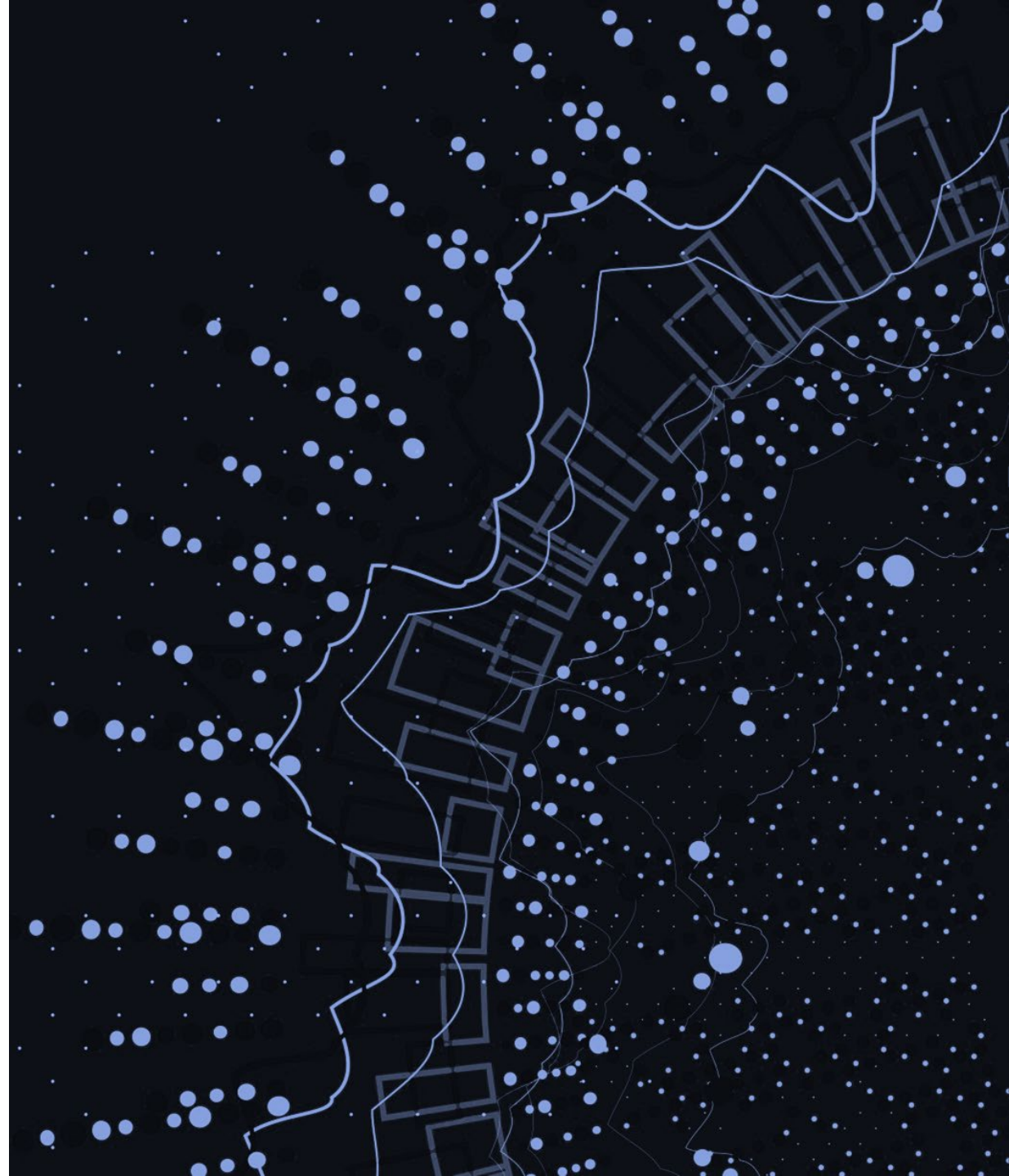

High-variability phonetic training in the acquisition of L2 German: the role of orthography vs. color-mapping

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Bradley Weiss.

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High Variability Phonetic Training (HVPT)

- High Variability Phonetic Training is an instructional approach to teaching learners to perceive new L2 speech sounds.
- HVPT involves increasing variability in the presentation of sounds in order to help learners narrow in on the variability that is relevant to distinguishing the target phonemes (Barriuso & Hayes-Harb, 2018).
- HVPT has been found to help L2 learners develop stronger perceptual skills and improve pronunciation (see Thomson, 2018).

HVPT Methodology

- Studies have investigated numerous methodological considerations for HVPT, including (see Barriuso & Hayes-Harb, 2018):
 - The type of variability (talker vs. phonetic contexts)
 - Blocking vs. interleaving talkers
 - Number of training targets
 - Type of training target (words vs. isolated phonemes)
 - Task type (identification vs. discrimination)
- While some studies on HVPT have taught learners to associate sounds with symbols (e.g., nautical flags; e.g., Thomson, 2011), most studies have used orthographic representations during training. This has never been compared directly.



The effects of orthography

- Some studies show benefits for orthography during pronunciation / perception training (Escudero et al., 2008, 2014; Showalter & Hayes-Harb, 2013)
- Some show no benefits of orthography (Durham et al., 2016; Hayes-Harb & Hacking; 2015; Pytlyk, 2011; Showalter & Hayes-Harb, 2015; Simon et al., 2010)
- Some evidence suggests that access to orthography during training can interfere with the acquisition of phonetic alternations, particularly when orthography provides “misleading information” (Bassetti, 2006; Barrios & Hayes-Harb, 2020; Hayes-Harb & Cheng, 2016).

Target Vowel Contrasts in the present study

- German short mid/mid-low central vowels: [ə] - [ɐ]
 - Represented orthographically with 'e' and 'er'
 - diese – dieser
 - alle – aller
 - solche – solcher
- German short high-back/front rounded vowels: [ʊ] - [ʏ]
 - Represented orthographically with 'u' and 'ü'.
 - Mutter – Mütter
 - musste – müsste
 - druckte – drückte

Research Questions

1. To what extent does HVPT training result in increased ability to accurately perceive the target vowel contrasts ([ə] / [e] or [ʊ] / [ɤ]), as measured by accuracy during training and accuracy on the ABX discrimination task?
2. To what extent does the training condition (color vs. orthography) modulate the effectiveness of HVPT training for the target contrasts?

