

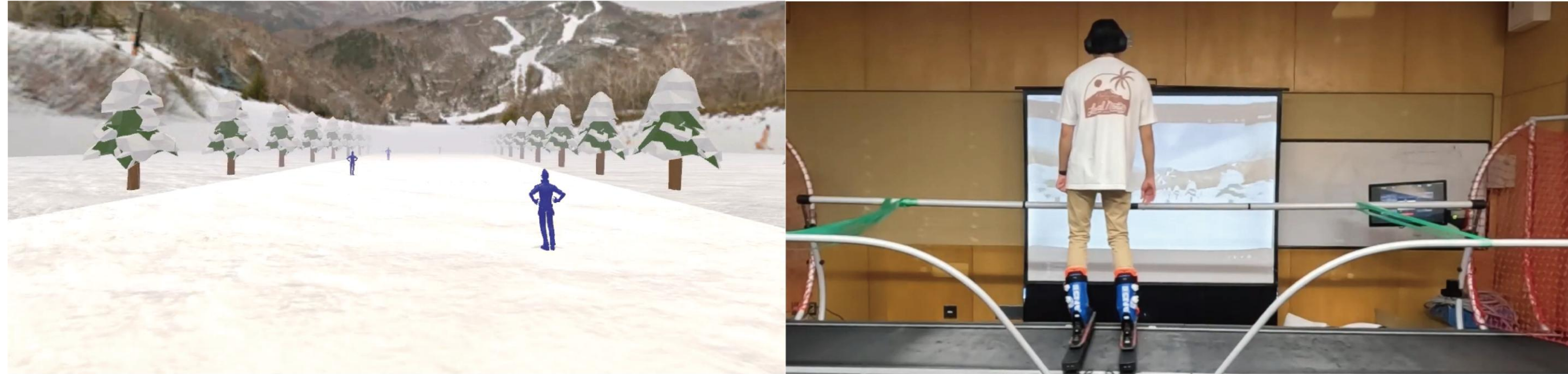
Spatial Audio for Ski Simulation with Visually Impaired Users in Dynamic Environments

Yuta Taguchi¹ Toshihiro Hirano² Masaki Kuribayashi¹
Yichen Peng² Erwin Wu² Hideki Koike² Shigeo Morishima³

¹ Waseda University ² Institute of Science Tokyo ³ Waseda Research Institute for Science and Engineering

Overview

We propose **spatial audio** for blind people to ski in **dynamic environments**.



