Impact of Siblings on Pragmatic Development in Children with Cochlear Implants

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Abstract

The purpose of this study was to investigate the development of pragmatics in young children who have received cochlear implants (CI). There are limited studies that focus specifically on the pragmatic development of these children. This led to the questions of this study that focused on the development of early pragmatics and the possible role of older siblings on this development. Three children and their families participated in this study, one with bilateral cochlear implants, one with a unilateral implant, and one with hearing aids in both ears (who was a cochlear implant candidate). The child with bilateral cochlear implants had an older sibling while the others did not. Data was collected using a developmental questionnaire, the MacArthur Bates Vocabulary Inventory, and 30 minute video recordings of two target activities that required age-appropriate play and demand cooperation between the child with the researcher and a familiar other. The results of this study seemed to both support and refute what was expected about language development in children born with significant hearing loss. Specifically, a younger age of implantation does not necessarily facilitate better language development specifically in the areas of understanding and producing spoken language even if these lag behind age peers. On the other hand, all of the children in this study exhibited age appropriate early pragmatic skills when these were coded for non-verbal and vocal means of communication and therefore, had better pragmatics regardless of implantation status.

Key Words: Pragmatic development; hearing loss; cochlear implants
Impact of Siblings on Pragmatic Development in Children with Cochlear Implants

The literature on language development in children with cochlear implants is still evolving and widely varies (Seung, Holmes, & Colburn, 2005; Ruggirello & Mayer, 2010). It is known, however, that children with cochlear implants received before the age of two have greater opportunities for success in developing language in a manner that is comparable to their like-aged peers. The earlier implanted, the better the chance that child has of being exposed to language learning opportunities, and implantation before the age of two makes children more likely to acquire developmentally appropriate language skills (Ruggirello & Mayer, 2010). Along with early implantation, another important factor in language development is the actual opportunities the child receives for linguistic interactions. This includes any type of rehabilitation, therapy, and/or familial support following the cochlear implantation. And while it is typical for children with cochlear implants to experience some sort of language delay, studies that focus on pragmatics, which is how language is socially used, have received limited attention. Still fewer studies have extended such research to the role of hearing siblings in this aspect of development. The purpose of this study is to investigate the development of pragmatics in young children with cochlear implants who have older siblings.

Review of Literature

Cochlear Implants

First, it is important to have an understanding of who uses cochlear implants, what a CI is, and how CIs work. In order to be eligible for an implant, the child or adult in question has to be severe-to-profoundly deaf (http://www.nidcd.nih.gov). Cochlear implants are made up of two parts: an internal receiver with electrodes surgically placed under the skin, and an external piece consisting of a microphone, speech processor, and a transmitter. The external transmitter sits on
the outside of the ear and sends a signal to the auditory nerve by electrically stimulating it directly. This creates noise that is perceived as sound by the patient (ASHA.org). According to data from the National Institute on Deafness and Other Communication Disorders, as of December 2010, approximately 28,400 children in the US had received cochlear implants.

Language acquisition in children with cochlear implants depends on several factors, including the patient’s age when they receive the implant, what type of CI they use, how long the patient has been deprived of normal hearing, the level of language abilities before and after the procedure, how the hearing was lost, presence of other disabilities, and quality of family care (ASHA.org; Melo & Lara, 2012). Melo and Lara (2012) state that “early CI implantation enables electrical stimulation [and activates] the auditory pathways concomitantly with the critical period for the development of this [auditory] sensory system” (p. 391). This article emphasizes that earlier implantation, in coordination with rehabilitation, is best for facilitating receptive and expressive language development. Rehabilitation can include combining speech-language therapy with the actual process of learning the sounds being produced in the ear by the CIs. In the study done by Melo and Lara (2012), they examined the language differences of two children with CIs; one that had speech rehabilitation in conjunction with usual cochlear implant recovery, and one that did not receive any extra rehabilitation. The child that received extra therapy had a more advanced linguistic performance than the child that did not, because “auditory development is [thought to be] directly linked to oral development” (p. 393). The child with no extra therapy could only “produce isolated words…induced by repetition and not spontaneously” (p. 393). These results support the hypothesis that increased opportunities for language, such as therapy in conjunction with interactions with peers and family, can help increase language skills. A longitudinal study done by Ruggirello and Mayer (2010) compared the language development in
a twin with normal hearing and a twin that had received bilateral cochlear implants at 1 year of age. Results showed that after a 28-month period, the twin with the CIs demonstrated a smaller language delay than is usually displayed in children with a hearing loss. They assert that this is due to the bilateral cochlear implantation itself, because it provided more opportunities for the child to hear language (Ruggirello & Mayer, 2010). Essentially, the more practice a child has with language the better the language will be, especially in the case of children with cochlear implants.

