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**Early Word Learning Skills of Hearing-Impaired Children
Who Use Cochlear Implants: Development of Procedures
and Some Preliminary Findings¹**

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Abstract. In recent years, cochlear implant (CI) technology has advanced and can now greatly facilitate the spoken language learning of prelingually deafened children. However, there is a great deal of variability in linguistic outcome measures among pediatric CI recipients. Many factors may contribute to this variability in performance, including age of implantation, amount of speech therapy, cognitive factors (such as memory span), and numerous linguistic factors. An important basic linguistic skill that may play a central role in later language development is the ability to map the sound patterns of spoken words onto their referents. This report summarizes and describes the development of a procedure and some preliminary findings of 2- to 5-year-old CI users' and normal-hearing controls' word learning abilities. Each child was presented with either four (2- and 3-year-olds) or eight (4- and 5-year-olds) Beanie Babies™ and labels for their names using interactive play scenarios. Across multiple sessions, the participants were tested for receptive and expressive knowledge of the learned names. This report also describes current plans to test more children and to compare the results of this test with subsequent outcome measures in order to ascertain whether there are any correlations between early object labeling abilities and later language skills.

Introduction

Cochlear implants (CIs) provide profoundly deaf children with the possibility of learning spoken language by allowing them to receive auditory input. However, CIs provide an impoverished signal, and children who receive them have had some amount of prior auditory deprivation. These two factors and others may contribute to the finding that some profoundly deaf children do not succeed in learning spoken language. One of the most interesting and challenging discoveries about pediatric CI users is that there are enormous individual differences in language skills after implantation. Recently, Pisoni, Svirsky, Kirk, and Miyamoto (1997) showed that for individual children with CIs, performance on speech perception, speech production, and language tests were highly correlated with each other. They postulated that the common variance might be attributed to cognitive processing skills, including the phonological encoding, storage, and retrieval of spoken words. In this project, we investigate the early word learning abilities of hearing-impaired children with cochlear implants.

Normal-hearing children begin producing words at approximately 12 months of age. By 18 months, most infants can produce over 50 words and they seem to learn several words each day (Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994). Most research on word learning focuses on how children learn to correctly associate the sound patterns of words to their referents (e.g., Clark, 1973, 1983; Markman, 1991; Nelson, 1988). Recently, some work has explored children's ability to encode the sound patterns of words. Jusczyk and colleagues have shown that by 8 months, infants can encode the sound pattern of words into memory (Houston & Jusczyk, submitted; Jusczyk & Aslin, 1995; Jusczyk & Hohne, 1997). The ability to encode phonological information into memory enables children to form word representations. Gathercole and Baddeley (1989, 1990) have found a strong relationship between phonological working memory span and vocabulary size. Huttenlocher, Haight, Bryk, Seltzer, and Lyons (1991) found a

significant correlation between how often parents use words and their children's acquisition of those words, suggesting that frequency of exposure affects how quickly children learn words. Taken together, all these findings suggest that early word learning may be an important subcomponent or skill that affects later language development.

Children with hearing impairment may be at a disadvantage for encoding phonological information because, to varying degrees, they are unable to discriminate the fine acoustic-phonetic details of speech in their surrounding environment. There is some evidence to suggest that any degree of hearing loss may lead to problems in phonological processing and word learning. For example, in a study of hearing-impaired children who used hearing aids, Gilbertson and Kamhi (1995) assessed children's ability to encode phonological information and to learn words when wearing their hearing aids. The investigators found that hearing-impaired children's unaided level of hearing loss (ranging from mild to moderate) did not correlate significantly with word learning abilities but the ability to encode phonological information did correlate. One group of the hearing-impaired children, when using sensory aids, performed as well as normal-hearing children on language learning tasks, whereas another group had much more difficulty. However, whether any particular hearing-impaired child fell into the normally performing group or the group that had more difficulty did not depend on his/her unaided level of hearing loss. The authors concluded that even a mild hearing loss was a significant risk factor for language impairments characteristic of children with Specific Language Impairment (SLI)³.

