

CHILD VOCALIZATIONS AS INDICATORS OF SENSORY AID BENEFIT

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Vocal Development is...

- a process by which infants and toddlers produce **increasingly complex, phonetically diverse, and speech-like** vocalizations prior to saying words on a regular basis.



Three-Category System Adapted from the Stark Assessment of Early Vocal Development-Revised (SAEVD-R; Nathani, Ertmer, & Stark, 2006)

Simplified classification of vocalizations

- 1. Precanonical**
(SAEVD-R levels 1 – 3)
- 2. Basic Canonical Syllables**
(SAEVD-R level 4)
- 3. Advanced Forms**
(SAEVD-R level 5)

Precanonical Vocalizations...

(Range of emergence 0 – 6 months in NH children)

- ...lack true vowels and true consonants in combination with a rapid transition between them (Oller, 2000)
- Types
 - Quasi- and fully-resonant nuclei (Oller & Lynch, 1992)
 - Squeals
 - Vowels / vocants in isolation or in series (Kent & Bauer, 1985)
 - Consonants / Closants in isolation or in series (Stark, 1980)

Basic Canonical Syllables

(Range of emergence 6 – 10 months in TD children)

- characterized by...
 - Normal phonation (voicing)
 - Full vocalic resonance (a vowel)
 - At least one consonant
 - Rapid CV transitions

(Oller & Lynch, 1992)
- Types
 - CV syllables and disyllables (CVCV)
 - Reduplicated and nonreduplicated babbling
 - Whispered vocalizations

Oller, D. K. & Eilers, R. E. (1988). The role of audition in infant babbling. *Child Development* 59, 441 -449.

