Enhancing Blind and Low Vision Viewers' Ability to Visualize Tennis Gameplay via Co-design

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Abstract

In this work, we are making tennis videos more accessible to BLVs by recognizing gameplay directly from videos, i.e., from pixels. Sports enhances people's cultural and social life. However, for people who are blind and low vision (BLVs) it remains largely inaccessible. Many BLVs usually rely on non-visual format such as radio to follow sports. Existing systems that make visual sports media accessible to BLVs, rely on specialized hardware, which is not always available. To help BLVs better visualize the game, we follow a co-design process to design 3D-spatialized audio for feedback.

Methods

Step 1: Identifying specific needs from BLVs when watching sports

Step 2: Prototyping systems that will meet the user needs

Step 3: We conducted interviews based on questions that analyze participants understanding of various 3D-spatialized audio feedback

Step 4: Collecting qualitative and quantitative feedback from user evaluation

Step 5: Implementing system improvements based on feedback from user evaluations

Step 6: Iteratively perform steps 2 through 5

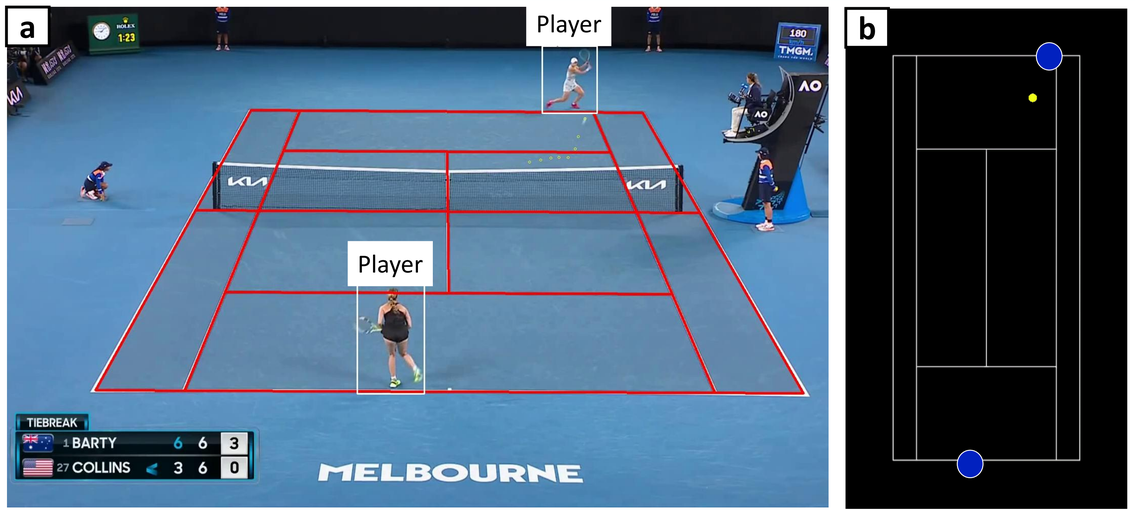

Figure 1: Overview of the proposed system for recognizing gameplay directly from tennis videos. **(a)** The system recognizes gameplay by extracting information about the court, players, and the ball. (**b**) The information is used to project the extracted position from pixel coordinates to a top-down view of the court with the purpose of using 3D-spatial audio paired with the view.

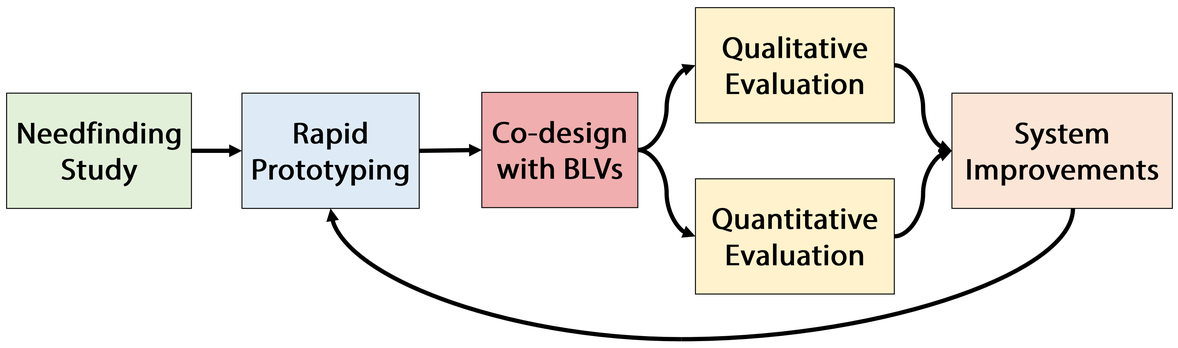

Figure 2: Our process to update the design of our system to better suit the user's needs for enhancing BLVs' ability to visualize tennis gameplay through multiple evaluation methods.

References

[1] Action Audio. 2021. Making Sports Broadcasts Accessible to People Living With Blindness or Low Vision. https://action-audio.com/

[2] C. Yoon, R. Louie, J. Ryan, M. K. Vu, H. Bang, W. Derksen, and P. Ruvolo, "Leveraging augmented reality to create apps for people with visual disabilities," The 21st International ACM SIGACCESS Conference on Computers and Accessibility, 2019.

Progression

System Improvements:

- Smoothed the detection of player position tracking using averaging functions
- Detecting ball hits through changes in direction of the ball movement
- Custom-trained a player detection model to recognize the two players on court

3D audio feedback:

- Provide ball-hit information instead of constant sounds for ball position.
- Identified best placement for the listener with respect to the court.
- Ensuring that the system works with ***any*** off-the-shelf pair of headphones

Discussion

- Gain a better idea on BLVs' understanding of spatialized audio and the methods involved with improving that understanding
- Give BLVs real time feedback when playing tennis-based video games
- Used with recreational tennis games, historical tennis games and even live streaming tennis content on platforms such as Twitch