It is possible that difficulty in early word learning for some children may be due to difficulty with a specific aspect or stage of word learning. Susan Carey and colleagues have described the word learning process in terms of two stages (Carey, 1978; Carey & Bartlett, 1978). The first stage, "fast mapping", refers to the initial encoding of the sound pattern of the words and some basic understanding of the meaning. The second stage involves developing a fuller understanding of words by hearing them in several different contexts so that hypotheses about their meaning can be tested. Carey and Bartlett (1978) showed that after a single presentation of a word, preschool children already started to form some basic hypotheses of the meaning of the word when the word was used to name a color term. In another study, Heibeck and Markman (1987) have shown that children as young as two years show fast mapping of shape and texture terms as well as color terms. Hence, while a complete understanding of words may involve a complex and lengthy process, the basic process may begin with an initial "fast mapping" stage of word learning that is immediate and crucial in establishing a solid foundation for later lexical development.

The fast mapping stage of early word learning requires children to encode the phonological information of words very rapidly. Children who have difficulty with phonological encoding may show great difficulty learning words. There may be a high incidence of poor phonological encoding ability among CI users for two reasons. First of all, the auditory information provided by a CI is impoverished when compared to normal hearing. It is possible that this impoverished signal may be a limiting factor in encoding the sound pattern of words. Second, hearing impairment may be a risk factor for SLI (Gilbertson & Kamhi, 1995), and one of the factors of SLI is difficulty with phonological processing skills (Leonard, 1998). Thus, it is possible that children with SLI have difficulty with fast mapping. Support for this possibility has come from a series of studies by Rice and colleagues who have shown that children with SLI

³ Specific Language Impairment (SLI) is often operationally defined as the presence of language impairments in the absence of other cognitive and sensory impairments, including hearing loss. However, it is possible children could have language impairments associated with SLI (e.g., mapping sound to meaning) in addition to language impairments specifically caused by hearing loss (e.g., encoding phonological information). In this respect, it is reasonable to discuss the possibility of hearing impaired children also having SLI.

have difficulty with “quick and incidental learning,” which is similar to fast mapping (Oetting, Rice, & Swank, 1995; Rice, Buhr, & Nemeth, 1990; Rice, Oetting, Marquis, Bode, & Pae, 1994). In one investigation, Rice et al. (1994) found that children with SLI needed many more exposures to words than normal language learners in order to display even a basic understanding of the words. Moreover, children with SLI were particularly prone to forgetting the meaning of words after a short delay, suggesting that their long-term memory representation for words was impoverished. In sum, hearing-impaired children who use CIs may have some difficulty quickly learning novel words because the speech signal they receive is impoverished. Some of these children might have difficulty due to poorly developed phonological processing skills.

It is possible that the ability to quickly encode the sound patterns of words and some basic aspects of meaning may account for the individual variability observed in the language skills of children who use CIs. In the present investigation, we explore the possibility that children who use CIs will demonstrate a high degree of variability in learning novel words after only a few exposures. If this hypothesis is correct, then we would expect there to be a correlation between performance on an early word learning task and other language outcome measures, such as vocabulary knowledge and language development.

The goal of this project was to develop a procedure that assesses young children’s ability to learn words after only a few exposures. This project is part of an ongoing investigation to explore how quickly children with cochlear implants can map sound patterns onto referents and to determine the relationship between measures of early word learning and other outcome measures such as spoken word recognition, speech intelligibility and receptive and expressive language abilities. This report describes the results of a preliminary study that was conducted to develop a procedure that can be used to test preschool-aged children’s ability to learn words after a brief exposure period. The first part of the project involved selecting names for the Beanie Baby™ stuffed animals that would be taught to the children. This was done by eliciting names from adult participants. Next, we describe the results of a pilot study with several children with CIs who were given variations on our initial word-learning procedure. The results of the pilot testing with the children helped us modify several aspects of the procedure. Finally, we present preliminary data from twenty-four normal-hearing children and two children with CIs.

Pilot Phase

Selection of Stimulus Materials

The stimulus materials used in all of the experiments consisted of a set of sixteen Beanie Baby™ stuffed animals. Each Beanie Baby™ comes with a name assigned by the manufacturer (Ty Corporation®). We did not use these names because some children might already know the names while others might not and because some of the names were related to physical attributes of the stuffed animals while others were not. We decided to elicit names from adult participants that corresponded to salient physical attributes of the Beanie Babies™. This was done to facilitate the association between the names and the Beanie Babies™. Because many of the Beanie Babies™ have several features that could be considered salient, a pilot experiment was conducted to determine the characteristics of each Beanie Baby™ that were most perceptually salient. The goal of this pilot study was to select labels for each Beanie Baby™ that would be used in the experimental study.