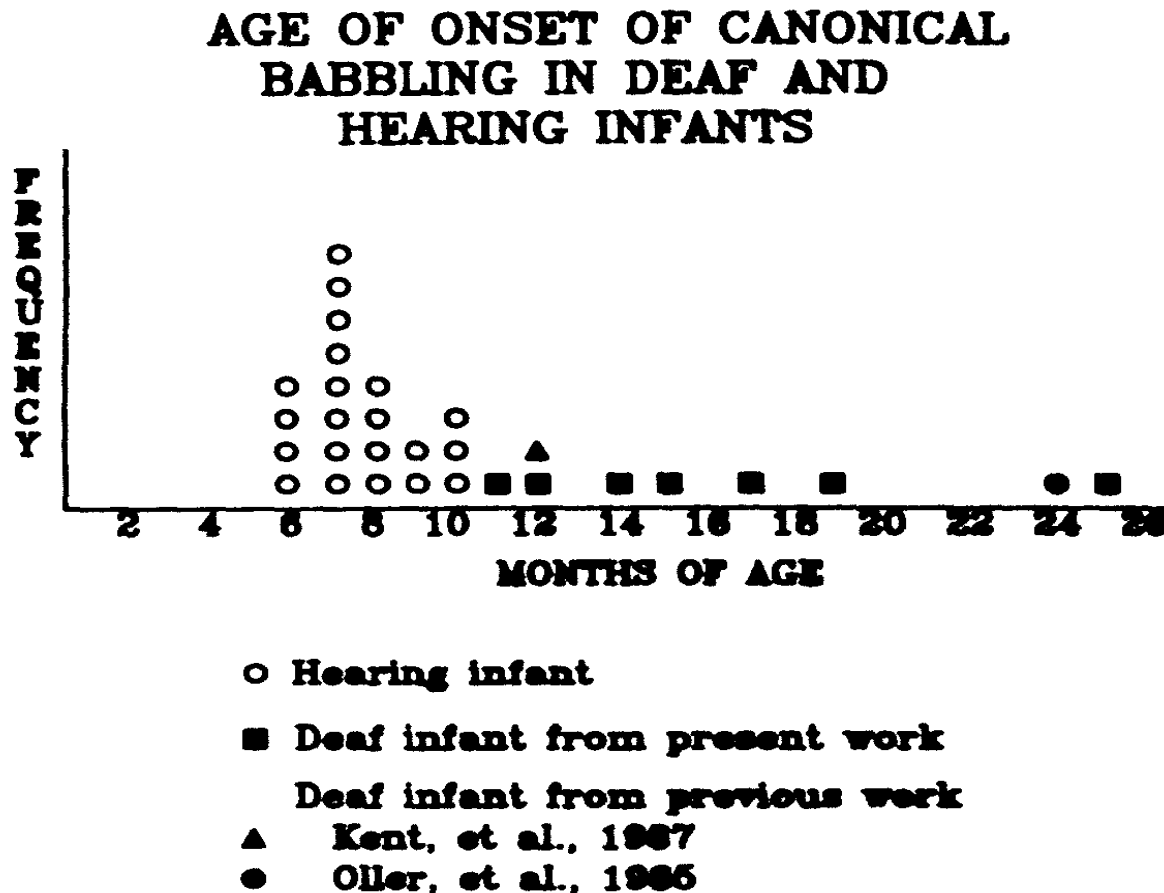


FIG 1 — Frequency distribution for ages of onset of canonical babbling in deaf and hearing infants

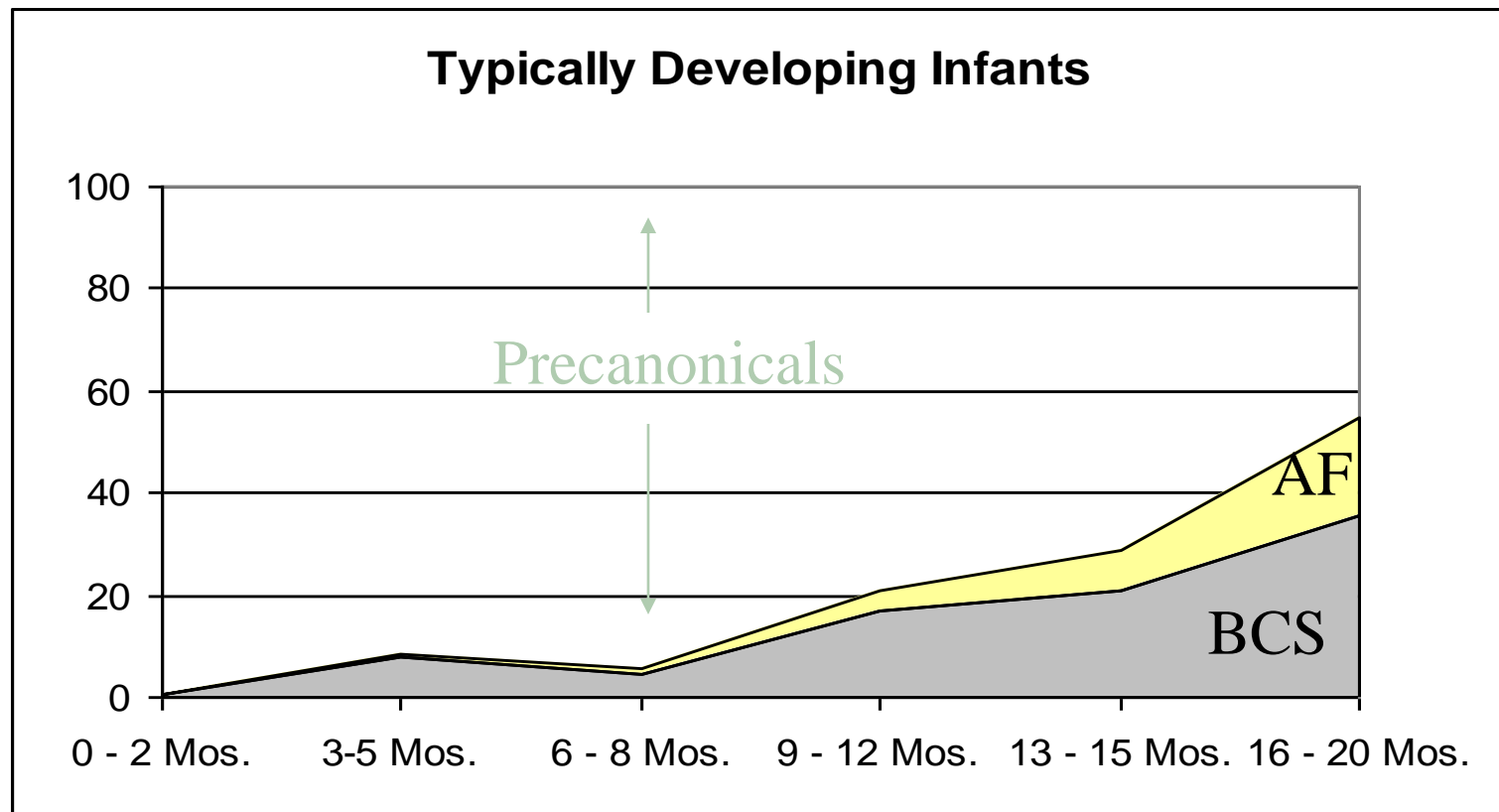
Advanced Forms

(Range of emergence in NH children: 10 - 18 months)

