Music and Sounds
Sonification with Practical Benefits

Forming Sonic Messages from Data and Information

Sonification is about Conversion, Transformation, or Translation

Information to Sound
Sound for Interpretation

In 2015 we formed a team at TAUCHI to explore data to music scenarios for five companies in Finland.

This was a three year innovation project funded by Tekes.

We combine the studies of Music & Human Computer Interaction.

We asked the companies what their needs were and developed data-to-music software to make sonifications that would meet those needs.

Each company had different areas of focus.

We can use what we learned from the Data-to-Music project for the MIXER project.

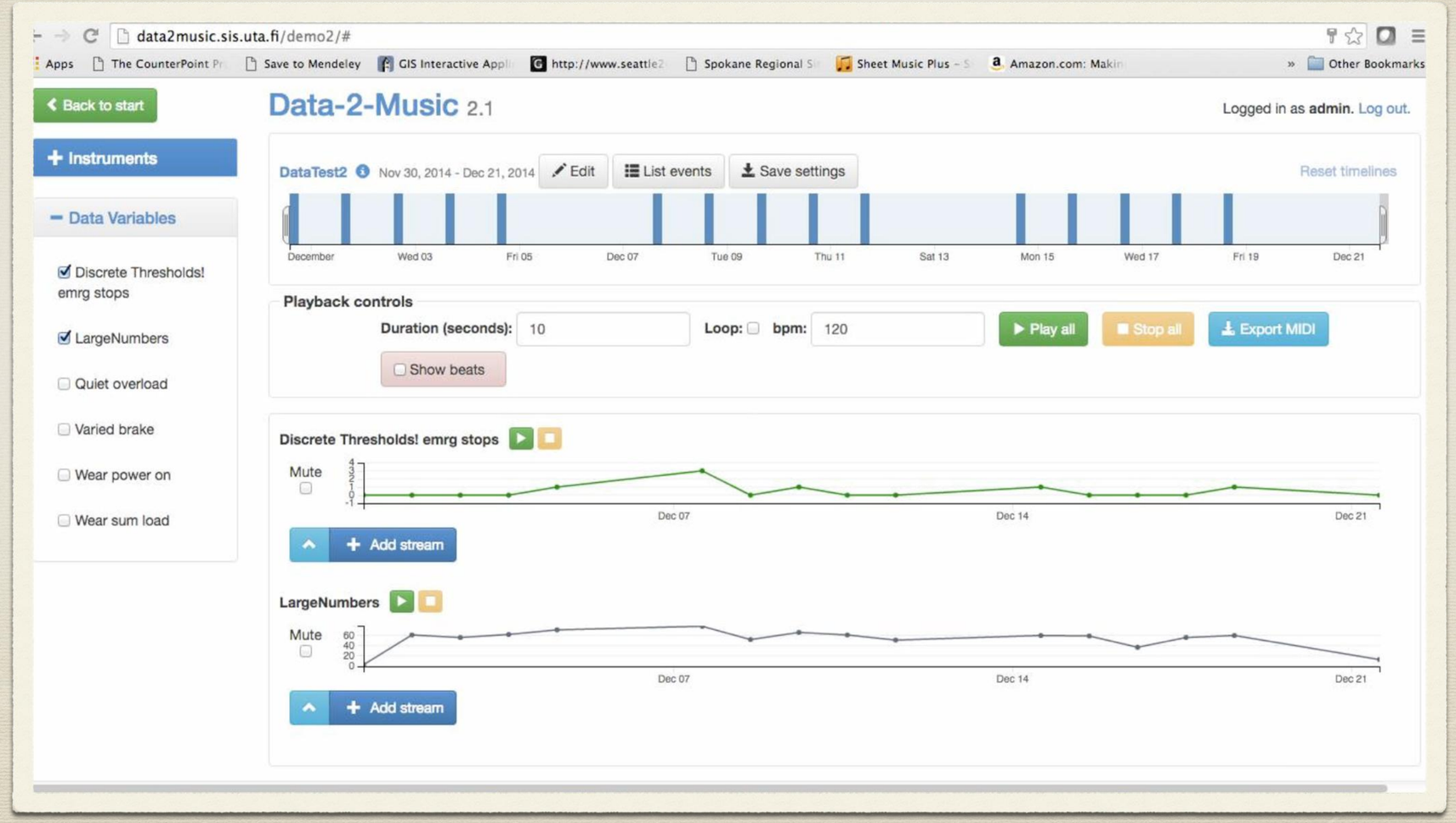
Our Sonification Models are Designed Algorithmically

Our approach is different from more familiar sounds
known as Earcons and Auditory Icons.
These are basic and brief sound designs that provide generic notifications

- Earcons are often short sounds that we become familiar with from devices. The sounds usually convey a notification. Basic examples are the Windows start-up sounds or the bells and beeps in your car or from your phone.

