The Role of Cued Speech in the Development of Spanish Prepositions

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American Annals of the Deaf; Fall 2003; 148, 4; Health & Medical Complete pg. 323

The aim of the present study was to advance the knowledge of the linguistic development of students with prelingual profound deafness, especially the acquisition and use of prepositions in Spanish, a lexical category with an important role in verbal comprehension. The researchers sought to learn the level of mastery students with prelingual profound deafness can achieve in the command of prepositions, depending on the system of communication they have been exposed to: classic oralism, Cued Speech, or signed language. The results show that the different systems of communication contribute, to different degrees, to the acquisition of Spanish prepositions, with the best results being obtained with Cued Speech.

Children with prelingual profound deafness generally experience slower verbal linguistic development than hearing children (Lepot-Froment & Clerc, 1996; Mogford, 1988; Torres, Rodriguez, Santana, & González, 1995). This verbal linguistic delay becomes apparent in these children's shorter mean length utterance, their greater use of simple sentences, their limited variety of syntactic constructions, and their relatively less frequent use of (in this order) determinants, pronouns, prepositions, adjectives, and connectors.

In the present article, we focus on a specific aspect of lexical-semantic development: the acquisition and early use of Spanish prepositions. Though, in the past, lexical development did not raise as much interest as phonology or syntax, nowadays it is considered an important subject because of its impact on later morphosyntactic development (Locket, 1997).

Our starting point is the classification of the lexicon (Fries, 1952, for English; Alcina & Bléceau, 1978, for Spanish) in content words (nouns, verbs, adjectives, and adverbs), and in function words (articles, auxiliaries, prepositions, connectors, and pronouns). According to this classification, people who are deaf make greater and better use of the semantic categories than of the grammatical
The Role of Cued Speech

Deaf children exposed to classic oral systems, those based on speechreading and auditory rests, make up their own signs to designate objects that are easily represented, while producing very few signs related to function words (Goldin-Meadow, 1979). Researchers investigating the order and the moment of acquisition of prepositions have noticed that both deaf and hearing people follow the same order—that is, space, time, and relational prepositions (Kluwin, 1982)—while they differ greatly in regard to moment of acquisition (Clark, 1973). Kempt and Maxwell (1989) compared a group of hearing children ages 6 to 9 years with a group of deaf adolescents ages 12 to 20 years in a task with space prepositions in sentences implying a pragmatic conflict, for example, "The glass is in the water." The hearing study participants, who were, on average, 10 years younger than the deaf participants, did not make any mistakes, while the deaf participants, regardless of their age or the form of communication they used, made mistakes both in electing prepositions and understanding the sentence.

Dubuisson, Vincent-Duroux, and Nadeau (1991), analyzing 14-year-old deaf adolescents' oral productions, saw that more than 50% of the sentences these adolescents produced were agrammatical; they made mistakes in most of the lexical categories, prepositions included. According to the authors, these mistakes are also made by advanced or university deaf students exposed to sign language, signed oral language, or both. The comparison between hearing and deaf study participants shows not only a substantial delay in the deaf participants but also deviations in acquisition. Deaf participants seemed to adopt the strategy of selecting the words with semantic content in the sentence, apply thematic roles to them depending on their order of appearance in the sentence (subject-verb-object), and, from this, guess the answer.

In the face of classic oralism's weakness, in recent decades signed and bilingual systems have gained much interest. The oral linguistic development of deaf people with deaf parents who had signed as first language has been studied. Geers, Moog, and Schick (1984) have shown that deaf people with deaf parents have better oral linguistic development than deaf people exposed to classic oralism or signed oral language. Nevertheless, a comparison of hearing and deaf study participants disclosed big differences; for instance, 8-year-old deaf participants produced only 70% of the simple syntactic structures that 4-year-old hearing participants produced. Research by Taeschner, Devescovi, and Volterra (1988) and Volterra and Bates (1989) points in similar directions.

