



Accessible Data and Sound

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Designer, Educator, and Author

Let's begin with some
terms we should all
get familiar with

Ableism

Ableism is discrimination and social prejudice against people with disabilities or who are perceived to have disabilities. Ableism characterizes persons as defined by their disabilities and as inferior to the non-disabled.

Ableism is systematic, the institutional devaluing of bodies and minds deemed deviant, abnormal, defective, subhuman, less than... Ableism is violence.

Do you include people with disabilities in your design process?

Are your design solutions intended to be used by your future-self?

Does your product promote an inclusive language?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

Assumptions

Our inferences and ideas are often based on assumptions that we haven't thought about critically. A critical thinker is attentive to assumptions because they are sometimes incorrect or misguided.

What are your assumptions about what the people and the context that you are researching?

Have you double-checked the truth of your assumptions?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

Bias

Bias is disproportionate weight in favor of or against one thing, person, or group compared with another, usually in a way to be considered unfair.

Self-Correction against implicit or unconscious bias takes a lot of conscious work.

Have you acknowledge your biases and tried to counter them by trying to understand the perspective of others?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

Justice (social)

Social justice is concerned with the just relationship between individuals and their society, often considering how privileges, opportunities, and wealth ought to be distributed among individuals.

How can you use your design concept to advance a social justice agenda?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

Marginalization

Marginalization is the process where something or someone is pushed to the edge of a group and is treated as insignificant or peripheral.

How does your design disrupt the marginalization of people?

If you work with marginalized groups, how will you ensure that the work is developed from their perspective and not your own?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

Self Awareness

Self Awareness is having a clear perception of your personality, including strengths, weaknesses, thoughts, beliefs, motivation, and emotions.

Self Awareness allows you to understand how other people perceive you, your attitude and your responses to them in the moment.

How can you become self-aware enough to realize how self-aware you are not?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

Unlearning Oppression

Some everyday practices seem normal and go unquestioned but discriminate against minorities. Many well-intended people are unaware that their actions are oppressive.

Oppression affects both the oppressed and the oppressors.

To unlearn oppression, we must acknowledge our everyday oppressive practices and engage in critical self-reflection with the aim of becoming actively anti-oppressive.

What will you do to unlearn oppressive behaviors?

The Designers Critical Alphabet Lesley-Ann Noel, PhD

You

You play an active role in change and transformation. You have the agency to question what is happening around you and to take action as a response. Design may be one form of response.

What are the attitudes needed to be a manager, change agent, facilitator or researcher?

The Designers Critical Alphabet Lesley-Ann Noel, PhD



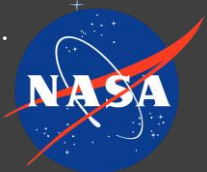
The Designers Critical Alphabet created by
Lesley-Ann Noel, PhD is available on Etsy

