

# Vocabulary and Phonological Growth in Childhood Apraxia of Speech

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## Introduction

We conducted a case study designed to understand the vocabulary and phonological growth of children with Childhood Apraxia of Speech (CAS).

### Childhood Apraxia of Speech

- A speech disorder in which children are unable to consistently initiate voluntary movements of the muscles and oral structures necessary for speech.
- They have great difficulty articulating consonants, vowels, and syllables in a consistent way, so that their speech is hard to understand.
- Currently there is no known cause for this disorder.

### Our Participant, "William"

- 6-year-old boy who early in development demonstrated many of the characteristics reported for CAS (cf. ASHA, 2007), including:
  - Very slow expressive vocabulary growth.
  - Inconsistent ability to articulate.
  - Absence of complex consonants from his phonetic repertoire.
  - Vowel errors.
  - Speech production often limited to single words.
  - Difficulty with pronunciation of multisyllabic words.
  - Better listening than speaking skills.
  - Did not begin speaking until after 2 years of age.
  - Demonstrated a great deal of struggle when trying to articulate a word.
  - Communicated by using his augmentative and alternative communication (AAC) device in addition to speech at 5 and 6 years of age.

## Aim

Our objective was to document how one child with severe CAS learned vocabulary and phonology when the onset of speech was delayed and expressive speech was extremely difficult.

### With respect to vocabulary, we asked:

- What kind of vocabulary growth patterns occur when a child begins to speak after 2 years of age and presents with CAS?
- Do some word categories grow faster than others?

### With respect to phonology, we asked:

- What types of speech sounds, syllables, and word pronunciations is William willing to attempt at different points in his speech development? How complex are the speech sounds in the target words he tries to say and the pronunciations he is able to articulate?

## Acknowledgments and References

Special thanks to William, his family, and the many professionals who contributed their experience and expertise. Thanks also to Mary Kubalanza for her assistance with data analysis.

American Speech-Language-Hearing Association. (2007). *Childhood Apraxia of Speech* [Position Statement]. Available from [www.asha.org/policy](http://www.asha.org/policy).

Jakielski, Kathy (2000). Quantifying phonetic complexity in words: An experimental index. Paper presented at the Child Phonology Conference, University of Northern Iowa, Cedar Falls, Iowa.

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## Method

Presented here is a portion of the data collected in a more extensive study of William's vocabulary and phonology. In the larger study, we collected data from a number of different standardized tests, spontaneous speech-language samples, medical records, parent reports, home videotapes, and published assessment measures. To reveal growth, data were collected from 5 time periods: Preschool 1, 2, 3, 4, and Kindergarten.

### Retrospective data include:

- 4 completed forms of the MacArthur-Bates Communication Development Inventory-IV (MB-CDI)
- 2 completed forms of the Hodson Assessment of Phonological Patterns-3 (HAPP-3)
- 1 completed form of the Functional Communication Profile-Revised (FCP-R)
- Educational and medical records supplied by William's family
- A phonetically transcribed vocabulary diary kept by William's mother
- Videotapes supplied by William's family, including a previous administration of the Verbal Motor Production Assessment for Children (VMPAC) and Goldman-Fristoe Test of Articulation-2 (GFTA-2)

### Other data include:

- Spontaneous speech-language samples (Total Number of Words, Number of Different Words, and MLU from SALT; Percent of Consonants Correct; Bleile, 2004; Shriberg, et al., 1997)
- Ages and Stages Questionnaire (ASQ) describing William's nonverbal cognitive abilities
- Interviews about William's speech, language, and development with his parents, brother, babysitter, preschool teacher, and 2 speech-language pathologists
- A new calculation for words from the MB-CDI and HAPP-3—the Index of Phonological Complexity (IPC; Jakielski, 2000, 2002)
- An inventory of spontaneous productions of 10 multisyllabic words and their phonetic transcriptions

Only data from the MB-CDI and HAPP-3 are reported here.

Figure 1. Phonological Complexity of Words as Spoken by William (Age: P4 = 5;8)

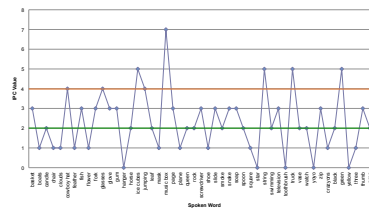
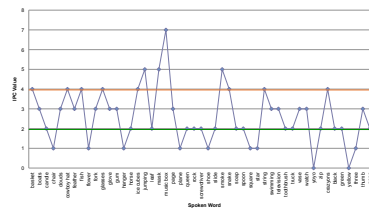


Figure 2. Phonological Complexity of Words as Spoken by William (Age: K = 6;0)



**Note.** IPC Value = the sum of points awarded for more complex consonants, vowels, and syllables.

Figure 3. William's Vocabulary Growth Based on the MB-CDI (Age: P1 = 3;10)