Experimental Overview

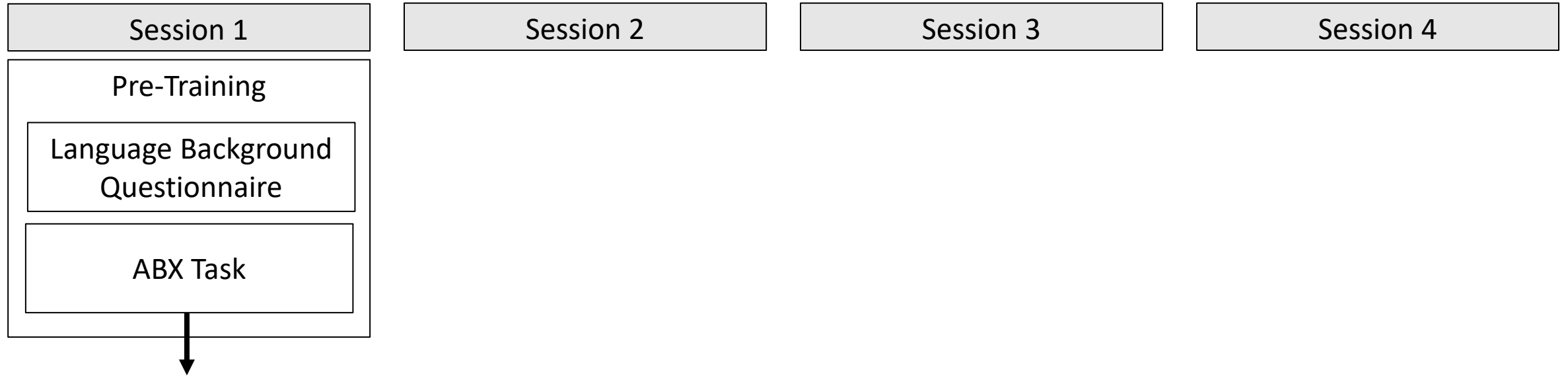
Session 1

Session 2

Session 3

Session 4

Experimental Overview



Experimental Overview



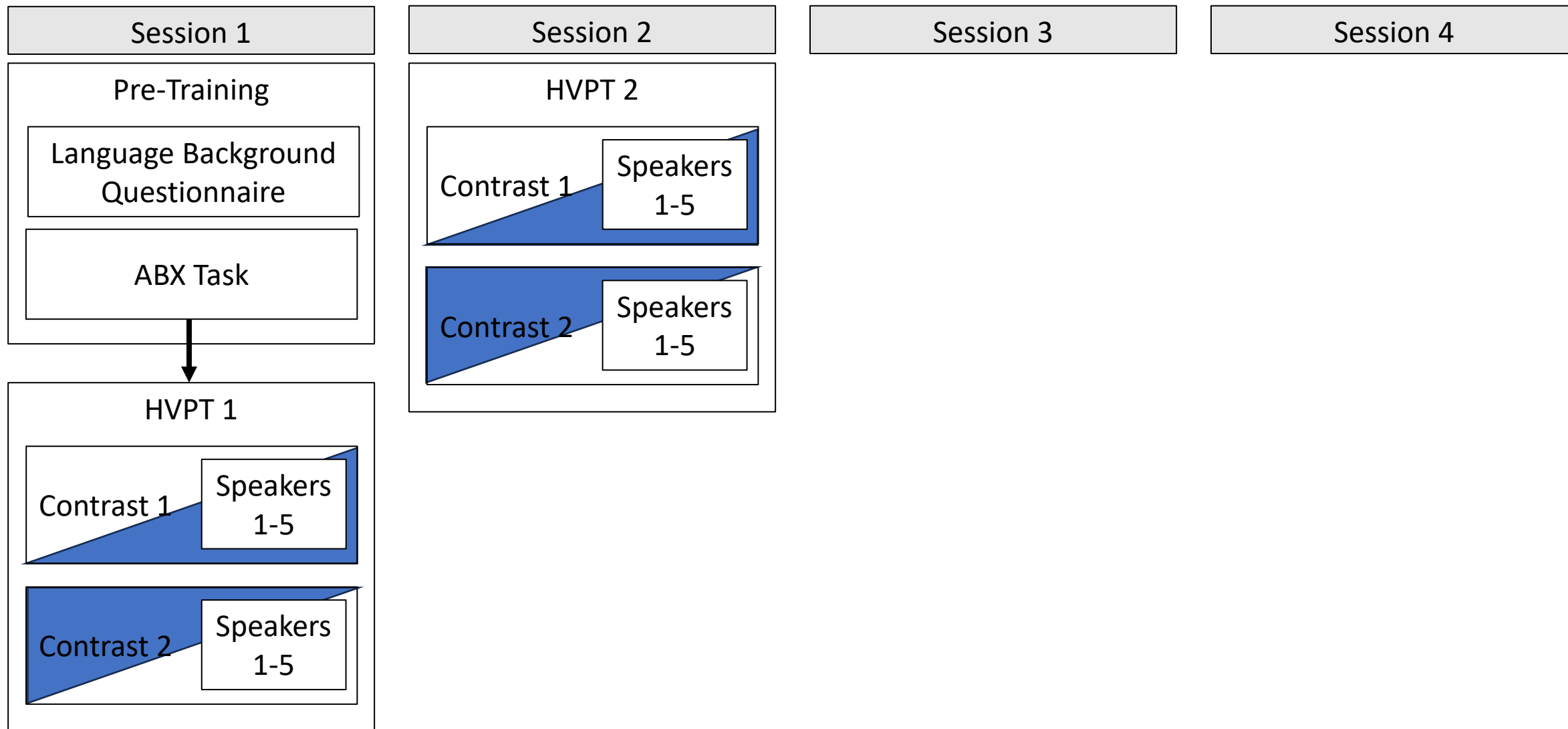
Experimental Overview



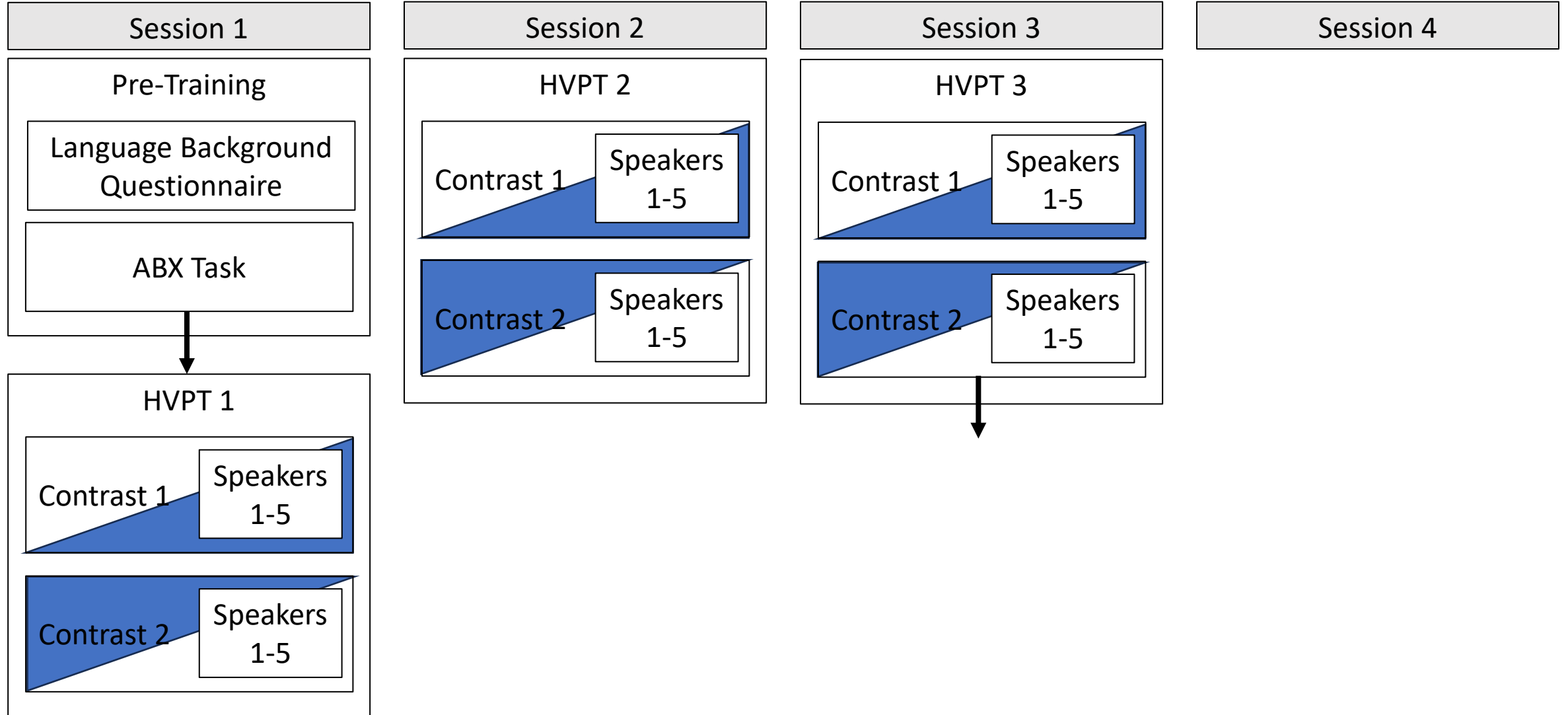
Experimental Overview



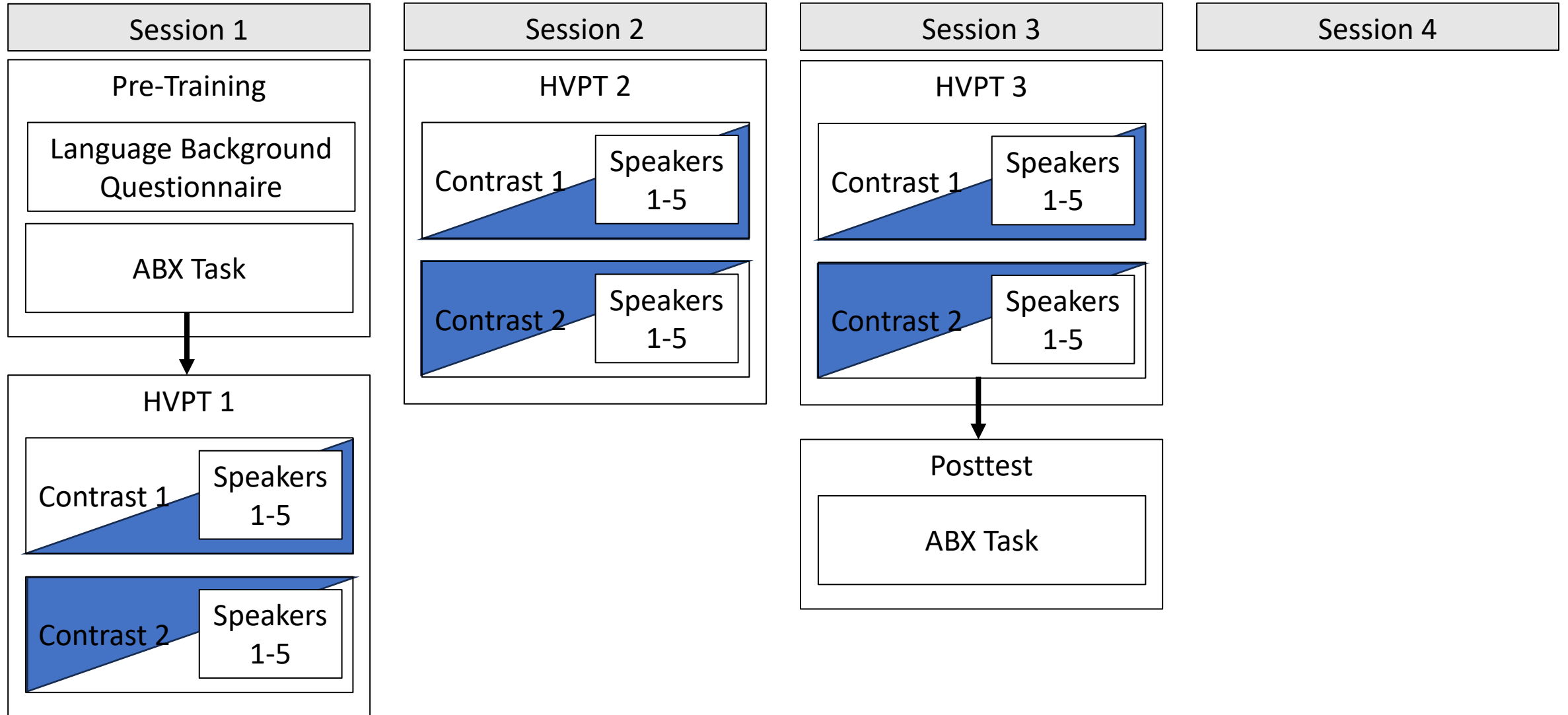
Experimental Overview



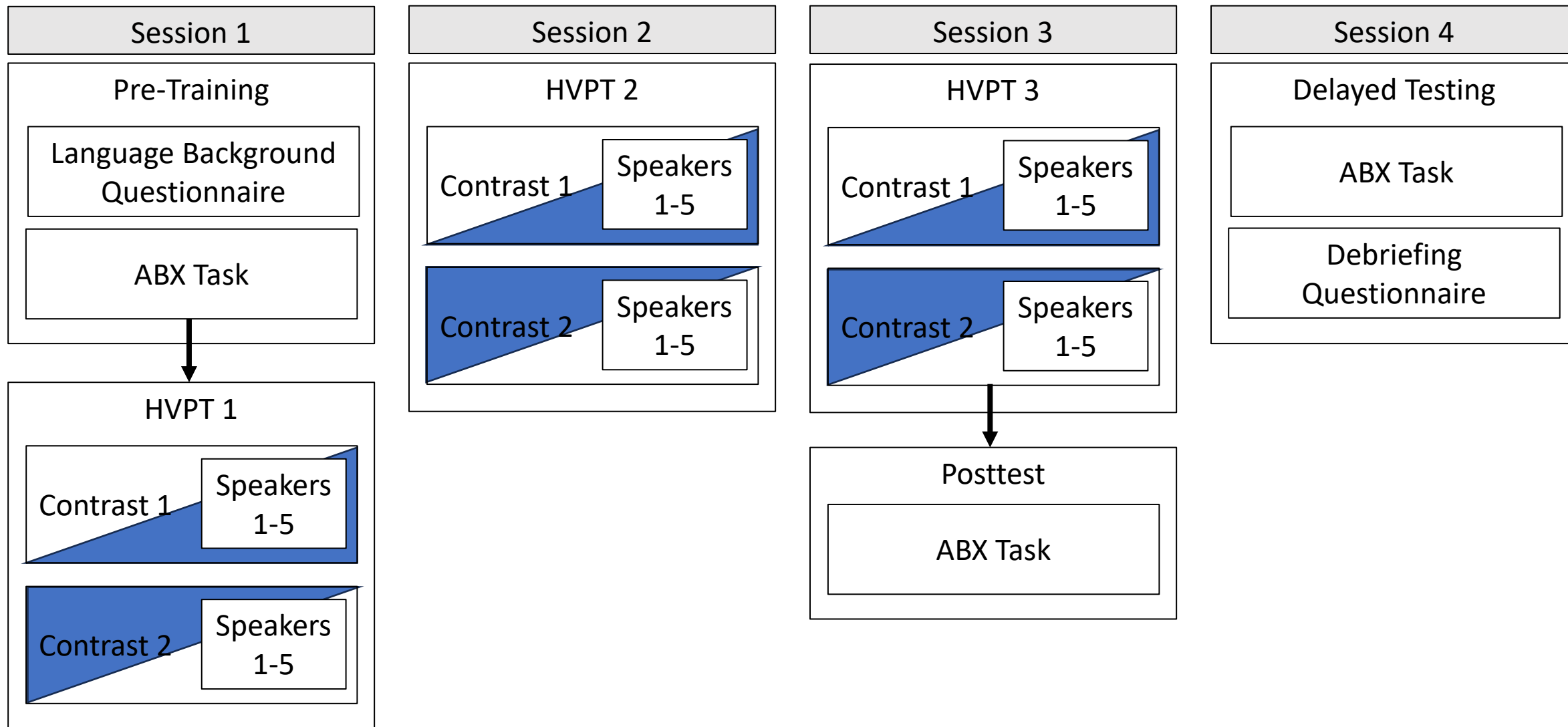
Experimental Overview



Experimental Overview



Experimental Overview



Participants

- 35 First semester German learners
 - Complete all tasks according to protocol (n=7)
 - No reported issues of color blindness (n = 0)
 - Less than intermediate knowledge of a language with the target vowel contrasts. (n=6)
 - Final n = 22
- For analyses, must have scored less than 70% on ABX task (eliminated for analyses of the relevant vowel contrast)
 - [ə] / [e] (signified by “ER”)
 - Color = 10 | No Color = 8
 - [ʊ] / [ʏ] (signified by “U”)
 - Color = 11 | No Color = 10

HVPT Training - Stimuli

- 10 minimal pairs for each of the two vowel contrasts.
- Recorded by 5 L1 speakers of German (two female, 3 male)
 - Recorded in program Audacity (44.1 kHz per second)
 - Each word was recorded four times, and the best exemplar was chosen for the training.

[e]	[ə]	[ʊ]	[ʏ]
dieser	diese	Mutter	Mütter
mancher	manche	musste	müsste
solcher	solche	druckte	drückte
jener	jene	spuren	spüren
aller	alle	wurde	würde
großer	große	Bunde	Bünde
kleiner	kleine	lufte	lüfte
fetter	fette	durfte	dürfte
fauler	faule	kurzer	kürzer
netter	nette	furchte	Fürchte

[ə] / [a]

Orthography



dieser



diese

[e] / [ə]

Orthography



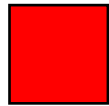
dieser



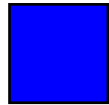
diese

Color

dies



dies



[ɐ] / [ə]

/ʊ/-/ʏ/

Orthography



dieser

Mutter



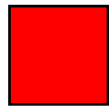
diese

Mütter

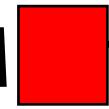


Color

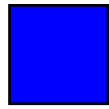
dies



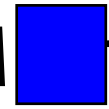
M



dies



M





HVPT Procedure

In this first exercise, you will practice listening to two vowels that are often difficult to tell apart.

Look at the two example words below. The box in each word represents the vowel sound.

Click on the two boxes below to hear each word spoken aloud. You may play these as many times as you wish before you continue.

dies 

dies 

Press the spacebar to continue with the instructions.

HVPT Procedure



Instructions

HVPT Procedure

In this first exercise, you will practice listening to two vowels th

vowels th

Look at the tw

Click on the

aloud. You may

Click on the box that represents the sound you heard.

