

# Emotional Contributions to Developmental Stuttering

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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).

# 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).

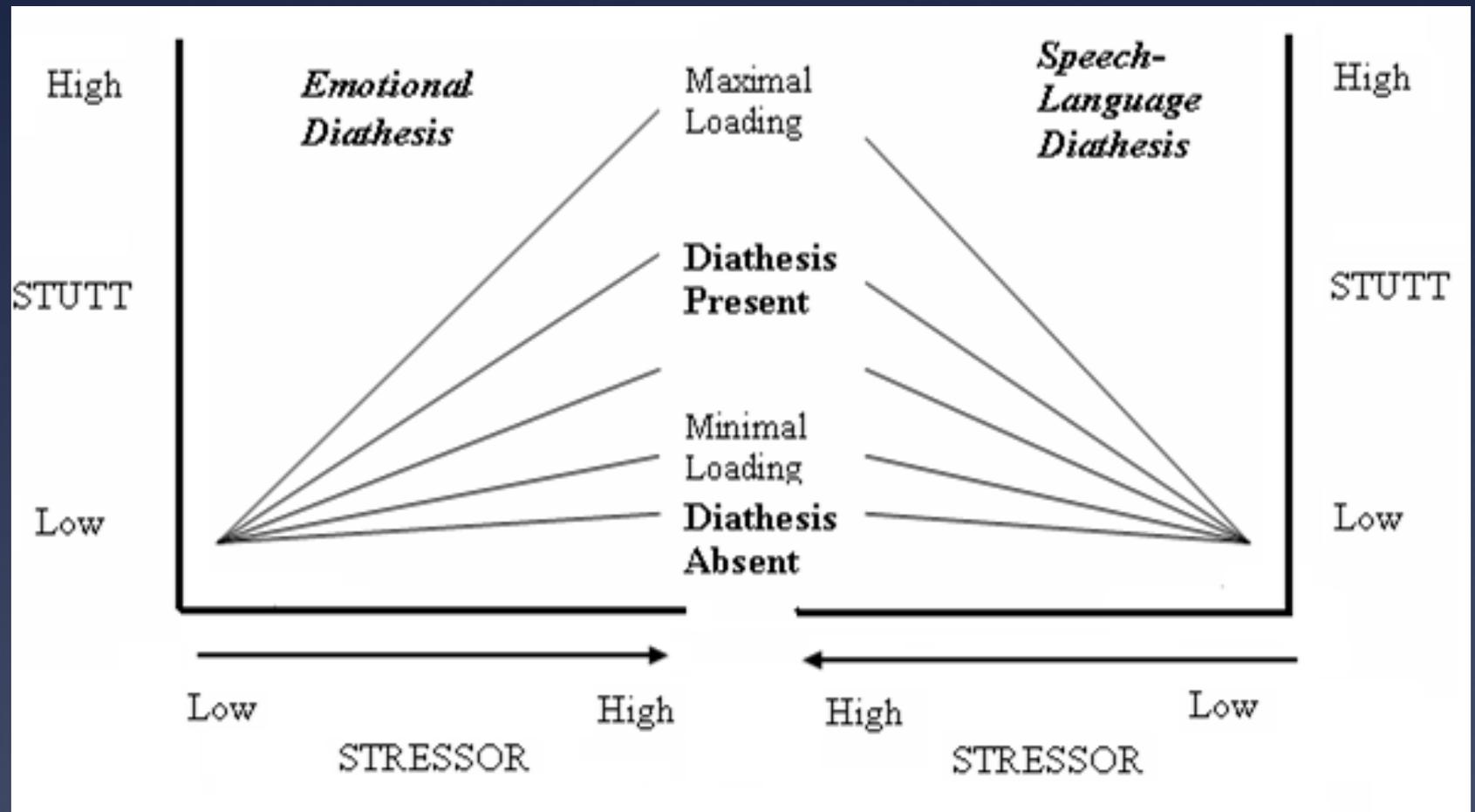
# Stress

- **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

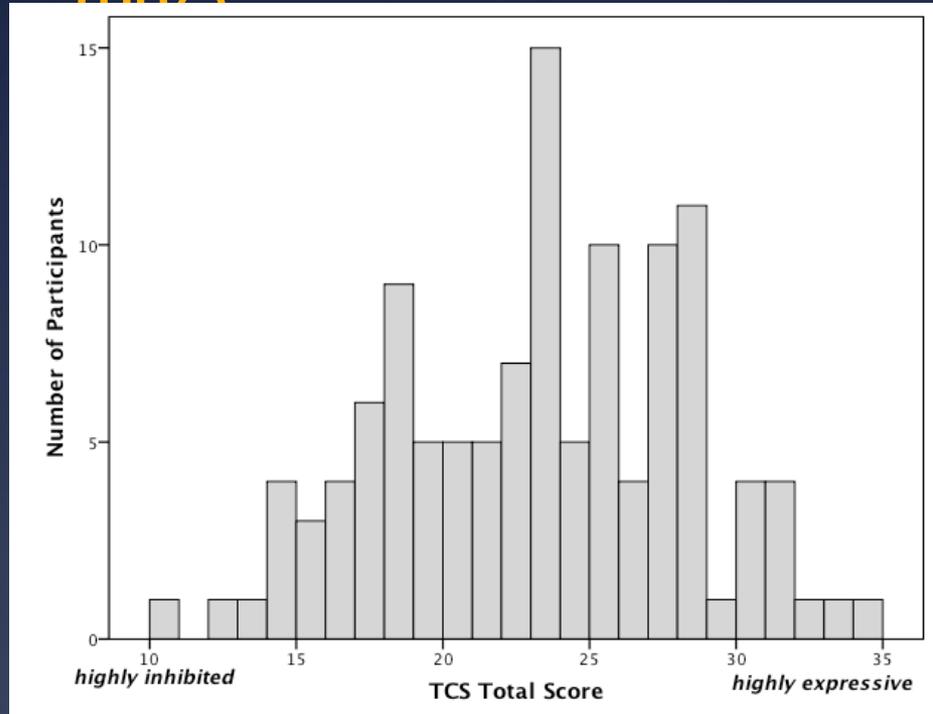
# Part II: Parent report and observational evidence

