

# University of Stuttgart

Visualization Research Center (VISUS)

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## Augmented Reality Visualization for Musical Instrument Learning

### Overview

- Visual feedback on performance and mistakes helps learning an instrument
- Feedback is easier to understand and apply to playing the instrument, when it is shown directly on the instrument
- We demonstrate two design studies with *augmented reality (AR)* visualizations

### Projector-Based AR for Drums

- Feedback on either tempo or hit strength
- 1) Color visualization: after each hit, color from blue to red for *too early/soft* to *too late/hard*
- 2) Tachometer: a needle that shows deviations in its angle, straight up for perfect
- 3) Pie charts: summaries for different error classes, e.g., very early, slightly early, ...

#### Advantages

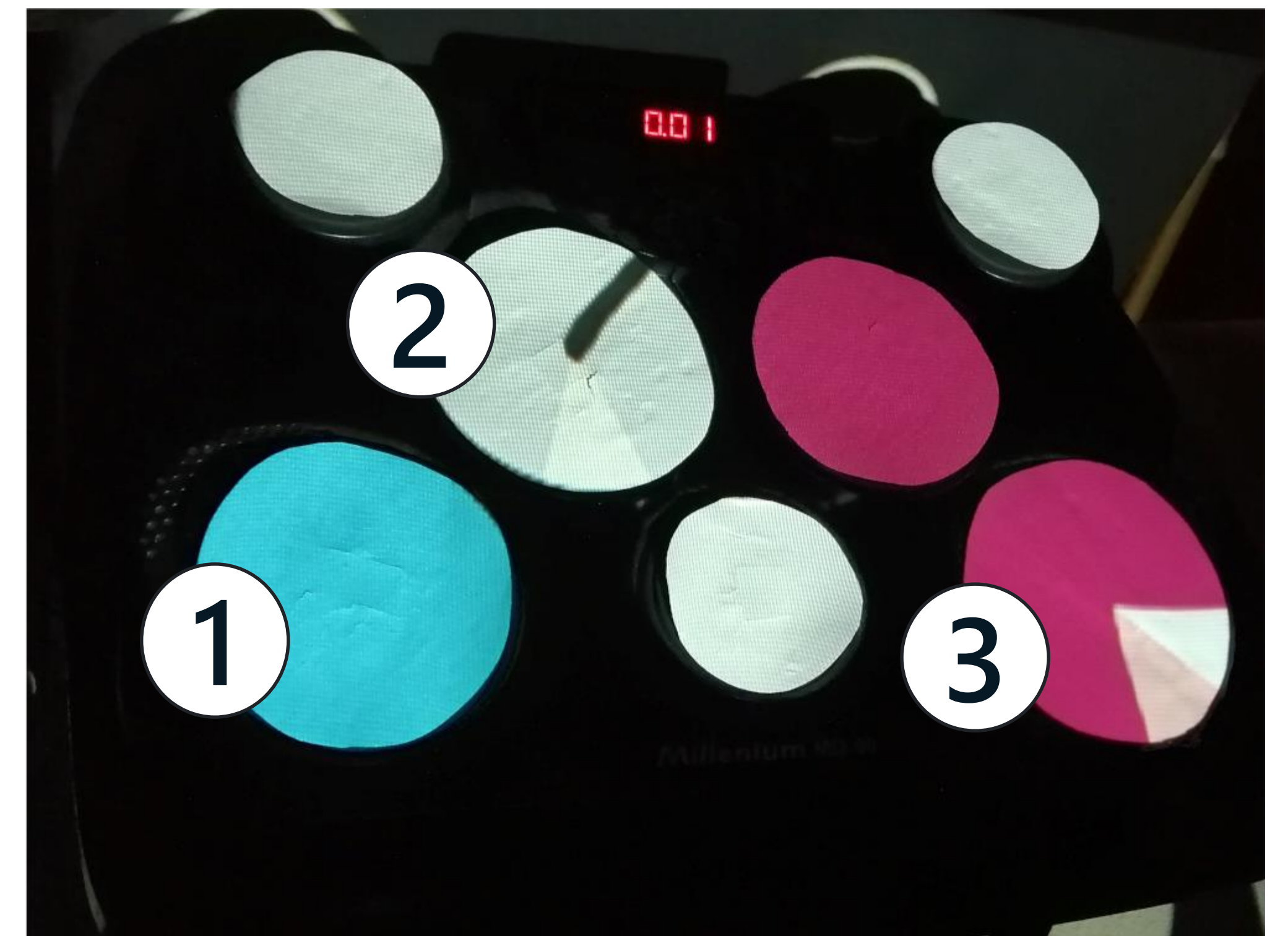
- Affordable hardware (about \$ 300)
- Nothing attached to the user

#### Disadvantages

- Only for flat, non-moving instruments
- Only 2D visualizations
- Only directly on the instrument



Left: Hardware setup with projector and webcam (for calibration) on a tripod.  
Right: Visualizations using 1) color, 2) a tachometer needle, and 3) pie charts.