The delay in vocabulary acquisition is seen as a serious problem (Locke, 1997); this viewpoint is supported by neurolinguistic research in cortical activation and verbal information processing, which provides data on significant differences between deaf and hearing neurophysiological records (Neville, 1991; Neville & Bavelier, 1996). There are two types of differences: On one hand, it has been noticed that, in hearing people, different lexical categories are reflected in different foci of cortical activity; on the other hand, specific cortical activity has been registered when hearing people process function words, while this activity is not reflected in deaf people when doing the same task. It could be that the acquisition of certain aspects of complex grammars, among which would be the use of prepositions, depends both on the linguistic input modality and on the moment of exposure to those aspects (Kim, Relkin, & Hirsch, 1997), and that in deaf people both factors are altered. In the face of this somber prospect, Cued Speech, as a speech augmentation system, could offer some hope, as long as two requirements were met: (a) that Cued Speech were used to make all speech visible to a deaf person at the same level at which audition makes it perceivable to a hearing person (input's quantity and quality factors), and (b) that the deaf person received very early exposed to this system (time factor).

Speech Perception: The Main Problem

In an intuitive way, speech perception is associated with audition, save for very specific exceptions such as the four enumerated by Summerfield (1987): a signal-noise ratio unfavorable to the signal, auditory deficiency, laryngectomy, and conflict between auditory and visual information (see also Campbell, Dodd, & Burnham, 1998; Dodd & Campbell, 1987). This premise persisted until the mid-1970s, sustained by the argument that people who are born blind develop language normally, excluding small alterations in the order of production of certain phonemes (Campbell et al., 1998; Dodd & Campbell, 1987). A thought-provoking article by McGurk and McDonald, "Hearing Lips and Seeing Voices" (1976), in which sight's contribution to speech perception is proven, made things change. In McGurk and McDonald's classic experiment, study participants received input via two noncongruent sources of information, visual and auditory. For instance, while study participants were visually...
presented with the articulation of the segment /ga/ (consonantive voiced glottal plosive sound), by audition they were presented with /ba/ (consonantive voiced bilabial plosive sound). In this situation, the study participants would say they perceived /da/. But if they were asked to close their eyes, they would say they perceived /ba/. What is particularly interesting about this effect observed by McGurk and McDonald is not only the spontaneous nature of speechreading but, above all, its demanding or imperative nature: The study participant does not deliberately chooses the help of speechreading, but its effect occurs without the participant being able to neutralize it.

These data have important implications for people who are deaf. They have to elaborate phonological representations from their residual audition, but, above all, from visual information perceived through lip-reading (LR). It seems appropriate at this point to report some research that shows the restrictions on speech perception faced by people who are deaf. Nicholls and Ling (1982), doing research in English, reported that 25% of word discrimination was exclusively in the visual modality (i.e., LR only), and 42% with auditory prosthesis plus LR. Cornett and Daisey (1992), also doing research in English, reported that deaf study participants exposed to series of 100 meaningless syllables (na, wi, se, mu, etc.) correctly identified 20% to 30%. Deaf people studied by Charlier and Paulissen (1986, cited in Charlier, 1994), who were doing research in French, got a 66% rate with LR and 73% with audition plus LR, in a task consisting of word identification. Charlier, Hage, Algeria, and Périer (1990) got identical results in a task consisting of sentence recognition. Doing research in Spanish, Villalba, Fernández, and Ross (1996), in a word identification task with 30 children with prelingual profound deafness who were between the ages of 8 and 15 years, got a 61.4% identification rate with LR and a 69.0% rate with audition plus LR.

The Contribution of Cued Speech to Speech Perception
For centuries, a system that could make speech visible to the deaf has been dreamt of. In recent years, several systems have been developed, the most popular being Cued Speech (Cornett, 1967), known in its Spanish version as La Palabra Complementada (The Complemented Word). Cued Speech makes speech perception possible through sight, thanks to its two basic components: LR and a limited series of hand complements (see Figure 1 for an example of La Palabra Complementada). A hand complement consists of three parameters, which are perceived simultaneously:

- **Hand location**, in relation to the face. There are three positions in Spanish: side position for /a/, chin position for /e,ə/, and throat position for /o,ɔ/.
- **Hand shape**. In Spanish there are eight shapes in all, which are used to deambiguate consonants.
- **Hand movement**. In Spanish there are four in all. The two main ones are forward movement, a soft movement that goes with a direct syllable (consonant-vowel), for example, /ma/; and flick movement, a brief and energetic move-

**Figure 1**
Spanish Cued Speech: An Example (Torres, 1988; Torres & Ruiz, 1996)

![Image of hand movements and positions for cued speech]
ment that goes with any consonant outside the consonant-vowel sequence, for example, /m/ in /am/.

The hand complement is, therefore, the simultaneous combination of position, shape, and movement, which, having no linguistic meaning by itself, is used to deambiguate speechreading, thus making speech visible in its totality.

