Comparing Biofeedback Types for Children with Residual Speech Production Errors on /ɹ/
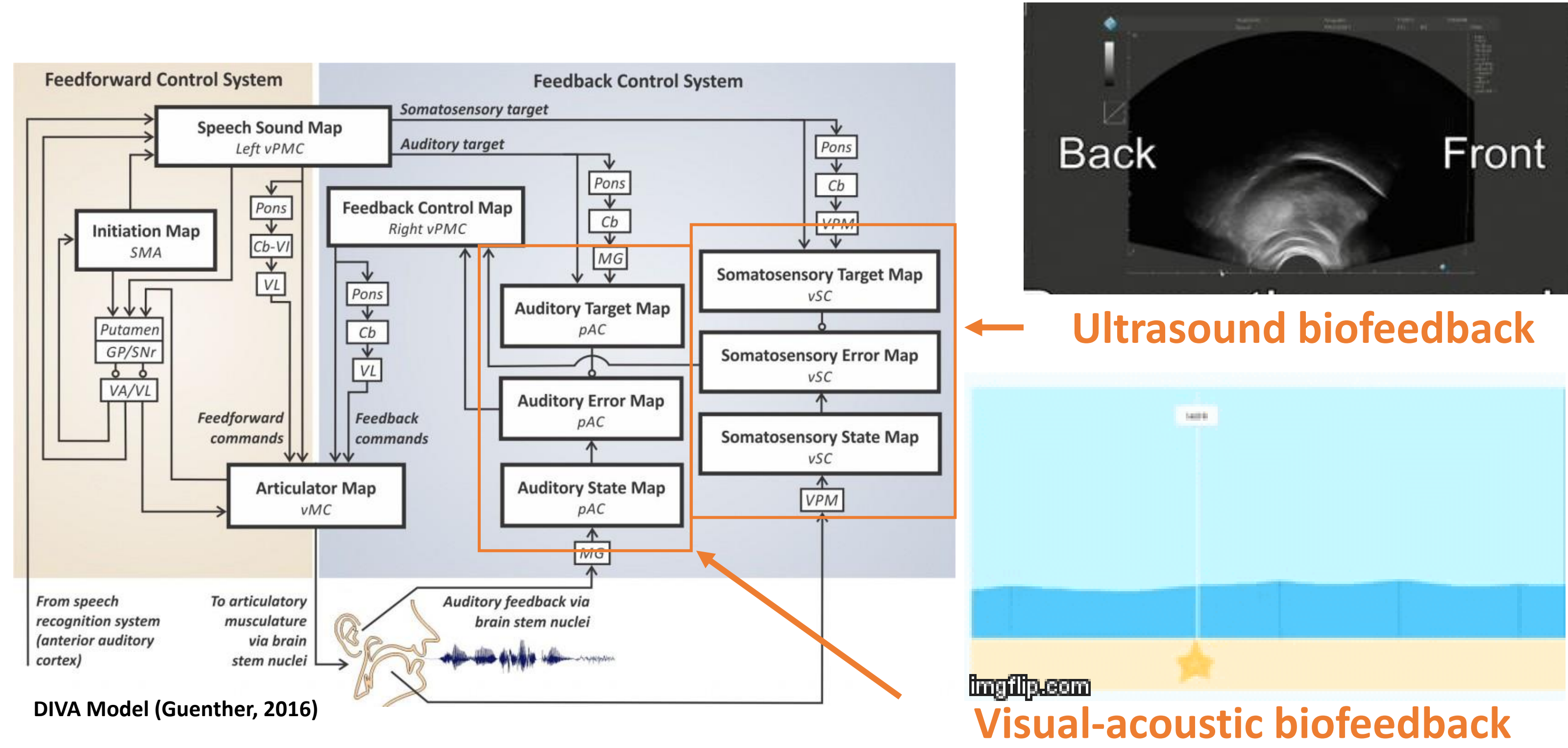
Nina R. Benway[1], Tara McAllister[2], Elaine Hitchcock[3], and Jonathan L. Preston[1,4]
