



WHAT IF... Your everyday objects could become musical instruments?



MOTIVATION

Problem: Current AR music systems can be expressive, but they are often difficult to learn, interpret, and control reliably during live interaction.
Opportunity: Everyday objects already support familiar actions such as holding, moving, rotating, and positioning, making them promising anchors for interaction.
Aim: To design and evaluate an object-centred AR prototype for expressive, understandable, and reliable musical interaction.

RESEARCH QUESTIONS

- RQ1** How can everyday objects become expressive AR musical instruments?
- RQ2** How can mapping and feedback support learnability, understanding, and confident control?
- RQ3** How do reliability-oriented techniques affect confidence, control, and trust in performance?

The prototype uses a two-tier interaction architecture:

- 12 handheld-object presets for rhythmic and melodic interaction.
- 3 large-object spatial consoles for ambient and structural sound control.
- Everyday objects and stable surfaces act as spatial anchors for AR music interfaces.
- Colour feedback indicates system states.

PROTOTYPE OVERVIEW

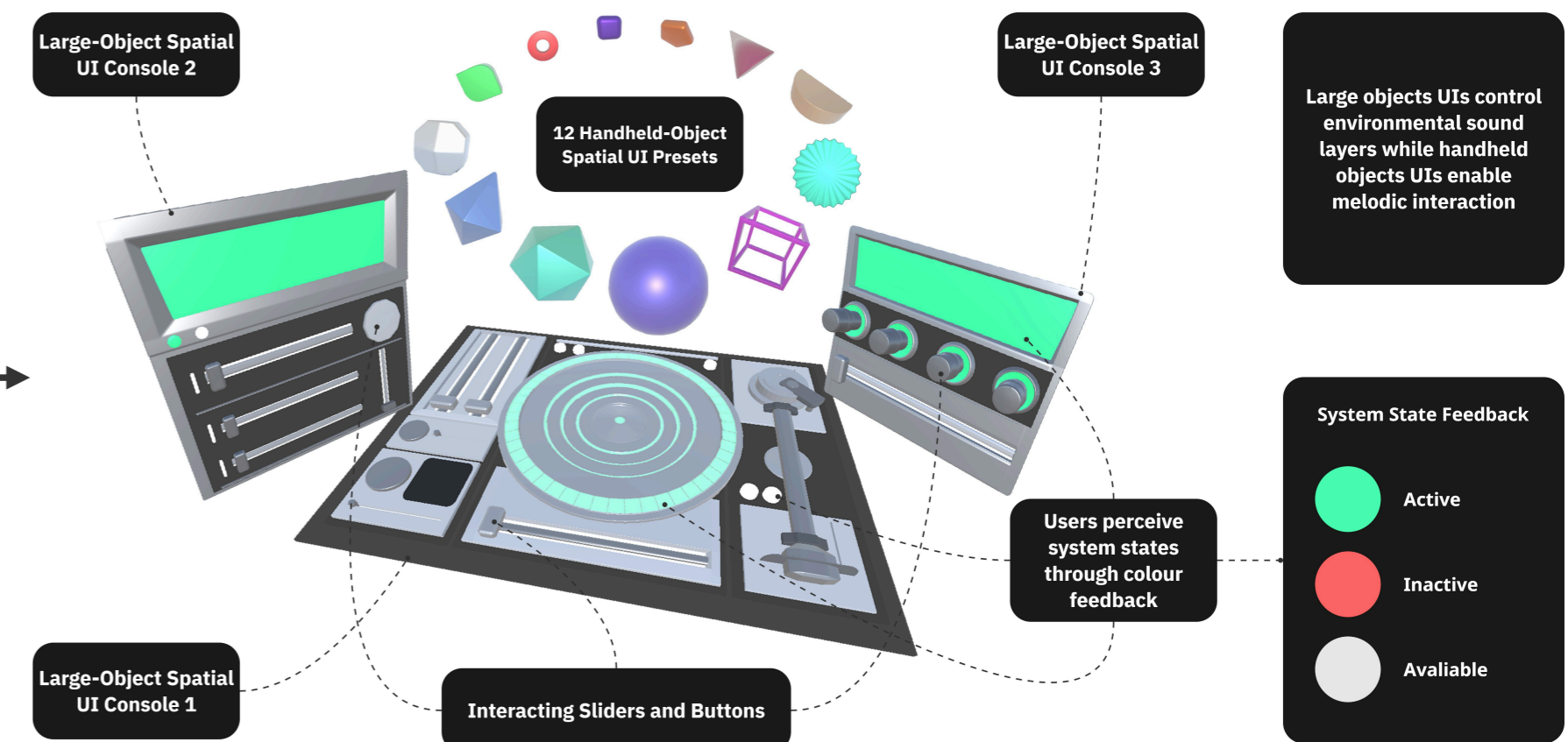
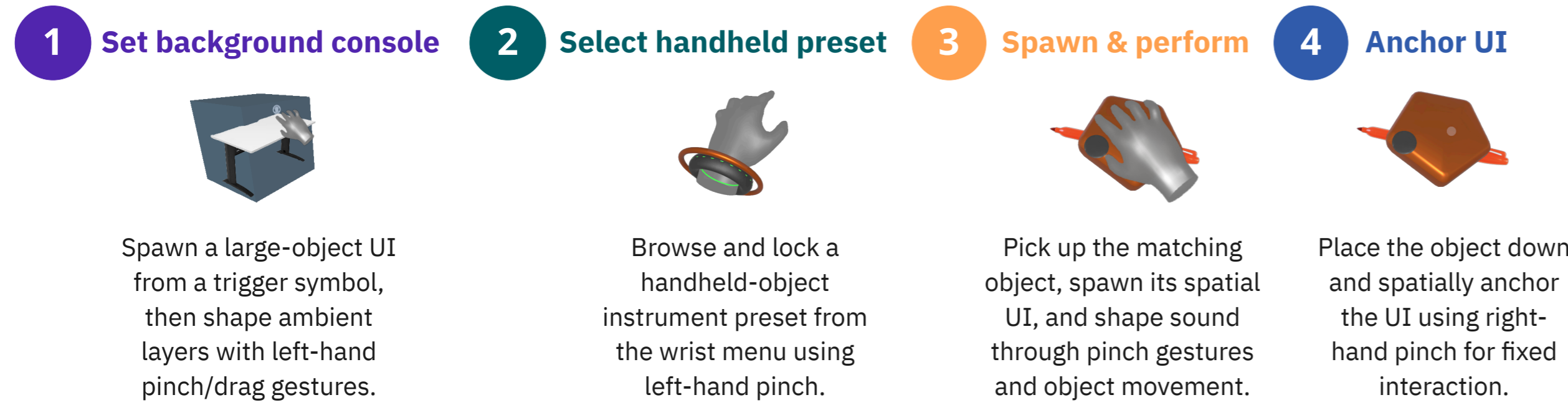
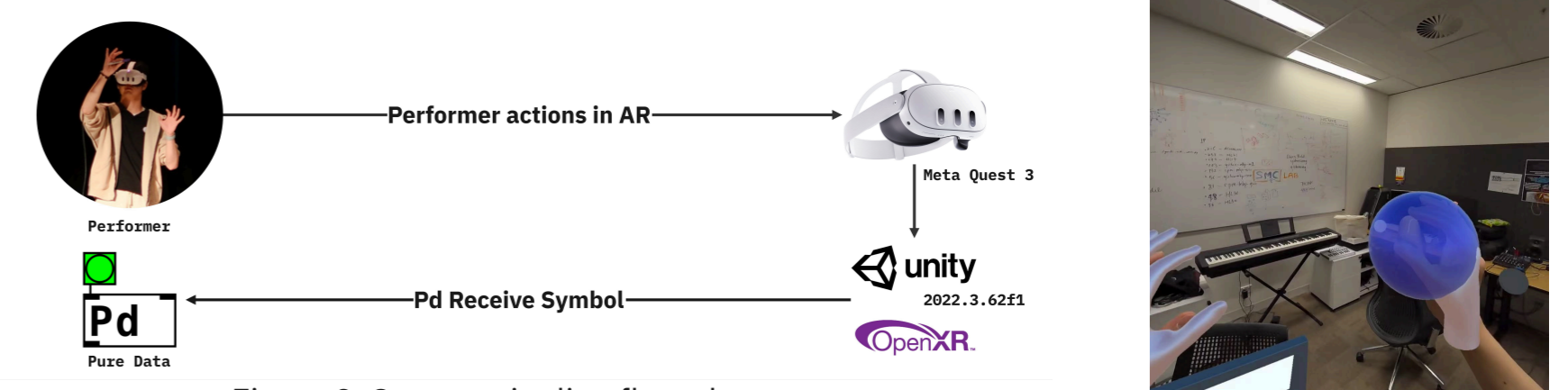


