Picture Description Performance of Normally Developing Children

THESIS

Presented in Partial Fulfillment of the Requirements for the Degree Master of Science in the Graduate School of The Ohio State University

By

Julia Stern

Graduate Program in Speech and Hearing Science

The Ohio State University

2013

Master's Examination Committee:

Michelle Bourgeois, Ph.D., Advisor

Monique Mills, Ph.D.
Abstract

Aphasia is a communication disorder caused by damage to the areas of the brain involved in expressing and understanding language. Currently, speech-language pathologists who work with children with aphasia and/or traumatic brain injury use many tools that are designed for use with adults. One tool in particular is the Cookie Theft Picture, which is designed to elicit language samples that contribute to the diagnosis of a neurogenic communication disorder. Currently there is very little published research on the performance of children, either normally developing or with a brain injury, on the Cookie Theft Picture, limiting the usefulness of the Cookie Theft Picture as a diagnostic tool within pediatric populations.

The current study aims to collect normative data for children describing the Cookie Theft Picture. Twelve children between the ages of 10;11 and 13;11 were given one minute to describe the Cookie Theft Picture. Resulting language samples were analyzed using three measures: mean length of utterance (MLU) was used as a measure of morphosyntactic development and growth; content units (Yorkston & Beukelman, 1980) were used to measure the amount of content conveyed; and content units per minute was used as a measure of efficiency of communication. No significant differences were found in these measures between age groups, grade levels, or gender. The mean MLU among the entire sample was 11.28 morphemes with a standard deviation of 3.18. The mean number of content units was 16.58, with a standard deviation of 3.40. The mean number of content units per minute was 16.38, with a standard deviation of 2.93.
No correlation was found between MLU and number of content units per language sample, nor between MLU and number of content units per minute.

The results of the current study with regards to MLU are comparable to an age-matched database of language samples of children participating in a narrative task. The current findings were in line with Yorkston and Beukelman’s (1980) findings among adults with respect to content units per language sample. However, with respect to efficiency, the current study found children produced fewer content units per minute in comparison to normal adults. This difference is likely due to a difference in methodology between the current study and Yorkston and Beukelman (1980), as well as a difference in topic of description between children and adults.

The current study is a pilot study, and further research is needed to reliably use the Cookie Theft Picture as a diagnostic tool with children. Such research should include a larger and more heterogeneous sample in order to better represent the pediatric population.
Acknowledgments

I would like to thank Dr. Bourgeois for guiding and mentoring me through the research process. I would also like to thank Jennifer Brello and Dr. Mills for their invaluable help and support.
Vita

2007-2011 ........................................... B.S. Speech and Language Pathology, Indiana University

2011 to present ..................................... M.S. Speech and Hearing Science, The Ohio State University

Fields of Study

Major Field: Speech and Hearing Science
# Table of Contents

Abstract ................................................................................................................................. ii

Acknowledgments ............................................................................................................... iv

Vita ......................................................................................................................................... v

Table of Contents ............................................................................................................... vi

List of Tables ....................................................................................................................... viii

List of Figures ..................................................................................................................... ix

Chapter 1: Clinical Problem .............................................................................................. 1

Chapter 2: Pediatric Aphasia ............................................................................................ 4

Chapter 3: The Cookie Theft Picture ................................................................................ 15

Methods ............................................................................................................................... 22

Results ................................................................................................................................. 27

Discussion ............................................................................................................................ 35

References ............................................................................................................................ 44

Appendix A: List of Content Units ................................................................................... 48

Appendix B: Parental Permission Form ............................................................................. 49
Appendix C: Child Assent Form .......................................................... 54

Appendix D: List of Codes Used on SALT Transcriptions.......................... 58
List of Tables

Table 1. Performance on the Boston Diagnostic Aphasia Examination ................................2
Table 2. Description of Subjects’ Age, Grade, and Gender................................................22
Table 3. Description of Subjects’ Performance on Language Measures .............................28
List of Figures

Figure 1. The Cookie Theft Picture, taken from the Boston Diagnostic Aphasia Examination .... 15
Figure 2. Mean MLU by Age ........................................................................................................... 28
Figure 3. Mean MLU by Grade Level ............................................................................................ 29
Figure 4. Mean MLU by Gender .................................................................................................... 29
Figure 5. Mean Number of Content Units by Age........................................................................ 30
Figure 6. Mean Number of Content Units by Grade Level......................................................... 31
Figure 7. Mean Number of Content Units by Gender.................................................................. 31
Figure 8. Mean Efficiency by Age............................................................................................... 32
Figure 9. Mean Efficiency by Grade Level.................................................................................. 33
Figure 10. Mean Efficiency by Gender.......................................................................................... 33
Chapter 1: Clinical Problem

Clinicians are often limited in their choice of assessment tools for measuring the language behavior in children with specific disabilities such as aphasia. While there are many child language assessment tools designed to document the acquisition of language structure, content, and use (e.g., the Clinical Evaluation of Language Fundamentals (Semel, Wiig, & Secord, 2003), the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 2000), and the Peabody Picture Vocabulary Test (Dunn & Dunn, 2007)), there are fewer tools designed to measure language impairment subsequent to a brain injury. Clinicians working in acute care settings often use tools designed for adults when there are not acceptable pediatric measures. While this is not ideal because of the lack of normative data for children on these measures, it provides some means to document the child’s language performance.

The following case is an example of the clinical dilemma facing speech language pathologists in acute care hospitals. A 12 year old female was admitted to Nationwide Children’s Hospital following a motor vehicle accident. She was enrolled in sixth grade, where she earned high grades, at the time of the accident. Upon admittance to the hospital, she presented with a Glasgow Coma Scale score of 7. CT scan revealed damage to the left lateral basal ganglia and the left medial temporal lobe, as well as tissue damage in the left gray and white matter, the fronto-temporal cortex, and the left cerebral peduncle. Further MRI revealed sites of hemorrhage in both the right and left cerebral hemispheres as well as in the cerebellum.

Speech and language assessment revealed patterns of behavior consistent with mixed non-fluent aphasia, as well as cognitive-linguistic impairments and mild apraxia of speech.
Within eight weeks of hospital admission, the patient’s receptive language had improved, she was better able to follow one step directions, and she was able to request clarification when asked questions. Expressive communication was characterized by 1-4 word phrases, paraphasic errors, perseveration, circumlocution, and neologisms. At approximately this time, the patient was evaluated using the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass, Kaplan, & Barresi, 2001). Her performance on this assessment tool is outlined in Table 1.

<table>
<thead>
<tr>
<th>SUBTEST</th>
<th>PERCENTILE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Receptive Language</strong></td>
<td></td>
</tr>
<tr>
<td>Basic Word Discrimination</td>
<td>35</td>
</tr>
<tr>
<td>Following Commands</td>
<td>15</td>
</tr>
<tr>
<td>Complex Ideational Material</td>
<td>20</td>
</tr>
<tr>
<td><strong>Expressive Language</strong></td>
<td></td>
</tr>
<tr>
<td>Conversational Speech: Social Responses</td>
<td>100</td>
</tr>
<tr>
<td>Conversation Speech: Complexity Index</td>
<td>15</td>
</tr>
<tr>
<td>Fluency: Phrase Length</td>
<td>25</td>
</tr>
<tr>
<td>Fluency: Grammatical Form</td>
<td>30</td>
</tr>
<tr>
<td>Recitation/Music</td>
<td>100</td>
</tr>
<tr>
<td>Repetition: Words</td>
<td>30</td>
</tr>
<tr>
<td>Repetition: Sentences</td>
<td>35</td>
</tr>
<tr>
<td>Boston Naming Test</td>
<td>40</td>
</tr>
<tr>
<td><strong>Reading</strong></td>
<td></td>
</tr>
<tr>
<td>Picture/Word Matching</td>
<td>20</td>
</tr>
<tr>
<td><strong>Written Language</strong></td>
<td></td>
</tr>
<tr>
<td>Scores were not obtained, however the</td>
<td></td>
</tr>
<tr>
<td>patient demonstrated the ability to</td>
<td></td>
</tr>
<tr>
<td>occasionally use writing to name items,</td>
<td></td>
</tr>
<tr>
<td>write her own name, and write the</td>
<td></td>
</tr>
<tr>
<td>alphabet slowly. The patient was</td>
<td></td>
</tr>
<tr>
<td>unable to write to dictation.</td>
<td></td>
</tr>
</tbody>
</table>

In addition to these subtests, the patient was administered The Cookie Theft Picture, the picture description task from the BDAE, in order to elicit a language sample. Typically, a
patient’s performance on this task, as well as the other subtests of the BDAE, is compared to normative data. Though the patient’s performance on these tasks revealed a number of deficits and strengths, normative data is only available for adult subjects. Thus, the patient’s performance on the BDAE cannot be interpreted validly in comparison to normative data.

This is a dilemma commonly found among speech-language pathologists working with children with brain injuries. A study published in 2005 reported an estimate of 475,000 traumatic brain injuries among children annually, with 2,685 TBI-associated deaths, 37,000 hospitalizations, and 435,000 emergency department visits (Langlois, Rutland-Brown, & Thomas). Thus, a significant number of children are evaluated using the Cookie Theft Picture, as well as similar picture description tasks. However, a thorough review of the literature failed to reveal any normative data on the BDAE for persons below the age of 20 years. If the BDAE is to be a viable diagnostic tool for pediatric clients, there needs to be normative data collected with pediatric clients for comparison purposes.