- ... have canonical attributes but are phonetically or prosodically more complex than BCS (Nathani, Ertmer, & Stark, 2002)
- Types
 - Complex syllables (e.g. CCV or CVC)
 - Jargon
 - combinations of different consonants and vowels with changes in stress or intonation
 - Diphthongs

Cross-sectional Data: 30 Infants with NH

Nathani, Ertmer, & Stark (2006)



<http://www.vocaldevelopment.com>

- Definitions
- More audio and examples of PC, BCS, and AF vocalizations
- Video examples of language input and response strategies
- Prelinguistic Intervention program (SPPI)

More Video Examples

Precanonicals

<http://www.youtube.com/watch?v=RoXgiqR9gAU>

- <http://www.youtube.com/watch?v=os0DQ7mXeg8&feature=related>

Basic Canonical Syllables

- <http://www.youtube.com/watch?v=JMRs5m2k9As&feature=related>

- <http://www.youtube.com/watch?v=r77hfsFprCo>

□ Advanced Forms

- <http://www.youtube.com/watch?v=PzebHoSuxO4>

- <http://www.youtube.com/watch?v=hiaYZ-jdb3w>

Profiles of Vocal Development in Young Cochlear Implant Recipients

Ertmer, D. J., Young, N. M., & Nathani, S. (2007)

This project was supported by a grant from the National Institute on Deafness and other Communicative Disorders (1R03DC04226) awarded to the first author.

Contributors:

Data collection: Kristin Corbett, Kathy Saindon, Jennifer Mellon, and Mary Nallenweg

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Claire Johnson, Lynnette Strong, Lisa Lachowicz, Christine Miller, and Jennifer Quesenberry