Various studies focusing on deaf people's speech perception through Cued Speech (English: Clarke & Ling, 1976; Nicholls & Ling, 1982; Quenin, 1992; French: Alegria, Charlier, & Martris, 1995; Charlier et al., 1990; Spanish: Santana, 1999; Torres, 1988) have opened a new perspective on the education of the deaf. From these studies some conclusions can be drawn.

First, deaf children who receive speech through residual audition plus Cued Speech achieve speech perception levels very close to those obtained by hearing children through audition (Santana, 1999). Second, different modalities of speech introduction produce different effects on perception: according to Nicholls and Ling, 30% and 25% for syllables and words, respectively, through LR, in contrast to 80% and 95% for syllables and words, respectively, through Cued Speech. Charlier et al. find similar scores in French, and Torres and Santana in Spanish. The latter (the lead author of the present article) has a special interest in these findings because they have facilitated interpretation of data on the knowledge and use of the Spanish prepositions, the main object of study of the present work, which consists of research carried out with 68 profoundly deaf Spanish children, classified into four different groups according to the main system of communication they had been exposed to (classic oralism, signed oral, sign language, and Spanish Cued Speech), who were assigned a task consisting of the identification of words and pseudowords. In the audition-plus-LR experimental condition, the results obtained by the different groups on the word discrimination task were Spanish Cued Speech: 82.8%, classic oralism 70%, sign language 66%, and signed oral language 28%, while for the pseudoword discrimination task the results were Spanish Cued Speech: 16%, classic oralism 18%, sign language 19%, and signed oral language 3% (Santana, 1999). These data contrast with those obtained by the Spanish Cued Speech group in the Cued Speech experimental condition: 92% for words and 52% for pseudowords. One could argue that if Cued Speech makes the whole of speech visible, how can the 52% for pseudowords be understood when the result should be closer to 100%? The explanation could be that the study participant looks for meanings in the speech segments introduced to him or her, and, when meanings are not found, doubts or does not answer.

As Cued Speech removes the ambiguities related to LR, one would think that those study participants exposed to the system for several years should not have problems with verbal comprehension. Nevertheless, they have problems when exposure to the system occurs after the age of 3 years. A satisfactory answer to this problem would require more research, and with study participants whose only system of communication between birth and age 3 years had been Cued Speech. A group of Spanish deaf people with such characteristics has already been formed, and research results will be available in the next few years.

The Role of Cued Speech in Function Word Development

The premise of Cued Speech is that if a child who is deaf is exposed to speech in a clear and distinctive way during the first years of life, that child will develop an oral language equal to the hearing child's, except that the deaf child will be using sight as the main way of receiving information. Nevertheless, more research is needed to validate this hypothesis. Hage (1994) studied 170 deaf children between the ages of 11 and 14 years and classified them into six groups, according to the system of communication followed at home, school, or both. Evaluated on different linguistic aspects (such as vocabulary, gender, prepositions, and determinants), the Cued Speech group was always significantly superior to the rest of the groups in the experiment. Afterward, Hage subdivided the Cued Speech group into CS+ (study participants who had been exposed to Cued Speech at home before they were 36 months old) and CS- (study participants who had been exposed to Cued Speech after the age of 3 years). In general, the CS+ group performed better than the CS- group. On the preposition task, the CS+ group performed as well as the hearing control group, although the difference of age between the deaf and the hearing participants leaves some questions open for future research. These results reinforce the hypothesis on the existence of critical periods for the development of different linguistic aspects, including vocabulary acquisition.

Aims of the Research for the Present Study

In relation to the Spanish prepositions, the present study tested two hypotheses:
• The augmentative systems of communication, which make speech visible in a clear and distinctive way, will play a decisive role in oral linguistic development. It is expected that Cued Speech, in this case Spanish Cued Speech, as a system that removes the visual ambiguity of speech, will make it possible to be aware of the less perceptible segments of speech, among which are the prepositions.

• It is expected that, in this preposition task, study participants using Spanish Cued Speech will show a higher level of performance than participants exposed to other augmentative systems of communication, although this effect in this research will not be as strong as desired, as the participants in this experiment have been partially exposed to Spanish Cued Speech.

