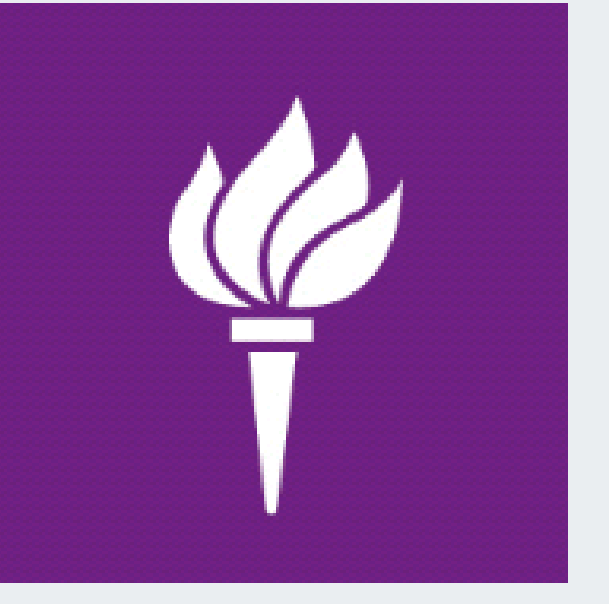


Perceptual Characteristics of Children with Rhotic Misarticulation



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Introduction

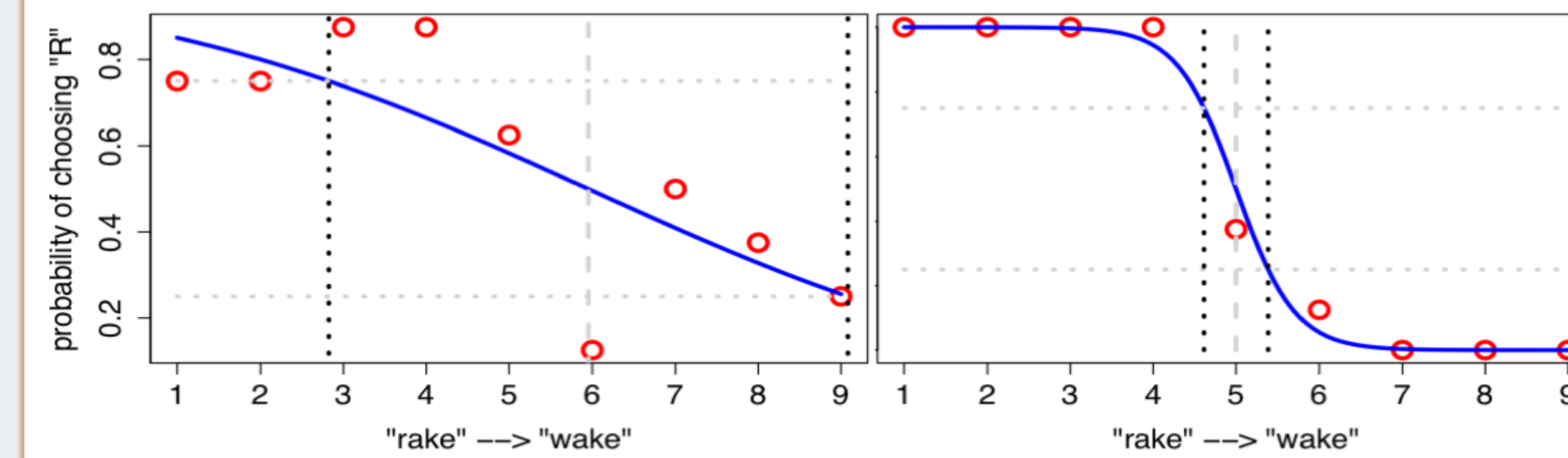
- English /r/ is typically acquired by age 8 [1]; children over 8 who misproduce /r/ may be diagnosed with residual speech errors (RSE).
- English /r/ may be difficult to produce for many reasons: complex articulatory configuration [2], variability in tongue shapes across and within individuals, **perceptual deficits in differentiating accurate vs inaccurate productions of /r/**.
- Previous research indicates children with speech production deficits can exhibit perceptual difficulties compared to typically developing children [3]. Children with RSE tend to show reduced perceptual acuity for the sound(s) they produce inaccurately [4,5].
- Recent research shows that biofeedback-enhanced treatment can eliminate RSEs affecting /r/ in some individuals; however, most studies also report non-responders to biofeedback intervention [6,7,8].
- If there are subtypes within the RSE population (e.g., individuals with and without auditory-perceptual deficits), could explain some heterogeneity in response to biofeedback

