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# Social Functioning Characteristics of a Young Adult with a History of Childhood Apraxia of Speech

Nicole Anne Hill

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SOCIAL FUNCTIONING CHARACTERISTICS OF A YOUNG ADULT WITH A  
HISTORY OF CHILDHOOD APRAXIA OF SPEECH

A Thesis

Submitted to the John G. Rangos Sr. School of Health Sciences

Duquesne University

In partial fulfillment of the requirements for  
the degree of Master of Science

By

Nicole Hill

August 2016

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Nicole Hill

2016

SOCIAL FUNCTIONING CHARACTERISTICS OF A YOUNG ADULT WITH A  
HISTORY OF CHILDHOOD APRAXIA OF SPEECH

By

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Approved June 28, 2016

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## ABSTRACT

# SOCIAL FUNCTIONING CHARACTERISTICS OF A YOUNG ADULT WITH A HISTORY OF CHILDHOOD APRAXIA OF SPEECH

By

Nicole Hill

August 2016

Thesis supervised by Megan S. Overby, Ph.D.

Childhood apraxia of speech (CAS) is a pediatric speech sound disorder (SSD) that results from a motor planning impairment for volitional speech movements. This underlying impairment causes pervasive errors in speech sound production and often leads to problems with intelligibility, thus inhibiting effective communication. Longitudinal studies have found children with various communication impairments to be less successful in social interactions compared to their typically developing peers, and that this can lead to poor social functioning outcomes (Beitchman et al., 1996; Clegg, Hollis, Mawhood, & Rutter, 2005; Craig, 1993; Durkin & Conti-Ramsden, 2007). Yet, there is no research to date on what the particular effects are for individuals with CAS. This mixed methods single subject case study examined, first, the speech production characteristics of a young adult with a history of CAS, and, second, whether or not her

earlier experiences with inefficient communication had long-term effects on her pragmatic skills, self-esteem, friendships, and/or selection of occupation.

Speech tasks from the Madison Speech Assessment Protocol (MSAP) – such as nonword and multisyllabic word repetition, lexical stress, and diadochokinesis tasks – were used to assess the participant’s precision and consistency of speech sound production and prosody. Measures of personality, nonverbal intelligence, and language abilities were also taken to further describe the participant and provide a context to interpret the subsequent results. The participant’s pragmatic skills and self-esteem were assessed by triangulating data collected from quantitative measures as well as two separate semi-structured interviews with the participant and her mother. The effects of the participant’s communication impairment on the formation of friendships and her selection of future career were examined through the semi-structured interviews. Quantitative analysis included comparing the participant’s performance to available norms in the research literature, and qualitative analysis was conducted using a grounded theory approach.

Overall, the participant’s conversational speech was 100% intelligible with a mild /s/ distortion noted. The participant demonstrated further errors associated with CAS when she attempted the more challenging speech tasks of the MSAP. Results revealed the participant’s overall pragmatic skills to be within normal limits but deficits were expressed in specific social situations. The participant’s self-esteem was scaled on the low end of the average range, and maintaining her self-esteem has been a continuous process that has necessitated outside support at times. Also, the participant’s speech sound disorder hindered her ability to form a high number of friendships, but her few

close friendships are of high quality. Lastly, the qualitative results demonstrated how the participant's past experiences with inefficient communication have driven her to find a career path in which she can advocate for children facing similar challenges.

## DEDICATION

I dedicate my thesis to the children with CAS who have stolen my heart. May Ann's story be one of hope and encouragement to you and your families.

## ACKNOWLEDGEMENT

First and foremost, I must thank Dr. Overby. None of this would have been accomplished without you. I was so fortunate to have started my research journey with you, and you have continued to be the driving force behind my progress. I cannot thank you enough for your continuous encouragement and belief in me. You have been such an inspiring mentor for the past few years; you've allowed me to discover new ideas and answers on my own, but you've always been there to guide me when I get lost. Thank you for everything.

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## CHAPTER I

### Introduction

#### Childhood Apraxia of Speech

Childhood apraxia of speech (CAS) is a pediatric neurological speech sound disorder that affects the precision and consistency of the movements required for speech production in the absence of a neuromuscular deficit (American Speech-Language-Hearing Association [ASHA], 2007). Difficulties are suspected to arise from an underlying impairment in the planning and/or programming of the spatiotemporal aspects of speech movement sequences (Duffy, 2013; Grigos, Moss, & Lu, 2015; Murray, McCabe, Heard, & Ballard, 2015; Nijland, Maassen, & Van der Meulen, 2003; Shriberg, Aram, & Kwiatkowski, 1997a; Shriberg, Lohmeier, Strand, & Jakielski, 2012) resulting in speech sound errors, variability, and inconsistencies in both the segmental and suprasegmental aspects of speech (ASHA, 2007; Grigos et al., 2015; Iuzzini, 2012). Although CAS has no established set of diagnostic markers, three primary features of the disorder are frequently reported: “(a) inconsistent errors on consonants and vowels in repeated productions of syllables or words, (b) lengthened and disrupted coarticulatory transitions between sounds and syllables, and (c) inappropriate prosody, especially in the realization of lexical or phrasal stress” (ASHA, 2007, p. 7). Recent prevalence data on this population are lacking, however it has been estimated that CAS affects one to two children per thousand (Shriberg et al., 1997a).

**Effects on speech sound production.** Differences in the speech sound production of children with CAS have been noted early in their development. In a retrospective study examining home videos of children from birth to two years of age, Overby and Caspari

(2015) found toddlers with CAS used 3.4 times fewer resonant English sounds and 2-3 times fewer different consonants during their first two years of life than typically developing toddlers.

Not only do children with CAS appear to produce limited resonant consonants as toddlers, but the speech of older children with CAS is often characterized by multiple speech sound errors, possibly related to variability of the temporal and spatial aspects of motor speech gestures. Grigos et al. (2015) compared the consistency of speech sound production across speech tasks of increasing phonological complexity among three groups of children (3-7 years old) with: CAS, speech delay characterized by articulation/phonological impairment (SD), and typical development (TD). In the CAS group, production accuracy of the target improved the more time the child took to produce the target, and stability of the child's articulator movements decreased as the phonological length of the target increased.

Other effects of CAS on speech sound production are slow articulatory movement, articulatory groping, "staccato-like" transitions between sounds and syllables, and abnormal prosody (Campbell, 2003). Shriberg, Aram, and Kwiatkowski (1997b) found the extended duration of articulation seen in children with CAS adversely affected the rhythm and prosody of their speech. The authors examined prosody in two groups of children (4 – 7 years old): those with suspected CAS and a typically developing control group. Significant between-group differences were found in rate and stress. The excessive pause time between words, excessively long articulation time, and/or "excessive/equal/misplaced stress" demonstrated by the CAS group greatly decreased prosodic accuracy.

Prosodic disturbances and inconsistency in articulation in the speech of children with CAS were also reported by Lewis, Freebairn, Hansen, Iyengar, and Taylor (2004a) and Jacks, Marquardt, and Davis (2006). Unusual errors on both consonants and vowels (i.e. voicing errors, velar fronting, deletion of stridents, stopping of fricatives, liquid simplification, vowel errors, glottal replacement, and metathetic errors) resulted in inconsistency in the accuracy and intelligibility of the children's speech production. Omissions, substitutions, and stopping errors were the most prevalent phoneme-level errors (Jacks et al., 2006). At the syllable level, these children demonstrated initial consonant deletion, final consonant deletion, cluster reduction, and syllable reduction.

**Residual errors.** The course of remediation for CAS can be an intensive, prolonged process that may last into adolescence. According to Fish (2016), some children with CAS can remediate their speech sound disorder with the proper therapeutic interventions, while others have persistent speech production challenges leading to residual articulation errors and/or unresolved phonological processes. Continued errors include: inappropriate suprasegmentals; substitutions and distortions, frequently of the later developing phonemes (e.g., /s, r/); inaccuracy in the production of complex phonemic sequences; cluster reduction; weak syllable deletion; omission of medial and/or final consonants; voicing errors; and vowel errors. In a study of six children (aged 9;10 to 15;10) with persisting speech sound errors associated with CAS, all participants demonstrated errors in the production of rhotics, and several demonstrated substitutions or distortions of vowels and consonants (including alveolars and affricates) or cluster reduction errors (Preston, Brick, & Landi, 2013). As with younger children with CAS, the severity of residual errors in older children/adolescents can vary.

**Effects on intelligibility.** Given the pervasive effect CAS has on speech production (i.e. inconsistent consonant/vowel errors, limited sound repertoire, disrupted rhythm and prosody), intelligibility is a reported deficit among this population (ASHA, 2007; Ball, Bernthal, & Beuklman, 2002; Campbell, 2003; Hall, 2000; McCabe, Rosenthal, & McLeod, 1998; Teverovsky, Bickel, & Feldman, 2009; Shriberg et al., 1997b). McCabe et al. (1998) examined the speech production characteristics of 50 children with the broad diagnosis of “functional articulatory or phonological impairment.” The researchers described each child’s speech sound production according to two characteristics: number of CAS features present (NFP) and the “feature severity ratings” (FSRs) based on the severity of the clinical features of CAS. Because both NFP and FSR had a strong correlation coefficient with the child’s percent of consonants correct (PCC), the number and severity of CAS characteristics were associated with the child’s intelligibility level.

In a published letter to parents of this population, Hall (2000) pointed to vowel errors and the inconsistent coordination of the velopharyngeal port during speech production as contributing factors to unintelligibility. CAS can have such widespread effects on the production of speech that overall intelligibility can be a great challenge.

**Associated language difficulties.** Possible communicative effects of CAS go beyond speech sound production and can reach the linguistic level. All aspects of language (i.e., form, content, use) have been reported as being affected in individuals with CAS (Lucas, Weiss, & Hall, 1993; Milloy & Summers, 1989). Frequently, this population will demonstrate relatively higher receptive than expressive language abilities (Hall, Jordan, & Robin, 1993); however, difficulties in both receptive and expressive

syntactic skills have been reported in children with CAS (Aram & Glasson, 1979; Ekelman & Aram, 1983; Lohr, 1978; Snyder, Marquardt, & Peterson, 1977), and phonological awareness skills are often impaired (Marion, Sussman, & Marquardt, 1993). In addition, reading and spelling difficulties are frequently reported among children with severe speech sound disorders, including CAS (Lewis, Freebairn, & Taylor, 2000; Snowling & Stackhouse, 1983). Hall et al. (1993) specifically noted children with CAS, “with their phonological sequencing difficulties and co-occurring language problems, are at risk in learning to read” (p. 85).

