

The studies and essays reviewed here are from general education research, investigations in the area of learning disabilities, and studies in deaf education. While not exhaustive, they have the potential to explain the Cued Speech connection with reading and may, because of that, appear to reflect an opinion in "the great debate" in general education reading. This apparent bias is not deliberate but comes out of the search for a logical link between the Cued Speech approach and what is known about the reading process.

Popular debate on the value of phonics in reading followed publication of the best seller *Why Johnny Can't Read: and What You Can Do About It*

(Flesch, 1955). Flesch attacked what he called the "look-say" method of reading instruction. His work was criticized by academic researchers as unsupported by scientific study.

The academic debate began in earnest when *Learning to Read: The Great Debate* (Chall, 1967) appeared on public library shelves. Chall published the results of a number of studies on the effects of phonics instruction on early reading and, conversely, on the results of the lack of such instruction. Her work eventually demanded the attention of the research community; and hundreds of studies followed, with conflicting articles and reports documenting the debate.

Journal literature appeared to shift subtly after Stanovich's (1986) analysis of work in the field. His critique of experimental design and methodology in reading research and his insightful analysis of the work that had been done, may have engendered greater caution in the discussions and conclusions drawn from research results.

Reading Research: Models and Theories

Theories of the reading process and their reflective models currently fall into three categories: bottom-up, top-down, and interactive. Bottom-up, very simply, refers to letter recognition, phoneme awareness, or word recognition. Those who support bottom-up theories posit that reading has to do with recognizing words and subsequently attaching meaning. The phonics component is strong here because "recognizing" the printed orthography, coming to know it as a matched word in your spoken lexicon, or decoding, is the prerequisite to getting meaning from the text.

Top-down theorists approach orthography as shapes of characters and words that take on meaning as they are used in an ever-expanding visual lexicon. The young reader has a dictionary of sight words and makes educated guesses about unknown words by using syntax, semantics, and prediction. While certainly simpler than the modern researcher would describe the process, this explanation generally corresponds to what is known as the "whole language approach" to reading. Some whole language advocates believe a phonological connection is made by early readers and then abandoned as unnecessary when they become skilled readers. Others believe a phonological connection is made when the word becomes clear through contextual clues. They place the phonetic component at the end of a graphic model of the process.

Interactive model proponents suggest that both word recognition and context contribute to the process and that one influences the other. Some models suggest the possibility of the early, or bottom-up, components influencing the later, skilled, or top-down, components. Since Stanovich's 1986 review of the research, the interactive model has gained acceptance as the most likely schemata.

Over time, models of the reading process have evolved from simple flow charts that either emphasized the phonetic component or discounted it, to complex interactive designs that include all components, though not always at the same place in the reading process nor with the same emphasis. Under the influence of behaviorists, graphic representations of the reading process previously included only observable phenomena. Now, advances in the cognitive sciences and the advent of computer information-processing models have resulted in complex flow charts. They typically begin with eye contact on the text and progress through letter recognition, phonemological coding, short and long-term memory storage, and semantic and syntactical manipulation--all leading unilaterally or multidirectionally to a decision known as comprehension.

The inclusion of phonology in this process may seem obvious and essential, but the fact that not all spoken languages are closely related to their written orthography raises questions. In comparisons among languages, Chinese characters probably bear the least relationship to the spoken dialects of Chinese of any orthography; and written Korean probably resembles its corresponding spoken language more than any other orthography. English is closely connected, but not precisely, to its written form. Clearly, it is possible to ignore the spoken language and learn to read. Most educators agree, however, that the process is facilitated by the phonological connection, depending on its richness.

Hearing speakers of English access the written lexicon more or less through the phonological connection--more, if they have an awareness of letter-sound correlations and phonemic segmentation, and if they are reading unfamiliar words; and presumably, less, if they learned to process text through syntactic, semantic and experiential clues.

The current debate may be, in the final analysis, whether top-down reading is compensatory to phonologic decoding or bottom-up reading is compensatory to whole language skills.

Cued Speech

Cued Speech is a speech-based code. It is a phonemically-based hand supplement to speechreading comprised of eight handshapes to represent consonant sounds and four positions about the face that represent vowel sounds. Combined with the information available on the lips, the cues make spoken phonemes visible to deaf readers of the system. Cueing to a deaf child, then, would be analogous to speaking to a hearing child. Rather than presenting one-on-one, letter-by-letter representations of written words, the cuer presents the equivalent of sounds, leaving intact the ambiguities present in spoken communication between hearing people.