## a. Temperamental/Trait Emotion: Parent-based report

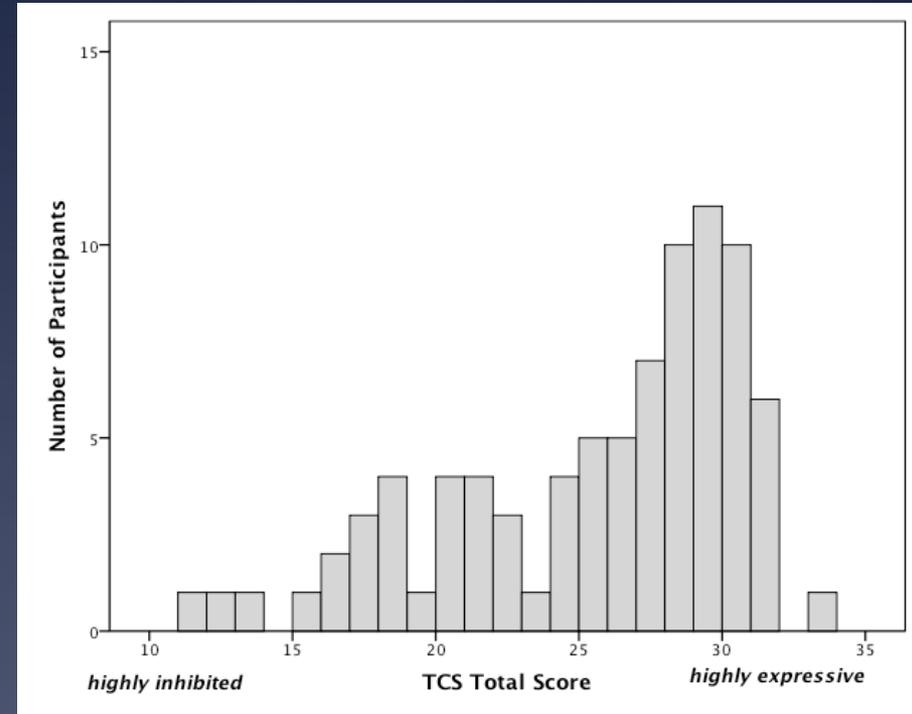
# Vanderbilt's Developmental Stuttering Project: Empirical test DD-S model

- 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, 1997)