The purpose of the present study was to collect normative data on the BDAE picture description task, allowing clinicians to compare the performance of a child with language deficits/aphasia to his/her age matched peers. In using such data, clinicians will be able to assess expressive language skills with increased validity.
Chapter 2: Pediatric Aphasia

Control of language is most commonly located in the left fronto-temporal area of the brain, including Broca’s Area and Wernicke’s area (Helm-Estabrooks & Albert, 2004). This “language area” works with other areas of the brain such as the auditory cortex and the motor strip for the production and comprehension of language, both spoken and written. Occasionally, language is lateralized in the right hemisphere of the brain (Helm-Estabrooks & Albert, 2004), however the percentage of the population in which right lateralized language occurs is very small. Often, right hemisphere language control is found in individuals who are left handed, though this correlation is not consistent across all left handed individuals (Helm-Estabrooks & Albert, 2004).

Aphasia is considered a language disorder caused by neurological damage to the areas of the brain involved in language comprehension and expression. The etiology of aphasia is most commonly cardiovascular disease or traumatic brain damage, but can also include such causes as tumors and infections (Helm-Estabrooks & Albert, 2004).

It should be noted that aphasia is a symptom of brain damage that is differentiated from cognitive disorders. Aphasia refers to deficits specific to receptive and expressive language. Cognition is a broad term that includes mental processes such as attention, memory, executive function, and visuospatial skills. Attention refers to a person’s ability to “select and manipulate external or internal stimuli for just a moment through to extended periods of time” (Murray, Keeton, & Karcher 2006). Memory includes long term memory, short term memory, episodic memory, and working memory, or a person’s ability to temporarily hold information such that it can be manipulated (Helm-Estabrooks & Albert, 2004). Visuospatial skills include a person’s
ability to discriminate, analyze, recognize, and interpret visual stimuli, as well as combine visual perception with motor movement (Helm-Estabrooks, Albert, 2004). The final domain of cognition is known as executive function, and refers to higher level cognitive skills that allow a person to plan, organize, and monitor activities in order to accomplish a task (Purdy, 2010). Executive function enlists other cognitive domains such as attention to complete tasks, and allows a person to find a variety of solutions when faced with a problem.

The language disorder, aphasia, often occurs in conjunction with cognitive deficits. In fact, deficits in attention, memory, or executive function can exacerbate a person with aphasia’s difficulty communicating with others, and can negatively affect the efficacy of aphasia treatment (Murray, Keeton, & Karcher, 2006). Purdy (2010) examined executive function abilities among individuals with aphasia in comparison to their normal peers, and found that individuals with aphasia had significantly more difficulty completing tasks requiring the use of executive function. More specifically, subjects with aphasia had difficulty switching between tasks and completing tasks that required cognitive flexibility. In addition, Purdy found that subjects with aphasia completed tasks much more slowly than subjects without aphasia. Thus although aphasia is not a disorder of cognitive abilities, language and cognition are highly interrelated.

Patterns of language and cognitive deficits have been useful in classifying different types of aphasia (Helm-Estabrooks & Albert, 2004). Variations in three features of aphasic language -- verbal fluency, repetition, and auditory comprehension – help to classify the different types of aphasia. Verbal fluency pertains to phrase length. Non-fluent speech is characterized by a phrase length of five words or less, while fluent speech consists of phrases nine words or more in length. Speech consisting of a phrase length of between six and eight words is considered borderline fluent (Helm-Estabrooks & Albert, 2004).

Auditory comprehension, a second language skill refers to a person’s ability to
understand spoken language. Though auditory comprehension is seldom unaffected in aphasia, the extent of a person’s deficits in auditory comprehension is used to further diagnose and classify different types of aphasia. A person with aphasia may present with difficulties ranging from an inability to understand individual words, to an inability to understand phrases or sentences, to an inability to understand and follow more complex, multi-step commands (Helm-Estabrooks & Albert, 2004).

A third skill used to classify aphasia is repetition. Repetition refers to a person’s ability to hear and immediately repeat the language heard. Repetition is a complicated process that enlists auditory processing skills, phonological analysis (the ability to analyze the individual sounds in a word or string of words), and the ability to associate these phonemes with the appropriate motor movements for successful language expression (Baldo, Katseff, & Dronkers 2012).

These three language skills, fluency of speech, auditory comprehension, and repetition, are used to classify the various types of aphasia. For example, Broca’s Aphasia is a type of non-fluent aphasia most commonly associated with damage to Broca’s Area, found within the frontal lobe. Broca’s Aphasia is characterized by intact auditory comprehension, and poor repetition, as well as agrammatism (language output lacking in functor words). Other types of non-fluent aphasia include Transcortical Motor Aphasia, characterized by intact auditory comprehension and repetition, and Global Aphasia, characterized by poor auditory comprehension and poor repetition (Helm-Estabrooks & Albert, 2004).

In contrast, Wernicke’s Aphasia is a type of fluent aphasia most commonly associated with damage to Wernicke’s Area, found within the temporal lobe. Wernicke’s Aphasia is characterized by poor auditory comprehension and poor repetition, as well as anomia (word-finding difficulty) (Helm-Estabrooks & Albert, 2004). Other fluent aphasias include:
Transcortical Sensory Aphasia (characterized by poor auditory comprehension and good repetition), Conduction Aphasia (characterized by good auditory comprehension and poor repetition), and Anomic Aphasia (characterized by good auditory comprehension and good repetition) (Helm-Estabrooks & Albert, 2004).

Aphasia presents with many other symptoms that are not used for classifying type or severity, yet must be addressed during treatment. Such symptoms include: paraphasias (substitutions for words or phonemes), perseverations (providing the same response for a variety of stimuli), echolalia (the repetition of heard utterances), neologisms (distortions of words to the extent that they are incomprehensible), and jargon (speech consisting of meaningless utterances) (Van Hout, 1997).

Factors that influence the course of language recovery following onset of a brain injury include the etiology and the severity of the injury. Etiology refers to the cause of the injury, and includes causes such as cerebrovascular disease and traumatic brain injury. Traumatic brain injury is caused by a blow to the head (Bhatnagar, 2008) and usually results in diffuse, widespread damage within the brain. Oftentimes, inertia causes the brain to impact the skull at a significant speed, bounce off the skull, and impact the opposite side of the skull, causing what is known as a coup and contra-coup injury (Helm-Estabrooks & Albert, 2004).

Cerebrovascular disease affects the nature of blood flow within and around the brain. It can present as an ischemic attack, caused by a lack of oxygen supply to the brain tissue. Ischemic attacks can take the form of thrombosis or embolism. A thrombosis is caused by fatty material that builds up, narrowing or blocking an artery. An embolism is caused by a piece of fatty material that breaks off and travels to a smaller blood vessel, where it becomes trapped and subsequently blocks blood flow (Bhatnagar, 2008). As a result of ischemic attacks, brain tissue served by the blocked blood vessel is deprived of oxygen and subsequently dies. Death of brain
tissue can also be caused by hemorrhage of blood vessels, leaking blood tissue into the brain. Leakage of blood into the cerebral space causes direct contact between brain tissue and blood tissue leading to death of brain tissue, as well as puts pressure on surrounding brain tissue. For these reasons, hemorrhage of blood vessels usually causes more diffuse damage in comparison to ischemic attacks (Bhatnagar, 2008).

Severity of the brain injury often refers to the size or extent of the injury. A brain injury can be focal, impacting a limited area of the brain, as is sometimes the case in ischemic attacks. On the opposite end of the spectrum, a brain injury may be diffuse, affecting a widespread area of the brain. This is often found in secondary damage in traumatic brain injury, when pressure caused by bleeding and/or swelling in the brain leads to death of brain tissue (Helm-Estabrooks & Albert, 2004).

During recovery of language, the brain generally recruits brain tissue surrounding the lesion as well as the corresponding areas in the opposite hemisphere to serve language functions, in an attempt to compensate for the death of brain tissue in the language area (Saur et al., 2006). Saur and colleagues studied adults diagnosed with aphasia due to CVA in the middle cerebral artery. This blood vessel is commonly implicated in cerebrovascular lesions within the language area. The authors found that control of language in the brain shifts over time as the patient moves from the acute to chronic stages of aphasia. In the acute phase, the left inferior frontal gyrus, located within the language area, was not strongly activated during language tasks in an fMRI. A few months after the patients sustained the stroke, the entire language network as well as the right inferior frontal gyrus showed an increase in activity during language tasks. In the chronic stage of recovery, activation during language tasks shifted back to the left hemisphere, which corresponded with significant language improvement. It should be noted that these results were found in a very homogeneous group of subjects. Saur and colleagues’ participants suffered only
one embolic stroke in the left middle cerebral artery, were less than 70 years old, and were able to
tolerate an fMRI examination. Because brain damage is extremely variable across individuals,
these findings would not generalize to all individuals with aphasia, such as those who have
suffered multiple strokes or who have suffered a traumatic brain injury. However, this study
highlights the dynamic recovery process that takes place in persons with aphasia.