For example, if the sender communicates with dactylology (fingerspelling), manually spelling "two," the receiver almost directly accesses the written lexicon. If a sender cues to communicate, however, the receiver has to decode the phoneme, recognize the word in its spoken form, then consult contextual clues to determine which of three like-sounding words is meant. Consulting the cognitive linguistic manipulator--most likely in the left hemisphere--to determine which similar-sounding phoneme was presented, is common in such instances to both hearing and deaf receivers.

Clearly, dactylology (fingerspelling) may be an attractive vehicle for teaching English reading and writing to deaf children. Indeed, some deaf adults recommend using it for that purpose; and they have had support from professionals in the field of deaf education (Moores, 1970). Their rationale points to the difficulties posed by ambiguities in the spoken language that challenge young hearing readers.

One could argue that ambiguity should be eliminated for deaf children; but, recognizing their cognitive and intellectual ability as equal to hearing children, replicating the development of language experienced by hearing children would, logically, achieve the same results. Based on the little that is actually known about the development of the hemispheres, the process of linguistic manipulation and interpretation encountered by hearing children likely enhances the development of other cognitive skills. Teachers of mathematics at Gallaudet University's School of Preparatory Studies have begun to study the approach of deaf students to problem solving from this linguistic perspective. Modern cognitive explorers would need to study the effects of direct access to the written lexicon through dactylology to know whether it slows or alters the development of other components, particularly those linked to language learning.

In his analysis of reading research, Stanovich (1986) borrowed from the biblical book of Matthew to describe a phenomenon he called the "Matthew effect" on reading. He suggested that, as poor readers encounter decoding problems, they read less. Skilled readers read more. The effect is that poor readers fall farther and farther behind while skilled readers continue to gain. Thus, the rich get richer and the poor get poorer.

Stanovich pointed to mounting evidence that the primary mechanism that enables early reading success is phonological awareness--conscious access to the phonemic level of the speech stream and some ability to manipulate cognitively representations at this level. He acknowledged the position that reading itself facilitates phonological awareness (Ehri & Sweet, 1992) and the probable reciprocal causation, thus the Matthew effect.

Stanovich concluded his research review by suggesting that, if there is a specific cause of reading disability, it resides in the area of phonological awareness. In his view, identification and subsequent training in that area can overcome the reading deficits of many children.

Various researchers have studied remediation through direct instruction in phonemic segmentation. Ball and Blachman (1991) studied 90 kindergarten students from three city public school systems. Group A received instruction in phoneme awareness, letter names, and letter sounds. The result was significant improvement in the early reading and spelling. Group B was trained in letter names and letter sounds alone. This group showed no significant improvement in early reading or spelling skills. Ball and Blachman also demonstrated that young children can be taught to recognize phonemes and that they will carry over this skill to novel items.

Jorm, Share, Maclean, and Matthews (1984) measured phonological abilities of children at the end of kindergarten in groups matched on sight word reading, verbal intelligence, sex, and school attended. The researchers followed their progress over grades one and two and found that children who had better phonological skills at the start were significantly ahead of those who did not by the second grade and that the two groups diverged further with time.

A study in the Netherlands (Reitsma, 1984) designed experiments to test various explanations about the place of phonics in the reading process. Reitsma's study provided evidence that beginning readers translate print to sound before meaning can be retrieved. He suggested that early readers

identify graphemes, map them into phonemic code, and determine meaning from that code. He mentioned the relative difficulty of the decoding task, noting, however, that Dutch is more regular in its sound/spelling correlations than is English. Reitsma concluded that, for a long period in the development of beginning reading skills, phonemic representations need to be reproduced on the way to word identification.

Foorman and Liberman (1989) studied 80 first graders and found that those reading above grade level had stronger phonological skills, effectively applied grapheme-phoneme correspondence rules, and were weaker in the use of visual-orthographic knowledge. Those below grade level applied visual more than phonological coding. The researchers did not blame the lack of phonological awareness for the performance of poor readers. Instead they attributed inadequate "bootstrapping" (Stanovich, 1986) of phonological awareness on orthographic awareness as the cause and went on to discuss the difference between phonics rules and assignment of sound representations to semantic units.

Ehri and Sweet (1991) studied 36 preschool children in an investigation of how beginners process print. They concluded that knowledge of letter sounds, sight words, and phonemic segmentation was important when children read word-by-word. They cautioned against an interpretation of their work as a challenge to memorized reading instruction in the classroom; however, they found that phonemic segmentation contributed to subjects' ability to remember how to read individual words in the text and match print with speech. The evidence indicated that phonemic segmentation was more important than preprimer reading skill. They suggested that phonemic units may be more central than lexical units in learning the kind of finger-point reading they examined.

