

Investigating Blind People's Route Perception of Complex Pre-Mapped Routes in Virtual Reality

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Overview

VR system for blind people to explore and learn large, complex routes in virtual environment.



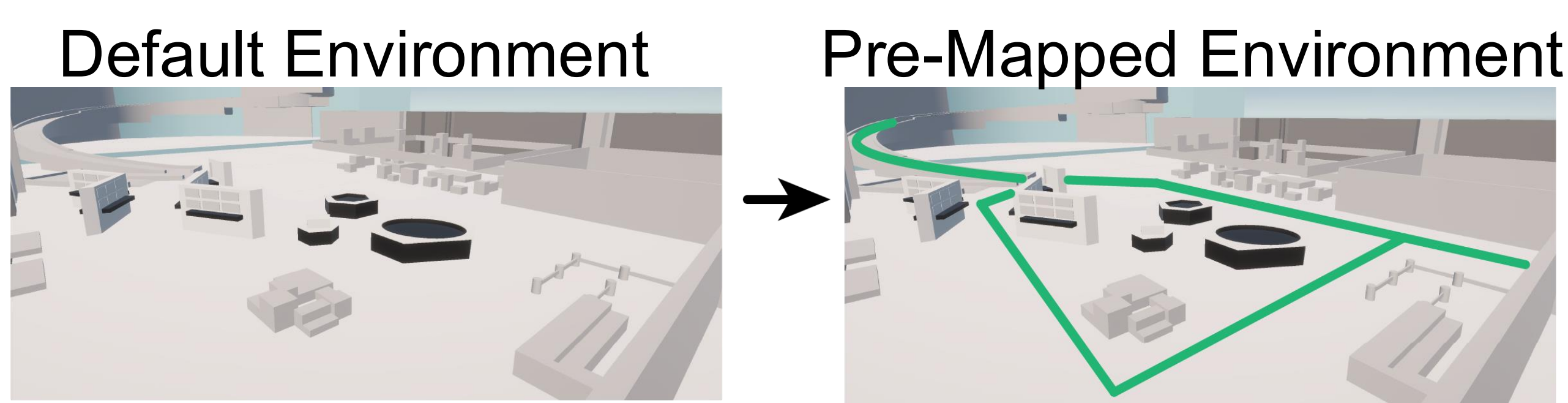
Motivation

Virtual navigation systems used devices like smartphones^[1] and cane controllers^[2]. Still, **these approaches struggle with complex routes** involving curves and intersections.

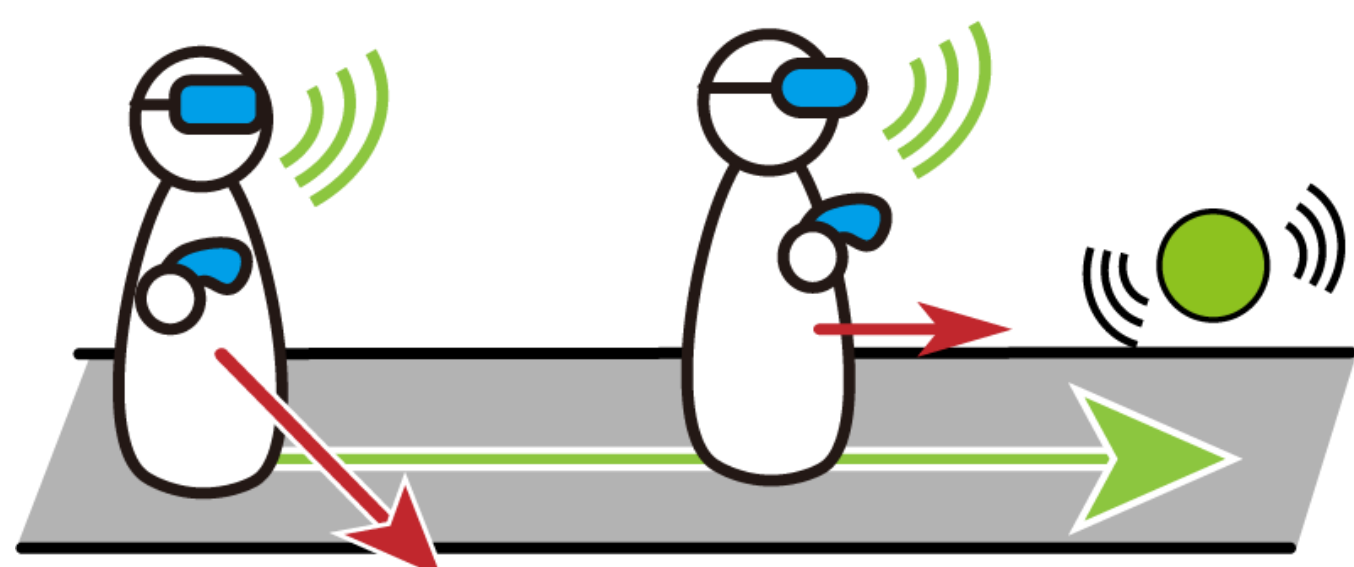
Goal: Convey complex paths in virtual environments.