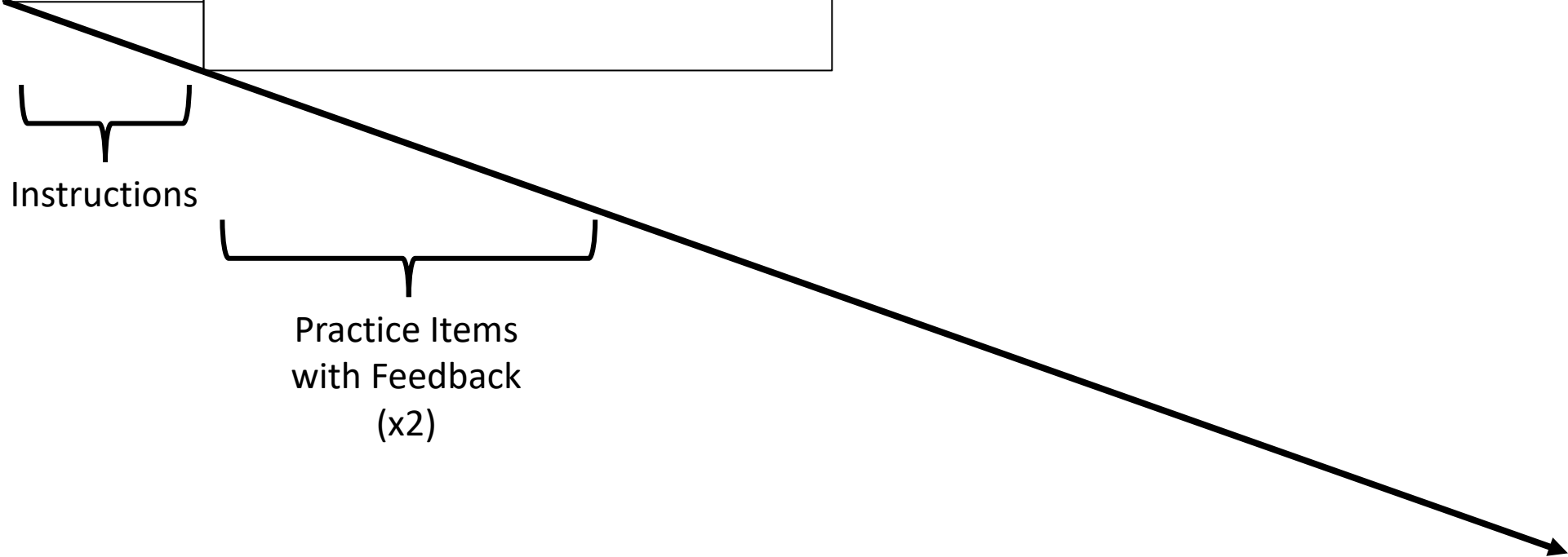
dies

dies

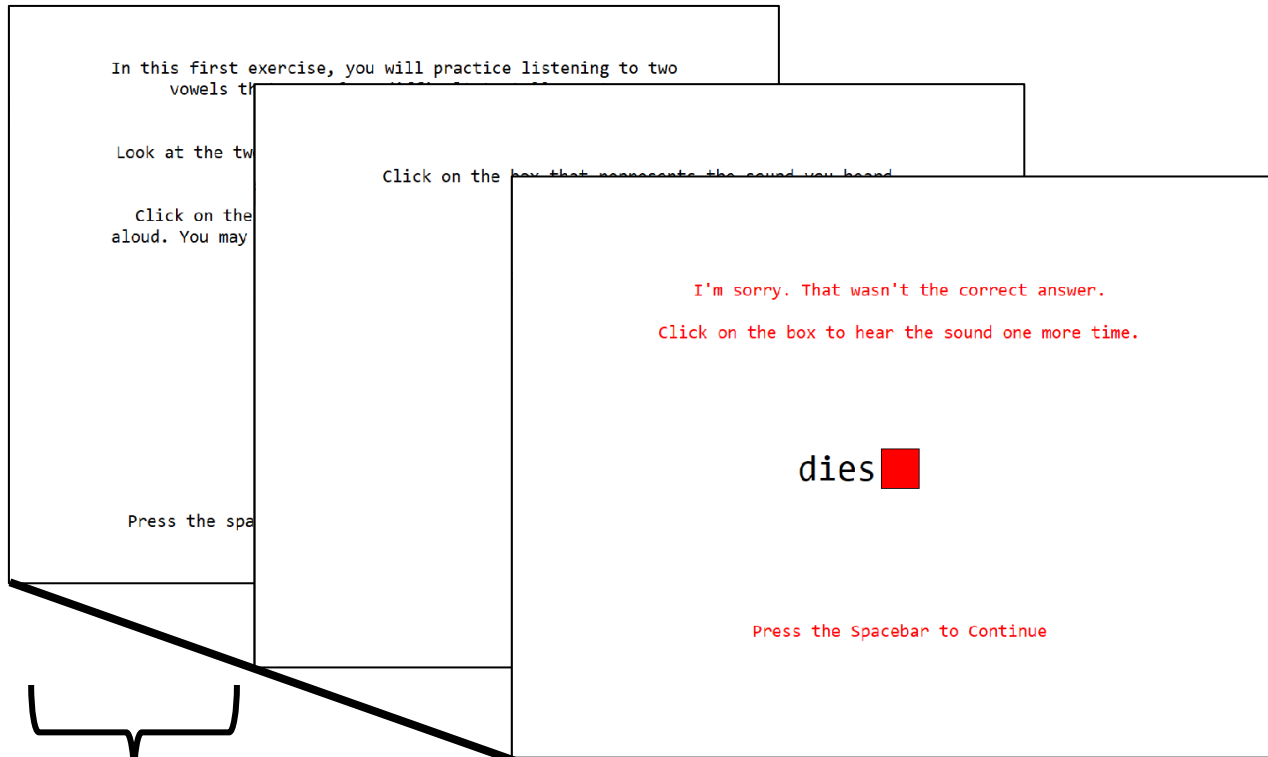
Press the spa

Instructions

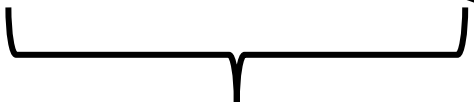
Practice Items
with Feedback
(x2)



