Emotional Contributions to Developmental Stuttering

Edward G. Conture and Robin M. Jones
Vanderbilt University, Nashville, Tennessee, USA

Anthony P. Buhr
Queen Margaret University, Edinburgh, Scotland, UK

in collaboration with:
Carl B. Frankel, Ellen M. Kelly, and Tedra A. Walden
Vanderbilt University

2010 ASHA Conference Philadelphia, PA
Emotion.... So What?

“...emotions are not just messy toddlers in a china shop, running around breaking and obscuring delicate cognitive glassware. Instead, they are more like the shelves underlying the glassware, without them cognition has less support” (p. 5).

Immordino-Yang, M. & Damasio, A. (2007). We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education. *Mind, Brain and Education, 1*, 3-10.
Purpose

To discuss emotional contributors to Dual Diathesis-Stressor (DD-S) model of developmental stuttering, and to present empirical evidence from preschool-age children.

Presentation/Research Supported in part by:

NIH/NIDCD Research Grants 1R01DC006477-01A2, 2R56DC000523-14A1, 2R01DC000523-14A2 and a Vanderbilt Discovery Grant
Outline of Presentation

- **Part I:** Dual diathesis-stressor (DD-S) model of developmental stuttering
  - *Diatheses* = proclivity to respond in particular way
  - *Stressor* = what activates situational (emotional) response

- **Part II:** Parent report and observational evidence
  - Temperamental emotion: *Parent-based report*
  - Situational emotion: *Behavioral observation*

- **Part III:** Psychophysiological evidence
  - Temperamental and situational emotion: *Respiratory Sinus Arrhythmia (RSA)*

- **Part IV:** Conclusion
Part I: Dual Diathesis-Stress Model of Stuttering
Emotion and stuttering...

• “...a varying effect may not be accounted for by reference to an unvarying cause” (p. 5)

• In essence, stuttering changes over time. Thus, truly viable models of stuttering must account for the variable nature of stuttering

Emotion defined

- Temperamental emotionality: relatively stable, trait-like aspects of emotional responding - here considered as a diathesis.

- Situational emotions: relatively variable, state-like aspects of emotional responding - here considered in response to a stressor.
Emotion continued...

• “Emotion is a process, a constant, vigilant process...which periodically reaches a level of detection for the person (i.e., a feeling) or an observer” (Cole et al., 2004, p. 319)

• Emotional behavior can be unconscious, quick (LeDoux, 1996).

• Feelings can be conscious, slower (LeDoux, 1996).


Stress

- **Stressor** is anything that pushes autonomic nervous system out of homeostasis
  - Physical stressors (e.g., exercise)
  - Psychological stressors (e.g., social threats)

- **Stress response**: “… activating specific cognitive and affective processes and their central nervous system underpinnings.” (p. 356)

- “… effects of psychological stressors on physiological systems are **highly variable**.” (p. 355)

Diathesis-Stress model

- “Stress activates a diathesis, transforming the potential of predisposition into presence of psychopathology” (p. 406)
  - Presenters are NOT suggesting that stuttering = psychopathology
  - Stress can come in many forms, not just emotional

- Relatively stable diatheses (emotional or linguistic) can be activated by relatively variable stressors (emotional or linguistic) to contribute to relatively variable stuttering

Dual Diathesis-Stressor (DD-S) account of developmental stuttering

Summary: DD-S model of stuttering

- **Stuttering is variable**
  - Any model of stuttering needs to be able to account for the variable nature of stuttering

- **Emotion**
  - Emotional diathesis (i.e., temperament) may distinguish CWS from CWNS, thereby possibly contributing to the onset of stuttering as a diagnostic entity
  - Situational emotional responding is more variable, thereby possibly contributing to instances of stuttering as speech events

- **Stressor**
  - A stressor can activate a diathesis, the effect of which may be to increase the frequency of situation emotional responding, and thus increase the frequency of stuttering
Part II: Parent report and observational evidence

a. Temperament/Trait Emotion: Parent-based report
Vanderbilt’s Developmental Stuttering Project: Empirical test DD-S model

- All participants were preschool-age children - between 3 years 0 months and 5 years 11 months - who do (CWS) and do not stutter (CWNS).
- All CWS were assessed prior to any prescribed treatment and typically assessed 3 to 12 months since time of onset.
Temperamental emotion: CWS boys (n=118) exhibited significantly less expressive temperaments \( (z = -3.548, p < 0.001) \) than preschool CWNS boys (n=85) on Temperamental Characteristics Scale (TCS; Oyler, 1996).

Preschool-age CWS

Preschool-age CWNS

Temperamental emotion: Preschool CWS (n=31) slower to adapt, exhibit less rhythmicity, and less distractible than preschool CWNS (n=31) on Behavioral Style Questionnaire (BSQ; McDevitt & Carey, 1978).

Temperamental Emotion: On measures derived from BSQ (McDevitt & Carey, 1978), scores for CWS (n=65), when compared to CWNS (n=56), showed higher emotional reactivity, lower emotion regulation, and lower attention regulation.

Temperamental emotion: What have we learned from parent reports?

