How good are you seeing with your ears?

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We will be building a mini-game for the course project. It will put to test the hearing skills of the player. The virtual scene will consist of a pitch black environment where some spatial sounds will be played. The objective of the game is to locate the sound sources in the minimum amount of time. To locate a sound source, the user has to orient their head towards its direction. The flow of the game is as follows: a single sound source is played, and whenever it's located, the next sound source is played. The player is awarded points, not only for every correct localization, but also for how quickly they were located.

In order to implement this game, we will be combining parts of the code-bases given-to and developed-by us in the HWs. The sound infrastructure given and developed in HW7 will be combined with the state machine of HW5, which included head tracking including the head-and-neck model. We will change the scene to have black background and delete the teapots. We will possibly leave the grid for debugging purposes.

We will try to find a more complete HRTF bank than the one provided in HW7, which was, in our opinion, lacking data points. This made the transitions between HRIRs feel discontinuous. A team member will attempt to get the new bank from the CCRMA at Stanford (Center for Computer Research in Music and Acoustics). It will take some thinking to figure out how to import this new bank into the framework used in HW7, because it might be given in a different format.

Additional mechanics will be implemented to add to the experience. Whenever the user correctly locates a sound, a green ring centered at the source will be rendered. This will give the player feedback on when they succeeded. Our intention is to also add "proximity feedback": as the user's head gets closer to the orientation of the sound source, light around it will start glowing. It will glow stronger as the player's head gets closer to the source.

When implementing the green circle, we can assume that can will always be rendered right in front of the player's view. This is because whenever a sound source is located, the user's head is facing in the direction of the source. The green circle size, however, will depend on how far away the source is. The closer it is, the bigger the green circle. To implement this feature, we will create a 3D model for the green circle, put it in world space according to the coordinates of the sound source, and let the pipeline render it when it's needed. To allow this, we will add a property to the state controller that tells the pipeline that a sound source was located.

To implement the proximity feedback, we will look at the projection of the IMU orientation vector to the direction of the sound source. The bigger the projection, the brighter the area close to the source will glow.

We will also give audio feedback to the user when a source is correctly located, by playing back a "correct" audio effect. We will use the following sample: https://www.youtube.com/watch?v=worclOeTALw.

A point counter will be located at (100, 0, -50) in the world coordinates. As mentioned above, this counter will increase every time a source is correctly located. The size of the increase will depend on how fast the user located the source.

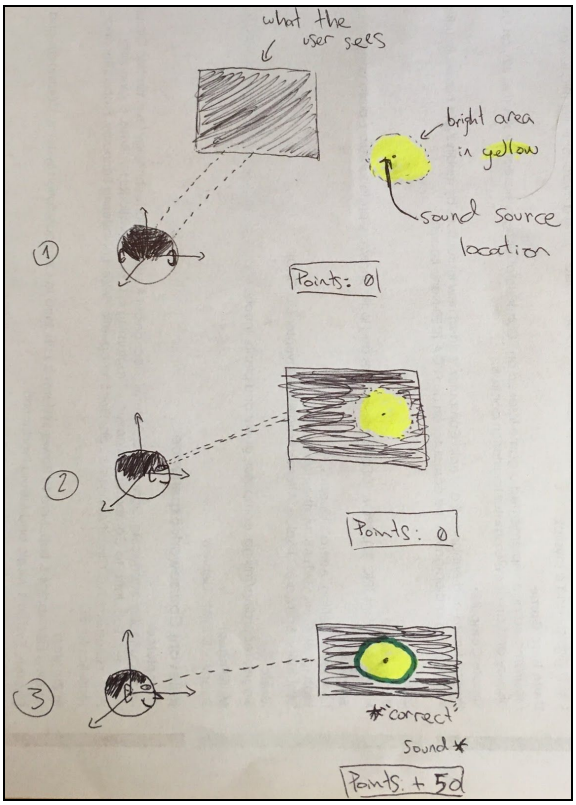

Figure 1. Summary of game flow described.

Each audio sample will be looped until the player finds it. They will consist of multiple type of sounds. Our intention is to use video game characteristic sounds, ninja sounds and/or percussive loops. We will probably change our minds about this.

We hope this project will be achievable. We do know, however, that we will get stuck multiple times just trying to make the assets coherent with each other: combining the framework HW7 with HW5, importing new data models for the green circles, and importing the new HRTF bank. We believe these will be the major challenges. But it will be achievable.

-maybe use unity? Not sure how complex it will be