Aphasia is commonly believed to be a disorder of individuals who have acquired
language. In contrast, children who sustain brain damage to the language areas before language
is fully acquired experience an interruption of language development. Acquired Childhood
Aphasia (ACA) refers to deficits in language following brain damage in children after language
has been acquired (Van Hout, 1997). The minimum age of onset of ACA is 2 years, as this is the
age at which sentences emerge developmentally (Van Hout, 1997). The causes of ACA are
similar to those of aphasia in adults, and include vascular lesions, trauma, tumors, and infections
(Van Hout, 1997), as well as congenital disorders such as Landau-Kleffner Syndrome (Grote,
Van Slyke, & Hoeppner, 1999). Landau-Kleffner Syndrome is a rare disorder characterized by,
among other symptoms, acquired aphasia along with abnormal EEG, and seizures (Grote, Van
milestones, and gradually lose language abilities. Expressive and receptive language is affected,
and children often communicate with short, simple, telegraphic sentences, though the syndrome
can also present as fluent aphasia (Paquier, Van Dongen, & Loonen, 1992). Landau-Kleffner
Syndrome can be treated with surgery, after which language has been shown to improve (Grote,
Van Slyke, & Hoeppner, 1999).

There are a number of differences between aphasia in adults and acquired childhood
aphasia. For example, the correlation between right handedness and lateralization of language in
the left hemisphere is not as high in children as in adults (Hynd, Leathem, Semrud-Clikeman,
Hern, & Wenner, 1995). Thus, damage to the left hemisphere in a child may not affect language abilities to the same extent as in a more mature adult brain. Furthermore, the incidence of fluent aphasia, commonly known as Wernicke’s aphasia, is not as high in children as in adults (Hynd, Leathem, Semrud-Clikeman, Hern, & Wenner, 1995).

The differences between acquired childhood aphasia and aphasia in adults largely stem from developmental factors. Of particular importance is the concept of plasticity, or the ability to create new neural connections (Meinzer, Elbert, Wienbruch, Djundja, Barthel, & Rockstroh, 2004). An immature brain is thought to be in the process of developing and establishing neural connections. As a result, recovery in children occurs differently than in adults. Liégeois et al. (2004) state that “the gross sparing of speech and language functions after early lesions of the left hemisphere has been attributed to the impressive plasticity and reorganizational capacity of the immature brain, which may enable speech and language functions to develop in the right hemisphere.”

The effects of damage to the language area in the brain are largely dependent on the stage of language acquisition at the time of injury. Two years of age is chiefly considered the point at which language has been acquired (Van Hout, 1997). Damage to the language area after language acquisition leads to prominent deficits in language production and comprehension when compared to normally developing peers. These deficits may be in syntax, auditory comprehension, fluency, or repetition, and may co-occur with paraphasias, echolalia, and perseverations, depending on such factors as location and severity of the lesion (Van Hout, 1997). However, brain damage that occurs prior to two years of age results in much fewer and more subtle language differences by age 5 to 7 in comparison to peers. In fact, by age 5 to 7, children with brain damage perform similarly on standardized tests to their normally developing peers (Hoff, 2009). Feldman, Holland, Kemp, and Janosky (1992) examined language development
over the first 45 months of life in children who had suffered unilateral antepartum or perinatal brain injuries. The authors examined syntactical development and lexical development, finding that children with left hemisphere injuries were developmentally delayed in these domains, though they demonstrated steady improvement. By 45 months of age, four of five children with left hemisphere injury demonstrated mean length of utterance in language samples within or above one standard deviation from the mean of normative data. However, when examining lexical development (the number of different words used during a language sample), three of the five children with left hemisphere lesions remained below their normally developing peers (Feldman, Holland, Kemp, & Janosky, 1992).

Language development after two years of age is a complex process that occurs throughout childhood and well into adolescence. Thus, while differences have been found between persons who sustained neural damage before and after acquisition of language (two years of age), further differences have been found just among persons who sustained neural damage after language acquisition. Ewing-Cobbs et. al. (1987) examined language deficits in individuals who had sustained closed head injuries as children (age 5-10) and adolescents (age 11-15). Using the Neurosensory Center Comprehensive Examination for Aphasia (NCCEA) (Spreen & Benton, 1969), the authors found that the onset of traumatic brain injury at a younger age leads to more language impairment than onset at older ages. This age effect was particularly present in the written language task requiring subjects to write to dictation. The authors attribute this to the fact that written language skills develop most between the ages of 6 and 8, much later than spoken language skills. Neurological damage at this phase in life, when written language skills are emerging, leads to more severe deficits in reading and writing abilities in comparison to neurological damage after these skills have developed (Ewing-Cobbs et. al., 1987). Neuroimaging studies reveal that the reorganization of language to the right hemisphere is more commonly
found in persons who sustained an injury prior to five years of age, at which point language
development occurs at a rapid pace (Liégeois et al., 2004).

The presence of aphasia in children is also related to the location of the brain injury. The
location of neural damage plays a large part in not only the types of resulting language deficits,
such as auditory comprehension or fluency, but also the course of recovery. Liégeois et. al.
(2004) found in their study of ten children with early damage to the left hemisphere that lesions
within or near Broca’s area were correlated with intra-hemispheric language reorganization. In
other words, control of language in the brain was reallocated to areas in both the left and right
hemispheres. This pattern of recovery is in contrast with adults who sustain damage to the
language area of the left hemisphere, after which language remains lateralized on the left
hemisphere (Liégeois et. al., 2004).

Catroppa and Anderson (2004) found that the severity of the TBI and the time elapsed
since the onset of injury, had significant effects on measures of language skills in their study of
recovery over two years following damage to the language area due to traumatic brain injury in
68 children from eight to twelve years of age. Subjects were divided into groups based on
severity of TBI (mild, moderate, and severe) and were examined at the acute phase and again 24
months after injury. Language assessment included subtests from the Wechsler Intelligence Scale
for Children – Third Edition (Wechsler, 1992), as well as the Expressive One Word Picture
Naming Test (Gardner, 1979), Controlled Oral Word Association Test (Gaddes & Crockett,
1973), and the Verbal Learning Test from the Wide Range Assessment of Memory and Learning
(Sheslow & Adams, 1990). Results of this study showed that children with severe TBI made the
most improvement over the two year period in comparison to children with mild and moderate
TBI. However, when assessed at two years post onset, children with severe and moderate TBI
still showed greater language deficits in comparison to children with mild TBI. Thus, it is
apparent that a wide variety of factors, including neural plasticity, age at onset, site of lesion, severity of damage, and time since onset, play a role in the nature of aphasia and recovery of language in children with acquired childhood aphasia.

The ability to produce and comprehend language, both spoken and written, is vital for academic success, as language is the main vehicle for teaching in classroom settings. A child must be able to process, understand, and use the information in a teacher’s speech or in written materials such as textbooks or tests. In addition, success in the classroom requires that a child be able to use language to participate in classroom discussions and activities, complete written assignments, ask questions for clarification, etc. Thus, Acquired Childhood Aphasia has significant educational implications, making it an important consideration in a child’s lifelong success. Hynd, Leathem, Semrud-Clikeman, Hern, and Wenner (1995) describe a subject who suffered a left temporoparietal hematoma, the removal of which resulted in anomic aphasia. In this study, the subject made considerable improvements during the months following the onset of the lesion. However, eight months post-onset, she still presented with language deficits, particularly in her naming ability. This recovery, the authors note, is consistent with other reports of acquired childhood aphasia (Hynd, Leathem, Semrud-Clikeman, Hern, & Wenner, 1995). Lasting deficits such as this could significantly impact classroom performance.

Sullivan and Riccio (2010) explain in their review of the literature on pediatric aphasia that children with aphasia often use lower level strategies, such as interpreting information literally rather than inferencing implied information, when completing tasks such as summarizing information (Sullivan & Riccio, 2010; Dennis & Barnes, 2001). Classroom tasks that require the ability to summarize information could thus present obstacles for children with aphasia. These authors describe additional struggles experienced by children with aphasia such as the inclusion of fewer details when retelling stories and difficulties making inferences from given information.
The ability to make inferences and draw conclusions from information presented is a skill that is frequently used in academic tasks, and children who struggle with this naturally struggle with many classroom activities.
Chapter 3: The Cookie Theft Picture

