

# **Sonification: Bringing Data to your Audiences' Ears**

**Jordan Wirfs-Brock**

*National Press Foundation  
Data & Accountability Journalism Training*

January 12, 2022



## Jordan Wirfs-Brock

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- PhD Candidate in Information Science at the University of Colorado, Boulder
- Researches how to communicate data using all of our senses, especially sound 🧠
- Former data journalist at a small public media news organization, [Inside Energy](#)



Jordan Wirfs-Brock | @jordanwb

## Roadmap for Today

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- What is sonification?
- Examples (let's listen!)
  - What kind of data works best?
  - Dimensions of sound to play with
  - Narrative patterns for engaging audiences
- Tools for getting started
- Resources

**Throughout:** Get ready for some hands-on and ears-on activities!



# SONIFICATION is...

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communicating data with sounds  
— charts that you can listen to

# SONIFICATION is...

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communicating data with sounds  
— charts that you can listen to

data-driven  
sound art

foley

auditory icons

sound tracks

sonic logos

alarms

**AUDITORY DISPLAY**

# WHY SOUND?

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- Highlight different dimensions of data & new ways to engage
- Sound & visuals together reinforce insights
- “Slow data” — invite people to linger
- Accessibility

# A SOCIAL DATA + SOUND RECIPE

## ABOUT HOW MUCH TIME WE SPEND INSIDE/OUTSIDE

1. Think about **6 am to noon today** and write down when you were **INSIDE** & when you were **OUTSIDE**:

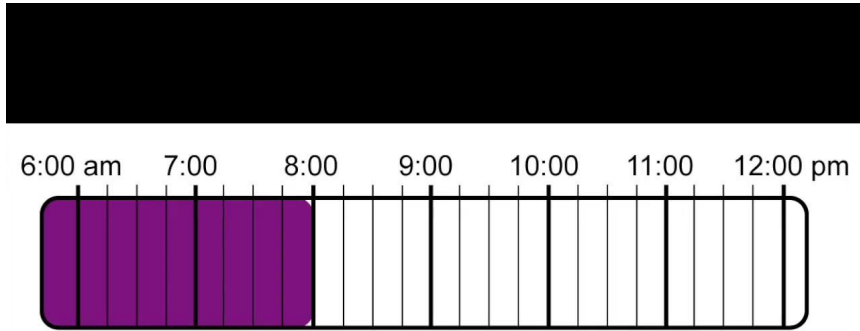
*6:00 - 7:30 = INSIDE (breakfast etc.)*

*7:30 - 8:15 = OUTSIDE (walking dogs)*

*8:15 - noon = INSIDE (working)*

2. Play video that counts 6 am to noon

3. As the video plays, make a **SOUND** for your corresponding **INSIDE/OUTSIDE** state



# SONIFICATION EXAMPLES

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What **characteristics of data** work well with sonification

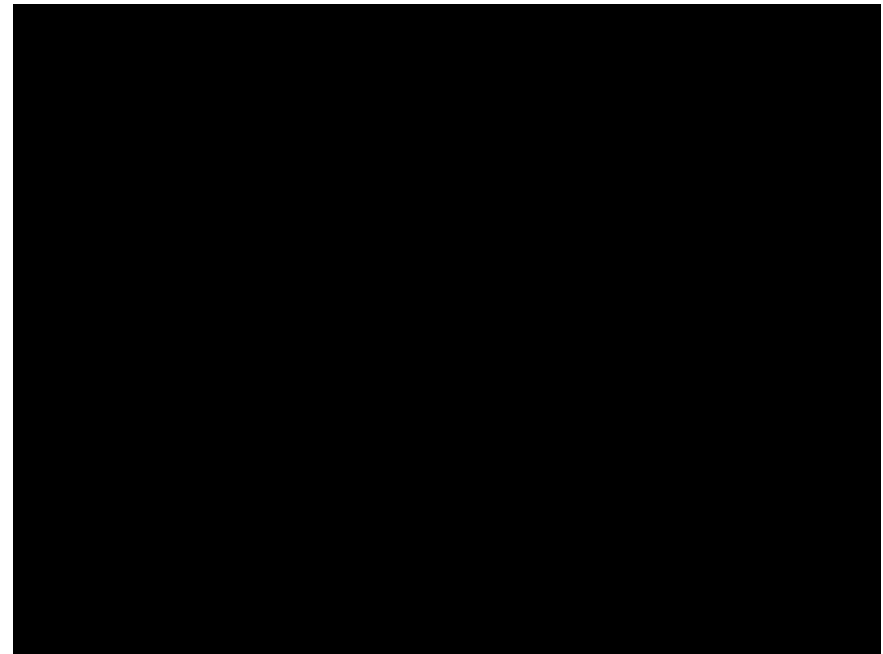


# SONIFICATION EXAMPLES

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Representing **frequency** or **timing** of events in data