**Origins/Etiologies.** Reputed causes of CAS include known neurological etiologies and complex neurobehavioral disorders of known or unknown origin. CAS may also be classified as an idiopathic neurogenic speech sound disorder (ASHA, 2007). In addition, there has been converging evidence CAS has a genetic origin (Fisher, Lai, & Monaco, 2003; Lai, Fisher, Hurst, Varga-Khadem, & Monaco, 2001; Lewis et al., 2004b; Worthey et al. 2013). A genetic origin for developmental speech and language disorders has received a great deal of support in the research literature (Bishop, North, & Donlan, 1995; Lewis & Thompson, 1992; Tomblin & Buckwalter, 1998).

Looking at CAS specifically, one family has been extensively studied due to their expression of a severe speech-language disorder across three generations. Half the members of the KE family exhibit cognitive deficits, language impairment, orofacial apraxia and apraxia of speech. On the tests of word repetition, nonword repetition, and simultaneous and sequential orofacial movements, none of the affected individuals’ scores overlapped those of any nonaffected family members (Vargha-Khadem et al., 1998). That is, the members of the KE family that are affected by this disorder are most

significantly impaired in the area of motor planning/programming of speech and non-speech oral movements. The pattern in which the speech and language disorder is passed down through the family is indicative of a single autosomal dominant gene (Fisher et al., 2003). Multiple researchers (Belton, Salmond, Watkins, Vargha-Khadem, & Gadian, 2003; Lai et al., 2001; Liegeois, Baldeweg, Connelly, Gadian, & Vargha-Khadem, 2003) have pointed to the disruption of the *FOXP2* gene on chromosome 7 as responsible for the resulting speech and language impairments within this family.

A great deal of research into the genetic origins of CAS has been conducted outside of the KE family, also. Five different chromosomes (3, 6, 7, 9, and 17) and numerous genes (*FOXP1*, *CNTNAP2*, *ATP13A4*, *CNTNAP1*, *KIAA0319*, *SETX*, *FOXP1*, *FOXG1*, *ELP4*, *RAI1*) have been indicated as affecting speech and language development in children with CAS (Shriberg et al., 2012; Worthey et al., 2013). A variety of combinations of the aforementioned affected genes have resulted in the phenotype of CAS. Thus, individuals affected by CAS do not demonstrate a homogenous group of causative genes.

Because children are born with CAS, the errors and deviations in their speech and language development manifest early (Highman, Hennessey, Sherwood, & Leitão, 2008). The pervasive effects of CAS require a long process of remediation. In some cases, like the KE family, errors can continue into adulthood. Due to the persistence of disordered speech, we would expect there to be social consequences as a result.

### **Social Consequences of Speech and Language Impairments**

Research has shown that children and adolescents with communication disorders are not as successful in peer interactions as their typically developing peers, and this can

lead to long-term effects on their social functioning (Beitchman et al., 1996; Clegg et al., 2005; Durkin & Conti-Ramsden, 2007). Speech sound disorders and/or language impairments can adversely affect an individual's pragmatics, self-esteem, formation of friendships, and/or occupational outcomes (Anderson & Felsenfeld, 2003; Craig, 1993; Crichton-Smith, 2002; Felsenfeld, Broen, & McGue, 1994). Because children with CAS may have poor speech sound production skills as well as impaired language skills, they are therefore at high risk for experiencing adverse social consequences.

**Social consequences of speech sound disorders.** Evidence supports an association between children's abilities to express themselves and their participation and success in social interactions (Aro, Laakso, Maatta, Tolvanen, & Poikkeus, 2014; Hadley & Rice, 1991; Mueller, 1972; Rice, Sell, & Hadley, 1991). Disordered verbalizations pose a threat to successful social communication. Specifically, Mueller (1972) found unintelligibility and grammatically unclear utterances to be the highest predictors of failure for an interaction among preschoolers. Unintelligibility and syntactical difficulties are well-documented problems for individuals with CAS.

SSDs can lead to poor social outcomes including: bullying, impaired social interactions, and decreased general life satisfaction (Hitchcock, Harel, & Byun, 2015). In a systematic review of articles addressing the association of speech impairments in childhood and the Activity Limitations and/or Participation Restrictions, as defined by the International Classification of Functioning, these disorders were found to be associated with limitations in forming and maintaining interpersonal relationships (McCormack, McLeod, McAllister, & Harrison, 2009).

Repeated failed attempts at social interactions would likely discourage a child from initiating future interactions with peers. This limited peer interaction among children with speech impairments is what Rice et al. (1991) found in their study of preschool-age children. In this study, the children with speech impairments directed more of their initiations towards adults than towards their peers. Also, preschool-age children initiated conversations less often with children with speech or language impairments than with their typically developing peers. A follow-up study by Hadley and Rice (1991) reported that children with speech impairments were the least successful in conversational peer interactions, as compared to language impaired and typically developing children. In addition, the investigators found that compared to their typically developing peers, children with language impairments and children with speech impairments: interacted with peers less, were ignored by peers more, and were less likely to respond when peers attempted to interact. Limited social interactions with peers reduce the opportunities children with speech impairments and/or expressive language impairments have to learn socially appropriate communication skills.

In summary, CAS is a severe speech sound disorder that manifests early in a child's development and has associated errors that may persist into adolescence and even adulthood. The unusual errors on consonants and vowels, disrupted prosody, and resulting unintelligibility commonly found in children with CAS can lead to disrupted communicative interactions.

**Social consequences of expressive language impairments.** Children with CAS are often reported to have expressive language impairments, sometimes severe, because of their underlying difficulty with speech sound production. Adverse social effects for

children with impairments in expressive language have been reported through multiple stages of life. Even at the age of 3 years, toddlers identified as late-talkers (expressive vocabularies of <10 words at 18-23 months of age; or expressive vocabularies of < 50 words or no use of 2-word combinations at 24-34 months of age) demonstrated deficits in socialization (Paul, Looney, & Dahm, 1991). Delays in expressive language development put children at risk for disrupted social skill development. Kindergarten-age children who were delayed in expressive language development were more withdrawn and exhibited lower executive and regulatory skills (i.e., behavioral, emotional, and social difficulties) than typically developing peers (Aro et al., 2014). Communication is required to establish reciprocal relationships. Among typically developing school-age children, talking to each other is the most natural form of reciprocal communication; therefore, children with expressive language difficulties are at a distinct disadvantage in forming relationships with peers.

In adolescents with a history of specific language impairment, expressive language abilities had a significant effect on quality of friendships (Durkin & Conti-Ramsden, 2007). A longitudinal study of adolescents and young adults with histories of communication impairments found negative social effects in adolescence to be more likely for children with comorbid language impairments than with SSDs alone; however, neither SSDs nor language impairments were significantly associated with psychosocial effects in adulthood (Lewis et al., 2016).

Comorbid language impairments can further compound the possible negative effects of CAS on social interactions. Evidence suggests areas of social functioning that

can be affected by the communicative impairments associated with CAS are pragmatics, self-esteem, friendships, and occupation.

### **Areas of Possible Social Consequences of CAS**

**Pragmatics.** Pragmatics is the social use of language. The rules for social language vary across cultures and are typically learned throughout a child's development. According to ASHA, "pragmatics involve three major communication skills: using language for different purposes [e.g., 'greeting'], changing language according to the needs of a listener or situation [e.g., 'speaking differently in a classroom than on a playground'], following rules for conversation and storytelling [e.g., 'rephrasing when misunderstood']" ("Social Language Use: Pragmatics"). Although difficulty with social language use has not been extensively reported as a result of CAS, at least one study recognized "Social Communication Difficulties" as a problem for their selected sample of children with CAS (Teverovsky et al., 2009). In this study, 192 parents filled out a functional assessment survey, including the Activities and Participation section of the International Classification of Functioning, Disability, and Health- Children and Youth version. The majority of parents reported their child with CAS had problems in the functional domains of conversation (75%) and discussion (68%). Thus, the speech production impairment in children with CAS appears to limit social interactions with peers, and hence, temporarily or permanently hinder the development of pragmatic language skills. The reported problems the investigators labeled as "Social Communication Difficulties" included "understanding non-verbal and spoken messages and producing non-verbal messages" (p. 98). Children with CAS may have trouble producing non-verbal messages, such as appropriate changes in intonation, due to

difficulties with prosody. However, because 14% of the sample had co-existing neurological conditions and 21% had additional developmental or mental health conditions (including autism spectrum disorders), these results may have been confounded by comprehension difficulties associated with comorbid conditions.

Conversation is the central medium in which pragmatic rules are applied; and children with CAS have demonstrated stark difficulties in conversational interactions during formative years (Lucas et al., 1993; Teverovsky et al., 2009). Because early speech-language profiles of children have been associated with later social competence outcomes (Beitchman et al., 1996), it is possible that pragmatic difficulties in children with CAS may persist into adolescence/adulthood.

**Self-esteem.** Delayed speech and language development may put a child with CAS at risk for decreased self-esteem. Prizant and Meyer (1993) posited the socioemotional development that occurs in childhood is the process of developing a sense of self and overall emotional well-being, and it is influenced by language and communication development, due to their shared context early in life. Therefore, a disruption of a child's communicative development can hinder his/her development of a sense of self. Contributing to a possible poor sense of self are the unfavorable comments and exclusion from others that children with disordered speech sound production can experience (Gordon-Brannan & Weiss, 2007).

The passing of judgments on individuals with SSDs is not reserved for children alone. Overby, Carrell, and Bernthal (2007) illustrated that adults behave similarly when rating students with SSDs. Second grade teachers rated academic, social, and behavioral competence of moderately intelligible and normal intelligibility speech samples. Results

showed that the teachers had significantly lower expectations across all three of those domains for the moderately intelligible speech samples. These low expectations pose a threat to children's success when students internalize such attitudes and perform only to the level of this perceived potential. Consequently, the negative assumptions made by teachers about the overall competence of children with SSDs can have a detrimental effect on their academic and social development.