Assessment tools designed for use with aphasia must be able to determine an individual’s communication deficits and must aid the clinician in classifying the type of aphasia a client presents with. The Boston Diagnostic Aphasia Examination (BDAE) (Goodglass, Kaplan, & Barresi, 2001) is a commonly used assessment tool that aids clinicians in diagnosing aphasia. The Cookie Theft Picture, shown in Figure 1, is used in the BDAE as a means of measuring a person’s descriptive language skills. The picture includes a mother washing dishes at an overflowing sink while children in the background attempt to steal cookies from a cookie jar on a shelf. The person being assessed is instructed to describe what he/she sees in the picture, allowing the examiner to analyze how well the person is able to convey information using connected speech. The Cookie Theft Picture is designed to be used with a variety of populations including individuals with Alzheimer’s disease, aphasia, right hemisphere lesions, and schizophrenia (Mackenzie, Brady, Norrie, & Poedjianto, 2007).
The Cookie Theft Picture is designed to elicit language from which the syntactic and semantic composition of a person’s language output can be determined. Language samples collected are transcribed, and then analyzed by the examiner for the nature of the utterances produced. In normal speech, an utterance is considered a sentence. However, this definition is difficult to apply to language output produced by people with aphasia, as language in aphasia often consists of incomplete sentences. To address this, the authors of the BDAE consider an utterance as the expression of a thought or idea that ends by falling intonation and a pause (Goodglass, Kaplan, & Barresi, 2001). Using this definition, language samples resulting from the Cookie Theft Picture are divided into utterances. Each utterance is classified as: empty utterances (utterances such as “I don’t know” or “I can’t remember” that don’t add content), single clause utterances (utterances that contain a verb, a subject, and where applicable, an object), and multi-clause utterances (utterances consisting of at least one independent clause and at least one dependent clause), and subclausal utterances (utterances that consist of sentence fragments that fail to meet the definition of a clause). In addition, the examiner is instructed to note agrammatic deletions, or the omission of grammatical words such as “the,” “a,” “is,” etc. (Goodglass, Kaplan, & Barresi, 2001). Additionally, the examiner derives a Complexity Index for the language sample collected, which serves as a measure of overall syntactic complexity and is arrived at by dividing the number of clauses by the number of utterances produced (Goodglass, Kaplan, & Barresi, 2001).

When the Cookie Theft Picture task is combined with the Free Conversation subtest and the Aesop’s Fables subtest of the BDAE, the examiner derives an Aphasia Severity Scale, ranging from 0 to 5. The severity scale is a descriptive measure quantifying an individual’s ability to communicate effectively. A score of 0 corresponds to an absence of usable speech or auditory comprehension. In contrast, a score of 5 corresponds to minimal speech difficulties, with
possible difficulties that are not immediately apparent (Goodglass, Kaplan, & Barresi, 2001).

Using these measures, the Cookie Theft Picture provides insight into a person’s language functioning that many other measures are unable to assess. Most psycholinguistic assessments designed for use with aphasia involve tasks such as picture naming, sentence completion, repetition of words or phrases, and description of objects’ functions, and result in a correct/incorrect scoring system. According to Yorkston and Beukelman (1980), many of these tasks are so simple that people with mild aphasia perform well on them, despite the fact that they may have difficulty communicating with others. These deficits, though not significant enough to affect performance on standardized tests such as these, can affect a person’s participation and activity levels, and thereby their quality of life. The use of the Cookie Theft Picture addresses this by supplementing such assessment procedures with the discourse analysis procedure described above. By rating language samples using the Complexity Index and the Aphasia Severity Rating Scale, the Cookie Theft Picture description task illuminates communication deficits that may not be apparent using more structured tasks.

Furthermore, the Cookie Theft Picture is useful in that it minimizes the effect of confounding variables on an examinee’s performance. This is often a problem in a number of highly structured assessment tools used to examine language deficits. As discussed above, individuals with aphasia often also have comorbid cognitive deficits. This becomes problematic when evaluative tasks require executive function, attention, and/or working and short term memory. Deficits in these areas can negatively impact an individual’s performance, resulting in poorer scores. Thus, cognitive deficits may decrease the validity of a test’s results, as the results are skewed by factors other than language deficits. The Cookie Theft Picture, in contrast, is a simple picture description task that limits the effects of cognition on performance. The individual being assessed does not have to switch or divide their attention between stimuli, and needs not
retain directions in order to complete the task.

Test results may further be affected by an individual’s receptive language abilities, in that many tasks include extensive instructions that are presented to the examinee verbally. If the examinee has deficits in auditory comprehension, as is often the case in aphasia, instructions may not be understood, leading to poorer test performance. Thus, performance on a test of expressive language abilities, for example, may reflect receptive abilities instead. The Cookie Theft Picture avoids this problem by including minimal instructions, limiting the effect of receptive language on performance.

Another drawback to several psycholinguistic measurements is the degree of learnability, or a person’s ability to learn the correct answers to a test and thereby perform better with repeated administrations. Learnability often prevents clinicians from using a given assessment tool to measure improvement over time. The Cookie Theft Picture provides an examinee with a constant visual stimulus, removing the need to memorize the picture. In addition, performance on this task is not dependent on familiarity, but rather on a person’s ability to find words and generate syntactically sound utterances. It therefore allows repeated uses without compromising validity, making the Cookie Theft Picture a useful tool for evaluating improvement over time.

The Cookie Theft Picture, and other similar picture description tasks such as the Picnic Scene from the Western Aphasia Battery (Kertesz, 2006), allows clinicians to evaluate a person’s language skills as they relate to everyday functioning. In contrast to more structured assessment tasks, the Cookie Theft Picture allows for a wide variety of language output around the given picture. Thus, it allows the diagnostician to measure a number of linguistic elements, such as syntax, word finding, content, fluency of language output, etc. A number of researchers have described measurement procedures for language samples, each measuring a different linguistic element.
In a seminal study, Yorkston and Beukelman (1980) measured performance on the Cookie Theft Picture in terms of speaking rate, content, and efficiency of communication. Rate of speech was measured by determining the number of syllables produced within thirty seconds. Content of language output was measured using content units, outlined in Appendix A. The authors define content units as “a grouping of information that was always expressed as a unit by normal speakers” (Yorkston & Beukelman, 1980). Content units include two, children, little, boy, girl, on stool, falling over, by sink, faucet, etc. The authors then used measurements of speaking rate and content to arrive at a quantification of each subject’s efficiency of communication. Results showed a statistically significant difference between normal adults, with a mean of 41.9 content units per minute, and those with mild, high-moderate, and low-moderate aphasia, with a mean of 18.7, 13.2, and 8.3 content units per minute respectively.

Another approach to language analysis was used by Kemper, Thompson, and Marquis (2001) in which language samples elicited from open-ended questions were assessed using two factors. The first factor is termed Developmental Level, which measures grammatical complexity within a language sample ranging from one-clause complete sentences to multi-clause complete sentences with embedding. The second factor is termed Propositional Density, a measure of content within a language sample. Propositional density was arrived at by calculating the number of propositions (or ideas) in a language sample per ten words, based on both complete sentences as well as fragments. These measurements were used to assess language functioning in a sample of aging adults with dementia in comparison to a sample of healthy aging adults. Results indicated that both normal older adults and adults with dementia showed a decrease in grammatical complexity and Propositional Density. However, adults with dementia showed a much more rapid decrease in language abilities than their normal peers. Within 15 years, healthy adults decreased in grammatical complexity from a mean of 6.06 to 2.98, and decreased in
propositional density from a mean of 7.25 to 6.49. Meanwhile, adults with dementia decreased in grammatical complexity from a mean of 4.24 to 1.42 and decreased in propositional density from a mean of 4.46 to 1.84 within 24 months.

These measurements of discourse tasks are vital for the assessment of language functioning because they allow clinicians to compare performance of their clients to normative data. However, the ability to compare a language sample to normative data is not sufficient unless it reveals how a person’s language abilities affect functioning or quality of life per the framework of the International Classification of Functioning (World Health Organization, 2001). A study undertaken in the UK aimed to evaluate descriptions of the Cookie Theft Picture in terms of functioning using a quality of life framework (Mackenzie, Brady, Norrie, & Poedjianto, 2007). They described a person’s behaviors and their degree of success or failure in communicating messages. Concept analysis in this study was measured by examining the presence of seven concepts in language samples (woman doing dishes, sink overflowing, boy on stool, children stealing cookies, girl reaching for cookie, stool falling, woman not noticing), as well as the degree of completeness of each concept. Each concept was designated as accurate and complete, accurate but incomplete, inaccurate, or absent based on each subject’s description.

The results of this study showed that among the 221 subjects, there was a significant relationship between educational level and description of concept. More specifically, individuals with higher educational levels performed better in concept analysis than individuals with lower educational levels. Furthermore, the authors found that, while age did not have a statistically significant effect, the data showed a trend toward significance with younger individuals performing better in comparison to older individuals.

By examining completeness of concepts as well as presence of concepts, concept analysis in this study differs from the methods of content analysis described in Yorkston and Beukelman.
Concept analysis was chosen by Mackenzie and colleagues in order to provide standardized data on a parameter that would relate to client functioning, as this variable directly affects a person’s ability to communicate effectively and efficiently with a partner.

The aforementioned methods of quantifying language output elicited by the Cookie Theft Picture allow for the collection of normative data for the purpose of comparing an individual’s language to his/her peers, while shedding light on the nature of a person’s expressive language abilities. Performance is often compared to available normative data, in order to determine the degree to which an individual’s language production deviates from normal peers. The Cookie Theft Picture, as part of the Boston Diagnostic Aphasia Examination, is commonly used in children with Acquired Childhood Aphasia, in order to assess language, however there is a paucity of normative data for children completing the Cookie Theft Picture task. The present study aims to provide normative data for the Cookie Theft Picture that can be compared to the language produced by children with Acquired Childhood Aphasia.
Methods

Participants.

