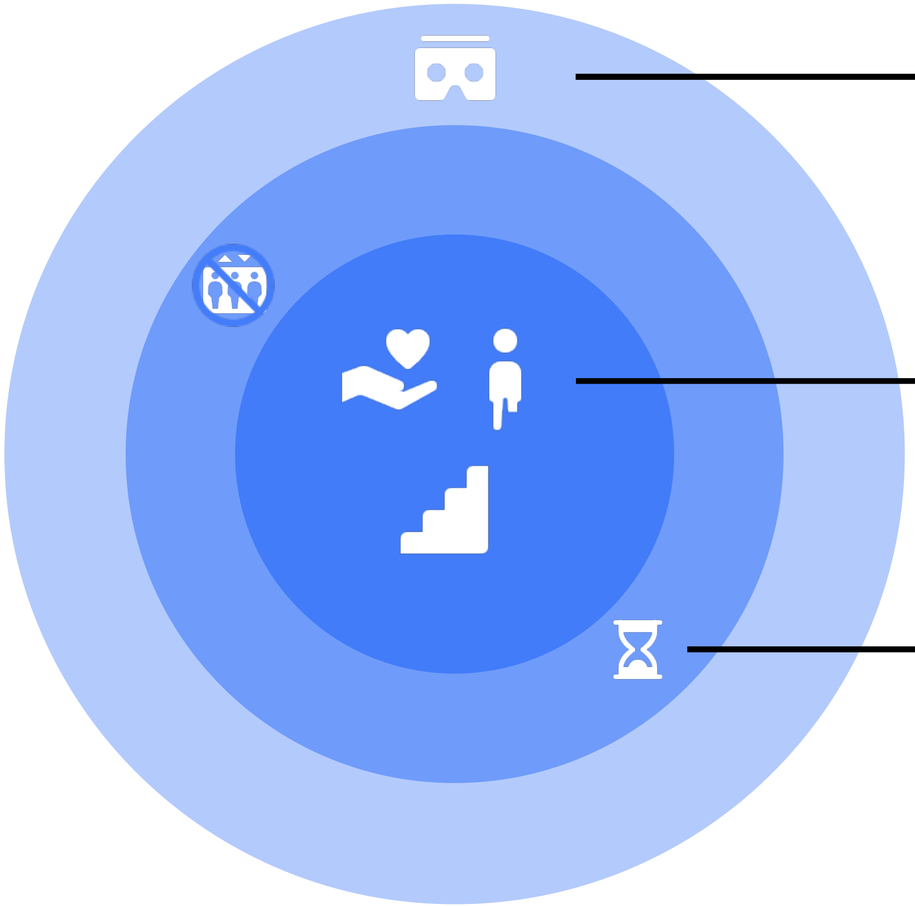
BEYOND THE STEPS

Sakshi Karandikar | Anvika Agane | Om Surkutwar

Stairway Navigation for Limb Impairment - A Springboard for Inclusive Design with AR

INTRODUCTION



Results of the study

Focus areas

Issues faced by existing creatives making solutions

Despite its promise, there is a notable gap in research concerning AR's effectiveness across different patient groups. Given lower limb reliance in daily life, studying AR's potential for lower limb rehabilitation is crucial.



“**Disability affects approximately 15%** of the global population, translating to around 1 billion individuals, as reported by the **World Health Organization (WHO) in 2011.** ”

PROBLEM STATEMENT

Many technologies remain inaccessible to individuals with limb impairments, highlighting the need for innovative tools like Augmented Reality to help designers better understand and address these accessibility challenges in real time.

MAIN OBJECTIVE

To help people design better for disabled individuals by using Augmented Reality to enhance designers' understanding of accessibility challenges.

SUB OBJECTIVE

01 Collect real-time data on user movements and limitations within the AR environment.

02 Instantly visualize and test different design solutions for staircases and related assistive products, enabling an iterative design process within AR.

METHODOLOGY

Secondary Research



This literature review integrates insights from biomechanics, human-computer interaction, and inclusive design, citing important studies that offered valuable data from their experiments and surveys.

This information informed our conceptual framework and guided the development of our experimental methodology to address existing gaps.

It establishes a rationale for exploring augmented reality (AR) as an intervention, guiding hypothesis formulation, variable selection, and user-centered trial design.