Our Approach

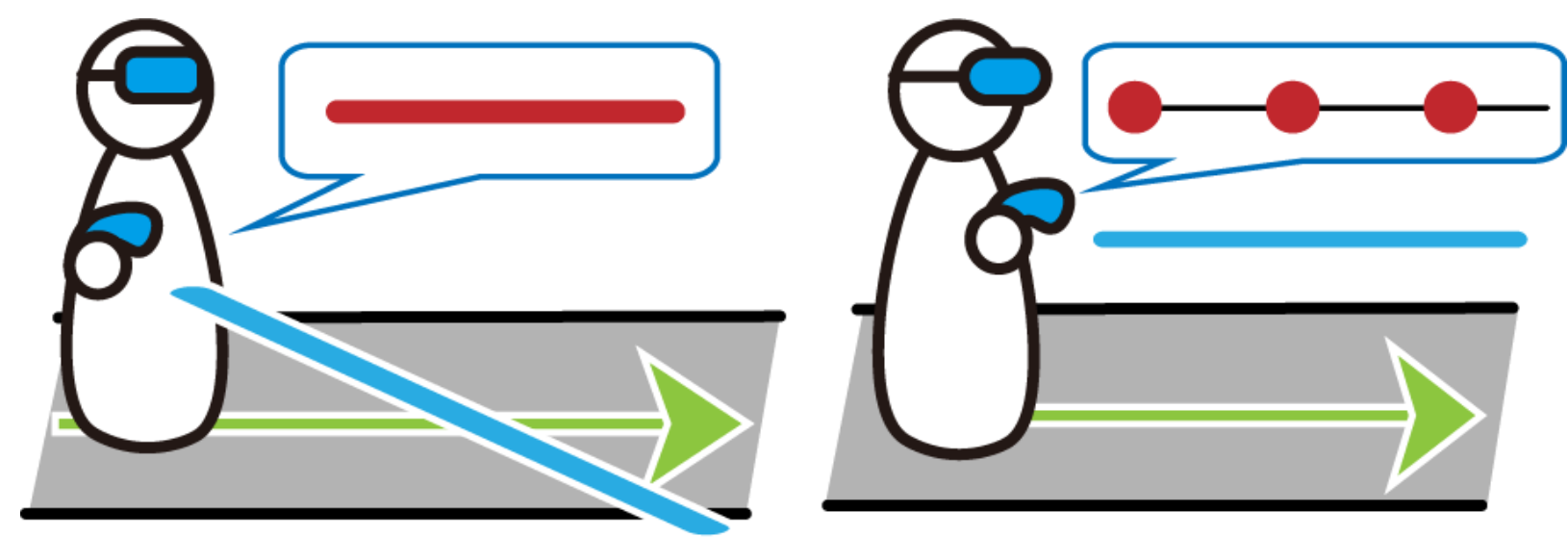
Key Idea: Use a pre-mapped route design to provide a clearer spatial structure.