Participants for the current study were recruited from a local private school. They were reported by their parents as being between 11 and 13 years of age, being without history of neurological damage or language or speech disorders, and as a native English speaker. Of the approximately 56 students who fell into the required age range, 14 students returned parental permission forms. Among these 14 students, the researchers were able to successfully contact and schedule appointments with 12 parents, all of whose children met inclusionary criteria. Of these 12 subjects, 7 were male and 5 were female. When subjects were divided into age groups, one subject was 13 years old, 5 subjects were 12 years old, and 5 subjects were 11 years old. One subject was 10 years and 11 months, and was included in the 11-year-old age range. When subjects were broken into grade level, there were 4 7th graders, 5 6th graders, and 3 5th graders.

Table 2. Description of Subjects’ Age, Grade, and Gender

<table>
<thead>
<tr>
<th>Subject</th>
<th>Age Group</th>
<th>Grade Level</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>11</td>
<td>6</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 2</td>
<td>11</td>
<td>5</td>
<td>Female</td>
</tr>
<tr>
<td>Subject 3</td>
<td>11</td>
<td>6</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 4</td>
<td>11</td>
<td>5</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 5</td>
<td>12</td>
<td>6</td>
<td>Female</td>
</tr>
<tr>
<td>Subject 6</td>
<td>12</td>
<td>7</td>
<td>Female</td>
</tr>
<tr>
<td>Subject 7</td>
<td>11</td>
<td>5</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 8</td>
<td>11</td>
<td>6</td>
<td>Female</td>
</tr>
<tr>
<td>Subject 9</td>
<td>12</td>
<td>6</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 10</td>
<td>13</td>
<td>7</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 11</td>
<td>12</td>
<td>7</td>
<td>Male</td>
</tr>
<tr>
<td>Subject 12</td>
<td>12</td>
<td>7</td>
<td>Female</td>
</tr>
</tbody>
</table>
Methods.

The researchers came to the middle school and junior high classrooms toward the end of the school day. They explained the research study and distributed parental permission forms (found in Appendix B), instructing the students to have their parents sign and return the forms. Once parental permission forms were received, the researchers contacted parents to collect inclusionary information and to schedule a time to collect data.

At the scheduled time, the researcher met with each student individually in the school’s library, introduced herself, established rapport with the child by conversing socially, explained the study, and solicited questions about the study. At this point, each participant was asked to sign an assent form (found in Appendix C), indicating they understood the goals of the study and were willing to participate. Each participant sat at a desk next to the researcher. They were told “I’m going to show you a picture, and I want you to tell me everything you see happening in this picture. Keep talking for one minute when I will signal you to stop.” Each participant was then shown a large print of the Cookie Theft Picture (Goodglass, Kaplan, & Barresi, 2001), and their description was recorded using a standard digital audio recorder (Olympus VN-8100PC). If the participant stopped talking during the one-minute time period, the researcher provided the participant with a prompt such as “What else do you see?” or “Tell me more about this.” Prompts were given as needed until the one-minute time period was finished. If a participant was in the middle of an utterance or an idea at the end of one minute, they were permitted to complete the utterance or thought, and then were told to stop. The resulting audio recordings were later transcribed and the dependent variables were coded.

Data Analysis.

Transcription. Language samples were transcribed into Systematic Analysis of Language Transcripts (SALT) (Miller, Andriacchi, & Nockerts, 2011). SALT is a computer program that
uses a coding system to analyze language features such as morphemes, mazes, and root words within irregular verbs. (The coding scheme used in the current study is outlined in Appendix D.) From this information, SALT uses functions to calculate a variety of descriptive measures, such as total number of words, total number of utterances, elapsed time, and mean length of utterance. SALT was used in this research study to describe utterances using a variety of punctuation marks, each indicating the nature and type of utterance (for example, “.” indicates a statement). In order to maximally resemble the standard procedures laid out by the Boston Diagnostic Aphasia Examination, an utterance was defined in this study as an idea that ends in downward intonation and a pause. In the current study, SALT was used to determine one dependent variable, mean length of utterance, described further in the following sections.

Dependent Variables. Average Utterance Length. In the present study, SALT functions were used to analyze the structure of the language samples gathered from the participants. SALT determined the mean length of utterance (MLU) by computing the mean number of morphemes per utterance in each language sample. Morphemes are considered the smallest unit of meaning in language. A morpheme can be either a word or a part of a word. For example, “cookie” contains one morpheme, while “cookie/s” contains two morphemes (“cookie” and the plural marker “-s”). After each language sample was entered into SALT and coded, the first dependent variable, MLU, was calculated as an indicator of language growth.

Content Units. In addition, transcripts of the collected language samples were analyzed for content units, which served as the second dependent variable. The procedures for measuring content units in each language sample was adopted from Yorkston and Beukelman (1980), as these procedures are commonly used to analyze language samples elicited from the Cookie Theft Picture. (A full list of content units as described by Yorkston and Beukelman can be found in Appendix A.) The number of content units in each language sample was counted to determine
the amount of content conveyed by each participant. Each content unit was counted only once per language sample, even if a participant repeated one. For example, if a participant stated “The woman is washing dishes. The woman is a mother,” this statement would contain four content units: woman, washing, dishes, and mother. In addition, words or phrases in the language samples that were similar to the listed content units were counted. For example, “mom” was considered as “mother,” “making fun of” was considered as “laughing,” and “garage” was considered as “house next door.” These procedures for measuring content in language output were chosen for this study because they are commonly used when analyzing descriptions of the Cookie Theft Picture.

Efficiency. By determining the number of content units within the given time period, the present study was able to determine both the amount of information, as well as the expressive efficiency with which such information was conveyed. Efficiency was calculated as the number of content units per minute and served as a third dependent variable.

Reliability. In order to calculate inter-rater reliability, another graduate student was trained in SALT procedures for marking bound morphemes, mazes, and utterance segmentation. This student was given three language samples to transcribe and analyze for content units. Interrater reliability was determined for accuracy of transcription, coding of bound morphemes and utterances, and content units. The number of agreements between the transcriptions was divided by the number of agreements plus disagreements. For accuracy of transcription, inter-rater reliability was 97%. For accuracy of bound morpheme coding, inter-rater reliability was 93%. For accuracy of utterance segmentation, inter-rater reliability was 94%. For accuracy in content units, inter-rater reliability was 89%. In addition, Krippendorff’s Alpha, a measure that takes into account a variety of reliability coefficients (Hayes & Krippendorff, 2007) was calculated for MLU agreement, and yielded an alpha of 97%.
Design. The design of the present study was a between subjects design comparing language use across age, grade level, and gender.

Statistical Analysis. Microsoft Excel was used to organize the data and to calculate descriptive statistics, such as the mean and standard deviation of data. ANOVA and t test determined the presence of differences between groups by age, grade level, and gender. Correlational analysis was used to determine the presence of relationships between MLU and number of content units per language sample as well as between MLU and number of content units per minute.
Results

Each participant’s transcript was analyzed for total number of words, utterances, and morphemes and summarized in Table 3. Overall, a mean of 124 morphemes per transcript was produced with a standard deviation of 27.58 and a range from 85 to 181. The overall sample produced a mean of 101 words, with a standard deviation of 26.27 and a range from 49 to 150. The overall sample produced a mean of 11.67 utterances, with a standard deviation of 2.87 and a range from 6 to 16. Analysis of the three dependent variables showed an overall mean MLU of 11.28 morphemes with a standard deviation of 3.17 and a range of 5.38 to 18.00. Overall, a mean of 16.58 content units was produced per language sample, with a standard deviation of 3.40 and a range from 12 to 25. Analysis of efficiency showed an overall mean of 16.38 content units per minute across all subjects, with a standard deviation of 2.93 and a range from 10.75 to 23.07.

Mean Length of Utterance

As shown in Figure 2, analysis by age revealed that children between ages 10;11 and 11;11 produced an average of 12.22 morphemes per utterance (s.d. = 3.45; range = 8.50 – 18.00). Children between ages 12;0 and 12;11 produced an average of 10.32 morphemes per utterance (s.d. = 3.21; range = 5.38 – 13.92). The subject that fell in the 13-years-old range produced an MLU of 10.50 morphemes per utterance. One way ANOVA found no significant differences in MLU between age groups, F(2, 11) = .469, p > .05.
Table 3. Description of Subjects’ Performance on Language Measures