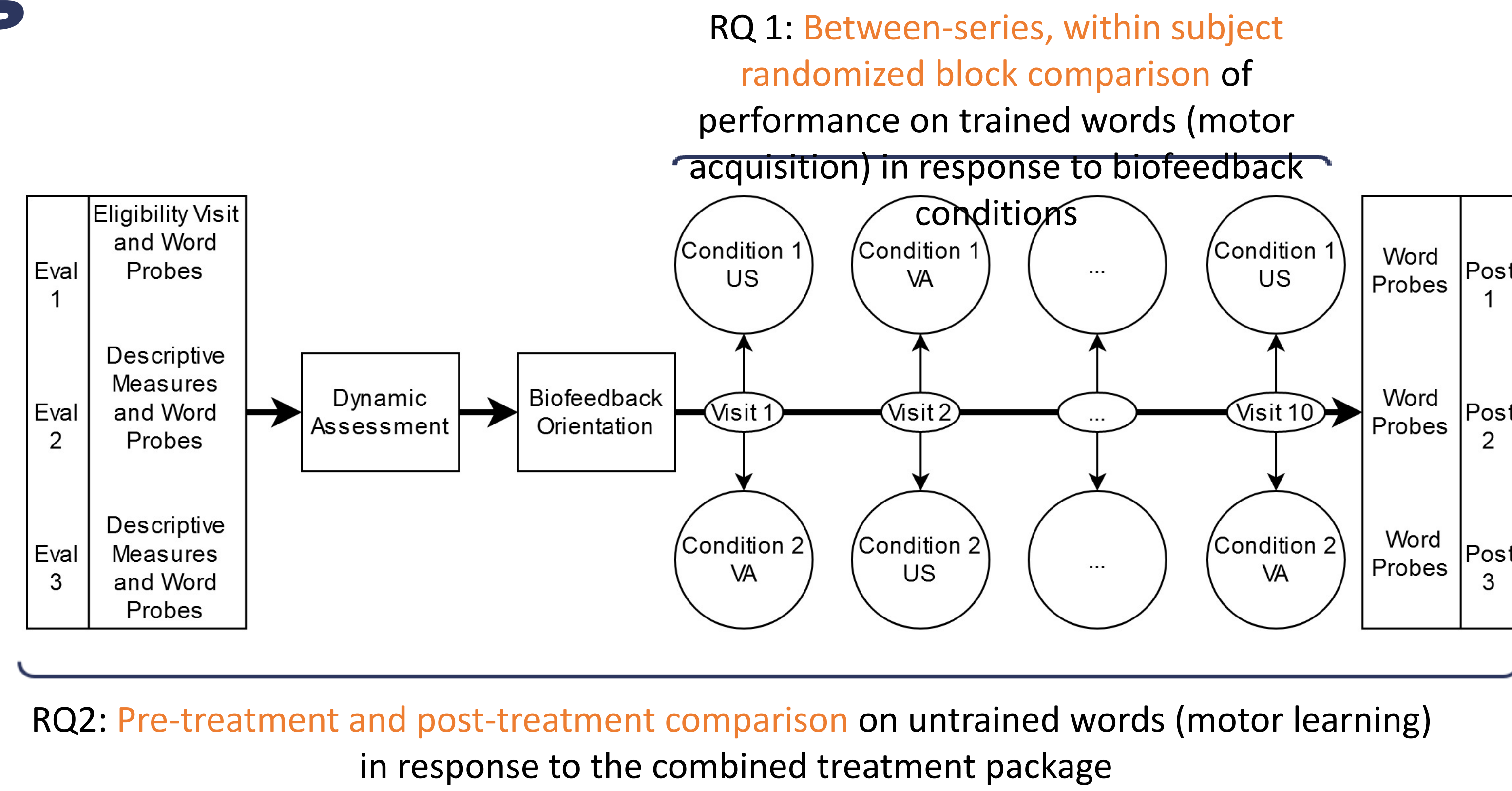
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Hypothesized Relationship between Biofeedback & Speech Motor Learning