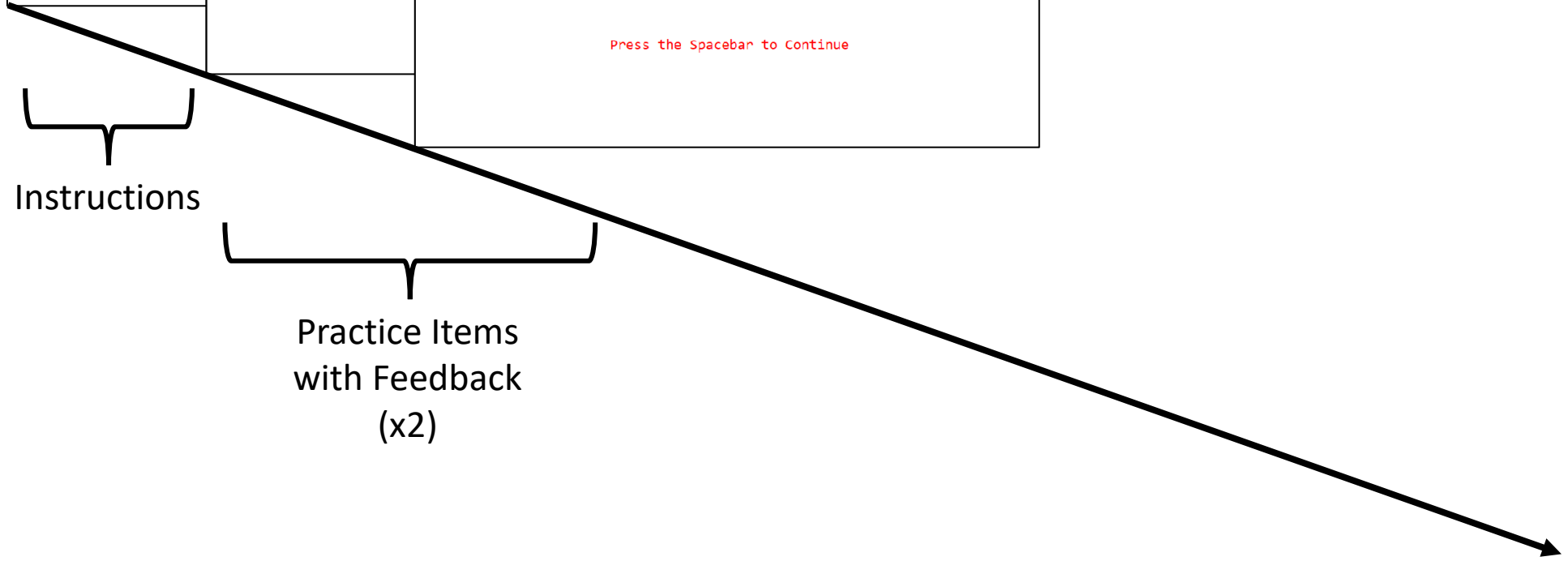
HVPT Procedure



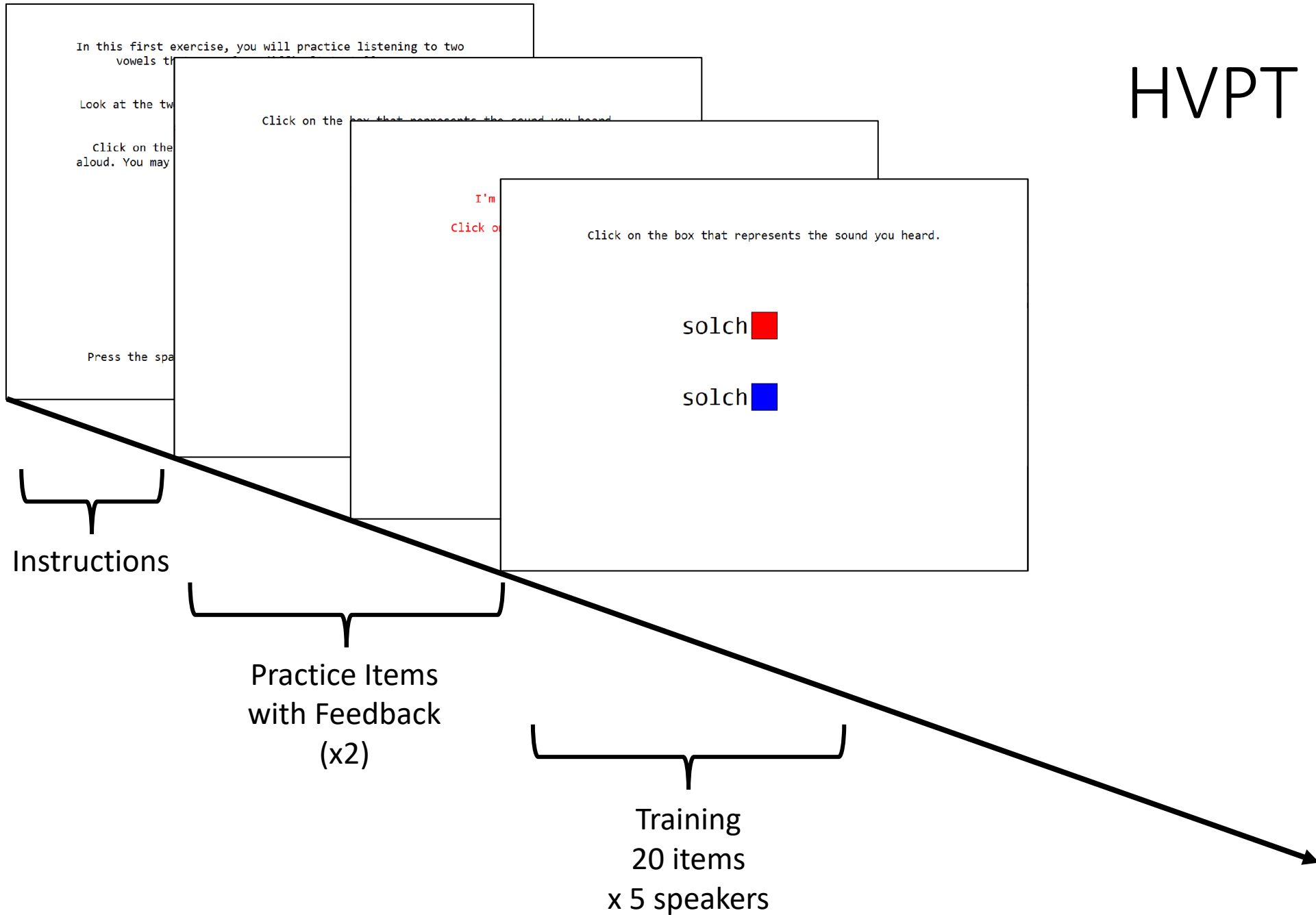
Instructions



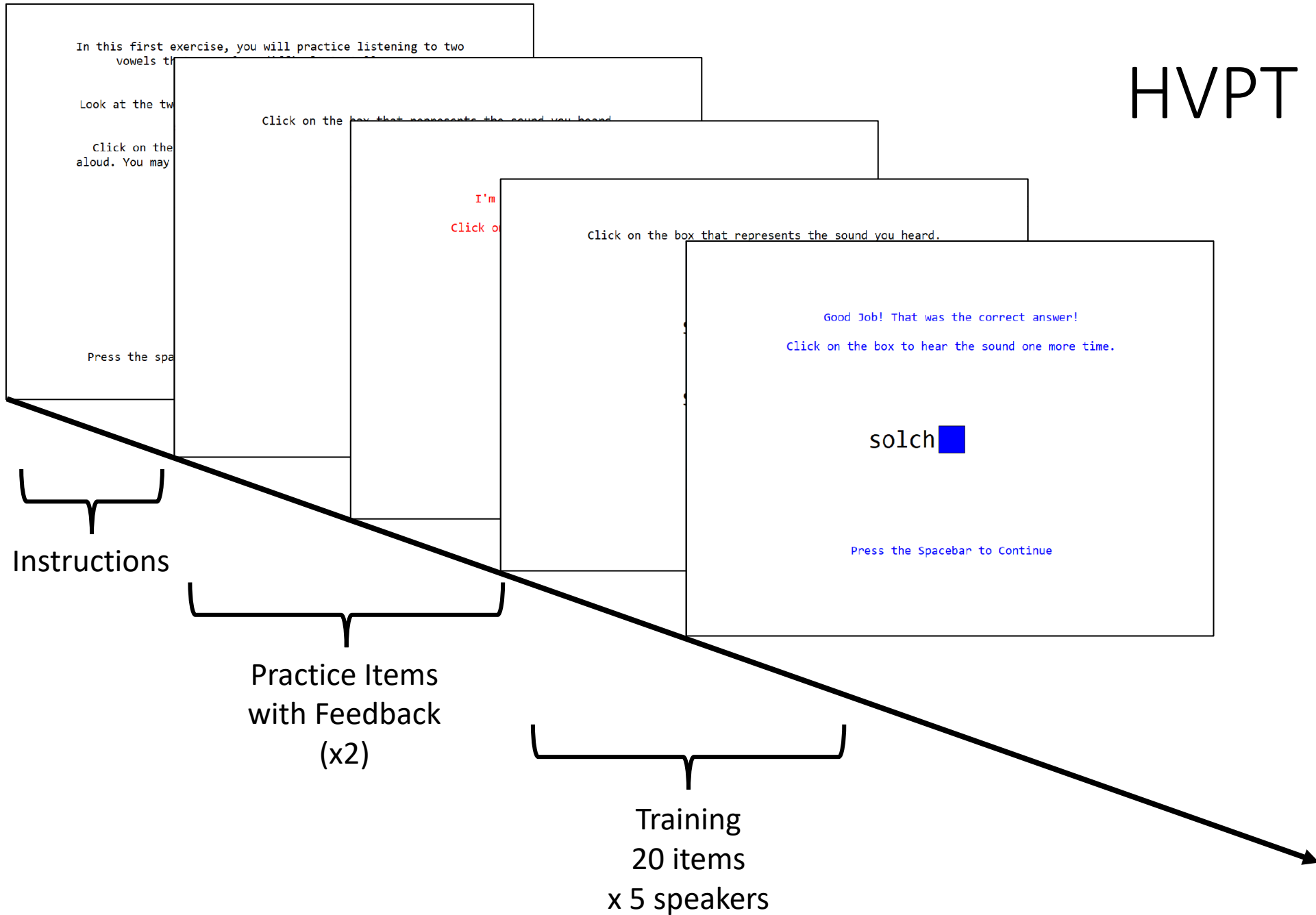
Practice Items
with Feedback
(x2)