Eclipse Soundscapes Project

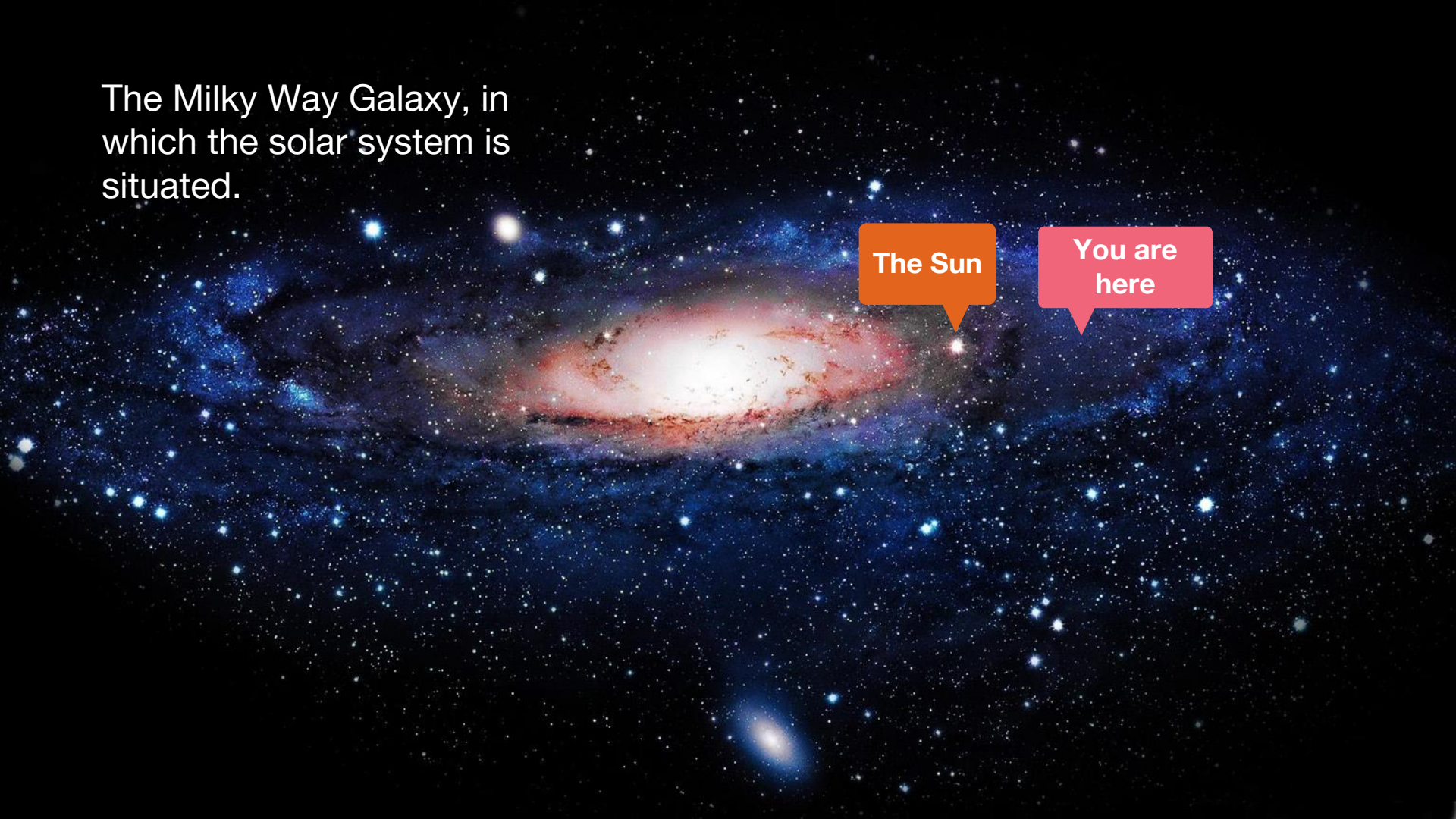
This presentation is based upon work supported by NASA under project Eclipse Soundscapes: Citizen Science Project, award No. 80NSSC21M0008