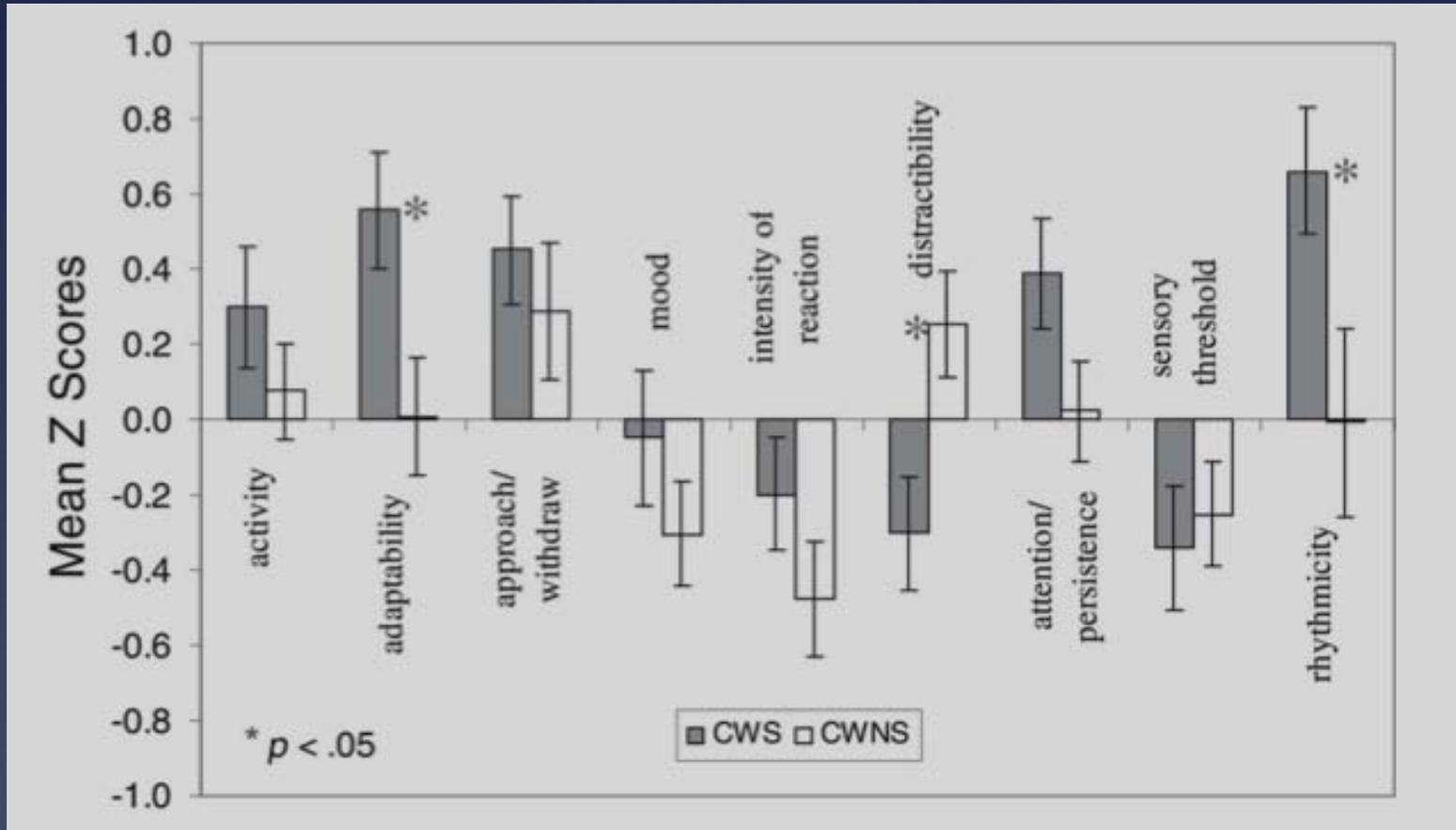


Preschool-age CWS

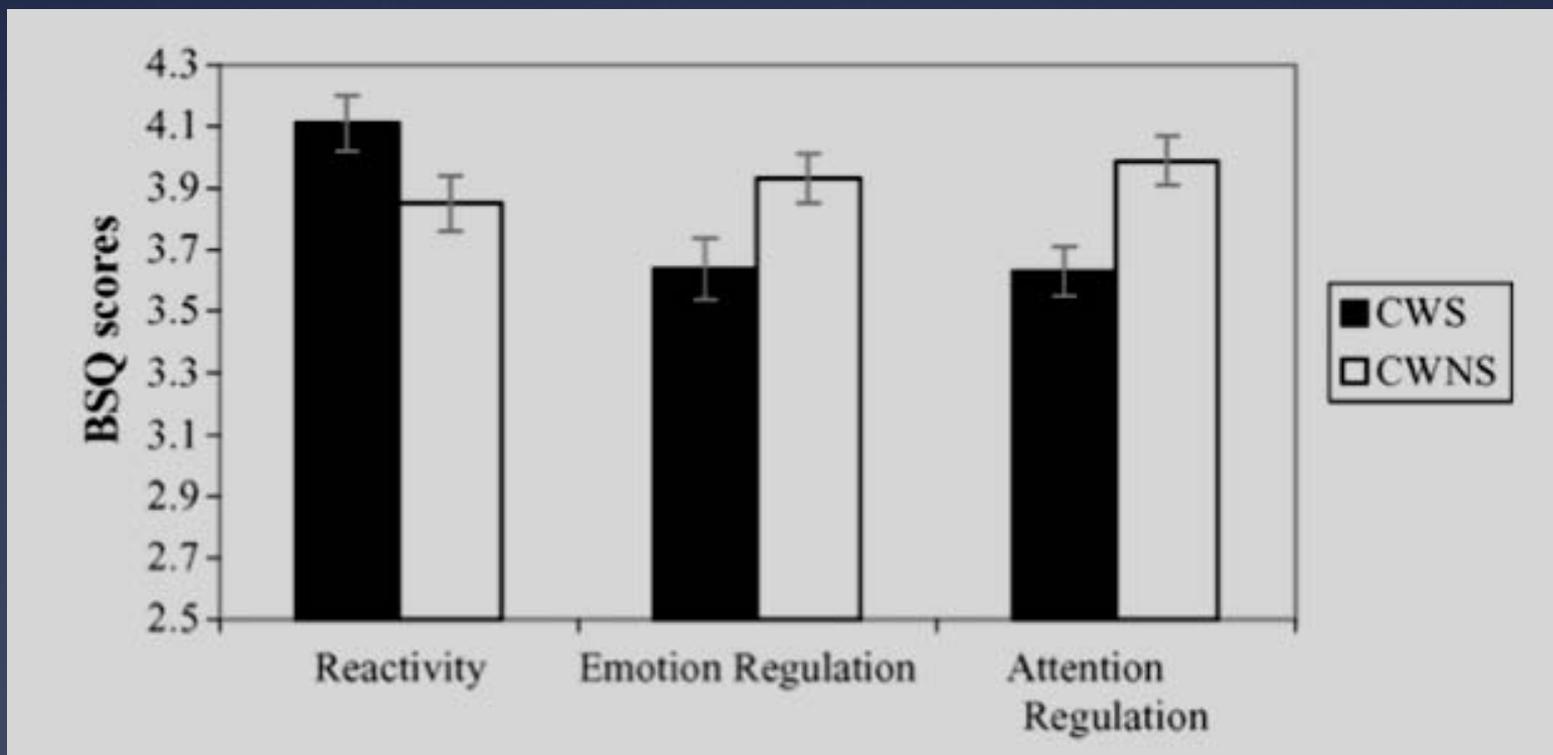


Preschool-age CWNS

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.



Karrass, J. Walden, T. A., Conture, E. G., Graham, C. G., Arnold, H. S., Hartfield, K. N., & Schwenk, K. A. (2006). Relation between emotional activity and regulation to childhood stuttering. *Journal of Communication Disorders*, 39, 402-423.

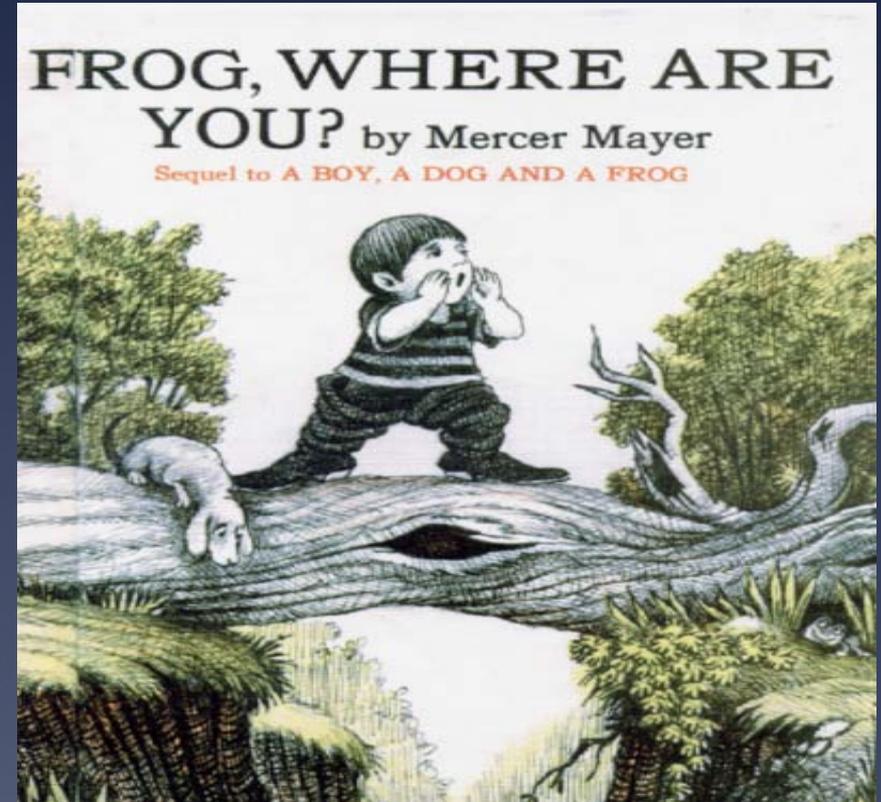
# Temperamental emotion: *What have we learned from parent reports?*

- CWS less **expressive temperaments** than CWNS
- CWS **less adaptable, less distractible, and less rhythmic** than CWNS
- CWS **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