Methods

Participants. The participants were 37 IU undergraduates, with no reported history of speech or hearing disorders. Thirty-five of the subjects were native English speakers. All subjects were recruited from the Indiana University community and all received partial credit towards an Introductory Psychology class for their participation. The mean age of the participants was 19.9 years ($SD = 1.3$).

Materials. Sixteen Beanie Baby™ stuffed animals were used as stimuli. In order to control for possible familiarity effects with the original names, we developed a new set of names for the Beanie Babies™. We decided as a first pass to create the new names in such a way as to give a semantic bootstrap to enable word learning, for example, by using a distinguishing physical characteristic of the animal. The Beanie Babies™ were therefore selected from a larger set of Beanie Babies™ on the basis of whether they had distinguishing characteristics that could be easily named, such as a very long tail, horns, or a bright color.

Procedure. Subjects were tested in three groups in a small experimental classroom. They were given written instructions, in which they were told that the experimenter would hold up each of the sixteen Beanie Babies™ individually, and they would be asked to invent new names for the Beanie Babies™, as if they were teaching the names to a young child. Subjects were asked to re-name the Beanie Babies™ using names that described some physical attributes of the Beanie Babies™. Subjects were instructed to provide up to three new names for each animal, and to use one-word names only. Subjects were provided with answer sheets on which to write the new names. The Beanie Babies™ were presented individually, one at a time, in a random order to the three groups.

Results

For each Beanie Baby™, the responses were recorded and tallied to calculate the frequency of the names generated. A new Beanie Baby™ attribute name was chosen from the response tallies based on two criteria: (1) that the name was the most frequent response among students, and (2) that it reflected a true physical attribute of the animal. For example, the name “Red” was the most frequent response and was also an appropriate name for the red bull because it refers to the color of the bull. In contrast, a non-attribute name, “Teddy,” was the most frequent response for the brown bear, but was inappropriate for our purposes. The second most common response was “Fuzzy,” which we used as it describes an attribute of the bear. The new attribute name was the most frequent response for seven of the Beanie Babies™ (“Blue,” “Red,” “Stripes,” “Pink,” “Spots,” “Ears,” “Tail”), the second most frequent response for four of the animals (“Wings,” “Fuzzy,” “Legs,” “Cottontail”), the third most frequent response for five of the animals (“Horns,” “Gray,” “Teeth,” “Bushy”), and the fourth most frequent response for “White.” Table 1 lists each original Beanie Baby™ stuffed animal name and description, its new attribute name derived from this procedure, and the percentage of subjects who used the new attribute name.

| Original Beanie Baby™ name | “New” attribute name | Frequency of new name response (%) | Original Beanie Baby™ name | “New” attribute name | Frequency of new name response (%) |
|----------------------------|----------------------|------------------------------------|----------------------------------|----------------------|------------------------------------|
| <i>Crunch</i> the Shark | <i>Teeth</i> | 11.8 | <i>Dotty</i> the Dalmatian | <i>Spots</i> | 46.6 |
| <i>Rocket</i> the Bird | <i>Blue</i> | 36.6 | <i>Halo</i> the Angel Bear | <i>White</i> | 6.1 |
| <i>Batty</i> the Bat | <i>Wings</i> | 13.7 | <i>Spunky</i> the Cocker Spaniel | <i>Ears</i> | 14.9 |
| <i>Kuku</i> the Bird | <i>Pink</i> | 29.6 | <i>Nuts</i> the Squirrel | <i>Bushy</i> | 11.1 |
| <i>Snort</i> the Bull | <i>Red</i> | 32.4 | <i>Nibbly</i> the Bunny | <i>Cottontail</i> | 14.1 |
| <i>Goatee</i> the Goat | <i>Horns</i> | 8.2 | <i>Spinner</i> the Spider | <i>Legs</i> | 14.9 |
| <i>Buster</i> the Bear | <i>Fuzzy</i> | 9.8 | <i>Prance</i> the Tabby Cat | <i>Stripes</i> | 25.6 |
| <i>Tiptoe</i> the Mouse | <i>Tail</i> | 18.5 | <i>Spike</i> the Rhino | <i>Gray</i> | 7.8 |

Table 1. Original Beanie Baby™ names, new given attribute names, and the frequency with which each new name was generated.