Advanced Research in
Inclusion & STEAM
Accessibility Lab



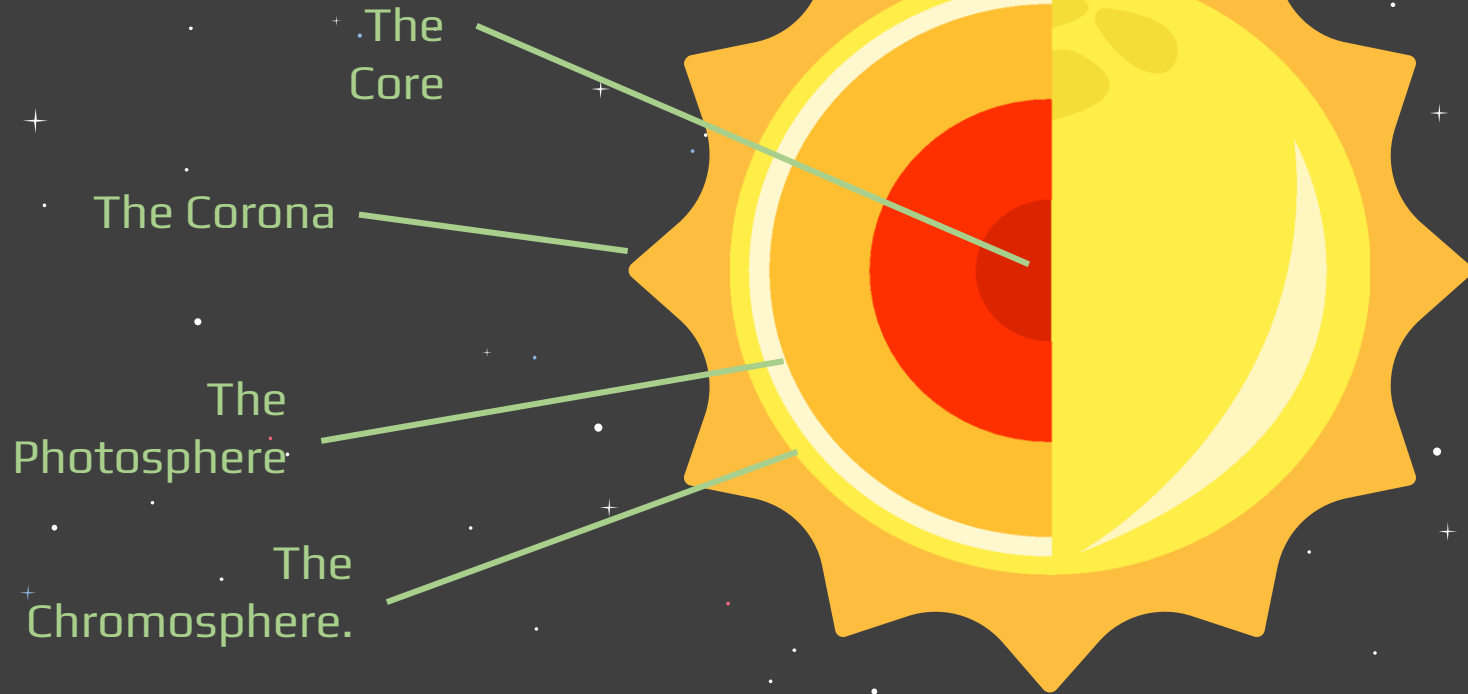
The Milky Way Galaxy, in which the solar system is situated.



The Sun

You are
here

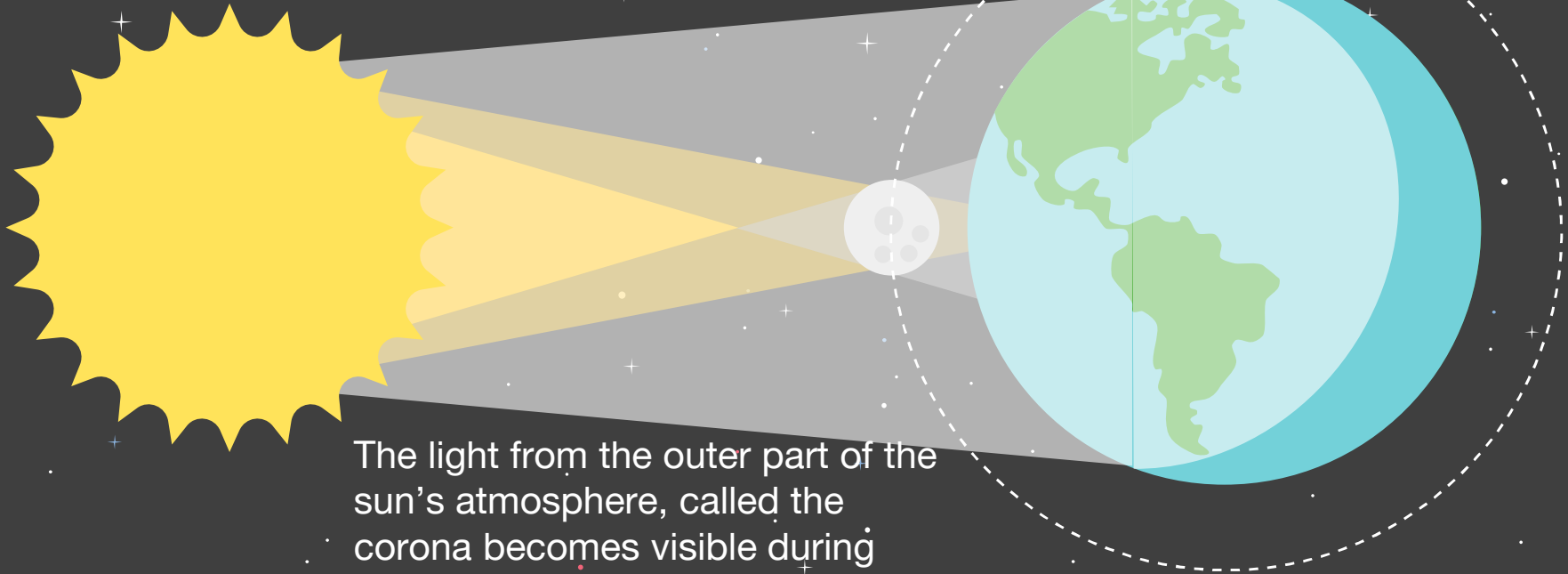
The sun mainly has four layers:



