

3:183 Introduction to Stuttering

Patricia M. Zebrowski, Ph.D.
University of Iowa

History of Stuttering Research, Theory and Treatment at the University of Iowa

HISTORY

- First program in professional training and research in speech and hearing disorders established at UI in 1922
- Led by Carl Seashore and Samuel Orton, faculty from a number of disciplines (psychology, psychiatry, speech otolaryngology, neurology, physics) created curriculum
- Chose Lee Travis, a graduate student in psychology to be first Ph.D. student

- Travis received Ph.D. from Dept. of Psychology in 1924
- He started the first speech and hearing clinic at the University of Iowa in 1927, as well as the original laboratory from which the present program developed.
- The first work to come from this lab tested the “Cerebral Dominance” theory of stuttering, developed by Travis and Orton

From 1935 to the present day, Iowa researchers have studied many different aspects of stuttering, including:

- * Interrelationship between stuttering and personality
- * Description of the “moment” of stuttering
- * Onset and development of stuttering in children

- * Learning and stuttering
- * Speech physiology associated with stuttering
- * Listener judgments of stuttering
- * Parent-child interaction and stuttering
- * Subtypes and risk factors in childhood stuttering
- * Physiological correlates of stuttering development

“Subtypes and Risk Factors”

Core Longitudinal

- To delineate subtypes of developmental stuttering, with particular focus on persistent (chronic) and recovered (transient) stuttering in preschool children.
- To map pathways of stuttering development over time, evaluating patterns of strength and weakness in performance across a range of areas (language, temperament, speech motor), and epidemiological, genetic and environmental factors (i.e. ‘risk factors’).

Core Longitudinal

- University of Illinois, University of Iowa, University of Wisconsin-Milwaukee and Northern Illinois University.
- Across all sites, complete data sets collected from 90 preschool children who stutter within 12 months of reported onset, and 50 age-matched nonstuttering children (Iowa: 59 subjects total).
- Data collected at intake, 6 mos, 1 yr, 1.5 yr, and 2 year intervals.

“Subtypes and Risk Factors in Childhood Stuttering”

Hypotheses

- No significant between-group (stuttering vs nonstuttering) differences in individual ‘risk’ factors
- Significant between-group (persistent vs recovered) differences manifest as “dissociations” or “developmental asynchronies” over time.

“Subtypes and Risk Factors”

Analysis of Core Longitudinal Data

- Multivariate discriminant analysis of specific risk factors to separate groups (e.g. stuttering and nonstuttering; persistent and recovered, at intake (Visit 1) and across time).

Epidemiology – U. Illinois

Language – U. Illinois, U. Wisconsin-Milwaukee

Temperament – U. Illinois

Motor – U. Iowa, Northern Illinois U.

“Subtypes and Risk Factors”

Branch Specific

- To assess speech motor behaviors associated with perceptually fluent speech in various contexts.
 - * Stuttering and nonstuttering children
 - * Variability of jaw movement in multiple repetitions across levels of complexity

“Subtypes and Risk Factors in Childhood Stuttering”

- * Relative timing

- * Variability of F0 in devoicing and voicing gesture in multiple repetitions across levels of complexity

“Physiological Correlates of Stuttering”

- Purdue University and University of Iowa
- Three-year project to assess the physiological bases of motor and language processes in preschool children who stutter, and to follow the development of these processes longitudinally

“Physiological Correlates of Stuttering”

Hypothesis

Stuttering in some children develops when motor control and coordination for speech is delayed or deficient compared to language processing skills or demands

Experimental Methods

- Observe motor output while performing speech and nonspeech tasks of varying complexity
 - * Optotrak – hand coordination in temporally constrained clapping, and production of sentences that vary in length and syntactic complexity

“Physiological Correlates of Stuttering”

Experimental Methods

* EMG – spectral analysis of OOI for tremor-like oscillations during speech

- Record electrical activity of the brain while children listen to linguistic and nonlinguistic stimuli

* Averaged EEGs time-locked to (non)linguistic stimuli to produce event-related potentials (ERPs).









What is Stuttering?

Defining 'Stuttering' ...

- **As a behavior, with observable and unobservable features**
- **As a disorder of communication**

Stuttering as a Disorder: Etiology

- **Proximal causes**

What triggers stuttering in the ‘here and now?’

- **Distal causes**

What are the conditions under which stuttering emerges in children?