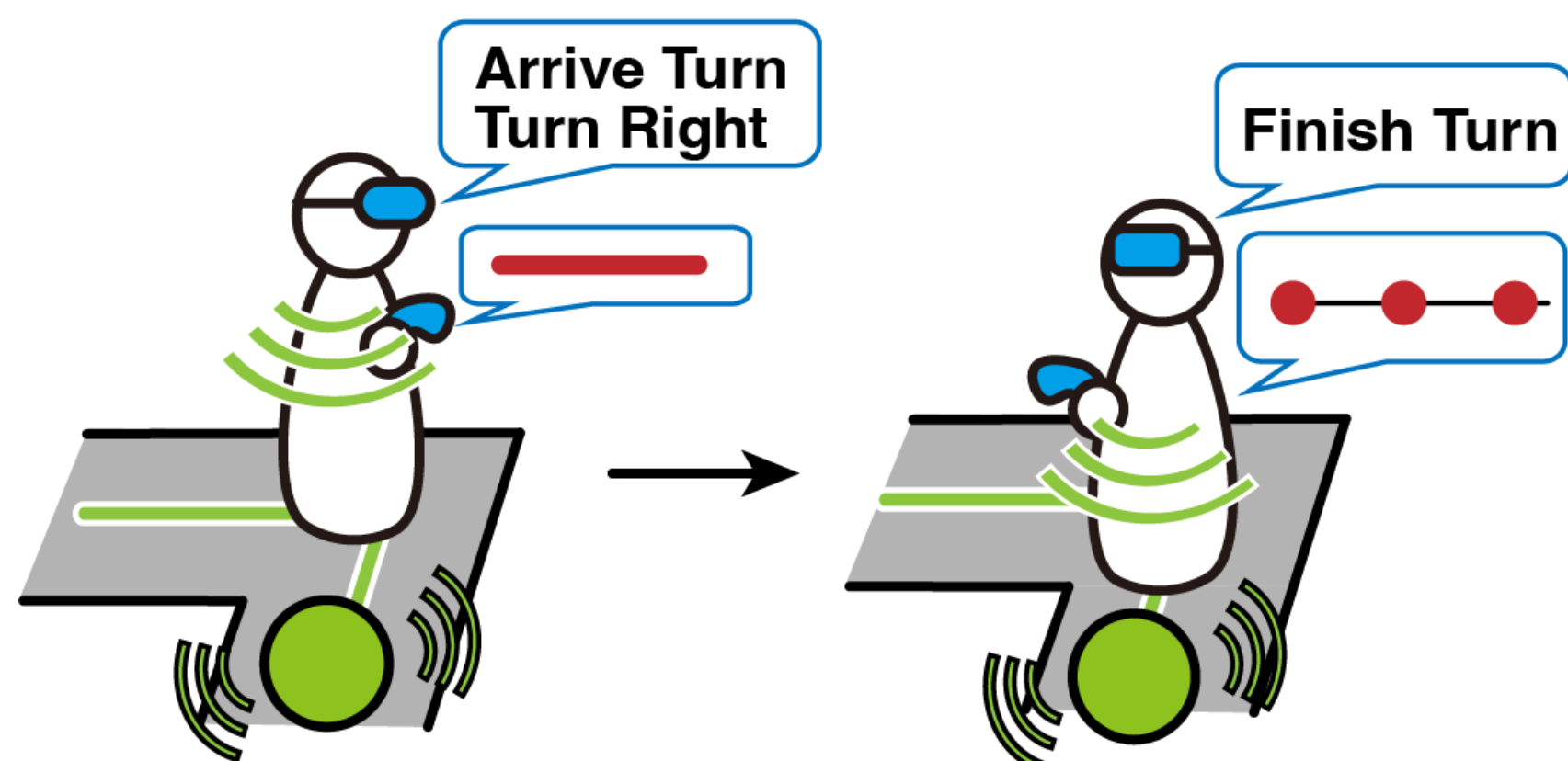
Spatial Audio: Indicates the direction and distance with spatial sound from the target direction.



Haptic Feedback: Provides two vibration patterns to distinguish navigable and non-navigable directions.



Interaction at Turn Point: Announces the turning direction, and users orient their body.



Acknowledgement

This work was supported by JSPS KAKENHI (21H05054, 24H00742, 24H00748).

References

- [1] João Guerreiro et al., "Virtual Navigation for Blind People: Building Sequential Representations of the Real-World."
[2] Alexa F. Siu et al., "Virtual Reality Without Vision: A Haptic and Auditory White Cane to Navigate Complex Virtual Worlds."