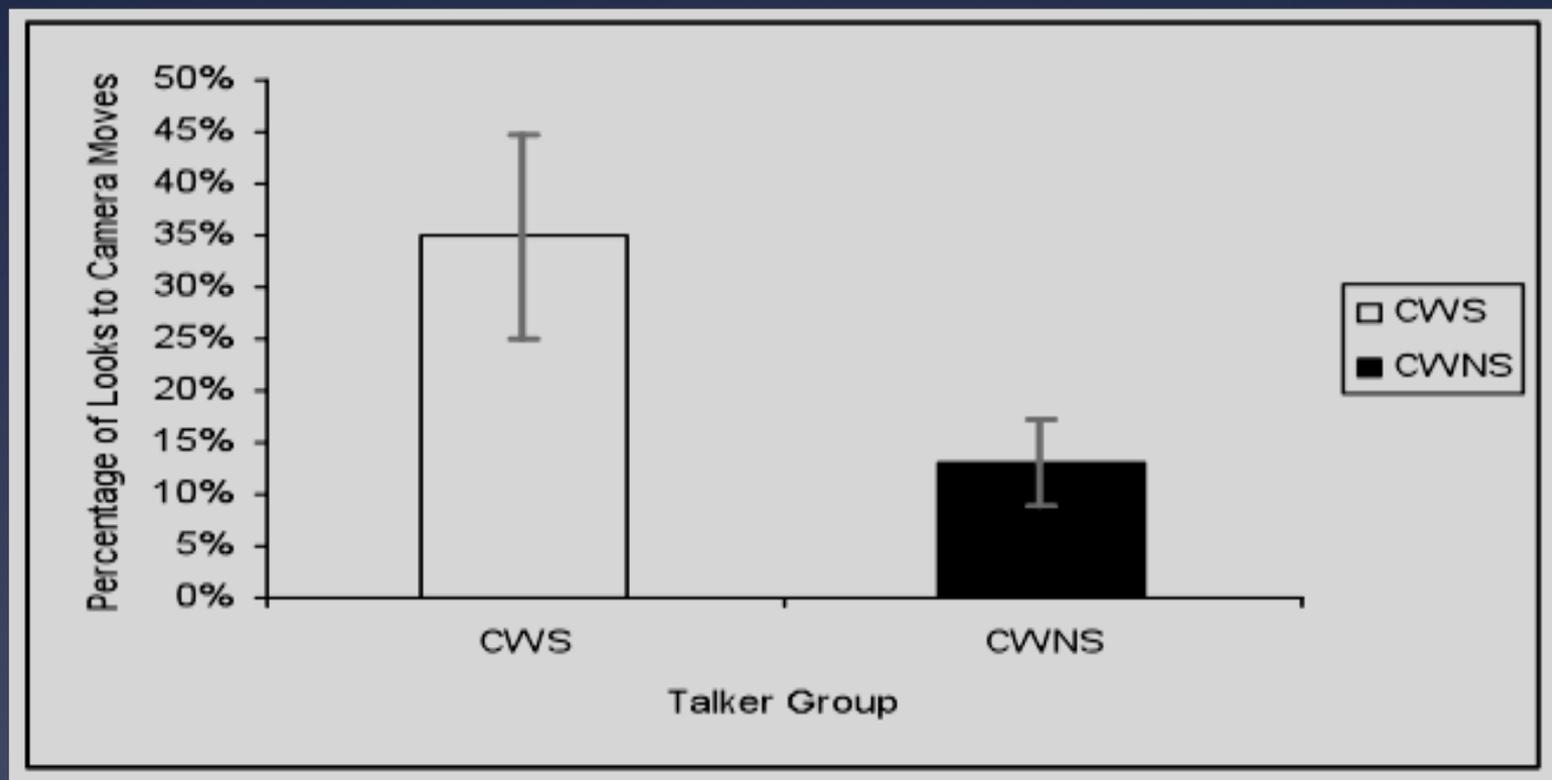


Berman, R. & Slobin, D. (1994). *Relating events in narrative: A crosslinguistic developmental study*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers

# “Jeep” data-collection apparatus

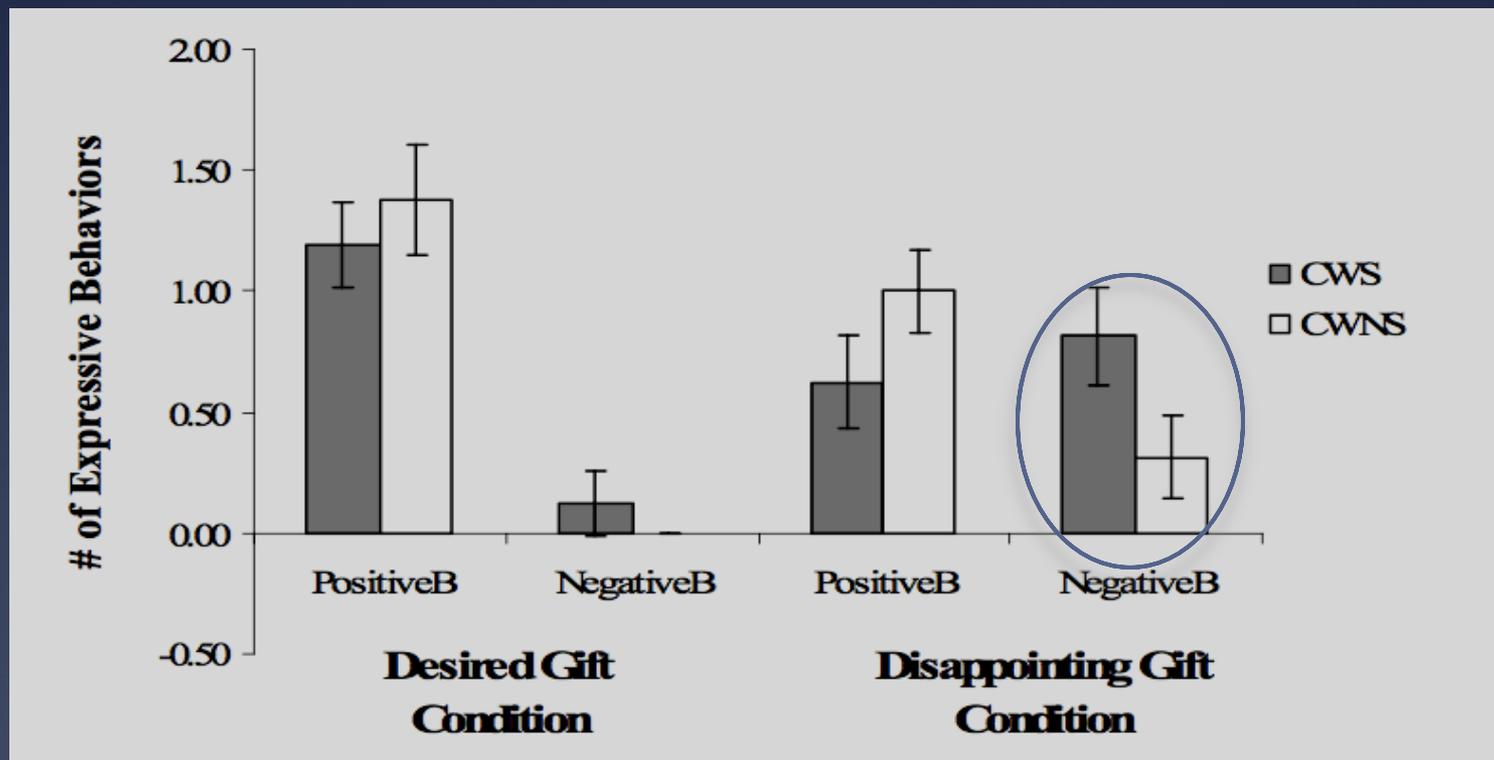


Situational Emotional Responding (observational data):  
CWS (n=13) exhibited greater percentage of looks per camera move during conversation compared to CWNS (n=14).