Virtual Ski Slope

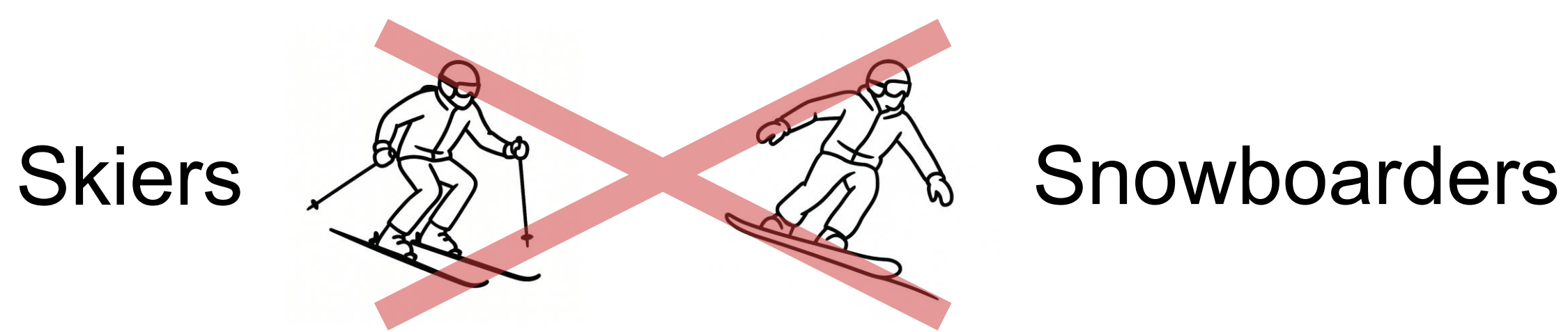
Ski Simulator

Motivation

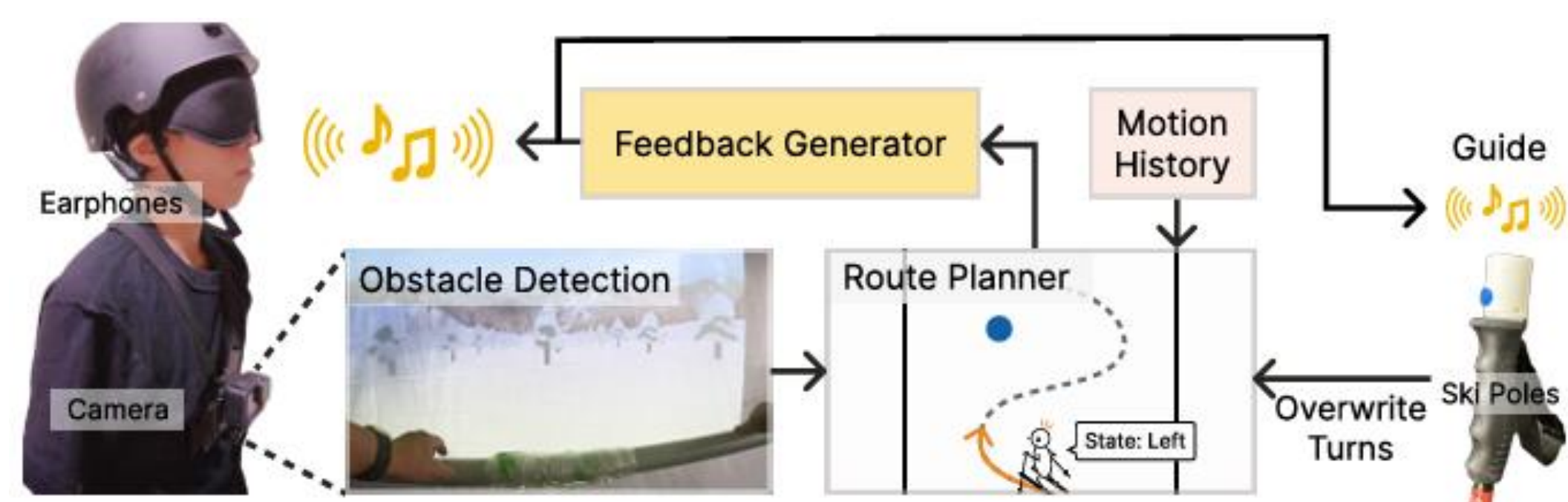
Enable **solo skiing** in virtual environments with **dynamic obstacles**