DIVA Model (Guenther, 2016)

Ultrasound biofeedback

Visual-acoustic biofeedback

Study Design

RQ 1: Between-series, within subject randomized block comparison of performance on trained words (motor acquisition) in response to biofeedback conditions

RQ2: Pre-treatment and post-treatment comparison on untrained words (motor learning) in response to the combined treatment package

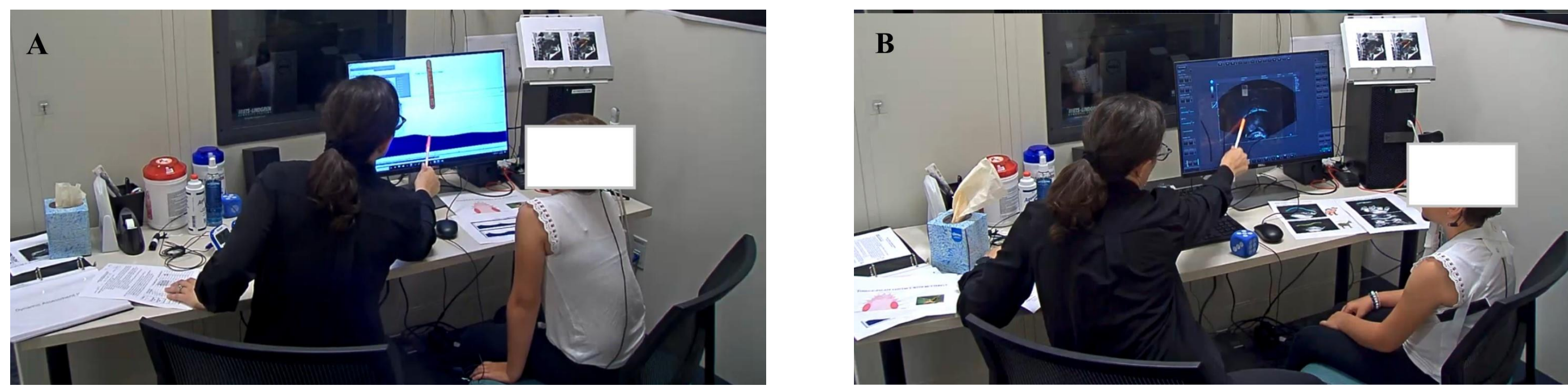## Participants

Participant	Age	Sex	Average Baseline Probe Percent Correct	WASI-II T Score	GFTA™-3 Standard Score	SRT PCC	SRT Additions	LAT Inconsistency Score	Auditory Perceptual Acuity	Articulatory Awareness Task	Speech Mindset Scale
3101	9;9	F	1	40	56	88	1	0	-0.43	-0.44	26
3102	11;10	M	6.33	37	51	84	0	0	-2.36	0.75	20
3104	9;9	F	0	55	57	100	1	0	-0.97	-0.44	28
6102	15;8	F	0	65	40	88	0	2	-4.3	-0.44	20
6103	14;11	M	0	42	40	100	0	0	-0.22	-2.11	27
6104	9;5	F	0.33	52	40	96	0	1	-3.4	-2.11	16
6108	14;6	M	0	44	40	100	1	2	0.12	-1.87	23

