

Sonification: Bringing Data to your Audiences' Ears

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Link to Slides

https://docs.google.com/presentation/d/1CVFiMu9XKVi73UDxWB_CDjdV2mApmuvr6zpDn-VMMyko/edit?usp=sharing

[What is data sonification?](#)

[What kind of data sets work well with sonification?](#)

[What are some examples of data sonification?](#)

[Sonification/Sound Tools & Resources](#)

What is data sonification?

Sonification is the practice of using sounds to communicate data. (Traditionally, this refers to *non-speech* sounds, although this is changing.) You can think of sonification as charts and graphs that you can listen to.

Sonification includes many different techniques, and one of the most widely used is **parameter mapping**: you connect a dimension of data onto a dimension of sound — for example, mapping *magnitude* onto *pitch*, or *category* onto *timbre*.

What kind of data sets work well with sonification?

- Sound always unfolds over **time**, so sonification is particularly useful for emphasizing time relationships, like the frequency or timing of important events happening.
 - There are lots of ways to do this, for example by putting discrete sonic events on a timeline ([NY Times bump stock sonification](#)) or by using a familiar sound clip and changing the tempo ([Kuang Keng Kuek Ser's "How Many floods will these American cities have in 2030, 2045?"](#); [Jordan's "The Day Oil Prices Went Negative"](#))
 - You can also use a steady tempo to establish a sonic time scale (i.e., a metronome in the background), and then have a different sonic element (volume, pitch, etc.) represent something that varies over time ([FT's yield curve](#), [Jordan's dissertation proposal sonification](#))

- Emphasizing large changes or **disruptions** – you can use sound to establish a “status quo” and then perturbations ([Jordan’s coal prices sonification](#))
- Evoking **physical/tactile metaphors** by using sounds that connect to the material properties of objects ([Elias Elmquist’s solar system sonification](#))
- Infrequent events – think alarms! How can you play with ambience and attention?

What are some examples of data sonification?

- Larry Buchanan, Jon Huang and Adam Pierce, “Nine Rounds a Second.” *New York Times*, <https://nyti.ms/3zv7Fgh>
- Michael Corey, “Oklahoma Shakes.” *Reveal*, <https://bit.ly/3JN0WTz>
- Elias Elmquist, “OpenSpace Sonification,” <https://vimeo.com/528822742>
- Jordan Wirfs-Brock for *Marketplace*:
 - “Here’s what the crescendo of unemployment sounds like,” <https://www.marketplace.org/2020/06/24/heres-what-the-crescendo-of-unemployment-sounds-like/>
 - “What sound does a volatile stock market make?” <https://www.marketplace.org/2020/03/31/the-sounds-of-a-volatile-stock-market>
- Alan Smith, “Sonification: turning the yield curve into music,” *Financial Times*, <https://ft.com/music-from-data>
- BBC Visual and Data Journalism team, “Coronavirus: How can we imagine the scale of Covid’s death toll?” <https://www.bbc.co.uk/news/resources/idt-7464500a-6368-4029-aa41-ab94e0ee09fb>
- Simon Huwiler, “A Song of Crowns and Tears,” <https://www.youtube.com/watch?v=DqfrOPs2pKM>
- Brian Foo, *Data-Driven DJ*, <https://datadrivendj.com/>
- Jacob Goldstein and David Kestenbaum, “U.S. Home Prices, Sung As Opera,” *NPR/Planet Money*, <https://www.npr.org/sections/money/2011/04/27/135737940/the-case-shiller-in-dex-sung-as-opera>
- Peter Frigh-Wright and Robbie Carver, “Early Bloom,” *How Sound*, <https://transom.org/2014/early-bloom/>
- “Colors,” *Radiolab*, <https://www.wnycstudios.org/podcasts/radiolab/episodes/211119-colors>
- Loud Numbers podcast: <https://www.loudnumbers.net/>
- Loud Number sonification festival: <https://www.youtube.com/watch?v=X17zV8-4CdI>
- And many, many more at **Data Sonification Archive**, <https://sonification.design/>

Sonification/Sound Tools & Resources

No coding required:

- TwoTone.io – <https://twotone.io/>
- Highcharts Sonification Studio – <https://sonification.highcharts.com/#/>
- Audiographs – <https://workspace.google.com/marketplace/app/audiographs/1078303178825>
- StarSound – <https://www.jeffreyhannam.com/starsound>

Coding languages and packages:

- Sonic Pi (runs on Ruby) – <https://sonic-pi.net/>
- Supercollider – <https://supercollider.github.io/>
- MAX (visual programming language for music) – <https://cyclimg74.com/products/max> (\$)
- Pd – <https://puredata.info/>
- MIDITime (Python package) – <https://github.com/cirlabs/miditime>
- SoniPy (Python package) – <https://github.com/lockepatton/sonipy>

Audio editing and mixing (going from basic editing to music creation and more...):

- Garage Band (comes with MacOS)
- Audacity – <https://www.audacityteam.org/>
- Adobe Audition – <https://www.adobe.com/products/audition.html> (\$)
- ProTools – <https://www.avid.com/pro-tools> (\$\$)
- Ableton Live – <https://www.ableton.com/en/> (\$)
- Reaper – <https://www.reaper.fm/> (\$)
- And many more...

Web dev tools for sound:

- Web Audio API – https://developer.mozilla.org/en-US/docs/Web/API/Web_Audio_API
- Tone.js – <https://tonejs.github.io/>

Other fun and useful stuff:

- SoundGym and ToneGym (audio ear training games) – <https://www.soundgym.co/> and <https://www.tonegym.co/> (free and \$)
- Loopback (routing sound on your computer, for example, recording screen grabs and porting in audio from a web browser) – <https://rogueamoeba.com/loopback/> (free and \$)

- Audio Hijack (for recording sounds from computer applications) – <https://rogueamoeba.com/audiohijack/> (free and \$)

Places to get sound samples:

- Freesound – <https://freesound.org/>
- Looperman – <https://www.looperman.com/>
- Storyblocks – <https://www.storyblocks.com/> (\$)
- Soundsnap – <https://www.soundsnap.com/> (\$)
- Library of Congress audio archives – <https://www.loc.gov/audio/>
- British Library Sounds – <https://www.loc.gov/audio/>

Web-browser based synthesizers (fun to play with!):

- Chrome Music Lab – <https://musiclab.chromeexperiments.com/About>
- Audiosauna – <http://www.audiosauna.com/>
- Midi.city – <https://midi.city/>

Learn more about sonification:

- [International Community for Auditory Display \(ICAD\)](#) – Academic community of sonification practitioners, runs an annual [conference](#), has a wealth of research and examples in the [conference proceedings](#)
- [The Sonification Handbook](#) – free ebook version available, with audio examples!
- The Programming Historian’s “The Sound of Data” – really nice introduction with tools and examples, <https://programminghistorian.org/en/lessons/sonification>
- Brianna Tomlinson’s Coursera class, “Sound & Sonification Design for Interactive Learning Tools” – <https://www.coursera.org/learn/sound-and-sonification-for-learning>
- Scott Gresham-Lancaster’s podcast for interviews with sonification designers – <https://createdisturb.libsyn.com/webpage/category/Sound%20and%20Data>