User Study with Blind People (N=6)

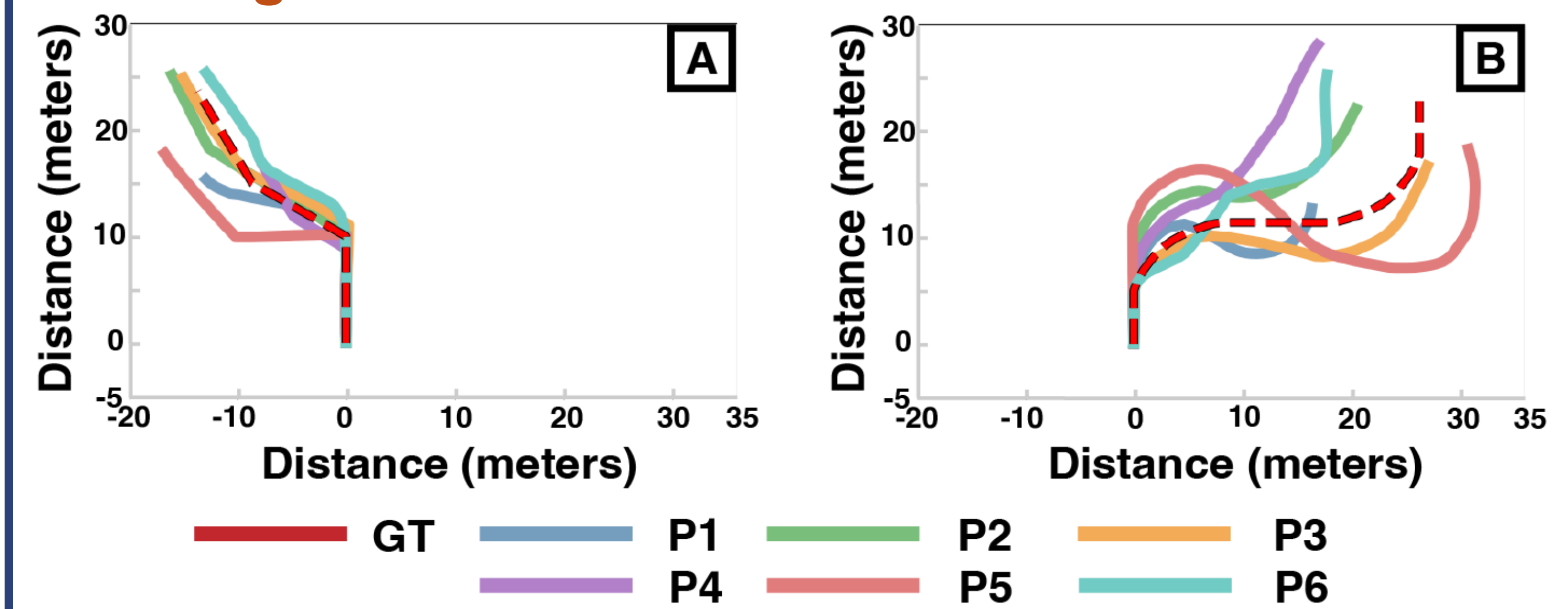
Participants virtually navigated 8 paths, in 2 conditions:

Guided Navigation: Navigate pre-mapped paths using our system.