DIGITAL PROTOTYPE DEVELOPMENT

Brief of Experiment Design & its Analysis



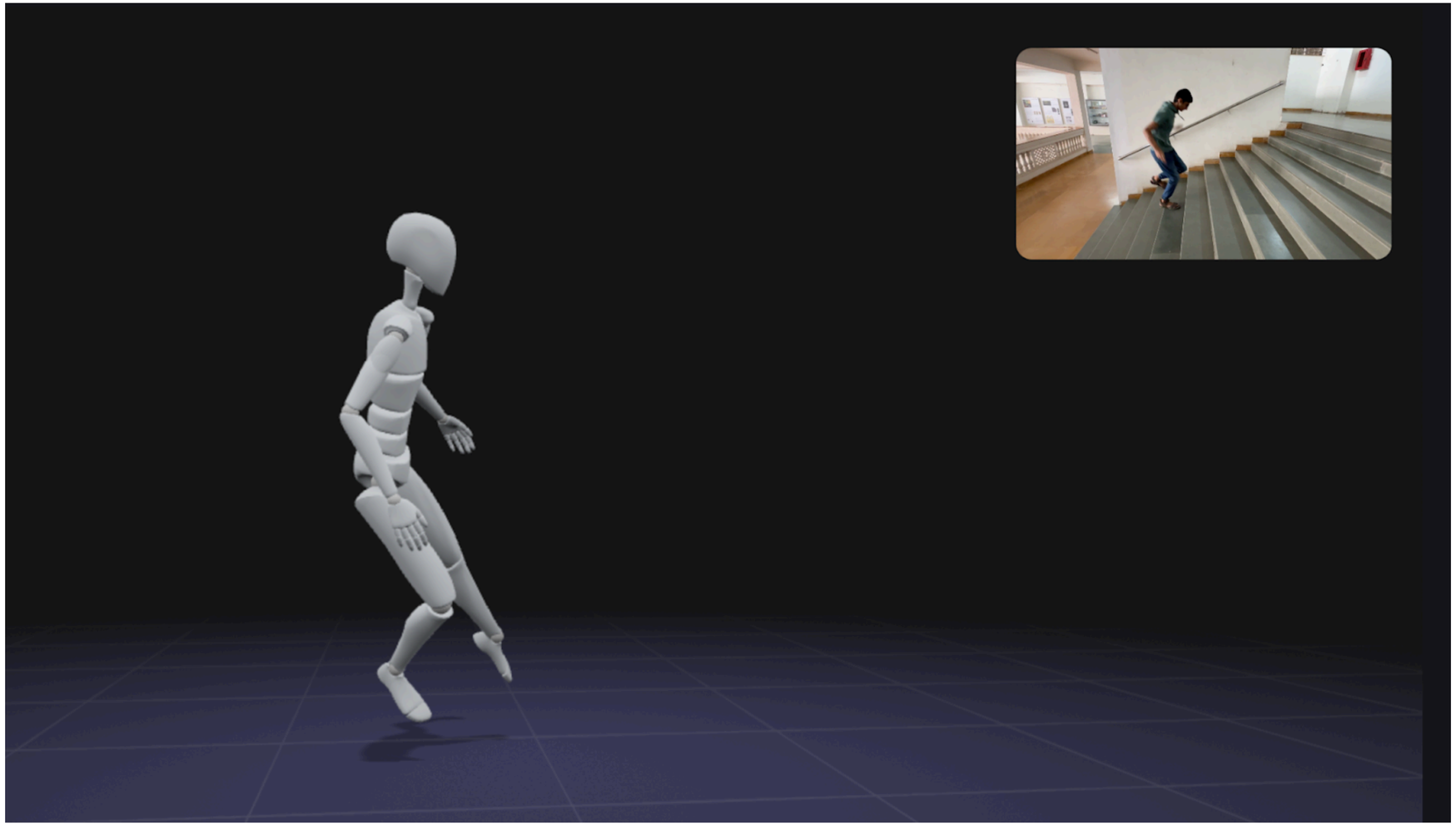
Exploration of Rokoko Vision

We used Rokoko Vision for AI motion capture.

We simulated the movements of a lower-limb amputee, creating a detailed AR model to replicate gait and mobility challenges.