While children with CIs can experience delays in many areas of language, such as “acquiring grammatical morphemes” (Seung et al., 2005), they can also experience very quick and significant growths in language skills after implantation. Impressively enough, it has been proven that children with CIs can have a receptive vocabulary on par with their typically hearing like-aged peers “after 18 months of implant use”, as well as “rate[s] of receptive and expressive language development” that are similar when examined according to how long they have had actually the implant, which sometimes means the amount of time that these children have had any sense of sound perception at all (Seung et. al, 2005).

**The Impact of Siblings on Language Change**

Rehabilitation can also mean coordinating therapy into the family’s daily environment and routine. Family support, including the everyday communication of siblings, aids language development (Owens, 2012), yet the contribution of the sibling relationship as a developmental factor, specifically for children with hearing loss, has often been overlooked or unheeded. In the study previously mentioned by Ruggirello and Mayer (2010), they hypothesized that having a twin sister seemed to help alleviate the stress on the twin with CI by providing a strong language model. One could conclude that this improvement may also have been because of the
interactions with the sibling and the opportunities for communication that this created. So, would such an improvement be expected in children with cochlear implants that do not have siblings to interact with on a regular basis?

In a longitudinal study of two twins, one with a CI and one without, Seung and his colleagues (2005) evaluated the language every six months after the initial cochlear implantation, which took place at the age of 20 months. They suggest that future research be done on sibling sets that do not include twins “to help separate out the influence of being a twin from having a sibling with hearing loss” (p. 186). And while they did find a language delay in one of the twins, the suggestion for more research is because twins typically have delayed language compared to children with normal hearing (Seung et al., 2005). In the study conducted by Ruggirello and Mayer (2010), the results revealed that at just 23.5 months, the twin with CI had receptive and expressive language skills comparable to her typically hearing twin’s skills at 19 months and remarkably, the twin that received the implant also showed “age appropriate receptive and expressive language just 11.5 months post implant” (p. 284).

**The Development of Pragmatics**

Pragmatics is the area of language defined as the set of rules concerning the appropriate usage of language. This includes skills such as adapting to the context of a situation, shifting speaking styles depending on the conversation partner, turn-taking, and contributing information about a certain subject to a conversation (Most, Shina-August, & Meilijson, 2010). The development of these skills begins in earliest childhood and is considered a foundation of language development by some theorists (Dore, 1975; Owens, 2012).

*The impact of hearing loss.* The literature suggests that children with hearing loss display difficulties with the pragmatics of language due to their decrease in opportunities for engagement
in typical social interaction. This lack of opportunity is thought to have an adverse effect on language development in the area of pragmatics (Houston, Beer, Bergeson, Chin, Pisoni, & Miyamoto, 2012). The pragmatic skills of children examined in a study done by Lederberg and Everhart (2000) showed that the children who were deaf were just as eager to participate in the study as children with normal hearing, but they displayed problems with “co-reference to absent (or imaginary) objects” (p. 268) and with requesting what others meant or what their intent was (Le Maner, Dardier, Pajon, Tan-Bescond, David, Deleau, & Godey, 2010). DeLuzio and Girolametto (2011) discovered in their comparison study that children with hearing loss did not differ from children with normal hearing in initiation skills or skills concerning maintaining conversation, but they employed related activity strategies only half the amount of times that normal hearing children did. They also found children with hearing loss to be more hesitant because they employed “Wait and Hover almost twice as much” (p. 1204). In this study, they also found that children with hearing loss were often excluded by their normal hearing playmates, that they received fewer invitations to intermingle, and that nearly 80% of the attempts at interaction were ignored. The researchers suggested that this could be because of a lack of initiation skills on the part of the children with hearing loss, or that it could be because the children with hearing loss were less intelligible to their peers. If the former is true, then speech-language pathologists, educators, and parents need to provide more prospects of learning peer interaction (DeLuzio & Girolametto, 2011).