Level of intelligibility and "peculiarity of speech disorder" have been identified as factors contributing to the degree of negative reactions experienced by individuals with communication disorders (Gordon-Brannan & Weiss, 2007; Overby et al., 2007). These factors are particularly pertinent for individuals with CAS. We perceive speech as "natural" when there are predictable inflections in intonation and a variety of stressed and unstressed syllables and words. However, individuals with CAS may exhibit inconsistency of errors, occasional groping tendencies, and impairments in the suprasegmental aspects of speech that result in unusual speech patterns. Specifically, the "excessive-equal-misplaced stress" (Shriberg et al., 1997b) that is characteristic of CAS can make children sound robotic. This unnatural quality is very peculiar to listeners and could lead to a greater degree of negative reactions and judgments.

Gordon-Brannan and Weiss (2007) explained, "because articulation is so visible and audible, it invites judgments and penalties by listeners that are out of proportion to the severity of the actual deviation" (p. 3). In other words, negative assumptions about the speaker's overall abilities are frequently made when a disorder in speech sound production is perceived. Our society values articulate communication. Because of this societal standard, when a deviation is encountered (such as an SSD), negative judgments

may be passed on that individual, leading to social consequences such as isolation, impaired interpersonal interactions, and decreased general life satisfaction (Hitchcock et al., 2015).

**Friendships.** Sufficient communication skills are necessary to have positive social interactions and thus, form friendships. Hence, children with expressive language difficulties are at a disadvantage when attempting to interact with and relate to peers. Craig (1993) examined the social skills of children who “fail[ed] to develop language expression like other children, in the absence of clinically significant problems in specific non-linguistic aspects of development” (p. 206). Through a review of the available literature, Craig (1993) found these children experienced reduced opportunities (i.e. a lower quantity) for interactions with peers as well as a poorer quality of interactions. The reduced quantity and quality of peer interactions pointed to the conclusion that children with expressive language difficulties are not well accepted by their peers.

Communicative competence can have a direct effect on the formation of peer relationships. Gertner, Rice, and Hadley (1994) examined peer popularity in three groups of preschoolers (children with: normally developing language skills (ND), speech and/or language impairments (S/LI), and English as a second language (ESL)). Verbal ability was a determinant of peer status, in that the children with S/LI and ESL were less popular, and even more disliked, than the ND children. The authors noted, “Children with communication limitations are less well equipped to use language to establish and maintain friendships” (p. 920).

A speech sound disorder does not have to be significantly impairing to invite negative responses. Even children with mild articulation disorders are reported to be

negatively perceived by their peers. For example, Crowe Hall (1991) had fourth and sixth grade students watch videos of peers with normal articulation, /r/ distortions, and /s/ and /z/ distortions. The students then rated each speaker on what they thought of him/her as a talker, as a peer, and what they thought he/she would be like as a teenager. In these three respects, both age groups expressed significantly more negative attitudes towards peers with articulatory errors. The author suggested these results indicate even mild articulatory disorders may affect popularity and acceptance among peers (p. 338). Premature negative attitudes toward an individual would act as a significant hindrance in trying to form positive relationships with others.

An alternative, more positive outcome is supported by the results of a study completed by Clegg, Ansorge, Stackhouse, and Donlan (2012). These investigators examined adults who had attended a specialist residential school for children with pervasive and complex developmental communication impairments. The parents of the adult participants described a direct relationship between their children's communication difficulties and problems with social and emotional functioning. Social isolation, specifically, was a significant theme expressed by these parents. However, the adult participants, themselves, did not recognize communication difficulties as relating to issues with friendships or relationships in adult life. It is possible a learning environment in which students were surrounded by others with similar difficulties may have protected them from potential negative social effects. On the other hand, it is also possible the adult participants were not objective reporters of their own social functioning, indicating a more direct relationship between early communication difficulties and later issues with social functioning and friendship formation.

**Occupation.** Children with articulation disorders may experience adverse reactions from listeners that can then lead to the development of negative attitudes about themselves, such as feeling stupid or socially incompetent (Gordon-Brannan & Weiss, 2007; Overby et al., 2007). In turn, these attitudes may start to affect participation or performance in school and the child's behavior in social situations. Individuals with articulation disorders may begin to fit the mold that has been created for them by others. It has been posited that these unfavorable attitudes toward articulation disorders can be contributing factors to later truancy, delinquency, and even time spent in prison (Gordon-Brannan & Weiss, 2007; Sample, Montague, & Buffalo, 1989). Even if children with SSDs do not allow negative attitudes to be internalized, the judgments from other people can still be inhibitory in their occupational development. Especially if residual speech errors persist into young adulthood, less favorable occupational outcomes may result due to a societal bias against disordered speech (Gordon-Brannan & Weiss, 2007).

Depending on its severity, a communication disorder can have disabling effects on an individual's social functioning outcomes. In a 28-year follow-up study, individuals with a history of moderate phonological disorders (including those with later identified comorbid language disorders) were more likely to hold semi/unskilled jobs than those who had typically developing articulation skills (Felsenfeld et al., 1994). Similar occupational outcomes were found in a 20-year longitudinal study of young adults with histories of speech or language impairments (Johnson, Beitchman, & Brownlie, 2010). When compared to the control group, participants with histories of speech or language impairments were less likely to have completed an undergraduate degree; plus those with histories of language impairments had less skilled jobs and reported lower incomes.

However, when self-reported quality of life was examined, there were no significant differences among the three groups of young adults. This subjective measure of well-being was associated with strong networks of friends and family.

### **Purpose**

Because CAS may significantly disrupt social interactions as a child learns to communicate, the child may develop persistent and/or significant difficulty with social functioning, even if the original presentation of the speech sound disorder has resolved. However, there is no research to date on the potential long-term social functioning effects of CAS on adults with the disorder. This case study aims to examine first, any residual speech production difficulties of a young adult with a history of CAS, and, second, whether or not her earlier experiences of inefficient communication had long-term effects on social functioning.

The research questions to be addressed are:

- 1) What are the current speech sound production characteristics of a young adult who has a history of CAS?
- 2) What are the current pragmatic abilities of a young adult who has a history of CAS?
- 3) What is the current level of self-esteem of a young adult who has a history of CAS?
- 4) How did growing up with a significant speech sound disorder affect the participant's formation of friendships?
- 5) How did early experiences with inefficient communication skills affect the participant's future occupation?

## CHAPTER II

### **Methods**

The present study was a mixed methods single-subject descriptive case study.

#### **Independent Variable**

The independent variable was the diagnosis of CAS.

#### **Dependent Variables**

The quantitative dependent variables were the participant's: speech production characteristics, measures of pragmatic language skills, and measures of self-esteem. Pragmatics and self-esteem were also examined qualitatively, in addition to the qualitative-only dependent variables of formation of friendships and selection of occupation.

#### **Participant**

The participant "Ann" (female, 20;11 years old) responded to a flyer (circulated through the Childhood Apraxia of Speech Association of North America [CASANA] website) recruiting adults with a history of CAS, normal hearing, typical oral structures, and a first language of English.

**Developmental history.** Ann's mother reported a full-term pregnancy and an uncomplicated birth history. Developmental milestones in language and fine motor skills were delayed while gross motor skills were within normal limits (see Table 1).

**Table 1. Developmental Milestones**

<b>Developmental Milestone</b>	<b>Age Mastered</b>
Crawled	Almost 10 months
Walked w/o assistance	16 months
First words	Almost 12 months
Said sentences	4-5 years
Said alphabet in order	3.5-4 years
Buttoned clothes	4 years

**Speech sound development.** Ann’s speech sound development was consistent with literature reports of early speech sound development of children later diagnosed with CAS (Overby & Caspari, 2015) and with possible CAS speech sound difficulties (Campbell, 2003; Jacks et al., 2006).

According to parent report, Ann babbled infrequently and sounds would often appear once and not be heard again for a month or so. Ann’s pediatrician referred her to early intervention (EI) at age 2 ½ due to parental concerns about slow speech-language development. EI assessment led to a diagnosis of CAS by a neurologist. EI speech-language services were provided for 5 months at which time Ann’s intelligibility was judged as “fair” due to substitutions, cluster reduction, syllable deletion, and initial consonant deletion speech sound errors.

At 3;4 years old, Ann started private speech-language therapy once a week for 60 minutes. In the therapy progress note excerpt below, Ann’s SLP described Ann’s speech motor planning difficulties:

[Ann] is noted to experience difficulty imitating and/or following directions involving volitional sequential oral movements and often requires additional demonstrations as well as visual and tactile cues/feedback. [Ann] presents with some oral tactile defensiveness. Marked difficulty in repeated speech tasks is

noted. Misarticulations are inconsistent and predominantly consist of omissions and distortions, however, substitutions have been noted. Initial consonant deletions are common in [Ann's] connected speech. The inconsistency and frequency of misarticulations affect the intelligibility of [Ann's] speech particularly in unfamiliar/unstructured activities. Misarticulations increase in conjunction with word and sentence length. Disfluencies have been noted on an inconsistent basis particularly when initiating speech movements. Intonation is inconsistently affected (9/17/98).

The SLP also noted Ann's use of equalized stress on words, at age 4;7, had an adverse effect on prosody. The diagnosis of "verbal dyspraxia" was applied to Ann at 5 ½ years old by her SLP because of Ann's various and inconsistent sound substitutions and "decreased control of both respiration and phonation during connected speech."

At 7 years old, Ann was reported to demonstrate difficulties with multisyllabic words, sentences of increasing complexity, and initiating speech movements; when she was age 10, novel listeners noted compromised speech intelligibility during spontaneous discourse, an unnatural rhythm to Ann's speech, and lateralization of the /s, z/ phonemes. At the end of sixth grade, distortions of the /s, z/ were again noted and errors arose when she was asked to produce unfamiliar multisyllabic words. However, Ann's intelligibility was judged to be very good across contexts with consistent self-monitoring focused on a slower rate of speech and the production of medial and final consonants.

**Expressive language development.** Many children with CAS have reported expressive language difficulties (Lewis et al., 2004a). EI services for Ann's speech sound development also addressed her expressive language (e.g., expanding utterance length).