Developmental Language Disorders

By definition, dyslexic children have normal or above average IQs, but exhibit difficulty in learning to read and spell. Familial factors and heritability have been established. Studies have shown that reading disabilities occur more often in near relatives than in the general population and occur more often in twins than in siblings, with a higher rate in monozygotic twins (DeFries, Fulker & LaBuda, 1987). Longitudinal studies of children (Wagner & Torgesen, 1987) suggest that future dyslexics have phonological processing problems in preschool years.

Studies of dyslexic students, like those of other readers, employ a variety of methodologies. Some measure reading abilities of students of the

same age; others compare specific abilities of students at different ages but at the same level of reading development; and some attempt to allow for a period of incubation after a particular method of remediation is used. So much research is underway and so many methods are used that analysis is problematic. At this juncture, no firm conclusion can be drawn as to the basic nature of the problem. Dyslexics may have primarily a deficit in phonological language skills, or they may have uniformly deficient component reading skills (Rack, Snowling & Olson, 1992).

After reviewing models of reading development and studies of short-term memory, pig-Latin experiments, nonwords and phonemic segmentation, Rack et al suggested that there may be two types of dyslexia: developmental phonological dyslexia and developmental surface dyslexia. Rack and colleagues, however, cite Ehri's models of reading development and consider the possibility that phonologic information contributes to direct lexical access. Dyslexic readers may, therefore, encounter restrictions at different points in the development of phonemic decoding. The literature suggests that phonological dyslexics may be remediated and become surface dyslexics.

While it is too easy to label deaf children dyslexic, at the same time they have been essentially denied the advantages of children so identified by the exclusive definition of the disorder in PL 94-142. At first glance, the phonological remediation recommended by disabilities specialists seems inappropriate in the case of deaf children with no sound base; however, recent studies of skilled deaf readers may indicate otherwise.

Recent Studies of Skilled Deaf Readers

Hanson, Goodell & Perfetti (1991) studied effects of the phonetic content of sentences in the silent reading of hearing and deaf college students. The researchers were interested in establishing the importance of phonological process in reading. Their investigation built on earlier findings in short-term memory research that some deaf subjects are sensitive to rhyme and do use phonological coding. To avoid the confounding results from some previous studies that involved proofreading tasks, they used tongue-twister tasks. Silent reading and semantic acceptability judgments of tongue-twister sentences take longer than those of typical control sentences.

Presenting mixed grapheme tongue twisters to reduce the effects of visual similarity, Hanson et al found that both the hearing and deaf college students made more errors on acceptability judgments when reading tongue-twister sentences. The researchers suggested the possibility that a phonolog-

ical code for deaf readers could be developed through speechreading. They noted that studies of hearing lipreaders have shown that hearing subjects, without explicit instruction in lipreading, demonstrate an awareness of the visual correlates with phonemes.

Narrowing the Focus

It would appear on the surface that phonological awareness through visual input of phonemic units accounts for the reading ability of deaf students with Cued Speech experience. The study of reading, however, is far from simple. While Cued Speech communication delivers incidental, however precise, phonemic information, it simultaneously transmits accurate syntactical information. Phonological and syntactical input may very well work together to produce the positive outcome. The phonological connection, therefore, remains a part of the cognitive process that cannot be effectively isolated.

However complex current reading models may be, the study of deaf readers should interest researchers in general education and cognitive psychology. Deaf subjects by definition lack auditory input. The missing auditory input is replaced by identifiable means--manual language (American Sign Language); that language adapted for English and aided by speechreading; signs used with speech to represent English words rather than concepts; speechreading alone; fingerspelling with speech; and finally, Cued Speech. If Cued Speech continues to produce skilled readers, and if other inputs do not produce similar or comparable results, then in addition to the implication within the field of deaf education, proponents of an essential phonological component in the reading process will have strong support.

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Special Section

GUIDELINES AND POLICIES

National Cued Speech Association

NATIONAL CUED SPEECH ASSOCIATION (NCSA)

Guidelines and Policies for Review and Approval of Cued Speech Materials

(Approved by the NCSA Board of Directors, March 5, 1994)

Policy A. The NCSA will review and approve as warranted and/or requested appropriate Cued Speech materials, including articles, books, workbooks, written lessons, audiocassette lessons, videocassette lessons, and other instructional and/or informative materials.

Policy B. Review and approval procedures can be initiated and carried out either during the process of production or afterward. It is strongly advised that producers initiate the review process as early as possible, even when materials are in the planning stage. Suggestions offered during or as a result of the NCSA review process can both enhance quality and reduce errors or deviations that might prevent NCSA approval.

Policy C. For review of written materials, producers are asked to submit one complete copy, typewritten, double-spaced. More copies will be requested if needed. For materials to be recorded on audiocassette or CD, a copy of the written text should be sent with a preliminary audiocassette copy. A copy of any written instructions to accompany the audiocassette materials should also be submitted.