The impact of siblings. It has been asserted that all children learn the pragmatics of language through interactions with adults (Le Maner-Idrissi, 2010), but one could argue that learning through interactions with siblings is just as useful in the development of pragmatics. The literature reviewed above on the role of siblings in general language development certainly
suggests this. Continuing the expansion of literature on pragmatic development particularly with children with cochlear implants will hopefully bring to light any significant differences that exist and could suggest the importance of the sibling connection in the development of social skills. Discovering that siblings have a positive effect on the pragmatic abilities in children with cochlear implants might provide insight that can be therapeutically useful for all CI children.

**Summary and Questions of the Study**

As can be seen from the literature, young children who received CIs develop speech and language skills that can be commiserate with age level hearing peers when the implantation is followed by intervention. A key and early aspect of language development is pragmatic. The development of pragmatics after CI as well as the contribution of family, particularly siblings, on this development has received little attention in the research literature. This led to the specific questions of this study.

**Questions of the study:**

1. Does age of implantation of cochlear implants impact the development of pragmatics?
2. Does having an older hearing sibling improve pragmatic development?

**Methodology**

**Participants:**

Participants were sought through nomination and given code names. Three children and their families participated in this study; George had bilateral cochlear implants, Charles had a unilateral implant (right ear), and Mary had hearing aids in both ears and was expecting to be implanted three weeks after the study was conducted. The child with bilateral cochlear implants had an older sibling while the others did not. All children were between the ages of 12 and 39 months of age.
Materials:

Written materials included a developmental questionnaire (see Appendix A) and the MacArthur Bates Communicative Development Inventory (or CDI) (Fenson, Marchman, Thal, Dale, Reznick, & Bates, 2007). Two target activities that required age-appropriate play and demanded cooperation between siblings, the researcher, and familiar others were used to gather data. The materials for these activities included two age appropriate books, toy trucks, a fishing game, a bin with holes for shaped blocks, and a piggy bank.

Procedures:

Families were solicited by nomination from professionals in the area. Families completed a brief developmental questionnaire and the MacArthur Bates Communicative Vocabulary Inventory: Words and Gestures (Fenson et al., 2007). Children participated in planned play and free play at their homes with their mothers present, and in George’s case his older brother, to obtain the interaction sample that constituted the data of the study. Planned play consisted of the primary researcher and a familiar other (either the sibling or the mother) engaging in the book sharing with each child, and the free play segment recorded interaction with age appropriate toys (trucks, piggy bank, blocks, fishing game) between each child and a familiar other (parent/sibling). Sessions, which lasted 30-35 minutes, were video-recorded using a JVC Everio digital camera.

Analysis:

The videotaped interactions were analyzed with Dore’s Primitive Speech Act coding (Dore, 1975). The coding for children with and without hearing siblings, and with and without cochlear implants, was compiled descriptively to answer the questions of the study.

Results
Demographics

Three children, all from middle-class, English speaking homes, participated in this study. Code names were used for each. George and Charles, both Caucasian, and Mary who is African-American, were all identified as needing cochlear implants between two and three months of age. At the time of the study, George was 39 months old, and had been implanted in one ear at 12 months of age and the second ear at 20 months. He had one sibling that was one year older. Charles, 30 months old, received his cochlear implant at 22 months of age, and had no siblings. Mary, who wore hearing aids in both ears and had no siblings, was 12 months old expected to be implanted three weeks after the study was conducted. This information is summarized in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Chronological Age</th>
<th>Age CI Recommended</th>
<th>Age of Implantation</th>
</tr>
</thead>
<tbody>
<tr>
<td>George</td>
<td>39</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Charles</td>
<td>30</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Mary</td>
<td>12</td>
<td>n/a</td>
<td>3</td>
</tr>
</tbody>
</table>