Questions

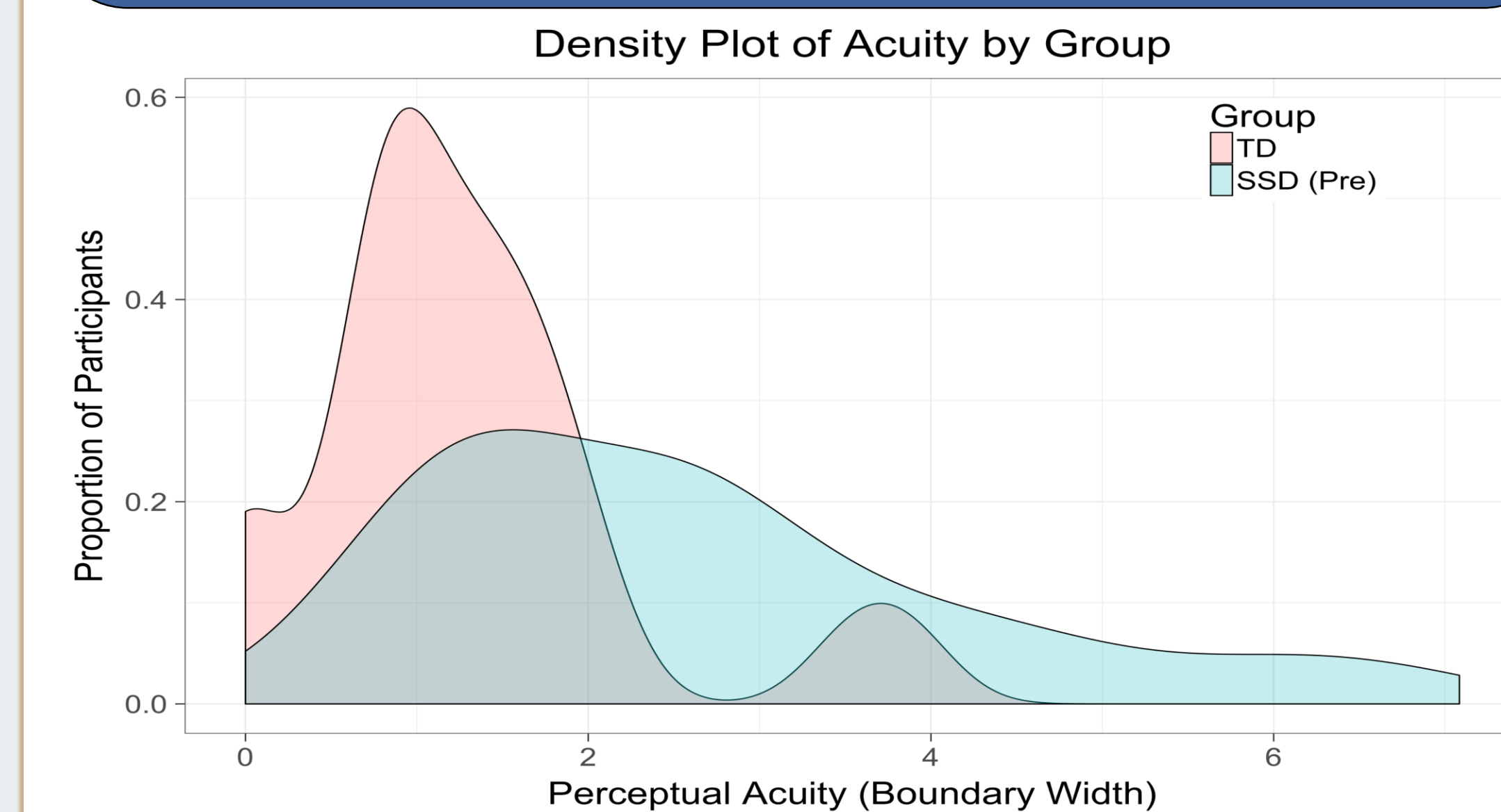
- Does perception of /r/ differ across children with RSEs vs typically developing children?
- Is there a relation between perception and production of /r/ in children with RSEs before treatment?
- Does perceptual acuity at baseline predict magnitude of response to biofeedback treatment (heterogeneous, pooled across studies) in children with RSE affecting /r/?

Methods

- Data pooled across multiple sites: New York University, Syracuse University, Haskins Laboratories, University of Cincinnati
- Experimental group: N = 62** children aged 9-15 with RSE affecting /r/
 - All received biofeedback treatment, but heterogeneous in type (visual acoustic or ultrasound) and duration.
- Control group: N = 53** age-matched controls
- Perceptual acuity measure [9]:
 - Synthesized nine-step continuum between /r/ and /w/ (*rake-wake*), presented 8 times each.
- Auditory acuity measured as width of fitted probit function from 25th to 75th percentile of probability. **Wider boundary reflects less acute perception for /r/** [10].
- RSE group produced standard /r/ stimulability probe [11] both before and after treatment.



