

Dissonance Model Toolbox in Pure Data

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Abstract

This paper presents the development of a toolbox based on Dissonance Psychoacoustic Models departing from Terhardt's theory, which includes Sharpness, Roughness, Tonality, Root Relationship & Pitch Commonality. Dissonance perception studies are found under many approaches in psychology and musicology. There is no final word on how each parameter contributes to its perception of Dissonance. A review of the theories has been discussed by the author. Here, the theory is only briefly discussed, the implementation section carries a bit more information on each attribute before the patches and creative applications are presented.

Keywords

Dissonance, Psychoacoustic Models, Live Electronics.

1 Introduction

This paper is part of a PhD program currently in progress. The research is on Psychoacoustic Dissonance Models to be applied over digital audio signals in realtime. The usage of this theory has been mostly applied in computer aided composition, but not much has been done for Live Electronics. Another contribution is to make such studies and concepts more accessible to composers and musicians.

The most familiar term is Roughness, which has usually been the only attribute present in Dissonance Models like Sethares' [1]¹. It's common for such attributes to be usually implemented independently, so part of this research relies on the investigation of many different implementations of each attribute, as to put them together in a Pure Data library dedicated to Dissonance Modeling.

1.1 Sensory Basis of Musical Dissonance

In Terhardt's theory [2], the sensory basis of Musical Dissonance depends on perceptual attributes divided into two groups. The "Sensory Dissonance" group refers to innate (objective) aspects of perception. The term was coined to distinct itself from subjective aspects of the "Musical Dissonance" concept (known to carry cultural factors) and made lots of research under a scientific approach possible [3]. But some authors have worked with an expanded notion of the sensory basis for Musical Dissonance [2,

4, 5] in which Sensory Dissonance is part of it. Complementary, "Harmony" is the second group. But there is still a clear separation from cultural aspects of perception [5 pp.48].

Nevertheless, inside a sensory approach, there are still further distinctions from lower to upper levels, such as: Psychoacoustics, Music Psychology and Cognitive Psychology. But an outline of Music Cognition research is not considered here. Many new outcomes are appearing, but a current review of this findings is not pertinent to the goal of research, as no applicable model has yet emerged from these researches.

Sensory Dissonance	Harmony
- Sharpness - Roughness - Tonality	- Root Relationship - Affinity of Tones: Pitch Commonality

Table 1: Perceptual Attributes of Musical Dissonance according to Terhardt.

While the attributes of Sensory Dissonance can be applied to any kind of sound, the "Harmony" group deals with what is called "musical sounds", and that means basically sound spectra such as those of musical instruments – and not noise or speech.

Moreover, the Harmony group is related to sounds that evoke the perception of Pitch, and this does not discard sounds that have a weak and diffuse pitch image, like inharmonic sounds. But a very important detail is that it's related to chord structures with three or more notes (as in Root Relationship), and the relationship between successive tones or chords (as in Pitch Commonality). So it's very much related to the concept of "Harmony" in music – hence the given term.

2 Implemented Perceptual Attributes

2.1 Sharpness

The concept of Sharpness can also appear under the term of *Brightness* or *Density*, which are equivalent or closely related [6]. The

¹ He was clearly aware of other attributes and describes them in his book while explaining his approach/choice.

Pure Data Manual

Mark Wickham



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Making Musical Apps Peter Brinkmann,2012 Pure Data Pd is a graphical programming environment for audio and more libpd is a wrapper that turns Pd into a portable embeddable audio library The purpose of this book is to present tools and techniques for using Pure Data and libpd as an audio engine in mobile apps for Android and iOS

[Plastic Optical Fiber Design Manual - Handbook and Buyers Guide](#) ,1993

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