Proximal Causes (some examples)

**Stuttering results from discoordination
of phonation with articulation and
respiration**

**Stuttering results from a breakdown in
phonetic transition**

**Stuttering results from a mismatch
between the capacity to produce
fluent speech, and the demands
for fluency**

**Stuttering results from the 'covert'
repair of phonemic selection errors**

Distal Causes

Diagnosogenic Theory (Johnson)

**Communicative Failure/Anticipatory struggle
(Bloodstein)**

**Demands and Capacities Model (Andrews & Harris,
1964; Adams, 1990)**

Interaction Theory (Conture, 2001)

**Communicative/Emotional Model (Conture, Walden,
Karrass, Arnold, Hartfield & Schwenk, 2005).**

Multifactorial Model (Smith & Kelly, 1997)

DIAGNOSOGENIC THEORY (Johnson)

- **Stuttering is caused by parental tendency to label ‘normal’ disfluency as ‘stuttering’.**
- **“Stuttering develops from the avoidance of normal disfluency.”**

COMMUNICATIVE FAILURE/ANTICIPATORY STRUGGLE (Bloodstein)

Stuttering develops from a child's continued frustration and failure when trying to speak.

This failure/frustration may be related to:

- Delay or disorders in speech and language;**
- Emotionally traumatic events during which child tries to speak.**
- Normal disfluencies criticized by significant listeners.**

COMMUNICATIVE FAILURE/ANTICIPATORY STRUGGLE (cont.)

Frequently occurring frustration/failure leads to anticipation of future difficulty. This anticipation may lead to tension in speech musculature during speaking, resulting in hesitation, struggle, and 'fragmented' or 'stuttered' speech (within-word disfluencies).

CAPACITIES AND DEMANDS MODEL

(Andrews et al.; Starkweather)

Normal disfluencies and stuttering emerge when the child's CAPACITIES for producing fluent speech are not equal to the DEMANDS on the child for fluent speech.

CAPACITIES may include:

- **Speech articulation development.**
- **Ability to rapidly move speech structures in coordinated sequences.**
- **Overall neurological development.**
- **Language stage.**
- **Temperament.**

DEMANDS may include:

- Internal demands such as increasingly complex thoughts to be expressed in increasingly sophisticated linguistic forms.
- External demands for rapid, precise, adult-like speech and language.
- Negative environmental reactions to child's communication attempts.

INTERACTION THEORY

The cause of stuttering is unknown, but there are several factors that may put a child at risk. Most experts agree that some children are born with an inherited tendency to develop stuttering;

whether or not they will depends on the ways in which their physical makeup and environment interact during the first three to four years of life.

(after Conture, 2001).

Communicative-Emotional Model (Conture et al., 2006)

Two levels of contributing factors:

1. Distal: Interactive contributions of genetics and environment
 2. Proximal: Interactive contributions of disruptions in speech/language planning leading to instances of stuttering
- *** Over time and through experience, emotional reactivity and regulation exacerbate and maintain stuttering related to (2).

MULTIFACTORIAL MODEL

(Smith and Kelly, 1997)

**In essence, there is no
core factor(s) necessary for
stuttering to emerge or persist
in young children.**

**Rather, stuttering results from
the complex interaction of a
number of risk factors**

**Stuttering is a complex disorder,
and stuttered speech is a
complex behavior. As such, it is
not likely to be triggered by one
stimulus, but by several.**

These variables can be either external or internal, and are 'packaged' in different ways for different children. They are considered to be 'risk factors'.

Factors include:

*heredity *status of speech motor system

*language *emotion *temperament

*cognition *environment

*communicative context

These **factors** are present in widely varying proportions in people diagnosed to be stuttering (so are differently weighted). In addition, proportions change over time. A small change in one factor, or in the complex interaction between and among factors, can result in (1) **the onset, development or persistence of stuttering**, or (2) **a stuttered disruption or event**.

These same risk factors may also be relevant to both recovery from *and* persistence in stuttering for young children who are close to the onset of stuttering (Yairi and Ambrose, 1999; Guitar, 1997; Zebrowski and Conture, 1998).

Speech Motor Function

- Accumulated evidence suggests that young children who stutter are not *appreciably* different in their speech motor skill development when compared to children who do not stutter.