Policy D. Materials intended for videocassette production should go through several stages. The text of any accompanying materials, such as a workbook, should be submitted along with the written text for the material to go on the audio track of the videocassette. Finally, a trial copy of the videocassette should be produced and submitted for review. This can easily be done with a camcorder. No one is likely to be able to make an initial set of videocassette lessons on Cued Speech that is entirely free of errors or deviations from accepted practice.

The procedures outlined above are designed to reduce errors and deviations in finished materials with the goal of improved quality and effectiveness. Producers may expect the review process to result in substantive suggestions which the producer may be utilized to enhance the acceptability and usefulness of the product. Finally, this sequence of submission and review may result in the full endorsement and support of the product by the NCSA.

Rationale for Establishment of Guidelines for Persons Producing Cued Speech Materials They Wish the NCSA to Approve, Recommend and/or Distribute

The National Cued Speech Association (NCSA) is a relatively young organization, incorporated in 1982, after several other countries had already formed national Cued Speech (CS) organizations. Though the NCSA has accomplished a great deal in a dozen years, many needed policies and guidelines are yet to be established. A conspicuous example is in the area of furnishing guidelines for persons preparing Cued Speech materials and establishing procedures for reviewing such materials in advance of publication.

Scholarly journals make regular use of early communication with authors submitting manuscripts. Editors not only furnish guidelines but engage in editorial negotiation and make suggestions to the authors after a manuscript has been received and judged generally suitable for publication. This procedure typically results in improvement of manuscripts and conformity with established standards.

The NCSA follows a review procedure similar to that of most scholarly journals in its production of the *Cued Speech Journal*. As time permits, the NCSA editorial committee works with the editor in carrying out review, revision and approval of submitted manuscripts. However, the NCSA has not until this year established policies or guidelines in connection with other CS materials, such as books, manuals, and lessons. In the past these have been evaluated after the fact, if at all, and typically listed, promoted and even sold by the NCSA without any official review or approval process.

Up to this point, persons producing Cued Speech materials have had to proceed essentially on their own, soliciting input from others as they chose, or not. At its meetings in San Antonio in March, Rochester in June, and at Cue Camp Virginia in September, 1994, the NCSA Board of Directors established three sets of guidelines, one establishing procedures recommended to producers of CS materials, one for terminology regarding CS, and one for the mechanics of the cueing process. Producers are under obligation to follow those guidelines only if they desire the presumed

advantages of early communication and assistance and/or advance approval and support. After-the-fact approval and promotion of CS materials by the NCSA will still be possible. The guidelines are intended to be helpful also to teachers of CS, certifiers of CS instructors and transliterators, and cuers in general.

In summary, the guidelines and procedures have three purposes:

1. To enable producers of Cued Speech materials to have the benefit of prepublication input that will both lead to improvement of the product and enhance the probability of NCSA approval and support.

2. To protect the NCSA from the danger of allowing Cued Speech materials to be treated as if approved or recommended by the NCSA without their having gone through appropriate review and approval procedures.

3. To enable instructors, certifiers and cuers in general to follow desirable standards of terminology and of the mechanics of cueing.

NATIONAL CUED SPEECH ASSOCIATION (NCSA)

Terminology Guidelines for Cued Speech Materials

(Approved by the NCSA Board of Directors, September 25, 1994)

Producers of instructional and other materials on Cued Speech (CS) should give careful attention to the following terminology guidelines:

1. Reference to Cued Speech should never be made in such a way as to imply that the process of cueing equates with CS. In other words, CS in its complete form includes both cueing and speaking.

2. Care must be taken to avoid statements that imply that a specific cue represents a specific sound. The cues represent groups of sounds, not individual sounds. The hand configurations represent groups of consonants, from which the individual consonant is selected by use of what is seen on the mouth. The placements represent groups of vowels, from which the individual vowel is determined by use of what is seen on the mouth. Such statements as: The sound of /m/ is represented by handshape 5." are incorrect, and should be replaced by statements such as "The sound of /m/ is cued with handshape 5." or "The sound /m/ is one of the group represented as a group by handshape 5."

3. Definitions of Cued Speech cited or written in CS materials should be in accord with the resolution adopted June 4, 1989, by the NCSA Board of Directors, and as modified September 25, 1994, as follows:

Resolution Regarding Definitions of Cued Speech

Whereas, the National Cued Speech Association recognizes its responsibility for supporting and maintaining accurate perceptions of Cued Speech, and for hedging against confusion and misunderstanding, and

Whereas, the NCSA has become aware of the diversity of stated definitions of Cued Speech, many of them incorrect or misleading,

Be it resolved that the Association issue the following guidelines regarding the nature of Cued Speech, and definitions thereof:

A definition of Cued Speech, in order to describe it accurately and to distinguish it from all other systems developed for the benefit of hearing-impaired persons, must include at least the three basic ideas in the following statement:

> Cued Speech is a communication system which (1) utilizes hand configurations (eight in English) in locations (four in English) near the mouth, (2) to supplement the normal visual manifestations of speech, (3) in such a way as to render the spoken language clear through vision alone.

