

# OPEN SONIFICATIONS

A MANIFESTO FOR MANY ECOLOGIES OF DATA & SOUND

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## Abstract

Open Sonifications is a manifesto for a more inclusive approach to data sonification. The practice of turning data into sound is dominated by approaches that prioritise analysis and algorithmic sound synthesis. This pictorial expands the boundaries of what is considered sonification by challenging existing conventions around what we can do with sonification, who gets to use sonification, why we sonify, what counts as valid data or valid sound, and the tools used to make sonifications. Alongside conventional sonification values such as insight and accuracy, we also value raw energy, expressiveness, polyphony, participation, decentralisation, performance, accessibility, approachability, community, and plurality of perspectives. The approaches we describe do not seek to replace established methods, but to enrich them. We contribute a set of values, examples and instructions for joining this movement, and reflections on how people working beyond sonification might benefit from these ideas.

## Authors Keywords

Data sonification, auditory display, data performance, workshop methods, sonic thinking, data visceralization

## CSS Concepts

Human-centered computing~Human computer interaction~Interaction techniques~Auditory feedback

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Doodles on this page are inspired by various ways of visually representing sounds: hand-drawn [10] and computational [20] bird song scores, alternative musical notation systems [16], comics [49], and audio-visualizer software.

## INTRODUCTION

In a world where everyone, at all times, generates massive amounts of data about our behaviours, our bodies, our relationships, our homes, our movements, and more, the technologies and systems that control our data often leave us feeling overwhelmed and disempowered. One way to counter this is to encourage people to **treat data as a creative material** for understanding themselves and the world—not just an object of study for analysts, researchers, and technologists.

Sonification, typically defined as the use of non-speech sounds<sup>1</sup> to convey data, subverts the dominant paradigm of visual data representation. By doing so, it invites musicians, sound artists, and sound designers to engage with data, attracting a broader range of people into the practice.

And yet, sonification is a challenging field for newcomers to enter: It often requires coding skills, knowledge of psychoacoustics, musical training, audio storytelling expertise, and more. This difficulty is accentuated by the norms that have developed around sonification as a community of practice and an area of research. The ways in which data can be experienced in sound are almost limitless, but the field is dominated by approaches that prioritise analytical insight and algorithmic sound synthesis. These include sonification as science communication [33,37,55], data journalism [15, 46,57], and auditory display [7,53,59].

Anthropologist Alexandra Supper has explored the complicated relationship sonification has with visualization by interviewing sonification practitioners and conducting ethnographies at the annual International Conference on Auditory Display (ICAD), which has existed since 1992. While sonification is often seen as a disruptive challenge to visualization, Supper found that practitioners also look to visualization as a model

<sup>1</sup> We contest the idea that sonification should exclude speech-based sounds. The line between speech and non-speech is fuzzy and we consider sonifications and their narrative explanations to be entangled. Speech can also be a useful tool for annotation in sonification itself.

to emulate, simultaneously being both subversive and deferential [51]. Supper observed a tension within the sonification community, between the ‘Correlation Coefficients’ who take a positivist, engineering-based approach, evaluating sonifications with quantitative user listening tests, and the ‘Trained Ears,’ who draw from music and art practices, relying on experts to assess the quality of a sonification with a ‘Gestaltist approach’ [39].

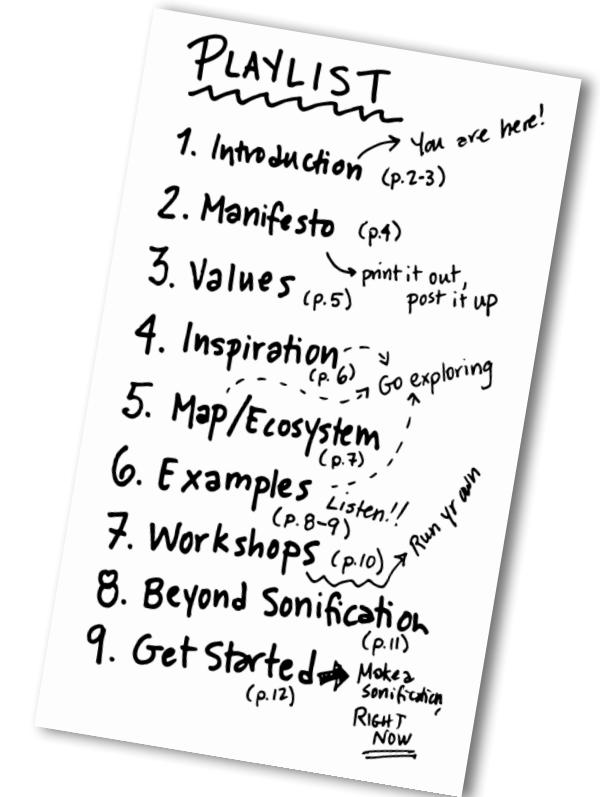
This internal identity crisis might be a reason sonification remains a niche practice. Further, an important tradition is left out completely: **design**. As sonification practitioners, we the authors identify neither as ‘Correlation Coefficients’ or ‘Trained Ears,’ and occupy and observe additional sonification identities: designers, tinkerers, explorers, novices, community engagers, activists, and questioners. With a design affinity, we can tap into methods uncommon in sonification, such as cultural probes [25] and critical technical practice [2]. Open Sonifications is a manifesto for a more inclusive approach to data sonification that acknowledges and embraces the diverse identities and techniques that have not been traditionally represented within the sonification research community. The approaches we map out in this manifesto are not intended to replace the status quo, but to expand it. Sonification is a powerful tool for thought that can benefit all kinds of people.