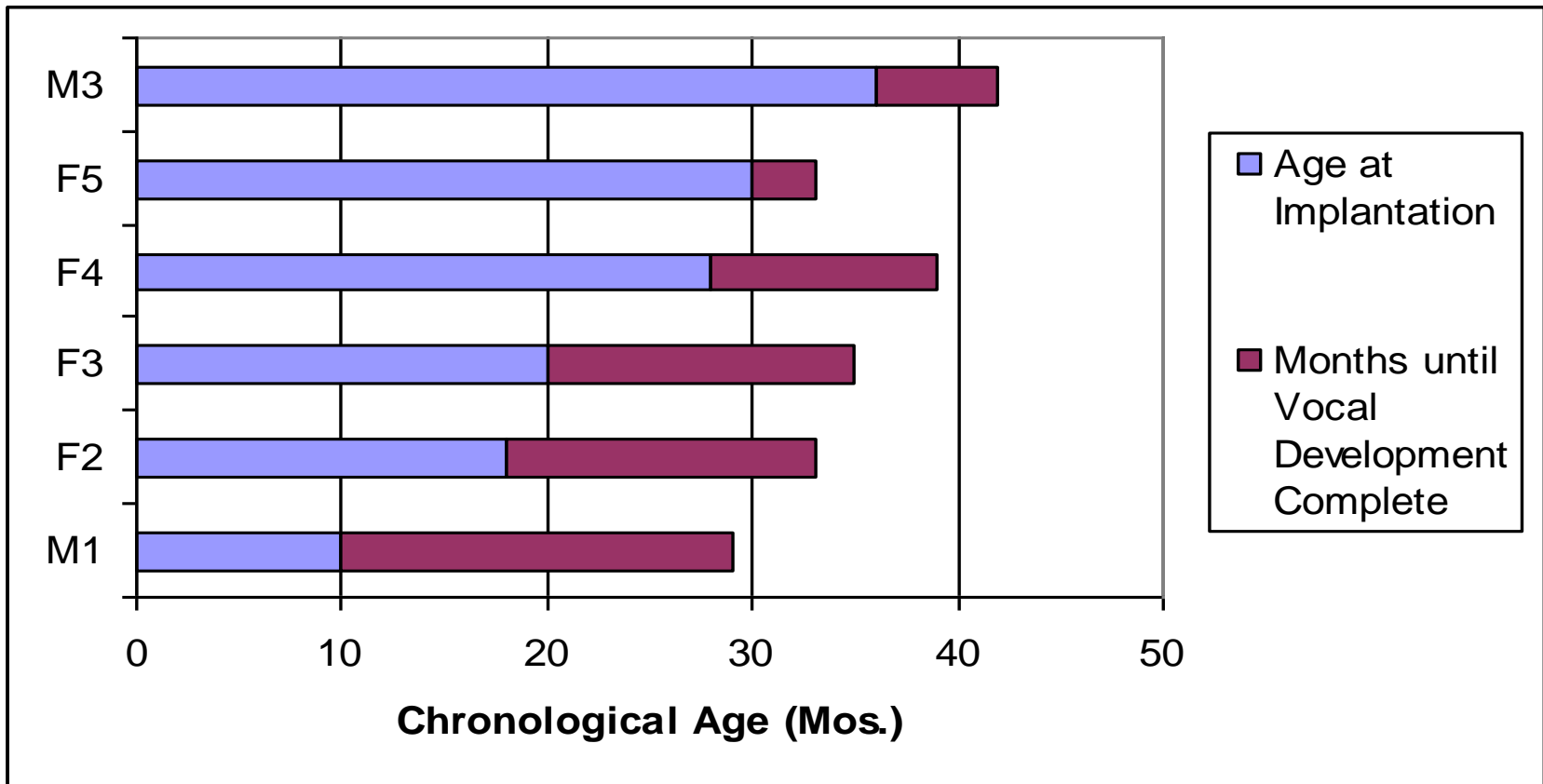
“Profiles” Participants

- 3 male and 5 female children
- Implanted by 36 mos.
- Reported to be typically developing
- From English-speaking families
- Half of families used signs before implantation
- All received in-home intervention and were enrolled in oral education programs after 3 years of age

Data Collection

- Half-hour parent-child play sessions recorded
 - Twice pre-implantation
 - Monthly after activation until vocal development completed:
 - BCS and AF levels are established ($\geq 20\%$)
 - Precanonicals are produced less frequently than either BCS or AF
- 50 utterances analyzed per session

Time-course for Completion of Vocal Development



Vocal Development during the First Year of CI Use: Comparisons with Typically Developing Infants