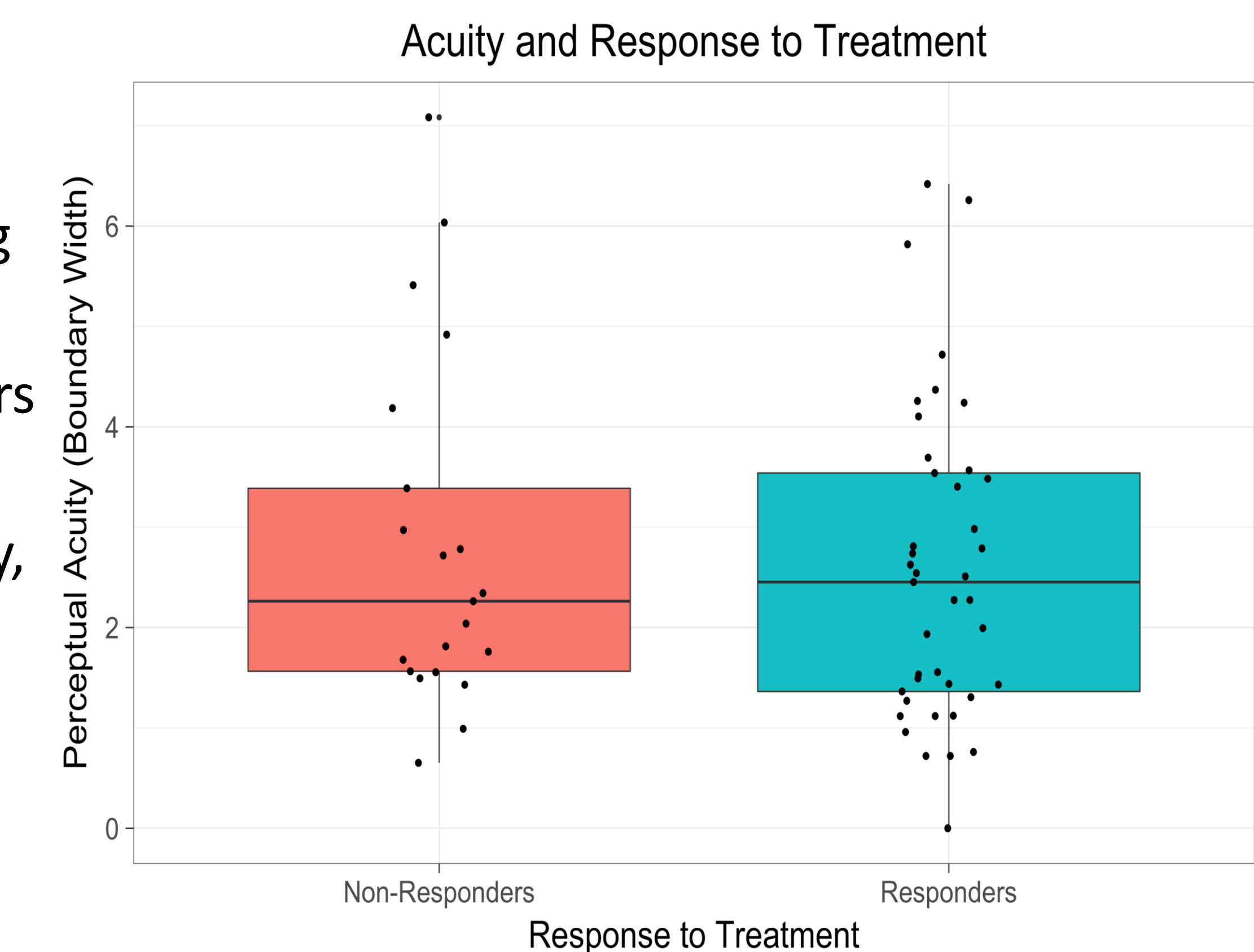
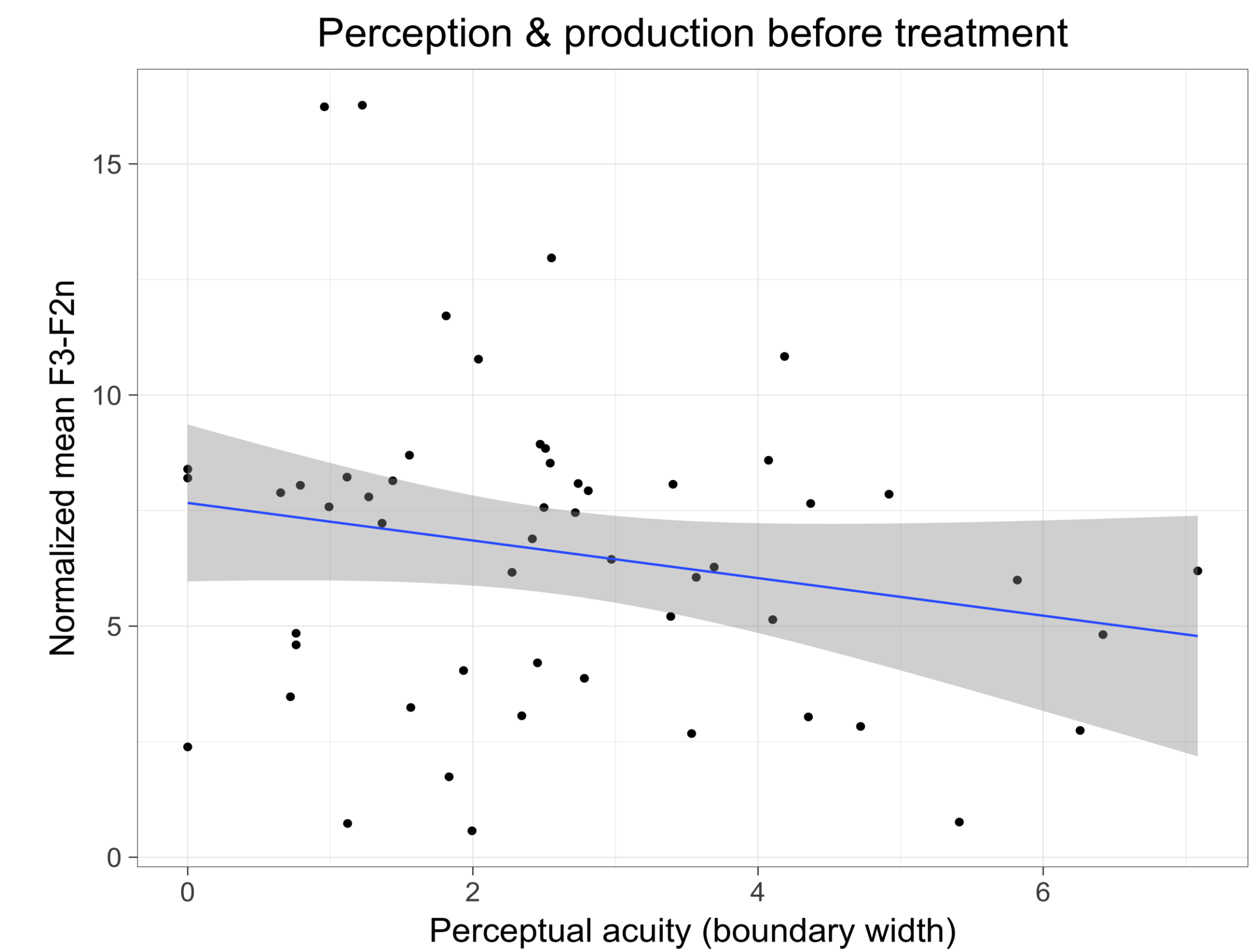
Perceptual Results