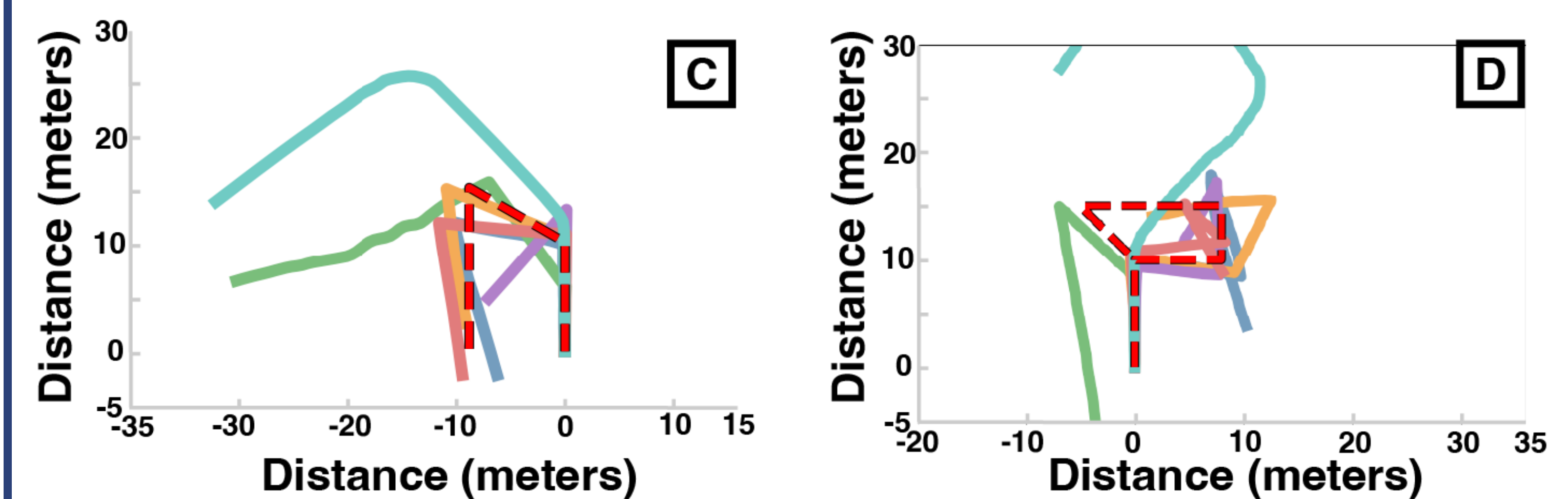
Reconstruction: Reconstruct the path without the system, guided only by footstep sounds in an open virtual space.

Result and Future Work

Participants correctly recognized **turns up to 90 degrees and the general curvature.**