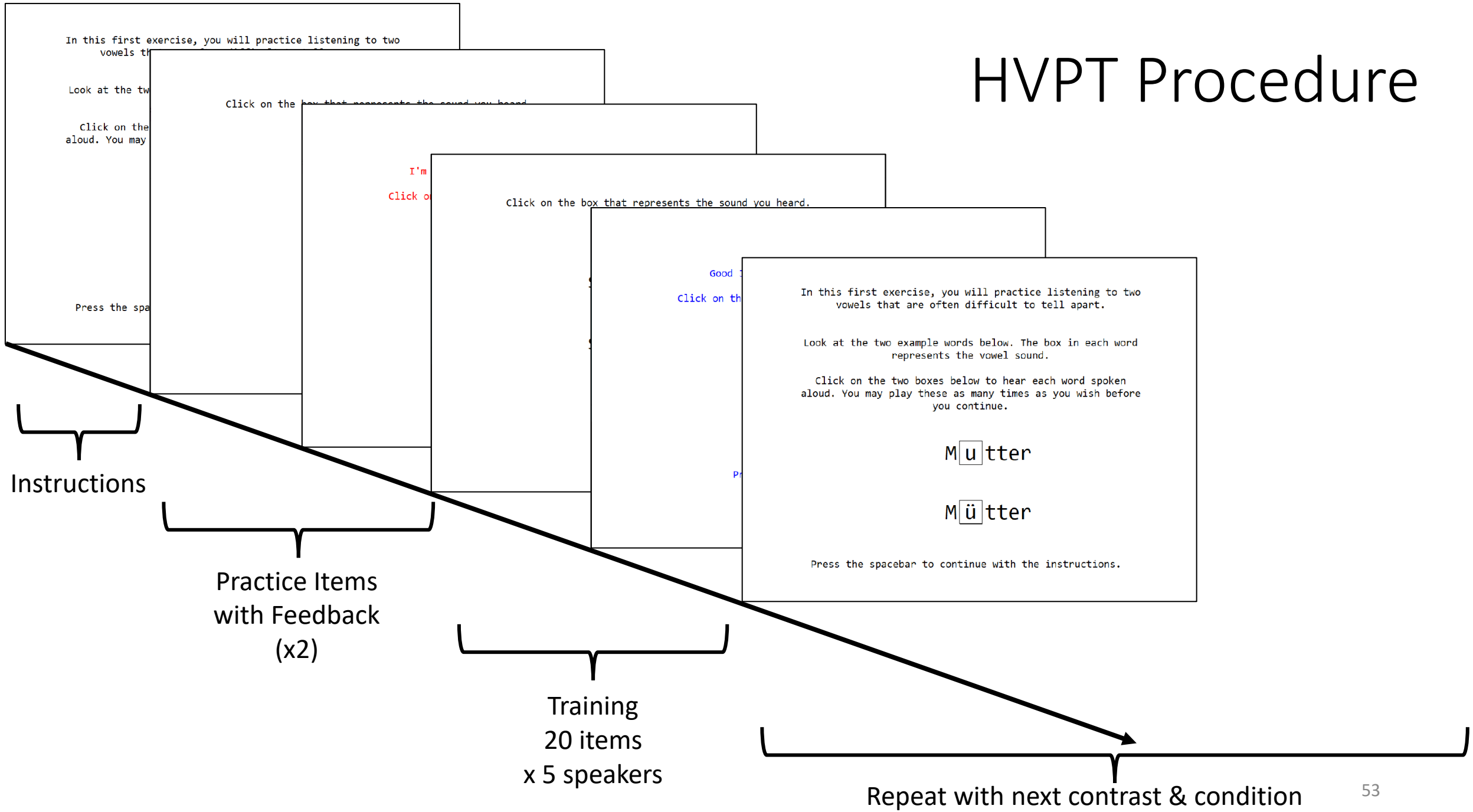
HVPT Procedure



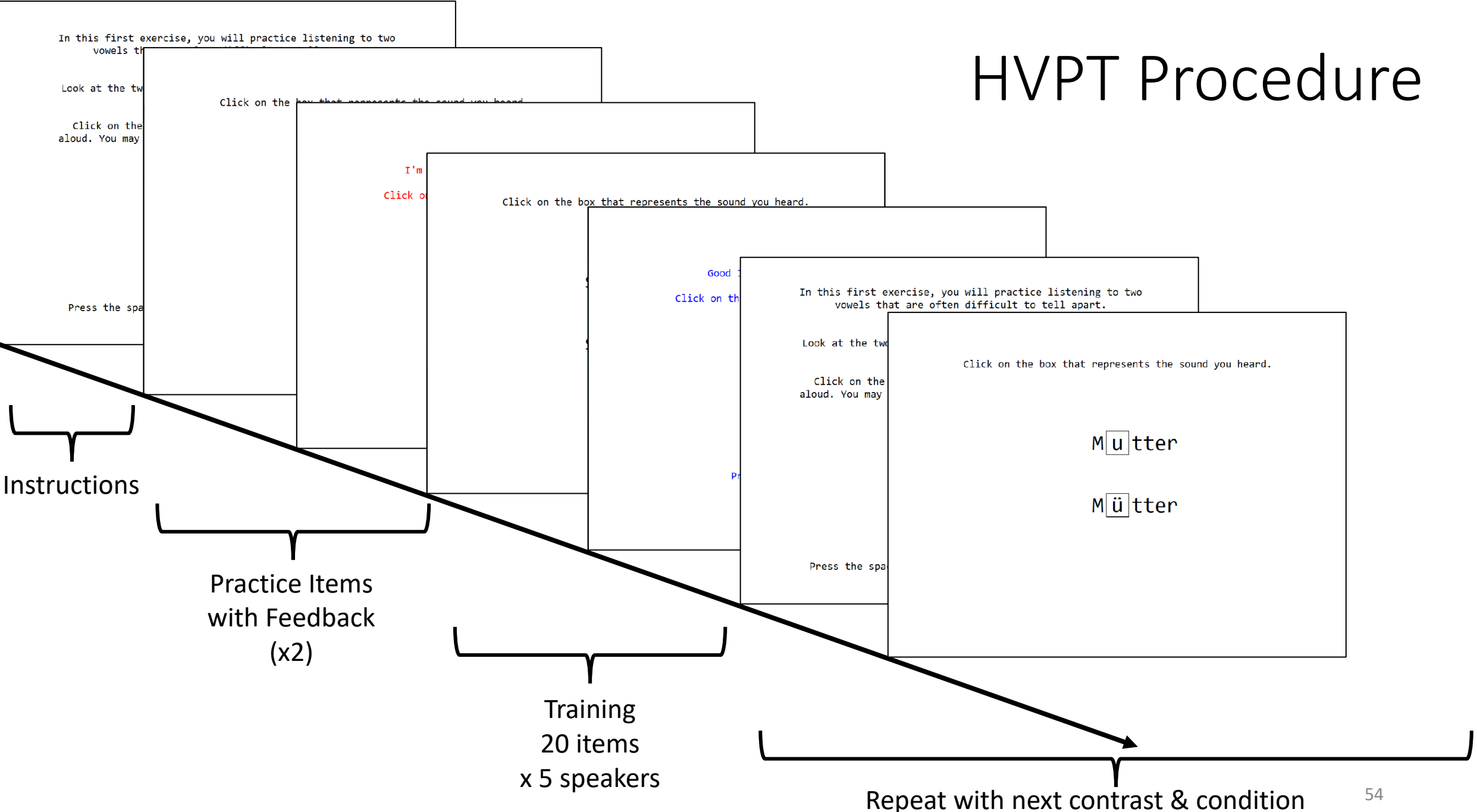
HVPT Procedure



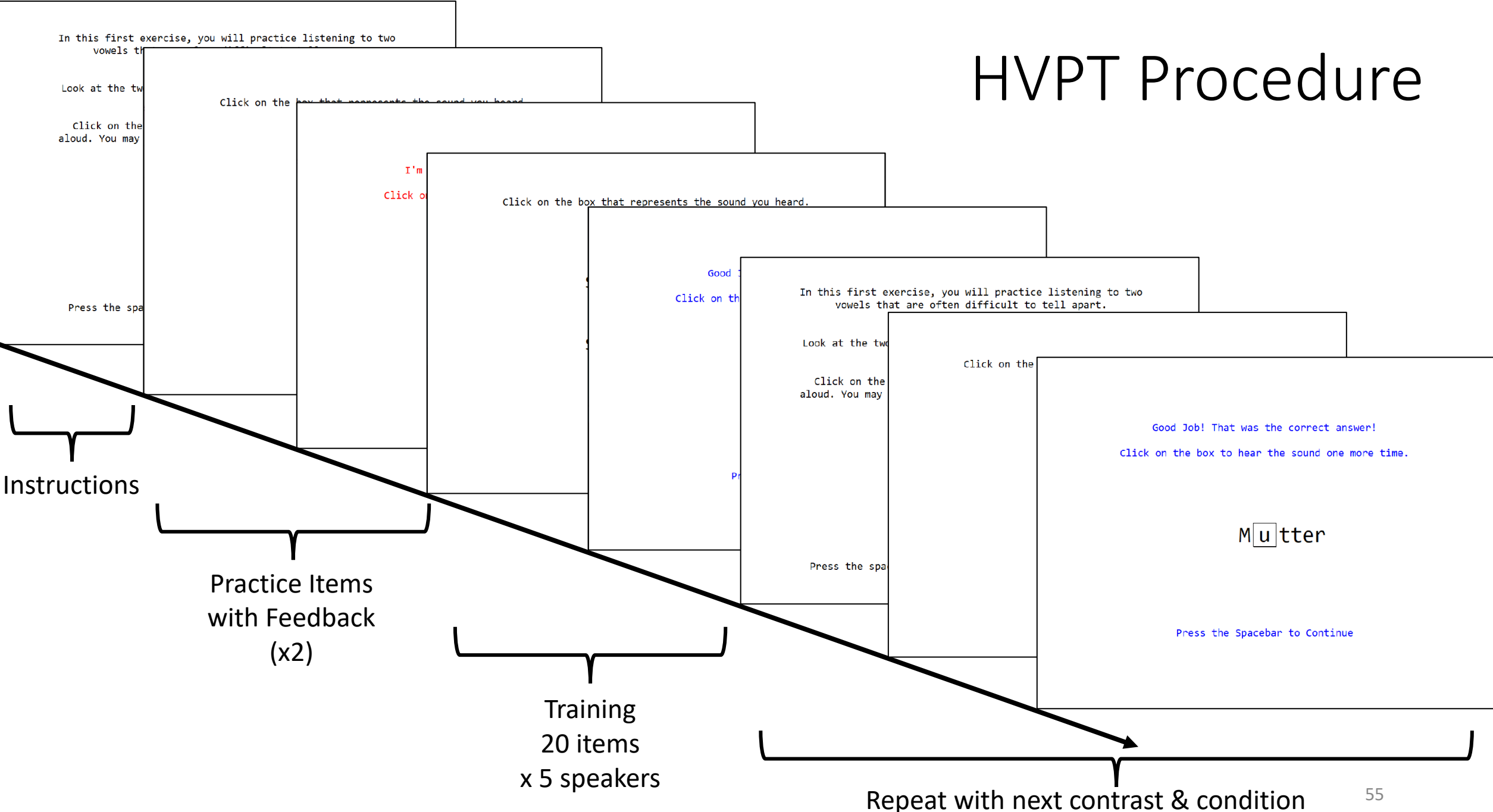
HVPT Procedure



HVPT Procedure





HVPT Procedure





ABX Task

ABX Task



1



2

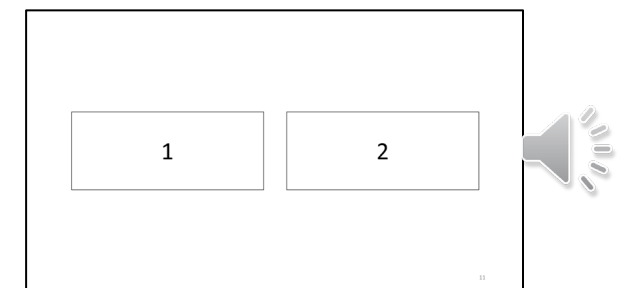
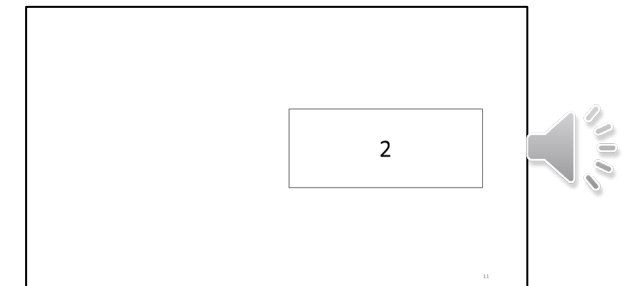
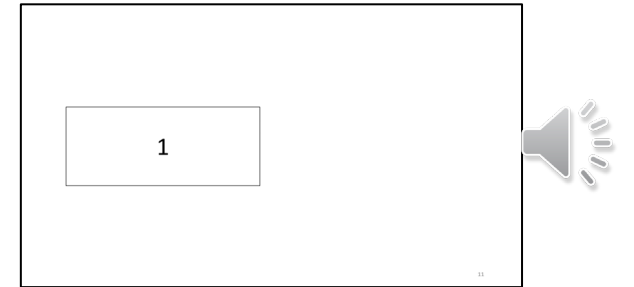


1 2



ABX Task

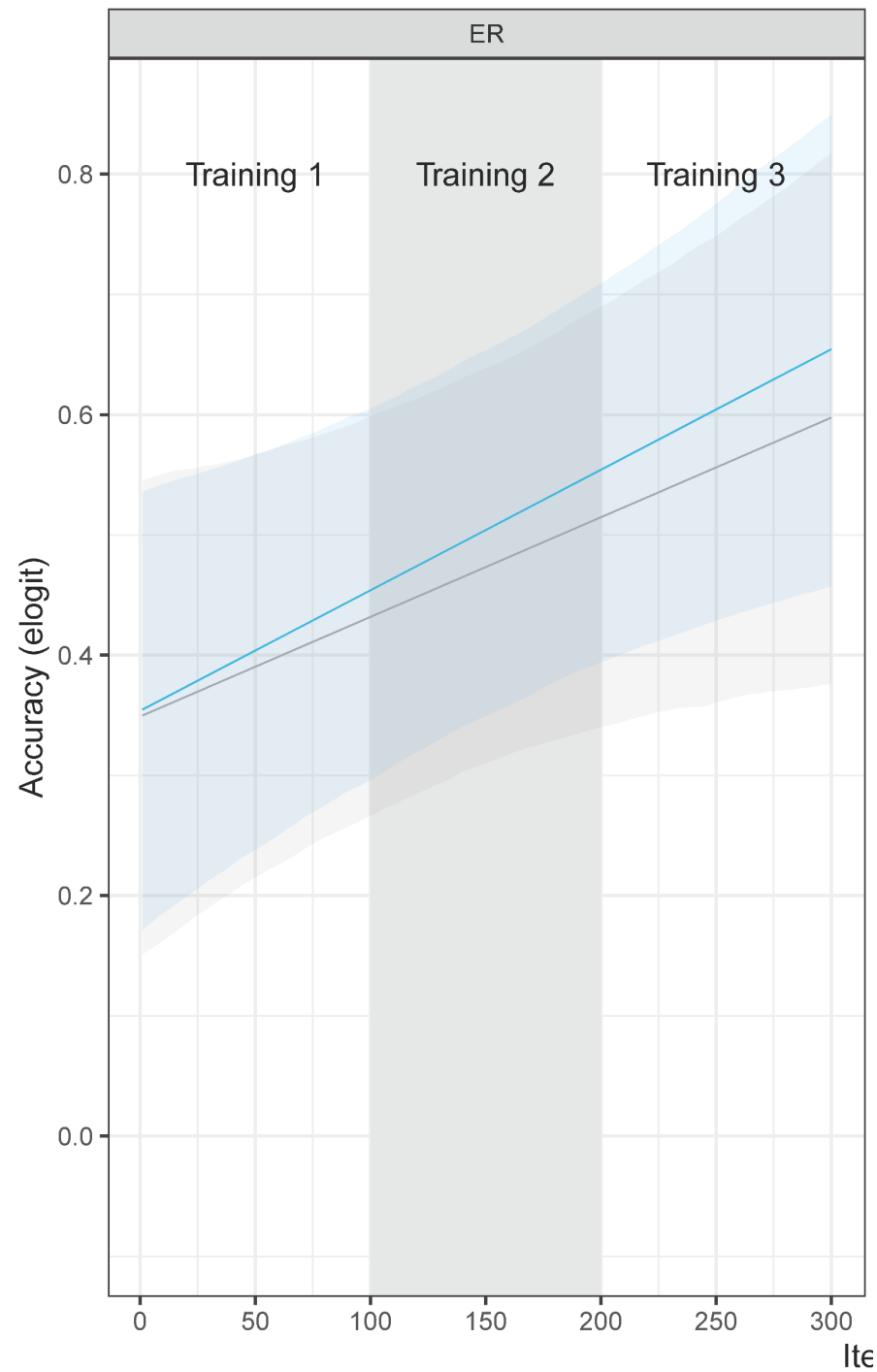
- Participants heard 3 words and decided whether the 3rd was the same as either the 1st or 2nd
- Stimuli were 4 target minimal pairs with for each vowel contrast
 - For [ʊ] / [ɤ] these were all novel
 - For [ə] / [e] one was repeated from training, 3 were novel.
 - 6 Distractor pairs for each contrast
- Audio was recorded in the same manner as the HVPT task by the same speakers.
 - Two male speakers were selected as the 'A' and 'B' samples. One female speakers was selected as the 'X'.



Analyses

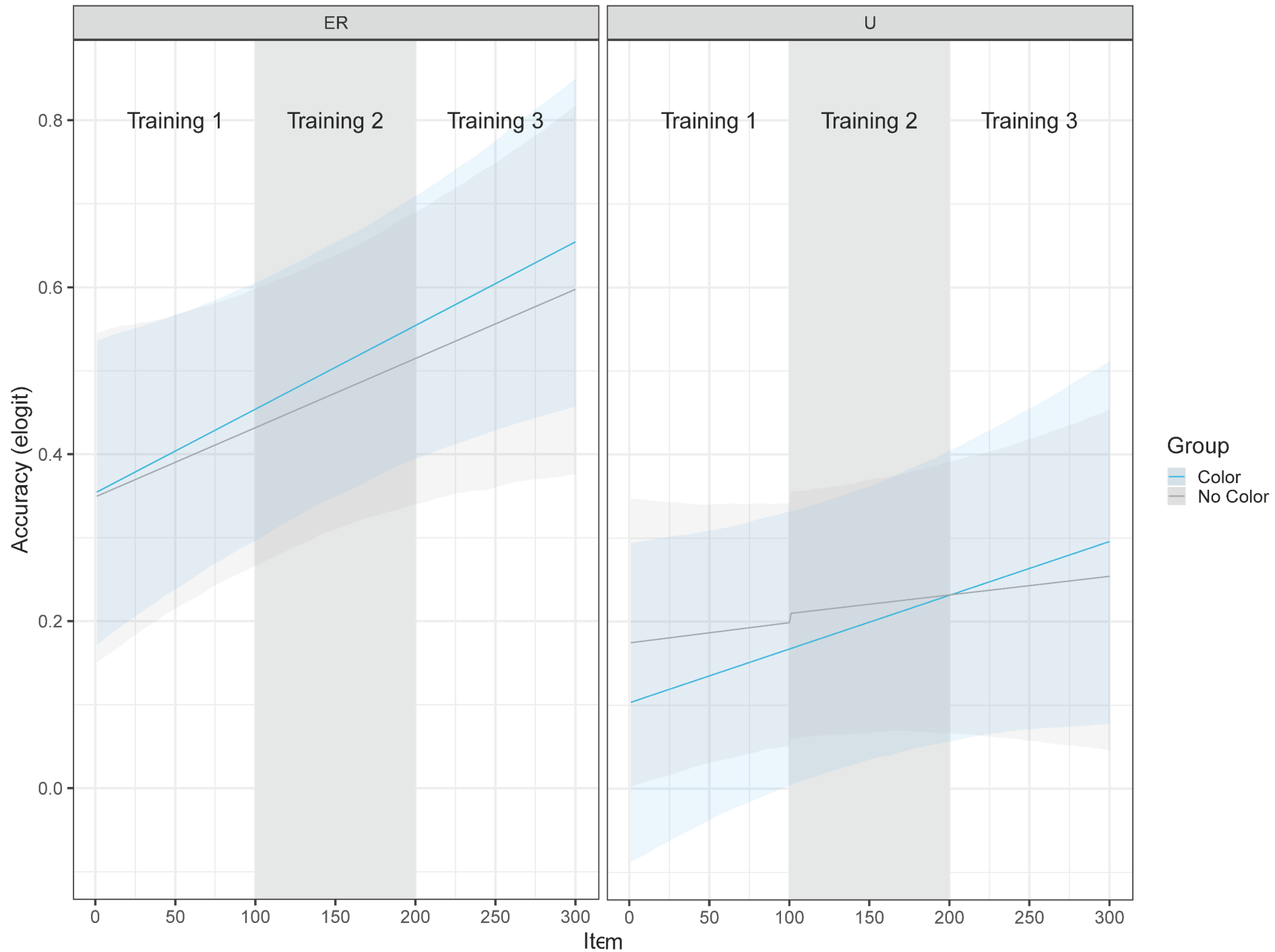
- Training
 - Accuracy across training item
 - Linear growth model (Mirman, 2014) with first-order orthogonal polynomial.
 - Fixed effects of Vowel Contrast, Color, and Contrast x Color
 - Random effects of Time by Subject
- ABX Task
 - Accuracy at Pretest, Posttest, Delayed Posttest
 - Separate Linear Mixed effects models for each contrast
 - Fixed effects of Color, Time, & Color x Time
 - Random effects by Subject