In the data analysis, reference will be made to the difference between full Spanish prepositions, which are used for a reduced number of performances according to their meaning, and empty Spanish prepositions, more abstract and ambiguous, which appear as simple linking marks with many possibilities of relation, and whose meaning depends both on the word they relate to and on the term they introduce (Alcina & Bleccia, 1975). Full Spanish prepositions are ante (before), in the face of), bajo (under, below), contra (against), desde (since, from), entre (between, among), hacia (toward, around, about), hasta (up to, to, until, till), para (for, to, toward), segun (according to, depending on), sin (without), sobre (on, over, above, about, upon), and tras (behind, after).

Empty Spanish prepositions are a (at, every, per, to, on, by), con (with, by), de (of, about, from, in, with), en (in, on, at, into, by, from), and por (because of, for, by, in, at, through, per).

Method
Study Participants
Thirty-five deaf students were picked from 29 educational centers in five different regions of Spain. Participants in the experiment all met four criteria:

1. All were prelingually profoundly deaf (onset and detection before age 12 months).
2. All had neurosensorial bilateral auditory loss, according to the BIAP classification, with a mean loss in the better ear at the frequencies of 250, 500, 1000, and 2000 Hz, equal to 100 dB.
3. No associated impairment was present that could by itself could cause severe language delay.
4. All had been consistently exposed, for at least for 3 consecutive years, to one of three systems: classic oralism, Spanish Cued Speech, or Spanish Sign Language. This variable was used as the criterion for assigning each participant to one of three groups: the oral group, the Spanish Cued Speech group, and the Spanish Sign Language group.

The characteristics of the groups are presented in Table 1.

Because the experimental task required the ability to read sentences, the study participants' reading skills were evaluated. Only participants with a reading age equal or superior to 8 years, as measured by a standardized test, Bateria de Evaluacion de los Procesos Lectores de los Ninos de Educacion Primaria (Battery for the Evaluation of Reading Processes in Primary Education), commonly known as PROLEC (Cuetos, 1996), were included in the data. With this condition, we were trying to guarantee that the difficulties with prepositions were not due to problems with basic decoding skills. The IQs of the participants were measured with the manipulative scale of the Weschler Intelligence Scale for Children; those who scored below their chronological mean were eliminated from the analysis. On the basis of these criteria, three groups of deaf people and one group of hearing people were formed:

- Oral group: Deaf participants exposed to classic oral systems, in which verbal input is presented through speechreading and auditory rests, and the output through speech and writing. The commu-

Table 1
Characteristics of the Sample (N = 52)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hearing group (control)</th>
<th>Oral group</th>
<th>Spanish Cued Speech group</th>
<th>Spanish Sign Language group</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>17</td>
<td>16</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Mean age (years, months)</td>
<td>8.3</td>
<td>12.4</td>
<td>11.7</td>
<td>11.4</td>
</tr>
<tr>
<td>Age range (years, months)</td>
<td>(8.0-8.11)</td>
<td>(10.4-13.8)</td>
<td>(10.2-13.8)</td>
<td>(9.0-13.8)</td>
</tr>
<tr>
<td>Mean hearing loss (dB)</td>
<td>–</td>
<td>100</td>
<td>104</td>
<td>101</td>
</tr>
</tbody>
</table>
nication system of the family and school was mainly oral.
- Spanish Cued Speech group: Deaf participants exposed to Spanish Cued Speech in rehabilitation and school environments. This was not a pure Cued Speech group, as most of its members had received a classic oral rehabilitation during their first 3 years of life and only afterward were exposed to Cued Speech, mainly at school.
- Spanish Sign Language group: Deaf participants with deaf parents, whose native language was Spanish Sign Language. These children were included regardless of whether they had received simultaneous or subsequent oral rehabilitation.
- Control group: Hearing children attending the same schools as the deaf participants. Members of the control group were to be close in reading age of the members of the deaf groups; although, to avoid the “ceiling effect” when executing the planned task, we were forced to lower the age to 8 years, 2 months. The members of the control group were randomly selected by the researchers among students whose performance on the PROLEC and IQ tests was within their chronological mean, and who belonged to the same sociocultural environments as the study participants.

In its final form, the sample consisted of 52 children: 35 deaf and 17 hearing.

Materials
Each item consisted of a simple sentence in which the preposition, which had been replaced by suspension points, was the key word. In the making of the sentences, normative studies on Spanish preposition usage frequency and frequency order in students between the ages of 6 and 13 years (Justicia, 1995; Justicia, Santiago, Palma, Huertas, & Gutierrez, 1996) were taken into account, as well as the frequency of Spanish prepositions gathered in the dictionary of frequencies by Alameda and Cuertos (1995).