At age 3, Ann's receptive language skills were age-appropriate but expressive language skills were weak due to minimal use of the "ing" verb ending, inability to appropriately respond to questions, and a decreased mean length of utterance (MLU). According to Ann's private SLP, at age 4;7 Ann's MLU had increased to 3-8 word utterances, and Ann was utilizing questions, comments, and requests. By 7 years old, Ann was able to respond in complete sentences but sometimes needed prompting to do so. At 9 years of age, Ann's written expression was a continued weakness, especially in complex sentence formation. Direct speech-language support services continued through her 8<sup>th</sup> grade year. Beginning in 9<sup>th</sup> grade, reading and writing goals were addressed through special education services, only. At 15 years old, a speech-language reevaluation showed Ann's receptive and expressive language abilities within the average range.

**Educational challenges.** Children with CAS appear to be at-risk for academic delays (Hitchcock et al., 2015; Lewis et al., 2000). When Ann was 6 years old, special education services were introduced 3 times/week to address foundational reading skills. At seven years old, spelling was also addressed and Ann's parents reported frustration in their daughter with increasing reading and writing demands. At the end of second grade, Ann's frustration related to literacy continued; in addition, support services for math were implemented. Deficits in visual tracking and visual processing made reading comprehension and multiple-choice tests difficult.

In fourth grade, Ann was referred to the Learning Disabilities Program at her local Children's Hospital. Her reevaluation report from 2010 showed her performance was improved with repetition and a multi-modal presentation of information. When Ann was

17 years old, it was recommended she be given repetitions of auditory material and copies of lecture notes or other visuals to be paired with auditory information.

In college, Ann is allowed to utilize assistive technology for taking notes, is given extra time on some formal assessments, and meets with a professor on a regular basis to go over her written assignments.

**Social challenges.** Children with CAS may be at-risk for social challenges due to their speech sound disorder (Hadley & Rice, 1991; Hitchcock et al., 2015; McCormack et al., 2009) When Ann was 6 years old, a school progress report noted:

[Ann's] verbal dyspraxia ...sometimes affects her ability to express herself adequately during ...social situations due to the possibility that [Ann] would have difficulty responding to peers in a time-pressured situation (4/24/2001).

When Ann was in fourth grade, her IEP team discussed the social consequences of her inability to properly express herself and recommended that an adult facilitate her peer interactions in small groups. Also, the Learning Disabilities Program initial evaluation at Children's Hospital revealed Ann was at risk for a "decreased sense of self-efficacy" due to her difficulties in school.

At the beginning of her sixth grade year, the IEP team added a goal for social interaction because Ann could not always read social cues or keep up with the flow of social communication and was expressing feelings of vulnerability to her family. She began participating in social skills group meetings conducted by the school counselor. By the end of sixth grade, no specific psychological concerns were indicated, but continued monitoring of self-esteem and coping skills was recommended. At the end of her eighth grade year, Ann's IEP team noted that anxiety negatively affected her academic

performance and self-esteem, and a self-advocacy goal was added to encourage Ann to be proactive in managing her school-related stress.

See Appendix A for a full timeline of Ann's support services.

**Summary of participant's history.** Concurrent with the literature on the characteristics of CAS, Ann demonstrated: reduced babbling as a baby, a limited repertoire of sounds as a toddler, consonant and vowel errors (e.g., initial consonant deletion, substitutions, distortions), syllable-level errors (e.g., syllable deletion, cluster reduction), increased difficulty on multisyllabic words, inappropriate intonation, periods of reduced intelligibility, and some residual speech sound production errors. In addition, Ann's expressive language development was delayed, she struggled with foundational literacy skills, and writing continued to be an area of difficulty through high school. Although CAS is challenging to diagnose, all the above difficulties strongly suggest Ann has the disorder.

Along with academic challenges, Ann experienced roadblocks to her social development as a result of her communication impairment. Ann's elementary school teachers identified high-stress communicative interactions (e.g., large groups, time-pressured responses) as difficult and recommended adult facilitators to help her negotiate social settings. Also, throughout Ann's development, her inability to express herself was noted to take a toll on her self-esteem, sometimes necessitating counseling support. Overall, Ann presented with a documented history of social difficulties associated with her communication impairment.

## Materials

All assessments with accompanying visual materials were scanned into PDF documents by the primary investigator to allow for administration via telepractice.

The *Madison Speech Assessment Protocol* (MSAP; Shriberg et al., 2010) consists of four age-based protocols (i.e., preschool, school-aged, adolescent, and adult) that assess an individual's speech, voice, and prosody. The adult protocol was used in this study to assess the current status of Ann's speech production. The investigator utilized 13 tasks "to quantify the competence, precision, and stability of speech production" (Shriberg et al., 2010). The MSAP obtained speech samples through imitation as well as spontaneous production. Speech was examined in the context of sounds, syllables, words, and utterances and in both simple and complex phonetic contexts. The 13 tasks were:

- Conversational speech sample
- Lexical stress task
- Challenging word task
- Vowel task 1
- Vowel task 2
- Vowel task 3
- Syllable repetition task
- Non-word repetition task
- Emphatic stress task
- Rhotics and sibilants task
- Multisyllabic words task 2
- Speech phrases task

- Diadochokinesis task

Included in the MSAP is the administration of the Listening Comprehension and Oral Expression scales of the *Oral and Written Language Scales, Second Edition* (OWLS-II), the Word Identification and Word Attack tests of the *Woodcock-Johnson III Tests of Achievement* (WJ-III), and the *Kaufman Brief Intelligence Test- Second Edition* (KBIT-2). However, due to convenience and accessibility, the *Test of Nonverbal Intelligence- Fourth Edition* (TONI-4) was administered in place of the KBIT-2.

The Listening Comprehension and Oral Expression scales of the OWLS-II (Carrow-Woolfolk, 2011) were administered. Semantics, syntax, pragmatics, and supralinguistics were examined within these scales. A raw score was calculated for each scale and then converted to a standard score and compared to normative data for the appropriate age. Both scales took a total of 30 minutes to administer.

The WJ-III consists of 22 tests examining abilities in the areas of reading, writing, oral expression, mathematics, and general academic knowledge. The MSAP only called for the use of two tests of reading (i.e., Letter-Word Identification and Word Attack) that are found on the Woodcock Reading Mastery Test (WRMT-III). These two tests assessed the participant's understanding of the grapheme to phoneme relationship and word decoding (Wendling, Schrank, & Schmitt, 2007). The two tests from the WRMT-III took about 15 minutes to administer.

The TONI-4 (Brown, Sherbenou, & Johnsen, 2010) is a measure of overall cognitive ability and non-verbal problem solving skills. The authors of the TONI-4 accounted for various levels of education, cultural differences, and various experiential backgrounds when creating and modifying the test items. The test contains 60 items,

from which the raw score was calculated. From the raw score, the index score was calculated and then the percentile rank. Administration of the TONI-4 took about 15 minutes.

According to a review by Bruni (2014), the *Social Responsiveness Scale Second Edition* (SRS-2) is an objective rating scale of the social functioning characteristics typical of ASD, but it can also be used as a broader measure of social interaction and pragmatic language for individuals without the disorder. It has 65 items, each with a 4 point Likert scale (1=not true, 2=sometimes true, 3=often true, 4=always true). The adult form (ages 19-89 years) used included a self-report form along with a form completed by Ann's mother. Each form took about 15-20 minutes to complete. There were five subscales (Social Awareness, Social Cognition, Social Communication, Social Motivation, and Restricted Interests and Repetitive Behavior) that comprised the total, reported as a T-score (M=50, SD=10).

The *NEO-Five Factor Inventory-3* (NEO-FFI-3; McCrae & Costa, 2010) is a questionnaire with a 5-point Likert scale (1=strongly disagree, 5=strongly agree) that gave a general indicator for the participant's personality, which could affect level of social interaction. The NEO-FFI-3 is based on a five-factor model of personality: neuroticism, extroversion, openness, agreeableness, and conscientiousness. From the raw score, a T-score was derived and compared to the established norms. It took Ann about 5-10 minutes to complete the questionnaire.

The *Rosenberg General Self-Esteem Scale* (RGSE; Rosenberg, 1965) is a widely used measure of self-worth. The RGSE consists of 10 statements, five positive and five negative, regarding an individual's perception of him/herself. Each statement is rated

using a 4-point Likert scale (i.e., “strongly disagree, disagree, agree, strongly agree”). Thus, the scores range from 0-30, with 0 as the lowest and 30 as the highest possible score. This was a self-report instrument completed by Ann in about five minutes. Please see Appendix B for a copy of the RGSE.

According to Piven et al. (1997) and Landa (2013), the *Pragmatic Rating Scale* (PRS) assesses the use of social communicative behaviors that violate accepted pragmatic rules. There were 30 behaviors examined and grouped into three categories (i.e., Pragmatic Behaviors, Speech and Prosodic Behaviors, and Paralinguistic Behaviors). These behaviors were examined during a conversation between Ann and the investigator. The behaviors were scored on a three point scale, where 0=no evidence of pragmatic error, 1=moderately inappropriate, and 2=clear violation of pragmatic rules. The investigator rated each behavior, then computed a raw score for each category by summing the scores of the items included in that category. A total raw score was also calculated by adding the scores of all the behaviors.

The investigator conducted two separate qualitative semi-structured interviews: one with Ann and one with the same parent that completed the SRS-2 form (i.e., Ann’s mother). The interview asked open-ended questions regarding Ann’s experiences growing up with CAS and living with it today. Questions specific to each of the dependent variables were asked to provide an opportunity to triangulate the data collected through the quantitative measures. The responses to the interview questions were analyzed for possibly occurring themes. Please refer to Appendix C for a copy of the targeted interview questions.

## **Procedures**

**Service delivery mode.** Assessment was accomplished through telepractice, defined as: “the application of telecommunications technology to the delivery of speech language pathology and audiology professional services at a distance by linking clinician to client/patient or clinician to clinician for assessment, intervention, and/or consultation” (“Telepractice: Overview”). Telepractice has been proven to be a reliable and valid assessment tool, similar in results to face-to-face encounters (Hill, Theodoros, Russell, Cahill, & Ward, 2006; Hill, Theodoros, Russell, & Ward, 2009; Waite, Theodoros, Russell, & Cahill, 2010).