- CWS have less expressive temperaments than CWNS.
- CWS are less adaptable, less distractible, and less rhythmic than CWNS.
- CWS have more emotional reactivity and less emotional and attention regulation (the latter an important means for regulating emotions).
Part II: Parent report and observational evidence

b. Situational/State Emotion: Observational evidence
Conversational and narrative samples in natural and experimental settings

“Jeep” data-collection apparatus
Situational Emotional Responding (observational data): CWS (n=13) exhibited greater percentage of looks per camera move during conversation compared to CWNS (n=14).

Situational emotional responding (observational data): Preschool-age CWS (n=16) compared to CWNS (n=16) exhibited significantly more negative emotional expressions after receiving undesirable gift.

Situational emotional Responding (observational data): For preschool-age CWS (n = 8), increased stuttering was significantly related to decreased regulatory strategy duration ($r = -0.862, p = .003$) and regulatory strategy frequency ($r = -0.676, p = .045$).

Situational emotional responding (observational data): CWS (n=19) and CWNS (n=22) participated in narrative tasks after positive, negative, or neutral overheard conversations.

Situational emotional responding (observational data): For preschool-age CWS (n = 8), stuttered utterances, compared to fluent, were significantly more likely to be associated with emotional reactivity (p < .001).

Directionality (stuttering → emotion vs. stuttering ← emotion)?

Situational emotion: What have we learned from observational data?

- Preschool-age CWS slower to habituate to irrelevant stimuli than CWNS
- CWS more apt to react with frustration when disappointed than CWNS
- CWS’ regulation of their negative emotional reactivity influences their frequency of stuttering
- CWS’ stuttered utterances more apt to be associated with emotional reactivity than their fluent utterances
Part III: Psychophysiological Evidence

Temperamental and Situational Emotion: The psychophysiological measure of respiratory sinus arrhythmia (RSA)
Respiratory Sinus Arrhythmia (RSA)

- Defined as the increase in heart rate with inspiration and the decrease in heart rate with expiration
- Provides an index of parasympathetic influence on the heart
  - Baseline RSA index of capacity for emotion regulation
  - Suppression (decrease) RSA in response to a stressor index of emotion regulation

Vagus (10th cranial nerve) originates in nucleus ambiguus of brainstem

Hierarchical organization of parasympathetic and sympathetic branches of autonomic nervous system

- **Parasympathetic branch**
  - Active during times of rest and relaxation, keeping heart rate low
  - Functions as a vagal “brake” on the heart

- **Sympathetic branch**
  - Activated in response to a stressor, leading to an increase in heart rate
  - Enabled by release of vagal brake on the heart

## Polyvagal Theory (Porges, 2007)

<table>
<thead>
<tr>
<th>ANS Component</th>
<th>Behavioral Function</th>
<th>Lower motor neurons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myelinated vagus (ventral vagal complex)</td>
<td>Social communication, self-soothing and calming, inhibit “arousal”</td>
<td>Nucleus ambiguus</td>
</tr>
<tr>
<td>Sympathetic-adrenal system</td>
<td>Mobilization (active avoidance)</td>
<td>Spinal cord</td>
</tr>
<tr>
<td>Unmyelinated vagus (dorsal vagal complex)</td>
<td>Immobilization (death feigning, passive avoidance)</td>
<td>Dorsal motor nucleus of the vagus</td>
</tr>
</tbody>
</table>

Film clips used as “stressors”

Neutral

Negative

Positive

Physiological responding: heart rate, respiration, and inter-beat interval (IBI)
**Results:** CWS ($n = 11$) exhibited significantly greater respiratory sinus arrhythmia (RSA) than CWNS ($n = 15$)

Temperamental and situational emotion: What have we learned from psychophysiological data?

- CWS exhibit higher RSA
  - Less efficient release of the vagal brake.
  - Thus, in some situations may be less able to produce appropriate emotional response.

- Other potential implication of finding
  - Vagus also mediates control of laryngeal muscles used for vocalization
  - Failure to develop efficient control of vagus for emotion regulation may extend to laryngeal control for vocal communication.

- This finding requires replication before firmer conclusions can be drawn.
Part IV:

Summary and Conclusion
Temperamental and situational emotion: Summary

- Temperamental emotion may account for between-group differences (CWS vs. CWNS), suggesting that emotional diathesis contributes to onset of stuttering.

- Situational emotional responding in conjunction with the variable presence of stressors may account for variability of stuttering.

- Experimental manipulation of emotional arousal, in which appropriate stressors are used to elicit behavioral and psychophysiological response, may be one useful paradigm for future studies of emotion and stuttering.
Temperamental and situational emotion: Conclusion

**Directionality:**

- (a) Stuttering → Emotion
- (b) Emotion → Stuttering
- (c) Emotion ↔ Stuttering

**Regulation of emotion is salient to stuttering:**

- To date, more of a focus on emotional reactivity
- Far less attention to emotion regulation
- Some of our findings suggest that the regulation of emotional processes are a major piece of the puzzle.

**Quick, efficient adaptation to environmental change**

- Childhood stuttering may impacted by the child’s ability to adaptively respond to environmental change or novelty. This is characterized by appropriate regulatory activity given situational requirements.
Great presentation... I haven't slept that well in weeks!
Immordino-Yang, M. & Damasio, A. (2007). We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education. Mind, Brain and Education, 1, 3-10.