Procedure Development

Once the new names were chosen, a piloting phase was initiated to develop a procedure for assessing word learning in young children with cochlear implants after a brief exposure period. The initial conception of the experiment was as follows. Children would be taught the new names of the Beanie Babies™. Younger children (2;0 – 3;11) would be taught four names and older children (4;0 – 5;11) would be taught eight names. In order to get a baseline measure of how likely it was that the children would spontaneously label the Beanie Babies™ with the target labels, the experiment started with two pretests. In the first pretest, children were presented with each of the Beanie Babies™ they would be taught and were simply asked to give it any name, using a free response format. The second pretest used a forced-choice procedure. The Beanie Babies™ were placed in a row in front of the child, and the child was asked to select the one that might have the name that the experimenter presented to them. For example, the experimenter might say, “Which one do you think is named *Fuzzy*?” The experimenter did this for each of the Beanie Babies™.

Following the pretests, each child was given a sequence of training phases in which they were taught the names of the Beanie Babies™, one at a time, using play scenarios. The experimenter provided the name of each Beanie Baby™ exactly three times. Toys were used to give each Beanie Baby™ some sort of memorable personality. For example, in one scenario, the experimenter would say, “This is *Fuzzy*. *Fuzzy* likes to eat grapes. Can you give the grapes to *Fuzzy*?” After exposure and training with each Beanie Baby™, the children were given tests to assess whether or not they learned to associate the names with the Beanie Babies™. The first test used a forced-choice procedure, exactly like the second pretest. The second test used a cued-recall procedure. The cued-recall test required an expressive response from the child. In this procedure, each Beanie Baby™ was presented one at a time to the child as a cue, and the child was asked to recall its name from memory.

The initial procedure underwent several stages of development during the piloting phase. Six children who use cochlear implants participated in the piloting phase: SHM (4;1), SHZ (6;2), SHS (2;5), SNW (3;2), SMH (5;11), and SOC (4;1). Here, we will summarize our major observations during the piloting phase and describe how these pilot results shaped the final design of the experimental procedures.

- **Children often perseverate on the names they initially choose for the Beanie Babies™.** The initial conception of the procedure involved two pretests. During the procedures, we discovered that the children who were given the pretests (SHM and SHZ) were very resistant to learning new names for the Beanie Babies™. Instead, they tended to perseverate on the names that they initially selected. Hence, the pretests were dropped from the procedure.
- **Children who use cochlear implants need several exposures to words.** In the first stage of the pilot, children received only three exposures to each name before they were tested. With only three exposures per item, two of the participants in the pilot study did not perform above chance. Given the poor performance of the pilot subjects tested under this condition, the number of exposures was increased from three to eight for each name.
- **Imitation is important for word learning.** Another factor that seemed to contribute to the poor performance in the early stages of our pilot testing was that no measure was taken to ensure that the children actually encoded the names they were being taught. To make sure that the children encoded the sound pattern of the words, we asked the children to repeat the names that we produced. It is possible that the act of producing the words helps with children's memory for words because there may be a strong developmental interaction between perception and production (e.g., Vihman, 1993). There are recent data supporting the importance of immediate memory and imitation in novel word learning (Gupta & MacWhinney, 1995).
- **Children often show a preference for new Beanie Babies™.** During one phase of the pilot testing we decided to try teaching the names of the Beanie Babies™ to the children one at a time. Thus, they were first presented with one animal and then were given the forced-choice and cued-recall tests for that animal. If they were correct, they were taught the name of an additional Beanie Baby™. If they were incorrect, they were re-taught the original name. Each time they were correct on both the forced-choice and cued-recall tests, the set size increased by one. The set size increased until the child could no longer respond correctly on three consecutive trials. In carrying out this procedure with SHS, SNW, and SMH, we discovered that as the set size increased, the children showed a novelty preference for the most recent Beanie Babies™ presented. As a result, we decided that during each session, the child would be presented with all of the Beanie Babies™ (four or eight), one at a time, and then tested on all of them.
- **A minimum of one year of cochlear implant experience is necessary.** One of our initial criteria for inclusion in the study was that the child must have had at least six months of implant use. The participant SOC, who had exactly six months of experience, clearly did not have sufficient auditory skills to participate in the study and carry out the tasks. Hence, we increased the criterion to one year of implant use.

Experiment

The piloting phase ended when a procedure was settled on that was simple enough for the pilot participants to complete but did not yield ceiling performance. Children were taught and tested on two sets of Beanie Babies during one session. Their long-term memory of the names

was subsequently assessed in a second session by re-testing them at least two hours later. The final design is described here and some preliminary results from two children with CIs and twenty-four normal-hearing children are reported below.