Language Status of Participants

The MacArthur-Bates Communicative Development Inventory: Words and Gestures (Fenson et al., 2007) was used to determine language ages for each of the participants. This
normative, parent report instrument provides age ranges and percentiles for the understanding and expression of phrases, vocabulary, and early pragmatics. The combined-sex normative score tables were used to obtain results for all three of the children. Per the scoring instructions, scores for both Charles and George were set at the 50%-ile since they were above the chronological age of the test while scores by age were used for Mary since she fell within the normative age range for the Words and Gestures protocol. If a score fell between two age equivalencies or two percentile ranks, the highest was chosen for reporting. Mary’s results were used interpretively as a baseline for vocabulary and gesture comprehension and production pre-implant, as her hearing age is zero months.

For her chronological age group (12 months), Mary scored below the 5th percentile for phrases understood and words understood, which is below age expectations for hearing children and reflects her lack of auditory input. While she scored at the 25th percentile for words produced even though she had no spoken words, this is because many children just turning 12 months are not yet speaking. Her reported actions and gestures total score placed her at the 20th percentile, while her score for early gestures placed her in the 15th percentile, and the score for later gestures placed her in the 25th percentile. These %-ile scores, except for phrases and words understood are within expected limits for her age. Table 2 includes a summary of Mary’s percentile scores.
George’s scores for total phrases understood at the 50\(^{th}\) %-ile were comparable to that of a 13 month-old. Using this same metric, his words understood were at a 15 month-old level, and his words produced at a 17 month-old level. Charles’ scores for phrases understood at the 50\(^{th}\) %-ile were comparable to those of a 14 month-old, and his words understood at a 16 month-old level. The number of words he produced exceeded the age reference at the 50\(^{th}\) %-ile.

George and Charles were both above the age reference for the 50\(^{th}\) %-ile for total gestures, early gestures, and later gestures, all of which reflect early pragmatic actions. This information is summarized in Table 3. The percentage of vocabulary words understood for each child was calculated by the researcher and is summarized in Table 4.
Table 3.

*Age Equivalency Scores in Months for George and Charles*

- Ages equivalencies of 18 months shown on graph all exceed the age limits of the test.
Table 4.

**Vocabulary Comparison of Participants**

![Bar chart showing vocabulary comparison of participants]

**Coding**

All data were coded according to Dore’s Primitive Speech Acts: calling, requesting an action, requesting an object, answering, labeling, protesting, and imitating (Dore, 1975).

Additionally, these categories were organized nonverbally, vocally, and verbally. The speech acts were organized in four different categories for coding: planned play with the researcher, planned play with a familiar other(s), free play with the researcher, and free play with a familiar other(s). The totals in each category for each act were compiled and analyzed descriptively.

**Question One**
The first question of the study asked if the age of implantation impacted the development of pragmatics. This question was subdivided into two different sections. First, the total number of communicative gestures of all three children were compared, which included nonverbal, vocal, and verbal communicative processes. Mary, who had, up to that point, had no access to normal hearing, was almost entirely nonverbal, with only four of her 63 total acts being vocal. Despite Charles being nine months younger chronologically than George, he totaled 117 speech acts while George totaled just 122. It is important to note the distribution between the two males the number of acts in each type of communication process. George had larger amounts of verbal and vocal acts than Charles, while Charles had almost double the amount of nonverbal acts. This information is summarized in Table 5.

Table 5.