Results - Training



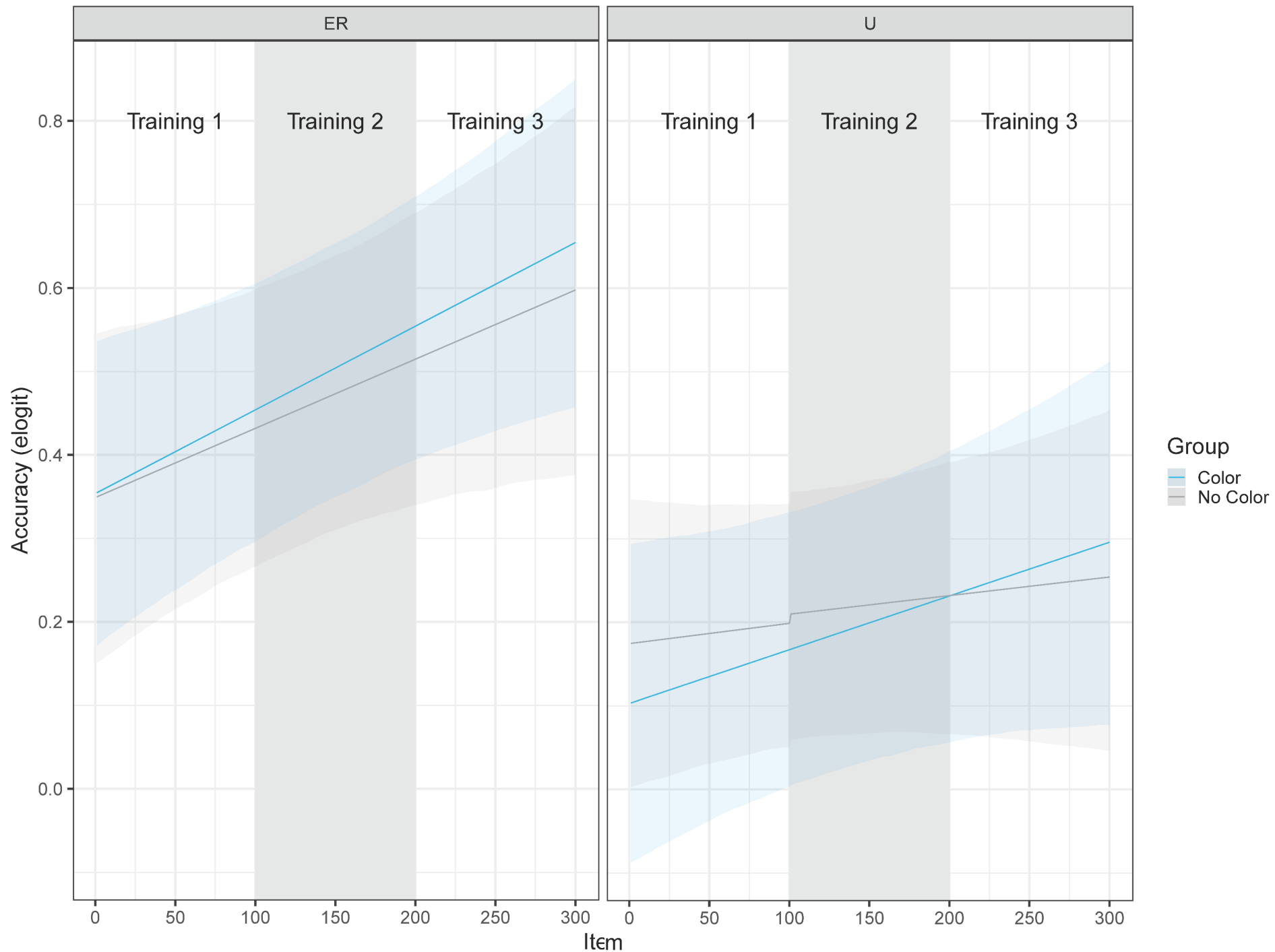
Group
Color
No Color

Results - Training

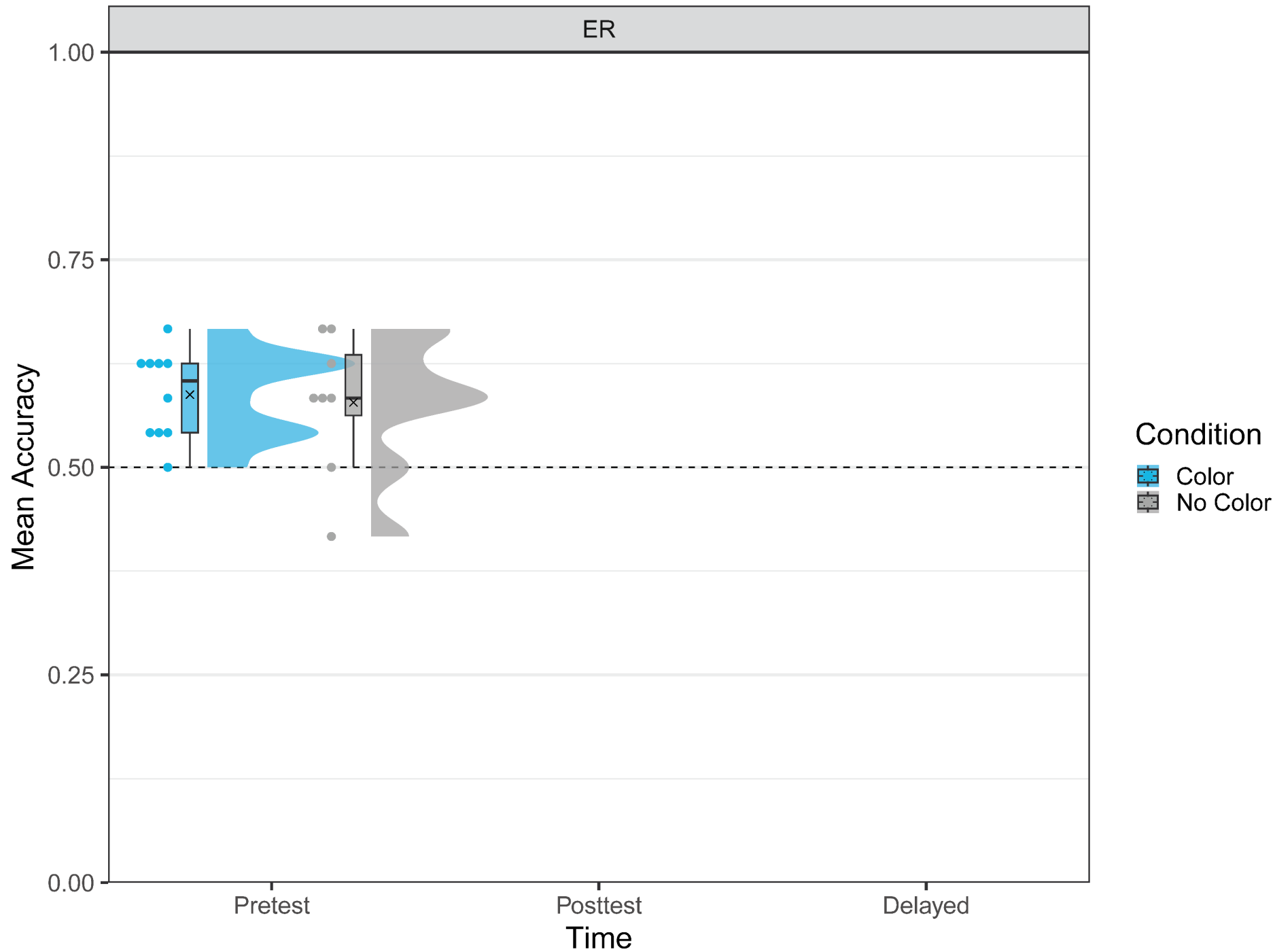


Results - Training

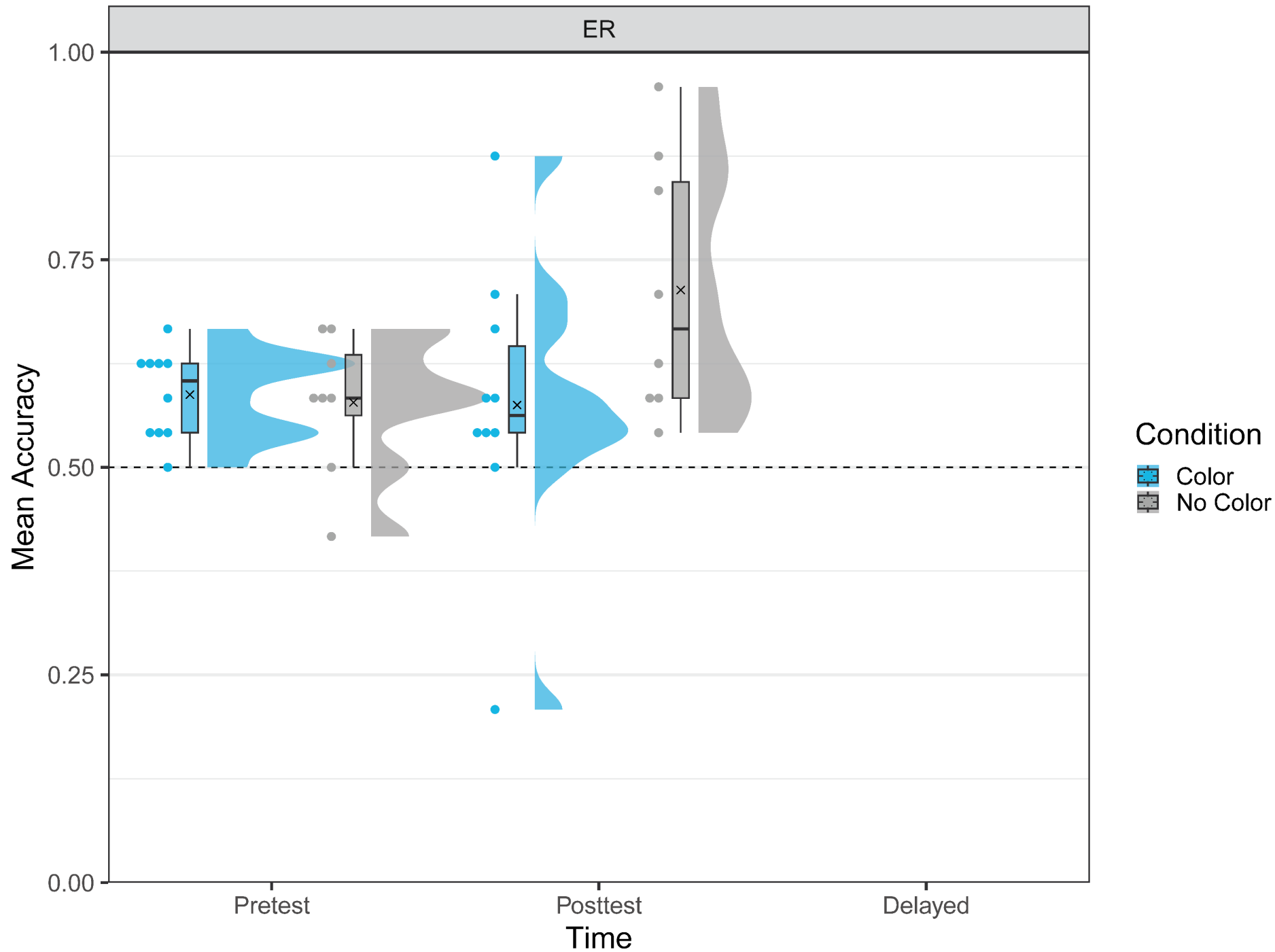
- Main effect for Time (slope) indicating overall increase in accuracy ($p < .001$)
- Main effect for Contrast ($p < .001$) & †Time x Contrast ($p = .079$)
- No effects for color