Speech Motor Function

Studies of various acoustic correlates of fluent speech suggest subtle between- and within-group differences in

- Laryngeal function (e.g. F0, jitter, shimmer; Hall & Yairi, 1991)
- Laryngeal/respiratory/articulatory coordination (e.g. Zebrowski et al., 1985; Subramanian et al., 2003)

Speech Motor Function

- Speed of motor execution in speech, (Zebrowski, 1994; Hall et al., 1999) as shown by reduced articulatory rate, in some cases related to a larger proportion of sound prolongation

Speech Motor Function

- It may be the case that some children who stutter exhibit more frequent use of inefficient (not deficient) speech production strategies (Zebrowski and Conture, 1985; Conture, Rothenberg and Molitor, 1986; Conture and Kelly, 1991).

Speech Motor Function

- Subtle and inconsistent between and within-group differences in various speech motor behaviors suggests that perhaps some children who stutter possess systems that are more vulnerable to various stressors, for example: verbal environment, language complexity, speech rate, or some combination of stressors (Conture and Kelly, 1991).

Phonology/Language

- Evidence suggests that children who stutter are *more likely* to exhibit (co-existing) phonological delay or disorder when compared to their nonstuttering peers (Louko, Edwards and Conture, 1990; Paden and Yairi, 1996; Paden, Yairi and Ambrose, 1999; Paden, 2005).

AND...

Phonology/Language

- Comparisons of children who recover from, and persist in, stuttering show that the persistent group are more likely to achieve poorer scores across a number of tests of phonological proficiency (Paden and Yairi, 1996; Paden, Yairi and Ambrose, 1999; Paden, 2005).

Phonology/Language

- Some children who stutter may exhibit developmental asynchronies (Watkins, Yairi and Ambrose, 1999; Watkins, 2005), perhaps contributing to a lower threshold for perturbation or disruption.

FURTHER...

Phonology/Language

- Evidence for a relationship between disfluency and both utterance length and complexity (Logan, 2003; Logan and Conture, 1997; Zacheim and Conture, 2003).
- Children who stutter are more apt to stutter on function as opposed to content words (Bernstein Ratner, 1981; Graham, Conture & Camarata, 2004; Howell, Au-Yeung, & Sackin, 1999).

Temperament

- A largely inherited, multi-faceted construct that characterizes a child's general disposition and range of moods (Goldsmith, 1987)
- Reactivity – excitability of the nervous system to behavioral responses or external stimuli

- Self-regulation – the processes that inhibit or facilitate reactivity (for example, attention, approach-avoidance strategies, etc.)
- Activity – lethargic to hyperactive

- **Emotionality** – emotional response to new or novel stimuli
- **Sociability** – comfort in being alone as opposed to being with other

Temperament mediates the influence of the environment on the child.

The “Behaviorally Inhibited” (BI) Child

- Described by Kagan (1984; 1994) as one type of *normal* temperamental profile
- Relatively timid, sensitive to environment and own behaviors, higher levels of *reactivity* and lower thresholds for *excitability* than other children

Inhibitory responses to strong reactivity take three forms: freezing, fleeing, or avoidance. (Gray, 1987).

AND...

BI children may exhibit higher levels of physical tension, especially in the laryngeal muscles, when they experience relatively high degrees of emotional reactivity (Kagan, Reznick and Snidman, 1987) SO...

Some stuttering children who present with a BI profile may be at increased risk for persistent stuttering.

- Based on results from administration of the *Temperament Characteristic Scale (TCS)* and the *Parent Perception Scale*, Oyler (1996a, 1996b) and Oyler and Ramig (1995) determined that young children who stutter were significantly more behaviorally inhibited and less likely to take risks than children who do not stutter.

- Further, Anderson, Pellowski, Conture & Kelly (2003) used similar measures and observed that children who stutter are less adaptable, less rhythmic in physiological functioning, and less distractible than their nonstuttering peers.

Summary

- There is growing evidence that specific risk factors are related not just to the *onset* of stuttering, but may also be predictive of both recovery and persistence
- Different subgroups within the population of children who stutter may be identified by the presence or absence of various risk factors and the nature of their interaction.

Summary

- Presently, there is a need to understand both the *nature* of salient risk factors, and the *mechanisms* through which they may be related to the disorder of stuttering in young children.
- In addition, there is a need to identify those factors and *combination* of factors that may serve to predict unassisted recovery and persistence, as well as treatment outcomes for young children who stutter.

Summary

For example, Conture and associates (2004) have observed relationships between 'emotional regulation', stuttering, and language in some children who stutter. This research group has also reported that children who stutter with 'less regulated biological cycles' benefit less from motor practice.

Summary

In addition, Watkins (1999; 2005) has reported evidence for developmental asynchronies between language and phonology in some children who stutter.

Stuttering as a Behavior

Disfluency and Stuttering reflect a disruption in the smooth transitioning between sounds, syllables , and words.