- Auditory icons are notification sounds that sound like something we know well. These sounds mimic real sounds, like dropping a computer file in the trash can and we hear a thump. The sound affirms a task.

In the Data-to-Music Project, we researched sonification mapping parameters and shared auditory results with clients



Variable Music Parameters

- Pitch
  - Stratification: High, Medium, Low
  - Tonal Systems, scales, modes
- Organization & Texture
  - Density, harmony
- Timbre & Articulation
  - Percussive, sustained
  - Harmonic richness
  - Instrumentation, effects

Variable Music Parameters

- Rhythm & Timing
  - Synchronous, asynchronous
  - Tempo/rate, rate of change, beat and patterns
- Dynamics
  - Overall level and range
  - Contrast, rise and fall, removal and addition

Coordination of Parameters

- Spatial audio: stereo, multichannel, binaural
  - Binaural synthesis over loudspeakers
  - Sound selection for enhanced spatial perception (pitch, timbre)
- Orchestration for contrast or emphasis
- Patterns & motifs, structure, periodicity and rates of change
- Pairing with static or random elements (cohesion, variation)

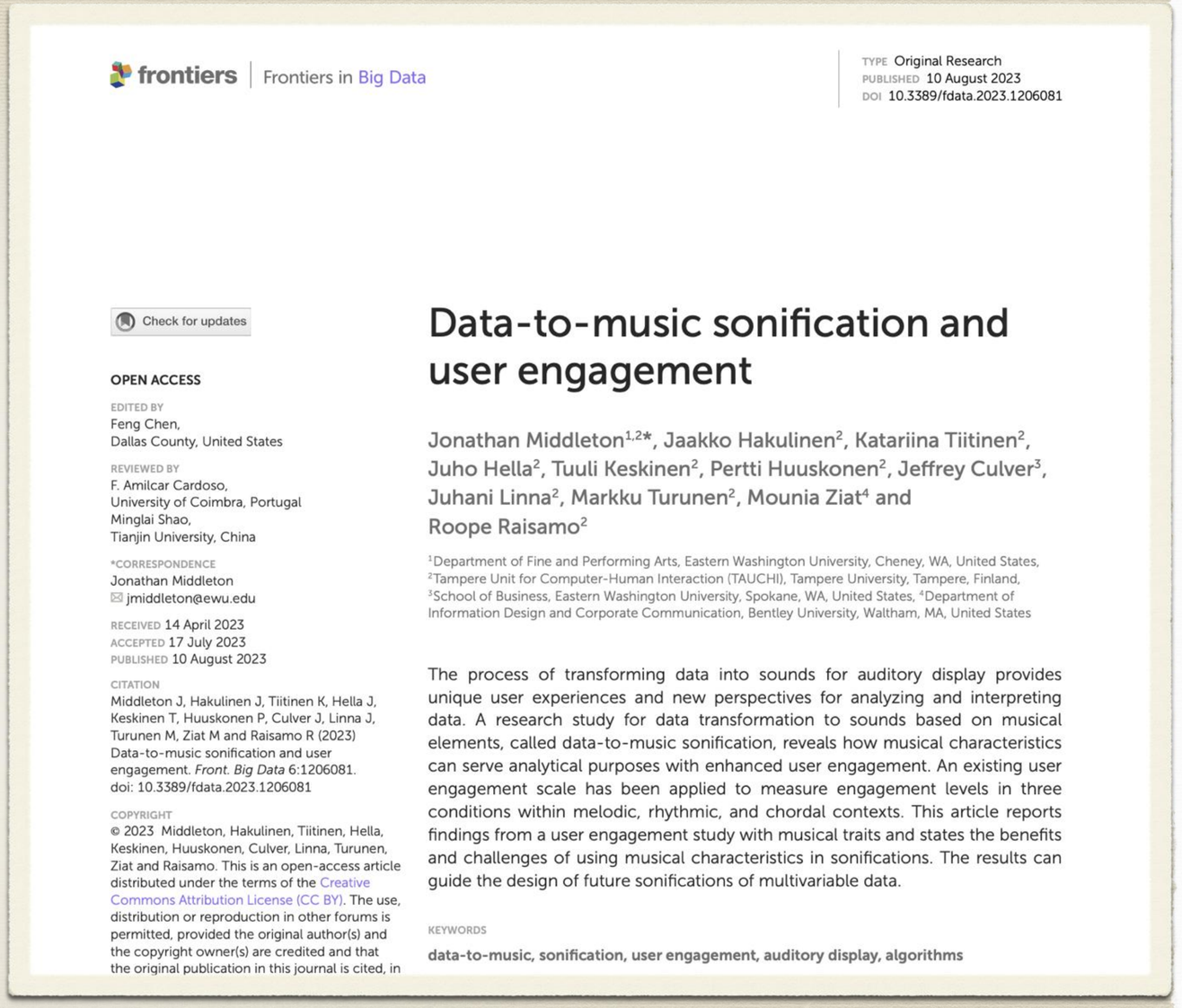
Use Case Ideas for MIXER

- Continuous or discrete (ambient sound, earcons)
- Convey environmental data, machine status & performance
- Navigation, target & obstacle location
- Task-specific interactive feedback (similar to haptics)
  - Sensor data (position, load, etc.)
- Productivity: progress, activity, efficiency, scheduling
- Selectability and customization

Potential Gains

- User notifications
- User's ability to engage multiple sensory inputs
- User engagement

The Data-to-Music sonifications were useful and meaningful in many ways for multiple companies, but for our original research publication, we focused on sonification's overarching contribution towards user-engagement



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Data-to-music sonification and user engagement

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The process of transforming data into sounds for auditory display provides unique user experiences and new perspectives for analyzing and interpreting data. A research study for data transformation to sounds based on musical elements, called data-to-music sonification, reveals how musical characteristics can serve analytical purposes with enhanced user engagement. An existing user engagement scale has been applied to measure engagement levels in three conditions within melodic, rhythmic, and chordal contexts. This article reports findings from a user engagement study with musical traits and states the benefits and challenges of using musical characteristics in sonifications. The results can guide the design of future sonifications of multivariable data.