<table>
<thead>
<tr>
<th></th>
<th>Number of Morphemes</th>
<th>Number of Words</th>
<th>Number of Utterances</th>
<th>MLU in Morphemes</th>
<th>Content Units</th>
<th>Content Units/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>143</td>
<td>111</td>
<td>13</td>
<td>11.00</td>
<td>15</td>
<td>15.00</td>
</tr>
<tr>
<td>2</td>
<td>126</td>
<td>105</td>
<td>12</td>
<td>10.50</td>
<td>17</td>
<td>17.29</td>
</tr>
<tr>
<td>3</td>
<td>108</td>
<td>93</td>
<td>6</td>
<td>18.00</td>
<td>25</td>
<td>23.07</td>
</tr>
<tr>
<td>4</td>
<td>102</td>
<td>88</td>
<td>8</td>
<td>14.57</td>
<td>13</td>
<td>16.25</td>
</tr>
<tr>
<td>5</td>
<td>124</td>
<td>96</td>
<td>12</td>
<td>10.36</td>
<td>15</td>
<td>15.00</td>
</tr>
<tr>
<td>6</td>
<td>181</td>
<td>150</td>
<td>13</td>
<td>13.92</td>
<td>16</td>
<td>15.00</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>49</td>
<td>10</td>
<td>8.50</td>
<td>12</td>
<td>10.75</td>
</tr>
<tr>
<td>8</td>
<td>118</td>
<td>95</td>
<td>11</td>
<td>10.73</td>
<td>18</td>
<td>17.42</td>
</tr>
<tr>
<td>9</td>
<td>146</td>
<td>122</td>
<td>15</td>
<td>9.73</td>
<td>18</td>
<td>17.70</td>
</tr>
<tr>
<td>10</td>
<td>147</td>
<td>128</td>
<td>14</td>
<td>10.50</td>
<td>19</td>
<td>17.54</td>
</tr>
<tr>
<td>11</td>
<td>122</td>
<td>104</td>
<td>10</td>
<td>12.20</td>
<td>14</td>
<td>14.00</td>
</tr>
<tr>
<td>12</td>
<td>86</td>
<td>71</td>
<td>16</td>
<td>5.38</td>
<td>17</td>
<td>17.59</td>
</tr>
<tr>
<td>Mean</td>
<td>124</td>
<td>101</td>
<td>11.67</td>
<td>11.28</td>
<td>16.58</td>
<td>16.38</td>
</tr>
<tr>
<td>SD</td>
<td>27.58</td>
<td>26.27</td>
<td>2.87</td>
<td>3.17</td>
<td>3.40</td>
<td>2.93</td>
</tr>
</tbody>
</table>

As shown in Figure 3, analysis by grade level revealed that Fifth graders produced an average of 11.19 morphemes per utterance (s.d. = 3.09; range = 8.50-14.57 morphemes per utterance). Sixth graders produced an average of 11.96 morphemes per utterance (s.d. = 3.41; range = 9.73-18.00). Seventh graders produced an average of 10.50 morphemes per utterance.
(s.d. = 3.69; range = 5.38-13.92). One way ANOVA found no significant differences in MLU between grade levels, F(2, 11) = .203, p > .05.

As shown in Figure 3, analysis by gender revealed that male subjects produced an average of 12.07 morphemes per utterance (s.d. = 3.24; range = 8.50 – 18.00). Female subjects produced an average of 10.18 morphemes per utterance (s.d. = 3.06; range = 5.38 – 13.92). Independent t test found no significant difference in MLU between boys and girls, t(10) = 1.019, p > .05.
Content Units Analysis

As shown in Figure 5, analysis by age revealed that subjects between 10;11 and 11;11 produced an average of 16.67 content units (s.d. = 4.67; range = 12 – 25). Subjects between 12;0 and 12;11 produced an average of 16.00 content units (s.d. = 1.58; range = 14-18). The subject that fell in the 13-years-old range produced 19 content units. One way ANOVA found no significant differences in content units between age groups, F(2, 11) = .286, p > .05.

As shown in Figure 6, analysis by grade level showed that Fifth graders produced an average of 14.00 content units (s.d. = 2.65; range = 12 – 17). Sixth graders produced an average of 18.20 content units (s.d. = 4.08; range = 15 – 25). Seventh graders produced an average of 16.50 content units (s.d. = 2.08; range = 14 – 19). One way ANOVA found no significant differences in content units between grade levels, F(2, 11) = 1.589, p > .05.
As shown in Figure 7, analysis by gender showed that male subjects produced an average of 16.57 content units (s.d. = 4.50; range = 12 – 25). Female subjects produced an average of 16.60 content units (s.d. = 1.14; range = 15 – 18). Independent t test found no significant difference in content units between boys and girls, t(10) = -.014, p > .05.
Analysis of Efficiency of Communication (Content Units per Minute)

As shown in Figure 8, analysis by age showed that subjects between 10;11 and 11;11 produced an average of 16.63 content units per minute (s.d. = 3.99; range = 10/75 – 23.07). Subjects between 12;0 and 12;11 produced an average of 15.86 content units per minute (s.d. = 1.68; range = 14.00 – 17.70). The subject that fell within the 13-years-old range produced 17.54 content units per minute. One way ANOVA revealed no significant differences in efficiency between age groups, F(2, 11) = .152, p > .05.

As shown in Figure 9, analysis by grade level showed that Fifth graders produced an average of 14.76 content units per minute (s.d. = 3.51; range = 10.75 – 17.29). Sixth graders produced an average of 17.63 content units per minute (s.d. = 3.30; range = 15.00 – 23.07). Seventh graders produced an average of 16.03 content units per minute (s.d. = 1.82; range = 14.00 – 17.59). One way ANOVA revealed no significant differences in efficiency between grade levels, F(2, 11) = .936, p > .05.
As shown in Figure 10, analysis by gender showed that male subjects produced an average of 16.33 content units per minute (s.d. = 3.81; range = 10.75 – 23.07). Female subjects produced an average of 16.46 content units per minute (s.d. = 1.34; range = 15.00 – 17.59). Independent t test revealed no significant difference in efficiency between boys and girls, t(10) = -.072, p > .05.
Correlational Analysis

Correlational analysis revealed no significant relationship between MLU and number of contents per language sample, $r(10) = .403$, $p > .05$. In addition, no significant relationship was found between MLU and content units per minute, $r(10) = .436$, $p > .05$. 
Discussion

The purpose of the current research study was to collect normative data for children, ages 11 to 13 years describing the Cookie Theft Picture in order to increase the usefulness of the Cookie Theft Picture as a diagnostic tool for children with neurogenic language disorders. Each subject was given one minute to describe the picture, and resulting language samples were analyzed for measures of language growth, content, and efficiency. Statistical analysis revealed no significant differences between the twelve subjects by either gender, age, or grade level, suggesting language output when describing a picture such as the Cookie Theft Picture is relatively similar from age 11 to age 13. Across all subjects, the mean language growth was 11.28 morphemes per utterance with a standard deviation of 3.18, the mean number of content units was 16.58 content units with a standard deviation of 3.40, and the mean efficiency rating was 16.38 content units per minute with a standard deviation of 2.93.

Mean Length of Utterance.

Currently, there is no data on the structure of expressive language in children when describing the Cookie Theft Picture. However, there exists data on acquisition of expressive syntax and morphology. Existing research on mean length of utterance (MLU) as a measure of morphosyntactic complexity and language growth primarily focuses on ages 0 to 5 years. In typically developing children, MLU increases as language development progresses and language output becomes more and more complex. By the age of 2 years 7 months, children are expected to produce language with an MLU of approximately 1.50 to 1.99 morphemes. By the time a child is three and a half years old, that child is expected to produce an average of 4.5 morphemes per
utterance (Hoff, 2009). By the age of 5 years, a normally developing child is expected to have learned all morphosyntactic elements in their language and to produce language that is morphosyntactically similar to that of an adult (Hoff, 2009). However, as children continue to age, their language output continues to increase in morphosyntactic complexity. The results of the current study confirm this, as all subjects produced an MLU over 4.0, the published average MLU for 52 months and older.

The data collected by the current research study was compared to language transcripts contained in the Narrative SSS (student selects story) database based on children ages 11;00 to 13;11 (Miller, Andriacchi, Nockerts, 2011). This database is provided by SALT for comparative purposes and contains 330 transcribed narratives from normally developing children in Madison, Wisconsin preschools, the Madison Metropolitan Public School District, and rural areas in Northern Wisconsin. The children who contributed to the Narrative SSS database range from ages 5;2 to 13;3, and were in either kindergarten, first, second, third, fifth, or seventh grades (Miller, Andriacchi, Nockerts, 2011). While the Cookie Theft Picture task is a picture-description task and presents challenges different from that of the narrative retell task used to build the Narrative SSS database, both tasks require a speaker to describe an event and require very little participation from a second speaker, making them comparable, though not identical tasks.

The Narrative SSS database reported a mean length of utterance for children ages 11;00-13;11 of 9.48 morphemes, with a standard deviation of 1.9. In comparison, the current research study yielded a mean length of utterance of 11.28 morphemes with a standard deviation of 3.18. Though the current study resulted in a higher MLU than the Narrative SSS database, these two reported MLU measures are within one standard deviation of each other. In addition, the MLU for the age matched children’s language transcripts in the Narrative SSS database ranged from
5.46 to 17.00 morphemes, while the current study found a range of MLU from 5.38 to 18.00. The similar average MLU as well as the similar ranges between the current study and the NSS database suggests that the language of children who participated in the current study is comparable to the language of a wider sample of typically developing age-matched children.

**Content Units.**

The results for content in the current study were compared to those published by Yorkston and Beukelman (1980). In Yorkston and Beukelman, the normal adults, age 19 to 49, averaged 18.0 content units per language sample with a standard deviation of 4.7. In comparison, the current study’s results yielded an average of 16.58 content units per language sample and a standard deviation of 3.40. Because the normal adult speakers and the normally developing children produced average content units within one standard deviation of each other, the results of the current study suggest the children performed similarly to adults with respect to content of expressive language.