The use of telepractice in the current study was not only more convenient for the participant, but it may have served as an advantage over an in-person assessment. The ability of this assessment to be completed with the participant in a natural, comfortable setting may have lent itself to a better representation of her abilities.

**Setting.** Ann was assessed via telepractice at the Duquesne University Speech and Hearing Clinic. The investigator reserved a therapy room for the duration of the assessment session. All equipment was brought into the therapy room prior to beginning the session. The investigator used a Dell computer and monitor and Logitech speakers, microphone, and webcam. The primary investigator started a GoToTraining Virtual Classroom session and sent Ann an invitation to join via email. She accepted and entered the session. The investigator and Ann were the only two parties with access to the session. Ann was in a private room of her family’s vacation home.

**Participant procedures.** The NEO-FFI-3, RGSE, and the SRS-2 forms were sent by mail to Ann and returned upon completion. The NEO-FFI-3 was given to her as a

descriptor of personality type to increase the internal validity of the findings and provide a context for interpretation of the information gathered on her social functioning. During the testing session, the Listening Comprehension and Oral Expression scales of the OWLS-II were administered, followed by the TONI-4, and finally the Word Identification and Word Attack tests of the WRMT-III. These were administered to add to the descriptions of Ann's current language profile and to confirm she had no co-existing cognitive impairments. The MSAP was then administered to determine if Ann exhibited any residual speech production difficulties. The primary investigator advanced the PowerPoint slides of the adult protocol of the MSAP, guiding Ann through the tasks.

Following the quantitative data collection, the investigator conducted a semi-structured interview with Ann about her experiences with the disorder and the perceived effects it may or may not have had on various aspects of her life. The interview focused on a set of questions designed by the primary investigator to address each dependent variable, but questions were open-ended to allow for a conversational format, expansion upon responses, and follow-up questions (Edwards & Holland, 2013). This semi-structured interview was recorded with permission and transcribed word-for-word. The conversation sample generated during the interview was analyzed by the primary investigator, according to the procedures outlined in the PRS.

***Participant description.*** As shown in Table 2, Ann demonstrated average performance on all standardized tests (nonverbal IQ, Listening Comprehension, Oral Expression, and Word Identification) except for Word Attack, which fell approximately 1.5 SD below the mean.

**Table 2. Description of Current Cognitive and Language Abilities**

<b>Test</b>	<b>Score</b>	<b>Performance<sup>a</sup></b>
TONI-4	Index score: 87	Low average
OWLS II Listening Comprehension	Standard score: 94	Average
OWLS II Oral Expression	Standard score: 105	Average
WRMT-III Word Identification	Standard score: 92	Average
WRMT-III Word Attack	Standard score: 75	Below Average

<sup>a</sup>M=100; SD=15 (Strauss, Sherman, Spreen, & Slick, 2006)

Overall, Ann’s scores on the NEO-FFI-3 (Table 3) indicated she was secure, outgoing, down-to-earth, compassionate, and conscientious and well organized.

**Table 3. NEO-Five Factor Inventory-3 Personality Description**

<b>Personality Domain</b>	<b>T-score</b>	<b>Description<sup>a</sup></b>
Neuroticism	42	Secure, hardy, and generally relaxed, even under stressful conditions
Extraversion	56	Extraverted, outgoing, active, and high-spirited. You prefer to be around people most of the time.
Openness to Experience	37	Down-to-earth, practical, traditional, and pretty much set in your ways.
Agreeableness	65	Compassionate, good-natured, and eager to cooperate and avoid conflict.
Conscientiousness	66	Conscientious and well-organized. You have high standards and always strive to achieve your goals.

<sup>a</sup>Description from McCrae and Costa, 2010.

**Parent procedures.** The SRS-2 Adult Form was sent by mail to Ann’s mother (“Marie”) and returned upon completion. The parallel semi-structured interview with Ann’s mother was conducted immediately following the testing session with Ann. Ann

left the room and her mother entered alone for the interview. Neither Ann nor her mother was present for the other person's interview, in hopes of gathering the most honest information regarding their experiences with the disorder. The investigator then analyzed these interviews for themes.

### **Data Analysis**

The results of this case study are primarily detailed descriptions of the participant's results. Results from the NEO-FFI-3 were reported to describe Ann and provide a context for assessing how her inherent personality traits may have affected pragmatic skills, self-esteem, friendships, and/or future occupation. The MSAP and its associated tests provided a comprehensive description of the current speech and language abilities of a young adult with a history of motor planning and programming impairments for volitional speech acts. Where appropriate, Ann's scores were compared to the norms provided by the test measure. Ann's quantitative data regarding pragmatic language skills (collected from the SRS-2 and PRS) were compared to the available norms and analyzed against her and her mother's qualitative reports of social experiences. The results from the RGSE were also compared to available norms and the qualitative interview reports (both from Ann and from her mother) of how ineffective speech sound skills earlier in life affected Ann's self-esteem.

The qualitative data (i.e. responses from the semi-structured interviews) were analyzed using a grounded theory approach with no preconceived set of codes (Bradley, Curry, & Devers, 2007). All discrete responses were read to determine the main constructs and themes, and those not related to the outcome measures were eliminated.

The remaining responses were assigned to the appropriate themes. Please see Appendix D for the number of discrete responses assigned to each theme.

### **Reliability**

Reliability was completed for 10% of the items on the MSAP by three certified SLPs with an average of 20 years of experience. Percentage of agreement ( $\frac{\# \text{ of agreements}}{\# \text{ of agreements} + \# \text{ of disagreements}}$ ) was calculated for each speech task and then averaged to give an overall mean percentage of agreement of 96.66%.

Percentage agreement among the four raters for each task can be found in Table 4.

**Table 4. MSAP Percentage Agreement**

<b>MSAP task</b>	<b>Percentage agreement</b>
Lexical Stress Task (LST)	100%
Challenging Words Task (CWT)	93.75%
Vowel Task 1 (VT 1)	100%
Vowel Task 2 (VT 2)	90%
Vowel Task 3 (VT 3)	97.92%
Syllable Repetition Task (SRT)	100%
Nonword Repetition Task (NRT)	92.86%
Emphatic Stress Task (EST)	100%
Rhotics and Sibilants Task (RST)	93.75%
Multisyllabic Words Task 2 (MWT 2)	100%
Speech Phrases Task (SPT)	91.67%
Diadochokinesis Tasks (DDK)	100%

The percentage of agreement for 26 out of the 30 behaviors on the PRS was calculated among the primary investigator and two SLP graduate students, both of whom were blind to the participant. Percentage of agreement among the three raters was 94.87%.

In addition to the primary investigator, two SLP graduate students reviewed 10% of the discrete responses from the qualitative interviews and percentage agreement was

calculated. The three raters had 100% agreement on the appropriate themes for each of the discrete responses.

## CHAPTER III

### Results

#### Quantitative

**Speech production.** Overall, Ann did not have a prominent difficulty with speech sound production. Ann's persisting challenges included sequencing of phonemes (exhibited during the SRT and NRT), omissions and substitutions (exhibited during the CWT, NRT, MWT 2, and SPT), and a mild /s/ distortion. Initial consonant deletion was noted twice during the CWT, along with a substitution error of the voiceless cognate /s/ for /z/. During VT 2, 5/6 errors were a consistent distortion of the diphthong in "pout" to /ou/. During the RST, Ann consistently substituted l/r in the /r/ initial word "ride" resulting in the production of "lied." It is suspected that this consistent substitution error during one imitation task was a perceptual error due to the use of telepractice equipment because the substitution was not noted during other speaking situations. Additionally, Ann distorted the /s/ phoneme throughout the evaluation, illustrated by a PCC of 47.5 on the RST. Perceptually, this /s/ distortion was difficult to label (i.e., dentalized, palatalized, or lateralized) because it sounded as though Ann's tongue placement for the production of the /s/ was inconsistent. Norms were not available for the LST, CWT, EST, MWT 2, and SPT; however, because speech skills normalize by 8 or 9 years old in typically developing children, it is reasonable to assume that a young adult should produce accurate responses to nearly all speech tasks.

**Table 5. Madison Speech Assessment Protocol Results for Ann**

<b>MSAP task</b>	<b>Scores</b>	<b>Norms</b>	<b>Interpretation of Performance</b>
Lexical Stress Task (LST)	24/24=100%	None available	Average
Challenging Words Task (CWT)	33/36=91.7%	None available	Below Average
Vowel Task 1 (VT 1)	PVC=100	M=94.4 <sup>a</sup>	Average
Vowel Task 2 (VT 2)	PVC=86.4	M=94.4 <sup>a</sup>	Below Average
Vowel Task 3 (VT 3)	PVC=97.7	M=94.4 <sup>a</sup>	Average
Syllable Repetition Task (SRT)	2-syllables: PCC=100	M=94.8 <sup>a</sup>	2-syllables: Average
	3-syllables: PCC=83.3		3-syllables: Below Average
	4-syllables: PCC=87.5		4-syllables: Below Average
	Overall: PCC=90		Overall: Below Average
Nonword Repetition Task (NRT)	PPC 1=75	M=95.4 <sup>b</sup> SD=8.4 <sup>b</sup>	Below Average
	PPC 2=55	M=97.8 <sup>b</sup> SD=2.9 <sup>b</sup>	Below Average
	PPC 3=85.7	M=96.3 <sup>b</sup> SD=4.0 <sup>b</sup>	Below Average
	PPC 4=52.8	M=86.2 <sup>b</sup> SD=8.3 <sup>b</sup>	Below Average
	TOTPPC=65.6	M=92.7 <sup>b</sup> SD=4.6 <sup>b</sup>	Below Average
Emphatic Stress Task (EST)	7/8=87.5%	None available	Below Average
Rhotics and Sibilants Task (RST)	PCC (of rhotics and sibilants)=47.5	M=81.6 <sup>a</sup>	Below Average
Multisyllabic Words Task 2 (MWT 2)	12/20=60%	None available	Below Average
Speech Phrases Task (SPT)	17/25=68%	None available	Below Average

<sup>a</sup>Norms from Austin and Shriberg (1996).