Ertmer & Jung, manuscript in preparation

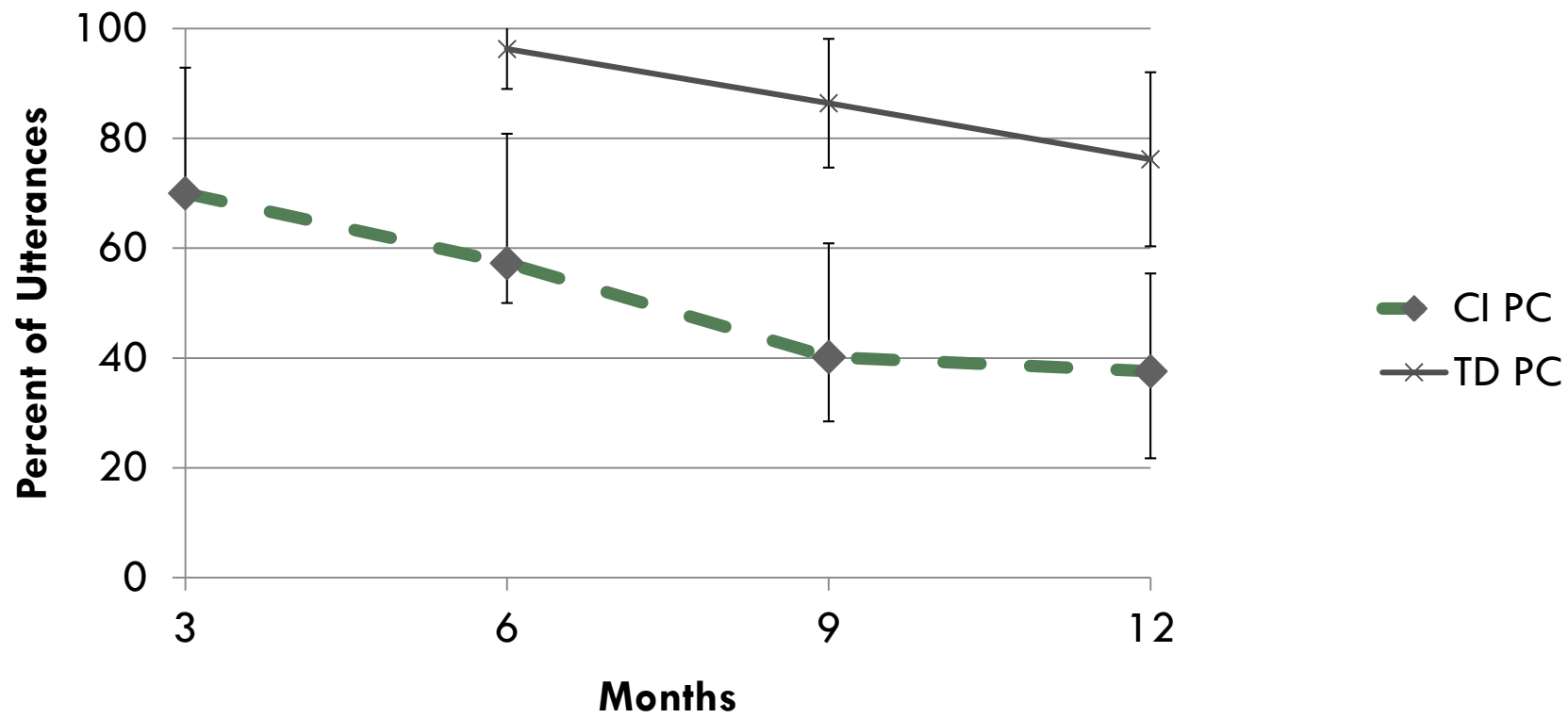
Acknowledgements: Project funded by a grant from the National Institute of Deafness and other Communicative Disorders (R01DC007863). Data Collection conducted at ChildsVoice school, Wood Dale, IL; St. Joseph Institute (St. Louis, MO and Indianapolis, IN); The Moog Center, St. Louis, MO; and Ohio Valley Voices, Cincinnati, OH. Data Analysis: Jen Slanker, Christie Macak, A.J. Olsciewski, Katie, Connell, and Elesha Sharp.

