

# Movement Coherence in High Visual Load Environments: Implications for Attention in Mixed-Hearing Classes

## The Problem

Mixed-hearing movement classes require DHH participants to track multiple visual streams at once.

- Spoken instruction, signed interpretation, and physical demonstration unfold in parallel.
- Participants must monitor the interpreter, instructor, and peers while moving.
- Sustained visual monitoring conflicts with the inward attention mindfulness practices are designed to support.

## Our Study

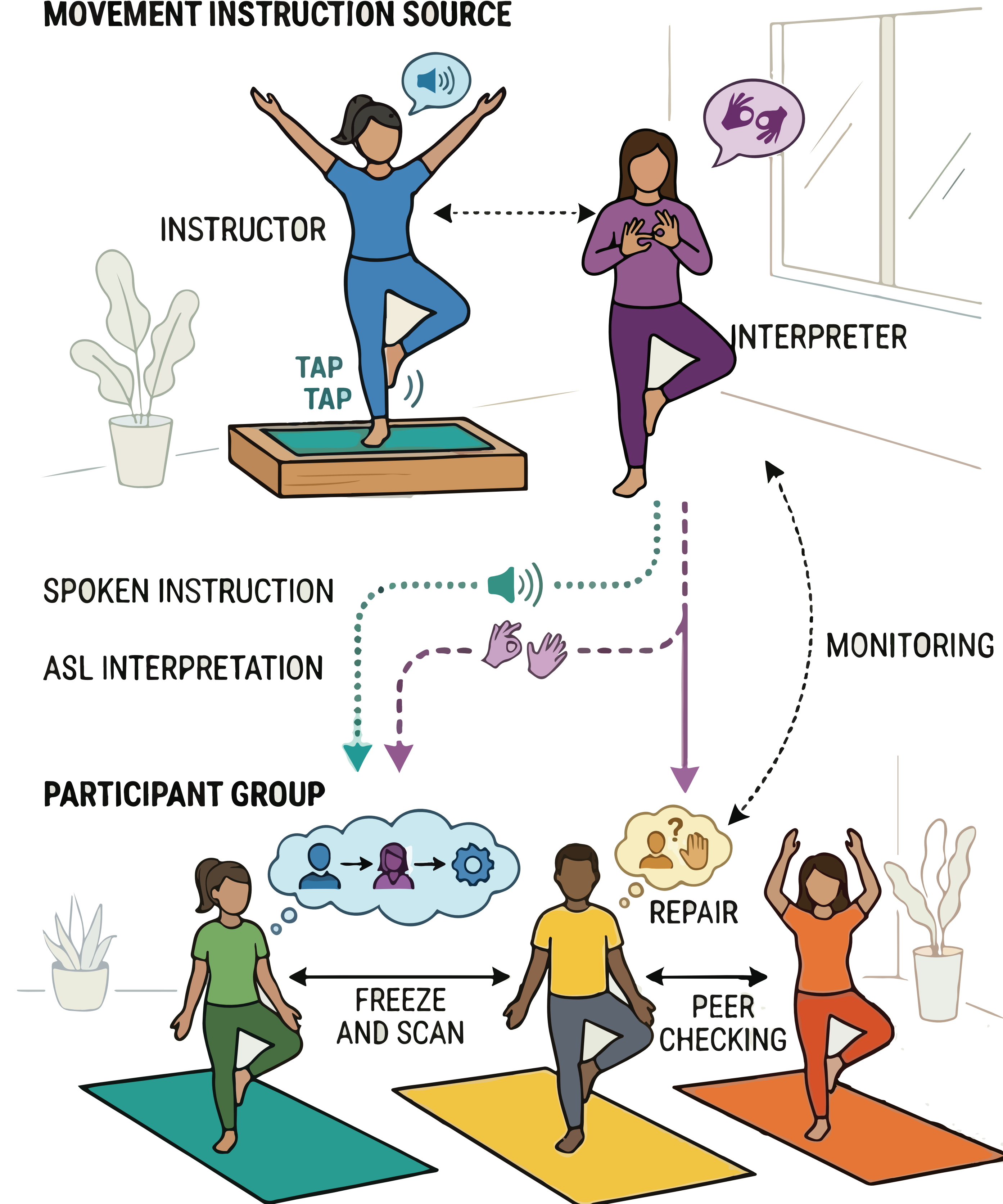
Participatory observational study of mixed-hearing movement and mindfulness classes.