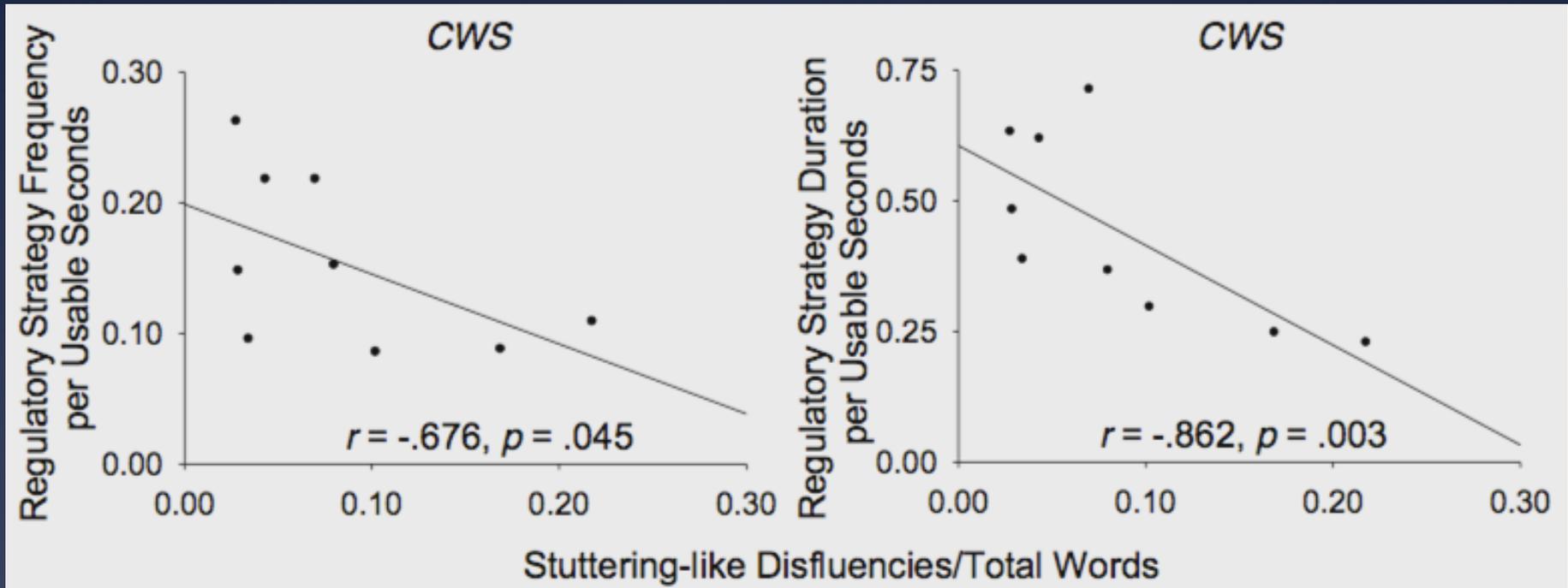
Schwenk, K., Conture, E., & Walden, T. (2007). Reaction to background stimulation of preschool children who do and do not stutter. *Journal of Communication Disorders*, 40 (2), 129-141. PMID: 16876188

**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.



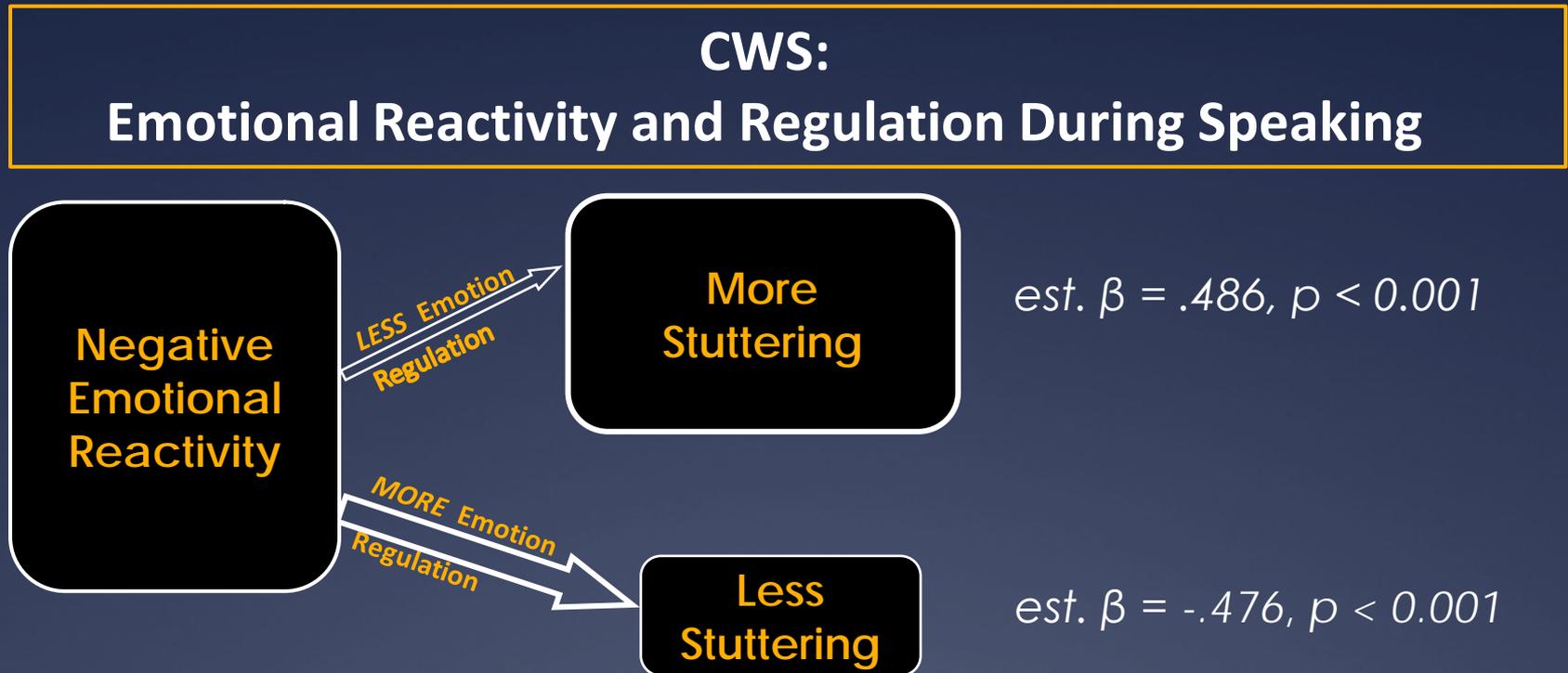
Johnson, K., Walden, T., Conture, E., & Karrass, J. (in press). Spontaneous regulation of emotions in preschool-age children who stutter: Preliminary findings. *Journal of Speech, Language and Hearing Research*.