On the basis of these studies, it was estimated that a task should include 30 sentences, which guaranteed the proportional and sufficient presence of each of the Spanish prepositions. A distinction was also made between full Spanish prepositions (10 sentences) and empty Spanish prepositions (20 sentences). A greater number of sentences with empty prepositions was used because of these prepositions’ higher usage frequency, their higher level of abstraction, and their earlier acquisition (Aguado, 1995). The sentences were affirmative and imperative, with a simple syntactic structure of the subject-verb-object and subject-verb-complement type, with a mean length of 5.84 words. The vocabulary of the sentences consisted of words with a very high usage frequency in Spanish, following the dictionary of frequencies already mentioned. The chance level of the task was 25%, as one and only one of the four options was correct. The sentences used in the task are listed in Table 2.

The materials for the task were introduced to the students in a 34-page booklet, 21 cm wide by 15 cm high. Each page contained one item, which consisted of a drawing (top part of the page), a sentence below the draw-
ing, where the preposition had been replaced by suspension points, plus four prepositions to choose from, placed below the sentence (see Figure 2). The first page of the booklet was a blank page, followed by two pages with practice items. The 30 pages with the task items followed. The booklet ended with an easily solvable item, placed there to determine if the study participant had been concentrating during the task. Two rehearsal items and the last item were not included in the statistics.

To test the materials and the procedures, as well as the level of difficulty of the task, several trials were made, with different normally hearing children grouped by age. To avoid the “ceiling effect” with this control group, the reading age was lowered to 8 years, 2 months, the point where all the requirements were accomplished. A trial with four students with special educational needs (students with speech pathologies but without hearing difficulties) was done, together with two more trials with 8 deaf study participants between the ages of 12 and 15 years. In order to avoid the “floor” and “ceiling” effects, the design of each sentence with its only possible answer was verified, as well as the standard amount of time used and the difficulty of the task.

### Procedure
The task was carried out individually at the study participants’ schools or educational centers, in a place adequate to the researchers’ requirements. The task was explained individually using the communication system with which each child was most competent (oral, Spanish Cued Speech, or Spanish Sign Language). The researcher made sure that each child understood that in each sentence there was one word, and only