- 9 observed sessions, 50 minutes each
- synchronized dual-camera video
- instructor and expert interviews
- participant and instructor surveys
- ELAN annotation of movement episodes, attention shifts, and repair sequences
- inter-annotator agreement:  $\kappa = 0.67$

## Our Framework

We introduce **movement coherence**: alignment across demonstration, signed interpretation, and bodily execution. When streams diverge, coherence breaks. Attention then narrows to one feature of the space, and any actor can initiate a repair to restore alignment.

## MOVEMENT INSTRUCTION SOURCE



## Contributions

- Challenges in mixed-hearing movement instruction documented through participatory study.
- Movement coherence definition and parsing algorithm.
- Taxonomy of 13 repair strategies.
- Convergent evidence from video annotation, instructor and participant surveys.

**Algorithm 1** Movement Coherence Parsing  
**Require:** Movement streams for instructor  $I$ , interpreter  $S$ , participant  $P$ ; lag threshold  $\tau$   
**Ensure:** Coherence state sequence  $L$   
 1: Extract movement features  $M_I, M_S, M_P$   
 2: for each movement episode  $t$  do  
 3:   Compute alignment and temporal lag between streams  
 4:   if streams are aligned and lag  $\leq \tau$  then  
 5:      $L_t \leftarrow$  ALIGNED  
 6:   else if streams diverge or lag  $> \tau$  then  
 7:      $L_t \leftarrow$  DIVERGENT  
 8:   end if  
 9:   if previous state was DIVERGENT and alignment is re-established then  
 10:      $L_t \leftarrow$  REPAIRING  
 11:   end if  
 12: end for  
 13: return  $L$

## Findings

### Coherence breaks trigger visible repair.

When demonstration, signed interpretation, and bodily execution fall out of alignment, attention narrows to the stream that can resolve the mismatch, and a repair follows.

**Repair is distributed across actors.** We document 13 repair strategies initiated by participants (peer-checking, freeze-and-scan, signing to the interpreter), interpreters (proximity adjustment, persistent signing), and instructors (tactile cueing, pacing adjustment).

**Comprehension and relaxation pull against each other.** The visual vigilance required to follow instruction prevents the inward attention that mindfulness aims to cultivate. Instructors describe DHH participants as "activated" throughout the session.

## Survey Convergence

Instructor survey confusion signals observed	Repair taxonomy from video annotation	Participant survey preferred attention methods
Copying peers 3 of 9 sessions	Peer-checking participant-initiated ( $n=7$ )	Peer tapping 2 of 10 participants
Scattered gaze 4 of 9 sessions	Freeze-and-scan participant-initiated ( $n=3$ )	Eyes: tired / no change 6 of 10 participants
Vibrational cues used 4 of 9 sessions	Tactile cueing instructor-initiated ( $n=4$ )	Floor tapping 5 of 10 participants

Instructor observations, video annotations, and participant surveys converge on the same coherence-repair cycle