### 3D AR for Guitar with a Head-Mounted Display (HMD)

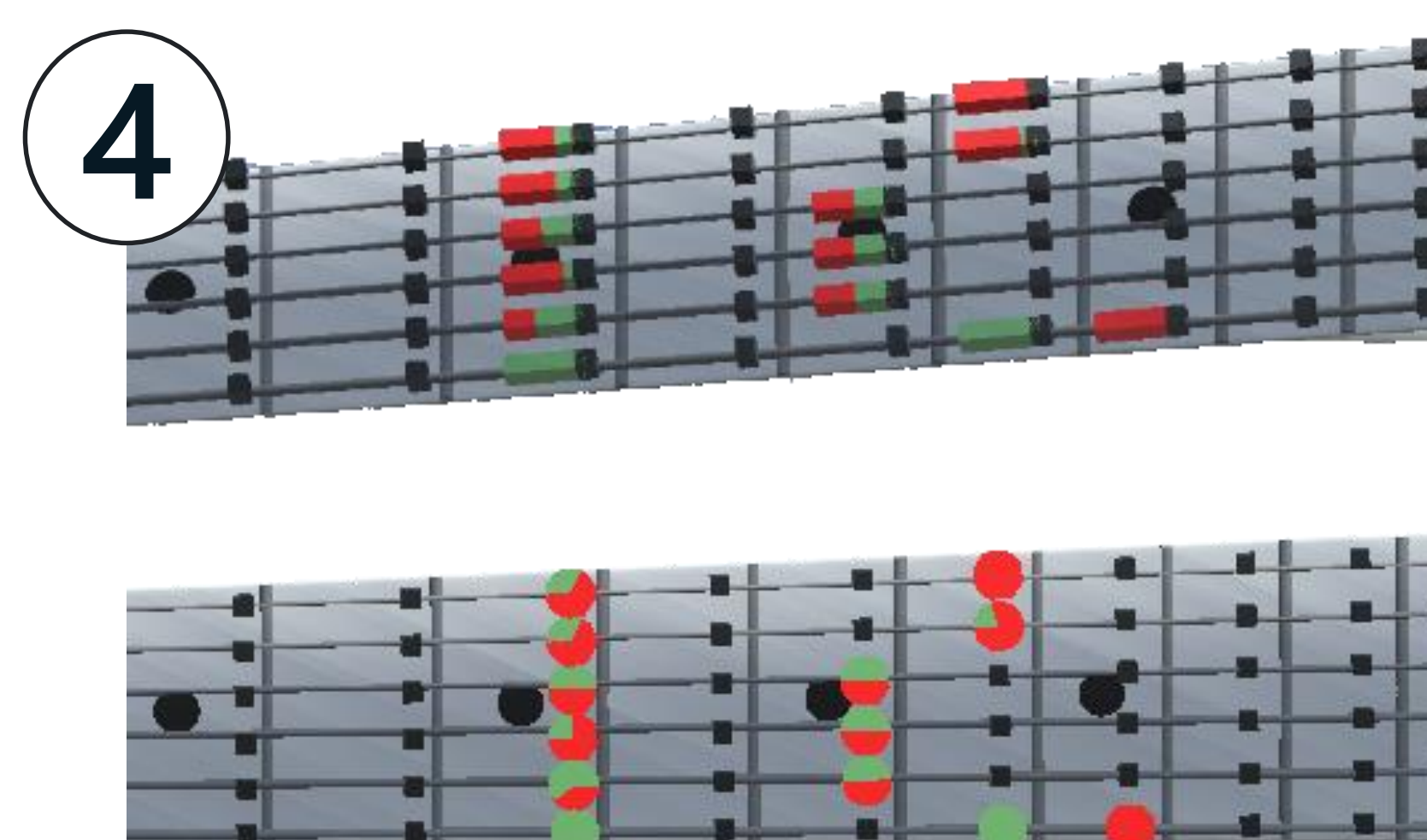
- Feedback on the total error made on different instrument parts
- Different encodings to trade-off between expressiveness, occlusion, ...
- 4) Flat pie and stacked bar charts, 5) 3D bars, 6) balloons