<table>
<thead>
<tr>
<th>Item</th>
<th>Sentence</th>
<th>Answer (correct answers in bold)</th>
<th>Type of preposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mamá entra ... puntillas</td>
<td>(a, con, de, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>2</td>
<td>Estos zapatos están hechos ... mano</td>
<td>(de, con, a, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>3</td>
<td>El policía le contestó ... chino</td>
<td>(por, en, a, para)</td>
<td>Empty</td>
</tr>
<tr>
<td>4</td>
<td>¿Come ... los dedos!</td>
<td>(a, por, para, con)</td>
<td>Empty</td>
</tr>
<tr>
<td>5</td>
<td>Salimos ... Barcelona en avión</td>
<td>(con, para, sin, en)</td>
<td>Full</td>
</tr>
<tr>
<td>6</td>
<td>Papá sale ... la puerta</td>
<td>(con, en, por, para)</td>
<td>Empty</td>
</tr>
<tr>
<td>7</td>
<td>Juan lleva dos días ... comer</td>
<td>(por, en, a, sin)</td>
<td>Full</td>
</tr>
<tr>
<td>8</td>
<td>El gato cae ... espaldas</td>
<td>(por, con, en, de)</td>
<td>Empty</td>
</tr>
<tr>
<td>9</td>
<td>Las bailarinas viven ... el mar</td>
<td>(entre, sobre, en, para)</td>
<td>Empty</td>
</tr>
<tr>
<td>10</td>
<td>El coche rojo es ... mi padre</td>
<td>(a, de, con, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>11</td>
<td>Nosotros vamos a la playa ... verano</td>
<td>(para, en, por, de)</td>
<td>Empty</td>
</tr>
<tr>
<td>12</td>
<td>Pedro sale ... su colegio</td>
<td>(en, a, con, de)</td>
<td>Empty</td>
</tr>
<tr>
<td>13</td>
<td>El tren se va ... mañana</td>
<td>(de, en, por, hasta)</td>
<td>Full</td>
</tr>
<tr>
<td>14</td>
<td>La niña se va ... la calle</td>
<td>(sobre, entre, en, a)</td>
<td>Empty</td>
</tr>
<tr>
<td>15</td>
<td>El profesor pone el libro ... la mesa</td>
<td>(sobre, hasta, entre, a)</td>
<td>Full</td>
</tr>
<tr>
<td>16</td>
<td>Son las ocho ... la mañana</td>
<td>(a, para, de, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>17</td>
<td>Pedro tiene sobresaíente ... matemáticas</td>
<td>(por, de, para, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>18</td>
<td>La entrada al cole es ... las nueve en punto</td>
<td>(por, en, de, a)</td>
<td>Empty</td>
</tr>
<tr>
<td>19</td>
<td>La maceta cayó ... el balcón</td>
<td>(con, para, entre, desde)</td>
<td>Full</td>
</tr>
<tr>
<td>20</td>
<td>¡Empieza ya ... trabajar!</td>
<td>(de, a, para, por)</td>
<td>Empty</td>
</tr>
<tr>
<td>21</td>
<td>El Barcelona juega ... el Madrid</td>
<td>(por, de, para, contra)</td>
<td>Full</td>
</tr>
<tr>
<td>22</td>
<td>Pedro pide un lápiz ... su profesor</td>
<td>(por, con, a, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>23</td>
<td>El barco va ... el puerto</td>
<td>(de, con, sobre, hacía)</td>
<td>Full</td>
</tr>
<tr>
<td>24</td>
<td>El niño se disfraza ... payaso</td>
<td>(con, a, de, en)</td>
<td>Empty</td>
</tr>
<tr>
<td>25</td>
<td>Mi papá viene ... avión</td>
<td>(para, en, de, con)</td>
<td>Empty</td>
</tr>
<tr>
<td>26</td>
<td>Terminaré los deberes ... hoy y mañana</td>
<td>(desde, hasta, entre, contra)</td>
<td>Full</td>
</tr>
<tr>
<td>27</td>
<td>El ladrón amenazó ... la pistola</td>
<td>(por, a, en, con)</td>
<td>Empty</td>
</tr>
<tr>
<td>28</td>
<td>Quiero los ejercicios ... mañana</td>
<td>(a, en, para, por)</td>
<td>Full</td>
</tr>
<tr>
<td>29</td>
<td>La muñeca está ... la cama</td>
<td>(entre, sobre, junta a, bajo)</td>
<td>Full</td>
</tr>
<tr>
<td>30</td>
<td>El árbol se partió ... la mitad</td>
<td>(en, para, de, por)</td>
<td>Empty</td>
</tr>
</tbody>
</table>
one, missing, and that this word was always one out of the four appearing below the sentence. The child’s task was to circle the chosen word. The study participants were told always to give an answer, even in cases of doubt. Once the task was explained, the researcher introduced two rehearsal items to make sure that the whole process had been understood.

Results
The proportion of correct responses was regarded as the dependent variable. The data from the task are shown in Table 3 as a function of groups and type of preposition. Data processing was done by means of the statistics package SPSS/PC+. An overall analysis of variance (ANOVA) was performed on the data, considering the group (control, oral, Spanish Cued Speech, and Spanish Sign Language) as the between-subject factor, and the type of preposition (empty, full) as the within-subject factor. The analysis showed a highly reliable main effect of group, $F(3, 48) = 18.229, MS_{E} = 0.916, p < .001$, but a nonsignificant effect of type of preposition, $F(1, 48) < 1$. The interaction group by type of preposition was not significant, $F(3, 48) = 1.2, MS_{E} = 0.012, p = .32$. As Table 3 shows, there were no differences between preposition types, despite the supposition that empty prepositions, being more abstract, could be harder to understand.

Differences between groups were explored through Scheffé post hoc analysis. The analysis showed that the scores achieved by the hearing control group and the Spanish Cued Speech deaf group were significantly higher than those of the oral and Spanish Sign Language deaf groups. There were no significant differences between the hearing control group and the Spanish Cued Speech deaf group. No differences between the Spanish Sign Language group and the oral group arose.

Discussion
In the light of the data obtained in the task and in relation to the first aim of the work described in the present study, we can state that the Spanish Cued Speech deaf group, like the hearing control group, performed well in showing an understanding of Spanish prepositions. (This was probably because the Spanish Cued Speech deaf group had clear and complete speech perception.) Despite the fact that these deaf participants did not form an early Cued Speech group, their language development, in such a critical component as the use of prepositions, showed significant differences from that of the other deaf groups (see Figure 3).

