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Summary

This research delves into contemporary approaches to musical harmony on the basis of algorithmic composition tools derived from psychoacoustics and microtonality. As an artistic, practice based research, it entails a cycle that involves programming, experimentation, composition and theorization. The experimentation itself comprises findings, reflections, tests, modifications, speculations, intuitions, surprises, and so on, successively. Which paths will produce the most fruitful findings cannot be determined in advance, leading as much to interesting discoveries as to dead ends. What is sought is to discern and comprehend some aspects of the pitch materials produced by the tools through notions such as harmonic duality, harmonic space and harmonic fields, ideas that provide resources for discovering new harmonic possibilities.

The written thesis is one of the outcomes of this research. It presents not only finished results but also bears witness to the way the research was conducted, showing the findings as they are encountered and reflecting the way they mold and influence the main research subject and questions. It begins by postulating the hypothesis of ‘harmonic duality’, according to which harmonic materials in music have an intertwined, double aspect: one relating to the character of pitch intervals, their proportionality, and the other pertaining to the high, low, dark and bright character of the pitches and sound qualities that comprise these intervals, their timbral facet. The first chapter sets the stage for understanding what this hypothesis means and how its two sides are embroiled. First it describes the hypothesis and the way it surfaces from a compositional practice, subsequently setting out to explore and read the topics of pitch perception and Greek harmonics in light of this duality, detailing and expounding its features and the way its facets are entangled while providing it with evidence and support. The chapter ends by revisiting Pythagoreanism in an attempt to recover some of its landmark ideas in relation to musical microtonal harmony, especially the ones involving the relation between number and perception and between the micro and the macro.

Most of the work has concentrated on compositional uses of dissonance curves, algorithmic devices that relate timbres to harmonic intervals, extracting microtonal pitch materials from sound spectra and analyzing them according to their timbral and harmonic properties. Putting them into motion through different rhythmic and textural procedures, these materials have been used to compose varied kinds of electronic and instrumental music, another principal outcome of this research. The analysis of the generated intervals has led to the study of their arithmetic features, interpreting them in ‘harmonic space’, a mathematical structure that helps characterize their properties and measure their harmonicity, ranking and separating pitch sets into distinct regions and contributing to the development of strategies for their deployment. The use of harmonic metrics also leads to the notion of ‘harmonic fields’, the algorithmic generation of pitches through probabilities. This leads to the third main outcome of this research, encapsulating many of these compositional experiments in computer programs and a code library of extensions for the composition and sound synthesis programming language SuperCollider.

Chapter 2 studies the timbral aspect of harmony. First it delves into the compositional description and uses of dissonance curves, also exploring the science behind them and some of their musical uses. A small section serves to wrap up most historical notions of consonance and dissonance in order to show their compositional possibilities. The second half of the chapter is an appraisal of twentieth century music in relation to pitch and the increasing emphasis that has been given to the timbral aspect of harmony, in close connection to the way that compositional materials have become ever more continuous at various time scales. It reads these uses from various styles and schools of compositions in an attempt to describe the current compositional situation with respect to
harmony and to suggest the incorporation of discrete elements and pitch proportions back into harmonic practices.

Chapter 3 inquires into the details of proportional harmony, employing ideas from several composers and theorists (Harry Partch, Ben Johnston, James Tenney, Clarence Barlow as well as Leonhard Euler and Adriaan Fokker) in order to treat some technical topics that involve pitch ratios: harmonic space, intervallic hues and fundamental intervals, commas, intervallic tolerance, harmonic metrics, visualization and some practical uses of the algorithmic tools developed by the author. The second section details the development of harmonic fields, the probabilistic generation of continuously varying harmonic textures, wrapping up many of the topics having been traversed during the study. It ends with some considerations on how harmony can be conceived in relation to form at various time scales.

Finally, Chapter 4 gives a recount of harmonic strategies used by the principal composers that have influenced this investigation (again, Tenney, Barlow and Johnston, additionally, Augusto Novaro and Ervin Wilson). Its second part explores the harmonic strategies behind some of the author’s own compositions, showing how they fit into the research at large, sometimes emerging from it, while at other times altering the research as a consequence of the findings and experiences gathered in the music making process. The second half of the chapter closes the whole endeavor by discussing some of the speculative meanings of harmony and how they might produce insights that reach beyond what has been examined in the research. There is a consideration of noise in relation to harmony and a brief dissection of John Cage’s notion of it. Some philosophical reflections of harmony follow, considering it as a coexistence of diverse elements and also as the relation between sameness and difference. After proposing an abstract definition of my own, the dissertation ends by shortly touching on randomness and the extraction of simple, small whole numbers, from within the complexity of the world.

The many terms stemming from disparate sources and disciplines (perceptual, mathematical, musical, philosophical) that have been either gathered or proposed during the study are given a separate treatment in the glossary, converging in a distilled section that isolates them as different notions that relate to harmony. Three appendixes follow, the first describing the technical details for the implementation of dissonance curves, the second showing a comparative table of sevenths, displaying the nuances involved in composing with seventh based intervals, and a third one showing the results of an investigation into an extended pitch set. This inquiry has been used as a stepping stone to compose one of the last pieces for this research, showing many timbral and proportional properties of these intervals: their nomenclature, accidentals, tempered approximations, degrees and functions, coupled with visualizations in harmonic space and a few examples of how they are used in instrumental writing.