#### Advantages

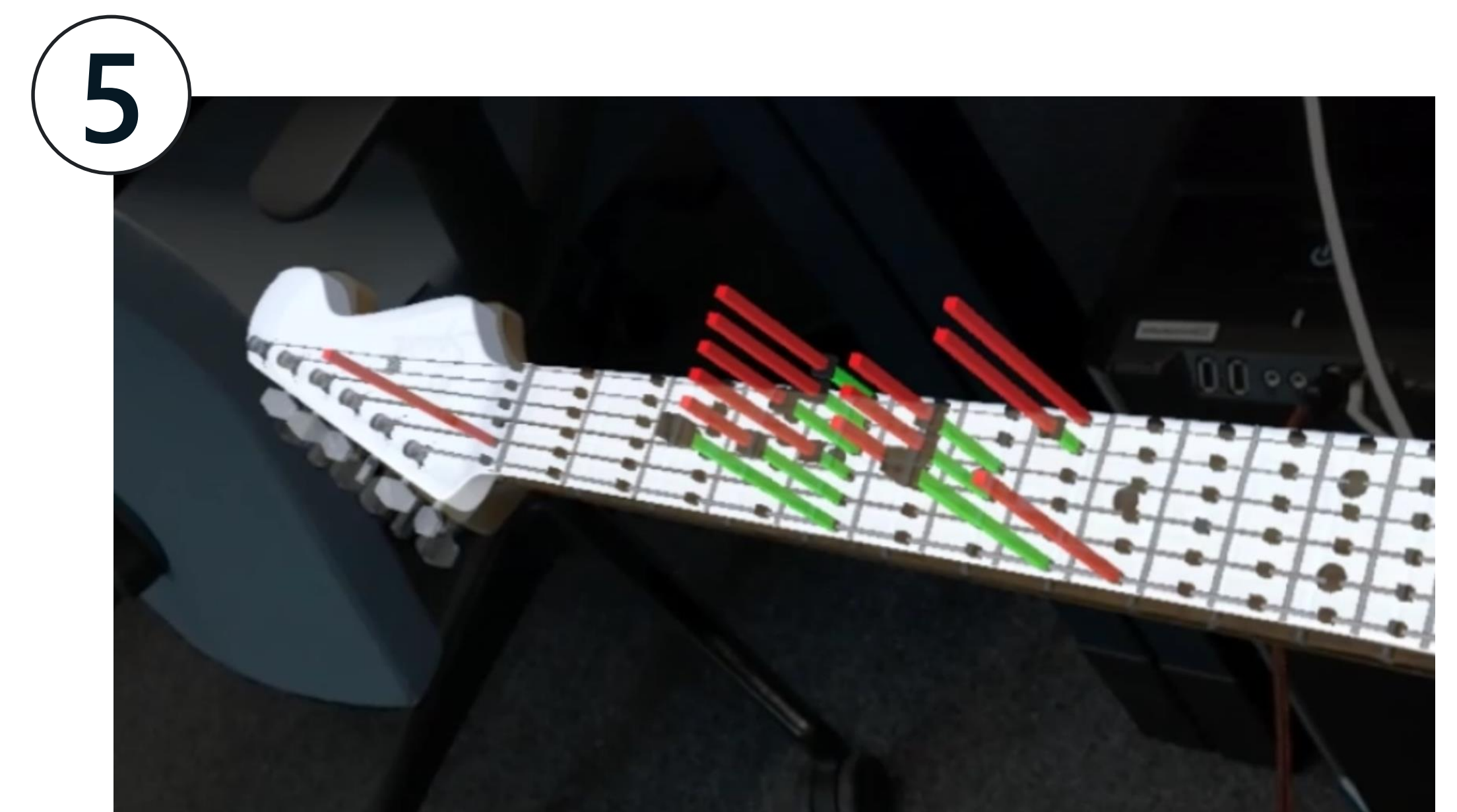
- Moving instruments require tracking
- 3D visualizations
- Positioning on, near, or away from the instrument and/or rotation for better visibility
- Multiple versions (e.g., teacher vs. student, multiple tries) can be shown juxtaposed