Single-Camera Motion Capture

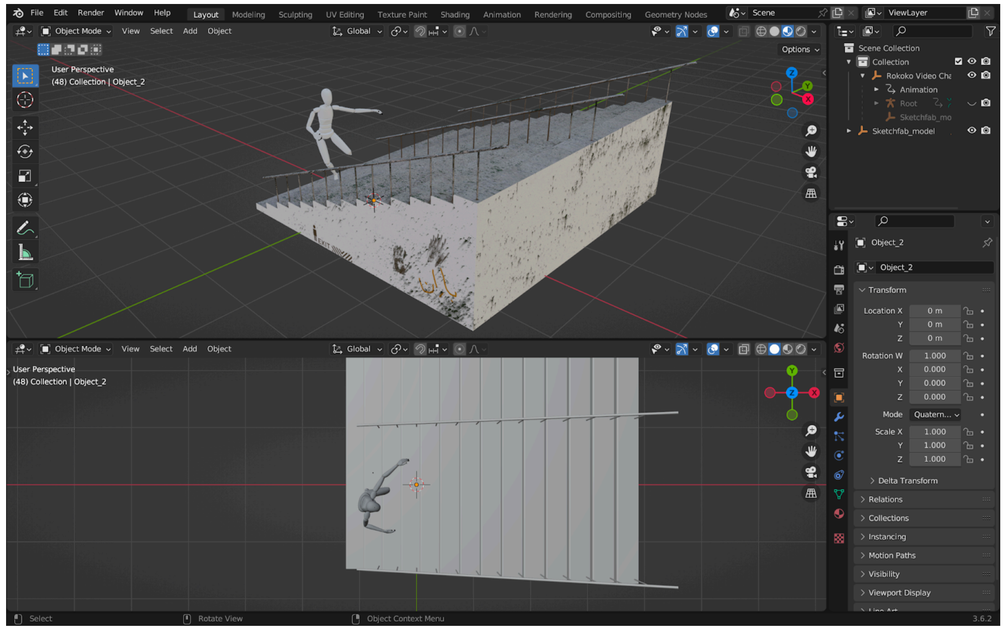
Three videos of a person climbing stairs with one leg were recorded, initially from the top.

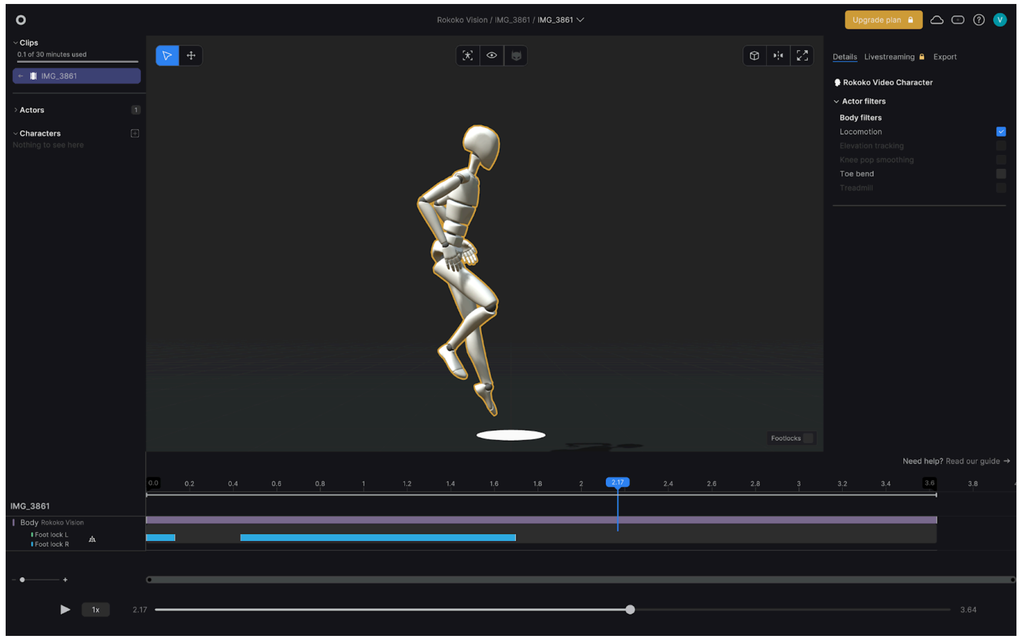


Adjusting to a side angle improved results.