<sup>b</sup>Norms from Moore, Tompkins, and Dollaghan (2010).

Ann produced fewer syllables per second on all diadochokinesis (DDK) tasks than adult females in the referenced normative samples (see Table 6). In addition, Ann's

productions were rhythmic during only 1/5 DDK tasks, suggesting a persistent challenge with coarticulatory transitions between syllables.

**Table 6. Ann’s Performance on Diadochokinesis Tasks**

Stimulus	Syllables/second	Performance <sup>a</sup>	Sounds were accurate	Production was rhythmic
pʌ	4.4	Below Average	+	-
tʌ	3	Below Average	+	+
kʌ	3.4	Below Average	+	-
pʌtʌkʌ	1.6	Below Average	+	-
pattycake	2.2	Norms not available	+	-

<sup>a</sup>Norms for each task were taken from the three most recent studies reported by Kent, Kent, and Rosenbek (1987).

**Pragmatics.** Ann received a raw score of 3 (“Inadequate clarification”=1; “Indistinct speech/mispronunciations”=1; “Unusual rhythm of speech”=1) on the PRS. Because no norms have been determined for this scale, Landa (2000; 2013) suggested the use of clinical judgment and data presented in scientific manuscripts to determine the "typical" range and if the threshold of pragmatic disorder has been crossed. Some researchers (Hurley, Losh, Parlier, Reznick, & Piven, 2007; Lam & Yeung, 2012) have marked a raw score of 5 as the cut-off between "typical" and "disordered"; using this criterion, Ann's score of 3 would be described as typical pragmatic skills.

Results from the SRS-2 Adult Self-Report form (Raw score=27; T-score=45) and parent-report form (Raw score=37; T-score=49) were classified as "Within normal limits" (T< 59). These results indicated Ann demonstrates the ability to pick up on and interpret social cues, has appropriate expressive social communication, is generally motivated to

engage in social-interpersonal behavior, and does not demonstrate restricted interests or repetitive behaviors.

**Self-esteem.** Ann's self-report on the RGSE yielded a raw score of 18/30 (M=22.62, SD=5.80) and a norm-based score of 42.04 (M=50, SD=10) falling within the average range (Sinclair et al., 2010).

### **Qualitative**

**Participant interview.** Analysis of the semi-structured interview with Ann revealed four constructs directly related to the questions posed: *Pragmatics, Self-esteem, Friendships, Education/Occupation*. An additional theme of "Not Remembering" emerged, related to difficulties with recall of information pertinent to the posed questions.

**Pragmatics.** The themes of "Situation" and "Openness" were identified under this construct. Ann expressed that her ability to communicate in a situation depended on the number of people with whom she was interacting. For example, she noted that "one-on-one, small group interaction with people... is more my style of communication," but with a larger group of people, she will "try to avoid it, but sometimes it's inevitable... I just do more listening and nodding and act like I'm engaged in the conversation." Situations in which Ann is required to respond quickly also adversely affect her pragmatic skills. She explained, "I will have a response, but then by the time my brain formulates the answer, they've switched topics." In addition, as a child, situations requiring Ann to initiate conversation were also a pragmatic challenge: "start[ing] a conversation with people was really hard," but as a college student, her anxiety is significantly reduced.

Ann explained that being "Open" about CAS and its residual effects on her communication has facilitated growth in her pragmatic skills: "When I wasn't open about

talking about it, it definitely scared me to open up and talk to people; but now I actually enjoy it.” In her opinion, “if you’re not open about talking about it,” CAS can negatively affect the pragmatic skills of adults with the disorder. Openness about the communication problems associated with CAS is also helpful in initiating conversations/interactions with others. Ann said, “now I find it easier... because I’m more open and honest with people if it may take me a second to get my point across.”

***Self-esteem.*** Two themes emerged related to the construct of *Self-esteem*, “Ability to Express Herself” and “Builds over Time.” Throughout much of her life, Ann’s self-esteem was affected by difficulty expressing her emotional needs. For example, when bullied by peers, Ann affirmed, “it affected me so much because I didn’t have the words to tell them how I was feeling.” Subsequent counseling was helpful because, as Ann said, “it was a way to express how I feel.” Ann’s fears about her ability to express herself have also affected her self-confidence in public speaking: “I’m afraid my apraxia moment’s going to come... I’ll open my mouth, and the words just aren’t going to be there.”

The theme of “Builds over Time” refers to the idea that Ann’s self-esteem has required continuous effort. She admitted, “I think I’m a little bit self-conscious of it [communication skills] but not to the point I used to [be].” Ann needed time to accept herself and her abilities as they are. Ann continued counseling therapy “off and on from fifth grade to senior year.” Now Ann is “proud to say” she has apraxia, whereas in the past, she “didn’t want people to just put that label on me,” and now says, “I’m going to embrace this.”

***Friendships.*** The themes of “Openness” and “Quality, not Quantity” were identified within the construct of *Friendships*. When discussing her friends, Ann

commented, “Coming out and telling them I had apraxia was the harder part.” This apprehension of being completely honest with her friends lasted until her senior year of high school when she was faced with a public speaking assignment. At that point she felt compelled to open up about her apraxia of speech, and “ever since then I’ve been more open and willing to talk about it with people.” Her recommendations for coping with CAS were to “be open about it. Warn your friends ahead of time: my speech tends to go when I’m tired, so be more patient with me. Don’t just keep harping on me.”

This “Openness” with her friends has also led to better quality friendships. As such, “Quality, not Quantity” emerged as a theme surrounding Ann’s friendships. She reported she has “a few very close friends.” The friendships Ann has formed are high quality, supportive relationships: “One of my friends came to the [CASANA] walk last summer. All my friends want to be involved and want to know more [about CAS].” Ann’s few, close friendships are very valuable to her. “One of my good friends actually wants to know more about apraxia and ways to help me if I need it. That was one of the nicest things I’ve seen.”

***Education/Occupation.*** “Success with Support” and “Advocacy” were two themes that were associated with the construct of *Education/Occupation*. Ann said that supports leading to academic success were: “Live Scribe pen [records lecture], books on tape, extended time on tests and quizzes, and being able to use a computer for an exam.” Ann perceived accommodations such as these as necessary for academic success. For example, when she “was denied accommodations for the ACT,” even though she “took it twice,” she received “horrible scores.” Ann felt that failure to provide proper academic supports to children with communication and/or learning impairments can have dire

consequences. She noted, “a lot of kids with learning disabilities that don’t have the support from home end up in the criminal justice system.”

Ann frequently expressed her passion for advocacy within the context of her future career. She is currently studying criminal justice and psychology in college. When asked what led her to her current field of study, Ann responded “The fact that a lot of kids with learning disabilities that go undiagnosed end up in the criminal justice system. I want to help those kids stay out of the CJ system... I want to be an advocate for them.” Given her past experiences, Ann wants to give a voice to those who may not have one. When asked why she participated in the current study, Ann said, “I think because I want to help people with apraxia. It’s one of my life goals to help other kids with learning disabilities who may not have gotten the support I was given when I was a kid. So I want to give back.”

Although not associated with any of the constructs, the theme of “Not Remembering” emerged throughout the semi-structured interview. On multiple occasions, Ann expressed comments such as, “I honestly don’t remember,” “just by what my parents have told me,” or “if I remember.”

**Parent interview.** Through analysis of the semi-structured interview with Ann’s mother, four constructs were identified: *Pragmatics*, *Self-esteem*, *Friendships*, *Education/Occupation*. The theme of “Not Remembering” also emerged, not associated with any of the aforementioned constructs.

**Pragmatics.** A single theme, “Situation,” emerged within this construct. Ann’s mother (“Marie”) noted that her daughter’s social use of language (i.e., pragmatics) was facilitated with adult conversational partners and that “always, she [Ann] was very much

more confident speaking to adults than kids her age.” Initiating and maintaining conversations were also easier with adults than with peers, so that Ann tended to be “on the periphery of everything” among groups of peers. Marie said, for example, “Recess and lunch were very difficult. It was very fast-paced – a lot of talking. She [Ann] couldn’t keep up with all that; so she would sort of stand off.” These fast-paced situations seemed to cause a type of loss of control for Ann. This loss of control was illustrated by Marie’s recount of a remark from Ann’s 5<sup>th</sup> grade teacher: “she [Ann] was like a deer caught in the headlights because she’s never going to win a battle of words. So when they would start doing things, she would get big eyes and not be able to say anything.” Marie felt Ann’s speech sound disorder inhibited her from taking control of the situation.

Another situational aspect that affected Ann’s pragmatic skills was the number of people conversing/interacting, such that peers would “be talking about something, and then by the time she could think of what she wanted to say, it was almost too late. They would look at her like ‘That didn’t really make sense because we were talking about that two minutes ago.’”

***Self-esteem.*** “External Factors” and “Success with Support” were themes associated with the construct of *Self-esteem*. Marie reported the external factors that had a direct effect on Ann’s self-esteem were “bullies” and academic pressures. Both of these resulted in Ann “feeling badly about herself, and thinking she was dumb and ‘why am I different?’” Ann’s mother noted the toll bullying took on Ann’s self-esteem: “It really took a while for her to be happy again at the school.” Although Marie said that Ann’s low self-esteem necessitated counseling, “it was only when something happened... we would take her back to talk to somebody.” When Marie was asked what might precipitate the

need for counseling, she said that it might be any of a number of external factors such as school stress, family disagreements, being teased by peers, etc.

The theme of “Success with Support” meant that, although Ann was often stressed due to her communication difficulties she was able to be successful and “feel good” when she was given the proper support (e.g., counseling therapist, “Claire”). Marie felt there was a direct relationship between her daughter’s SSD and her stress level. Marie described Ann’s loss of control and escalated stress that resulted from her communication disorder: “she [Ann] would get upset... stressed, and couldn’t get the right words out, she would just start spewing things...like ‘I don’t want to be here anymore!’” Marie said these “meltdowns” led to the re-initiation of counseling, at which point Claire determined, “she [Ann] doesn’t always know the right words to use.” Marie explained that as a strategy learned from counseling, Ann would excuse herself and later write down an apology for what she said because she didn’t mean it. Ann “was just so frustrated, and that’s what came out.” Ann went to therapy weekly for about a year and then was “weaned” off because “the therapist felt like she [Ann] was feeling good about herself again.” However, whenever Ann’s self-esteem was noticeably low again, Marie would ask, “Do you need a Claire fix?” and Ann would “see Claire for a few times then feel like she was good.” This outside support was an integral part of Ann’s success throughout grade school and high school.