Larry Buchanan, Jon Huang and Adam Pierce, "Nine Rounds a Second." *New York Times*, <https://nyti.ms/3zv7Fgh>



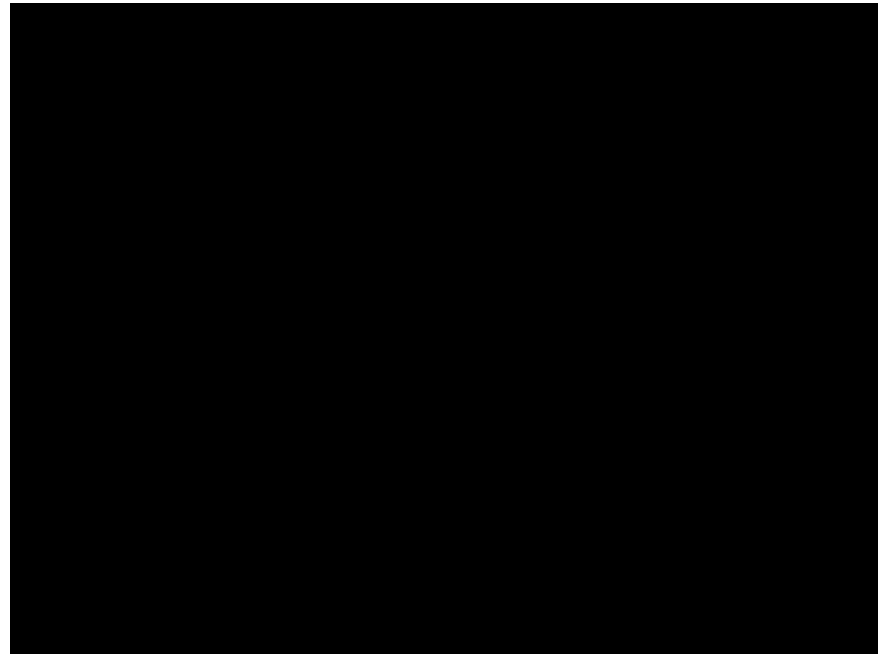
# SONIFICATION EXAMPLES

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Representing **frequency** or **timing** of events in data

Michael Corey, "Oklahoma Shakes."  
*Reveal*, <https://bit.ly/3JNoWTz>

Representing **magnitude** or **scale** of data points



# SONIFICATION EXAMPLES

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**Physical/tactile** properties  
of data → sonic metaphor

*Elias Elmquist, "OpenSpace Sonification,"*  
<https://vimeo.com/528822742>



# DIMENSIONS OF SOUND

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## Sonic Parameters

Pitch

Timbre

Loudness

Tempo

Spatial audio / panning

## Compositional Qualities

Auditory icons & sonic events

Key (minor v. major)

Complexity & layering

Looping / repetition

Ambience v. attention

# ACTIVITY: VISUAL & SONIC SKETCHING

BRAINSTORMING WAYS TO REPRESENT ORDINAL SCALES

# DIMENSIONS OF SOUND

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Sonic Parameters

Compositional Qualities

Some conventions and best practices do exist, but the rules are much less established than in **visualization**.

And this will be **totally new** for most people.

