

Implanted Children Become Linguistic Sharks

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It has been said that children are "linguistic sharks". This makes the point that children are aggressive little code breakers. They continually contrast their own system against the models of the people they interact with and then revise it as they discover differences. They parachute into the country where they are born and set to work cracking the code of the language around them. Through trial and error, within meaningful interactions, they discover what works, what doesn't work and what works better. Telling mommy "more juice" works better than just "more". Somehow they sort out that we say "two old brown socks" instead of "brown old two socks". As code breakers, children do best immersed in meaningful language interaction where they can try, fail, discover and succeed.

This is the job that normal-hearing preschoolers do. They crack the code of the language around them. They build a language system that works. The children in pre-school learn to listen. They then use that system and listen to learn.

Our goal for children with cochlear implants is that they develop an effective listening system to crack the code of the language around them. They should become "linguistic sharks" in the language experience they swim in. Clinicians often note that two children with similar speech perception test scores may differ greatly in their ability to listen and communicate in everyday situations. The better children are able to learn from everyday language experience, the more benefit they tend to receive from their cochlear implant. This "everyday learning" ability may be the best way to describe their true benefit.

Give a man a fish and he eats for a

day, teach him to fish and he eats for a lifetime.

Are the children who are developing a better listening system acting more as linguistic sharks? Are they provided with more language rich water to swim in? What can we do to improve the development of a listening system in the children not doing as well?

A paradigm is helpful in describing the variables that affect listening difficulty.

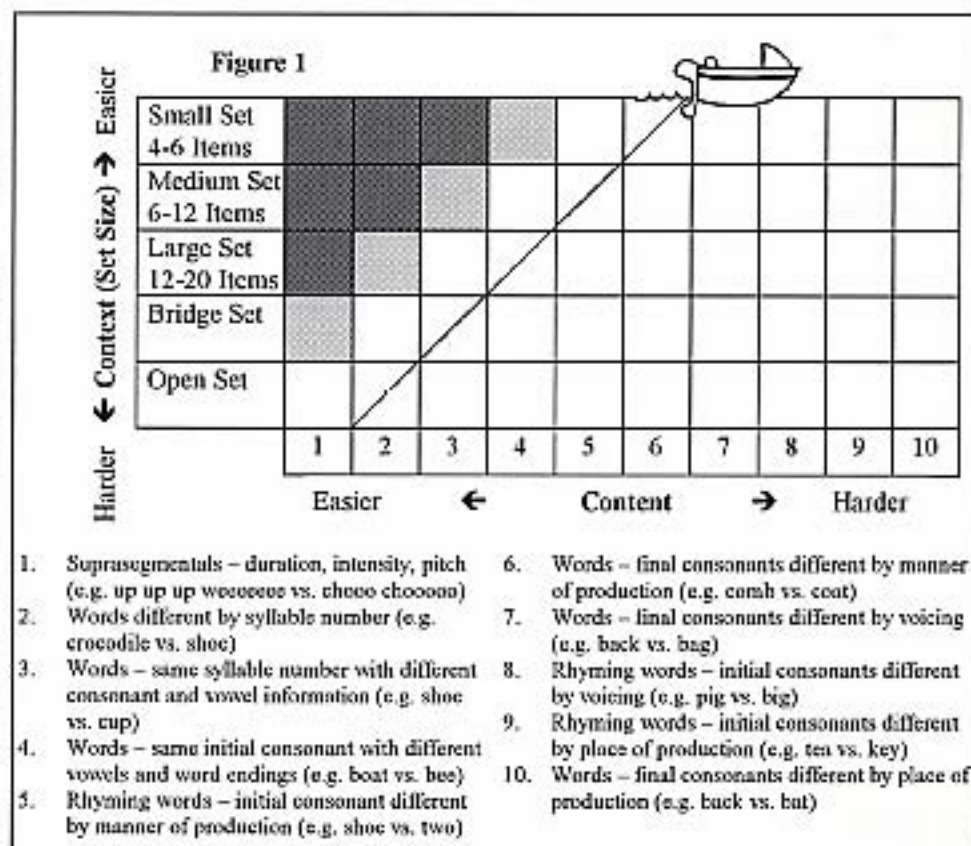
Figure 1 presents a paradigm that organizes the variables one should consider when setting up language experiences with implanted children. Each of the variables combines to estimate the difficulty of a particular listening situa-

tion. The variables considered are relatively easy to identify and modify. As one variable is controlled to make a listening task easier, another variable can be targeted when more difficult. They are grouped into variables of content, context and presentation¹. The boat and the line advancing below it represent a particular child's progress in his listening ability. The area passed by the boat describes listening situations where this child would be successful.