The motion capture was later refined for staircase alignment and jitter reduction using locomotion, then exported as a .fbx file.

Final Adjustments and Export in Blender



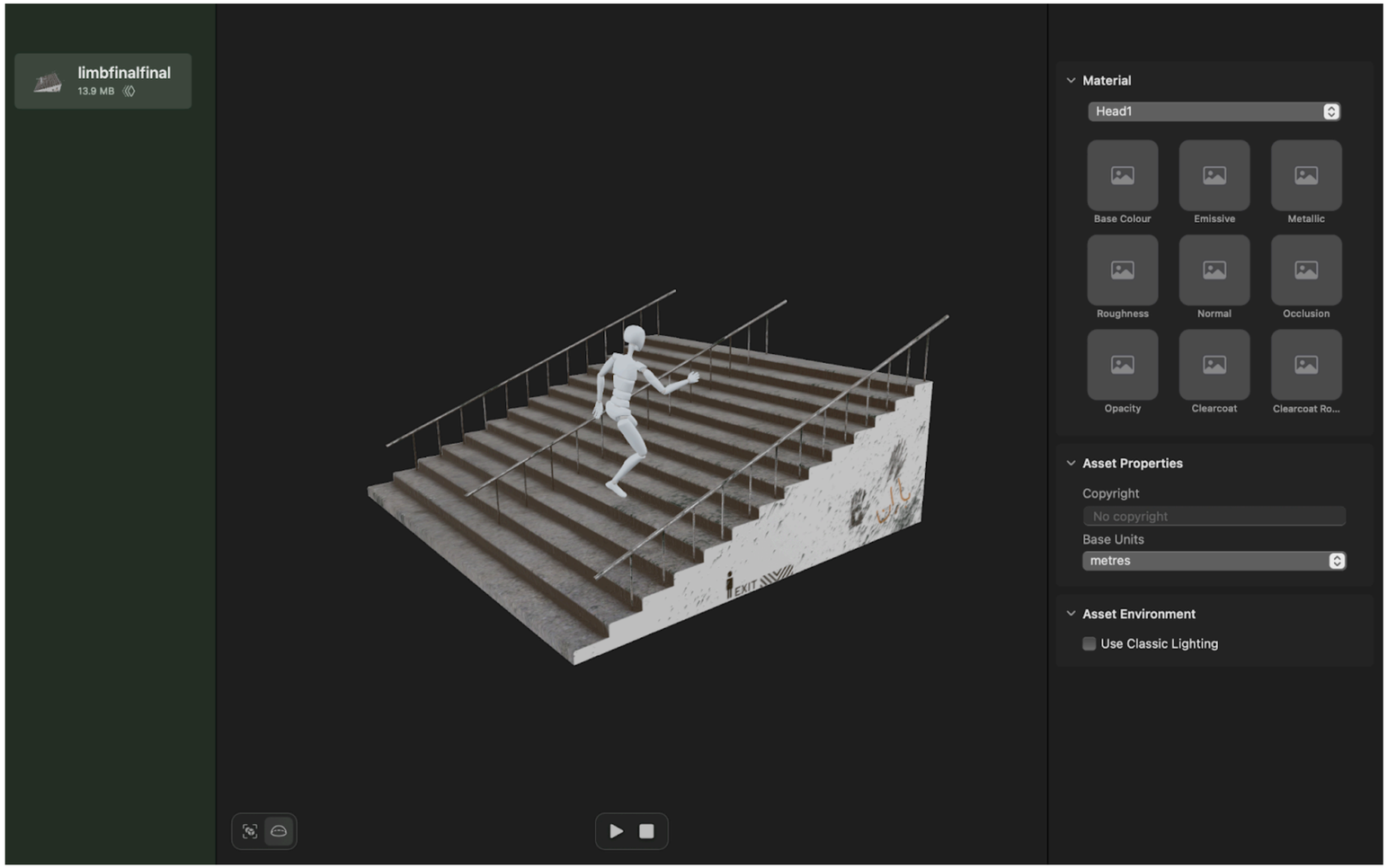


Blender Adjustments

The FBX file was imported, rotated 25 degrees to correct the 2D capture tilt, and the bent limb was removed.