**Situational emotional Responding (observational data):** For preschool-age CWS (n = 8), increased stuttering was significantly related to decreased regulatory strategy duration ( $r = -.862, p = .003$ ) and regulatory strategy frequency ( $r = -.676, p = .045$ ).



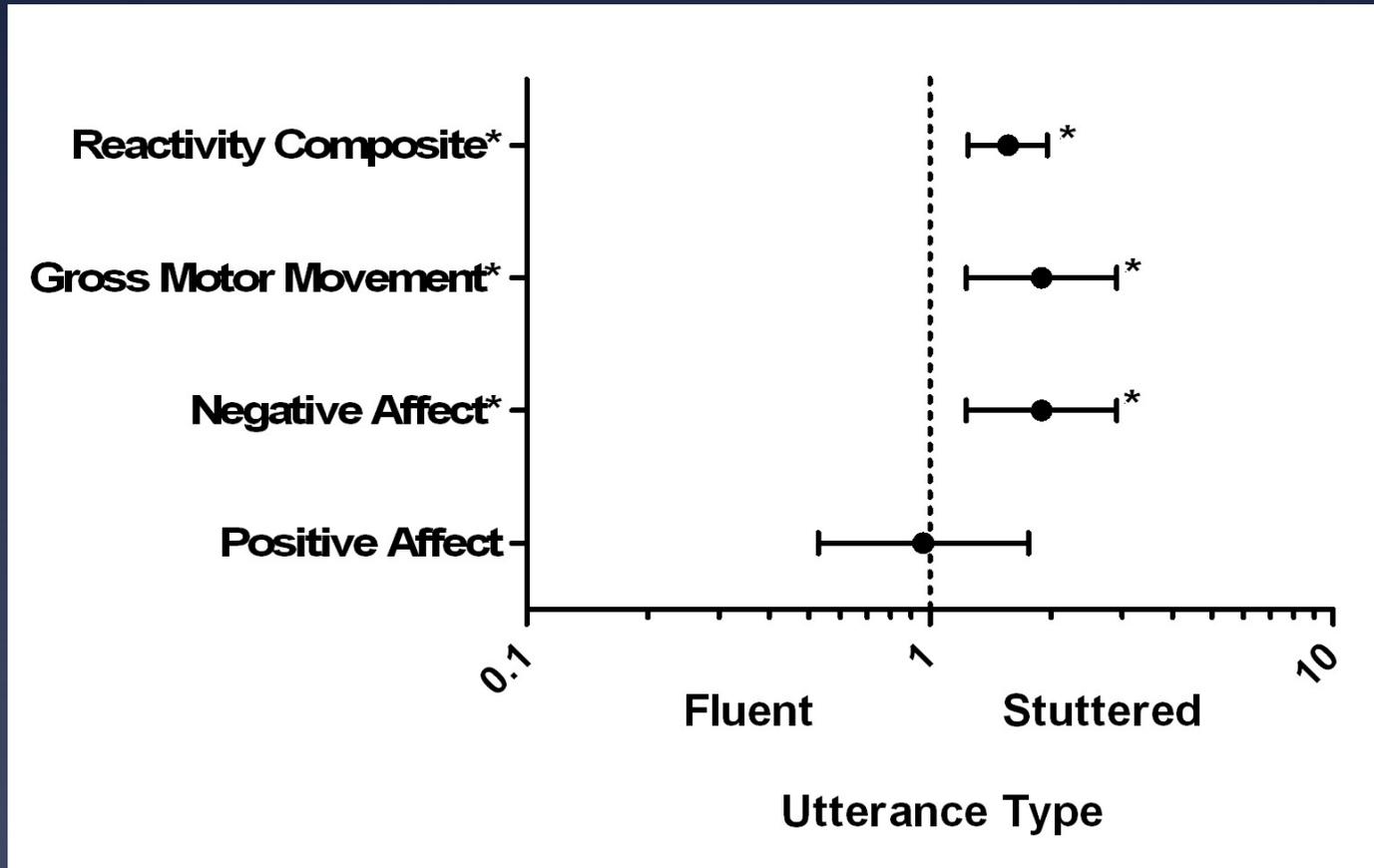
Arnold, H., Conture, E., Key, S., & Walden, T. (2010). **Emotional Reactivity, Regulation and Childhood Stuttering: A Behavioral and Electrophysiological Study**. Revised manuscript submitted for publication.

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



Walden, T. A., Frankel, C. B., Buhr, A. P., Johnson, K. N., Conture, E.G., & Karrass, J. M. (2010). **Dual Diathesis-Stressor Model of Emotional and Linguistic Contributions to Developmental Stuttering**. Manuscript under review.

**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

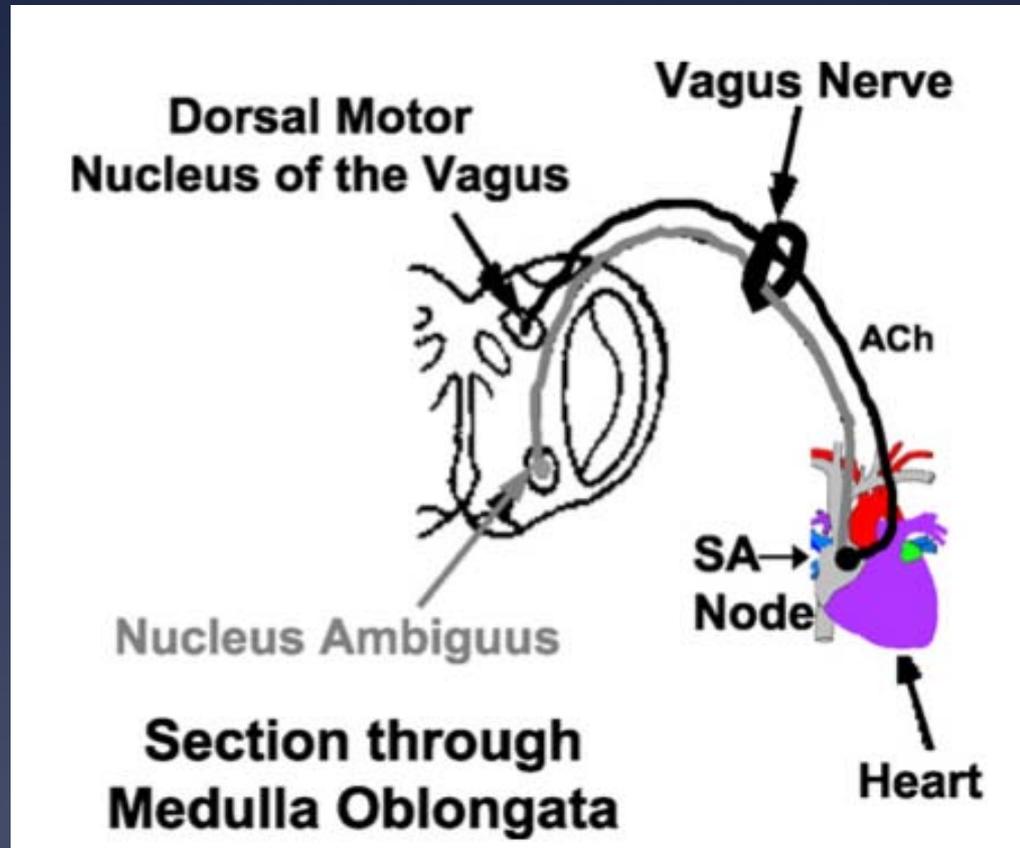
# Part III: Psychophysiological Evidence