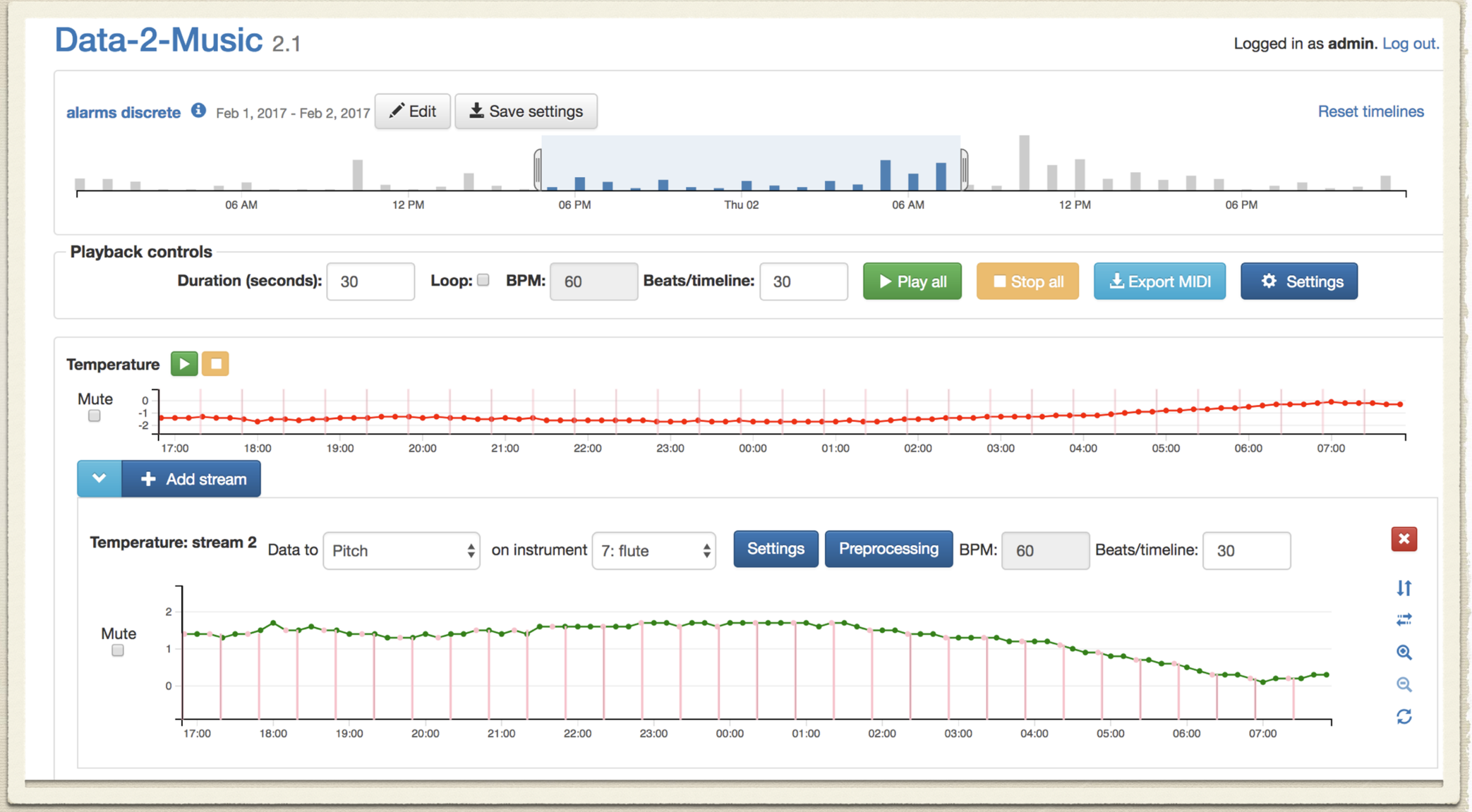
KEYWORDS

data-to-music, sonification, user engagement, auditory display, algorithms