Let's describe the variables to consider in this paradigm.

Content

Content refers to the words or sounds that are said. On Figure 1, content is represented on the horizontal



axis. Movement to the right on this axis (higher numbers) suggests more difficult listening tasks. In the beginning, sounds that are very different from one another in duration (length), intensity (loudness), and pitch are easiest to distinguish. With more listening experience, a child can distinguish between more subtle or fleeting differences. With continued improvement, the child is able to move from easier acoustic contrasts to harder ones.

When a child first experiences sound through a cochlear implant, only broad differences may be perceived. Discriminating when a sound is present or absent helps a child discriminate long sounds from short ones. Think of turning on a light in a darkened room. If you know the light is on vs. off, you can learn to tell when the light is on for a long pause vs. a short burst. You don't need to discriminate anything in the room to be able to do this.

When a child first begins to hear he has no auditory memory. Words fly by as identical bursts of sound. If words are the fish in our paradigm, they swim by too quickly for a beginning listener to distinguish. Early goals for comprehension may include processing and associating sounds that are more different than words can be. Sound-object associations, different in suprasegmentals may be easiest to learn in beginning stages. Whispered "puh puh puh" for boat vs. "aaaaaaah" (rising and falling pitch) for the airplane are much easier to distinguish than the words "boat" vs. "airplane". Similarly, common phrases contain more auditory information than do single words and are, therefore, easier for listeners to distinguish. Common phrases should be incorporated into early listening goals. When common phrases are said in the same way with the same intonation, there is a lot of information that helps a child in early stages to process what is said. For example²:

words: • •
 done more

phrases: • • • • •
 It's all done
 • • • • • •
 Do you want some more?

If vowel and consonant differences are flying by too quickly to process, a child may hear these words as

words: • •
 blah blah
phrases: • • • • •
 Blah blah blah
 • • • • • •
 Blah blah blah blah blah

Common phrases can be worked frequently into daily activities and are useful to promote early understanding and listening. As consonant and vowel sounds are repeated and/or extended, they are sorted out and a child can become faster at processing these differences. These skills scaffold towards listening for differences between words as they fly by.

As a child is able to discriminate finer and finer differences between sounds in words, the boat in our figure (Figure 1) moves along the grid to the right. Close to the "shore" on the left, the words (or sound-object associations) are very different from one another. Imagine again that the words are the fish. Just as an octopus would be easy to tell from a goldfish, stereotypic phrases like "Bye Bye" will sound different than "Put on your shoes". Sounds like "aaaaaaah" (rising and falling pitch) for an airplane would be easy to discriminate from "puh puh puh" (whispered) for a boat. As the boat progresses, mastery is built toward more difficult discriminations. Just as two carp with different fin shapes would be difficult to identify as they swim past, so too are words like "tea" and "key".

Content difficulty is also affected

by how familiar the words are to the listener. Pre-teaching the words that are to be heard in a classroom can greatly increase the chance of those words being understood. The familiarity decreases the content difficulty of that listening situation.

Context

Another variable affecting the difficulty of a listening situation is the context. Context helps a child to understand because it narrows the possible things that you might be saying. The context is generally described in terms of set size, shown along the vertical axis in Figure 1.

As words become familiar and discrimination of the acoustic contrast becomes more automatic, children are able to handle larger set sizes. They can hear the word, hold it in auditory memory, and scan the context for a match. If four objects are on the table and you are clearly asking for one, the set size is four, which is relatively small. With one item from which to choose, a child does not have to listen to understand. With two items they may trust guessing as a strategy more than listening. In order to adopt listening as a way of being, a child should be helped to discover that listening for meaning is their best bet for understanding. *If they guess they will probably fail and if they listen they will probably succeed.*

As the boat on the grid advances, work at a particular level of content can be approached in larger set sizes.

Set size also applies to situations away from a therapy table when standing by the door with a child, the set size could be two ("Give me a kiss" or "Open the door"). Standing further away from the door the set size increases as there are more things one could be talking about. We can describe listening situations as small set, medium set, large set, bridge set or open set. Bridge set is a step between large set and open set. Bridge set is narrowed from open set by association or topic. If I know that we are talking

about recess and I hear you say "sli*e" I will probably understand that you said "slide". In open set tasks you could have said "slight, slime, slice, sly, etc."