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 (10<sup>th</sup> cranial nerve) originates in nucleus ambiguus of brainstem



Grossman, P. & Taylor, E. W. (2007). Toward understanding respiratory sinus arrhythmia: Relations to cardiac vagal tone, evolution, and biobehavioral functioning. *Biological Psychology*, 74, 263-285.

# 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)

|  | ANS Component                                       | Behavioral Function  | Lower motor neurons               |
|--|---|--|-----------------------------------|
|  | Myelinated vagus<br><i>(ventral vagal complex)</i>  | Social communication, self-soothing and calming, inhibit "arousal" | Nucleus ambiguus                  |
|  | Sympathetic-adrenal system                          | Mobilization (active avoidance)                                    | Spinal cord                       |
|  | Unmyelinated vagus<br><i>(dorsal vagal complex)</i> | Immobilization (death feigning, passive avoidance)                 | Dorsal motor nucleus of the vagus |

# Film clips used as “stressors”

Neutral



Negative

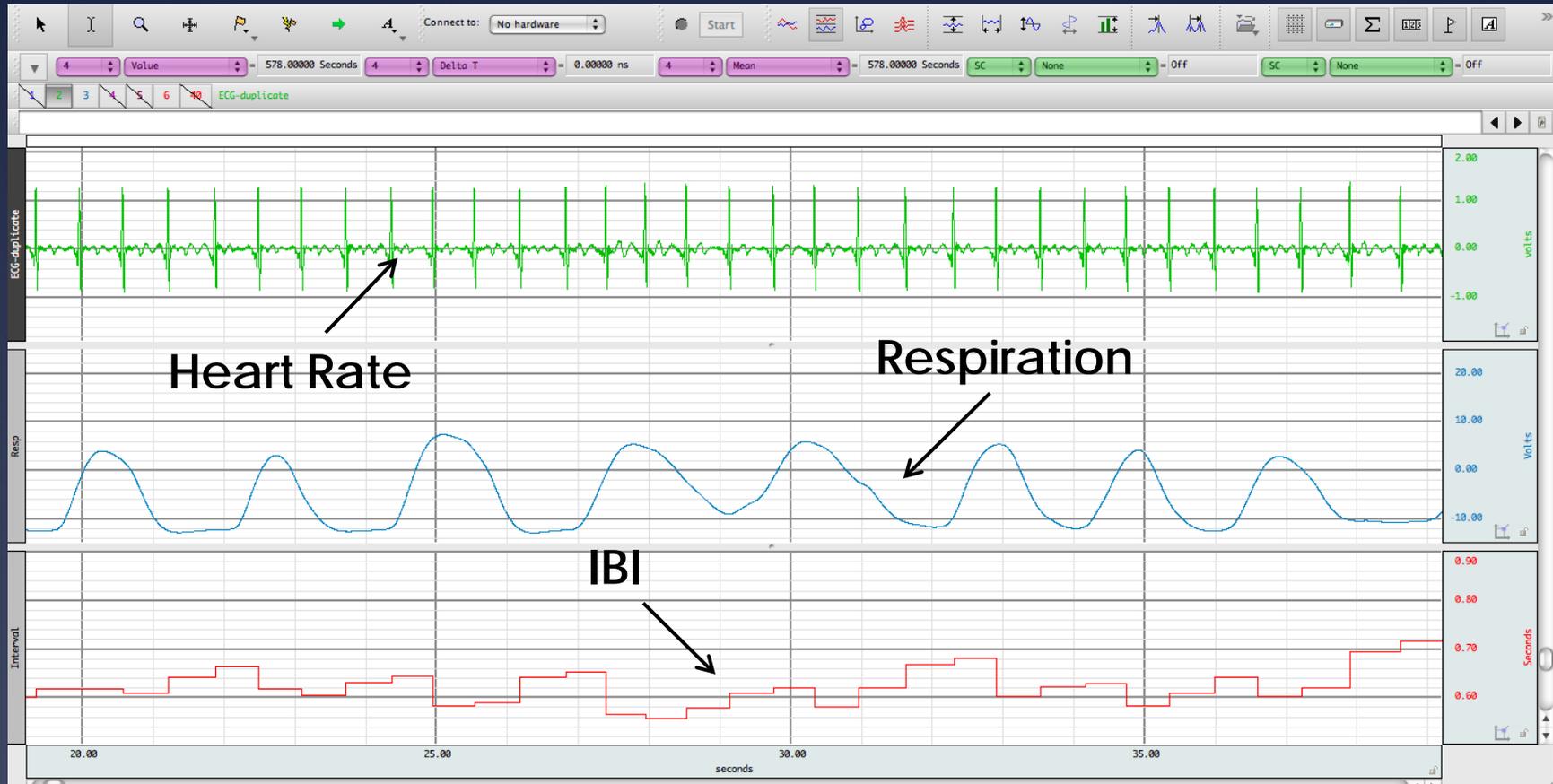


Positive

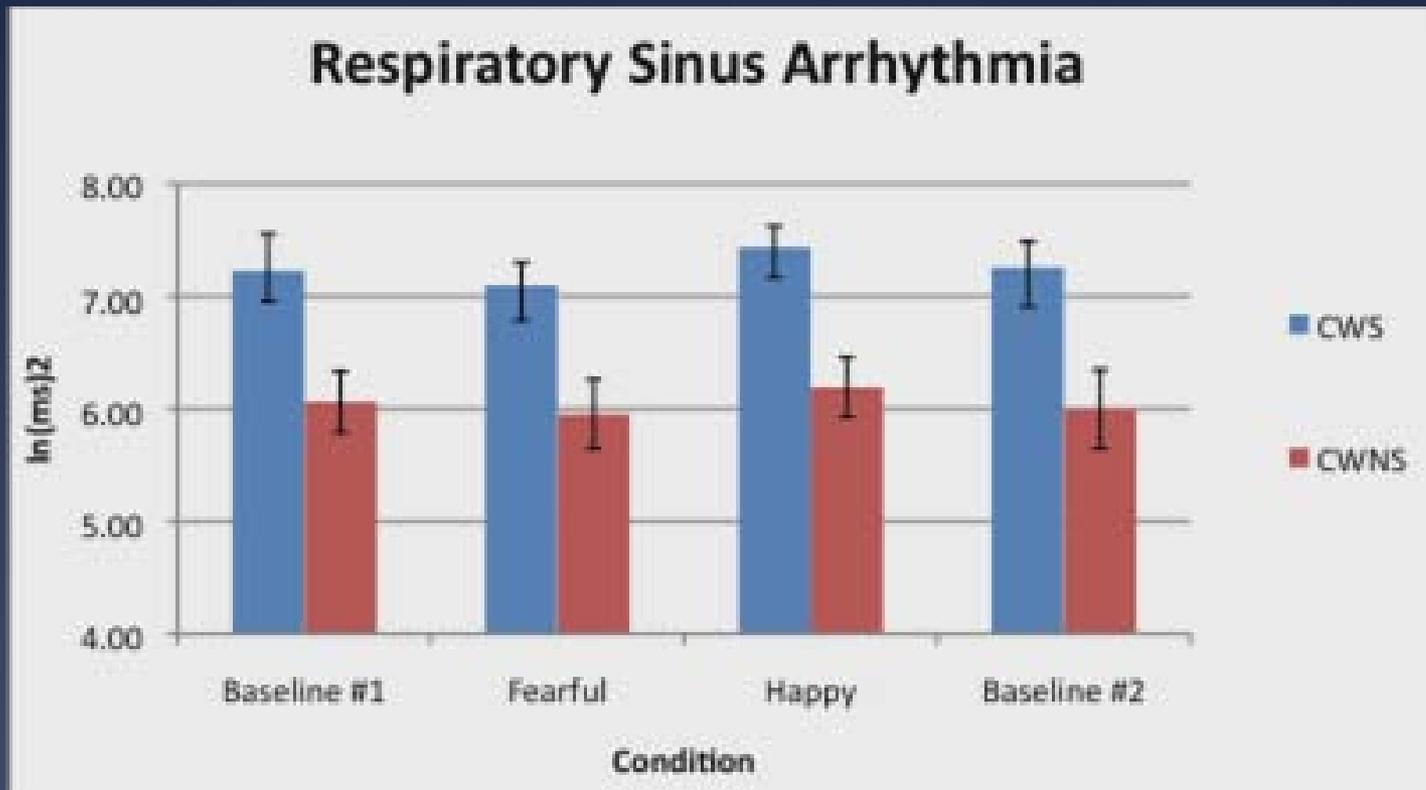


Walt Disney Pictures (Producer), & Allers, R., & Minkoff, R. (Directors). (1994). [Lion King](#). [Motion Picture]. Walt Disney Studios Home Entertainment.

# 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)



Buhr, A. P., Frankel, C. B., Walden, T. A., Conture, E. G., and Porges, S. W. (2010). **Respiratory Sinus Arrhythmia in Childhood Stuttering**. Manuscript in preparation be submitted for publication.

# 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  $\longrightarrow$  Emotion
  - (b) Emotion  $\longrightarrow$  Stuttering
  - (c) Emotion  $\longleftrightarrow$  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 suggests 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.

The End

The End

The End

The End

The End

Great  
presentation  
...I haven't  
slept that well  
in weeks!



# References

- Anderson, J. D., Pellowski, M. W., Conture, E. G., & Kelly, E. M. (2003). Temperamental characteristics of young children who stutter. *Journal of Speech, Language, and Hearing Research*, 46, 1221-1233.
- Arnold, H., Conture, E., Key, S., & Walden, T. (2010). *Emotional Reactivity, Regulation and Childhood Stuttering: A Behavioral and Electrophysiological Study*. Revised manuscript submitted for publication.