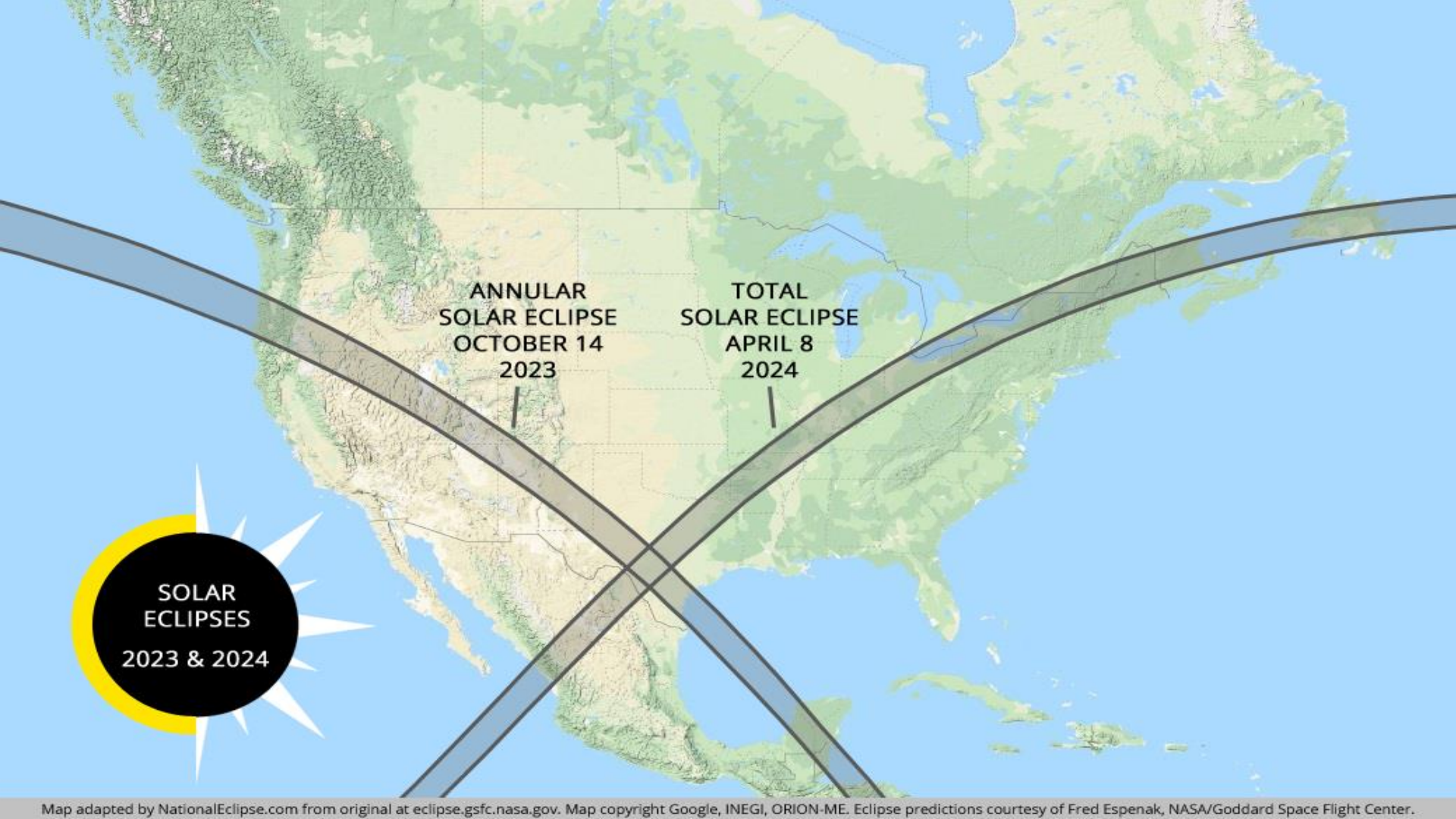
Solar eclipse

During the solar eclipse, moon moves in between the sun and the earth.