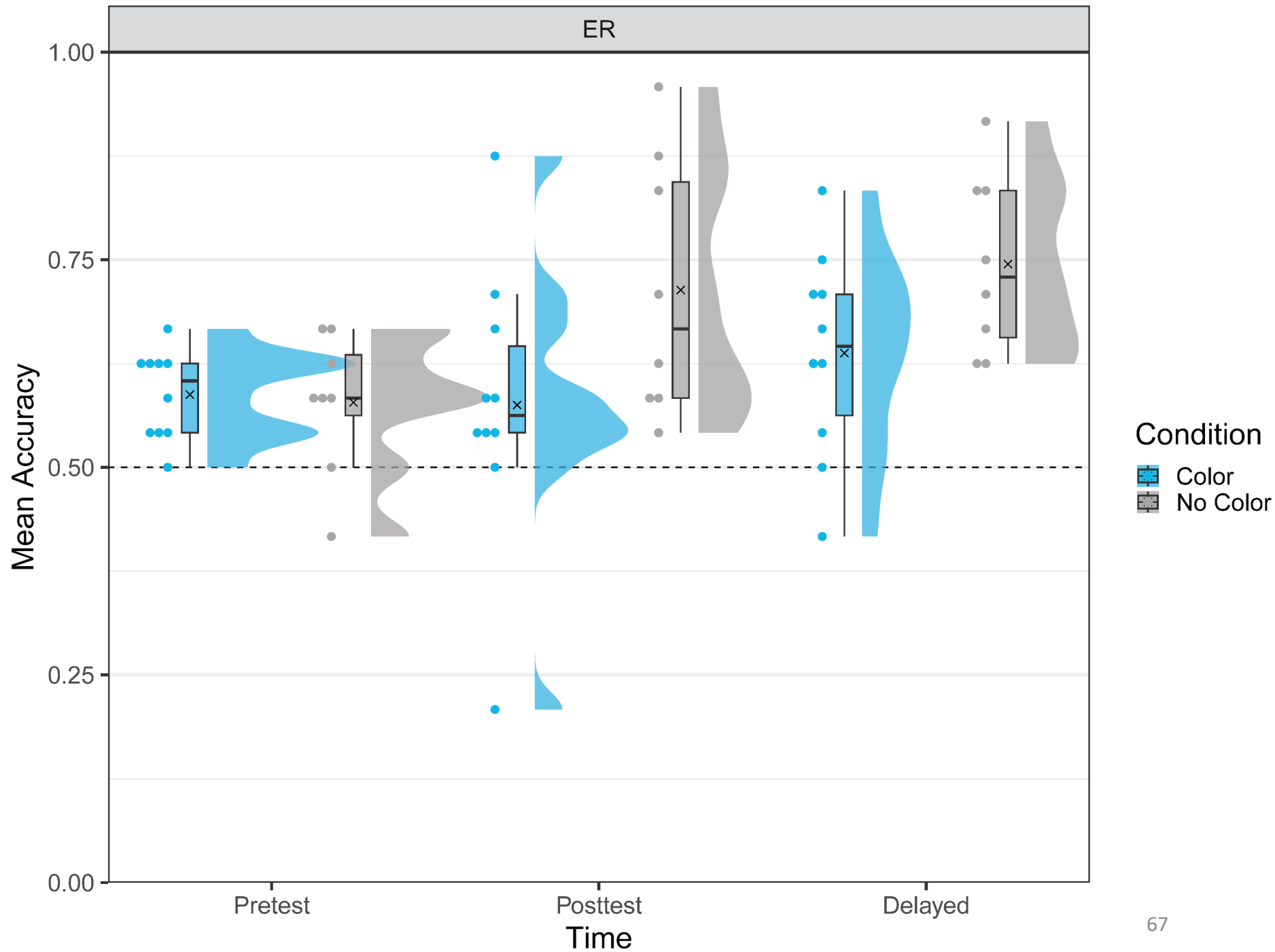
ABX Results [ə] / [e]



ABX Results [ə] / [e]

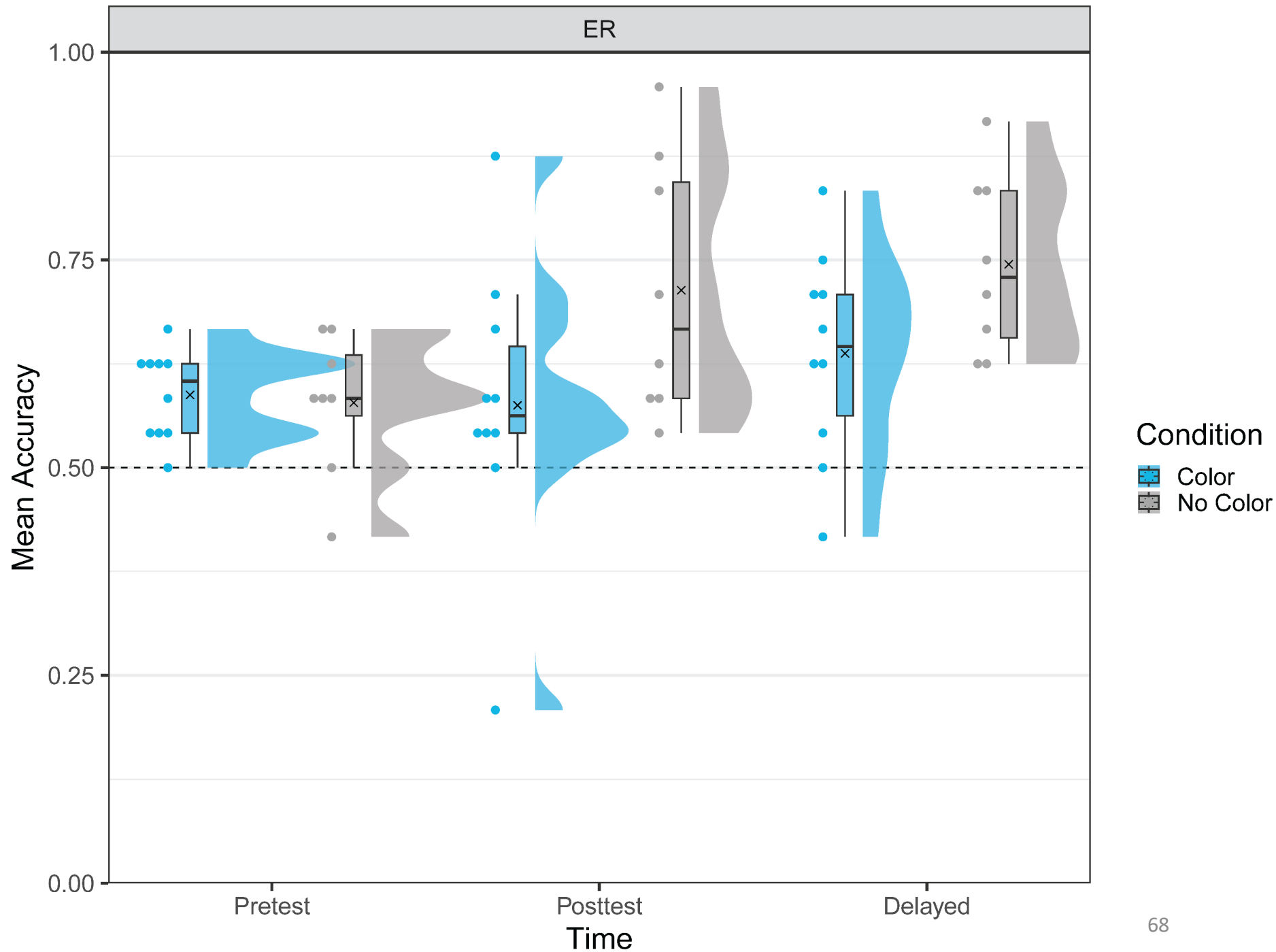


ABX Results [ə] / [e]



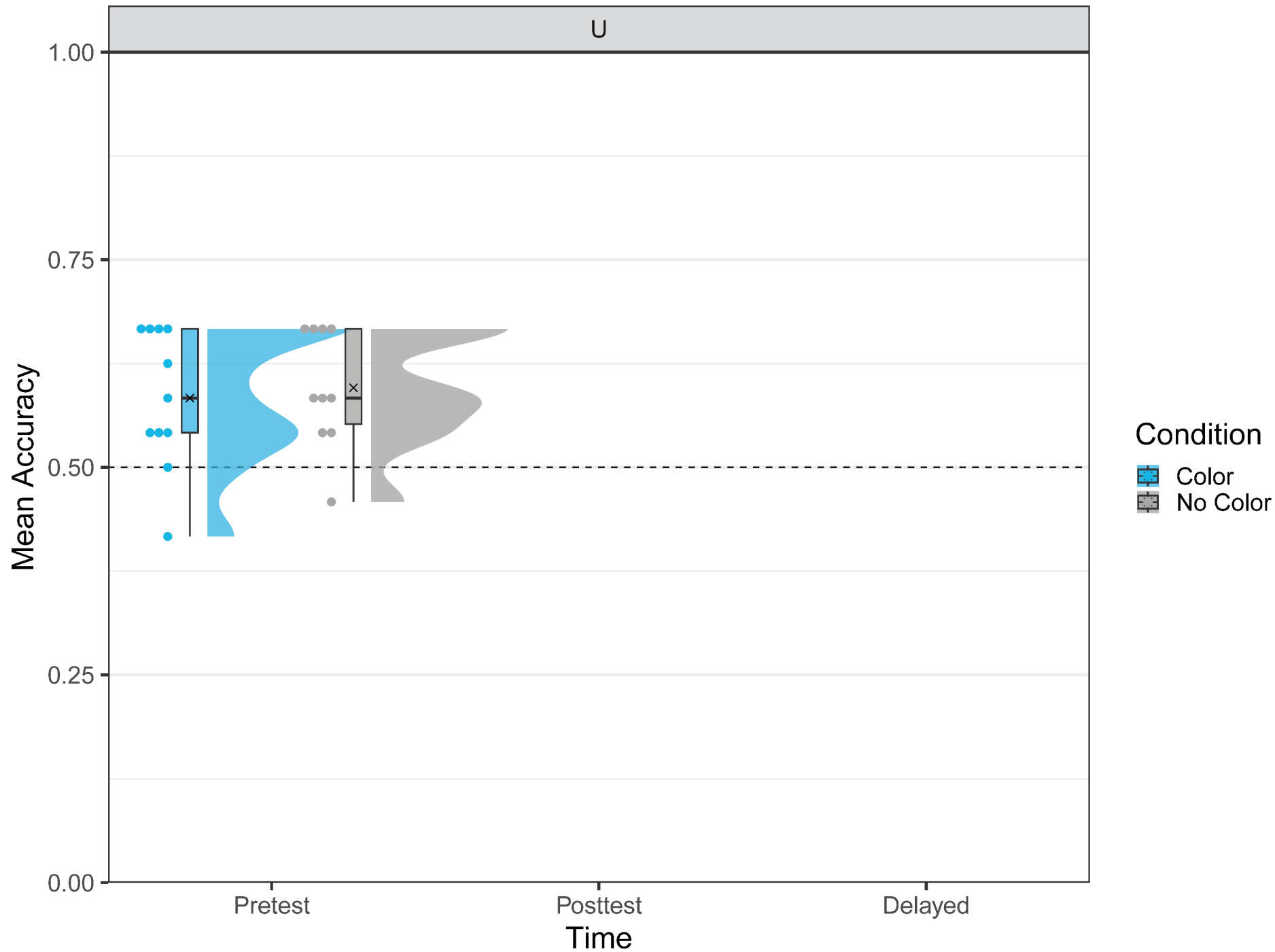
ABX Results [ə] / [e]

- Main effect for Time ($p < .001$)
- No main effect for Color ($p = .162$)
- †Effect for Time x Color ($p = .052$)