**Open Sonifications** is a call to discover and extend the outer edges of the sonification ecosystem, embracing a wider range of goals, perspectives and methodologies. This manifesto is an invitation to explore, participate, and innovate in an ever-evolving dialogue between data and sound. In this pictorial, we contribute:

- a definition of Open Sonifications,
- an explanation of our values and inspirations,
- examples of Open Sonifications and instructions for getting started on your own,
- suggestions for how our ideas apply broadly to human-computer interaction (HCI) and interaction design.

## How to read-listen to this pictorial

We present a series of tracks that collectively describe Open Sonifications as an ecology of loosely-coupled practices and values. We have arranged these tracks into a playlist that tells our story, though each track can stand alone. We encourage you to remix the experience of reading-listening to this playlist.



**Listen up!** An irony of this pictorial is that we present sonic ideas and artefacts which cannot fully be conveyed with images and text. Drawing on the practice of soundwriting [18], we provide audio clips (in supplementary materials) wherever you encounter this speaker:



## Why a Manifesto?

We view the manifesto as a way to explore new ideas in action: "To manifesto is to perform" [17]. Manifestos are a call to action [32]—they inspire people to feel and to do. We follow the avant-garde art tradition, where manifestos are simultaneously "critical and creative" [29]. Thus, rather than critiquing the landscape but offering no alternative, we seek to constructively show what open sonifications can be.

## Who we are

We are a group of collaborators who work in divergent spaces but have a common affinity for methods and values, and a shared experience of feeling like outsiders within conventional sonification spaces. We want Open Sonifications to invite participation from people who, like ourselves, might not see themselves reflected in the current sonification communities, or who find the dominant norms and practices of sonification unwelcoming. Thus, it was important for us to select a term for this movement (movements, really) that is welcoming, inclusive, and evokes our values. As a group of collaborators, each with our own unique sonification practices that share certain values, aesthetics, and social priorities, we spent a lot of time deliberately and collectively debating this manifesto.

To introduce ourselves, and to introduce Open Sonifications by way of examples, we open with a short description of ourselves and our work.



### Jordan Wirfs-Brock

Jordan is an HCI researcher, educator, and designer at a computer science department at a U.S. higher education institution. Her research explores how to engage data as a creative material for understanding the world. A former data journalist, she discovered sonification when trying to adapt visualizations and analysis into radio stories. Her sonification work includes hands- and ears-on workshops, and concert performances.

### A Writing Journey

During a highly stressful time of her life, writing her PhD dissertation proposal, Jordan turned data about the process – daily and cumulative word counts, notes about her mood – into a short sonification. The piece combines code-generated sounds with recordings of her speaking words: "grumpy," "centre of the onion". She found this act of sonic making deeply cathartic, putting creative distance between her and her writing.



### Jamie Perera

Jamie is an Asian mixed-heritage composer, sound artist and producer based in the UK. His work is inspired by transformation in the Anthropocene, with themes that juxtapose nature, people, places, and timescales. He combines electronic production and contemporary orchestration with field recordings, data, and video. Through music, performances, installations, and workshops he explores grief, radical deconstruction, re-imagining, and reclamation.

### Narrative of Simple forms

Painting simple shapes with sound through time and space, asking the question: If you can hear the form in your mind's eye is it still a painting? A meditation on the missing narrative of paintings, making this narrative audible, and questioning the interpretation of the narrative as well as the response from a "dynamic canvas" in the mind of the listener.



### Duncan Geere

Duncan is an information designer, tool-maker, data storyteller, and climate activist. He co-founded the Loud Numbers sonification studio and podcast, and the Decibels sonification community. The focus of his work lies in how sound can bring emotion to data narratives, giving listeners permission to feel something about the endless columns of numbers that catalogue the ways in which the world is changing.

### Migraines

Throughout 2022, Duncan noted down in his journal whenever he suffered a migraine. In January 2023, he turned these records into a sonification. The duration of the track represents the year, and on every day that he suffered a migraine a resonator is triggered, dropping a cacophonous clanging sound over the top of an unsettling drone. The work expresses the pain and frustration that migraine causes to millions.



# The Open Sonifications Manifesto

This is a manifesto in search of many sonifications. We invite you to use it as a map to explore the varied worlds of data + sound.

## CORE IDEAS

Sonification is not one thing, it is a diversity of things. We embrace and encourage curious approaches to exploring the world through data + sound. The act of making a sonification is just as, if not more, important than the final outcome.

(OPEN GOALS)

(TRADITIONAL GOAL)

In addition to providing analytic insight, we acknowledge that sonifications can have other goals that are just as meaningful. They can:

- Transform us and the way we see the world
- Prompt us to examine our assumptions about how the world works
- Engage us in activism or political/social commentary (have a point of view)
- Allow us to express ourselves and to understand data through our bodies

PRINT THIS PAGE OUT! POST IT IN A PUBLIC PLACE!