In other words, the sun is hidden by the moon



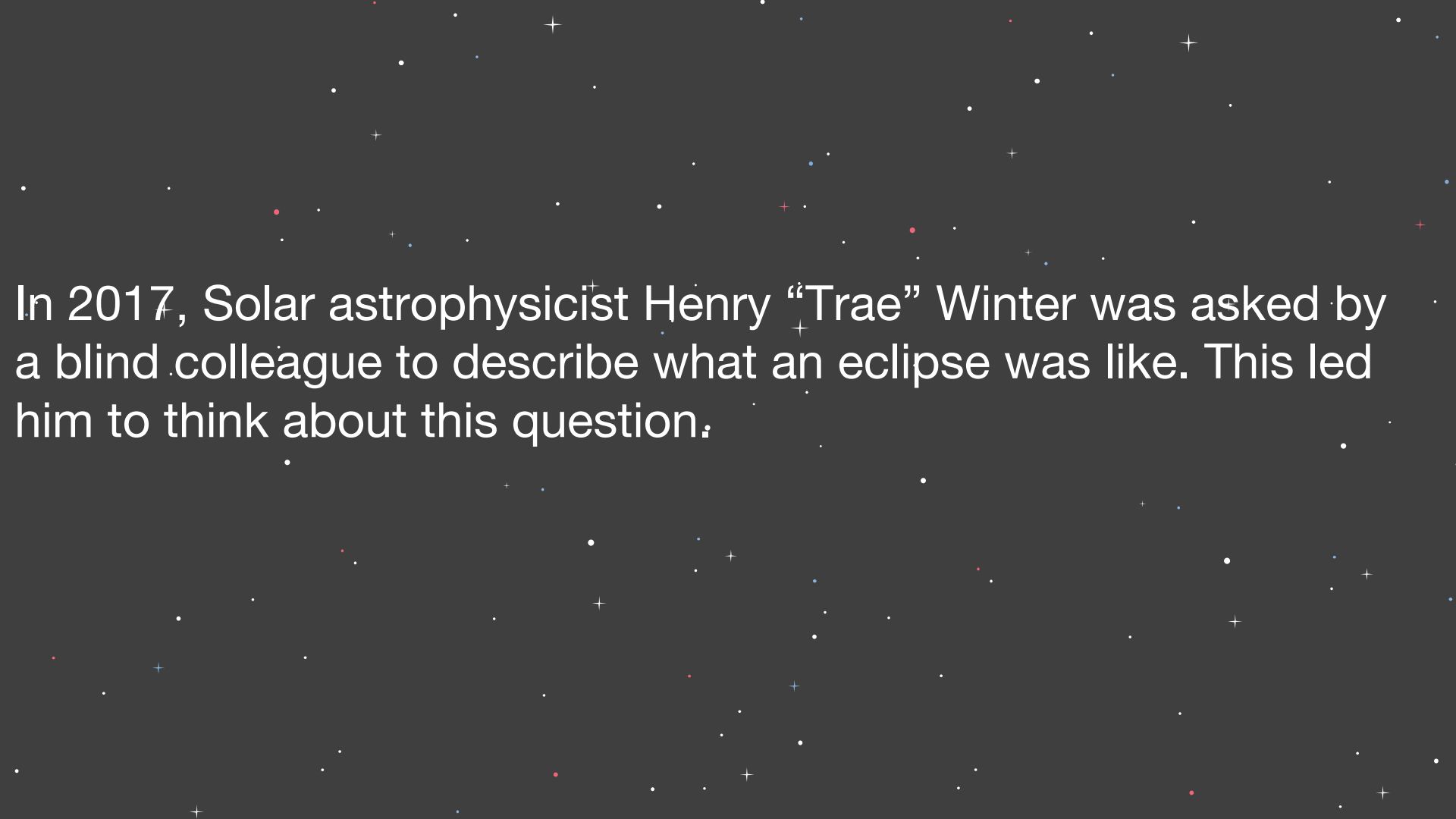
The light from the outer part of the sun's atmosphere, called the corona becomes visible during the total solar eclipse.