Note. WASI-II = Wechsler Abbreviated Scales of Intelligence – Second Edition Matrix Reasoning subtest (Wechsler, 2011). GFTA™-3 = Goldman-Fristoe Test of Articulation – Third Edition (Goldman & Fristoe, 2015), SRT = Syllable Repetition Task (Shriberg et al., 2009), PCC = Percent Consonants Correct, LAT = LinguiSystems Articulation Test - Normative Update (Bowers & Huisingh, 2018).
Auditory-perceptual acuity and articulatory awareness are presented as z-scores, with auditory-perceptual acuity reverse coded such that higher scores represent better acuity. These are experimenter-derived tasks, along with the Speech Mindset Scale, and are available on OSF.
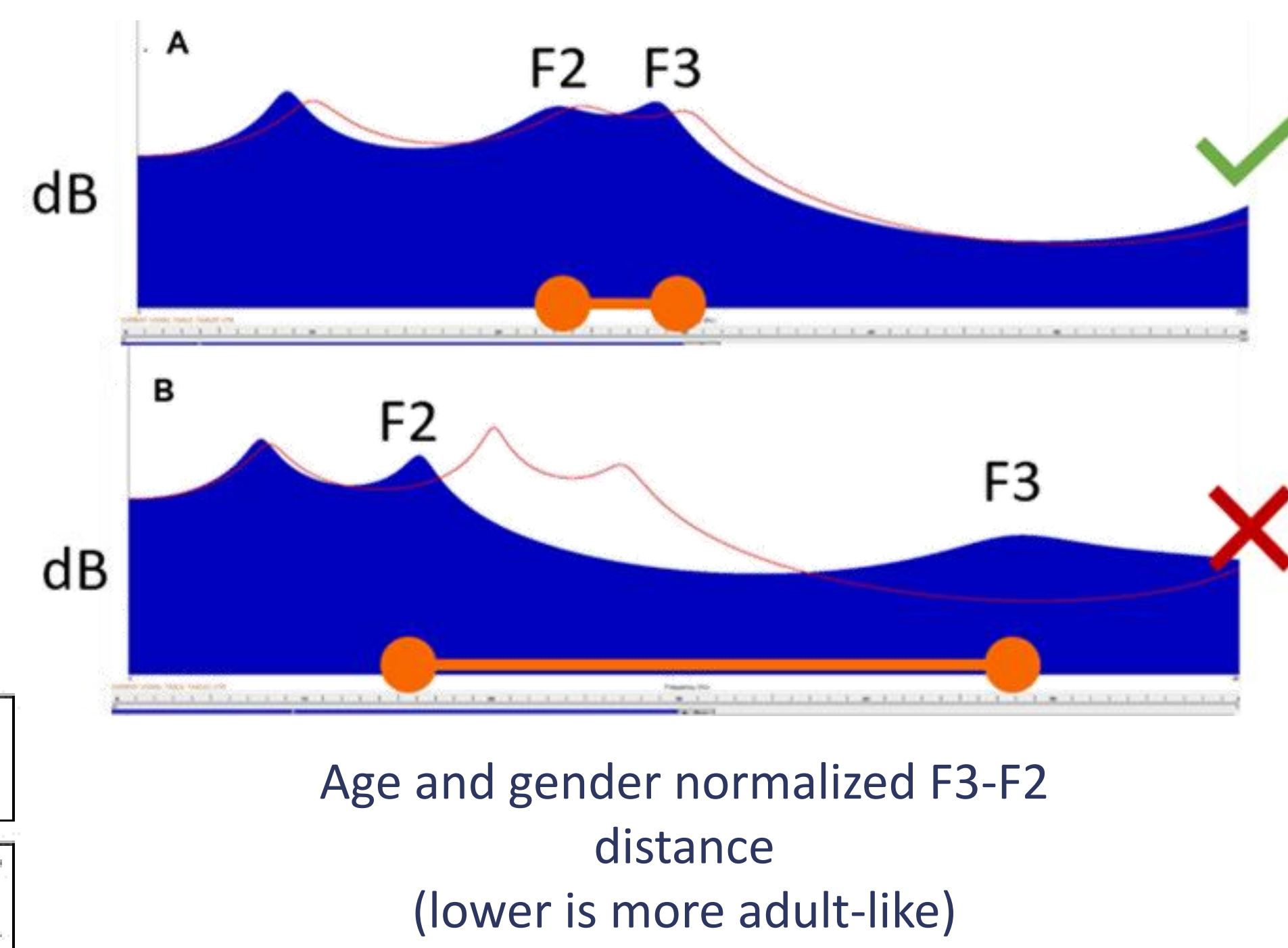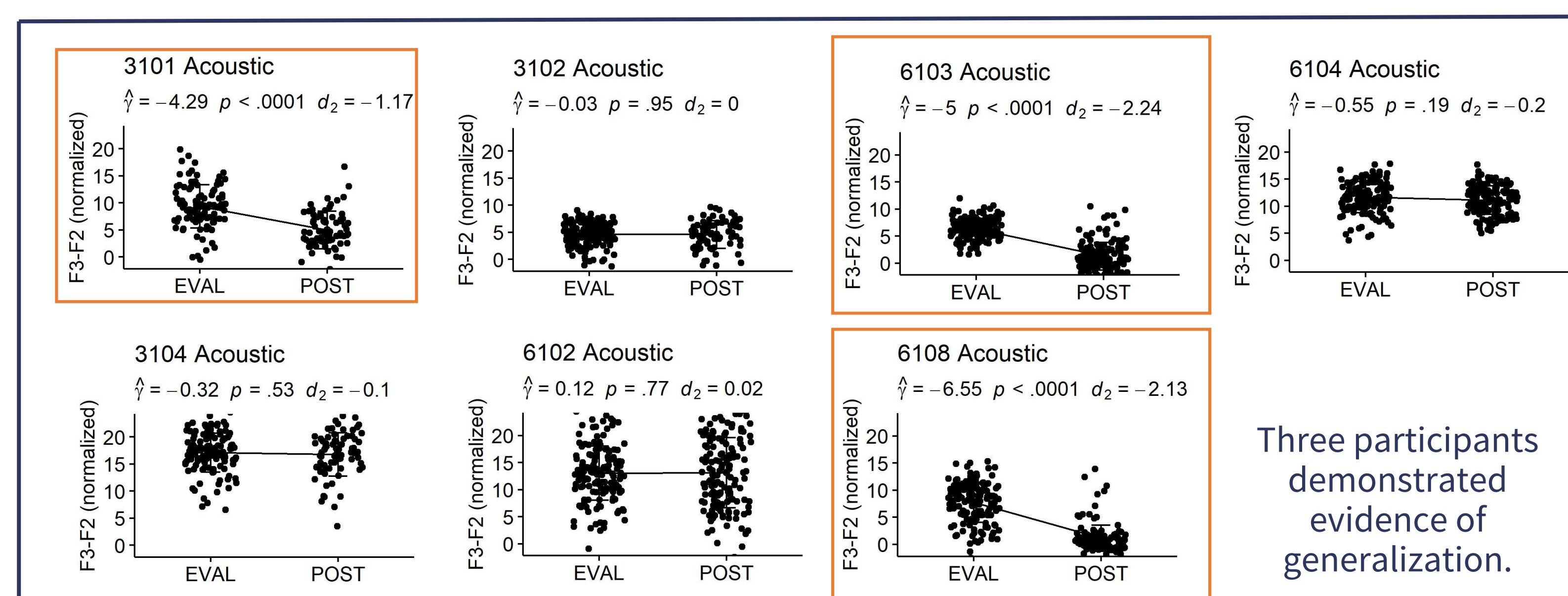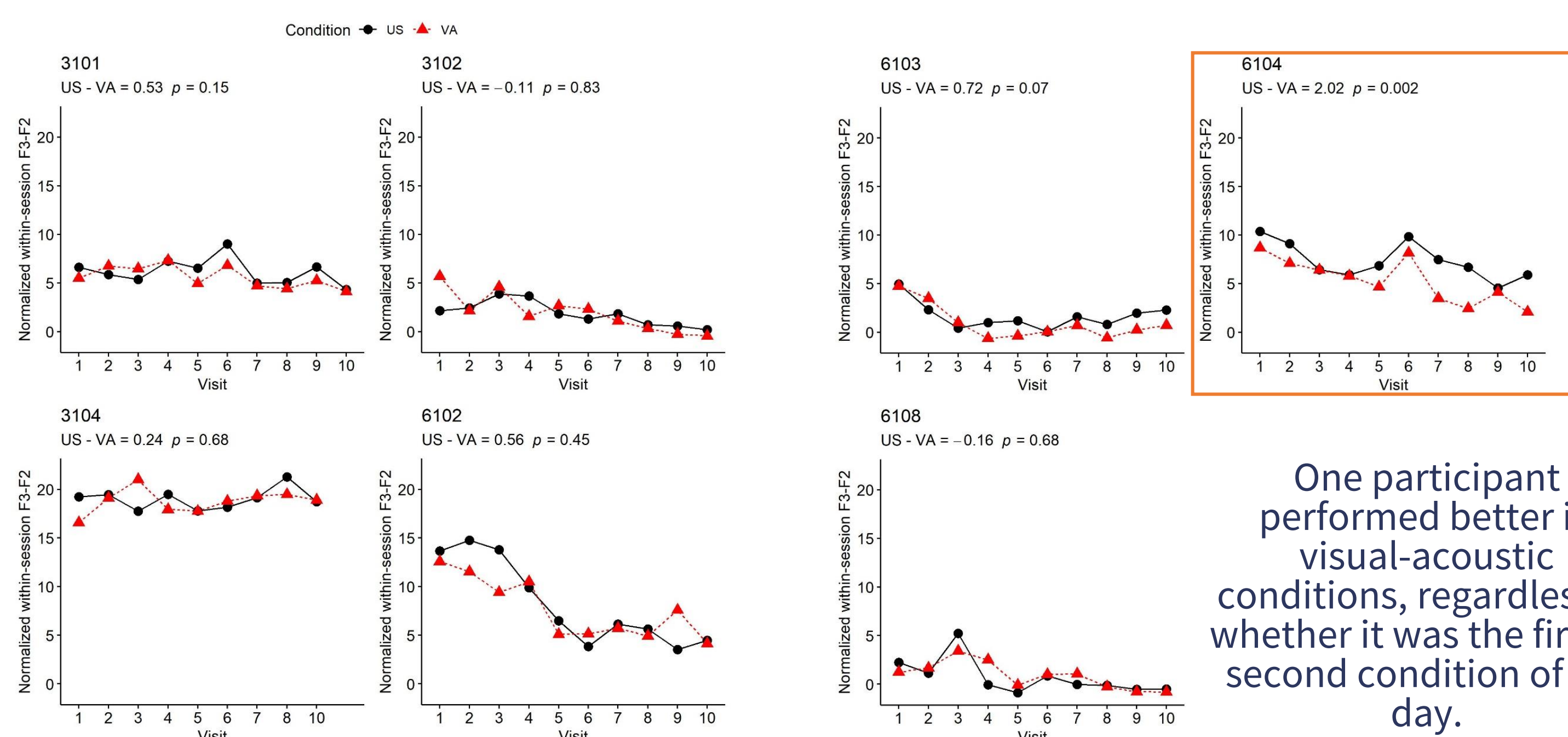
Treatment Methods