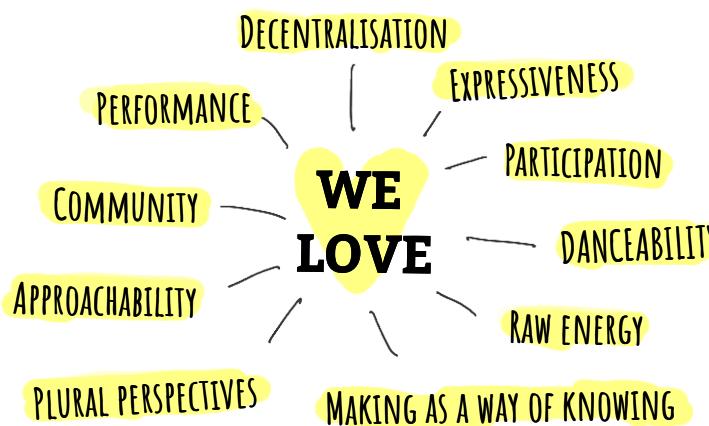
PLAY, EXPLORE, FEEL, TINKER  
ANYONE AND EVERYONE! NO TRAINING REQUIRED  
OUR BODIES, OUR EMOTIONS, OUR SOCIAL CONNECTIONS

We seek to explore the edges of what is possible with sonification by challenging and expanding existing conventions about

**WHY** we might sonify something  
**WHAT** we can **DO** with it  
**WHO** gets to do things with it  
 What counts as **VALID DATA**  
 What counts as **VALID SOUND**  
 What **TOOLS** we can use

INTENTION, PROCESS, MEANING  
 SUBJECTIVE DATA, □  
 PERSONAL DATA, □  
 THE WORLD IS □  
 OUR DATASET

FOUND SOUNDS!  
 WEIRD SOUNDS!  
 UGLY SOUNDS!  
 SPEECH!!!



We offer Open Sonifications as a **counter-approach** to dominant sonification strategies, but believe they can (and should) co-exist.

WE DON'T WISH TO OBLITERATE THE STATUS QUO, BUT WE DO WISH TO EXTEND IT.

LISTEN TO OUR AUDIO MANIFESTO!





## VALUES

### Intention

**Many Voices** – Open Sonifications seeks to be accessible and approachable for everyone, and welcomes unconventional and differing approaches. It observes intersectionality, ecosystems, and (bio)diversity, and concludes that collaboration brings strength. There are many ways to do things, there's no single right way.

**Community Engagement** – Open Sonifications fosters a strong sense of community and shared values. Sonifications might use community-generated or crowdsourced data, and they could be created collaboratively in a community workshop, with people from all walks of life, of all ages, from all kinds of backgrounds.

**Unbounded Intentions** – Open Sonifications can have a variety of intentions, including exploration, academic investigation, political and social commentary, or just fun. It is okay to include the issues behind the data as part of the “why” of sonifying something in the first place, or not. The aim is to engage people both emotionally and intellectually, encouraging them to create new knowledge and understanding about the inherent issues that affect them.

**The World is Our Dataset** – Open Sonifications engages the idea of autographic data [41], moving beyond the paradigm of data as numbers into the realm of data as objects. Sonification does not have to rely on large numerical datasets, but can be based on any object or set of objects that has a potential interpretation in time and space: E.g. rings on a tree, height of heads on a platform, or other patterns in everyday life.



### Process

**Many Approaches** – Open sonifications believes in a pluralism of approaches – being a tinkerer, a bricoleur [54], being close to the materials, being inspired by the materials. Open Sonifications welcomes construction or creation from a diverse range of available things. This could include working with multiple and diverse datasets, or working as a group to crowdsource decisions and choices.

**DIY** – Open Sonifications is not about high-end production but raw creative energy. This can mean using everyday objects, instead of high technology, to achieve what you want to achieve. For example, logging your data using paper and pencil rather than a spreadsheet, or creating sounds using your body and voice rather than with code. The emphasis should be on accessibility and enabling people without a technical background to engage with data through sound.

**Thing Power** – Open Sonifications draws from Jane Bennet’s idea that the materials we work with have their own “thing power” [8], and as designers we can be open to listen to and be inspired by wants and needs of those things. Open Sonifications encourages us to explore the story within the component parts of a sonification in an “ecology of matter” by treating sounds and data as living materials with agency.

**Embodiment & Transformation** – How do the sounds that are chosen resonate with the power of the “thing” being sonified? How does that relationship resonate within ourselves? Open Sonifications does not seek to separate itself from issues behind the data being explored, but instead sees them as an integral part of the creative process. The transformational aspect of data to sound is a bodily felt process that can shed new light on issues behind the data or objects being transformed.

### Presentation

**Many Sounds** – Open Sonifications may deviate from more ‘polished’ or ‘academic’ forms of sonification. This could mean using a voice, rather than a synthesizer, for example, or found sounds that relate to the data in some way. Anything around you can be an instrument.

**Place as Consideration** – How does the physical or virtual place in which you play or perform your sonification feed into the meaning that it creates? Open Sonifications is aware of place as a factor in the sonification process, and encourages practitioners to interrogate place as part of the presentation experience.

**Delight in the Disruption** – The world is a messy place and your creations might not have all the answers. However they might not need to – expressing something in sound maybe enough. Open Sonifications welcomes messiness, including mistakes, emotion, and rawness in expression. The sonification is not looking for an answer, but looking for meaning in the process.