Presentation

Presentation is the third variable. It has to do with *how* you say what you say to your child. If words are the fish in content, presentation is how the fish swim by. In Figure 1, presentation is represented by the shading in each square on the grid. The darker shading represents a more established ability to listen to words in terms of presentation variables. As listening for content in a particular set size becomes established, there is less need for modifying the way that the words are said. These are also areas in which a child can learn and then process more complex linguistic structures. Think of the areas in our grid as a wake widening behind our boat. The squares farthest behind the boat should theoretically be the ones first strongly established.

Let's consider two variables in presentation. They are acoustic highlighting and linguistic complexity.

Acoustic highlighting techniques are modifications that a speaker controls to help make what is said easier to hear. If we think of words as fish swimming by, acoustic highlighting makes the fish easier to see. Acoustic highlighting includes modifications such as:

- Prompt to listen - *It is easier to identify a fish if you are prompted to look for it.* Does the child need to be told to listen? Does he catch unexpected words or phrases? Does he seem to "turn on" his listening when he sees a hand cue or an acoustic screen?
- Repetition - *It is easier to identify a fish if it swims by twice.* Does the child depend on this? Does he expect a second or third chance or does he eagerly try to process the word the first time? Is the expectation that he listen the first time?
- Use of exaggerated intonation - *If a pattern of fish is important for understanding, it is easier to see the individual fish and the overall pattern if it is exaggerated.* Can the child understand with normal intonation?
- Use of stress - *It is easier to identify a fish if it swims in the foreground.* Can the child process the word when it is unstressed in the sentence?
- Use of a reduced rate - *It is easier to identify a fish if it swims by slowly.* Can the child listen and understand when someone speaks at a normal or fast rate?
- Use of "auditory space" (e.g. "Give me the...scissors...") - *It is easier to see a fish separated out*

from a school of other fish. Can the child listen for words at the end of a phrase? Can the child listen for a word within a phrase? How about at the beginning of a phrase?

- Listening close - *It is easier to see a fish close up than far away.* Does the child try to listen at a distance or does he give up?
- Listening in quiet - *It is easier to see fish in clean water than in dirty water.* Does the child try to make out the fish when he finds himself in murky water (noisy situations) or does he give up?

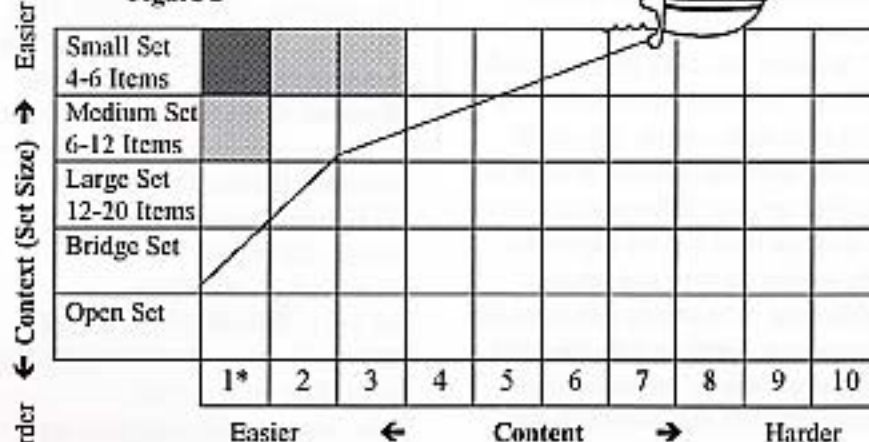
As skills improve, children should become adept at listening with fewer repetitions, more natural intonation, rate, and stress, to words said in running speech. They should also be more likely to succeed when the speaker is unfamiliar, further away, and/or there is noise. Parents and therapists continuing to use acoustic highlighting when it is not necessary run the risk of building a dependency that will hinder generalization.

Progress must also proceed from single items toward increased linguistic complexity. Listening for meaning is not just listening for each word. The pattern (grammar) of the words changes the meaning of the whole. "The boy chases the dog" means something different than "The dog chases the boy".