The 'Building Staircase' model from Sketchfab was adjusted to match the character's steps using Clean Keyframes and Apply Object Transform. The stairs were parented to the human model, and the final version was exported as an FBX file.

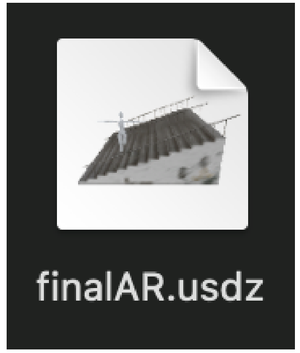
Converting the File and AR Integration



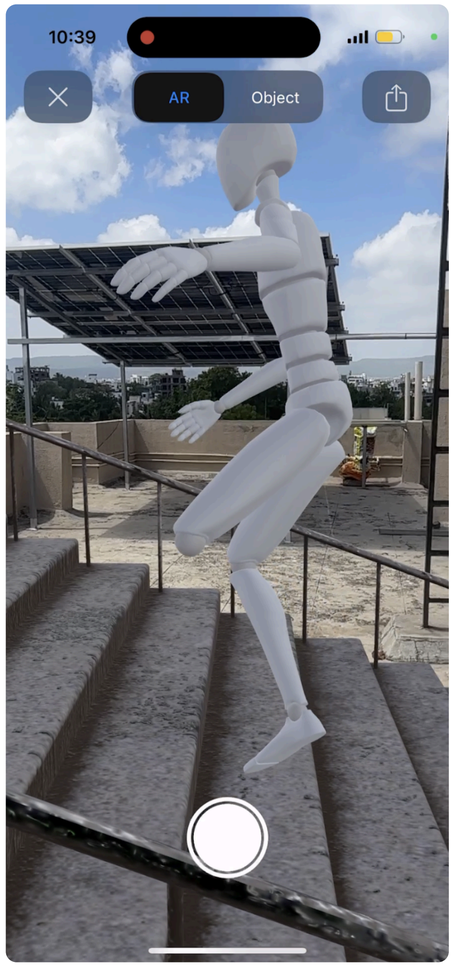
Reality Converter Usage

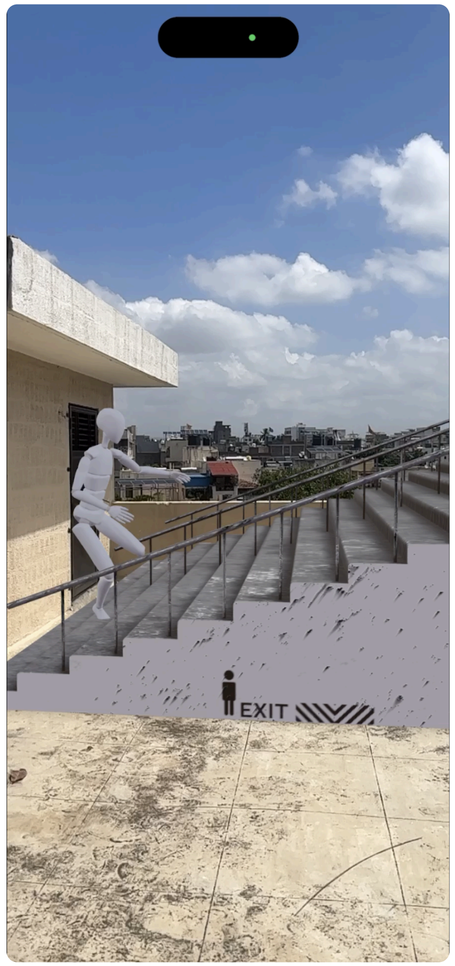
Apple's Reality Converter was used to convert the FBX file to USDZ format for AR content.

The model was previewed, lighting scenarios were selected, and it was exported to USDZ format.