Figure 1. The prototype separates handheld-object instruments from large-object spatial consoles, allowing everyday objects and stable surfaces to support different musical roles.

INTERACTION WORKFLOW



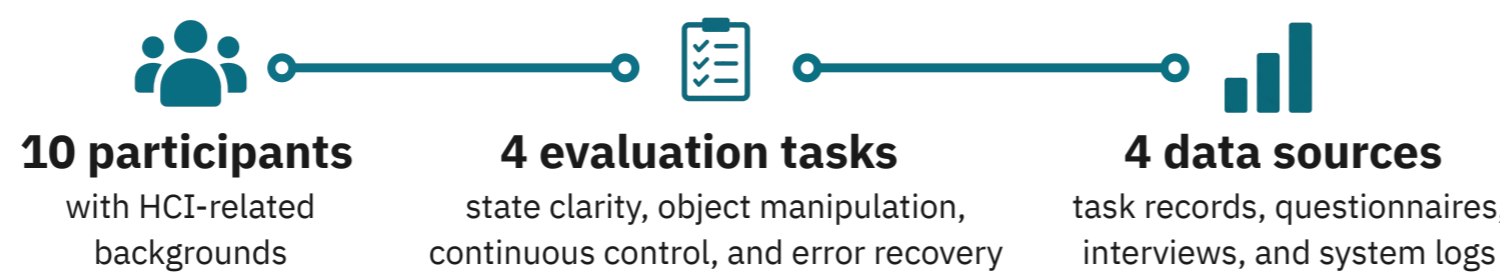
SYSTEM PIPELINE



Quest 3 hand tracking captures performer gestures; Unity maps them into musical control signals; Pure Data generates real-time sound and feedback.

PERFORMANCE & USER EVALUATION

The prototype was examined through a first-person performance reflection and a task-based HCI user evaluation.



In each session, the participant was given a short tutorial followed by four evaluation tasks. The evaluation examined learnability, confidence, perceived control, mapping clarity, and reliability of the prototype.

RESULTS

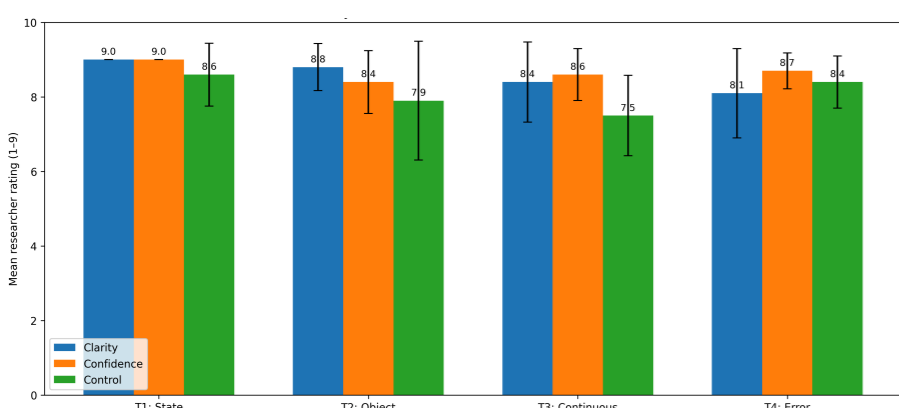


Figure 3. Task clarity, confidence, and control across evaluation tasks.