So... **how do you teach audiences how to listen to data???**

# LEARNING TO LISTEN



Marketplace,  
<https://bit.ly/unemployment-sonification>

Here's what the crescendo of unemployment sounds like

Kai Ryssdal and Alli Fam | Jun 24, 2020



Representing **magnitude** or **scale** of data points...with BIG changes

The New York Times  
VOL. CLXXV No. 58,645  
NEW YORK, FRIDAY, MARCH 27, 2020 \$3.00

## JOB LOSSES SOAR; U.S. VIRUS CASES TOP WORLD

**New Data Shows Staggering Toll of Outbreak**

This article is by Ben Casselman, Patrick Cohen and Hilary Keiser. About 100 million people have been infected by the coronavirus since it first emerged in Wuhan, China, in January. It is now spreading worldwide, with the United States reporting the highest number of cases. The virus has caused a global health crisis, with many countries imposing strict quarantine measures. The Centers for Disease Control and Prevention (CDC) has reported that the virus has caused more than 100,000 deaths worldwide. The United States has reported over 100,000 cases, with more than 20,000 deaths. The virus has also caused a global economic downturn, with many countries imposing strict quarantine measures. The United States has reported a record number of job losses, with over 10 million people losing their jobs in the past few weeks. The virus has also caused a global health crisis, with many countries imposing strict quarantine measures. The United States has reported a record number of job losses, with over 10 million people losing their jobs in the past few weeks.

**Under Trump, Unfilled Posts Hinder Action**

By SAMANTHA KATZ and NICHOLE L. PEREZ  
WASHINGTON — As the 100th anniversary of the Department of Health and Human Services (HHS) approaches, the agency is still struggling to fill a significant number of vacant positions. This is particularly true for the agency's top leadership, where several key positions have remained empty for months. The situation is a result of the political turmoil surrounding the agency's leadership, with several top officials being fired or resigning. This has led to a loss of institutional knowledge and a delay in the agency's operations. The HHS is responsible for a wide range of public health programs, including Medicare and Medicaid. The agency's inability to fill key positions is a major concern for many public health experts, who worry that it could lead to a breakdown in the agency's ability to respond to public health emergencies.

**Online Class With No Way To Get There**

By NAREDA STEWART  
ALBA, Pa. — A woman who has been teaching an online class for several weeks is struggling to get students to attend. She has spent a lot of money on advertising and promoting the class, but she is still having trouble getting people to show up. The problem is that the class is being held online, and many students are having trouble accessing the platform. Some students are having trouble with their internet connections, while others are simply not interested in the class. The woman is frustrated because she has put a lot of time and effort into the class, and she is not getting the results she needs. She is looking for ways to reach her students and get them to attend the class.

**Courage at a Brooklyn Hospital, At the Front of an Invisible War**

By SERAFINA  
It was not easy for the nursing staff at St. Vincent's Hospital in Brooklyn, N.Y., which was reported to have the highest number of coronavirus cases in the city. The staff members were working long hours, wearing protective gear, and facing a high risk of infection. Despite the challenges, the staff members showed great courage and dedication in their work. They were the front line of the fight against the virus, and they were doing it with a sense of purpose and determination. The staff members were also providing emotional support to their patients and families, who were often scared and confused. The staff members' actions were a true testament to their professionalism and commitment to their patients.

**Wish Supplies Missing, Workers Suffer On**

By SERAFINA  
It was not easy for the workers at St. Vincent's Hospital in Brooklyn, N.Y., which was reported to have the highest number of coronavirus cases in the city. The workers were facing a shortage of supplies, including personal protective equipment (PPE), which was essential for their safety. The shortage was a result of the global supply chain disruption caused by the pandemic. The workers were having to make do with whatever supplies they had, and they were often working in unsafe conditions. The workers' situation was a true testament to their resilience and determination in the face of adversity. They were doing their best to provide care to their patients, despite the challenges they were facing.

**Labeling Regions by Risk**

Deborah Thompson said government officials are labeling regions by the degree of risk according to the number of cases. This is a new approach to public health, and it is expected to help officials better understand the spread of the virus. The regions are labeled based on the number of cases per 100,000 people, and the labels range from low risk to high risk. This information is being used to guide public health officials in their decision-making, and it is expected to help them better target their interventions. The labeling of regions by risk is a key part of the government's strategy to control the spread of the virus, and it is expected to be a critical tool in the fight against the pandemic.