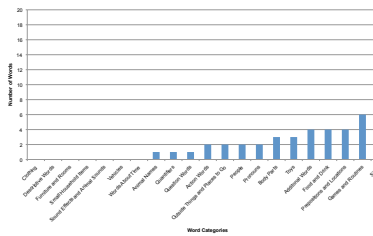


Figure 4. William's Vocabulary Growth Based on the MB-CDI (Age: P2 = 4;3)

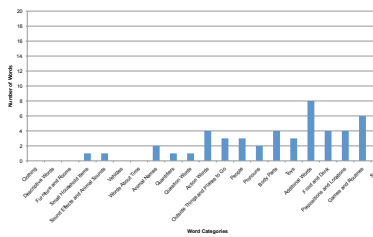


Figure 5. William's Vocabulary Growth Based on the MB-CDI (Age: P3 = 4;6)

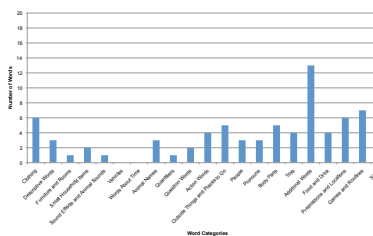
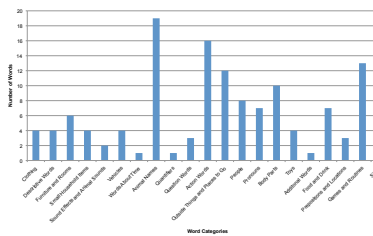


Figure 6. William's Vocabulary Growth Based on the MB-CDI (Age: P4 = 5;0)



**Note.** The "Additional Words" category represents a new word set at each time period, unlike other categories, because William's mother wrote in these words on each form of the MB-CDI.

Table 1. William's Vocabulary Based on the MB-CDI (Ages: P1 = 3;10, P2 = 4;3, P3 = 4;6, P4 = 5;0)

Time Period	Total Words	Growth in Words per Month	Total Signs	Total Words and Signs
P1	35	—	17	52
P2	47	2.4	18	65
P3	73	8.7	19	92
P4	129	9.3	5	134

Table 2. IPC Values for William's Productions of Words on the HAPP-3 (Ages: P4 = 5;8, K = 6;0) Maximum IPC score = 183

Time Period	William's IPC Values	Growth in IPC Points per Month	Top Category
P4	114	—	Ending Consonant
K	131	4.25	Ending Consonant

## Results

### With respect to vocabulary:

- William experienced a vocabulary spurt, gaining approximately 9 words per month from P2 to P4 (i.e., from 4;3 to 4;6 and continuing to 5;0).
- Signs appeared to diminish greatly by P4.
- The number of categories represented by spoken words increased steadily across the four time periods (from 14 categories to all 21 categories).
- The largest categories were:
  - Games and Routines
  - Clothing
  - Animal Names
  - Outside Things and Places to Go
  - Additional Words
  - Prepositions and Locations
  - Action Words
- Vocabulary growth was:
  - Broad from P1 to P2 (7 categories gained 1 word or sign)
  - Focused from P2 to P3 (5 categories gained 2 or more words)
  - Very Focused from P3 to P4 (11 categories gained 2 or more words)
- Greatest growth from P3 to P4 (12 to 16 words) was for:
  - Animal Names and Action Words
- Steady and large growth from P3 to P4 (4 to 7 words) for:
  - Outside Things and Places to Go, and Games and Routines
  - Furniture and Rooms, and Vehicles
  - Body Parts, People, and Pronouns

### With respect to phonology:

- The number of HAPP-3 words earning 2 or more IPC points from P4 to K increased from 66% to 80%. The number earning 4 or more increased from 16% to 24%.
- Approximately a third (34%) of William's HAPP-3 words (17 of 50) showed increases in complexity from P4 to K (increases of mostly 1 or 2 IPC points).
  - Notably, his pronunciation of "mask" increased by 4 IPC points [mæ:t → mæks]; and "smoke" [mou:k → smouk] and "crayons" [kwe:tə → kwetəns] by 3 points.
- Approximately half (52%) of his HAPP-3 words earned the same IPC score after 4 months of development, while only 14% decreased in complexity.
  - Decreases may represent inconsistent pronunciation, which is the hallmark of CAS. It is interesting to note that half of William's words showed stable pronunciation, while a third showed improvement, perhaps a sign that his CAS symptoms were abating.
  - Words that showed decreases in complexity contained consonant clusters, 3 syllables, or the late-acquired fricative, /z/.
- In preschool (P4), William's pronunciation of the HAPP-3 words earned 62% of the maximum 183 IPC points. By K, that percentage had increased by 10%.

## Conclusions

In summary, William increased the diversity of his spoken words throughout preschool, and the complexity of his pronunciations from preschool to kindergarten. This suggests that other children with CAS are capable of learning new words and adding to their phonetic repertoire after the age of 2, despite a later start at learning speech and expressive language.