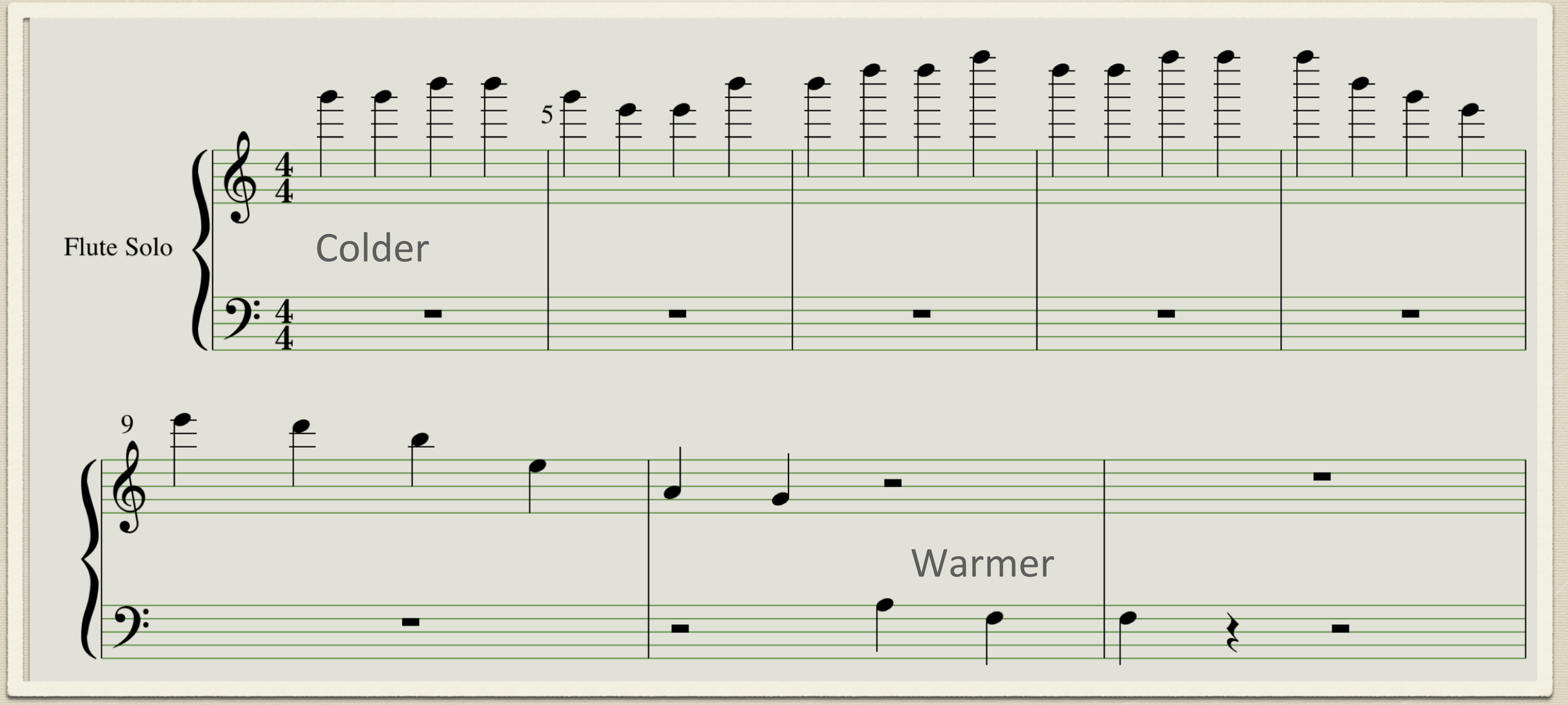
Examples of Simple Sonifications from Various Data Sources Using the D2M Algorithms