**No Crown, but I'll Take You Out to the Ballgame**

By BRIAN BARRY  
Professional football games are being held in stadiums with no fans, and the NFL is reporting a record number of empty seats. This is a result of the pandemic, and it is a major concern for the league. The NFL is trying to find ways to bring fans back to the stadiums, but it is facing a lot of challenges. One of the biggest challenges is the lack of fans, which is making it difficult for the league to generate revenue. The NFL is also facing a lot of criticism for its handling of the pandemic, and it is expected to face a lot of financial difficulties in the coming months. The NFL's situation is a true testament to the impact of the pandemic on the sports industry, and it is expected to be a major challenge for the league in the years ahead.

**A Fox Writes a Fantasy for Opening Day**

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**From the Streets to the Screen**

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**Weekly unemployment rate**

**Business**

**Armed With Sewing Machines**  
A health researcher has made and donated a device that allows her to sew masks for people in need. The device is a simple, hand-operated sewing machine that can be used to make a wide variety of masks. The researcher has donated the device to a local community center, and she is hoping to see it used to make many more masks for people in need.

**Chaos Can't Be Contained**  
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**Madness Is Infectious in U.S.**  
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**Natural Gas**  
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**New Focus on Health System**  
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**For Fox's Palms**  
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**It's Virtually Perfect**  
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**Starting Over on a Feature Case**  
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**Shut to Enhance a Delay**  
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**Breaking Aids a Slougher**  
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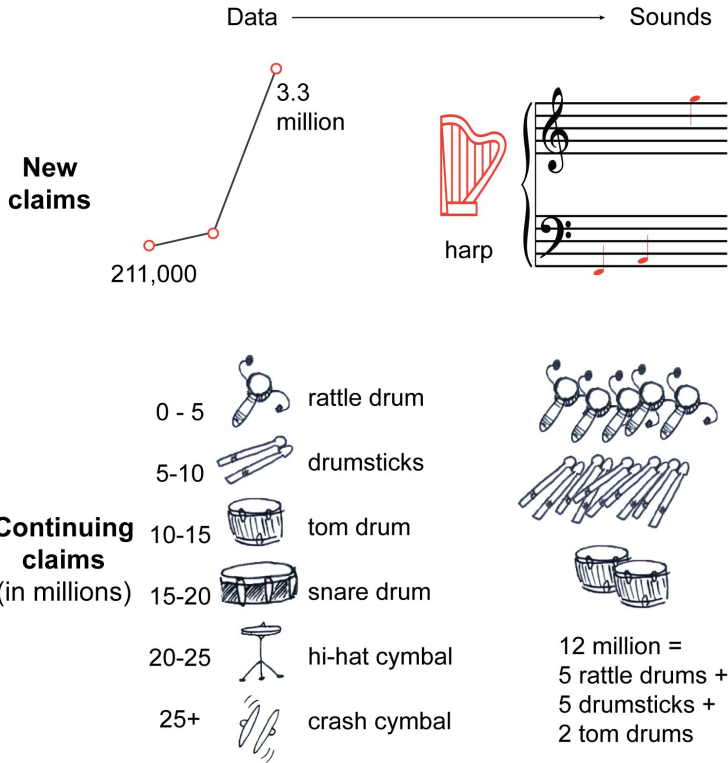
**Weekend Arts**  
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**Chancellor of U.S. History**  
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**Gabon's 'Dean of Drabble'**  
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**Paul Krugman**  
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# How to represent unemployment claims data?



# How to teach audiences how to listen to this data?

**The New York Times**  
VOL. CLXXV No. 58,645 FRIDAY, MARCH 27, 2020 \$3.00

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**Weekly unemployment claims**

**Business**  
Permal Weld Sewing Machines  
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**International**  
Madars in Infected in U.S.  
Nepal's River Rages  
Brinkling Aids a Slaughter