Images of visual-acoustic (A) and ultrasound (B) prepractice

Direct Imitation Trials x̄ = 45.7 σx = 12.9

Reading and Direct Imitation Trials x̄ = 137.4 σx = 41.6

50%|30% KP 30% KR 20%|40% NF

Acoustic Analysis

Age and gender normalized F3-F2 distance (lower is more adult-like)
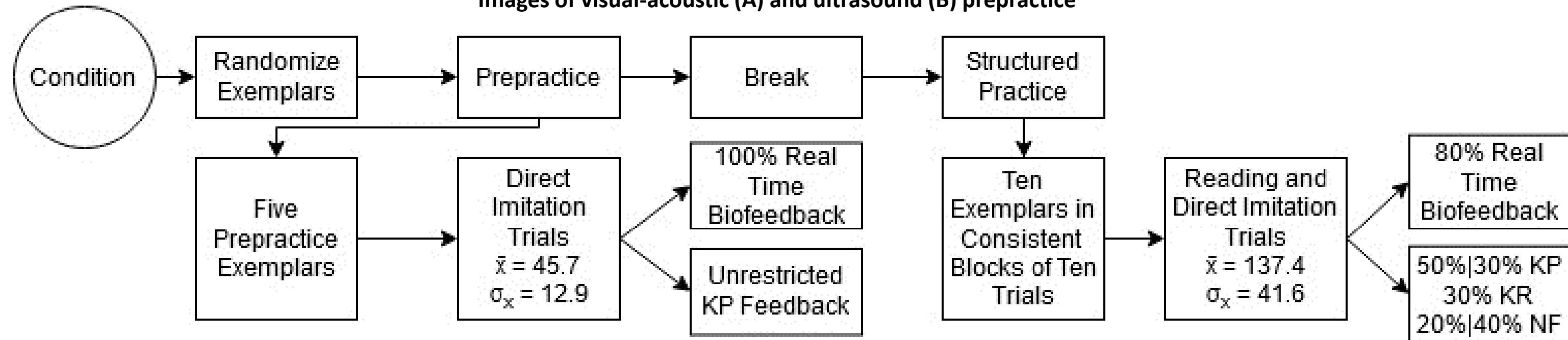
RQ 1: Most participants responded equally to the biofeedback conditions.

One participant performed better in visual-acoustic conditions, regardless of whether it was the first or second condition of the day.

Three participants demonstrated evidence of generalization.

RQ 2: Three participants demonstrated acoustic generalization.