**ANNULAR
SOLAR ECLIPSE
OCTOBER 14
2023**

**TOTAL
SOLAR ECLIPSE
APRIL 8
2024**

**SOLAR
ECLIPSES
2023 & 2024**



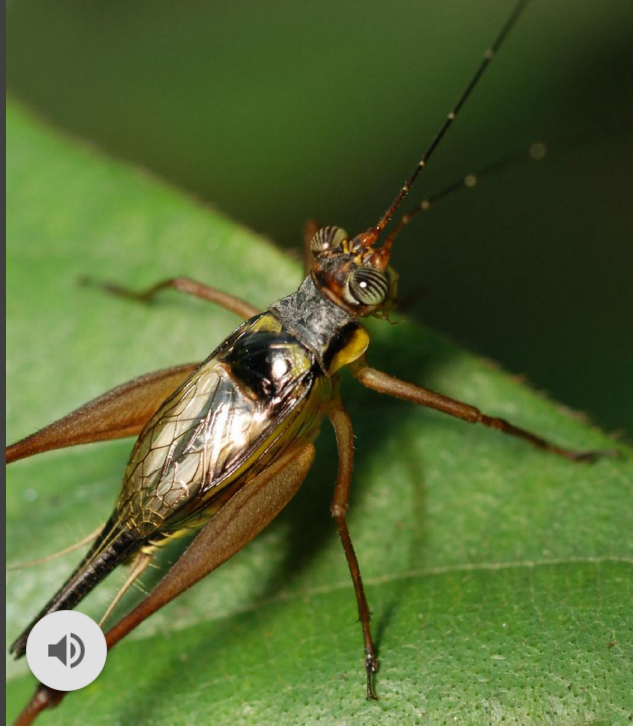
In 2017, Solar astrophysicist Henry “Trae” Winter was asked by a blind colleague to describe what an eclipse was like. This led him to think about this question.

The background of the slide is a dark grey-blue space filled with numerous small white stars and a few larger, fainter stars. On the left side, there is a large, stylized yellow sun with a jagged, gear-like edge. The sun's face is a lighter yellow circle containing several small yellow dots and three larger, elongated yellow shapes that resemble clock hands or markers. The text is positioned on the right side of the slide, overlapping the starry background.

If you cannot see an
eclipse, how can
you experience it?

When an eclipse occurs, the sounds in nature and around you change. For example, many noisy animals go silent at night, while others begin to make noises.

Crickets



Frogs



Birds



October 14, 2023

5 Minutes and 17 Seconds

April 8, 2024

4 Minutes and 28 Seconds


Soundscapes Eclipse Project



The original project kicked off in 2017. There was an app which provided sound and haptic feedback.

The Eclipse
Soundscapes App,
launched for iPads and
iPhones in 2017
featured real-time
narration of different
aspects of the eclipse
timed for the user's
location.