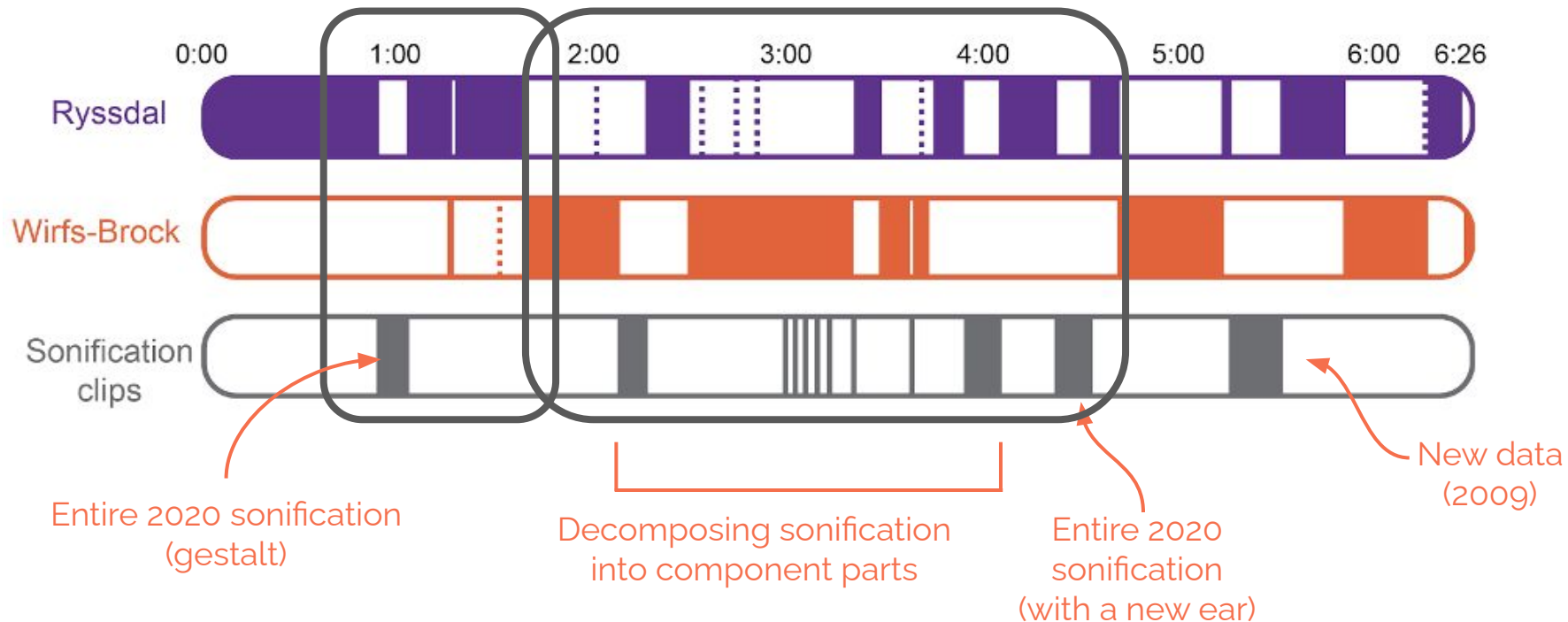
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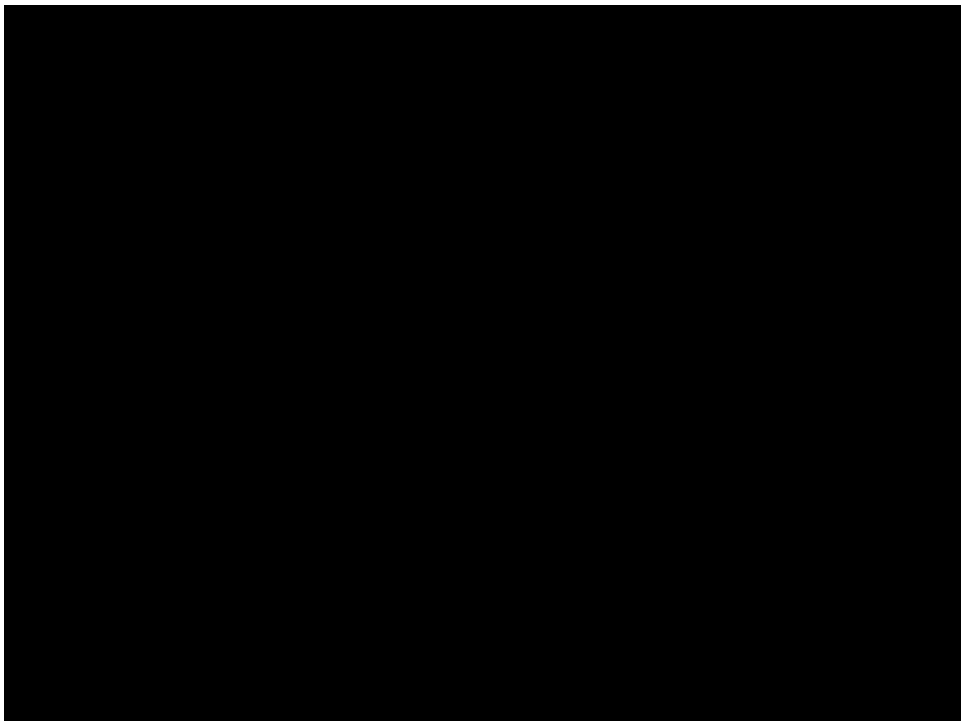


