

# Sonification of Biological Rhythms

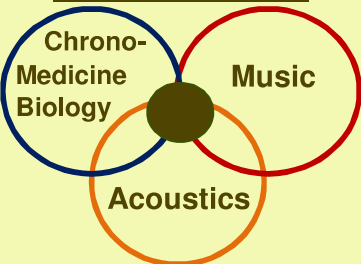
## exemplified by the sound of BRAC

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**A new kind of music therapy has been developed generating sounds of biological rhythms.**

### Multidisciplinarity



### Universal Parameters

- independent of
  - cultural and social background
  - gender, age
  - individual habits and preferences
- universally applicable

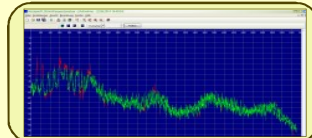
### Sonification of Biological Rhythms

**SBR** translates the inner logic of a rhythm to a simply structured **rhythmically moving mono sound**

## Sonification

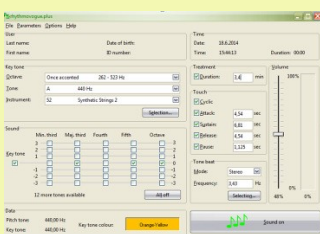
- heart beat ~ 1 Hz
- breathing ~ 66,6 – 83,33 mHz
- BRAC ~ 0,1388 mHz
- sympathetic nervous system ~ 3,3 – 40 mHz
- parasympathetic nervous system ~ 150 – 400 mHz

### Chrono-diagnosis



Voice Frequency Analysis (VFA) by Heinen A., Linde A.

### Rhythm Frequency Modulation (RFM)\*\*



- periodicity / time [s]
- key tone frequency [Hz]
- sound
- interval
- phase [s]
- beat (brain) frequency [Hz]
- intensity / amplitude [%]

**Oktavierung - self-similarity:**  
(acceleration / deceleration of rhythm's by halving / doubling its frequency)

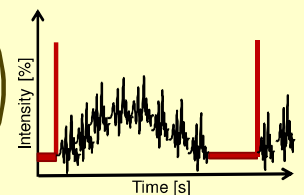
$$f \longleftrightarrow f_0 \xrightarrow{x2} f_1 \xrightarrow{x2} f_2 \xrightarrow{x2} f_3$$

$$\text{conversion: time } t [s] \longleftrightarrow \text{frequency } f [Hz] \quad f = \frac{1}{t} \longleftrightarrow t = \frac{1}{f}$$

## Mono Sound

### Attributes

- single tone
- harmonic sound
- rhythm's periodicity
- defined frequency
- wave character
- vibration



rhythmical movement

## Sonification of BRAC



- rhythm periodicity: ~7200 s
- key tone frequency: 145,63 Hz
- brain frequency  $\theta$ : 4,55 Hz
- intervals: oct +1/0/-1/-2/-3; 5th 0; maj 3rd 0
- sound: strings
- single sound motive 15,3 s
- phases: attack 3,4/sustain 6,8/release 3,4/pause 1,7



### Therapist:

- easy and quick handling
- universally applicable
- individual treatment
- optimum assessment and control of effects

### Patient:

- simplicity of structure
- maximal reduction of 'input'
- easy adaptation to a stressed / ill organism
- optimal perception
- easy assessment

## SBR in therapy

- independence of cultural and social background
- multisensory therapy
- affects **somatic, emotional and mental** states
- basic therapy - aiming at the retraining of body's own rhythmicity
- compatibility with any kind of therapeutical intervention
- all disciplines
- application: diseases (acute, chronic); prevention; rehabilitation; stress regulation;
- combination of **universality and individuality**

### Sciences / Research:

- clearly defined parameters
- optimal assessment and control of therapeutical effects
- interdisciplinary approach

