Strafing Gain: A Novel Redirected Walking Technique

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ABSTRACT

Redirected walking enables natural locomotion in virtual environments that are larger than the user's real world space. However, in complex setups with physical obstacles, existing redirection techniques that were originally designed for empty spaces may be sub-optimal. This poster presents strafing gains, a novel redirected walking technique that can be used to shift the user laterally away from obstacles without disrupting their current orientation. In the future, we plan to conduct a study to identify perceptual detection thresholds and investigate new algorithms that can use strafing gains in combination with other existing redirection techniques to achieve superior obstacle avoidance in complex physical spaces.

CCS CONCEPTS

• **Human-centered computing** → **Virtual reality**.

KEYWORDS

redirected walking, virtual reality, navigation, locomotion

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1 INTRODUCTION

In considering locomotion in virtual reality, it has been demonstrated that physically walking can reduce simulator sickness, increases immersion, and improve navigation. However, walking presents its own problems. Due to the lack of physical space that is available, walking will often result in collisions with the physical environment.

Originally developed by Razzaque et al., redirected walking (RDW) has transformed into one of the more ubiquitously deployed strategies to counteract the physical limitations of walking [1]. RDW seeks to guide the user in the most advantageous direction of physical space. This is done through "gains" which exploit the phenomenon where the user's visual sense will dominate their vestibular sense in the case of a mismatch, coaxing users to traverse a physical path differing from their virtual path.

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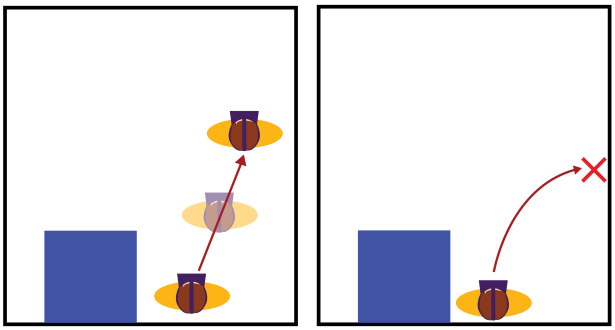

Figure 1: Strafing gain in comparison to curvature gain.

2 STRAFING GAIN

Strafing gain is a new RDW gain that is influenced by possible deficiencies in curvature gain. Where curvature gain steers users on an arc by applying a rotation to the user's forward movement, strafing gain instead steers users diagonally by adding a sideways translation to their forward movement. We postulate that curvature gain is not always the best gain to apply. For example, curvature gain may lead users into even greater problems due to orientation while steering them away from an obstacle (see Figure 1).

2.1 Future Study

We intend to implement an experiment similar to that of Steinicke et al. [2] in order to determine the detection thresholds of strafing gain. As participants navigate between two waypoints in the virtual world, strafing gain will be applied with several different values, including no strafing gain, over multiple trials. A two-alternative forced-choice task will be used, where upon reaching the destination waypoint participants will be asked if they strafed either left or right. The point of subjective equality will be derived from the strafing gain value where users respond left in 50% of trials. The upper and lower detection thresholds will be determined from the value where left was the response 75% and 25% of the time [2].

3 CONCLUSION

This poster presents the strafing gain motivation and future evaluation. We expect that strafing gain will become a staple compliment to RDW techniques previously developed. From what pilot tests have demonstrated thus far, we believe there exists strong potential for further works related to strafing gain.

REFERENCES

[1] Sharif Razzaque, Zachariah Kohn, and Mary C Whitton. 2001. Redirected walking. In *Proceedings of EUROGRAPHICS*, Vol. 9. Citeseer, 105–106.
[2] Frank Steinicke, Gerd Bruder, Jason Jerald, Harald Frenz, and Markus Lappe. 2010. Estimation of detection thresholds for redirected walking techniques. *IEEE Transactions on Visualization and Computer Graphics* 16, 1 (2010), 17–27.