# Unemployment claims radio piece for *Marketplace*



# LEARNING TO LISTEN

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Alan Smith, "Sonification: turning the yield curve into music," *Financial Times*, [ft.com/music-from-data](https://www.ft.com/music-from-data)

Representing **cyclic data**  
(loops) with interesting  
**evolutions**

# LEARNING TO LISTEN

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1. Explain sounds through a narrative:
  - *Story of how you made it*
  - *Story of how to learn (teacher/student dichotomy)*
2. Speech-based annotations
3. Break down into component layers (then put back together)
4. Highlight notable examples
5. Repetition (with variation)
6. Invite audience to gesture / karaoke along with you (embodiment)

# ACTIVITY: BRAINSTORMING WITH A DATASET

HOW MIGHT YOU USE SOUND TO COMMUNICATE DATA FOR A STORY YOU ARE WORKING?

# TOOLS FOR MAKING SONIFICATIONS

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## MAKING THE SOUNDS FROM THE DATA

### No coding required

TwoTone.io

Highcharts Sonification Studio

Audiographs (Google Sheets plug-in)

### Coding platforms

Sonic Pi

MIDI Time (Python)

SuperCollider

MAX

## AUDIO EDITING & MIXING

Garage Band

Audacity

Adobe Audition

ProTools

*and on and on...*

## **LIVE DEMO: TWOTONE.IO**

UPLOADING DATA, TWEAKING SETTINGS, EXPORTING AUDIO

## **LIVE DEMO: HIGHCHARTS**

UPLOADING DATA, TWEAKING SETTINGS, EXPORTING AUDIO

# SONIFICATION RESOURCES

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[International Community for Auditory Display](#)

[The Sonification Handbook](#)

[Data Sonification Archive](#)

[The Programming Historian's "Sound of Data"](#)

[Coursera: Sound & Sonification Design for Interactive Learning Tools](#)

Loud Numbers ([podcast](#)) ([sonification festival](#))

Sound libraries: [freesound.org](#) | [Library of Congress](#) | [British Library](#)

# GET INVOLVED (with my research!)

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Participate in a design research project:

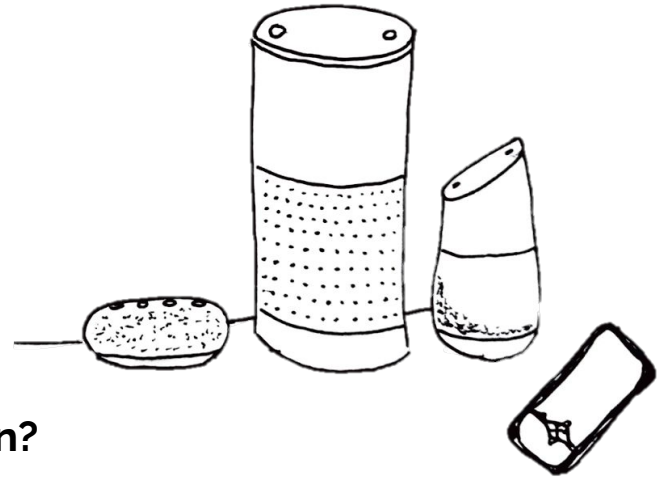
How might we design new interactions with  
**data,**  
**sound,**  
**and narrative storytelling**

that can help people understand themselves,  
each other and their world...

**...using voice user interfaces as sites for exploration?**

Seeking participants for **90-minute design workshops** with activities including sonic sketching + brainstorming interactions with data and sound.

Email **wirfsbro@colorado.edu** to sign up





# Thank you :-)

Email me at **wirfsbro@colorado.edu**

*Additional sound + music credits:*

Sound of Picture Library

Fanto8BC (via Looperman)

