The Acoustic Startle Response in Relation to Stuttering Severity

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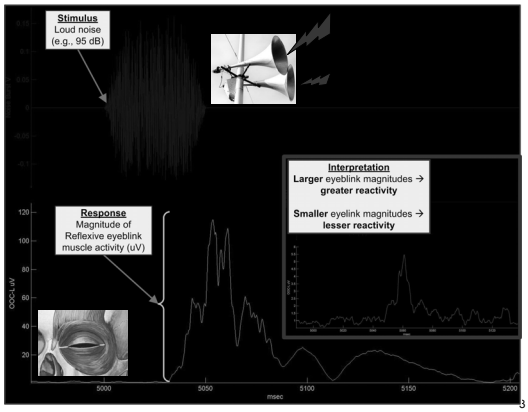
1

Acoustic Startle Eyeblink Response

- Measures physiological aspects of temperament
  - e.g., Kagan, J., & Snidman, N. (2004). *The long shadow of temperament.* Cambridge, MA: Belknap Press.
- **Stimulus:** Loud, unexpected noise
- **Response:** Reflexive eyeblink
- **Measurable:** *Orbicularis oculi* muscle activity
  - Brief, loud white noise burst
  - Stronger blinks → higher levels of neurophysiological reactivity or sensitivity
  - e.g., M. Dawson, A. Schell, & A. Bohmelt (Eds.), *Startle modification: Implications for neuroscience, cognitive science, and clinical science* (pp. 245-26). New York: Cambridge University Press.

2



3

Previous Findings

- Guitar (2003) reported group differences in acoustic startle response magnitudes.
  - Both the **initial** and **average magnitudes of acoustic startle** were **larger** in the stuttering group.
  - Guitar, B. (2003). Acoustic startle responses and temperament in individuals who stutter. *Journal of Speech, Language, and Hearing Research. 46*, 233-240.
- Results supported the notion that individuals who stutter, as a group, may display **a more reactive, or sensitive, temperament.**

4

Previous Findings

- Alm and Risberg (2005) **did not find** significant group differences in **acoustic startle magnitude,** despite having adequate power (0.93).
  - Also reported **nonsignificant differences** in **median latency** of acoustic startle response.
  - Alm, P. A., & Risberg, J. (2005). Stuttering in adults: The acoustic startle response, temperamental traits, and biological factors. In P. Alm, *On the Causal Mechanisms of Stuttering* (Doctoral dissertation, Lund University, 2005).
- Results indicated that increased reactivity and a sensitive temperament **may not be core features** of stuttering.

5

Our Hypotheses

- To examine the possible effects of **stuttering severity** on the **acoustic startle response**.
  - Do more severe stutterers display a larger (and perhaps faster) acoustic startle response?

Predictions:

- Stuttering status would significantly impact the (a) **magnitude** and (b) **onset latency** of the reflexive eye blink response.

6

Participants

	N	Males	Females	Mean Age	S.D. Age
Nonstutterers	10	8	2	33.0	10.9
Mild Stutterers	10	8	2	38.6	11.9
Moderate/Severe Stutterers	10	9	1	34.6	12.1

	Correlation	Sig.
Stuttering Status X ***SSI-3* Score**	0.90	< 0.01
Stuttering Status X ***PSI***	0.73	< 0.01
Stuttering Status X **Fluency Self-Rating**	0.68	< 0.01

- ***SSI-3:*** *Stuttering Severity Instrument-Third Edition* (Riley, 1994)
- ***PSI:*** *Perceptions of Stuttering Inventory* (Woolf, 1967)
- **Fluency self-rating:** 9-point Likert scale
  (1) "relatively fluent" to (9) "severe stuttering"

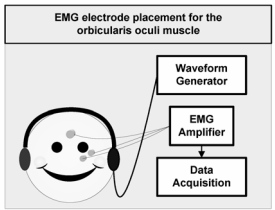
7

Procedures

- ✓ Pure-tone hearing screening
- ✓ No concomitant neurological, psychological, or speech-language disorders (other than stuttering)
- ✓ No medications 24 hours prior to data collection
- ✓ Prep skin areas and affix EMG electrodes….

8

EMG Electrode Placement



- ✓ Two electromyographic (EMG) electrodes placed 2 cm apart under left eye
  - ✓ EMG ground electrode placed on forehead
- ✓ Electrode impedance < 5000 Ω
- ✓ Acoustic startle stimuli
  - ✓ Identical to Guitar (2003) stimuli
  - ✓ 95.0 dB SPL white noise
  - ✓ Ten stimulus trials presented 20 to 30 seconds apart

9

Exploratory Correlations

- All Pearson correlations between the previous acoustic startle measures and (a) stuttering status, (b) *SSI-3* scores, (c) *PSI* scores, and (d) fluency self-ratings were **statistically nonsignificant** ($p > 0.05$).
- In our study, differences in acoustic startle responses were **unrelated to any measures** of stuttering or its severity.

10

Conclusions & Discussion

- Our results may be interpreted in 1 of 2 ways:
  1. **Stuttering severity** fails to predict **magnitudes** or **onset latencies** of the acoustic startle response.
     - i.e., No statistically significant relationship exists.
  2. Our study simply **failed to discriminate** a possible relationship between these variables that may exist.
     - Less likely given Alm & Risberg's results (2005).
     - Post hoc analysis: Even when all stutterers are pooled into a single group, **no significant differences** were found in comparison with nonstuttering controls.

11

Conclusions & Discussion

- In normal subjects, **extreme** subject-to-subject (and within-subject) **variability** in startle magnitude during both childhood and adulthood is a **common** feature (Ornitz, 1999, p. 254).
  - In general, 10% of people **fail to show any** startle response to very intense stimuli.
  - Ornitz, E. M. (1999). Startle modification in children and developmental effects. In M. Dawson, A. Schell, & A. Bohmelt (Eds.), *Startle modification: Implications for neuroscience, cognitive science, and clinical science* (pp. 245-26). New York: Cam-bridge University.
- In conclusion, á la Alm & Risberg (2005), our data **do not support** the view that increased neuromuscular reactivity—at least as measured by the acoustic startle response—typically characterizes stuttering.

12