Sample Definitions

1. "Cued Speech is a communication system which (in English) utilizes eight hand configurations and four handplacements near the mouth to supplement the visible manifestations of simultaneous speech. Each 'cue' (hand configuration or placement identifies a special group of two-to-four speech sounds within which each sound looks different from the others, on the mouth. The combination of cues and mouth movements makes all the essential speech sounds appear visibly different from each other, so that the spoken message is clarified with or without the aid of residual hearing, which can increase the redundancy of the system."

2. "Cued Speech is a combination of cues and speech designed to make spoken language clear through vision, with or without the aid of residual hearing. In English it utilizes eight hand shapes and four hand placements near the mouth to supplement the normal visible manifestations of speech in such a way as to make all the essential speech sounds that look the same on the mouth look different from each other on the hand, and all the sounds which look alike on the hand look different on the mouth."

3. An excellent example which has the advantage of brevity, but still contains the points essential in a definition of Cued Speech, appeared as a "filler" at the bottom of page 2 of the January, 1989, issue of *CENTER LINES*, published by the Cued Speech Center, Raleigh, North Carolina:

> "Cued Speech is a simple, sound-based system, which uses eight hand shapes in four different positions ('cues'), in combination with the natural mouth movements of speech, to make all the sounds of the English language look different and clearly understandable to hearing-impaired people of all ages."

Clarifying Statements

The following are clarifying statements that can be used in explanation. Some can also be part of a definition when brevity is not essential. They will help prevent misunderstanding and confusion about Cued Speech:

1. The hand configurations and locations are called **cues**. They are not Cued Speech, which is the combination of the cues with the normal visual manifestations of speech. A common error is to refer to the **cues** as Cued Speech, contributing to the misconception that the cues are readable alone. It is misleading to say that the cues make the spoken language clear, without including the clause "in combination with the information visible on the mouth."

2. When Cued Speech is used, sounds and syllables which look alike on the mouth look different on the hand, and sounds and syllables which look alike on the hand look different on the mouth. Each sound or syllable is thus read from the combination of hand and mouth, which is unique for that sound (phoneme) or syllable.

3. a. Each hand configuration identifies a **group** of consonant phonemes, whose members are visually distinct from each other on the mouth. A common error is to say that the hand configurations represent consonants (rather than groups of consonants), contributing to the misconception that the cues can be read alone.

b. Each hand location identifies a **group** of vowel phonemes, whose members are visually distinct from each other on the mouth. A common error is to say that hand locations represent vowels (rather than group of vowels.)

4. Cued Speech (the cues in combination with the mouth movements) renders spoken language clear at the levels of phonemes, syllables, and their durations, stress, and contributions to rhythm.

5. Cued Speech can, if desired, incorporate an indication of approximate voice pitch for each syllable uttered. This is essential in tonal languages, such as Thai, Cantonese, Mandarin, Igbo, and other languages in which the pitch pattern of a word can change its morphemic significance. For example in Cantonese the syllable **ma** can mean **mother**, **scold**, **horse**, or **Right?**, according to whether the pitch is high, high-falling, low-rising, or middle.

Tone cueing is also desirable in any language in speech therapy, when the objective is to develop good intonation patterns, and at home in teaching and supporting good intonation patterns.

Tone cueing is accomplished by changing the inclination of the cueing hand to indicate changes in pitch. The normal angle, from about 45 degrees in the side location to 30 degrees in the throat location, is changed toward the vertical for higher pitch, and toward the horizontal for los pitch, in the process of cueing.

NATIONAL CUED SPEECH ASSOCIATION (NCSA)

Guidelines on the Mechanics of Cueing

(Approved by the NCSA Board of Directors, September 25, 1994)

These guidelines are intended to supplement the National Cued Speech Association (NCSA) procedural guidelines for persons who desire to secure NCSA input during the production of Cued Speech instructional and practice materials, such as manuals, audio lessons and videocassette lessons. They will also be of help to teachers, parents and others seeking authoritative information on specifications for the mechanical details of the cueing process, not on teaching methods as such. Cuers, instructors, and persons preparing materials on Cued Speech should consult current sources of information on techniques and teaching methods for meeting these specifications, and for correcting deviations from them. The NCSA office will maintain an up-to-date list of such sources.