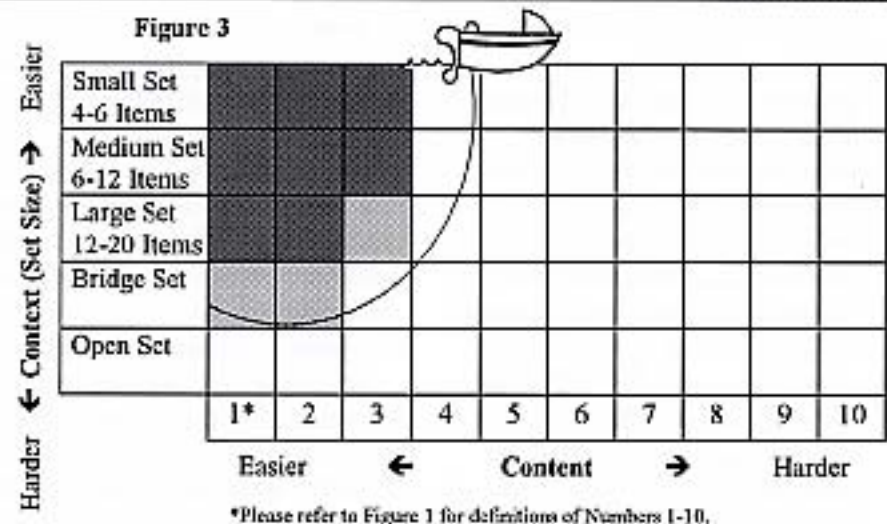
The established squares in the grid (Figure 1) with content easy and set size small are the best type of situation in which to have a child listen for a new, more complex sentence form. Listening for words at the beginning of a phrase different by vowels may help a child hear and learn the pronouns "she" and "they". The rhyming pronouns "she" and "he" might be confused until listening for more subtle sound differences becomes better established.

Dependence on acoustic highlighting and decreased linguistic complexity are analogous to a boat progressing with a narrow wake. A child involved in less than challenging language and listening

Figure 2



*Please refer to Figure 1 for definitions of Numbers 1-10.



situations may be described as a boat that stops moving. Two other common profiles in listening development could be described as follows:

The "Snag" describes a child who resists listening when the context is not clear. Figure 2 illustrates listening progress that is not developing as it should. You may see a child with this type of listening system resort to guessing when faced with larger set sizes, use a key word strategy when away from the therapy table, shut down listening skills when faced with less structured listening activities, spend time trying to organize items on the table before they feel they are ready to listen, or fail to process unexpected items (even those over-learned).

Sometimes the therapy approach contributes to this type of problem. Over-reliance on "sit down" treatment activities or auditory programs that focus on discrimination skills alone can lead some children to develop this type of listening system. These programs' activities are generally single word discrimination exercises used in small to medium set sizes. In our paradigm, this work can be plotted as occurring only directly behind the boat.

Children who receive cochlear implants often have experienced failure in listening through hearing aids. By setting up opportunities for children to hear and understand despite set size will build

trust in listening and generalize skills away from the therapy table.

"Slack"

Figure 3 describes a child who typically has good language skills and can fill in the consonant and vowels and even words that he doesn't hear from the context. His discrimination of vowel and consonant information is poor but his listening for the rhythm of the sentences and the syllables in words together with his strong language skills help him to cope. This child breaks down in performance when he loses his context. He may have good lipreading skills and, assuming the content and context are familiar, will do quite well. He will have trouble with topic switches, listening for new vocabulary, and at times a misunderstood phrase will get him temporarily lost.

Whereas this child performs well with the "fish" he does recognize, his problem is with content. This child may still have the potential to learn to discriminate finer differences in words. He may not have had the experience with smaller set sizes and acoustic highlighting to be able to sort these differences out. Working with this child using small sets and more difficult content can help him develop better discrimination in running speech. He

can build up to processing the differences between vowels and then consonants to use that skill in every day contexts. These children typically put to use skills they acquire in auditory exercises. Closed-set tasks can give them the acoustic highlighting they need to sort out the differences they weren't able to abstract from running speech.

Encouraging your Linguistic Shark to Swim

When we view a child as a linguistic shark, we view him as an active learner. He is not a passive participant. He does not need to be taught so much as to be provided with rich language learning experiences. In his development of the tapestry of language, the therapist and parent may only need to lead him to areas that need attention through meaningful and rich language interactions.

References

1. Cochlear Implant Auditory Training Guidebook. Sindrey, D., Wordplay Publications, 1997.
2. Listening Games For Littles. Sindrey, D., Wordplay Publications, 1997.

Books and materials by Dave Sindrey may be ordered through AG Bell or at the Wordplay Publications website www.exoculink.com/~wordplay.

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