- TD group had narrower mean boundary width than RSE group, indicating **more acute perception**, $t(101.24) = -5.21$, $p < 0.0001$.
- Overlapping distributions indicate that some children with RSE show high acuity and some TD children show poor acuity.

Predictors of BL Severity & Response to Biofeedback

- Linear regression was used to test for an association between perceptual acuity for /r/ (measured by boundary width) and severity of /r/ misarticulation at baseline (measured by mean F3-F2 distance) in RSE group.
- Results indicated **no significant association** between perceptual acuity for /r/ and baseline severity of /r/ misarticulation among children with RSE ($\beta = -0.39$, $SE = 0.26$, $p = 0.14$).
- Logistic regression was used to test for an association between perceptual acuity and response to biofeedback treatment.
- Due to heterogeneity of treatment, participants were coded as responders/non-responders.
 - Effect size of change in acoustics of /r/ from baseline to post-treatment was quantified using classical Cohen's d.
 - Cut-off between responders and non-responders was set at 1.0 [12]
- Independent variables: baseline perceptual acuity, baseline stimulability, sex, and age.
- Results indicated **no significant association** between baseline acuity and likelihood of response to biofeedback treatment in children with RSE ($\beta = -0.18$, $SE = 0.18$, $p = 0.30$).



Discussion

- Group difference in /r/ perception between children with RSE affecting /r/ and typically developing children is consistent with previous literature.
 - Children tend to show perceptual deficits affecting the same sounds they misproduce.
- Contrary to hypothesis, there was no relationship between perceptual acuity and production at baseline.
 - Speech sound disorders are multifactorial; auditory acuity is not the only potential predictor driving severity.
 - Other predictors, like somatosensory acuity, should be examined as well.
- Likewise, we found no relationship between baseline perceptual acuity and response to biofeedback treatment in children with RSE.
- However, biofeedback in the present multi-site study was heterogeneous in nature. Perceptual acuity may only predict response to a specific type of biofeedback (e.g., visual-acoustic).

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