Physical Constraints

Execution of the act of cueing is subject to some requirements that depend on the proportions of the cuer's body. In order that cueing shall be as consistent as possible for each cuer, that fatigue shall be minimized, and that readability of Cued Speech shall be enhanced, the following specifications should be met:

The Appropriate Arm Posture and the Side Placement

The arm should hang comfortably from the shoulder, so that tension in the ligaments attached near the shoulder joint is at a minimum. The tips of the fingers should be at the level of the chin for the side placement, for most persons. The angle between the forearm and the horizontal should be in the range of 45 to 80 degrees for the side placement. The best angle and distance of the elbow from the body will depend on the cuer's body proportions, that is, on the ratio of the length of the forearm and extended hand to that of the humerus, the length of the neck, and the height of the shoulder joint. The forearm angle, and the positioning of the elbow, should be chosen so as to place the tips of the longest fingers at a horizontal distance of about four inches from the vertical plane bisecting the chin. Ideally, this should place the fingertips at the level of the tip of the chin. This side placement can be achieved easily by most people, resulting in a

minimum of up-and-down movement in connection with the side-throat and side-mouth movements.

Some cuers' body proportions are such that the normal, comfortable positioning results in a lower side placement. Persons who suspect that their forearm-wrist-hand combination is too short to reach to the recommended chin-tip level without tension in the shoulder should get in touch with the NCSA office, which will either help them or refer them to qualified sources of help in determining (1) whether they actually need to use a lower side placement, and (2) how to select and use that placement if they should. This can be done by placing the elbow close to the body and raising the inclination of the straight forearm-wrist-hand combination to almost vertical (about 80 degrees above the horizontal). The shoulder must be neither raised nor lowered from the relaxed shoulder posture. If under these conditions the fingertips do not come up to the recommended chin-tip level, the level to which they come is the appropriate side placement level for the individual, who should use it consistently. Qualified guidance in carrying out this procedure and arriving at the right decision, preferably through face-to-face assistance, is essential. Individuals who find it necessary to use a side placement lower than the recommended one, and who thus need to keep the elbow close to the body, must be careful to follow the specification that the forearm-wrist combination shall be kept straight and moved as a unit.

If the cuer's body proportions result in a fingertip level above the recommended chin level, when the arm is close to the body and at an angle of 60 to 80 degrees, the inclination of the forearm should be reduced (to 45 degrees or so), so as to lower the fingertips to the chin level. This will require placing the elbow a little farther from the body.

The forearm inclination for the mouth placement will be essentially the same as for the side placement, or slightly less. That for the chin placement will tend to be less than for the mouth placement, and that for the throat placement still less. These differences, however, should be held to the minimum consistent with smooth, efficient, accurate cueing.

Beginning cuers should try to keep the forearm-wrist-hand combination straight, avoiding any bending of the wrist. As they become fluent and cue more and more rapidly, they will need to increase their effort to avoid excessive bending of the wrist. If beginners form the habit of bending the wrist at will, the tendency to increase the bending as they become fluent is likely to make them "floppy" cuers, which is undesirable. Cuers should also avoid any twisting of the wrist, unless they are cueing in

one of the languages in which pronation of the wrist is used to indicate palatized or aspirated consonants, or nasal vowels.

The wrist and the back of the cueing hand should remain even with the forehead and chin, that is, in the same vertical plane with the forehead and chin, when cueing at the side, mouth and chin placements.

The mouth, chin, and throat placements

The mouth placement

For the mouth placement, the tip of the pointer finger should touch just outside the corner of the mouth. Care must be taken not to let the site of the contact stray on to the mouth and cover part of it, but it needs to be very close to the corner. The pointer finger is the longest finger extended in the hand configuration, with one exception. For handshape 8, in which the index and middle fingers form a wide open "V", the middle finger is the pointer for the mouth placement. This differs from the chin and throat placements, for which the index finger is used as the pointer for handshape 8.

The chin placement

For the chin placement the tip of the pointer finger should touch the very tip of the chin, at its geometric center, that is, in the plane dividing the right and left halves of the face. Care must be taken not to execute this placement higher on the chin, or to either side of the center line.

The throat placement

For the throat placement the pointer finger should make contact at the site of the larynx, or 2 to 3 inches below the tip of the chin. Cuers who find the larynx sensitive to touching may touch below this level, but should not make contact lower than the hollow which marks the junction of the collarbones with the breastbone.

The importance of consistent touching

The mouth, chin, and throat placements have the advantage of furnishing a tactile response to the cuer if he/she is careful to touch the designated location. The tactile response serves two important purposes: (1) furnishing tactile feedback to the cuer that the placement and timing are correct, and (2) making sure that parallax (the error that results if the cue

placement is away from the face and is viewed from an angle) does not give a false impression of the placement for the reader, even when that placement is in front of the right location.

