Project Deliverable 1: Sonification Design

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Introduction

The goal of this project is to design an auditory notification system inspired by Nomadic Radio, which adapts to the user's context to decrease distraction while also increasing awareness. This system is designed to deliver notifications such as Twitter updates, emails, texts, calls, and voicemails by using auditory icons, earcons, and text-to-speech. This auditory interface will ensure effective information delivery regardless of what the user is doing.

Sonification Strategy

The auditory notification system uses a mix of auditory icons, earcons, TTS, programmatic audio generation, filters, and amplitude envelopes to effectively convey different types of notifications.

➔ **Auditory Icons:** provides immediate recognition, allowing users to quickly understand the nature of incoming events.

◆ **Twitter notifications**: represented by a short chirping sound. The intensity and frequency of the chirp will increase with higher priorities.

◆ **Phone Calls**: the conventional ringing sound will denote incoming calls, with patterns indicating urgency.

◆ **Voicemails**: a "message drop" sound will signal new voicemails. Similar to phone calls, frequency and duration change based on priority.

➔ **Earcons:** ensures consistency across contexts, offering a recognizable auditory pattern that users will become accustomed to over time

◆ **Emails**: a two-tone chime is used, with variations in pitch and rhythm to indicate priority. The tones are distinct from other notification types.

◆ **Text messages**: a three-note sound that varies in speed depending on urgency. This makes it distinguishable from emails.

➔ **Text-to-speech:** clear and concise, preventing cognitive overload while decreasing need for visual attention

◆ High-priority notifications, such as urgent texts or important emails, will use text-to-speech to convey essential information like the sender's name and a brief summary. This enables quick comprehension, which can be helpful in hands-free contexts such as working out.

➔ **Programmatic Audio Generation**

◆ The system will create sounds programmatically, such as urgent notifications that use synthesized waveforms rising in pitch and frequency to create a "beeping" sound that escalates based on urgency. This adds variation and adaptability to the sonification scheme.

➔ **Filters and Effects**

◆ **Lowpass Filters**: Used to soften sounds in quieter contexts to avoid distraction

◆ **Reverb**: Applied subtly to notifications in social contexts, mimicking the acoustics of a coffee shop, which helps blend notifications into the background while maintaining clarity.

➔ **Amplitude Envelopes**

◆ These will control the attack, sustain, and decay of sounds for smoother transitions. (Ex. notifications have a gradual attack and decay in quieter contexts)

◆ Will also help differentiate notification types with sharper attacks for urgent sounds to draw immediate attention

Adaptation Across Contexts

The application adapts to different user contexts by adjusting volume, type, and delivery to match environmental noise, user interruptibility, and social interaction needs. In high-noise, high-interruptibility contexts like working out, sounds are louder, more persistent, and more detailed, with TTS providing full content. While walking, the system favors brief, clear earcons

that ensure safety without drawing excessive attention. Social contexts use softer, lowpass-filtered earcons to blend with ambient noise, reserving TTS for urgent information to prevent disruption. In low-noise, low-interruptibility scenarios like presenting, only urgent notifications are delivered with subtle, lowpass-filtered earcons, ensuring minimal distraction. This strategy balances user awareness with attention demands, adapting the auditory scheme to maintain effectiveness across diverse situations.

Handling Simultaneous Messages

When multiple notifications arrive simultaneously, the system prioritizes handling based on urgency:

→ **Sequential Playback**: Messages are presented one after another, starting with the highest priority, ensuring that the most important notifications are heard first.

→ **Unified Sound**: If multiple similar events occur, a single sound summarizes them.

This approach reduces confusion and cognitive overload, preventing an overwhelming auditory experience while ensuring essential information is communicated.

Justification of Design Choices

The design aligns with principles of effective auditory interfaces, including consistency, context sensitivity, and cognitive load management. Auditory icons, earcons, and text-to-speech are used based on their ability to deliver varying levels of detail and urgency, ensuring they suit different user contexts. Filters, programmatic audio, and amplitude envelopes provide dynamic sound adjustments, enhancing realism and maintaining adaptability. These elements create a scalable, context-aware system that preserves user focus while offering necessary notifications across different environments.