Methods

Participants. Two groups of children participated in this study. One group of four children was recruited from the population of children with cochlear implants who are routinely followed as part of the ongoing longitudinal studies at Indiana University. The criteria for inclusion was that they were between the ages of 2;0 and 5;11, use oral communication, and had at least one year of cochlear implant experience. Two children who use CIs (ages: 3;2 and 3;10) completed the experiment, but the other two children (ages: 2;4 and 4;2) were unable to complete the experiment due to failure to give any responses and are not included in the Results section. Twenty-four age-matched normal-hearing controls were recruited from the Bloomington, Indiana area and the Center for Young Children daycare center on the Indiana-University-Purdue-University-Indianapolis campus. All 24 completed the initial experiment. Seven of the normal-hearing children and the two children with CIs who completed the initial testing participated in the long-term memory test.

Materials. The stimulus materials consisted of 16 Beanie Babies™ that were assigned names by normal hearing college students (see Stimuli Selection above). Each name corresponds to a salient physical attribute (e.g., “*Red*” is a red bull). The Beanie Babies™ were grouped into sets of four as shown in Table 2. The Beanie Babies™ were selected so that most of the attribute names could describe at least two Beanie Babies™ in the group. For example, “*Wings*”, “*Pink*”, and “*Blue*” all have wings. This was done so that the children would not be able to completely rely on identifying the attributes in the tasks. For example, when they were asked to identify “*Wings*”, three of the four Beanie Babies™ had wings.

| Set | Beanie Baby™ Attribute Name | Description |
|-----|-----------------------------|----------------------|
| A | Teeth | Shark |
| | Blue | Blue jay |
| | Wings | Bat |
| | Pink | Cockatoo |
| B | Red | Bull |
| | Horns | Goat |
| | Fuzzy | Brown bear |
| | Tail | Rat |
| C | Spots | Dalmatian |
| | White | White bear with halo |
| | Ears | Cocker spaniel |
| | Bushy | Squirrel |
| D | Cotton tail | Rabbit |
| | Legs | Spider |
| | Stripes | Cat with stripes |
| | Gray | Rhino |

Table 2. Word set stimuli.

Procedure. Children were taught a set of Beanie Babies™ (Training Phase 1) and then given forced-choice and cued-recall tests for that set (Testing Phase 1). Children were then taught another set of Beanie Babies™ (Training Phase 2) and subsequently given the same tests with the second set (Testing Phase 2). Finally, after at least a two-hour delay, children were given the same tests using the first set of Beanie Babies™ and then using the second set (Long-Term Memory Test).

Training Phase 1. *Children younger than four years.* Each child is exposed to four Beanie Babies™. Before the experiment, the exact order of Beanie Baby™ presentation was randomized and recorded on a form that was then followed during the experiment. One experimenter (Experimenter 1) interacted with the child while a second experimenter (Experimenter 2) assisted Experimenter 1 in following the correct order. Experimenter 2 also recorded the children's responses and the number of times Experimenter 1 produced the name of each Beanie Baby™.

Experimenter 1 presented each Beanie Baby™, one at a time, to the child. A different toy prop was used to create a different play scenario with each Beanie Baby™ in order to keep the task interesting. During the play interaction with each Beanie Baby™, Experimenter 1 used the name of the Beanie Baby™ exactly eight times. During the play scenario, Experimenter 1 tried to elicit three productions of the name from the child. Experimenter 2 recorded how many times the child produced each name. Positive feedback was given when the child produced the correct names. See Appendix for a sample scenario.

Children between four years and six years. The training phase was the same with older children as with the younger children, except that eight Beanie Babies™ were taught instead of four.

Testing Phase 1. *Forced-Choice Test.* The Testing Phase consisted of a forced-choice identification task and a cued-recall test given immediately afterwards. For the forced-choice identification test, all of the Beanie Babies™ (four or eight) were placed in a row in front of each child and hidden from view with a piece of cardboard. Then a toy bus or truck was brought out and placed in front of the child. Experimenter 1 then asked the child to “please put {one of Beanie Babies™} into the truck {or bus}”. The child was encouraged to select one of the Beanie Babies™ but was not given any feedback as to whether the response was the correct choice. For example, the experimenter said “thank you,” “good job,” or clapped when the child made a selection, regardless of whether or not the response was correct. The Beanie Baby™ was then placed back in the row and the next trial was initiated. Each Beanie Baby™ was requested exactly once.