Touching is important in maintaining synchronization of cues with the visible manifestations of speech, which is advantageous to decoding. Cuers should take care to touch consistently at these placements. When they cue faster, they will need to exert more concentration in order to maintain touching as consistently as possible. They will encounter most difficulty in maintaining consistent touching at the throat placement.

Acquiring and maintaining consistent synchronization

The synchronization of handshapes and placements with the visible manifestations of speech is an important part of the mechanics of Cued Speech. It is essential that beginners form the habit of accurate synchronization and endeavor to maintain it as they become fluent. Even expert cuers need to guard against poor synchronization at the side placement, particularly for final consonants. Techniques for preventing and overcoming synchronization problems are available in published materials listed by the NCSA office.

Execution of Handshapes

In executing handshapes the fingers not specifically bent to form the target handshape should be extended parallel to each other and in contact throughout their length, except in the case of handshape 8, for which the index and adjacent finger are separated as much as possible to make an open "V." For all handshapes the bent fingers (and the thumb, if not extended) should be out of sight of the cue-readers. This is accomplished by careful maintenance of the plane of the cueing hand parallel to the plane of the face and chest, plus keeping the thumb out of sight when it is not extended. In English the wrist should never be twisted.

In executing the handshapes for which the thumb is free to hold the bent fingers in position, it should do so. For example, in executing handshape 3, the thumb should actually hold the bent index finger in position, not just touch it, in order to make sure that the thumb and finger are out of view.

The Timing Movements

The execution of each cue must include a discernible movement or event that clearly indicates the time at which the key articulatory action takes place. This is needed because the mouth does not consistently furnish such information on an adequate basis.

Touching at the Appropriate Cue Placements

Touching at the throat, chin, and mouth placements furnishes the cuer a tactile verification of timing that is essential in maintaining synchronization of cues with speech. To the decoder of Cued Speech, synchronized touching in these placements furnishes the timing information needed in fully utilizing the cues.

Successive Touching

When a cue is executed at mouth, chin, or throat placement, and another cue or a repetition of the same cue is to follow immediately at the same placement, the fingertips are lifted slightly from the contact location, and replaced. This provides a tactile timing verification for the cuer and a visual timing indication for the Cued Speech reader.

Timing Movements in the Side Location

When a cue is executed at the side location there is nothing for the cueing hand to touch to indicate the initiation of articulation. Thus, some kind of specific movement or change in movement is necessary, as a timing signal.

Vowel sounds /ah/ and /oe/. For the vowel sounds /ah/ and /oe/, or a CV syllable containing one of them, a forward motion of about one inch is made. If another cue is to follow in the same location, the hand must first be moved back to the original location, so that the second forward movement made for the second syllable—if there is one—is initiated from the same location. Thus, */photo/* [foetoe] is cued 5 side forward and back, 5 side forward. Similarly, */polo/* [poeloe] is cued 1 side forward and back, 6 side forward; and */ha-ha/* [hah-hah], 3 side forward and back, 3 forward.

Beginning neutral vowel sounds. If an utterance begins with the neutral vowel [ ], spelled /u/ or /uh/ (stressed) in Funeemik Speling), or includes a CV syllable containing the neutral vowel, the timing is indicated

by a downward movement of about ½ to ¾ inch. As in the case of a forward movement, if another cue is to follow immediately in the side location, the hand must be returned to the original location before the next cue is made. Thus */uh-oe/* is cued 5 side down and up, 5 side forward. Similarly, */sofa/* [soefuh] is cued 3 side forward and back, 5 side down; and */buffalo/* [bufuloe] is cued 4 side down and up, 5 side down and up, 6 side forward.

The "flick" rule. "When the same handshape is executed twice in succession in the side placement, the second occurrence must be accompanied by a flick to supply timing information. Example: */left/*, 6 chin, 5 side , 5 side flick."

Cornett's interpretation of the flick rule is that it applies whether or not a vowel occurs between the two successive executions of the same handshape at the side placement. Examples of cueing for this interpretation are: */coke/* [koek], 2 side forward and back, 2 side flick; */pop/*[pahp], 1 side forward and back, 1 side flick; */coves/* [koevz], 2 side forward and back, 2 side flick, 2 side flick; */source/* [soers], 3 side forward and back, 3 side flick, 3 side flick.

A differing interpretation is that the rule does not apply when a vowel occurs between the two successive executions of the same handshape. According to this interpretation the words used as examples above should be cued as follows: */coke/* [koek], 2 side forward and back, 2 side; */pop/* [pahp], 1 forward and back, 1 side; */coves/* [koevz], 2 side forward and back, 2 side, 2 side flick; */source/* [soers], 3 side forward and back, 3 side, 3 side flick.