* Differences in Pragmatics across Three Ages

Second, each child’s gestures were analyzed independently and each session was briefly summarized. Refer to Tables 6 and 7 for detailed information on the specific number of instances of each speech act displayed by each child during the video sessions.
During George’s video session, much of the gestures completed consisted of answering and labeling (21/60 acts and 17/60 acts respectively) during planned play, as well as nine counts each of protesting and imitation during planned play. During free play George’s acts took a shift of consisting of nearly half protesting, with 28 out of 62 free play acts. George’s labeling, in particular, increased during the book activity in which he often matched the toys to the pictures in the book, as well as occasional imitation of the animal noises. The protesting occurred during planned play when the animals were not matched properly, however the protesting increased during free play once he began playing the fishing game with his older brother. Examples of George’s protestations included competing over which fish they wanted to catch, vocalizations like grunting, and nonverbal gestures like physically covering his face with frustration or waving his arms. There was little back-and-forth interaction and sharing between George and his sibling, but of the few attentions to the older sibling occurred as the sibling began to cry, in which George responded by going to the kitchen to retrieve a tissue and bringing it to his brother in an effort to comfort him.

Charles’ mother served as his familiar other during his video session. During planned play with the book much of Charles’ actions consisted of answering the researcher’s questions (6/19 acts) with pointing, vocalizations, and imitating animal noises (10/19 acts) made by the researcher. Compared to George, Charles’ play with the trucks led to more back-and-forth interaction between him and the researcher, as seen in the increase of total acts occurring from 19 during planned to 49 during free play with the research and 44 during free play with the familiar other. Charles imitated the researcher’s actions and sounds with the truck on 21 occasions during free play. The five instances of calling were noted only during free play with the researcher in which he would get the researcher’s attention with eye contact and other
nonverbal actions, like taking turns by rolling the truck, looking at the researcher to gain their attention until they imitated, and then repeating.

The data on Mary served as a baseline for pragmatic development in a child who cannot hear since she had not yet received her first CI at the time of data collection, but was fitted with hearing aids in both ears. Her mother was present during the session. She did not produce any verbalizations during any the video session, however she displayed 59 gestural acts and four vocalizations in that time. The most prevalent acts were nonverbally answering and requesting objects; 19 acts and 16 acts respectively. Mary did not exhibit any protesting behaviors, but she employed nonverbal calling eight times in the entire video session.

Table 6.

*Number of Speech Acts Occurring During Planned Play*

<table>
<thead>
<tr>
<th>Primitive Speech Act</th>
<th>George</th>
<th>Charles</th>
<th>Mary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calling</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Requesting an Object</td>
<td>0</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Requesting an Action</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Answering</td>
<td>21</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Labeling</td>
<td>17</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Protesting</td>
<td>9</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Imitation</td>
<td>11</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 7.

**Number of Speech Acts Occurring During Free Play**

<table>
<thead>
<tr>
<th>Primitive Speech Act</th>
<th>George</th>
<th>Charles</th>
<th>Mary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calling an Object</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Requesting an Object</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Requesting an Action</td>
<td>13</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Answering</td>
<td>27</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Labeling</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Protesting</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Imitation</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

**Question Two**

The second question of this study asked if having an older hearing sibling improved pragmatic development. Only one of the children in this study, George, had an older brother. Due to the lack of participants, there was not sufficient data to appropriately answer whether having an older sibling improved pragmatic development. The data from George and Charles were used comparatively to address this question. Despite a 9 month age difference, George and Charles’ scores on the MacArthur Bates vocabulary inventory were similar. Table 8 shows the researcher-calculated percentage of each category in the MacArthur-Bates that the parent reported the child as understood and/or produced. Percentage scores for both George and Charles are within ten percent of the other’s score, with some being the same level of mastery, for example both children were reported to perform 94% of the gestures and actions listed for Early Actions and Gestures. In addition, Charles produced only five fewer gestures during the 30-35
minute session than George, who has an older sibling and was 12 months of age when implanted compared to Charles’ 22 month age of implantation. When comparing the two, different strengths and weaknesses arose. For example, George was more verbally communicative and displayed more incidents of protesting than Charles, who used limited protesting but displayed more instances of imitation.

Table 8.