**Broad Audiences** – Open Sonifications seeks a wide audience both global and local. Creations are just as at home in public libraries, local gatherings and online communities, as they would be in news articles, academic journals or conferences. How can these audiences be included in the presentation process?

**Critically Inclusive** – Open Sonifications recognises that humans and data are inherently biased, and makes that part of the conversation. In revealing this bias, Open Sonifications may present data in ways that challenge conventional understandings of a subject. For example, using sound to reveal biases in data collection methods, questioning the ways in which data is traditionally interpreted, or reconsidering our relationship with technology and media.

**INSPIRATION:** An Open Sonifications mixtape



Drawing from dataviz, art, music, HCI, and beyond...

#### SIDE A: Traditions & Theories

- Zines [47], DIY & Craft Culture [52]
- Data Feminism [22]
- Data Activism [3,14,19,27,28]
- Deep Listening [42]
- Casual Visualization [44]
- Autographic Viz/"Data by "Proxy" [41]
- Thing Power [8]
- Fluxus (Maciunas [35], Ono [11])
- Ouxpo [6]

#### SIDE B: Techniques & Methods

- Hand-Drawn Viz [4,12,34]
- Data Karaoke [50]
- Vocal Sketching [23,38]
- Whimsical Prompts [24,26]
- HCI Improvisations [5,21]
- Recipes for Breaking Data Free [56]
- The Mind's Ear* [1]
- Sensory Translation [58]
- Bricolage [54]

## Data Feminism

Data Feminism, formalised by Catherine D'Ignazio and Lauren Klein [22], exposes the power structures and power imbalances inherent in data and its representations. Sometimes this can be achieved using the “god trick” rhetoric [30] common in data visualization, which perpetuates a myth that data can be objective, as when NASA’s Christine Darden and Gloria Champine created bar charts to show that women and men at NASA were being promoted at different rates. Other times, it is by countering the “god trick” with visceral approaches that engage all of the senses (including sound) and leverage emotion.

## Recipes for Action

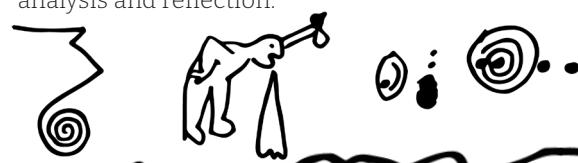
Sarah Geis’ *Audio Playground*, a series of audio homework assignments [26] sent as an email-newsletter, attempts to, “foster an audio doodle culture, with some community and accountability, whatever that means to you.” Assignments include recording a live weather report (“Literal and metaphorical weather both welcome”) and recreating a favorite scent in sound. The project is based on *Learning to Love You More* by Harrell Fletcher and Miranda July [24], a series of artistic prompts such as: “Make a child’s outfit in an adult size,” “Draw a constellation of someone’s freckles”. The whimsical prompt format has been used as a generative technique in HCI design research in the form of Fluxus-art inspired “Disruptive Provocations” [4] and “HCI Amusement” [21], which pose playful activities to break designers out of familiar patterns.

## Visceral Hand-Drawn Visualizations

**Data Portraits:** In 1900, W.E.B. Du Bois led the creation of a series of hand-drawn maps and charts telling the story of Black Americans through data. Du Bois intended that these images – illustrating topics such as employment, education, and migration using spirals, bars, and zig-zags in bold colours – be crafted by and accessible to the people they described, a “truly public sociology” [4].

