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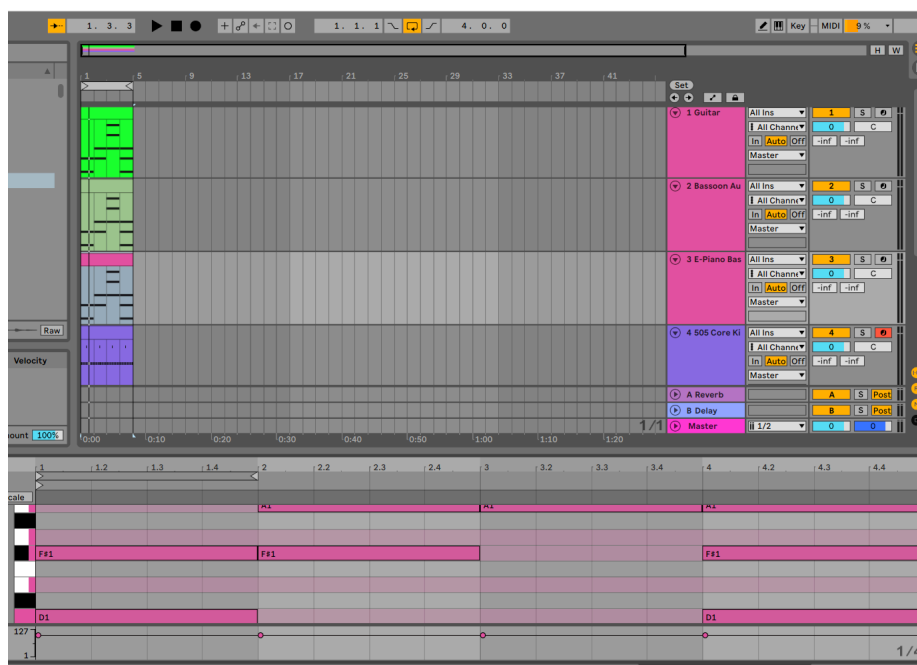
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Sound design has developed to become very crucial in diverse fields. In particular, sound design in film is so important to allow the audience to feel immersed in the experience. There have been many considerations and theories from psychological and acoustical perspectives. One is the use of audiovisual metaphors, which are used to unconsciously and metaphorically attribute an emotion to an idea or symbol in a story, and are created from the timbres, frequencies, reverberations, character and camera movement, and other aspects (Fahlenbrach 85–94). Extensive goals in the field include creating “silences” of different themes (sounds that sound silent due to some context but are not rest), removing the vast difference between natural and electronic sounds (Underwood 202), and to answer questions regarding the frequencies, types of walkers, and types of surfaces (Visell 947–959).

However, in order to understand sound design in film, one must understand how to incorporate acoustic environments, or soundscapes. The concept of soundscapes, which grew into fruition by R.M. Shafer in 1977, is very focused on what the human ear prefers. The psychoacoustic concept of masking is one that is most notable in soundscapes, where sounds “cover up” other sounds (Brown 1). Masking becomes of huge importance in the perception of a “natural quiet,” where natural sounds are not masked by humans. The question of exactly which sounds we prefer (whether it’s jogging, turning a knob, spinning a wheel, etc.) must be noted in any environmental design (Brown 1), which therefore must be considered in film sound design.

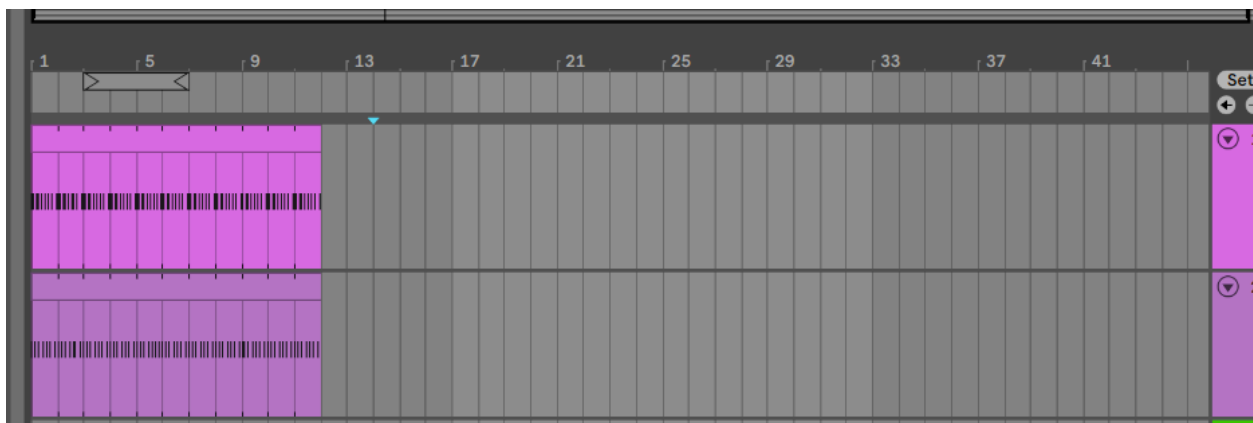
There are specific applications of soundscape design that have been a focus in research, including urban areas and robots. Experiments done for the Noise Control Engineering journal, using recordings of water movement and analyzing its characteristics, revealed that there are specific points of intensity for water and traffic where water sounded more appealing (You). It also connects back to the concept of masking, where water sounds with low frequencies masked the sounds of the road better, which correlates with how the basilar membrane functions. Another application of soundscape design was done by researchers investigating how robots can be more appealing to humans by changing their sound. In an experiment, it was found that participants were uncomfortable while hugging a robot due to the sound of its hand. It was found that masking was effective in removing such noise from human perception.

To confirm findings regarding robotic motors and the role of soundscapes to appeal to humans, an experiment was done where a repeated basic chord was played from speakers in a room, to where it was heard as background noise. The chord was played in the middle 7 pitch classes. A video of a robot (from Boston Dynamics) moving was played, and 6 participants had



to determine which pitches covered the robot motors best. This is an improvement from the original experiment, where only 3 pitch classes were considered (1, 4, and 6). The results mostly stayed the same, and lower background noise masked the motor sounds better. There were less discrepancies in what should be heard and what the effect should be in the 2nd experiment. People still pointed out that the motor had some periodic element, so percussive sounds had less of an effect.

An additional experiment was done where percussive sounds were used instead. These were composed using MIDI. A rhythmic pattern was played, and two instruments were used, each for their own trial: a high hat and a bass drum. The experiment was done with 3 participants. 2 said the bass drum masked better, and the 1 said the high hat did so.



Unfortunately, due to time constraints, there were not enough participants to make a significant experimental conclusion about comparing the two percussive sounds. Continuing this experiment further could reveal further chances for experimentation regarding timbre and aperiodic sounds.

It should be noted that the experiments done to confirm prior research were very limited in quality. There could have been many variables not kept constant that were overlooked, like wind from a window, or external noise from another floor above or below the room. Nonetheless, this discovery is continuing to expand. If noise masks the motor only occur when the motor

moves, is it as effective compared to if the “masker” was constant? That is to say, is soundscape masking less effective if it has temporal stops? What other designs can be come up with, and how can one describe the human-robot connection where the robot “does not sound scary”?

What matters most is that much of this research can be experimented with and generally be confirmed by the general public and be applied to greater innovations. Soundscape design being applied in sound design for film has allowed for effective scenes, and moreover, an indescribable human connection to a work of art on the big screen. It will be great to imagine a world that not only looks different, but *sounds* different, to have one whole complete human experience (Robinson).

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Assists in the introduction of sound design.