*MacArthur-Bates Total Percentages Compared in Male Participants*

<table>
<thead>
<tr>
<th>Category</th>
<th>George</th>
<th>Charles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phrases Understood</td>
<td>60.1%</td>
<td>39.1%</td>
</tr>
<tr>
<td>Vocabulary Understood</td>
<td>44.2%</td>
<td>44.2%</td>
</tr>
<tr>
<td>Vocabulary Produced</td>
<td>15.2%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Early Actions and Gestures</td>
<td>94.4%</td>
<td>94.4%</td>
</tr>
<tr>
<td>Late Actions and Gestures</td>
<td>91.1%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Total Actions and Gestures</td>
<td>92.1%</td>
<td>84.1%</td>
</tr>
</tbody>
</table>

**Discussion**

The purpose of this study was to investigate the development of pragmatics in young children who have received cochlear implants (CI). The results of this study seemed to both support and refute what was expected about language development in children born with significant hearing loss. Results suggest that a younger age of implantation does facilitate language development specifically in the areas of understanding and producing spoken language even if these lag behind age peers. On the other hand, all of the children in this study exhibited age appropriate early pragmatic skills when these were coded for non-verbal and vocal means of
communication, regardless of implantation status. While both George and Charles scored above the age equivalencies for actions and gestures at the 50th-ile reference level, they proved to have similar age-equivalencies for vocabulary understood and produced. This may indicate that they are both within normal limits for their ages. Also, in this small sample an older sibling did appear to have an impact on language use. Charles had a larger reported vocabulary than George, despite being implanted in his first ear ten months later than George. On the other hand, George, who had the older sibling, exhibited stronger pragmatic skills. Mary, the youngest and un-implanted participant, provided a baseline for vocabulary and pragmatic pre-implantation, as her hearing age was zero months at the time of data collection. Her understanding of language was below expectations yet her understanding and use of non-verbal and even vocal interaction for communication (pragmatics) was similar to expectations for hearing children.

The results of this study are interesting in light of the literature about language acquisition pre-and post-implantation in children born with severe hearing loss. As mentioned earlier, George, who has an older sibling, displayed a better mastery of actions and gestures than Charles, who did not have a sibling. This could be because a sibling provides more opportunities for interactions, as well as a model for pragmatics. On the other hand, Charles who was nine months younger than Charles had a more extensive vocabulary both receptive and expressively. This perhaps was due to the attention that parents gave to early language. Mary provides an exciting baseline to this development. While her understanding and production of language were minimal, her non-verbal and vocal pragmatic skills were consistent with expectations for 12 month old children.

Limitations
While video data collections many times have small numbers of participants, a smaller pool of participants was expected because of the lowered age of cochlear implantation. Nominations were sought medical professionals and speech-language pathologists who work with this population across the state of Arkansas. Therefore, it was surprising that only three participants were found, and of those, only two were already implanted. This could be attributed to several possible factors: a small population of children with cochlear implants living in the area of study, too strict parameters set for participants sought, or limited types of professionals used to seek nominations. Another limitation of the study could include the length of time of the video sessions of the study. It would have been beneficial, perhaps, to have conducted the study over a course of at least two sessions for each child.

**Future Directions**

While this study provided interesting insight into the world of pragmatics and sibling interaction of children with cochlear implants, there are several topics that can be further explored. Future directions of the study should include increasing the number of participants, possibly by expanding the area in which participants are sought ad broadening the parameters in which participants are chosen. Another suggested future direction could be looking at not only individual acts of pragmatics, but other interactions between the children and a familiar other or researcher. These could include sharing, displays of affection, and joint-attention; all interactions that go beyond the classical features of early pragmatic coding. After seeing the comfort levels of all three participants change as the researcher as the length of the session went on, a future study could also consist of multiple sessions with each child measuring how pragmatics improved and changed as the research shifted from an unfamiliar to a familiar other. Mary provided a foundation for this study for vocabulary and gestures in children before implantation. An
An interesting study could be conducted that analyzes the vocabulary and pragmatics of children before implantation, and then also in increments after receiving the cochlear implant.
References


http://www.nidcd.nih.gov/health/hearing/pages/coch.aspx; National Institute on Deafness and Other Communication Disorders
Appendix A