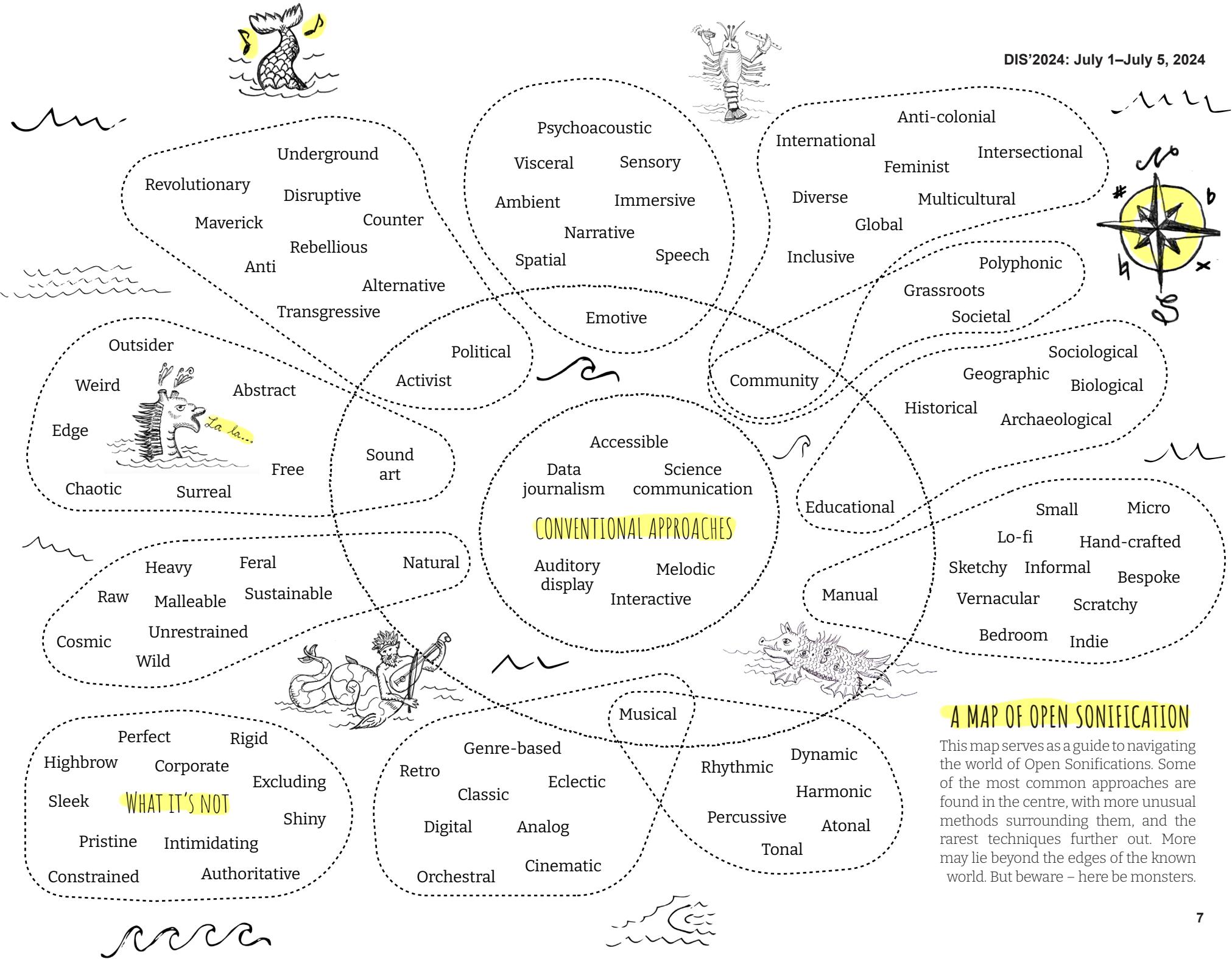
**Data Illustrations:** A bald man buckled over, clutching a drumstick, the length of his orange vomit represents cases of food poisoning caused by chicken [12]: Mona Chalabi’s data illustrations aren’t scared of the fact that we have bodies, and that bodies can be simultaneously terrifying and hilarious.

**Dear Data:** By sending each other hand-drawn postcards representing details of their daily lives – like how often they looked in a mirror – Giorgia Lupi and Stefanie Posavec prove that mundane data is worthy of our attention [34]. Grappling with the smudgy realities of pens and notecards while hand-drawing data visualizations presents opportunities for intimate self-analysis and reflection.



## Listening as a Lifelong Practice

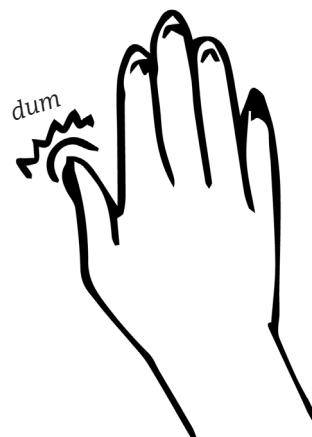
Composer Pauline Oliveros described “Deep Listening,” as “listening in every possible way to everything possible to hear no matter what you are doing” [42]. She treated listening as a lifelong skill that can be honed and practiced. Her work inspired the “Year of Deep Listening,” where artists, musicians, and others shared provocative “scores”: For example, Eli Neuman-Hammond’s *Description (for two people)*: “Write out all the sounds that you hear./Out loud, read these accounts, simultaneously, within a duration equal to that in which they were made” [40]. In *The Mind’s Ear* [1], Bruce Adolphe presents exercises for improving our ability to imagine sounds inside our own minds, asking us to conjure everyday sounds, music, and voices inside our own heads. These works challenge us to focus on the unique knowledge that can only be gained through listening.



**EXAMPLE: HANDS! (JAMIE)**

Create a sonification using the fingers on your hands and your voice. This approachable, hands-on, co-created sonification welcomes messiness and a diversity of opinions. It introduces the idea that anything can be a dataset, and encourages agency of the sonifier with regards to their relationship to the sonified object.

**Step 1:** Hold out your right hand, so you can see the back of it flat in front of you.



**Step 2:** Look at your thumb. Wiggle it. Sing a “base tone” that represents the height of your thumb: **dum...**

**Step 3:** Extrapolating the thumb’s base tone, wiggle each of your other fingers in turn and make a tone that steps up from the base tone based on the length of each finger: **dum, DUM, dummm...**

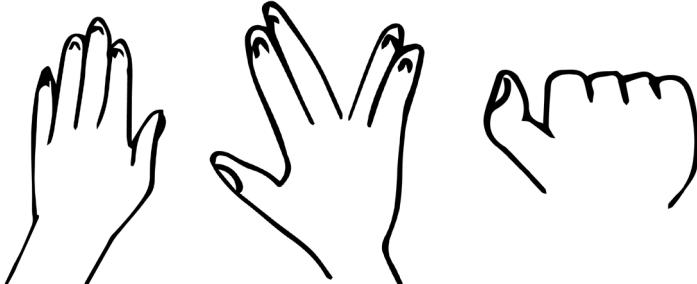
**Step 4:** Reflect. How does this simple act of singing the length of your fingers cause you to reflect on the data embedded in your own body?



