MELODIFICATION - REINVENTING THE SOUND OF TILTIFICATION

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ABSTRACT

The purpose of this paper is to present the results obtained during the development of my project submission for the Sonic-Tilt Competition 2023, proposed by Tim Ziemer and the ICAD Community. The purpose of the competition was to reinvent the sound design of the Tiltification app, in order to make it more sonically interesting while maintaining the degree of precision and functionality the app was meant to have. The main idea behind Melodification is to use sound parameters that are intuitive even for non-musical listeners, making the app even more accessible[1]. The chosen parameters for this project are melody and timbre.
After a presentation of the workflow, the results of a small user study will be presented, showing how this feedback influenced the direction of the project.

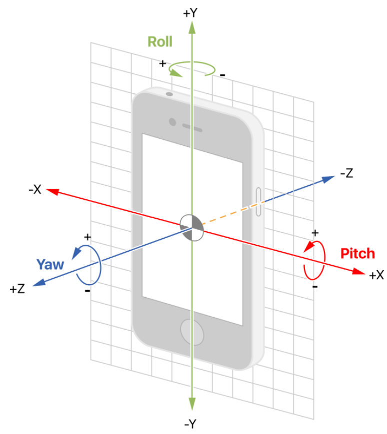

Figure 1: axes of rotation in a smartphone.

1. TILTIFICATION

The *Tiltification* app is a spirit-level application for smartphones, developed by students in the master project "Sonification Apps" at the University of Bremen in the winter term of 2020/21. It uses psychoacoustic sonification to provide the users with feedback on the spatial orientation of a smartphone along two planes, so that the device can be easily used to level any kind of surface or take perfectly horizontal photos.
This added psychoacoustic feedback improves the accessibility level of a physical spirit level, and is also meant to help bring sonification practices to a wider audience [1] [2].
The *Sonic-Tilt Competition 2023* is meant to give people the chance to reinvent the sonification design of the Tiltification app while maintaining all the functional points of the original design.

2. PROJECT DESCRIPTION

The first step for the development of the project was to choose what sound parameters I wanted to use to sonify the spatial orientation of the smartphone. A few fundamental points had to be kept in mind: first, users should be able to recognise only through sound when the device is entered in both planes (thus indicating that the surface is levelled). Second, there should be a clear difference between pitch and roll rotation [figure 1], and also whether the adjustment should be made clockwise or counterclockwise along each rotation axis. The app should also be very precise and, of course, pleasant to listen to.
In order to make the sound more appealing to a wider audience, that might not be used or keen to listen to continuous synthesised tones, I decided to keep the source sound material as musical as possible. I chose two main sound "characters" that were going to be affected by the sonification process: a simple, four on the floor sequenced drum loop and a bell-like synthesiser that played straight 16th notes.
Since I needed the app to be as effective as possible while at the same time maintaining a high degree of musicality, I had to decide what were the best sound parameters to be affected by the sonification, and for a first experiment I decided to work with melody and timbre.
In the first stages of the experimentation phase, which was conducted in Max MSP using the GyrOSC app to access my smartphone's gyroscope data, I worked on the melodic part of the sonification, mapped to the roll rotation of the device. When the device is centred, the bell tones play a steady stream of 16th notes with a middle C pitch. Clockwise rotation proportionally increases the degrees played in a C major arpeggio, up 3 octaves and including the 9th, 11th and 13th; counterclockwise rotation does the same but with a descending arpeggio from middle C. This way, the recognition of the direction of rotation is much more straightforward and recognisable regardless of the musical training level of the user. Moreover, it is much easier to detect a small change from the stable position, since it consists in moving away from a steady stream of repeating pitches.
For the pitch rotation, I decided to alter the timbre of the two sound sources through bit crushing: clockwise rotation distorts the bell synthesiser while counterclockwise rotation does the same on the drum loop. The rotation is shaped with a logarithmic curved so that the process is even more

[1] Link to demo video: https://vimeo.com/834347376?share=copy

sensitive to small changes. Finally, to help users detect the correct orientation, a subtle amount of reverb is added to the snare and hi-hat when the device is centred along both axes.

3. USER STUDY

Finally, in order to understand how well my project was suited for its intended purpose, I had nine people test the app and gave them a questionnaire to fill out.
The first three questions asked to rate, on a scale from 1 to 7, different features of the application for both pitch and roll axes. The following tables display a summary of the results.

Axis	1	2	3	4	5	6	7	Avg
Roll			1			1	7	6,44
Pitch				2	1	2	4	5,88

1) How difficult is it for you to recognise the exact centre position just through listening? (1 = impossible, 7 = perfectly clear)

Axis	1	2	3	4	5	6	7	Avg
Roll					2	3	4	6,22
Pitch				1	4	1	3	5,66

2) When the phone is tilted in any direction, how difficult is it for you to hear in which direction you need to turn the phone? (1 = impossible, 7 = perfectly clear)

Axis	1	2	3	4	5	6	7	Avg
Roll					2	2	5	6,33
Pitch					3	3	3	6

3) Is it easy to recognise a difference in sound between the centre position and the movement? (1 = impossible, 7 = very easy)

Although this study is not very meaningful because of the small number of participants, it can be seen that the melodic variation works pretty well for the purpose of the app. Users found it easy to identify both the centre position and the direction of the rotation and were also able to detect very small changes in orientation, which is an essential feature for a psychoacoustic level. The timbre axis obtained slightly worst results, especially with the direction of the rotation. This is probably because introducing an amount of distortion makes the overall sound more noisy, and thus it can be a bit more difficult to identify which sound source is being affected. In the end, all the questions had a pretty similar average result for both axes, and if we also consider the very small number of subjects this test was proposed to the study is not statistically relevant.

4. CONCLUSION

It would be interesting to further think about how sonification processes can be used for real-world applications such as this one, since psychoacoustic feedback can provide an added level of precision to a lot of common tasks and also increase the accessibility of many tools to visually impaired people.
Some future developments of my project could investigate what are the most meaningful musical parameters to vary in order to show the difference between stability and instability. A key point in this process would be to understand what are the musical qualities of a sound, rhythm or melody that are intuitively understood by anyone, regardless of their musical background. If we were able to identify them, then we could create sonification applications that are accessible to everyone while still being pleasant to listen to.

5. REFERENCES

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[2] T. Ziemer, N. M. Jadid - *Recommendations to Develop, Market and Distribute Sonification Apps*, The 27th International Conference on Auditory Display, June 2022.