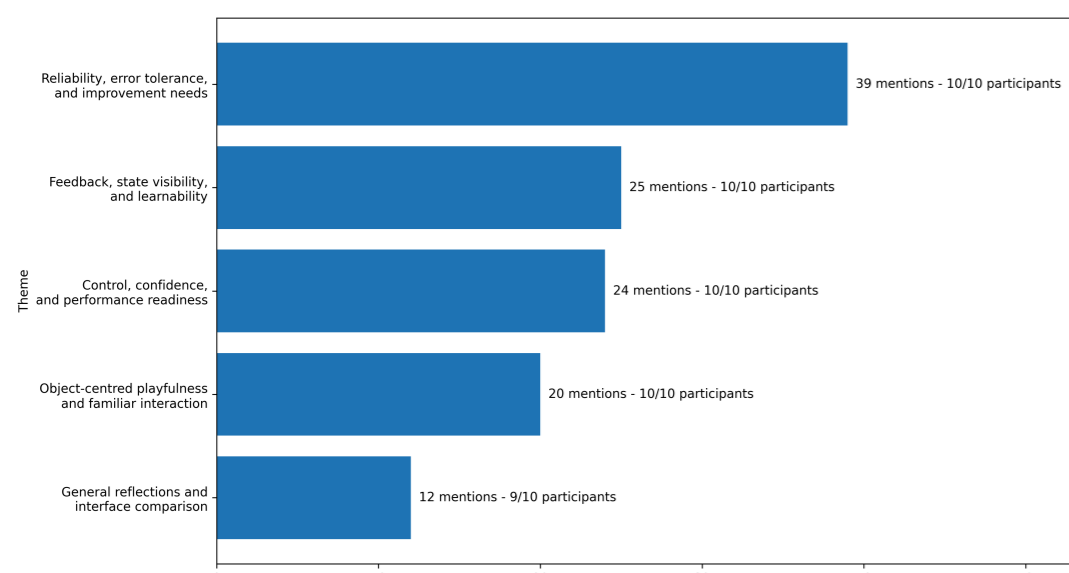


Figure 4. Interview theme frequency from user feedback.

Overall Findings

Participants generally understood the object–interface–sound relationship after a short introduction. Task ratings were positive, while interview coding identified reliability as the most prominent concern.

Key Results

- Clarity and confidence were consistently high across 4 evaluation tasks.
- Reliability concerns centred on trigger stability, repeated pinch attempts, and recovery.
- Expressive object mapping must be supported by clear feedback, stable control, and reliable recovery.

QUALITATIVE INSIGHTS

Object-centred Playfulness & Familiar Interaction

- Physical familiarity helped users approach the interaction quickly.
- Everyday objects made the system feel engaging and meaningful.

Feedback & State Visibility & Learnability

- Colour cues helped users recognise system states.
- Clear audio-visual feedback supported learning and confidence.

Control & Confidence & Performance Readiness

- Predictable responses helped users feel ready for performance.
- Confidence depended on predictable mappings and stable control.

Reliability & Error Tolerance & Improvement Needs

- Minor false or unstable triggers still occurred.
- Recovery support and control stability remain key refinements.

MAIN TAKEAWAYS

- **Everyday objects can become intuitive AR instruments.**
Familiar physical actions helped users understand object-centred musical interaction.
- **Clear mapping and feedback improved learnability and confidence.**
Colour cues, visible states, and consistent object-interface relationships supported control.
- **Reliability remains the key challenge for performance use.**
Stable triggering, continuous control, and clearer recovery are key future refinements.

CONTRIBUTIONS

- A working object-centred AR music prototype using everyday objects as spatial musical interfaces.
- Design insights for balancing expressiveness, learnability, feedback clarity, and reliability.
- Mixed-method evaluation evidence connecting feedback clarity, reliability, and user confidence in AR musical interaction.



Scan to watch the instruction video and the performance video