Methods

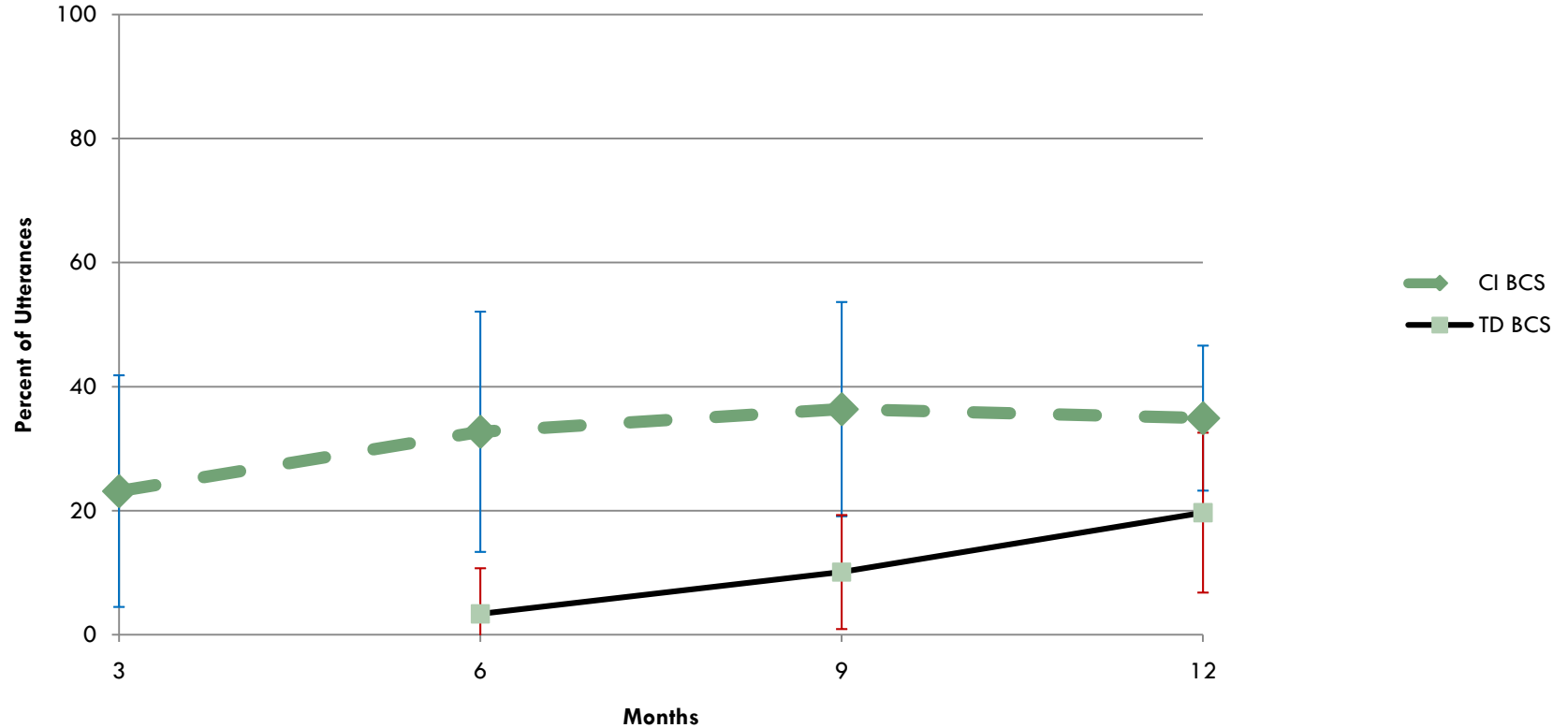
- **Participants:**
 - 13 children with CIs (Mean age at implant = xx months)
 - 11 Typically developing infants
- **Data Collection:**
 - **20-minute parent/El-child play interactions**
 - CI – 3, 6, 9, and 12 months post-activation
 - TD – 6, 9, and 12 months of age
- **Data Analysis:**
 - **Child vocalizations classified as**
 - Precanonical (PC)
 - Basic Canonical Syllables (BCS)
 - Advanced Forms (AF)