Final AR Animation Result





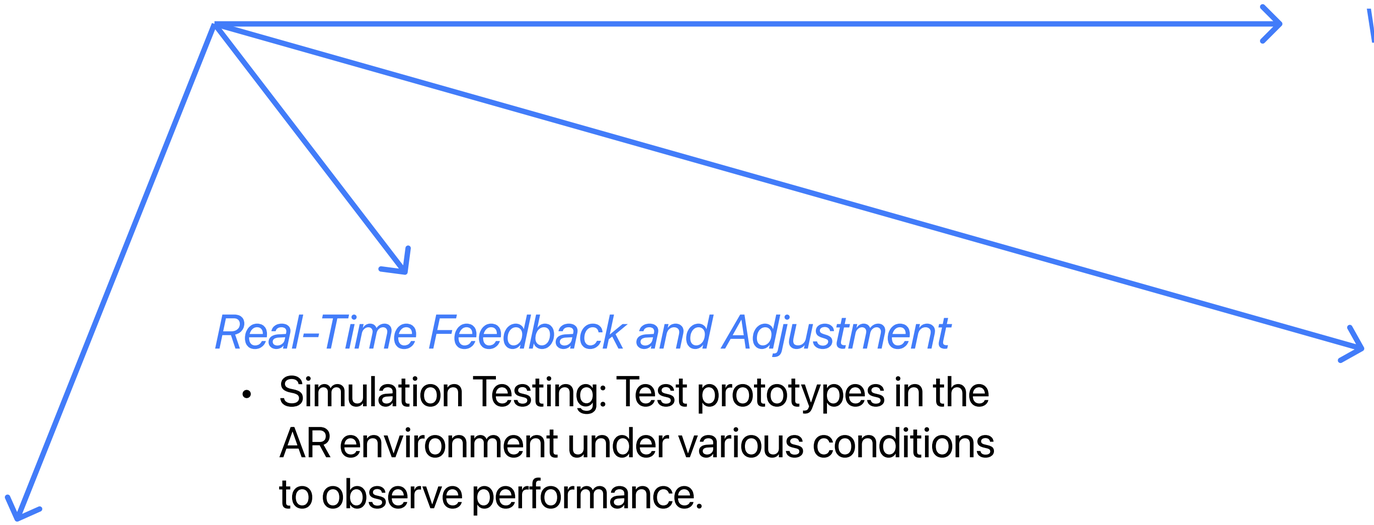


Deployment

The USDZ file can be shared to any iPhone, enabling the camera to scan the environment and play the animation in a loop, viewable from any angle

This experiment shows AR's effectiveness in accessibility research, simulating movements of people with disabilities to give designers insights and speed up inclusive product development.

Possible Outcomes for Using this Experiment to Design Better Products for Disabled People



Validation and Field Testing

- Real-World Testing: Conduct real-world tests after AR refinement to validate usability and comfort.

Real-Time Feedback and Adjustment

- Simulation Testing: Test prototypes in the AR environment under various conditions to observe performance.

Understanding User Challenges

- Analyse AR Model: Identify gait and mobility challenges for lower limb amputees, focusing on balance and movement patterns.
- Identify Pain Points: Highlight difficulties in simulated activities like navigating stairs or uneven surfaces.

Iterative Design and Prototyping

- Develop concepts for enhanced grip and adjustable supports; test prototypes with AR for instant feedback.

LIMITATIONS



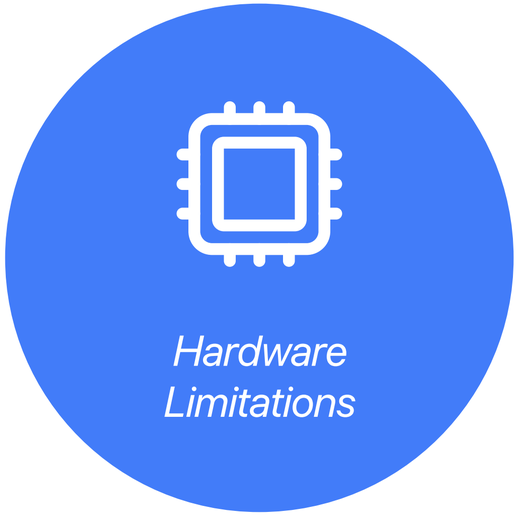
Amateur Experience

Team members' lack of experience with AR software created a steep learning curve, affecting accuracy and efficiency.



Technological Constraints

The motion capture and AR software used were not the most advanced, impacting simulation fidelity.