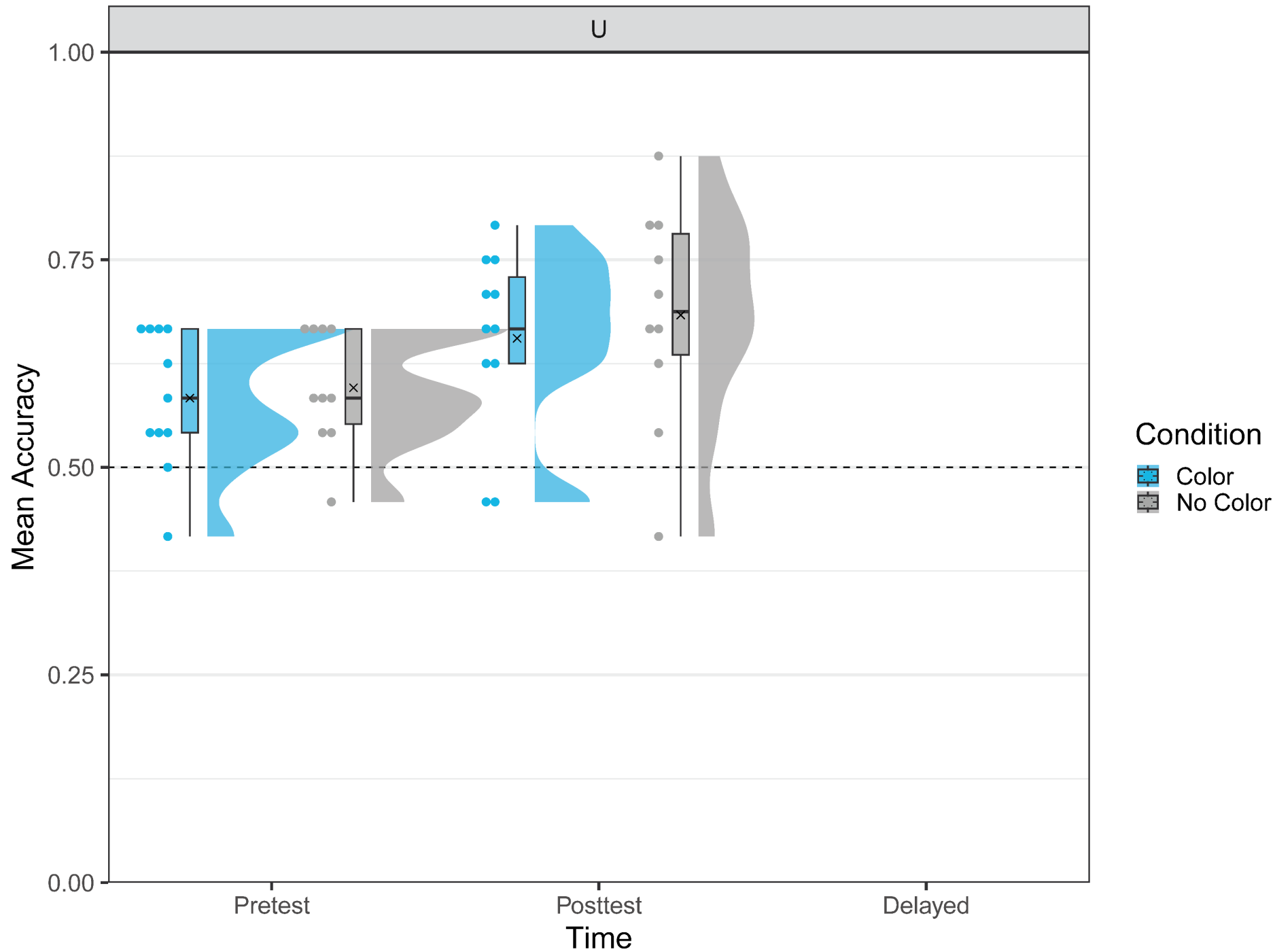
ABX Results

[ψ] / [γ]

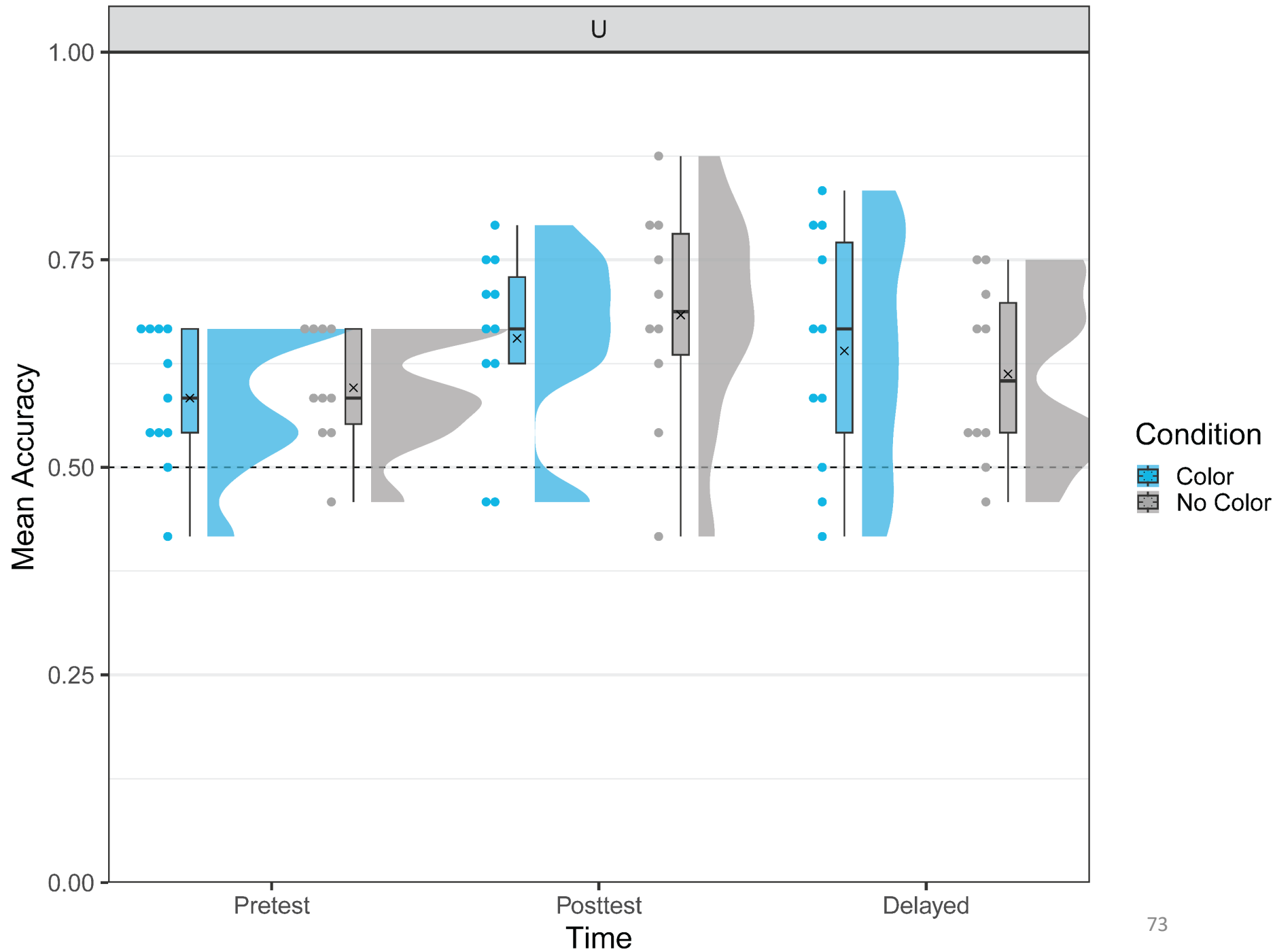


ABX Results

[ψ] / [γ]

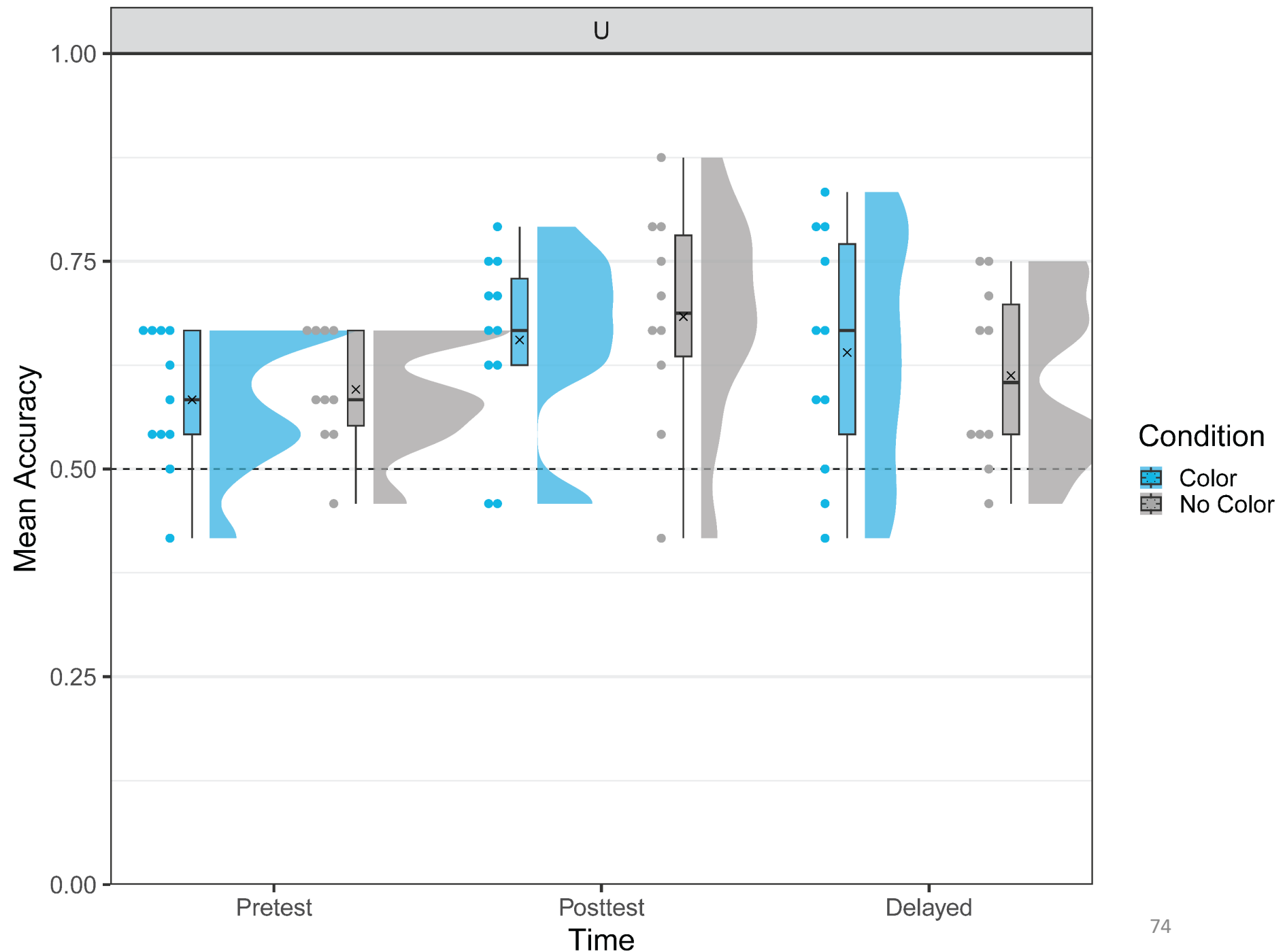


ABX Results [ψ] / [γ]



ABX Results [ʊ] / [ɣ]

- Descriptive increase in scores from pretest to posttest.
- No main effects for Time ($p = .121$) or Color ($p = .736$)
- No Time x Color interaction ($p = .412$)



Discussion – The effects of HVPT

- For the [ə] / [e] contrast:
 - Participants improved throughout the training.
 - Participants showed increased discrimination on the ABX task.
- For the [ʊ] / [ɣ] contrast:
 - There was mixed evidence of improvement
 - Participants improved throughout the training (though apparently not as much as with the [ə] / [e] contrast).
 - Participants did not show (statistically) increased discrimination on the ABX task.

The effects of color / orthography

- During the training, there was no effect color / orthography.
- In the ABX task:
 - For [ə] and [e]: The group that received orthography (e / er) had a greater ability to discriminate between the two vowels.
 - For [ʊ] / [ɤ] : The presence of orthography in training did not lead to differences in discrimination ability.
- Orthography may be helpful when participants can match the orthographic representation to a phonetic representation in the L1 (even if it is somewhat misleading).
 - When no match is available (or if both sounds would map to the same grapheme), the presence of orthography does provide any advantage.

Thank you!

- Special thanks to:
 - Jackie Cheng
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 - Ellen Jones



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ABX Stimuli

[ɐ] / [ə]				[ʊ] / [ʏ]			
A	B	Type	Items	A	B	Type	Items
dieser	diese	Target	12	musste	Müsste	Target	12
schöner	schöne	Target	4	Gluck	Glück	Target	4
toller	tolle	Target	4	junger	jünger	Target	4
schicker	schicke	Target	4	dummer	dümmer	Target	4
Kirsche	Kirche	Distractor	4	süchten	sichten	Distractor	4
Löcher	Löscher	Distractor	4	Bund	Band	Distractor	4
singen	Sänger	Distractor	4	Ruck	Rücken	Distractor	4
backen	Bäcker	Distractor	4	Kunst	Künste	Distractor	4
dieser	dieses	Distractor	4	Müll	Müller	Distractor	4
diese	dieses	Distractor	4	Stück	Stücke	Distractor	4