***Friendships.*** Two themes were identified within the construct of *Friendships*: “Success with Support” and “Quality, not Quantity.” Marie remarked that Ann’s friendships in school were successful, in part, because of the support from Ann’s teachers. Friendships were facilitated when the teacher would construct an environment

in which Ann could be successful, such as setting up interpersonal interactions with her peers.

The theme of “Quality, not Quantity” was similar to that identified within Ann’s interview. According to Marie, “She [Ann] didn’t have large groups of friends,” and “She would always have one or two really good friends,” but these close friends nevertheless made quite an impact on Ann’s life. Marie explained, “In fact, one of her best friends to this day is... very loud and outgoing in a different way than Ann. It was almost like she [the best friend] was her [Ann’s] voice.” Marie’s view was that Ann had built supportive, high quality friendships with a few key peers.

***Education/Occupation.*** Under this construct, Ann’s mother talked about three themes: “Challenges,” “Success with Support,” and “Advocacy.” “Challenges” in education stemmed from Ann’s “language-based learning disabilities.” Her mother explained how “her [Ann’s] spelling is terrible... and if things weren’t presented in the exact same way that she learned it, she couldn’t do it.” Even today, Marie continues to “just wonder, ‘is she going to need someone to look over her writing?’ A job where there’s a lot of writing- I think that’s where it’s going to be difficult.”

Despite these challenges, Marie believes that her daughter can succeed given the proper supports such as books on tape, a “smart pen” to record lectures, and pairing visual with auditory information (e.g. PowerPoint slides to go along with a lecture). A college level support that Marie felt was important to Ann’s educational success was writing assistance twice a week with a professor.

The theme of “Advocacy” for Marie was slightly different than that for Ann. Marie perceived Ann’s advocacy as her concern for the oppression of women in various

cultures as well as her interest in the concept of criminal justice within the context of the events of September 11<sup>th</sup>. Once Ann began a psychology class, her sense of advocacy became more focused, realizing she would like to be a “social worker, advocate, or something like that.”

Similar to her daughter’s interview, the theme of “Not Remembering” emerged within Marie’s interview. Multiple references to not remembering (e.g., “I don’t remember exactly; It’s such a blur; I do struggle with time frames because it just all sort of blends together.”) appeared across almost all topics.

## CHAPTER IV

### Discussion

This case study examined the current speech and social functioning characteristics of a young woman, Ann, who was diagnosed with CAS at a young age. This investigation asked five questions regarding the speech sound and social consequences of long-standing difficulties secondary to CAS. The questions were:

- 1) What are the current speech sound production characteristics of a young adult who has a history of CAS?
- 2) What are the current pragmatic abilities of a young adult who has a history of CAS?
- 3) What is the current level of self-esteem of a young adult who has a history of CAS?
- 4) How did growing up with a significant speech sound disorder affect the participant's formation of friendships?
- 5) How did early experiences with inefficient communication skills affect the participant's future occupation?

The results of this investigation indicate that: 1) Ann continues to demonstrate residual speech sound errors despite intense intervention throughout her development; 2) Ann's pragmatic skills are dependent upon the social situation (i.e., older adults vs. peers; group size; pressure of response time) and her willingness to be open about her communication difficulties; 3) Ann's self-esteem can be considered low average; 4) the quantity of Ann's friendships was affected by her speech sound disorder, but the quality of these friendships was not; 5) the challenges Ann faced resulting from her

communication difficulties sparked a passion in her to become an advocate for those facing similar challenges.

**What are the current speech sound production characteristics of a young adult who has a history of CAS?**

Ann's conversational speech was 100% intelligible, with the most notable speech sound production error being the imprecise production of the /s/ phoneme. The exact nature of the /s/ distortion was difficult to identify: some errors sounded dentalized; some sounded palatalized; and still other times, the /s/ sounded lateralized. Because /s/ is a "Late-8" phoneme (Shriberg, 1993), Ann's persistent distortion of this phoneme is concurrent with previous literature stating the residual speech sound errors demonstrated by individuals with CAS tend to be distortions of the later developing phonemes (Fish, 2016). Such distortions are not unexpected in individuals with CAS because residual speech sound errors may appear if a child has difficulty establishing the appropriate motor plan for a speech sound or coordinating the timing of movements associated with production of that sound (Preston et al., 2014). When Ann's speech production system was taxed during the production of nonwords and multisyllabic words, she demonstrated many of the residual speech errors commonly associated with CAS: vowel errors, inaccurate production of complex phonemic sequences, cluster reduction, and a breakdown in coarticulatory transitions between syllables.

**What are the current pragmatic abilities of a young adult who has a history of CAS?**

Results from the PRS, SRS-2 Adult Self-Report form, and SRS-2 Parent Report form identified Ann as being within normal limits in regards to her pragmatic abilities.

However, results from the semi-structured interviews revealed that Ann's pragmatic abilities are not equal across all contexts. Both Ann and her mother said that group size and pressure of response time had a detrimental effect on Ann's pragmatic skills. Additionally, Ann's mother mentioned improved conversational abilities when Ann is conversing with older adults versus peers. All three of these situational factors (i.e., group size, pressure of response time, and age of audience) emerged in childhood as being influential on Ann's pragmatic abilities and have persisted into young adulthood.

Ann's difficulty in initiating and maintaining conversations with peers also began in childhood and has persisted into young adulthood. This pragmatic difficulty is consistent with findings in Teverovsky et al. (2009) that conversation is a problematic area for children with CAS. Although Teverovsky et al. did not report specific reasons why conversation was difficult for this population, Ann and her mother reported that it was the "fast pace" of conversation and/or the pressure to respond to large groups that created problems for Ann.

Despite speech-language services throughout her development, Ann's aforementioned pragmatic difficulties persisted into her young adult life. According to results from the NEO-FFI-3, parent report, and direct interaction with Ann, she has an extroverted and conscientious personality. However, these positive prognostic factors for pragmatic abilities were not able to compensate for the challenges Ann faced in social situations secondary to her speech sound disorder.

However, Ann's "Openness" about her communication difficulties appeared to positively affect her ability to converse with others, serving as a possible solution to her conversational challenges. Ann implied that her willingness to talk about her difficulties

made her less fearful about the demands of conversation, even allowing her to initiate conversations in one-on-one or small group settings. Ann's secure, outgoing personality may have contributed to her ability to be "open" with others about her difficulties with communication and ultimately, may have been beneficial to her personal success.

### **What is the current level of self-esteem of a young adult who has a history of CAS?**

According to Ann's self-report on the RGSE, her level of self-esteem fell within the average range. Her norm-based score (42.04, M=50, SD=10) on this measure was on the low end of the range, indicating a continuous process of self-evaluation. Qualitative reports (from Ann and her mother) of Ann's development of a sense of self were aligned with the idea that Ann is a stable, young woman who has gone through periods of self-doubt.

Similar to reports from Gordon-Brannan and Weiss (2007), Ann faced external challenges to her self-esteem like teasing and exclusion from other children. Judgments from others became harmful once Ann began to internalize such negative attitudes. These results highlight the conclusion of Overby et al. (2007) that negative assumptions about children with SSDs can adversely affect their overall social development.

Although Ann went through periods of isolation and decreased "general life satisfaction" (Hitchcock et al., 2015), she was able to work through these obstacles with the support of her parents and her counseling therapist. The success of counseling is, perhaps, reflected in Ann's current personality description of being "secure... even under stressful conditions" (McCrae & Costa, 2010). Building her self-esteem has been a continuous process, and Ann still faces external challenges (e.g., public speaking) to her self-esteem today.

## **How did growing up with a significant speech sound disorder affect the participant's formation of friendships?**

“Quality, not Quantity” was a theme that appeared in both Ann’s and Marie’s interviews regarding Ann’s friendships. Ann always had a few very close friendships that made a significant impact on her. Although Ann experienced the reduced quantity in peer interactions previously associated with children with expressive language difficulties (Craig, 1993), she did not sacrifice the quality. Ann’s speech sound disorder may have affected her overall popularity and establishment of friendships, but it did not restrict the quality nor the maintenance of these friendships. Ann’s results partially support those of Gertner et al. (1994) in that her communication limitations made her “less well equipped” to establish friendships; however, Ann’s speech sound disorder did not affect her maintenance of friendships. Ann’s mother noted that due to Ann’s communication difficulties, support from adults during childhood had been facilitative in forming new friendships.

Not only did Ann feel “Openness” about her communication difficulties positively affected her pragmatic skills, but she also discussed the importance of “Openness” in improving the quality of her friendships. This reoccurring theme was novel relative to the previous literature about friendships among children with communication impairments. Previous literature discussed only detrimental effects (i.e., negative judgments from peers, social isolation); however, the results from this case study point to the overall positive effect of being “open” about one’s communicative challenges in facilitating and improving social interactions.

**How did early experiences with inefficient communication skills affect the participant's future occupation?**

Ann and her mother, Marie, described many of the same supports (e.g., Live Scribe pen to record lectures, extra time allotted for tests) they felt were crucial to Ann's academic success. Marie further discussed the various challenges Ann faced throughout her school years such as reading, writing, math, and test taking. Looking forward to Ann's future career, Marie expressed concern that the communicative challenges Ann continues to face (e.g., writing) would inhibit her potential career growth. Marie's concern was consistent with previous findings that individuals with histories of speech and language impairments did not achieve the occupational levels of success that typically developing individuals achieved (Felsenfeld, 1994; Johnson et al., 2010). Ann also expressed concern about the communicative demands (i.e., public speaking) of her future occupation, but she did not appear to believe this obstacle would limit her. This perspective fits Ann's personality, in that she has high standards for herself and always strives to achieve her goals (McCrae & Costa, 2010).