CONSIDER STUTTERING WITHIN THE CONTEXT OF FLUENCY AND DISFLUENCY

FLUENCY:

The smooth transitioning between
sounds, syllables, and words

DISFLUENCY:

A disruption in this process

CHARACTERIZING DISFLUENT BEHAVIOR

BETWEEN-WORD (aka “Other” Disfluencies; Yairi et al., 1999)

- Interjections
- Revisions
- Phrase repetitions

CHARACTERIZING DISFLUENT BEHAVIOR, (cont.)

WITHIN-WORD (aka “Stuttering- Like” Disfluencies; Yairi et al, 1999).

- Sound/syllable repetitions
- Sound prolongations
(audible and inaudible)
- Monosyllabic whole-word repetitions

**STUTTERING IS A FORM OF
SPEECH DISFLUENCY
CHARACTERIZED BY A
RELATIVELY HIGH PROPORTION
OF WITHIN-WORD SPEECH
DISFLUENCIES AND
ASSOCIATED BEHAVIORS**

...AND

LISTENERS MORE FREQUENTLY
JUDGE **WITHIN-WORD**
DISFLUENCIES TO BE 'STUTTERING'
OR 'ATYPICAL' AS COMPARED TO
BETWEEN-WORD DISFLUENCIES.

Different 'Levels' of Observation

- **Social context**
- **Listener response**
- **An increase in heart rate prior to speech**
- **Tremor in muscle activity during speech**

Different 'Levels' of Observation, (cont.)

- **Sound and syllable repetitions and sound prolongations**
- **Discoordination of respiratory and laryngeal behaviors prior to speech initiation**
- **Negative emotion**
- **Avoidance behaviors**

Different 'Levels' of Observation, (cont.)

- **Genetic make-up**
- **Eye blinks and head movement during instances of stuttering**
- **Linguistic context**
- **Temporal aspects of parent-child conversation**

**“Stuttering ‘is’ all these
phenomena and exists
at all these levels”**

(Smith & Kelly, 1997)

**What levels are the most useful for
speech-language pathologists?**

**What levels are directly
addressed by speech-language
pathologists?**

MEASUREMENT OF DISFLUENCY AND RELATED BEHAVIOR

Frequency of speech disfluency

**Relative proportion of disfluency types
(within and between)**

**Duration of within-word speech
disfluencies**

Associated (non) speech disfluencies

MEASUREMENT OF DISFLUENCY AND RELATED BEHAVIOR

Severity

Speech Rate (overall and articulatory)

Awareness and Emotionality

**Attitudes About Speaking and
Stuttering**

We begin to suspect that a child is either stuttering or at risk for developing a stuttering problem if (s)he meets BOTH of the following criteria:

- Produces THREE (3) or more WITHIN-WORD (SLDs) speech disfluencies per 100 words of conversational speech (i.e., sound/syllable repetitions and/or sound prolongations)**
- Parents and/or other people in the child's environment express concern that the child either stutters or is a stutterer.**

What Do We Know About Early Stuttering ?

- **Onset of stuttering typically between 2-4 years of age**
- **Probability of stuttering onset decreases with age**
- **Lifetime incidence (in USA and Western Europe) approximately 4-5% of the population**

- **Prevalence ranges from 0.5% to 1%**
- **Estimates of unassisted recovery or remission range from 32%-89%**
- **Stuttering runs in families**
- **More boys than girls develop chronic stuttering problems (3:1)**

Patterns of Unassisted Recovery

- **Probability of recovery highest from 6-36 months post onset**
- **Majority of children recover within 12-24 months post onset**
- **Period of recovery marked by steady decrease in sound/syllable and word repetitions and prolonged sounds over time, beginning shortly after onset**

- **Relatively brief beginning and ascending phase, and a relatively long declining phase**
- **Subgroup of children presenting with “severe” stuttering at onset, with frequency of behaviors peaking at 2-3 months post onset and full recovery seen by 6-12 months**

Recovery Predictors

- **Described by Yairi and associates (1992,1996)**
- **Onset before age 3**
- **Female**
- **Measurable decrease in sound/syllable and word repetitions, and sound prolongations, overtime, observed relatively soon post-onset**

- **No family history of stuttering or a family history of recovery**
- **No coexisting phonological problems (and possibly language and cognitive problems?)**

******ALL ARE PROBABILITY INDICATORS******

DEVELOPMENT OF STUTTERING

- Bloodstein's 'phases'
- Van Riper's 'tracks'
- Longitudinal data

ADAPTATION

- **Progressive decrease in the number of disfluencies during successive readings or repetitions of the same material.**
- **Many variables affect and influence adaptation.**
 - i.e., reading material
 - audience size

CONSISTENCY

Tendency to stutter on the same words or sounds during successive readings or repetitions of the same material.

