

Literature Review Notes

1. Skin is very sensitive to changes in intensity and amplitude

The skin is not very good at perceiving frequencies; it can only sense frequencies between 10 Hz and 1000 Hz, whereas the ear can hear frequencies up to 20,000 Hz. However, the skin is very sensitive to changes in intensity and amplitude. Deaf people can therefore have their skin sense changes in the intensity and amplitude of sound instead of their ears.

2. Compensatory Plasticity [1, 2, 3]

When one sense is unavailable, sensory responsibilities shift and processing of the remaining modalities becomes enhanced to compensate for missing information. This shift, referred to as compensatory plasticity, results in a unique sensory experience for individuals who are deaf, including the manner in which music is perceived.

3. Vibrotactile devices can enhance the experience of music for individuals who are deaf [4]

Vibrotactile devices can enhance the experience of music for individuals who are deaf. Deaf individuals report that vibrotactile devices, such as haptic chairs, are a significant contribution to their musical enjoyment [72]. Using vibrotactile technology, music has been created in which vibrotactile aspects supersede the auditory aspects of music [73]. Research has shown that incorporating additional vibrotactile stimuli through sensory substitution technology may be an effective way to convey the emotional information when experiencing music [74,75].

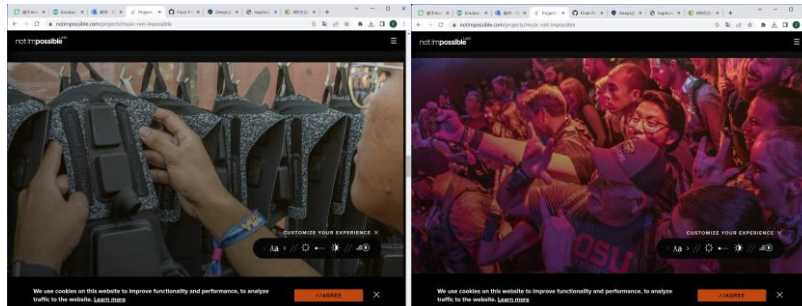
4. Vision combined with the sense of touch can achieve the effect of faking it [5]

(e.g. looking at a rubber glove and stroking your hand while your hand is being stroked, many people will be able to feel the plastic)

The Rubber-hand illusion [4, 23] illustrates how the tactile perception can be influenced by visual input. Participants watch a rubber hand being stroked, while their actual hand, hidden from their view, is also stroked synchronously. Most participants report feeling sensations on the rubber hand. This illusion arises because the human brain mislocalizes the tactile percept based on the visual percept.

5. Music.: Not Impossible [6]

Not Impossible Labs, with technology solutions support from Avnet, has engineered a complete platform for composing, translating and sending audio as vibrations wirelessly to the users' bodies with zero perceptible latency. Music: Not Impossible is a combination of wearables, hardware, software and wireless tools.



6. Different tactile stimuli are perceived: 【4】

How to increase the user's perception of touch:

Amplitude perceivable by participants.

Sequential squeezes by participants.

Cold was easier to notice than warmth.

1) Vibrations

The most intensive vibrations sounded loud (especially on the head) and felt unpleasant, weak vibration was not felt at all. Some people said the vibrations make them felt unpleasant on the head.

2) Thermal Stimuli

Cold was easier to notice than warmth and experienced as better for communicating things than hot feedback. But thermal stimuli are sensed slowly and the skin adapts to the temperatures after a while.

3) Squeezes

Faster squeezes were experienced as better than slow squeezes, because they are more noticeable, and for the same reason sequential squeezes were preferred over single ones.

7. Different ways can evoke different emotions:

negative emotions: hard squeeze (also aroused emotional), brief and forceful touch

positive emotions: finger touch, slow squeeze, prolonged actions

Squeeze was more suitable for communicating unpleasant and aroused emotional intention, while finger touch was more suitable for communicating pleasant and relaxed intention. 【7】

However, the message behaviors from both positive and negative conversation showed a good agreement with Huisman which observed that.

Participants mostly used brief and forceful touches for negative emotions, e.g., anger and fear and used prolonged actions to communicate positive emotions, which their experiments consisted of majority male participants (80%). 【8, 9】

8. Key Elements of Music Extraction

I mainly consider the first, second and the third music elements: rhythm, melody and pitch, these three are the most able to transform music emotions into tactile.

Rhythm: the basic elements of the composition, equivalent to drums.

Melody (the most expressive of the mood) & Pitch (vibrations):

Sad: slow vibrations, stress (heavy tactile stimuli)

Fear, anxious and angry: rapid vibrations, stress (heavy tactile stimuli)

Clam: slow vibrations, light tone (light tactile stimulus)

Happy, calm and euphoric: rapid vibrations, light tone (light tactile stimulus)

Musical compositions are complex blends of expressively organized sound consisting of five elements: rhythm, melody, pitch, harmony and interval. 【10】

The first element, rhythm, is the pattern of repeated sounds and silences and is music's most fundamental, essential, structural and organizational element. 【11】 By capturing an individual's attention, rhythm is an auditory cue for the synchronization of skeletal muscle movement and is the most important consideration when selecting music for specific and therapeutic purposes. 【11】 As the second element, melody is the sequencing of musical pitch and intervals between musical notes. Structured by its length and intensity, melody expresses a mood, a thought, an idea or an emotion. 【12】 Melody is a form of non-verbal communication that can elicit a broad spectrum of emotions from one extreme response (happy, calm and euphoric) to another (sad, anxious and angry). The number of cycles that a particular sound vibrates per second is the third element, pitch. Faster vibrations cause high-pitched tones that are usually associated

with cheerful or happy reactions. On the other hand, slower vibrations cause lower tones and typically connote dreariness or depression. The vibration rate per unit of time can influence an emotional response as rapid vibrations are viewed as stimulating and slow vibrations are considered as relaxing. 【10】

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