

17 Tones

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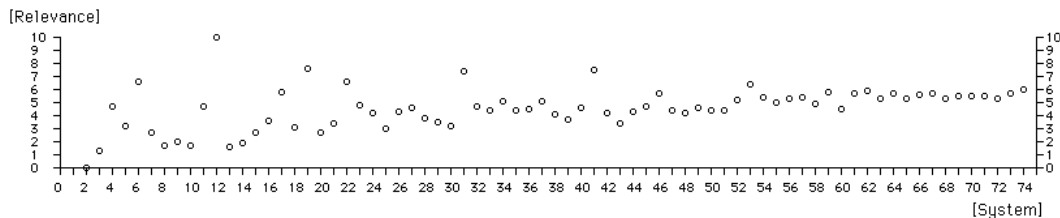
Introduction:

This paper describes the results of a project with microtonal music, for which the following five compositions have been written (Hajdu 1992a):

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|---------------------------|--------------------------------|
| 1. Carola Bauckholt | scala mòbile (1988) |
| 2. Clarence Barlow | OTodeBLU (1990) |
| 3. Georg Hajdu | Heptadecatonic Drops (1989/90) |
| 4. Caroline Wilkens | Piece for 17 Tones (1990) |
| 5. Caspar Johannes Walter | langer Samstag (1987) |

The aim of our project was to encourage composers to create pieces that were suitable for two mechanical pianos (occasionally with some additional instruments). The Cologne *Hochschule für Musik* provided the pianos for a semester in 1988, giving us the opportunity to experiment with this tuning. Microtonal music played an important role in Johannes Fritsch's seminar at the Cologne *Hochschule für Musik*. His preoccupation with universal harmony was supported by Clarence Barlow's theory of quantized harmony (Barlow 1987). Departing from Barlow's treatise I started to develop my own theory of harmonic energy, based on harmonic consonance and pitch strength—a unifying notion for internal (physiological and psychological) and external (physical) factors affecting pitch perception (Hajdu 1992b). The stability of a musical system can be calculated by combining harmonic energy values for each element of its interval set. In order to compare different systems, and to thereby determine their relevance, the differences between the combinatorial energy for each system and the average combinatorial energy are scaled so that the most negative result corresponds to 10, and the most positive to 0.

The following graphs shows the relevance for tempered systems with 2 to 74 steps (a high pitch-strength value was assumed in this case). According to this, temperaments with 6, 12, 17, 19, 22, 31, 41, and 53 steps per octave are marked by low system energies (i.e. high relevance), as opposed to tunings that are derived through equal division of the tempered whole tone (into three, four, five, etc. steps).



For two reasons, we decided on 17-tone temperament for our project (instead of the more favorable 19-tone tuning). First, the 17 tones of the heptadecatonic tuning form an enharmonic system with two alternative pitches for each black piano key, as the naming of the pitches would suggest (c#≠db). Consequently, the traditional diatonic structure is maintained after the assignment of the 17 pitch classes onto two piano keyboards. Second, its 11th step (705.9 cents) deviates only by 4 cents from the just fifth (3:2), an almost unnoticeable difference. The circle of fifths closes after 17 fifths, e# and gb being enharmonically equivalent. Easley Blackwood explored all tunings with 13 to 24 equal steps and wrote a collection of etudes for them. He describes the characteristics of the 17-tone temperament on the cover of his record (Blackwood).

The 17 pitches were assigned to both pianos as follows:

Step	Cents	Piano I	Piano II	Step	Cents	Piano I	Piano II	Step	Cents	Piano I	Piano II
1	0	x	x	7	424	x	x	13	847	x	
2	71		x	8	494	x	x	14	918	x	x
3	141	x		9	565		x	15	988		x
4	212	x	x	10	635	x		16	1059	x	
5	282		x	11	706	x	x	17	1129	x	x
6	353	x		12	776		x	18	1200	x	x

After reviewing the submitted compositions, it became obvious that the naming of the alterations was not universal, but rather depended on what (sub)set of pitches the composer focussed on. Two concepts of notation were distinguishable:

1. A notation based on the circle of fifths and leading tones. Here, the #-alteration of a particular step is sharper than the b-alteration of the succeeding step.

Circle of fifths (e# is enharmonically equivalent to gb, resp. a# to cb):

The resulting chromatic scale:



This notational system is applied in Caroline Wilkens' and my pieces. The #-alterations are all assigned to piano I.

2. A quasi-just tuning, derived from folkloristic material. Clarence Barlow uses three blues scales (on A, D, and E) in which neutral thirds and sevenths (blue notes) occur. A Pythagorean notation, as in 1. above, would contradict the semantics of the music, since the blue notes could only be notated as augmented seconds (sixths) or diminished fourths (octaves). Consequently, the #-notated pitches are assigned to piano II, the instrument with the flat tuning on the black keys.

Blues scale in D:



Resulting chromatic scale:



Caspar Johannes Walter, inspired by Sardinian chorus music, also conceives the altered pitches as chromatic progression away from a principal scale step and notates:



Carola Baukholt tries to avoid any confusion utilizing the historically less charged quarter-tone notation. Each †-alteration (‡-alteration) clearly denotes a narrow step upwards (downwards).

The †-pitches are assigned to piano II, like in Clarence Barlow's and Caspar Johannes Walter's pieces.

Demonstration:

The ICMC demo will provide an opportunity to study the heptadecatonic system as well as to hear the five compositions. A patch written in Opcode's MAX programming environment for the Apple Macintosh will serve as a interactive, hyper-media-like platform. The demo will first focus on the 17-tone interval set and the harmonic relationships that can be derived from this. Then, some interesting aspects of composition and notation will be stressed—before, finally, a modified version of David Wessel's Multi-Timbral-Player patch will allow the entire collection of pieces to be played.

References:

- Barlow, Clarence (1987). Two essays on theory. *Computer Music Journal*, **11**, 44-60.
- Blackwood, Easley. Twelve microtonal etudes for electronic music media. LP Blackwood E-639.
- Hajdu, Georg (ed.), (1992a). 17 Töne. A collection of compositions in 17-tone tempered tuning with recordings on enclosed cassette. Cologne: Thürmchen Verlag.
- Hajdu, Georg, (1992b). Low energy and equal spacing. The multifactorial evolution of musical systems. Available from the author.