Precanonical Vocalizations

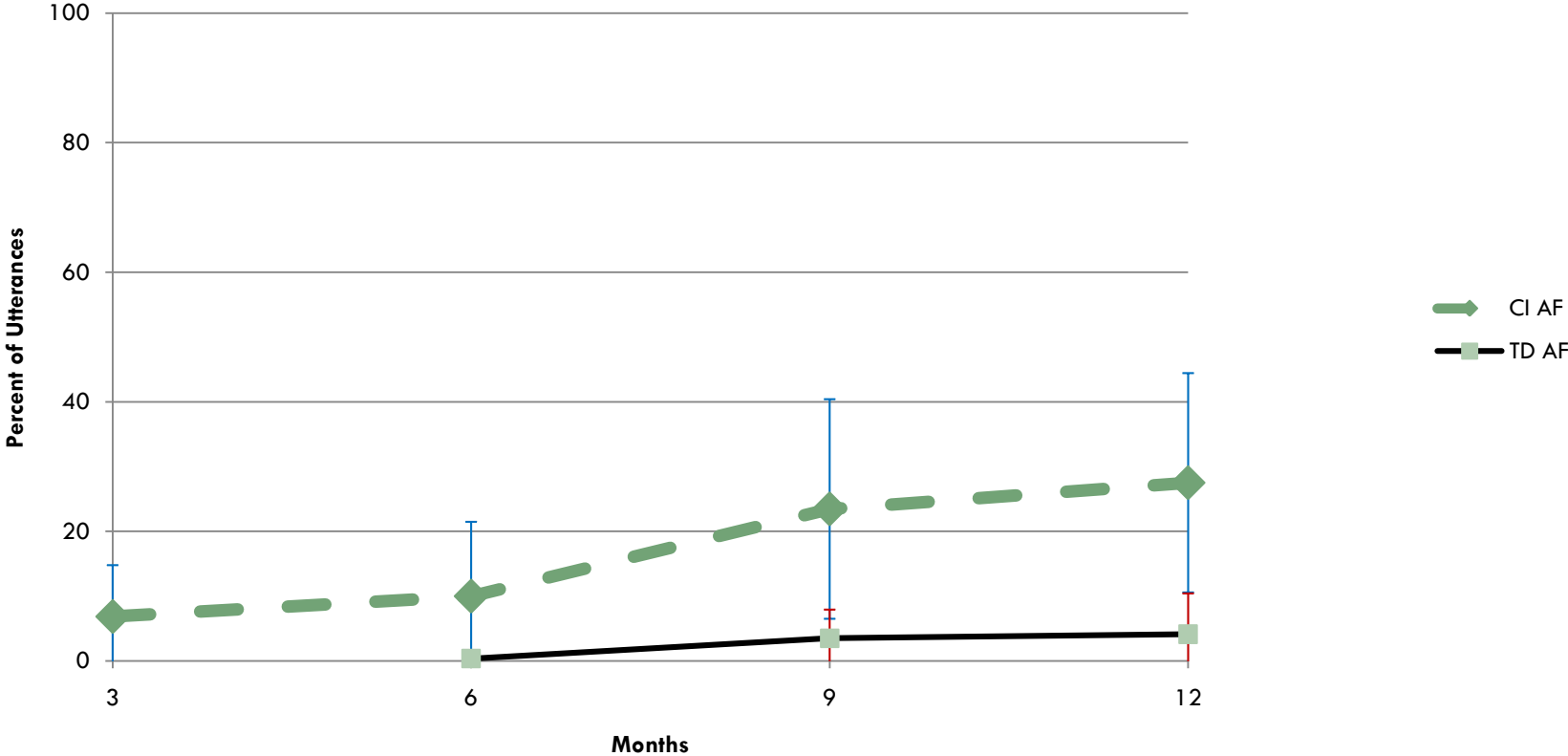
Precanonical



Basic Canonical Syllables



Advanced Forms



Assessing Progress in Vocal Development

**Method 1: Spontaneous Speech
Samples**

Method 2: Eliciting Imitations

Sampling Spontaneous Speech

- Step 1. Classifying 50 vocalizations as
 - Precanonical,
 - Basic Canonical Syllables or
 - Advanced Forms

- Step 2: Determine the child's current level of vocal development: The highest level that comprises at least 20% of the sample

Adapted from Ertmer, D. J. (2005). *The Source for Children with Cochlear Implants*.
 LinguiSystems, Inc., with permission from the publisher, LinguiSystems, Inc.

<p>Precanonical vocalizations Typical age of emergence: 0–6 months</p>	<p>Basic Canonical Syllables Typical age of emergence: 6–10 months</p>	<p>Advanced Forms Approximate age of establishment: 18 months</p>
<p><u>Definition</u> Vocalizations <i>lacking</i> true vowels and true consonants in combination with a rapid transition between them.</p>	<p><u>Definition</u> Vocalizations characterized by</p> <ol style="list-style-type: none"> 1. Normal phonation 2. At least one consonant and one vowel in combination 3. Rapid transition between consonant and vowel (Oller & Lynch, 1992) 	<p><u>Definition</u> Vocalizations that have the characteristics of Canonical Syllables but are more complex and later-emerging in typically developing children (Nathani, Ertmer, & Stark, 2002)</p>
<p><u>Examples:</u></p> <ol style="list-style-type: none"> 1. Squeals, 2. Grunts, 3. Vowel-like sounds in isolation 4. Multiple vowel-like sounds in a series 5. Closants sounds such as clicks, lip smacks, or “raspberries” 6. Isolated consonants (e.g., /m/, /n/) 	<p><u>Examples:</u></p> <ol style="list-style-type: none"> 1. CV syllables 2. CVCV syllables 3. Rhythmic production of reduplicated babbling 4. Rhythmic production of non-reduplicated babbling 5. Whispered vocalizations 	<p><u>Examples:</u></p> <ol style="list-style-type: none"> 1. Closed syllables (e.g., VC, CVC) 2. Consonant clusters (e.g., CCV) 3. Jargon (i.e., syllable strings with different vowels and consonants overlaid with rhythmic stress, intonation changes, or both)

Rules for classifying utterances into levels of vocal development. (Adapted from Ertmer, 2005)

- Classify 50 spontaneous or imitative utterances as either precanonical, basic canonical syllables, or advanced forms.
- An utterance is a vocalization or group of vocalizations separated from others by ≥ 1 sec. or an ingressive breath.
- Classify only speech-related vocalizations. Do not include coughs, cries, screams, laughs, snorts, or burps, etc.
- Do not count /h/ as a consonant.
- Count glides (/j/ or /w/) as true consonants only if they are combined with vowels at a near normal rate (i.e., not slowly produced)
- Classify each utterance according to its most developmentally advanced component (e.g., if an utterance contains a series of vowels, reduplicated babbling, and a squeal, the entire utterance would be classified at the Basic Canonical Syllable level because of the babbling.).
- Each level can be considered “established” when it accounts for at least 20% of the child’s vocalizations.