Developmental Survey

Demographic Information

1. How old is your child? ______________________________

2. Date of Birth: ______________________________

3. [ ] Male [ ] Female

4. How old was your child when you discovered s/he needed a cochlear implant?

5. At what age did your child receive the cochlear implant?

6. At what ages was it mapped?

7. What are three play activities that your child likes best?

8. Does your child have an older brother or sister who is a hearing child? [ ] Yes [ ] No

9. What is the age of this older sibling?

10. Do the children play together, and if so, what are their favorite play activities?

11. Is there any other information that you would like to give me about your child and his or her social and/or language development?
Appendix B

Primitive Speech Acts – Individually Defined with Examples

Greeting: making intentional note of someone’s presence
  Nonverbal: making eye contact and waving
  Vocal: accompanying eye contact with some sort of noise/vocalization
  Verbal: saying “hi”

Calling: intentionally trying to get someone’s attention
  Nonverbal: tapping a person repeatedly
  Vocal: vocalization made at the person whose attention is needed
  Verbal: looking at a person and saying their name

Requesting an Action: making a specific sign to someone that you want something done
  Nonverbal: pointing at the floor as a sign of wanting to sit down
  Vocal: vocalizations accompanying gestures
  Verbal: a word in conjecture with the gestures/motions (“sit?”)

Requesting an Object: making intentional noises or actions for someone to give you an object
  Nonverbal: reaching for an object out of reach
  Vocal: gestures accompanied by vocalizations (looking at an out of reach object and grunting)
  Verbal: pointing and naming the object

Labeling: identifying an object or person
  Nonverbal: pointing at something, especially in response to a question
  Vocal: noise/vocalization made when identifying an object
  Verbal: saying the name of the object in question

Answering: providing a noise or action in response to someone
  Nonverbal: nodding after being asked a question
  Vocal: babbling/vocalizations in response to an open-ended or yes/no question
  Verbal: using words or a single word to respond to a question

Protesting: making a point that you are not happy about something
  Nonverbal: stomping with an angry facial expression
  Vocal: screaming and/or crying in response to something unwanted
  Verbal: saying “no!” in response to something unwanted

Imitating: copying or trying to copy the sounds or actions of another person or object
  Nonverbal: repeating the physical motions of another person or object
  Vocal: repeating noises made by another person or object
  Verbal: repeating a word or phrase

Adapted from Albrecht, S. (2007)
Appendix C

PSA Coding Sheet

Family Code: ________________________

Child with CI:
Age: 
Older Sibling? Yes No

<table>
<thead>
<tr>
<th>Planned Play</th>
<th>Free Play</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dore’s Primitive Speech Acts</strong></td>
<td><strong>Dore’s Primitive Speech Acts</strong></td>
</tr>
<tr>
<td>Greeting</td>
<td></td>
</tr>
<tr>
<td>Calling</td>
<td></td>
</tr>
<tr>
<td>Requesting an action</td>
<td></td>
</tr>
<tr>
<td>Requesting an answer</td>
<td></td>
</tr>
<tr>
<td>Answering</td>
<td></td>
</tr>
<tr>
<td>Labeling</td>
<td></td>
</tr>
<tr>
<td>Protesting</td>
<td></td>
</tr>
<tr>
<td>Imitation</td>
<td></td>
</tr>
</tbody>
</table>

*directed to parent (P), researcher ®, or other(O).

Adapted from Albrecht, S. (2007)
MEMORANDUM

TO: Caitlin McAfee
    Fran Hagstrom

FROM: Ro Windwalker
      IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 13-09-083

Protocol Title: Impact of Siblings on Pragmatic Development in Children with Cochlear Implants

Review Type: ☑ EXPEDITED ☐ FULL IRB

Approved Project Period: Start Date: 10/03/2013 Expiration Date: 09/17/2014

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form Continuing Review for IRB Approved Projects, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (http://vpred.uark.edu/210.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 24 participants. If you wish to make any modifications in the approved protocol, including enrolling more than this number, you must seek approval prior to implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 210 Administration Building, 5-2208, or irb@uark.edu.