Previous Studies^{[1][2]}

→ Path-Following method using sound feedback



SlopeNav^[1]: Path-Generating method



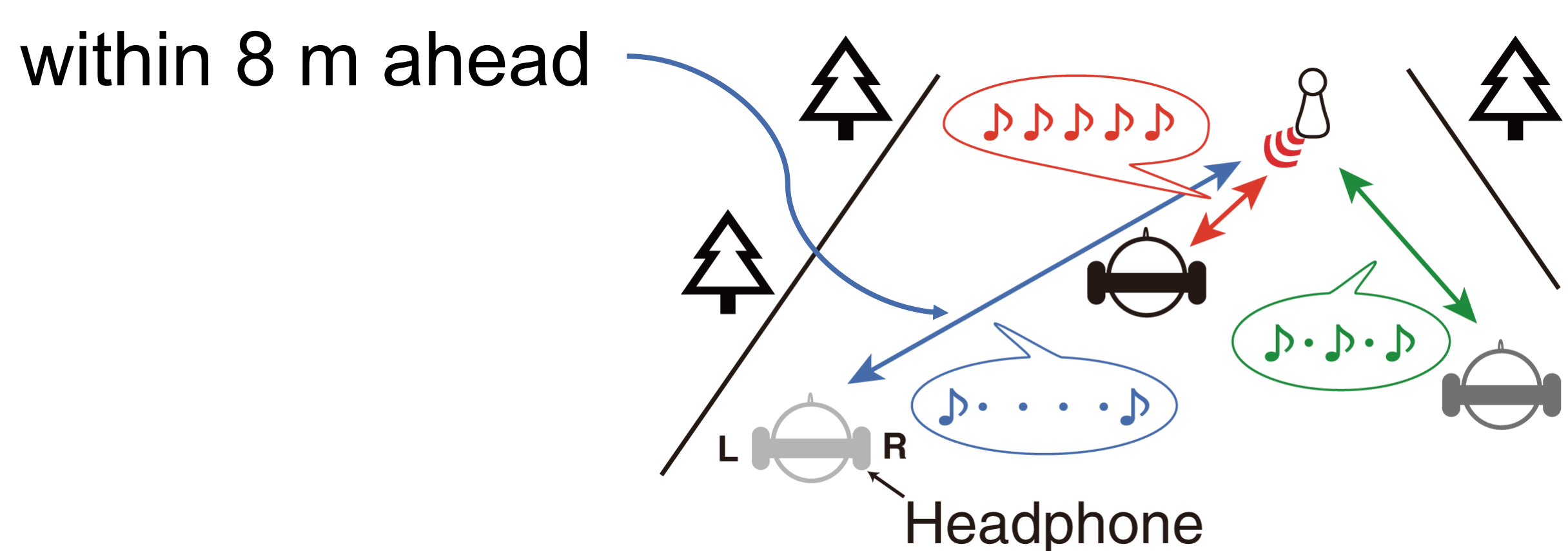
SlopeNav's path gets **updated frequently**, causing confusion.