Cold Temperature

Inverted Sound



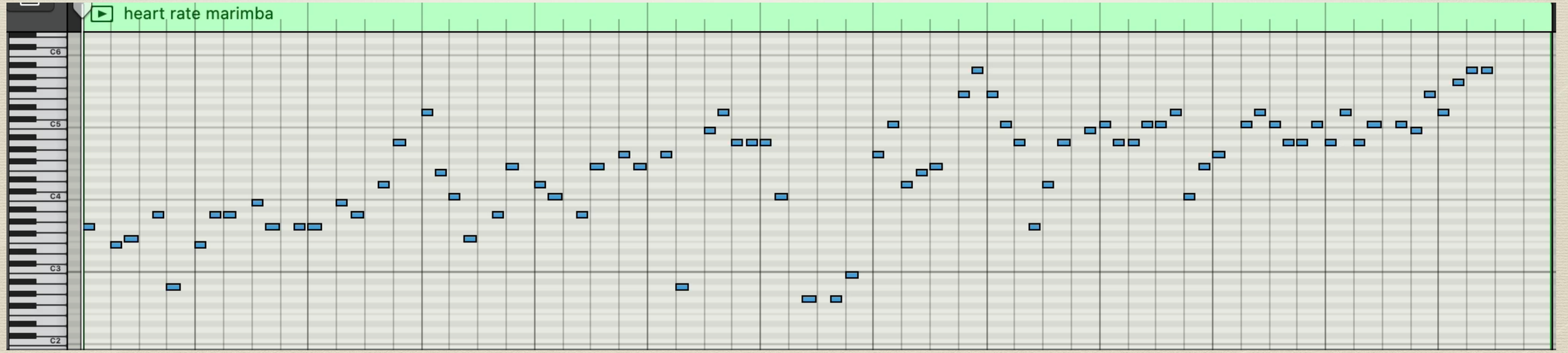
Music Score



Which Weather Do You Hear?

Heart Rate


data2music.sis.uta.fi/demo2/index.html
Back to start
Data-2-Music 2.1
Logged in as admin. Log out.
Instruments
Data Variables
Altitude
Cadence
Distance
HeartRate
Speed
VerticalSpeed
1318787_hard
Nov 6, 2016 - Nov 6, 2016
Edit
Save settings
Reset timelines
Playback controls
Duration (seconds): 20
Loop:
BPM: 150
Beats/timeline: 50
Play all
Stop all
Export MIDI
Settings
HeartRate
Mute
Add stream
HeartRate: stream 1
Data to Rhythm
on instrument 3: marimba
Settings
Preprocessing
BPM: 150
Beats/timeline: 50


heart rate marimba
C6
C5
C4
C3
C2

Questions?