Until research results or other considerations enable the NCSA board to resolve this difference in interpretation of the flick rule, both interpretations will continue to be taught and used by their supporters.

The flick with isolated consonants. The flick (a quick movement of about ¼ inch forward and back) is necessary in cueing an isolated consonant, as speech teachers may do in instructing. If one wishes to cue an isolated consonant sound several times in succession, as in transliterating a stuttered utterance, such as "t-t-t-Tommy" or "m-m-m-mee," one must make a flick with each isolated consonant, else the cueing furnishes no timing indication. Thus, "t-t-t-Tahmi" is cued 5 side flick, 5 side flick, 5 side flick, 5 forward, 5 throat, and "m-m-m-mee" is cued 5 side flick, 5 side flick, 5 side flick, 5 mouth.

Other Relevant Specifications

Cue What Is Said

The cardinal rule governing cueing is that one must cue what one says exactly the way one says it on that occasion. This requires accurate rendition of such options as variations in pronunciation, elision, liaison, assimilation, etc. Current sources of information on these subjects is available in several publications. Cuers, instructors, and preparers of materials should consult such sources in order to apply the principles in this document accurately in cueing exactly what is said.

Adequacy and Normalcy of Mouth Movements

About half the visual information provided by Cued Speech is delivered by the mouth and face movements. The readability of Cued Speech is greatly dependent on the adequacy and normalcy of the information delivered by the mouth and face.

It is a responsibility of Cued Speech instructors to emphasize and work on the development of accurate, normal mouth movements in beginning cuers, and to furnish suggestions (mirror work, etc.) for self-instruction in this aspect of production of Cued Speech. **All instructional materials for Cued Speech should address and emphasize this aspect of the development of competency in Cued Speech, not just competency in executing the cues.**

Ability to Cue With Either Hand

The advantages of acquiring the ability to cue with either hand should be made clear in Cued Speech materials and emphasized by instructors. Beginners should be encouraged to either learn initially to cue with the non-dominant hand, or practice cueing with both hands enough to be able to use either hand. Then, they should regularly cue enough with the non-dominant hand to become reasonably proficient with it. Being able to use either hand at will is useful when one hand is occupied, as in writing on the chalkboard, using the telephone, or when one hand/arm is tired or otherwise incapacitated. It is also important in transliterating for rapid indication of changes in speakers.

Angle of the Cueing Hand

As has been specified, the wrist and hand are supposed to form a straight extension of the forearm. The angle of the elbow (the angle between the upper arm and the forearm) changes with the placements. The inclination (from the horizontal) of the forearm-wrist-hand for the mouth placement will be very nearly the same as for the side placement, or slightly

less. The inclinations for the chin and throat placements will tend to be progressively less, as required for smooth, comfortable cueing.

Charts showing the handshapes, either in isolation or in relation to the face, should position the handshapes at an appropriate angle above the horizontal, not vertically or horizontally. Charts showing them in horizontal or vertical orientations, which have appeared in the past, have caused some people to try to cue that way. Charts included in instructional materials should orient the handshapes at about 45 degrees above the horizontal.

Cueing of Intonation

In tonal languages the level of voice intonation is indicated approximately by the angle of the cueing hand, in relation to its normal angle for a given placement. This makes it possible to distinguish the phonemically significant "tones" of tonal languages, as Thai, Igbo, Mandarin, Cantonese, etc. In English this technique can be used to indicate changes in intonation, but is rarely used except by speech therapists working on voice pitch problems and monotone speech, or in helping deaf children learn to carry a tune. More details are available in *The Cued Speech Resource Book For Parents of Deaf Children*, pp. 171-72.

The Ubiquitous ũ hũ

One of the most frequent utterances in American English is the expression commonly spelled *uh huh.* The nasal vowel in this expression was Inadvertently omitted from the original Cued Speech chart because it was not listed among the phonemes of English in phonetics books. This and the negative form, *huh uh,* are only in slang dictionaries, yet are used by most Americans many times a day. It is the nasal counterpart of the neutral vowel, the schwa. This vowel is a legitimate phoneme of American English, with at least one minimal pair.

The vowel ũ (as written in Funeemik Spelling) should be cued at the throat, as it is in French. Authors and producers of materials on Cued Speech should add this phoneme to the Cued Speech charts.

Many Americans also use the same expressions with the vowel suppressed, keeping the mouth completely closed and saying: *mmmm hmmmm* and *hmmmm mmmm.* These non-vocalic expressions can be cued at the side, but the forward motions must be reduced to flicks, else vowels would be indicated.