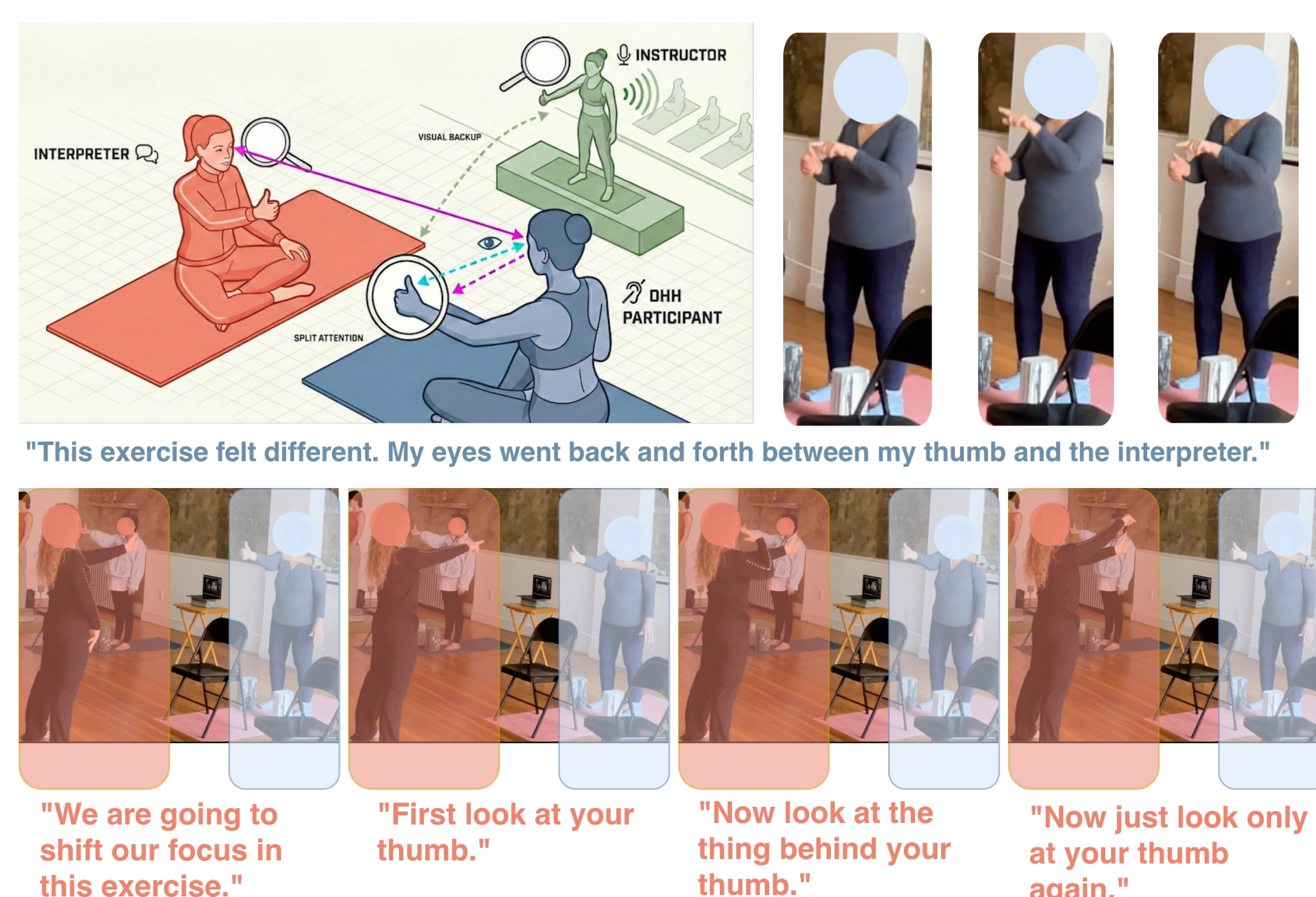
## Design Implications

- Reduce continuous visual monitoring
  - Repeat class structures and predictable sequences.
- Distribute cues across modalities
  - Use tactile, vibrational, proprioceptive, and visual cues.
- Support peer-based coherence
  - Pair participants or structure peer checking as a resource.
- Detect breakdowns in real time
  - Freezing, scanning, and movement divergence can signal repair needs.

Accessibility in mixed-hearing movement spaces is a question of environmental design. Coherence has to be maintainable, and repairable, without exhausting visual attention.

## Case Study: Eye Yoga

### When the task itself competes with the instruction



The eye yoga exercise demands sustained focus on the thumb while instruction about when to shift focus arrives through the same visual channel. Participants adapt by checking the interpreter between focus shifts, relying on peripheral vision, or following peer timing.