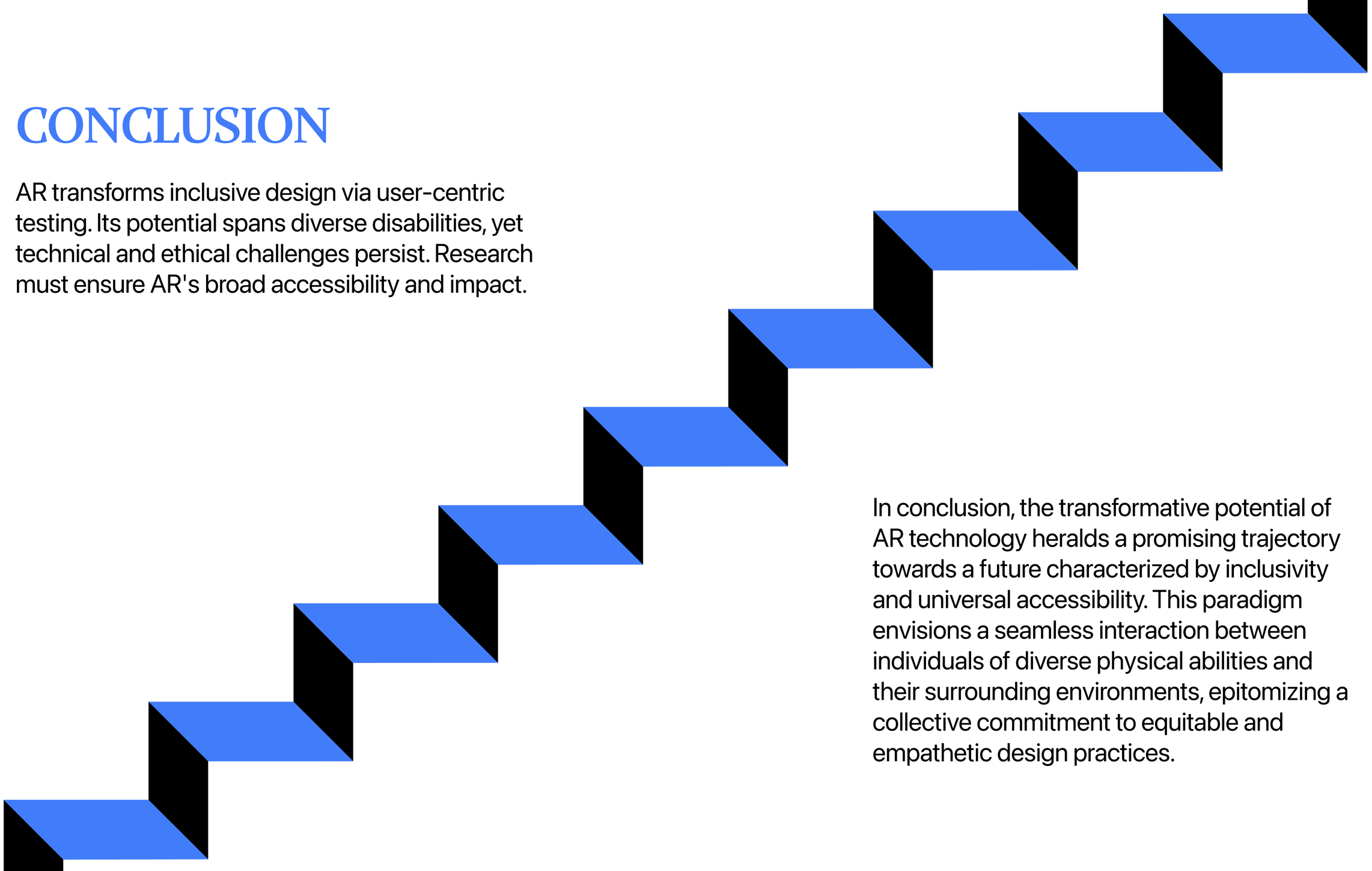


Hardware Limitations

Device restrictions influenced performance, smoothness, and realism of the AR simulations.

CONCLUSION

AR transforms inclusive design via user-centric testing. Its potential spans diverse disabilities, yet technical and ethical challenges persist. Research must ensure AR's broad accessibility and impact.



In conclusion, the transformative potential of AR technology heralds a promising trajectory towards a future characterized by inclusivity and universal accessibility. This paradigm envisions a seamless interaction between individuals of diverse physical abilities and their surrounding environments, epitomizing a collective commitment to equitable and empathetic design practices.