**Efficiency**

Results for efficiency in Yorkston and Beukelman were drastically different from those of the current research study. While Yorkston and Beukelman report an average of 41.9 content units per minute with a standard deviation of 13.2, the current analysis of children ages 11 to 13 yielded an average of 16.38 content units per minute, with a standard deviation of 2.93. This discrepancy in efficiency of expressive communication between children and adults may stem from the difference in methodology of language sample collection. Where Yorkston and Beukelman stopped recording either when a subject said they were finished or after a 30 second pause, the current study prompted subjects to continue speaking for the whole minute. As a result, after approximately 30 to 45 seconds in the current study, many subjects had exhausted the
more salient features of the picture and began to take more pauses to consider other elements to discuss. Such pauses likely decreased the resulting calculations for efficiency.

The difference in language sampling procedures poses additional concerns when comparing data from Yorkston and Beukelman to the current study. While the list of content units provided by Yorkston and Beukelman only focus on the most salient features of the Cookie Theft Picture, allowing the children in the present study more time to describe the picture resulted in description of information not included in the list of content units derived from adult speakers. For example, many subjects described what characters in the picture were wearing, stating that the mother was wearing a dress and the girl was wearing a skirt. Some subjects discussed elements of the picture’s quality, such as its black and white color scheme, its rectangular shape, etc. In addition, multiple subjects engaged in speculation about the characters in the picture. For example, some discussed the absence of artwork on the walls, suggesting the characters in the picture may have pictures stored away in closets. Other subjects suggested the family depicted in the Cookie Theft Picture was likely from the seventies and that each family member probably fills typical family roles. Such speculations and descriptions of less salient facts contained information that was not included in the list of content units derived from normal adult speakers in Yorkston and Beukelman, and thus did not contribute to the number of content units per language sample nor the measure of content units per minute, though they often included very specific and detailed information.

This difference in the semantic characteristics of language samples between adult and child speakers suggests a need for further research that aims to determine a list of typical content units specifically for the pediatric population. In addition, there may be a need for a modified method of measuring content and efficiency of language output in children that allows for a larger variety of descriptive topics. Such modification and research on pediatric populations may allow
for a more valid evaluation of both content and efficiency of language output.

**Correlational Analysis**

Additionally, there were no significant correlations found between measures of complexity and content, nor between measures of complexity and efficiency. In other words, the complexity of a child’s language output while describing the Cookie Theft Picture is not reflective of the content of his/her language output. This was demonstrated by the individual differences in language content observed in Participant 12 whose MLU was 5.38, the lowest in the sample. While other subjects used full sentences to describe the picture, this subject described the Cookie Theft Picture using primarily labels and sentence fragments such as “cookie jar,” “water spilling over the sink,” and “chair tipped over.” In doing so, she described and pointed out the presence of objects and characters, and did not go into detail describing what was happening nor how the characters related to or interacted with each other. However, this student produced 17 content units in her language sample, very close to the average number of content units found among the sample as a whole.

**Gender**

The current study found no significant differences between language measures based on gender. The existing research on language differences between genders is mixed (Burman, Bitan, & Booth, 2008). However, there do appear to be reported developmental differences between boys and girls. Girls begin talking earlier than boys and are quicker to develop vocabulary. Studies have shown that such differences are small, though persist into adulthood (Burman, Bitan, & Booth, 2008). A 2008 study examining behavioral and neurological differences between boys and girls on a variety of language showed an effect of sex, indicating a neurological difference in language processing between boys and girls, with girls showing more neurological activation (Burman, Bitan, & Booth). Thus, it is likely that further research on pediatric descriptions of the
Cookie Theft Picture may find statistically significant differences between boys and girls.

Case Study

The impetus for the current study was the child described in the case study above. This child was a female, approximately 12 years old, who was given the Cookie Theft Picture among other diagnostic tools in order to determine the presence of language deficits due to an automobile accident. During her description of the Cookie Theft Picture, there were multiple instances in which this child used dialogue to depict the events in the picture, giving the characters voices. This behavior was not observed among the 12 normally developing peers who participated in the current study. It is possible that by giving the characters voices rather than describing what was happening from a third person perspective, the child described in the case study was compensating for a language disorder caused by her automobile accident, though more extensive research is needed to definitively interpret this behavior.

Limitations and Future Research

It is important to consider the socioeconomic status (SES) of the participating students while interpreting the results of the current study. SES is a term that encompasses an individual’s access to wealth, power, and social status (Sirin, 2005). Current research operationally identifies SES using factors such as family income, parental educational level, and parental occupation. SES is also occasionally indicated by home resources, or household possessions including books, access to after school educational resources, a computer (Sirin, 2005).

SES has been found to have significant implications for a child’s language development. Research has found that mothers of higher SES brackets when compared to those of lower SES brackets generally talk more, spend more time on a single conversational topic, use a larger and more varied vocabulary when speaking, are more likely to describe objects when labeling them for children, ask children more questions, and elicit more language output from children (Hoff-
Ginsberg, 1998). All these behaviors are conducive to better language development. As a result, children growing up in lower SES brackets tend to experience less rich language input and are generally at a disadvantage in terms of language development (Hoff-Ginsberg, 1998).

In this light, the SES from which research participants come is extremely important to consider. In the current study, the school at which subject recruitment and subsequent data collection took place is a small private school. Many of the parents are university faculty, and a large number of the families fall within a relatively high socioeconomic bracket. In addition, only one school was used for the current study. As a result, the subjects that participated in the study are likely to have grown up with similar language input and similar access to books and written language. It is possible that conducting a similar study with children from lower SES brackets, from families unaffiliated with research or higher education, or from different areas of the city, state, or country would yield different results.

Further limitations of the current study relate to a low recruitment rate. Subject recruitment methods were dependent on the students, and recruitment rates were ultimately very low as a very few parental permission forms were returned. This low recruitment rate led to a small sample size, creating a potential for bias in statistical analysis and allowing for only very cautious generalization to the population of 11 to 13 year olds.

Additionally, all subjects went to the same school and thus had very similar educational experiences, as well as lived in the same city and thus spoke the same or a similar dialect of English. As a result, the results of the current study represent only a very small subset of English-speaking 11 to 13 year olds. Future research should address these limitations, using a much larger sample that is more representative of the population of 11 to 13 year old English-speakers.

In addition, future studies should examine a wider age range when researching pediatric performance on the Cookie Theft Picture. The Cookie Theft Picture, as well as the Boston
Diagnostic Aphasia Examination is administered to a wide range of ages in clinical practice, even though there is only normative data for age 19 and higher. The results of the current study cannot be generalized to children younger than 11 or older than 13, as such populations of normally developing children are at different stages of development both cognitively and linguistically. The descriptions produced by a child 5 years of age would be different than those collected in the current study in terms of morphosyntactic complexity as well as content and efficiency of language output.

Lastly, future studies on pediatric descriptions of the Cookie Theft Picture should examine a variety of language measures. There are many measures that are used to analyze language samples such as MLU and content units measured here. The Boston Diagnostic Aphasia Examination (Goodglass, Kaplan & Barresi, 2001) provides instructions for analyzing Cookie Theft Picture descriptions in terms of number and type of clauses produced. Additionally, SALT analysis provides a Subordination Index, a measure of clause density and syntactic complexity that is based on transcription coding (Miller, Andriacchi, & Nockerts, 2011). Other measures of morphosyntactic development include that described in Ward and Fisher (1990), which calls for analysis of picture descriptions by marking each utterance with a developmental stage and using each developmental stage to calculate a PESP (picture-elicited screening procedure) score. Ward and Fisher suggest that this procedure is applicable to children up to age 7:0.

Further research should also examine the Cookie Theft Picture as a tool for evaluating pragmatic communication in children. A similar study was conducted by Lowry et. al. (1994), in which a method of measuring development of pragmatic communication was used to analyze language samples collected during picture description tasks. Each utterance was coded as either belonging to the picture description task or to another communication task, leading to the
calculation of a percentage of genre-appropriate utterances within the language sample (Lowry et. al.). Further research analyzing pediatric descriptions of the Cookie Theft Picture using such measures of pragmatic development, as it relates to picture description, will allow for better understanding of pediatric performance on the Cookie Theft Picture and will allow for better clinical application of the Cookie Theft Picture to pediatric populations.

In conclusion, more research is needed in order to use the Cookie Theft Picture and the Boston Diagnostic Aphasia Examination as a whole for assessment purposes with children with brain injuries and suspected aphasia. There are very few studies examining the use of such tools with children, providing practitioners with little evidence on which to base their practice. With more research and increased understanding, children with acquired childhood aphasia will have access to more sound diagnostic and therapy services.
References


Kertesz, A. *Western Aphasia Battery – Revised (WAB-R).* Austin, TX: Pro-Ed, 2006.