Exploration: Auditory-perceptual acuity was related to amount of generalization following the combined treatment program.

Pre-to-post difference in age and gender normalized F3-F2
(lower is better)

ρ = -.86 p = .024

Normalized Auditory-Perceptual Acuity (higher is better)

Our OSF Page: https://osf.io/3qf2m/
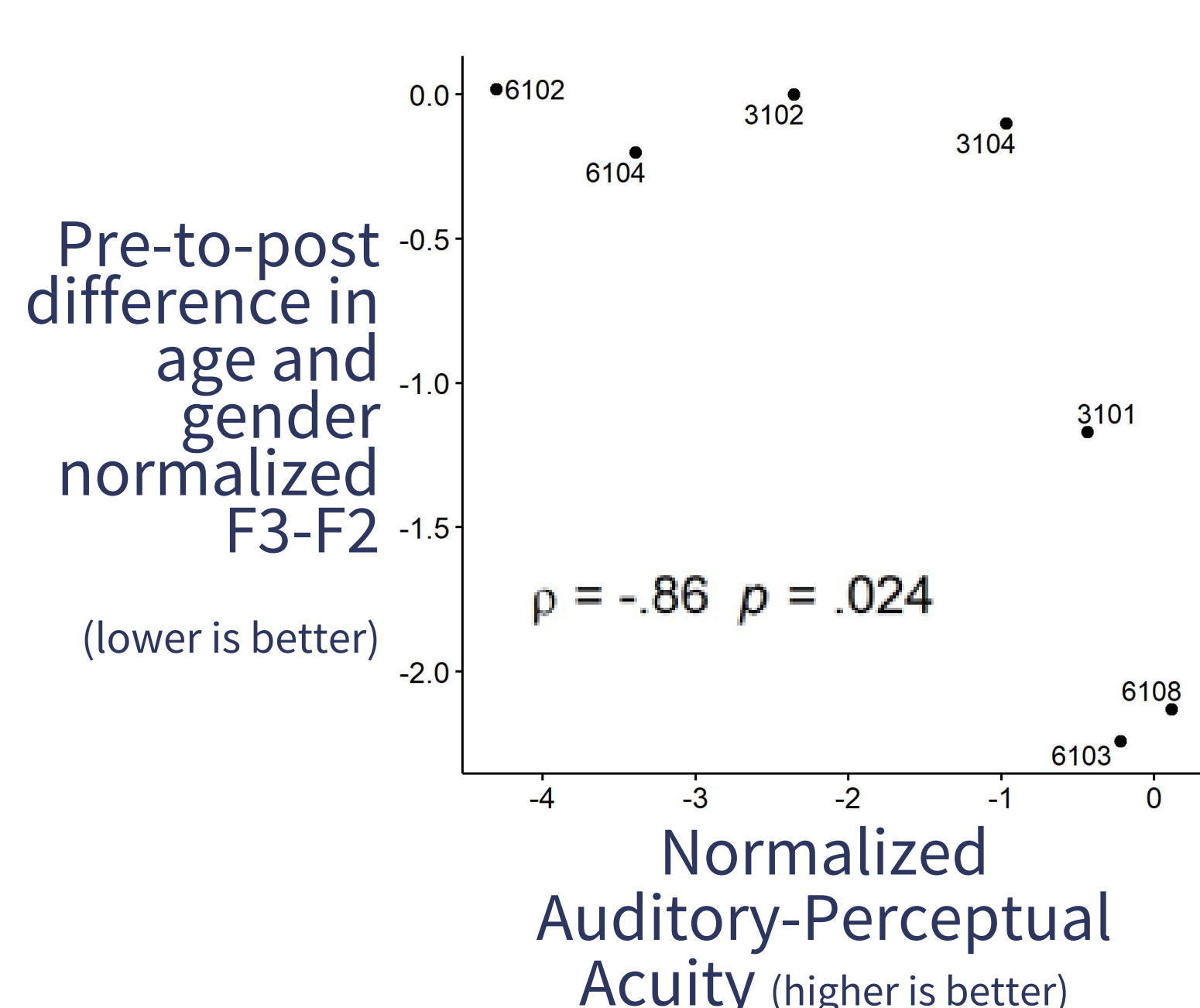
Selected References (full list available at OSF)

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