The control group of hearing students showed great skill in executing the task (93% correct responses). The Spanish Cued Speech group obtained a similar performance (88% correct), although we have to take into account that there were age differences between the groups: The mean age of the Spanish Cued Speech group was 11 years, 7 months, and the mean age of the hearing group was 8 years, 3 months.

The difference regarding preposition type has not been confirmed, which rules out the hypothesis that hearing participants would get better results with full prepositions, which carry a spatial and temporal meaning, than with empty prepositions, which appear as simple linking marks with many possibilities of relation (Alcina & Blecua, 1975).

The research we cited in the theoretical review shows that Cued Speech guarantees speech perception in general, but with the task presented in the present study, we could be showing Cued Speech’s helpfulness even for those least favored elements of speech at the perceptive level: the preposi-

Table 3
Correct Responses (Percentages) by Group and Type of Preposition

<table>
<thead>
<tr>
<th>Hearing group (n = 17)</th>
<th>Oral group (n = 16)</th>
<th>Spanish Cued Speech group (n = 12)</th>
<th>Spanish Sign Language group (n = 7)</th>
<th>Total (N = 52)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty prepositions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>93.82 (8.01)*</td>
<td>57.50 (24.29)</td>
<td>90.00 (10.87)</td>
<td>58.57 (22.31)</td>
<td>77.02 (24.04)</td>
</tr>
<tr>
<td>Full prepositions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>92.35 (9.7)</td>
<td>56.25 (23.91)</td>
<td>85.00 (14.46)</td>
<td>65.71 (18.13)</td>
<td>75.96 (22.95)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>93.14 (6.81)</td>
<td>57.08 (23.2)</td>
<td>88.33 (9.8)</td>
<td>60.95 (19.97)</td>
<td></td>
</tr>
</tbody>
</table>

Note: *Throughout, standard deviations are provided in parentheses. See also Figure 3.
tions, which are considered linguistically as brief, short, unstressed, monosyllabic or bisyllabic words, with abstract and context-related meaning. The study results support the idea that Cued Speech makes speech visible to the deaf and, with it, contributes to the implicit learning of linguistic contents that are difficult to teach—linguistic aspects that, going beyond the borders of speech as a medium of communication, are present in cognitive processes as important as working memory, or in cognitive tasks as powerful for learning as reading.

It seems that the mastery of prepositions depends on the spontaneous and functional verbal communicative interactions, as long as a clear and distinctive speech perception is guaranteed, as happens when Cued Speech is used before the age of 3 years. In the context of early exposure to Cued Speech, the linguistic differences of age between hearing and deaf study participants should be reduced or cancelled out. Naturally, this aspect needs additional research with study participants who have been exposed to Cued Speech, from the moment deafness is detected, as the only augmentative communication system. Our current research focuses on this point.

**Note**

The research for the present study was part of the investigation program developed by El Equipo de Investigación Modelo Oral Complementado (The Complemented Oral Model Research Group), which was formed by, among others, the authors of the present study. We thank the staff of the following schools for their active involvement in the development of this research: C.P. García Lores (Málaga), C.P. Tartessos (Málaga), C.P. Dr. Fleming (Málaga), C.P. Vicente Alexandre (Marbella), C.P. Los Olivos (Málaga), C.P. Bentayga (Gran Canaria), C.P. León y Castillo (Gran Canaria), C.P. Reyes Católicos (Gran Canaria), C.P. Ginés de los Ríos (Gran Canaria), Dominicas (Gran Canaria), Fuenterrealzuela (Madrid), Centro de E.E. Ponce de León (Madrid), Entender y Hablar (Madrid), Centro de Rehabilitación Príncipe de Asturias (Cartagena), Instituto Valenciano de Audiofonología (Valencia), Sagrada Familia (Valencia).

We are also grateful to the deaf and hearing children who took part in this research, for their patience and kindness. They agreed to devote part of their time to this research, which has the aim of understanding them better.

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On December 17, 2002, while this article was being written, Dr. R. Orin Cornett (author of the 1967 article “Cued Speech”) passed away. With the present research, the authors linked to him professionally and personally would like to pay a posthumous tribute to him and his work.—The Authors.

**References**


VOLUME 148, NO. 4, 2003

American Annals of the Deaf