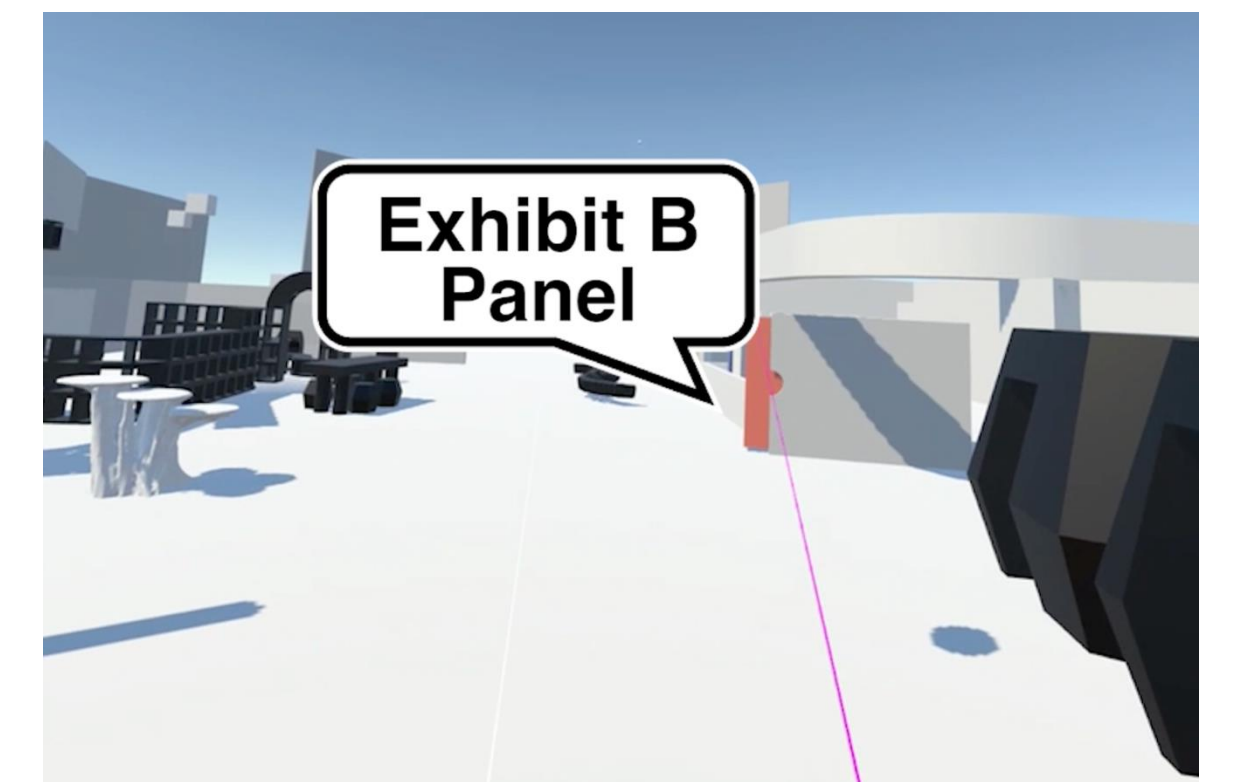
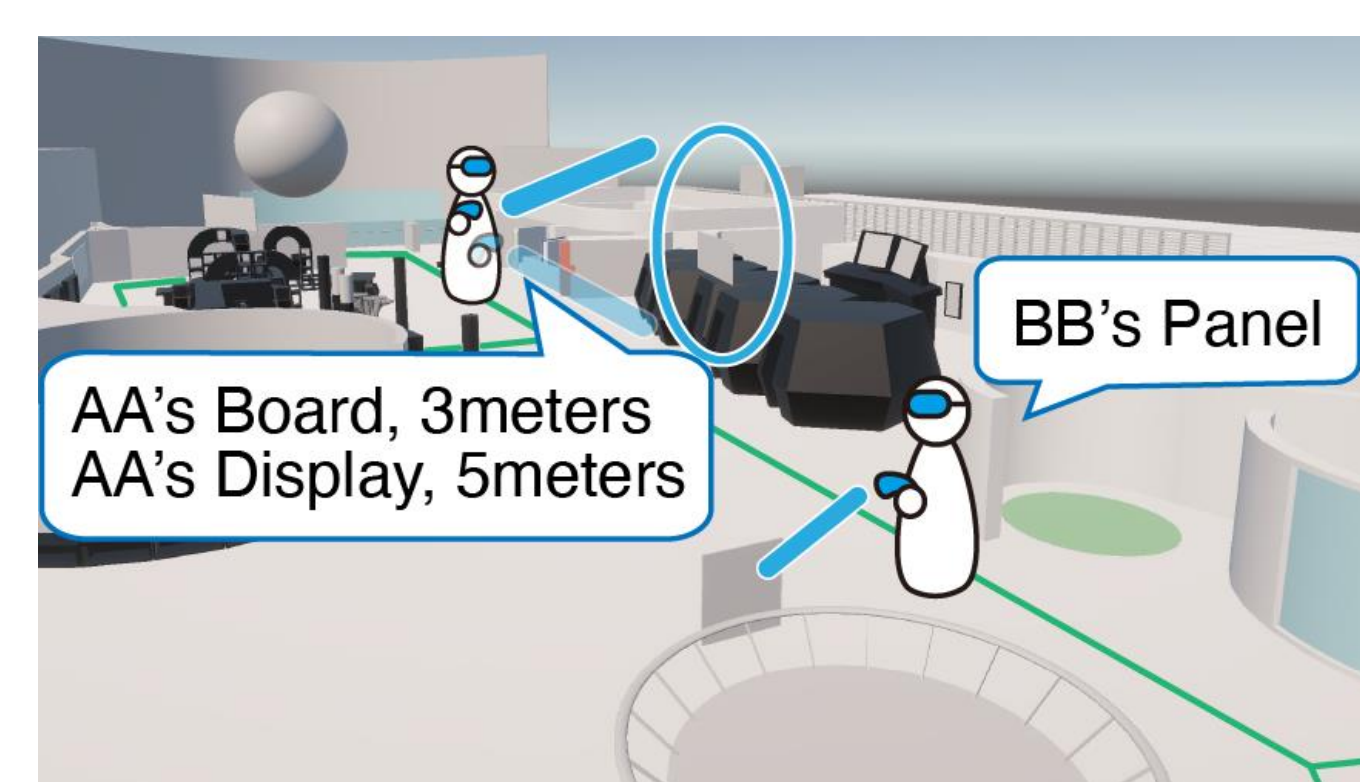