The involvement of "Advocacy" as a central aspect of Ann's future occupation was another similarity between the two interviews; however, Marie's idea of advocacy was broader (i.e., including women's rights) than that of Ann (i.e., focusing on children like her with communication/learning disabilities). Specifically, Ann spoke of her desire to help children who do not have the support she received from a strong network of family and friends. Ann's belief that family and friends played a crucial role in her current quality of life supports results from Johnson et al. (2010) that found a network of support was associated with a better perceived quality of life for individuals with a

history of language impairments. Ann wants to advocate and provide the support that is needed to give a voice to those who don't have one. This theme highlights Ann's compassionate nature.

### **Limitations**

This study's single subject case study design is a major limitation. Group trends cannot be identified because the reported results only apply to one individual with a unique history. Also, it is impossible to say whether these outcomes could be generalized to the overall population of individuals with CAS. The participant even admitted that her situation (i.e., sufficient support at home and school) and subsequent social functioning outcomes might not be the norm. Although the investigator cannot unequivocally state this participant was representative of the whole population, the participant did present with many of the classic features associated with CAS.

Also, the use of telepractice as the service delivery mode is a possible threat to internal validity. The amount of nonverbal information that can be gleaned from in-person assessments may be lacking or unavailable via telepractice (Luxton, Pruitt, & Osenbach, 2014). For example, the participant was only visible above her shoulders, so any potential fidgeting during challenging or uncomfortable parts of the session was not visible. This limited visibility was also true with the majority of the participant's hand gestures. In addition, the acoustic information transmitted through the computers had decreased precision, in comparison to face-to-face interactions. This decrease in precision may have altered the participant's results on the speech tasks of the MSAP.

## **Future Directions**

Because this case study only employed a single participant, further research should be conducted examining a larger number of participants. This study showed long-term effects on social functioning for one young adult with CAS, so it is necessary for future studies to examine a larger sample of this population to determine if such lasting effects are characteristic of this disorder. This case study also discussed resources that were beneficial to one individual with CAS; therefore, future studies should use this as a building block to more closely define possible resources or strategies that can lead to the social functioning success of children affected by CAS.

## CHAPTER V

### Conclusion

The purpose of this study was to examine the speech sound production and social functioning outcomes of a young adult with a history of CAS. The participant's conversational speech was 100% intelligible, but she demonstrated a notable /s/ distortion. When the participant attempted tasks designed to assess precision and stability of speech sound production and prosody, she exhibited residual errors associated with CAS (i.e., vowel errors, inaccurate production of complex phonemic sequences, cluster reduction, and a breakdown in coarticulatory transitions between syllables).

After quantitative and qualitative analyses, the results of this case study revealed that CAS and its associated challenges did have long-term effects on the participant's social functioning; however, when examined as a gestalt, her social functioning outcomes were positive. The participant was found to have an outgoing personality, however, her pragmatic skills are limited in social situations that involve large groups and quick response times due to her residual speech sound disorder. Throughout her development, the participant faced external challenges to her self-esteem as a result of CAS; yet, given extensive support from her parents and through working with a counseling therapist, she was able to overcome these periods of self-doubt. It was concluded that maintaining her self-esteem is a continuous process. The participant's speech sound disorder affected the quantity of friendships she formed, but the few close friendships she has maintained are high quality, supportive relationships. Finally, qualitative results revealed that the participant's past experiences related to CAS have inspired her to become an advocate for children currently facing similar challenges.

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## Appendix A

### Participant's Support Services throughout Childhood

<b>Age</b>	<b>Services (Provider)</b>	<b>Frequency</b>	<b>Goal</b>
2;7	SLT (EI)	2x/month	Increase use of 2-3 word utterances
	OT (EI)	2x/month	Improve attending skills, fine motor skills
3;0	Discharge from EI: 3-word utterances, good intelligibility within context		
	SLT (school)	1x/week (30 min)	Increase intelligibility through focus on target phonemes, use of "ing" verb ending, MLU
	OT (school)	1x/week (30 min)	Improve postural strength and tone, fine motor skills, and oral motor skills
3;4	SLT (private)	1x/week	Improve intelligibility and expressive language
4;7	SLT (private) Progress: 3-8 word utterances, use of questions/comments/requests, slow DDK, equalized stress on words adversely affected prosody		
5;6	SLT (private)	1x/month	Improve intelligibility and expressive language
	SLT (school)	2x/week	Increase MLU, improve syntax and oral narratives
	SLT/OT (school)	1x/week	Improve coordination of respiration with phonation and voicing
6;0	Special Education	3x/week	Improve foundational reading skills (i.e. phonological processing)
	OT consult (school)	1x/month	Monitor fine motor and visual perceptual abilities

7;1 (end of first grade)	SLT (school) Progress: Typically responded in complete sentences; intelligibility good within context, but difficulties noted on multisyllabic words, sentences of increasing complexity, and initiating speech movements; struggled to apply appropriate phonics skills to spelling		
8;1 (end of second grade)	SLT (school)	2x/week	Improve organization of oral expression in group settings; improve organization in written expression and spelling
	Special Education		Math
9;1	SLT (school) Progress: Good interpersonal and pragmatic language skills; good intelligibility; difficulty in the formation of sentences with complex structure, resulting in words being in an improper sequence Special Education Progress: Visual tracking and visual processing deficits made reading comprehension and multiple-choice tests difficult		
9;11 (fourth grade)	Learning Disabilities Program at Children's Hospital evaluation: Possible decreased sense of self-efficacy due to her difficulties in school; compromised speech intelligibility during spontaneous discourse with novel listeners; unnatural rhythm to her speech; lateralization of the /s, z/ phonemes		
11;5 (sixth grade)	Counseling (school)	1x/week	Increase ability to read social cues and keep up with the flow of social communication to improve social interactions
12;1	SLT (school) Progress: Receptive and expressive language scores within average range; very good intelligibility with consistent self-monitoring focused on a slower rate of speech and production of medial and final consonants; distortions of the /s, z/; errors in production of unfamiliar multisyllabic words Counseling (school) Progress: No specific psychological concerns were indicated, but continued monitoring of self-esteem and coping skills recommended		
13;1 (end of eighth grade)	Counseling (school)		Increase self-advocacy to be more proactive in managing school-

			related stress
17;1	SLT (school) Progress: Receptive and expressive language scores within average range; continued to struggle in the retention of auditory stimuli presented only once without additional aids; recommended Ann be given repetitions of auditory material, copies of lecture notes, and visuals to be paired with auditory information		

## Appendix B

### *Rosenberg General Self-Esteem Scale*

I feel that I'm a person of worth, at least on an equal plane with others.  
Strongly Agree      Agree      Disagree      Strongly Disagree

I feel that I have a number of good qualities.  
Strongly Agree      Agree      Disagree      Strongly Disagree

All in all, I am inclined to feel that I am a failure.  
Strongly Agree      Agree      Disagree      Strongly Disagree

I am able to do things as well as most other people.  
Strongly Agree      Agree      Disagree      Strongly Disagree

I feel I do not have much to be proud of.  
Strongly Agree      Agree      Disagree      Strongly Disagree

I take a positive attitude toward myself.  
Strongly Agree      Agree      Disagree      Strongly Disagree

On the whole, I am satisfied with myself.  
Strongly Agree      Agree      Disagree      Strongly Disagree

I wish I could have more respect for myself.  
Strongly Agree      Agree      Disagree      Strongly Disagree

I certainly feel useless at times.  
Strongly Agree      Agree      Disagree      Strongly Disagree

At times I think I am no good at all.  
Strongly Agree      Agree      Disagree      Strongly Disagree

#### **Scoring:**

“Strongly Disagree”=0 points, “Disagree”=1 point, “Agree”=2 points, and “Strongly Agree”=3 points. Items 3, 5, 8, 9, 10 are scored in reverse. Add the scores for all ten items. Higher scores indicate higher self-esteem.

## Appendix C

### Semi-Structured Interview Questions

Semi-structured Interview (\*When interviewing parent of adult participant, all questions will be in reference to his/her child.)

Background info:

- Describe any unusual conditions associated with your birth (e.g., premature, etc.).
- Other than speech therapy services, have you received any other therapy services (e.g., physical therapy, occupational therapy, psychiatric counseling) in the past?
  - If yes, what was the therapy for?
- Are you currently taking any medications? \_\_\_\_ If yes, please list:

Questions:

- Pragmatics
  - Do you enjoy conversing with others?
  - Have you always felt this way?
  - In the past, have you had difficulty interacting with peers in a social setting? If so, in what way?
  - How comfortable are you engaging in conversation with a new person?
- Self-esteem
  - Were you ever teased or ostracized because of your difference in communication?
  - If so, by who? How did this affect you and how did you respond?
  - Were you ever self-conscious of your communication? Why or why not?
  - What is your comfort level with public speaking?
  - Have you ever avoided certain situations because of communication?
- Friendships
  - Have you ever experienced difficulty making friends?
  - If so, why did you feel that way?
  - In the past two years, have you experienced difficulty forming new relationships?
  - If so, what contributed to that challenge?
  - Compared to your peers that did not grow up with CAS, have you noticed a difference in ability to form new friendships?
  - How many friends (i.e. closer than acquaintances) would you say you currently have?
  - Of those, how many would you consider to be close friends?
  - Are you content with your friendships?
- Job selection
  - What are you studying/ interested in pursuing?
  - What things did you consider when choosing a job? (e.g., salary, personal interests, communication demands, etc.)
  - Did your past communication difficulties affect your job selection? If so, how?

## Appendix D

### Allocation of Discrete Responses from Semi-Structured Interviews

#### **Participant Interview**

Construct	Theme	Number of discrete responses
<i>Pragmatics</i>	“Situation”	22
	“Openness”	9
<i>Self-esteem</i>	“Ability to express herself”	13
	“Builds over time”	10
<i>Friendships</i>	“Openness”	13
	“Quality, not quantity”	8
<i>Education/Occupation</i>	“Success with Support”	13
	“Advocacy”	10
	“Not remembering”	8

#### **Parent Interview**

Construct	Theme	Number of discrete responses
<i>Pragmatics</i>	“Situation”	38
<i>Self-esteem</i>	“External Factors”	22
	“Success with Support”	53
<i>Friendships</i>	“Success with Support”	8
	“Quality, not quantity”	10
<i>Education/Occupation</i>	“Challenges”	38
	“Success with Support”	21
	“Advocacy”	12
	“Not remembering”	31