#### Disadvantages

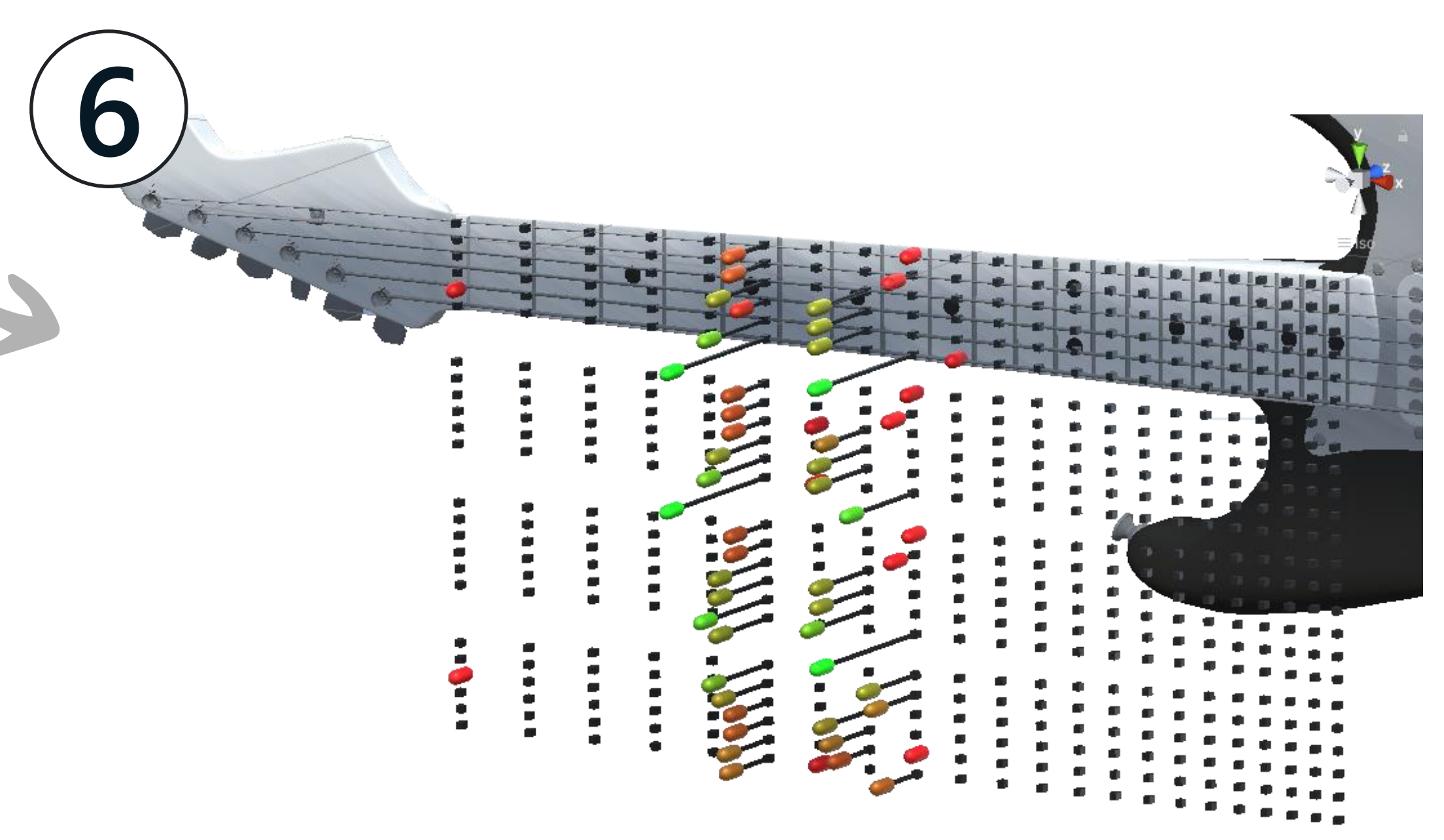
- Expensive hardware (\$ 3500)
- Small field of view (FOV)
- Tracking sometimes lost



Flat bar and pie charts.



A 3D stacked bar chart.



Multiple recordings side-by-side for comparison.

### Future Work

- Use multiple projectors with higher resolution
- Use video see-through HMDs with larger FOV
- Further, task-specific encodings
- Evaluation through field study with regular usage