Date	Precanonical	Basic Canonical Syllables	Advanced Forms
Example:	11111 11111 11111 11111 11111 = 25/50 (50%)	11111 11111 11111 11111 = 20/50 (40%)	11111 = 5/50 (10%)

Step 3: Indicators of Progress after CI or HA Fitting

- 1) Emergence / increase of BCS utterances to $\geq 20\%$ for 2 consecutive sessions
- 2) Emergence / increase of AF utterances to $\geq 20\%$ for 2 consecutive sessions
- 3) Reduction of Precanonical utterances to smaller proportions than Basic Canonical Syllables and Advanced Forms (mostly speech-like vocalizations)
- 4) Increased spoken word attempts

Assessment Method 2: Child Imitation of Vocalizations (Ertmer & Stoel-Gammon, 2008)

- **The Conditioned Assessment of Speech Production (CASP;** Clinician and parents provide models of
 - Precanonical
 - Basic Canonical Syllables
 - Advanced Forms
- Child's attempts to imitate are rewarded with a toy
- Child imitations are scored as
 - Acceptable matches (2 points)
 - Partially acceptable (1 point)
 - No response or not acceptable (0 points)
- CASP given every 3 – 4 months to assess improvement
 - (Progress : progressively higher CASP scores each time)
- Online demo of CASP at www.agbell.org/DesktopDefault.aspx?p=The_Volta_Review

Purpose of Short Periods of Prelinguistic Input (SPPI)

- To stimulate efficient (but not hurry) vocal development
- To help children recognize the relationships between what they hear and their own speech movements
- To provide practice with a variety of syllable shapes and vowel and consonant types

Short Periods of Pre-linguistic Input (SPPI)

(Ertmer, 2005; Ertmer, Young, et al., 2002)

- **1-minute periods** of repeated modeling of developmentally appropriate vocalizations (e.g., vowels, CVs, babbling, jargon)
- One model approximately every **5 seconds** during vocal play
- Provided approximately **5 times** a day

Encourage Parents to Continue Use of Other Stimulation Techniques

- For example....
 - Imitate the child's spontaneous vocalizations freely and with enthusiasm
 - Respond to the child's vocalizations as if they have meaning
 - Vary intonation and use motherese when talking directly to the child
 - Associate toys and actions with speech models to keep the child's interest

Rationale for SPPI and Concentrated Modeling

- Repetition of vocalizations may make associations between speech movements and sounds more salient.
- Earlier-emerging vocalizations likely to be more readily imitated/produced than more mature forms (i.e., words).
- Reduced cognitive load for vocal play vs word production may make imitation easier
- Kuhl & Meltzoff (1996) data support concentrated modeling with infants learning vowels

Desired Outcomes of SPPI

- 1) Increase vowel diversity
- 2) Move from Precanonicals to Basic Canonical Syllables
- 3) Move from Basic Canonical Syllables to Advanced Forms
- 4) Increase consonant and syllable shape inventories

SPPI: Where to start?

- 1. Reinforce and imitate vocalizations the child already produces

- 2. Model new vocalizations in typical order of acquisition. If the child's current level is...
 - Precanonical...increase vowel diversity; add Basic Canonical Syllables
 - Basic Canonical Syllables...emphasize CV, CVCV, and babbling with previously produced consonants and vowels...add new, Cs gradually, vary vowels
 - Advanced Forms...introduce CVC, VC syllables with varied Cs and Vs, jargon

- 3. Continue SPPI even after words begin to emerge

Video Example of SPPI

- <http://www.youtube.com/watch?v=o8pSpoOLwvA>
- Other video examples and more information on SPPI at
 - WWW.Vocaldevelopment.com

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Related Readings

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