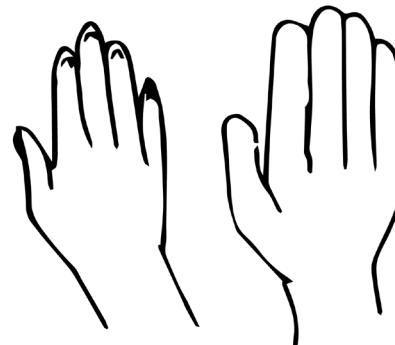
**SEE-LISTEN TO  
A PERFORMANCE  
OF “HANDS!”**

**Step 5:** Extend! You have now created a simple, DIY sonic algorithm you can extend to new scenarios. You can try...

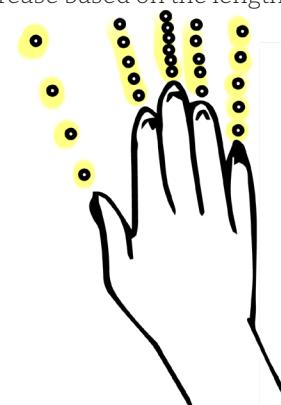
(a) Changing to your left hand. How does the tune change? What happens if you change your fingers into a “v” or a fist? What happens if you do it with your palm facing upwards? Does this also affect the way you sing?



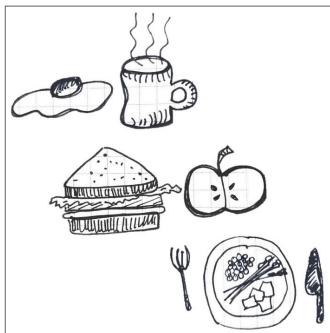
(b) Performing this as a duet with your friends and their hands.



(c) Instead of using a base tone, come up with a base rhythm (**ba/ba/ba/ba**) that you can increase based on the length of your fingers.



## MORE EXAMPLES



### Inside/Outside & Mealtimes (Jordan)

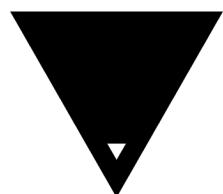
Jordan has created “data & sound recipes” that invite novices to use their bodies, nearby objects, or found sounds to represent mundane personal data — subverting the idea that sonifications need to be performed by serious people about serious data.

In *Inside/Outside*, participants write down the times when they were inside and outside that morning and chose sounds to represent each state. Together, they perform their data by making their sounds while following along with an audiovisual score. The social nature of this activity makes people more comfortable doing something awkward, as they collectively create an embodied, ephemeral, sonic data mash-up.

While *Inside/Outside* focuses on performing data, *Mealtimes* focuses on close listening: Participants anonymously share data about when they ate breakfast, lunch, and dinner (via a Google Form), then sit back and listen to sounds that have been created from their data, in real time (via a p5.js script). Participants can listen for their own data, the cacophony of the crowd’s data, or both.

**16**)  
Supplementary Materials

## TASTING NOTES



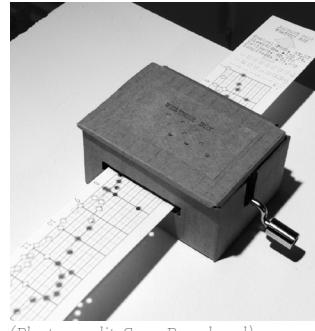
### Tasting Notes (Duncan)

Tasting Notes is a compilation of ten mini-sonifications that represent the sensory experience of drinking ten different kinds of beer. The data was gathered and provided by beer expert Malin Derwinger.

The project captures the aroma, mouthfeel, taste, and appearance of each beer. Aroma is made up of three components: malt, hops, and fermentation. Mouthfeel is made of two: body and carbonation. Taste is made of sweetness, alcohol, acidity, and bitterness. The louder each sound component is heard, the more pronounced it is in the experience of drinking that beer.

The individual sonifications within the track are woven together by narration from Derwinger, who shares some of her personal experiences with each beer, as well as its cultural context. This enriches what would otherwise be a purely data-driven experience with a human perspective.

**17**)  
Supplementary Materials



(Photo credit: Sara Bouchard)

### Sara Bouchard – Weather Box

Weather Box [9], a manually-powered music box encased in reused cardboard, comes with 12 punch card compositions inspired by weather data. Bouchard collected hourly updates from the National Climatic DataCenter, converting variations in temperature, wind, and rain into a visual timeline that informed the creation of each punch card melody. These melodies reflect a month of climatic observations gathered by the National Oceanic and Atmospheric Administration (NOAA) at the Belvedere Castle monitoring station in Central Park, New York City.

**18**)  
Supplementary Materials



(Photo credit: Miriam Quick)

### Miriam Quick/Stefanie Posavec – Sleep Songs

In 2018, Miriam Quick and Stefanie Posavec used breath trackers to monitor their and their spouses’ breathing patterns overnight, then transformed this data into two choral compositions, where one second of music equals two minutes spent asleep [45]. Each piece is a reflection of a couple’s sleep, weaving respiratory data into musical rhythms that fluctuate harmoniously, moving in and out of sync throughout the night.

**19**)  
Supplementary Materials



### Wind chimes

Wind chimes, which are commonly encountered in outdoor settings and often tuned to a pentatonic scale for harmonic appeal, act as a sonification of wind velocity. As wind speeds increase, a wind chime will produce louder, more complex melodies, offering an intuitive auditory representation of wind’s force. This acoustic feedback not only enriches the ambient environment but also serves as an intuitive gauge of wind activity, allowing observers to audibly discern changes in wind patterns.