Our Approach

Key Idea: Use **spatial audio** to convey **danger**

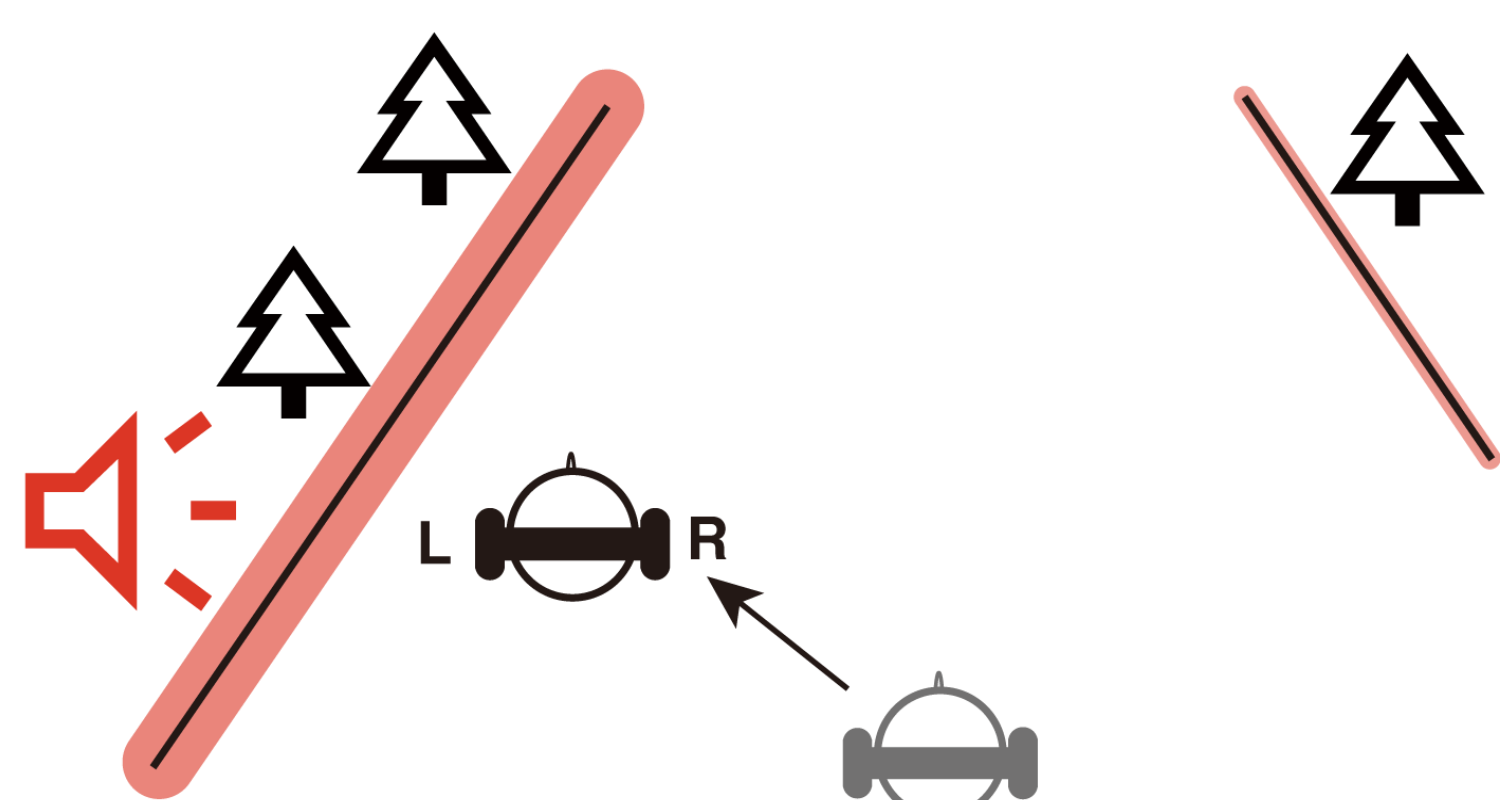
Object Audio

The position of obstacles by changing the **frequency**, **volume**, and **pitch**