LOCI

For adults, words that are consistently stuttered have been found to have the following characteristics (Brown, 1937; 1938).

1. Initial consonant
2. Longer words
3. Words at beginning of sentence
4. Nouns, verbs, adjectives, adverbs

LOCI

However.....

Children who stutter are more apt to stutter on function as opposed to content words (Bernstein Ratner, 1981; Graham, Conture & Camarata, 2004; Howell, Au-Yeung, & Sackin, 1999).

VARIABLES THAT INFLUENCE STUTTERING

FINDINGS

- **Singing**
- **Talking to beat of metronome**
- **Whispering**
- **Oral reading in unison**
- **Altered auditory feedback (DAF, FAF)**
- **Talking in presence of noise**

TREATMENT CONSIDERATIONS

- **Clinician's beliefs about onset and development**
- **Therapy targets**
- **Therapy goals**
- **How much attention paid to client's feelings/attitudes about stuttering?**
- **Counseling?**
- **Dealing with concomitant problems**

BEHAVIORAL APPROACHES TO STUTTERING TREATMENT

‘SPEAK MORE FLUENTLY’

‘STUTTER MORE FLUENTLY’

‘NORMAL TALKING PROCESS’

SPEAK MORE FLUENTLY

**(aka “Fluency Shaping” or “Smooth Speech” via
Fluency-Enhancing Strategies)**

- **Slow rate**
- **Prolonged vowels**
- **Slow and smooth speech initiation**
- **Phrasing and pausing**

- **Light articulatory contact**
- **Connecting across word boundaries**
- **Goals of Therapy: Spontaneous fluency and controlled fluency**

**ENTIRE SPEECH PATTERN IS
CHANGED**

STUTTER MORE FLUENTLY

(aka “Stuttering Modification”)

- **Identify and modify moments or instances of stuttering**
- **Reducing fear of stuttering and speaking**
- **Reducing or eliminating avoidance behaviors**

- **Counseling**
- **Goals of Therapy: Spontaneous fluency, controlled fluency, and acceptable stuttering (aka “easy” stuttering)**

**MOMENTS OR INSTANCES OF
STUTTERING ARE CHANGED**

'NORMAL TALKING' PROCESS

- Introduced by Williams (1957; 1979)
- Instead of focusing on reducing or replacing undesirable behavior, emphasis is placed on *increasing* desirable behavior.
- Attention is directed *away from* the perception of what is *happening to* the client, toward those things (s)he *is doing* to both facilitate and interfere with talking.

‘NORMAL TALKING’ PROCESS

Emphasis placed on behavioral awareness of five parameters that contribute to ‘forward moving speech.’

- tensing**
- movement**
- airflow**
- voicing**
- timing**

INTEGRATED (CLIENT-CENTERED) APPROACH

- **Behavioral awareness of the talking process**
- **Fluency enhancing strategies across entirety of speech**
- **Modification of moments or instances of stuttering using identification and fluency enhancing strategies**
- **Reducing fear of stuttering and speaking**
- **Reducing or eliminating avoidance behaviors**

INTEGRATED APPROACH

- **Fluency enhancing strategies across entirety of speech**
- **Modification of moments or instances of stuttering using identification and fluency enhancing strategies**
- **Reducing fear of stuttering and speaking**
- **Reducing or eliminating avoidance behaviors**

- **Counseling**
- **Choices, i.e.: Different levels of control/attention**
- **Primary goals of therapy: Spontaneous and controlled fluency; Acceptable stuttering, and transfer and maintenance of fluency skills**
- **Additional goals include: Natural sounding speech, effective communication, “fluent lifestyle”, and “becoming your own clinician”**

Treatment of Stuttering in Children

Parents

Direct

Child

Direct, indirect, or both

Direct

Teaching the child how to deliberately and overtly recognize and change speech behaviors

“Speak more Fluently” vs “Stutter more Fluently” or Both

Parents’ request for “cancellation” of disfluency, and subsequent reinforcement of fluency (after Onslow and associates).

Indirect

Monitoring

Parent counseling

Providing models of specific speech characteristics with NO overt or deliberate attention paid to the child's speech or speech disfluency.