Participants **misrecognized** turns **exceeding 90 degrees** and route with **four turns.**

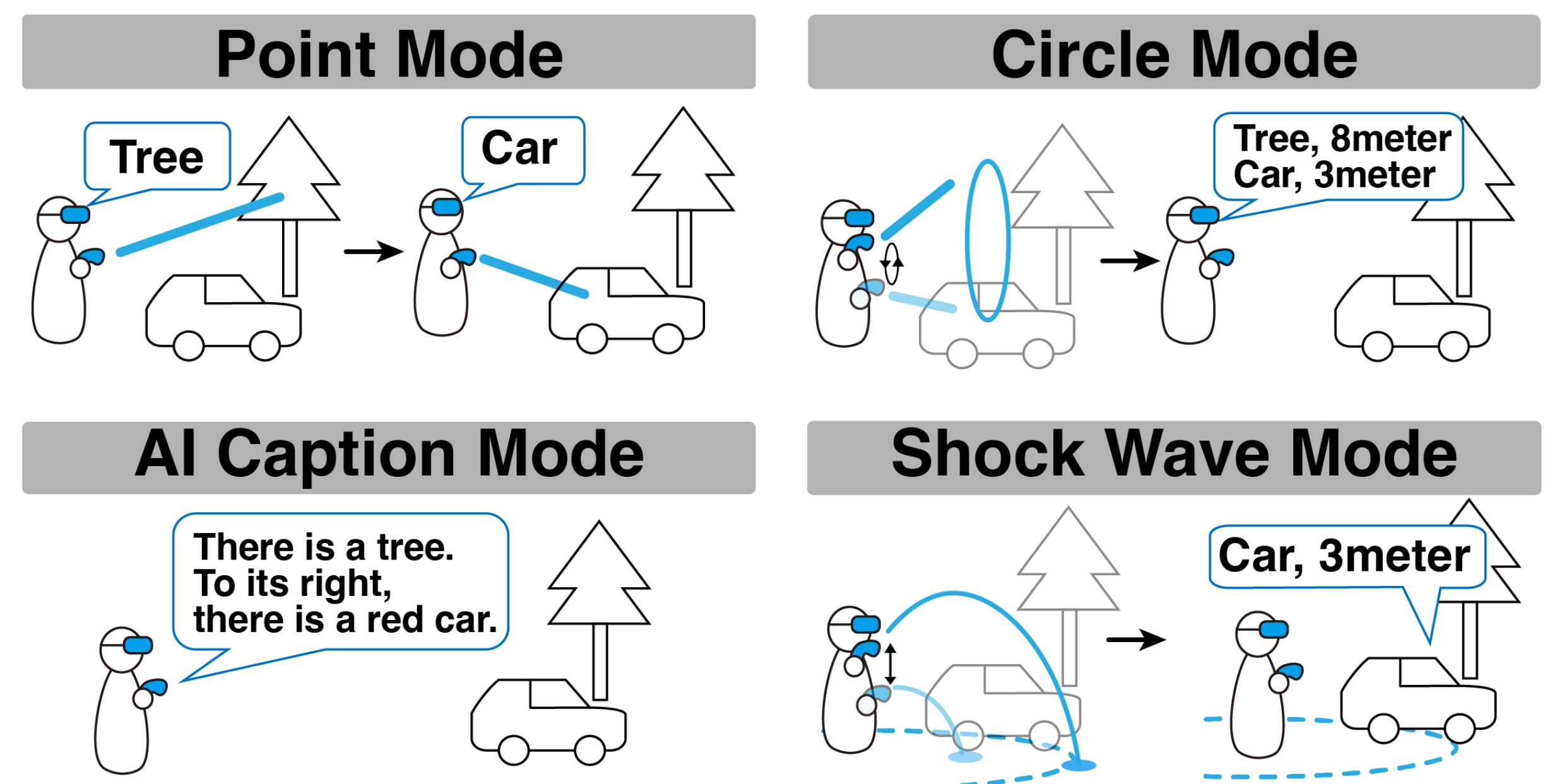


Future Work:

Develop a module that conveys the spatial feature



Designed 4 functions for spatial feature perception



Designed complex virtual environments containing numerous objects