Appendix A: List of Content Units

Content Units from Yorkston and Beukelman (1980)

<table>
<thead>
<tr>
<th>Two Children</th>
<th>Little Girl</th>
<th>Mother Woman (lady)</th>
<th>In the kitchen</th>
<th>General statement about disaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Boy</td>
<td>Standing</td>
<td>Children behind her</td>
<td>Standing</td>
<td>Standing</td>
</tr>
<tr>
<td>Brother</td>
<td>By boy</td>
<td>By sink</td>
<td>By sink</td>
<td>By sink</td>
</tr>
<tr>
<td>Standing</td>
<td>Reaching up</td>
<td>Washing (doing)</td>
<td>Washing (doing)</td>
<td>Washing (doing)</td>
</tr>
<tr>
<td>On stool</td>
<td>Asking for cookie</td>
<td>Dishes</td>
<td>Dishes</td>
<td>Dishes</td>
</tr>
<tr>
<td>Wobbling (off balance)</td>
<td>Has finger to mouth</td>
<td>Drying</td>
<td>Drying</td>
<td>Drying</td>
</tr>
<tr>
<td>3-legged</td>
<td>Saying <em>shhh</em> (keeping him quiet)</td>
<td>Faucet on</td>
<td>Faucet on</td>
<td>Faucet on</td>
</tr>
<tr>
<td>Falling over</td>
<td>Trying to help (not trying to help)</td>
<td>Full blast</td>
<td>Full blast</td>
<td>Full blast</td>
</tr>
<tr>
<td>On the floor</td>
<td>Laughing</td>
<td>Ignoring (daydreaming)</td>
<td>Ignoring (daydreaming)</td>
<td>Ignoring (daydreaming)</td>
</tr>
<tr>
<td>Hurt himself</td>
<td>Reaching up</td>
<td>Water</td>
<td>Water</td>
<td>Water</td>
</tr>
<tr>
<td>Reaching up</td>
<td>Water</td>
<td>Overflowing</td>
<td>Overflowing</td>
<td>Overflowing</td>
</tr>
<tr>
<td>Taking (stealing)</td>
<td>Cookies</td>
<td>Onto floor</td>
<td>Onto floor</td>
<td>Onto floor</td>
</tr>
<tr>
<td>Cookies</td>
<td>Feet getting wet</td>
<td>Dirty dishes left</td>
<td>Dirty dishes left</td>
<td>Dirty dishes left</td>
</tr>
<tr>
<td>For himself</td>
<td>Dirty dishes left</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
<tr>
<td>For his sister</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
<tr>
<td>From the jar</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
<tr>
<td>On the high shelf</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
<tr>
<td>In the cupboard</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
<tr>
<td>With the open door</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
<tr>
<td>Handing to sister</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
<td>Puddle</td>
</tr>
</tbody>
</table>
Appendix B: Parental Permission Form
The Ohio State University Parental Permission
For Child’s Participation in Research

Study Title: Normally Developing Children’s Descriptions of the Cookie Theft Picture
Researcher: Michelle S. Bourgeois, PhD

Sponsor:

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.
Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this study is to gather information describing how normally developing children, ages 11 through 13, perform on a picture description task that is often used to assess language development.

Procedures/Tasks:
Your child will be shown a picture and will be asked to describe the picture. Your child will be given one minute to provide a description, which will be recorded using an audio recorder for later analysis.

Duration:
Your child’s participation will require approximately 15 minutes. Your child may leave the study at any time. If you or your child decides to stop participation in the study, there will be no penalty and neither you nor your child will lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.
Risks and Benefits:

This study poses minimal risk to your child. Your child will be recorded using an audio recorder. Recordings will be kept by the researchers until the end of the study. The information gathered from your child’s participation in this study will help speech language pathologists to better understand the language development of normally developing children.

Confidentiality:

Efforts will be made to keep your child’s study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your child’s participation in this study may be disclosed if required by state law. Also, your child’s records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Participant Rights:

You or your child may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you or your child is a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you and your child choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.
Contacts and Questions:
For questions, concerns, or complaints about the study you may contact Mrs. Jennifer Brello, CCC-SLP at (614) 292-7504 or Julia Stern at (513) 378-0101.

For questions about your child’s rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If your child is harmed as a result of participating in this study or for questions about a study-related harm, you may contact Michelle Bourgeois at (614) 292-1742.
**Signing the parental permission form**

I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to permit my child to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

---

**Printed name of subject**

---

**Printed name of person authorized to provide permission for subject**  
**Signature of person authorized to provide permission for subject**  
**AM/PM**  
**Date and time**

**Relationship to the subject**

---

**Phone number for above signed parent/guardian**

---

**Investigator/Research Staff**

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

---

**Printed name of person obtaining consent**  
**Signature of person obtaining consent**  
**AM/PM**  
**Date and time**
Appendix C: Child Assent Form
The Ohio State University Assent to Participate in Research

Study Title: Normally Developing Children’s Descriptions of the Cookie Theft Picture

Researcher: Michelle S. Bourgeois, PhD

Sponsor:

- You are being asked to be in a research study. Studies are done to find better ways to treat people or to understand things better.
- This form will tell you about the study to help you decide whether or not you want to participate.
- You should ask any questions you have before making up your mind. You can think about it and discuss it with your family or friends before you decide.
- It is okay to say “No” if you don’t want to be in the study. If you say “Yes” you can change your mind and quit being in the study at any time without getting in trouble.
- If you decide you want to be in the study, an adult (usually a parent) will also need to give permission for you to be in the study.

1. What is this study about?

The goal of this study is to learn how normal children do on tests used to diagnose language disorders. This information will be used by speech pathologists to provide better treatment to children with language disorders.

2. What will I need to do if I am in this study?

You will be shown a picture, and you will have one minute to describe what you see in the picture. Your description will be recorded using an audio recorder.

3. How long will I be in the study?

You will spend about fifteen minutes participating in the study. Your participation in this study will end when you are finished describing the picture.
4. **Can I stop being in the study?**
   You may stop being in the study at any time.

5. **What bad things might happen to me if I am in the study?**
   You will not be harmed by participating in the study.

6. **What good things might happen to me if I am in the study?**
   Nothing will happen to you if you are in this study.

7. **Will I be given anything for being in this study?**
   You will be given a gift card to Barnes & Noble after you participate in this study.

8. **Who can I talk to about the study?**
   For questions about the study you may contact Mrs. Jennifer Brello, CCC-SLP at (614) 292-7504 or Julia Stern at (513) 378-0101.

   To discuss other study-related questions with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.
Signing the assent form

I have read (or someone has read to me) this form. I have had a chance to ask questions before making up my mind. I want to be in this research study.

_________________________  ____________________________  AM/PM
Signature or printed name of subject  Date and time

Investigator/Research Staff

I have explained the research to the participant before requesting the signature above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

_________________________  ____________________________  AM/PM
Printed name of person obtaining assent  Signature of person obtaining assent  Date and time

This form must be accompanied by an IRB approved parental permission form signed by a parent/guardian.
Appendix D: List of Codes Used on SALT Transcriptions (Miller, Andriacchi, & Nockerts, 2011)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Child’s utterance</td>
</tr>
<tr>
<td>E</td>
<td>Examiner’s utterance</td>
</tr>
<tr>
<td>.</td>
<td>Marks the end of an utterance that serves as a statement or comment</td>
</tr>
<tr>
<td>!</td>
<td>Marks the end of an utterance that serves as an exclamation</td>
</tr>
<tr>
<td>?</td>
<td>Marks the end of an utterance that serves as a question</td>
</tr>
<tr>
<td>X</td>
<td>Unintelligible word</td>
</tr>
<tr>
<td>XX</td>
<td>Unintelligible segment of an utterance</td>
</tr>
<tr>
<td>XXX</td>
<td>Unintelligible utterance</td>
</tr>
<tr>
<td>/s</td>
<td>Plural marker</td>
</tr>
<tr>
<td>/z</td>
<td>Possessive marker</td>
</tr>
<tr>
<td>/s/z</td>
<td>Plural and possessive marker</td>
</tr>
<tr>
<td>/ed</td>
<td>Past tense marker</td>
</tr>
<tr>
<td>/3s</td>
<td>Third person singular verb marker</td>
</tr>
<tr>
<td>/ing</td>
<td>Present progressive marker</td>
</tr>
<tr>
<td>/n’t</td>
<td>Negative contraction</td>
</tr>
<tr>
<td>/’t</td>
<td></td>
</tr>
<tr>
<td>/’ll</td>
<td>Contraction</td>
</tr>
<tr>
<td>/’m</td>
<td>Contraction</td>
</tr>
<tr>
<td>‘d</td>
<td>Contraction</td>
</tr>
<tr>
<td>‘re</td>
<td>Contraction</td>
</tr>
<tr>
<td>/’s</td>
<td>Contraction</td>
</tr>
<tr>
<td>/’ve</td>
<td>Contraction</td>
</tr>
<tr>
<td>(</td>
<td>Maze marker</td>
</tr>
<tr>
<td>*</td>
<td>Abandoned word or utterance</td>
</tr>
<tr>
<td>Ah</td>
<td>Filled pause words</td>
</tr>
<tr>
<td>Uh</td>
<td></td>
</tr>
<tr>
<td>Um</td>
<td></td>
</tr>
<tr>
<td>Hm</td>
<td></td>
</tr>
</tbody>
</table>