# Real-Time Auralization in Cellular Automata Based Sound Propagation Frameworks

Michael Walczyk
Advisor: Norm Badler

## Abstract

Auralization is the process by which sound signals are simulated in a virtual acoustic space. In cellular automata based frameworks, a proper implementation of auralization allows players to hear the sounds arriving at his/her avatar's current grid cell location.

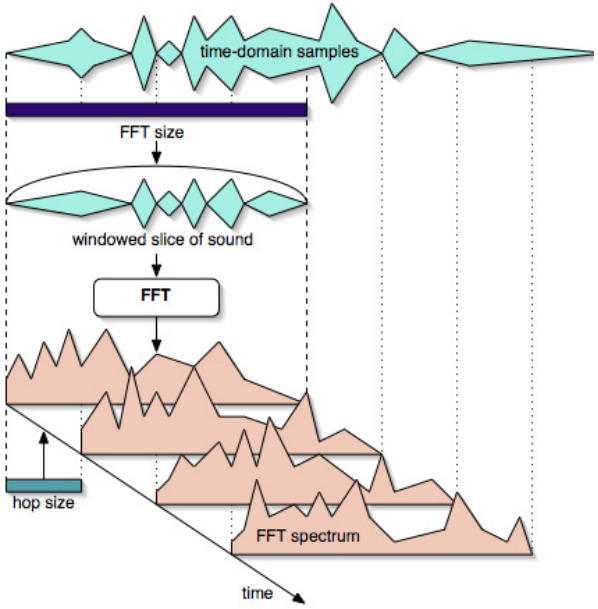
## Motivation

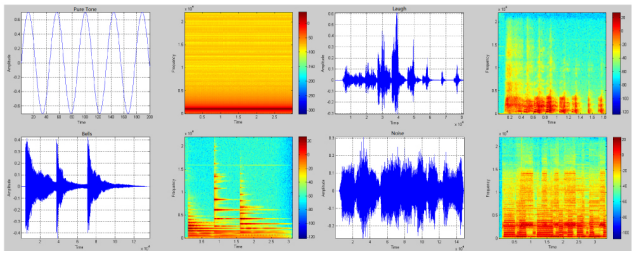
Implement an auralization procedure to achieve the following:

- Modify sound data in real-time using custom audio filters
- Auralize sound data using constructive synthesis, accounting for appropriate environmental degradation of sound signals

Doing so allows the listener to hear the sounds arriving at his or her avatar's location in the environment.

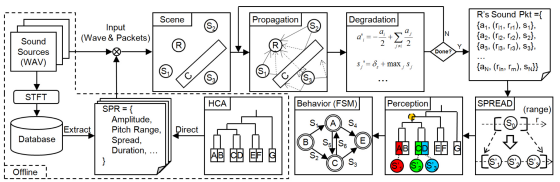
## STFT – Short Time Fourier Transform



## System Design

The unmodified agent-based sound propagation model: SPREAD




After propagation, we collect sound packets at the receiver's location and perform the following procedure:

- Convert the collected packets to the frequency domain through an STFT
- Alter the sound data to account for degradation
- Convert the sound data back to the time domain and output to the soundcard for playback