

What Is Childhood Apraxia of Speech?

Definitions

Praxis : "the generation of **volitional movement patterns** for the performance of a particular action, especially the ability to **select, plan, organize, and initiate the motor pattern** which is the foundation of praxis" (Ayres 1985).

Spatio-Temporal Coordination

- Critical to fluent, adult-rate speech-language production
- Basic patterns develop and stabilize over the first six-eight years of life.
- Gradual refinement and increase in overall execution speed of motor programs continue to development into late adolescence (Netsell 1981; Cheng et al. 2007)

Motor sequencing: ordering the individual gestures that make up the whole motor plan and coordinating them with each other. Includes:

- Determining the order of the elements
- Figuring out how to get from one to the other (Ayres 1985): **transitions**

Apraxia (or dyspraxia) :

- ❖ "a disorder in **carrying out or learning complex movements** that cannot be accounted for by elementary disturbances of strength, coordination, sensation, comprehension, or attention" (Strub & Black 1981).
- ❖ "...a group of phonological disorders resulting from **disruption of central sensorimotor processes** that interfere with motor learning for speech... Paralysis or weakness might be present, but is not sufficient to account for the nature and severity of the observed speech disorder" (Crary 1984).

Sensory integration:

- organization of sensory information for ongoing use
- crucial foundation for later, more complex learning & behavior
- Outcomes: motor planning ability, ability to adapt behavior to incoming sensations

www.sensoryint.com

- ❖ a breakdown in the use of the direct phonetic encoding mechanism (although previously encoded patterns are retained); apraxic speakers rely on indirect phonetic encoding mechanism and are unable to adequately compensate through this mechanism (Whiteside and Varley, 2006; as cited by Andrianopoulos, 2007)

Phonetic coding routes

Direct route

- automatic
- stored verbo-motor patterns
- include sensori-motor feedback mechanisms
- reduced computational load (higher frequency words)
- reduced naming latencies + reduced naming durations with high frequency syllables
- fewer degrees of freedom

Indirect route

- volitional i.e., more conscious, greater cognitive load
- sub-word unit on-line assembly and computation
- letter-to-sound conversion route if literate
- utilized for novel, low-frequency words
- greater degrees of freedom
- more conscious on-line control of speech production

- ❖ "viewed as a **syndrome**...developmental verbal apraxia might be defined as a **severe and persistent phonological disorder coupled with an expressive syntactic disorder** with **variable neurological and articulatory findings.**" (Aram 1984)

Unitary Disorder:

- One consistent symptom or set of symptoms is always present

Syndrome/Symptom Complex:

- A pattern of symptoms, with a common underlying cause, is used for diagnosis
 - No one symptom alone is adequate to identify the syndrome
 - Different children may have varying symptoms of the same disorder
- ❖ “a reduced capacity to form systemic mappings [between articulatory movements and their auditory consequences] might underlie the oral motor and early speech learning difficulties in DAS [CAS] and put the child at a disadvantage for the acquisition of the motor aspects of phonology, that is, the phoneme-specific mappings”... “higher-level [phonological] knowledge ... must be acquired by the child via the problematic speech production and perception skills” (Maassen 2002, pp. 261, 265)

Thus, apraxia or dyspraxia is a disorder of:

1. Volitional movement; automation of new patterns (Dewey et al. 1988, Maassen et al. 2003, Nelson, 1995; Whiteside & Varley, 2006)
2. Spatial-temporal coordination (Sussman et al. 2000, Nijland et al. 2002)
3. Motor sequencing (Crary & Anderson, 1991)
4. Carrying out or learning complex movements (Crary & Anderson, 1991)
5. Central sensorimotor processes (Crary 1984)
6. Accommodation to context (coarticulation, etc.; Maassen et al. 2001, Nijland et al. 2003, Nijland et al 2002).

Name?

developmental apraxia of speech
developmental verbal dyspraxia
☞ childhood apraxia of speech ☞
dilapidated speech ??

apraxia of speech: learning, planning, retrieving motor plans for speech

oral apraxia: learning, planning, retrieving motor plans for speech

CAS as a Secondary Diagnosis

- Approximately 60% of children on the autism spectrum have motor speech symptoms; about 13% report primarily symptoms of apraxia; 10% primarily dysarthria; remainder mixed (Marili, Andrianopoulos, Velleman & Foreman, 2004)
- Symptoms of CAS are common among children with Down syndrome (Kumin & Adams 2000; Rupela & Manjula, 2007)

Etiology?

Demographics:

- 86% of kids with CAS have @ least one family member w/ speech-language disorders
- 59% have @ least one affected parent
- Higher rates of family history than for other speech-sound disorders: suggests genetic basis in at least some cases (Lewis et al. 2003)
- Prevalence 1-2 children per thousand (Shriberg et al., 1997a); up to 3-4% of children with speech delay are given this diagnosis (Delaney & Kent, 2004)

FOXP2 (See references): Translocation on chromosome 7q31

Individuals (e.g., the “KE” family) with this genetic difference have the symptoms of oral and verbal apraxia. However, they also have oral-facial anomalies and non-verbal deficits. Thus, FOX-P2 may be the cause of some cases of CAS, but certainly not all of them.

7q11.23: Duplication on same chromosome where deletion causes Williams syndrome

Duplication of gene on chromosome 7

Same location where gene is deleted for Williams syndrome

12 children, 2 adults identified & tested

All but 2 have speech delay/disorder; all but one have/have had motor speech symptoms

Two with longest duplication have CAS

Several others have CAS symptoms

We're looking for more!

Features:

- Somewhat narrow forehead
- High, broad nose
- Posteriorly rotated ears
- Short philtrum
- Thin lips
- Small jaw
- Generous-sized teeth
- High palate
- Attention deficit/hyperactivity

(Somerville et al. 2005)

Commonalities among all dyspraxias/apraxias:

1. Difficulties with **sequencing**, including more difficulties with **transitions** between postures or states than within static postures or states.
2. Difficulties in combining smaller units (including units of movement) into larger wholes.
3. Decreased ability to accommodate to context: coarticulation, rate, complexity.

“Is CAS a motor disorder or a linguistic disorder?”

Wrong question!

- Difficulty organizing elements into larger and larger wholes for action planning.
- Can affect non-speech oral planning, speech planning, and/or linguistic planning.
- Not a problem of the elements themselves; a problem of bridging among elements.

Note: Oral or speech planning must be affected or it's not CAS.

CAS is a “symptom complex”

- No one feature is adequate for diagnosis
- Symptoms can include motor, linguistic, neurological..
- Inconsistency is expected across children and within same child
- Symptoms change over time (Lewis et al. 2004; Shriberg et al. 2003)

Official ASHA Definition:

Childhood apraxia of speech (CAS) is a **neurological** childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone). CAS may occur as a result of known neurological impairment, in association with complex neurobehavioral disorders of known or unknown origin, or as an idiopathic neurogenic speech sound disorder. **The core impairment in planning and/or programming spatiotemporal parameters of movement sequences** results in errors in speech sound production and prosody.

Three segmental and suprasegmental features that are consistent with a deficit in the planning and programming of movements for speech **have gained some consensus** among investigators in apraxia of speech in children:

- (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.**

Importantly, these features are not proposed to be the necessary and sufficient signs of CAS. These and other reported signs **change in their relative frequencies of occurrence with task complexity, severity of involvement, and age.**

The complex of behavioral features reportedly associated with CAS places a child at **increased risk for early and persistent problems in speech, expressive language, and the phonological foundations of literacy** as well as the possible need for augmentative and alternative communication and assistive technology.

<http://www.asha.org/docs/html/TR2007-00278.html>