

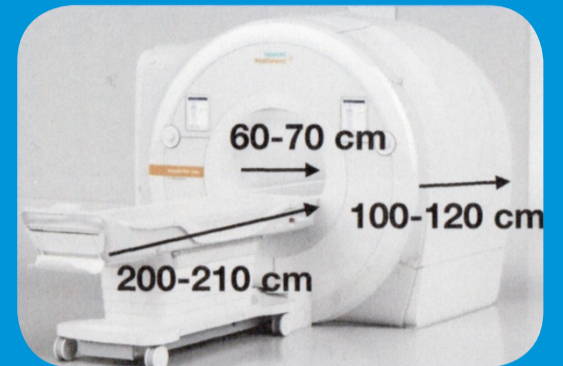
MAGNETIC RESONANCE IMAGING AND MUSIC: AN EXPERIMENTAL RESEARCH WITH THE ACOUSTIC ENVIRONMENT



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BACKGROUND

Anxiety and claustrophobic reactions during Magnetic Resonance Imaging (MRI) increase the length and costs of examinations through involuntary movements (causing Motion Artifact (MoA)), scan repetition and requested anaesthesia. There are many reasons for the appearing claustrophobic reactions, such as the fear of closeness and diagnosis' result, the loss of control, the requirement to stay still and the loudness of the equipment. The gradient pulsation causes a knocking sound in the gradient coils of the MR scanner, and it is the main source of the acoustic noise. A stronger magnetic field is required for better image quality; therefore the demand for hearing related interventions is expected to increase in the future. By synchronising the tempo of preferred music genres to the MRI sequences, music could modulate the soundscape of the MRI environment and promote well-being and relaxation, and as a result, reduce the amount of MoA and anaesthesia. The research also aims to help to better understand how music helps to relax people in general.



Dimensions of an average MRI equipment



Layout for the MRI tent

HYPOTHESES

Following these notions, the present study aims to mask the MRI's ambient noise by synchronous music playing and test the following hypotheses:

- 1) Music has better relaxation ability during MRI examination than noise attenuating devices (headphone) alone.
- 2) Music listening patients move less.
- 3) Music which tempo is aesthetically synchronised to the MRI pulsation has better relaxation ability during MRI examination than music in its original tempo.
- 4) New age music, as a commonly used genre for relaxation purposes has better potential than other genres to transform the anxiety evoking acoustic environment into a relaxing one.

RESEARCH QUESTIONS

How can music reduce anxiety in the MRI environment?

- How does music change the perception of noise during the examination?
- How does music influence the physiological reactions (micromotions, breathing, skin conductance, heart rate variability) during the scan?
- What are the most suitable musical features and genres to reduce anxiety in the MRI context?
- How much does the tempo synchronisation affect the ability of music to reduce anxiety?

What are the most anxiety evoking aspects of the MRI scans?

What are the environmental music therapy applications in this context?



NeXus Biofeedback Device

DESIGN AND METHODS

The procedure will follow the protocol of a structural skull MRI scan of a Finnish diagnostic institution, with all of its formality. The experiment will take place at one of the recording studios of the University of Jyväskylä, using a realistic MRI tent. The following sensors and questionnaires will be used:

- an accelerometer (National Instruments, LabView) to measure the oscillation of the head, and thus possible MoA;
- heart rate variability (NeXus);
- a respiration sensor (NeXus) to measure the frequency and depth of breathing;
- skin conductance sensor (NeXus) to measure sweat gland activity on the hand. It is closely correlated with sympathetic nervous system activity, arousal and stress;
- State-Trait Anxiety Inventory (Spielberger, 1983).

40 subjects are expected to participate who would all go through the same conditions in a randomised order. Participants will be asked to choose a genre-based relaxation playlist according to their preference. Possible genres: classical, pop, rock and soul. Participants will listen to all together 4 different songs (2 in the preferred genre and 2 new age songs), and listen to each songs synchronised and in the original tempo as well.



National Instrument Sound and Vibration Module