- Berman, R. & Slobin, D. (1994). *Relating events in narrative: A crosslinguistic developmental study*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- Biopac Acqknowledge 3.9 [Computer software]. (2007). Goleta, CA: Biopac Systems, Inc.
- Buhr, A. P., Frankel, C. B., Walden, T. A., Conture, E. G., and Porges, S. W. (in preparation). *Respiratory Sinus Arrhythmia in Childhood Stuttering*.
- Cole, P. M., Martin, S. E., and Dennis, T. A. (2004). Emotion regulation as a scientific context: Methodological challenges and directions for Child Development Research. *Child Development*, 75, 317-333.
- Conture, E. & Walden, T. (2010). *Dual diathesis-stress model of stuttering*. Manuscript submitted for publication in a scholarly monograph.
- Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, 130, 355-391.
- Grossman, P. & Taylor, E. W. (2007). Toward understanding respiratory sinus arrhythmia: Relations to cardiac vagal tone, evolution, and biobehavioral functioning. *Biological Psychology*, 74, 263-285.
- 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.
- Johnson, K., Walden, T., Conture, E., & Karrass, J. (in press). Spontaneous regulation of emotions in preschool-age children who stutter: Preliminary findings. *Journal of Speech, Language and Hearing Research*.
- Johnson, W. & Associates (1959). *The Onset of Stuttering*. Minneapolis, MN: University of Minnesota Press.
- Jones, R., Conture, E., & Walden, T. (2010). *Emotional Reactivity and regulation associated with utterances of preschool-age children who stutter*. Manuscript in preparation.
- Karrass, J. Walden, T. A., Conture, E. G., Graham, C. G., Arnold, H. S., Hartfield, K. N., & Schwenk, K. A. (2006). Relation between emotional activity and regulation to childhood stuttering. *Journal of Communication Disorders*, 39, 402-423.
- LeDoux, J. E. (1996). *The emotional brain*. New York: Simon & Schuster.
- Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, 74, 116-143.
- Schwenk, K., Conture, E., & Walden, T. (2007). Reaction to background stimulation of preschool children who do and do not stutter. *Journal of Communication Disorders*, 40 (2), 129-141. PMID: 16876188
- Walden, T. A., Frankel, C. B., Buhr, A. P., Johnson, K. N., Conture, E. G., & Karrass, J. M. (2010). *Dual Diathesis-Stressor Model of Emotional and Linguistic Contributions to Developmental Stuttering*. Manuscript under review.
- Walt Disney Pictures (Producer). & Allers, R., & Minkoff, R. (Directors). (1994). *Lion King*. [Motion Picture]. Walt Disney Studios Home Entertainment.