Cued-Recall Test. For the cued-recall task, Experimenter 1 played a “knock knock” game with the child. One Beanie Baby™ was placed behind a toy doorway. Experimenter 1 and/or the child said “knock knock,” the door would open and Experimenter 1 would ask the child, “Who’s there?” The child was asked to name the Beanie Baby™, up to three times. Experimenter 2 recorded any response. This procedure was repeated for each Beanie Baby™.

Training Phase 2. This phase was the same as Training Phase 1 except that a different group of four or eight Beanie Babies™ was presented to the child.

Testing Phase 2. This phase was the same as Testing Phase 1 except that the new set of Beanie Babies™ was used.

Long-Term Memory Test. On the same day of testing, but at least two hours after the completion of Testing Phase 2, the child was tested a second time, in order to assess long-term memory for the names. During the long-term memory test, Testing Phase 1 and Testing Phase 2 were repeated again without any retraining or feedback.

Results

The mean accuracy scores for all of the tests are summarized in Table 3 for normal-hearing children, and in Table 4 for hearing-impaired children with CIs. The preliminary data revealed that the normal-hearing children had very high scores for the forced-choice test in both the Immediate and Delay conditions. So far, the children who use CIs have performed comparably on the immediate forced-choice task. However, their performance on the cued-recall test, and both tasks after a delay, were very low.

Immediate Test

| | Forced-choice accuracy | standard deviation | Cued-recall accuracy | standard deviation |
|--------------|---------------------------|-----------------------|-------------------------|-----------------------|
| < 4 yrs (12) | 0.95 | 0.08 | 0.92 | 0.17 |
| > 4 yrs (12) | 0.95 | 0.10 | 0.97 | 0.08 |

Delay Test

| | Forced-choice accuracy | standard deviation | Cued-recall accuracy | standard deviation |
|-------------|---------------------------|-----------------------|-------------------------|-----------------------|
| < 4 yrs (3) | 0.88 | 0.22 | 0.75 | 0.25 |
| > 4 yrs (4) | 0.94 | 0.13 | 0.89 | 0.14 |

Table 3. Mean accuracy response for normal-hearing children (N=24).

Immediate Test

| | Forced-choice accuracy | standard deviation | Cued-recall accuracy | standard deviation |
|-------------|---------------------------|-----------------------|-------------------------|-----------------------|
| < 4 yrs (2) | 0.63 | 0.18 | 0.25 | 0.18 |

Delay Test

| | Forced-choice accuracy | standard deviation | Cued-recall accuracy | standard deviation |
|-------------|---------------------------|-----------------------|-------------------------|-----------------------|
| < 4 yrs (2) | 0.13 | 0 | 0.19 | 0.27 |

Table 4. Mean accuracy response for hearing-impaired children who use cochlear implants (N=2).

Discussion

The procedures that were developed in this project will allow us to assess the word-learning skills of children, which will be valuable in tracking the language development of children who use CIs. The results thus far are very preliminary because only a small number of children who use CIs have been tested. We will test at least 12 children who use CIs from each of the two age groups before analyzing the data and comparing it to the results from the normal-hearing children. Another step in the project is to analyze the results from this test and compare them to the results obtained on several outcome measures. The children who use CIs are routinely given a battery of speech perception, word recognition and language tests up to several years after they receive their CIs. One of our goals is to assess how the variability of children's performance in learning novel words in these tasks is related to the variability of language outcome measures. Measures of early word learning and "fast mapping" in this clinical population may be important new predictors of language development and other language-based outcome measures.

A future direction for this project is to manipulate the phonological properties of the names of the Beanie Babies™. Currently, we are using real names that correspond to salient visual attributes in order to make the learning task as easy as possible. Once these procedures are validated, subsequent experiments will use Beanie Babies™ with nonword names, which will vary in terms of phonological difficulty (e.g., phonotactic probabilities, syllable number or stress). These other projects should provide valuable new information about the ability of children who use CIs to encode phonological information in tasks that require novel word learning skills, imitation, and long-term retention.

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Appendix

Sample Scenario:

This is *Name*.
Can you say hi to him?
Say "Hi *Name*!"
Now your turn {child says "hi *Name*"}
Name likes to climb the tree.
Can you put him on the tree? {child interacts with BB}
Look – *Name* is on the tree.
Tell him to get down. {child says, "get down *Name*"}
Good. Now, *Name* has to go bye bye.
Say, bye bye *Name*. {child repeats "bye bye *Name*"}