**10**)  
Supplementary Materials

## RUN AN OPEN SONIFICATIONS WORKSHOP

Workshops are a fantastic way to engage people with Open Sonifications, learn how to embody feelings about various subjects and issues, and surface new ways to create sonifications. All three authors have independently conducted numerous workshops introducing participants ranging from journalists, to students, to civil servants, to artists, to scientists, facilitating sonification using approachable, playful activities that require no prior coding or music knowledge. We have found workshops to be invaluable situated community laboratories for developing Open Sonifications practices, and we invite you to conduct your own.

There is no one right way to run a workshop, but you may use the following as a general guide:

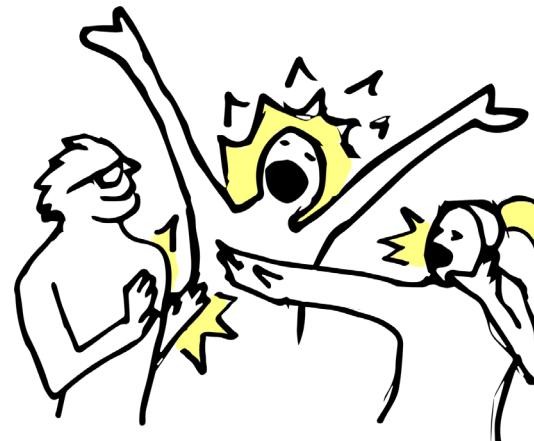


Workshops don't have to be in-person. Jordan has conducted workshops remotely using digital whiteboard tools, such as Padlet, that allow people to create sonic sketches by recording directly into a web-browser. Participants can then listen back to, and comment on, each other's sonic ideas.

### Set the stage and build community

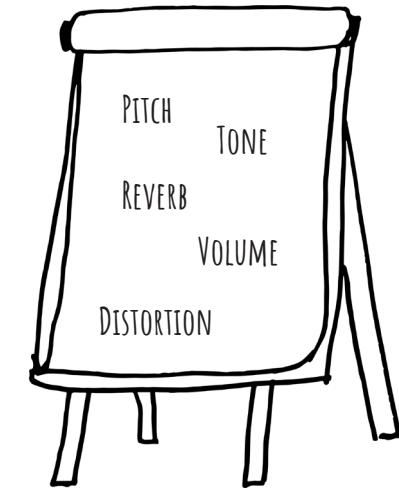
1. Find a group of people, get to know each other.
2. Warm-up with a fun activity that encourages people to make and listen to sounds—make the sound of your favorite food once you've swallowed it; share a sound that represents some aspect of your identity without revealing the source, then ask other participants to guess what it is.
3. Talk about why sonification is an interesting way to create new knowledge. Ask: What can you learn through the combination of data + sound that you cannot learn through other media?
4. Talk about the importance of valid data and awareness of data bias. Consider discussing: What counts as data?
5. Provide a specific dataset — or better yet, have the group find their own data. Surface data that corresponds to issues the group cares about and decide on what data they want to sonify.

*Encouraging people to participate in a playful performance – using their voices, objects, or instruments – can erase some of the inhibitions and nervousness people have about working with sound, as well as build rapport among workshop participants.*



### Perform with open ears and open minds

6. Introduce a number of sonification methods. Define who would like to do different aspects of the sonification process.
7. Interrogate how the data can be transformed, making a number of sonification tools available.
8. Investigate choices of sound, and provide a number of ways for people to create them.
9. Think about location, does where a sonification is presented have an impact?
10. Create your Open Sonifications!
11. Present your sonifications. Reflect. Allow yourselves to connect with the sounds, the data, and the stories behind them. Ask: How is this meaningful?
12. When possible, release the sonifications into the wild to be enjoyed by others.



*Encourage participants to think about the different ways that sound can be modified by getting people to name its properties. Pitch, volume, timbre, tone... what else can you map data to?*

## DISCUSSION: OPENING BEYOND SONIFICATION

### **Reframing sonification**

Open Sonifications invites all people, regardless of training or background, to use data and sound to make sense of themselves and the world. Anyone can do this! We hope this manifesto can lead to increased intersectional diversity, including more women, youth, and people with BIPOC and LGBTQ+ identities. We hope to make sonification a welcoming practice, by integrating overlooked dimensions of sonification, such as location, community, and agency of the sonifier. It's ok to be messy and make mistakes! It's ok to feel! We embrace the emotional aspects of experiencing sound, rather than treating them as a byproduct. We seek more awareness of deep listening and bodily sensations as a knowledge-generating step of the sonification process.

Sonification is not a bubble – it exists in the world. How can sonification strive to make the world a better place? To do so, we must openly question every part of a sonification process: human bias, data bias, tools, and the socio-technical systems in which we move.

We consider sonification to be a practice that can cross barriers and bring people together to uncover new perspectives. We all have the ability to listen, and we can always learn new ways to listen. We all have the ability to make meaningful sounds that allows us to express ourselves and to interrogate ideas, and we can always learn new forms of sonic creation. We all generate and interpret data, just by being alive, and we can always develop new techniques for reclaiming our own power in a datafied world. We hope open sonifications inspire people to seek out not just new ways to sonify data, but new reasons for doing so. This requires reframing success. For us, a successful open sonification helps someone feel agency through data and sound.

