**Evaluation 2**

**Objective and Validation Metrics**

Key objectives from the XR block assembly testing plan:

1. Whether users can intuitively assemble blocks to replicate a pictured table in XR.
2. How validation feedback impacts accuracy and user strategy.
3. If users engage playfully and curiously with the novel interlocking material.

Note – I have combined the fourth objective with the third, as both focus on differentiating user experience and performance based on visual cues.

Based on these objectives, the following metrics were used for evaluation:

Objective 1: Whether users can intuitively assemble blocks to replicate a pictured table in XR.

Metric:

* Users can pick up, move, and accurately place blocks onto target positions, benefiting from guiding cues and without extensive external assistance.

Objective 2: How validation feedback impacts accuracy and user strategy.

Metric:

* Participants correctly interpret blue hologram cues/shadows for block placement.
* Users distinguish colour coding for blocks, understanding the role of blue (placement), yellow/red (block type/orientation), and their effect on task performance.

Objective 3: If users engage playfully and curiously with the novel interlocking material

Metric:

* Participants report ease of reaching, grabbing, and manipulating all blocks.
* Boundary and workspace issues (like out-of-reach or floating blocks) are recorded and user feedback on physical comfort is collected.

**Results**

This table shows a concise overview of participant experiences aligned to each evaluation objective, facilitating quick pattern recognition for further iteration and reporting

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| --- | --- | --- | --- | --- | --- | --- |
| **Participant** | **Accurate Block Manipulation (Pickup, Place, Snap)** | **Interprets Blue (Placement) Cues** | **Interprets Colour Coding** | **Ergonomic/Workspace Comfort** | **Requests for Feedback Improvement** | **Requests for Guidance/Visual Reference** |
| **Ben** | Yes, but wanted rotation prompts, some blocks hard to reach | Yes, found blue cues very helpful | No, found colours not meaningful | No, hard-to-reach blocks, physical constraints | Yes, wanted positive and negative cues | Yes, suggested whole structure guide/hologram |
| **Lilly** | Yes, smooth and intuitive | Yes, blue cues "most helpful" | No, colour not functionally clear | No, some floating/out-of-reach blocks | No specific feedback mention | Yes, wanted a sheet near plate to show target |
| **Ella** | Yes, but some awkward placing | Yes, blue shadow guides helpful | No, blue cues more meaningful than colour | No, boundary issues and low reach | No specific feedback mention | Yes, recommended nearby visual guide |
| **Rithisha** | Yes, but lost tracking/reach issues | Yes, cues helpful even with setup issues | No, cues prioritized over colour | No, hand went out of play boundary, frustrating | No specific feedback mention | No direct mention (focused on setup/boundary) |
| **Prisha & Cimi** | Yes, intuitive and "like Lego" | Yes, blue cues critical for guidance | No, colour secondary to cues | No, some blocks out of reach, preferred flexible movement | No, but wanted easier distance grabbing | Yes, visual reference or overview requested |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Participant** | **Assembly Success** | **Most Challenging Task & Why** | **Helpfulness of Cues** | **Validation Feedback** | **Intuitive Controls** | **Curiosity/Experimentation** | **Suggested Improvements** | **Mental Demand** | **Physical Demand** | **Temporal Demand** | **Performance (1=best)** | **Effort** | **Frustration** |
| **Ben** | Yes | Hard-to-reach blocks due to workspace | Blue cues very helpful; colours not meaningful | Wanted both positive and negative cues | Grabbing/snapping intuitive, rotation suggestions | Structure clearer, reduced guesswork | Improve cue clarity, workspace, automatic snapping | 10 | 8 | 9 | 4 | 11 | 8 |
| **Lilly** | Yes | Floating blocks; out-of-reach | Blue cues helpful, colours not clear | No validation issues | Smooth, like Lego | Playful building | Add target sheet, fix floating blocks | 10 | 7 | 7 | 3 | 9 | 7 |
| **Ella** | Yes | Boundaries restrictive; chair interference | Blue shadow guides helpful | Boundaries affected feedback | Intuitive; boundaries awkward | Experimentation possible | Improve boundary and movement | 14 | 12 | 8 | 5 | 12 | 10 |
| **Rithisha** | Yes | Lost tracking, low boundary | Blue shadow cues helpful | Needed better boundary/feedback | Smooth, but setup issues | Playful interaction despite difficulties | Adjust virtual boundaries, tracking | 15 | 11 | 12 | 6 | 13 | 12 |
| **Prisha** | Yes | Out-of-reach blocks, preferred walking | Blue cues crucial, colour secondary | Wanted easier distance feedback | Intuitive, fun | Creativity encouraged | Overview of full structure, walking | 11 | 6 | 8 | 3 | 10 | 6 |

The above table and analysis provide a comprehensive view of participant experiences, strengths, and opportunities for further design iteration. Here is a synthesized and analysed table based on the user testing transcripts for the Post-Task Questions and NASA TLX Questionnaire:

**Analysis**

* Accurate block manipulation was mostly successful but limited by ergonomic or boundary setups for several users.
* Blue placement cues were consistently reported as the most helpful guidance tool, crucial for task clarity.
* Colour coding (yellow/red) was widely seen as secondary and not well-understood without deeper explanation or functional linkage.
* Workspace and ergonomic comfort were flagged as issues by nearly all users, emphasizing a recurring barrier that affected overall ease of interaction.
* Several recommendations focused on adding negative/positive feedback and structured in-scene guidance to improve confidence and reduce ambiguity.

**Evaluation of Aims**

Objective 1: Whether users can intuitively assemble blocks to replicate a pictured table in XR.

* **Partially Validated**: While most participants successfully grabbed and placed blocks, ergonomic challenges (especially unreachable or floating blocks) indicate room for improvement to ensure consistent success for all users.

Objective 2: How validation feedback impacts accuracy and user strategy

* **Validated**: Blue cues and placement shadows were clearly understood and appreciated, greatly aiding task completion. Other colours required further explanation to gain significance.

Objective 3: If users engage playfully and curiously with the novel interlocking material

* **Partially Validated**: Participants highlighted boundary and comfort issues as recurring challenges. Rectifying physical setup and expanding interaction flexibility is necessary.

**Concept Iteration**

Based on this evaluation, design updates for the next iteration will include:

1. Introducing both positive and negative feedback cues to confirm or correct user actions.
2. Adding in-environment visual references (e.g., hologram or instruction sheet showing desired final structure).
3. Improving boundary calibration, allowing users to reposition themselves or the workspace for better physical comfort.
4. Considering haptic feedback for weight/texture simulation and making block supplies more flexible (e.g., infinite mode).
5. Clarifying the purpose of colour coding or reducing colour reliance in Favor of spatial and visual guides.

**Reflection**

What Worked Well:

* Focused visual guidance like blue shadows significantly supported user learning and precision.
* Intuitive, real-world-inspired grabbing mechanics enabled rapid onboarding for most participants.

What Did Not Work as Well:

* Ergonomic limitations and insufficient negative feedback created occasional frustration.
* Some supporting cues (colour coding, task overview) lacked clarity or relevance and should be made more explicit.

Lessons Learned and Next Steps:

* Prioritize corrections to physical workspace design and cue feedback mechanisms.
* Implement more explicit onboarding and reference aids.
* Iterative testing cycles focused on comfort, guidance, and feedback clarity will ensure broader usability and satisfaction.

**References**

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| --- | --- |
| In-text reference (citation) | When prompted with “Improve grammar and spellings for the draft and give me relevant feedback on structure?” the perplexity-generated text (OpenAI, 2025). |