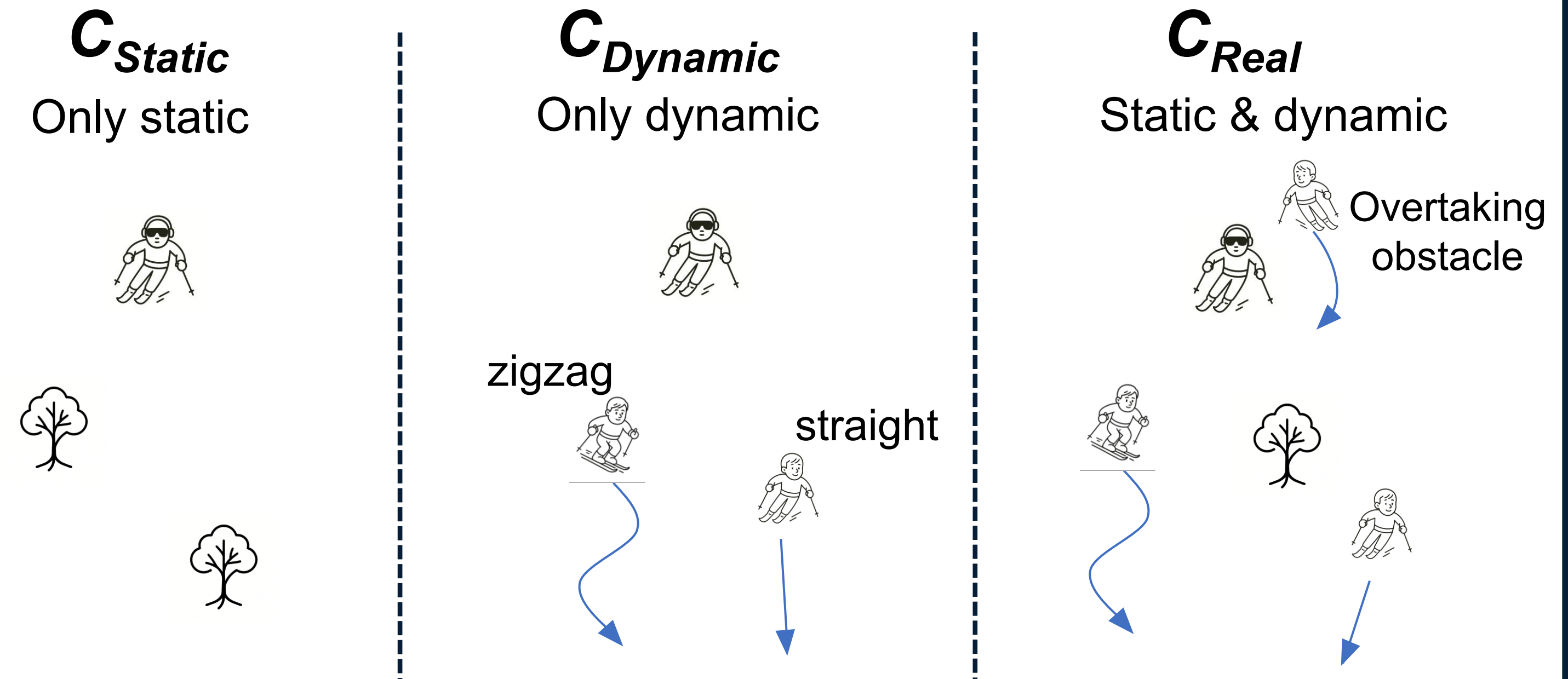


Side Audio

The edge of the course within 5 m

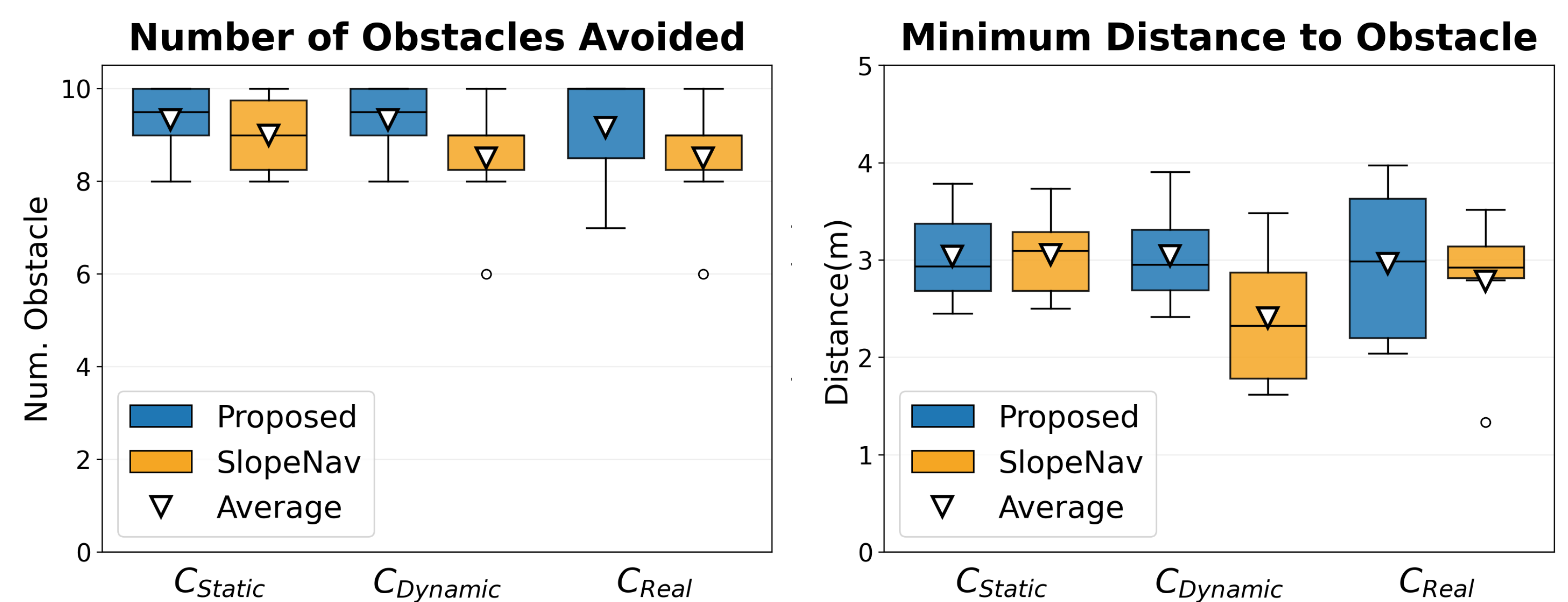


Pilot Study with Sighted People (N=6)

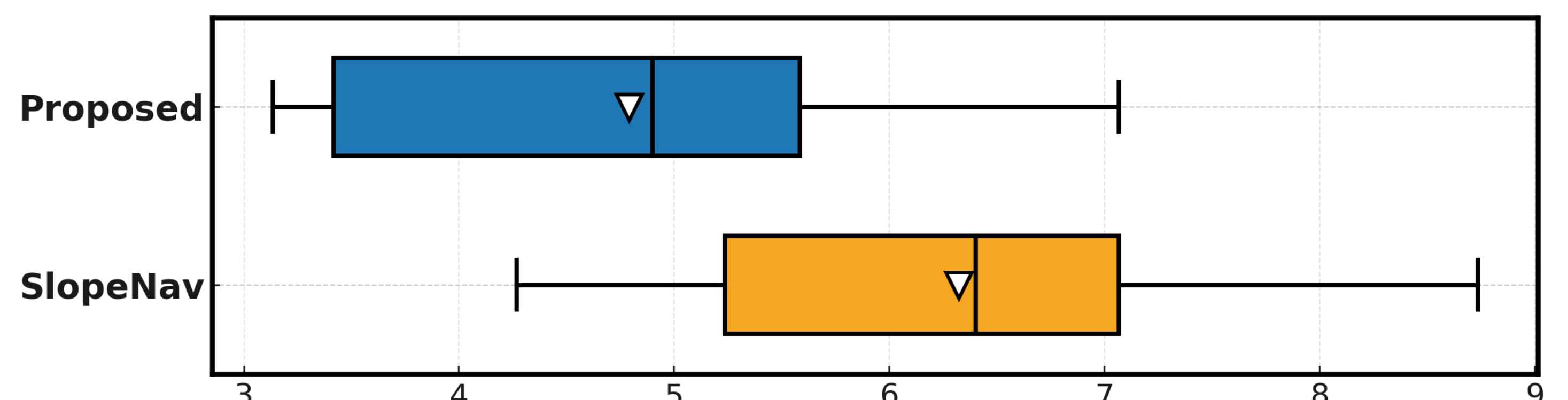


Result

Users avoided **90 percent** on avg.



NASA-TLX



"Knowing the positions of obstacles allowed them to glide with a sense of reassurance."

User Requests

- absence of numerous multiple sounds
- A different type of feedback between overtaking obstacles and overtaken obstacles

Future Work

1. Further improvement of the prototype
 - Restricted to the **closest** obstacle
 - **A short auditory cue** from an overtaking obstacle
2. Study with visually impaired users

References

- [1] Hirano et al. 2025. SlopeNav: A Realtime Wearable Blind Ski Assistance System with Adaptive Path Planning for Simulated Environments. In Augmented Humans.
[2] Miura et al. 2023. Exploration of Sonification Feedback for People with Visual Impairment to Use Ski Simulator. In Augmented Humans.