**"An effective open sonification makes people feel things."** - Duncan Geere



### **Foregrounding sonic ways of knowing and doing in interaction design and HCI**

Open Sonifications represent a broader theme of using novel interactions with technology and data to explore the epistemological possibilities of sound. Beyond sonification, we encourage HCI designers and researchers to consider sound as a material for sparking critical reflection on our relationship to technology. Through listening, we can know things that we cannot know by seeing, or touching, or tasting, thanks to sound's unique qualities: Sound is fundamentally temporal, it "imposes its duration on us" [13]. We feel it viscerally in our bodies as "primary and very material receivers, amplifiers, and interpreters of sound" [48]. Sonic thinking, the practice of "thinking with and by means of sound, not a thinking about sound" [31] is a capacity that people innately have, but can improve with practice. We urge the DIS community to explore: How might we design interactions, techniques, and technologies that support people in developing sonic thinking skills as a means of reflecting on the role of technology?

Digital technology has fundamentally transformed our relationship with sound: Sound is now something we can capture, transmit, transform, or generate [13]. It has become more "thing-like" [40]. In contrast, Open Sonification's playful, low-tech aesthetics embrace the ephemerality of sound. This dichotomy presents an opportunity to notice digital sound's thing-ness and reflect on its implications.

**From sonic awareness...**

**...to sonic thinking...**

**...to sonic doing.**

Sound design practices, which extend beyond sonification into interaction design, engage the thing-ness of digital audio to support sonic thinking: "Sounds are themselves informative, but the real epistemological potential lies in the manipulations that can be performed on them. Through the creation of sound designs, sounds and their resulting resonances may be brought to light that would have remained obscured" [33]. And yet, practicing sound design is intimidating. Open Sonifications' methods provide much-needed entry points that encourage designers of all backgrounds to embrace sound, subverting the assumption that sound is just too hard for participatory approaches.

We hope that Open Sonifications inspires HCI designers and researchers to treat sound as a first-class citizen in the technologies they develop, rather than an afterthought or tertiary sensory modality. We also hope that Open Sonifications encourages people to develop new sonic and data literacies to think critically about the role of data and technology in their lives – and move from sonic awareness, to sonic thinking, to sonic doing.

**"The form of sonification moving into equilibrium between worlds of science and art / articulation / non-articulation, facts and emotion, known and unknown. Not pushing for purely intellectual understanding or descriptions in words. Moving from a purely science-dominated place to a place of more balance with the inherent properties of sound."** - Jamie Perera

## GET STARTED

You don't need a fancy synthesizer to make sonifications. You don't need a spreadsheet. You definitely don't need to know how to code or play an instrument.

Open Sonifications can be made with the simplest ingredients. Collect some data about your life using a pencil and a sheet of paper, then figure out how you feel about that data. Come up with a system to convert those feelings into vocal sounds (sighs, coughs, yawns, and whoops are a great place to start), and you've got a sonification.

Better still, bring in some other people too. Compare your feelings with their feelings. Figure out how you'll convert those feelings into sounds together. With two voices, you could encode two columns of data at the same time, or just take turns. More voices means a greater diversity of experiences.

If you play an instrument, you can incorporate that too. If you don't, that's okay – almost everyone can find a resonant object that can be hit with another object to make sound. Expand your definition of an instrument to incorporate the objects around you, and you'll quickly find plenty of tools that can be used to sonify data.

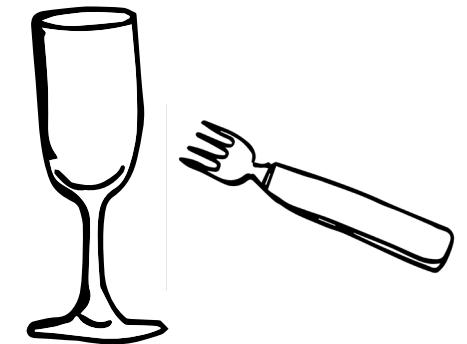
Before very long, you'll also start to notice sonifications all around you – how the sound of your breathing gets faster when you run, how people that are feeling sad will speak more quietly, the slight wobble in the voice of a conference speaker who's nervous. Borrow these approaches, systematise them, and use them to express your own feelings.

Stuck for inspiration? Try one of these approaches...

- Go through your calendar for the last week and write down every meeting you had on a bit of paper. Note down whether it was useful or pointless, and if it was a long meeting or a short meeting. In chronological order, run through the list and let out a "woo!" for every useful meeting, and a "yawn..." for every pointless one. Make your sounds longer or shorter based on the length of the meeting.
- Listen to a politician making a speech. Shout "that's a lie!" every time they lie. The bigger the lie, the louder you shout.
- Get a group of friends together and ask each of them to taste five different foods. Tell them to name each food, and then make a sound that represents how much they enjoyed eating it, on a scale of "ugh" to "mmm!"
- Pick six different physical exercises to perform. Immediately after each one, record some audio of how fast you're breathing.
- Read 12 different news stories. After each one, let out a scream with a length proportional to how that story makes you feel about the world.



THIS IS SOME DATA



THESE ARE SOME INSTRUMENTS



THIS IS AN AUDIO RECORDER

NOW MAKE A SONIFICATION!

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