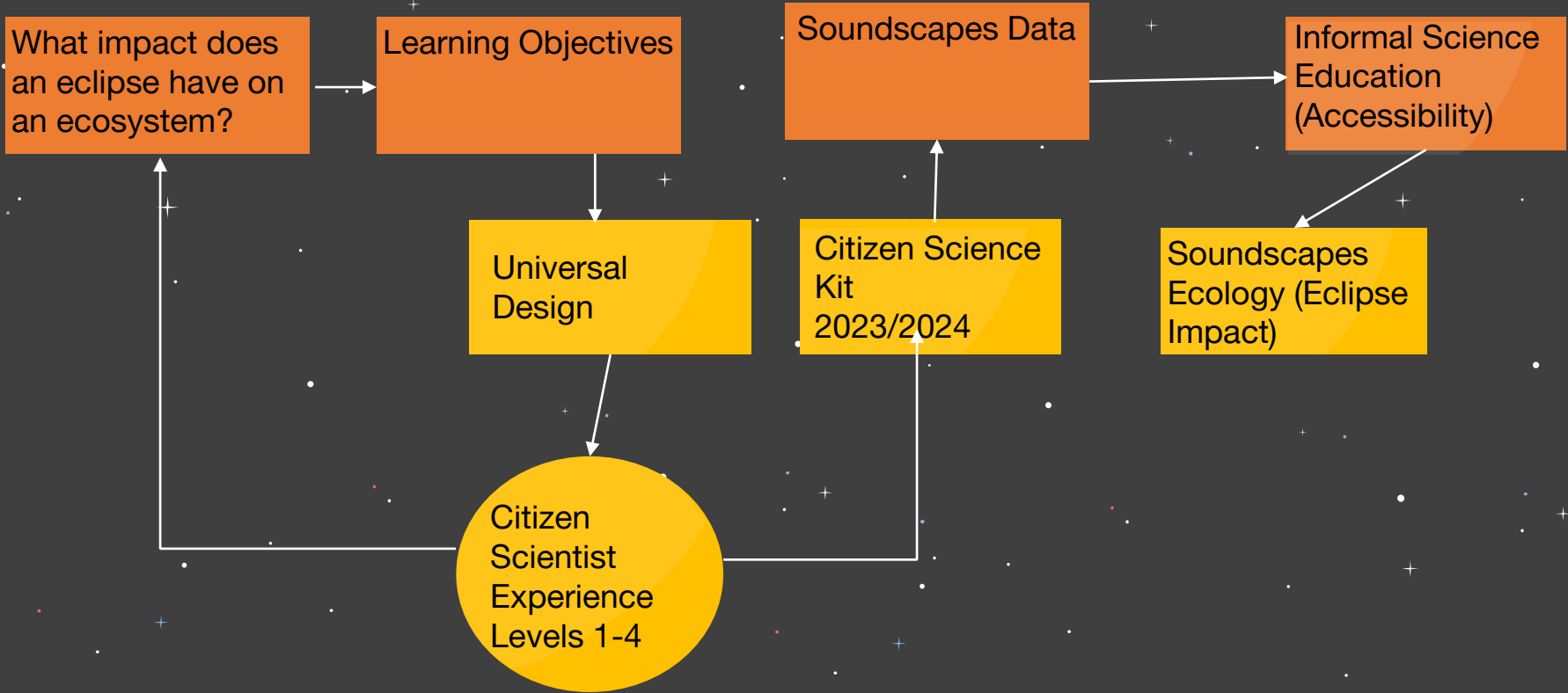


A stylized illustration of Earth and the Moon in space. The Earth is shown in the bottom left, with green continents and a light blue ocean. The Moon is a grey sphere with several grey circles representing craters, positioned in the upper left. A dashed grey line represents the Moon's orbit around Earth. The background is a dark grey space filled with numerous small white dots representing stars, some of which are four-pointed star shapes. A small yellow sphere is also visible in the upper middle area.

The current project will last 5 years from January of 2021 through 2026.

The goal of the project is to create *accessible* opportunities for citizen scientists to participate in real and meaningful scientific research that focuses on how eclipses affect life on Earth, specifically soundscapes.

Project Overview Flow



The basis of the project

- Builds on expertise gained from 2017 Eclipse Soundscapes project
- Made with not for the Blind and Low Vision communities
- Uses Universal Design for Learning principles to create accessible Citizen Scientist kits & data analysis interfaces
- Leverages partnerships

Universal Design for learning

- Focuses on three areas
 - Multiple means of engagement
 - Optimize individual choice and autonomy
 - Optimize relevance, value, and authenticity
 - Multiple means of representation
 - Offer ways of customizing the display of information
 - Offer alternatives for auditory information
 - Offer alternative for visual information
 - Multiple means of action and expression
 - Vary the methods for response and navigation
 - Optimize access to tools and assistive technologies

Project Partners

ARISA Labs

Blind and Low Vision
Consultants

National Center for
Accessible Media

National Federation of
the Blind

NYU Tandon School
of Engineering

Rainforest Connection

Social media experts,
developers,
designers, and
Science & Education
Advisory Boards

In the Spring/Summer/Fall of 2021, NYU students and I began researching the Citizen Science Project.

Research methodologies used

- Literature reviews
- Interviews
- Competitive Analysis
- Content Analysis
- Heuristic Evaluation
- User Journey Maps
- Affinity Diagramming
- Prototyping
- Usability Testing

Problem Statements

- The limited opportunities and poor user experience design with sound technology prevents all users from having a fun learning experience, and engaging with accessible information relating to eclipse's impact on the environment.
- People want to learn and research about the impact of the eclipse on soundscapes. They need an accessible educational platform to visualize and analyze sound data.

Problem Statements

- People who are interested in citizen science, especially those with visual impairments, don't have access to the necessary information and resources to learn about Eclipse Soundscapes. This can be resolved by creating an accessible and engaging web-based app that provides a multi-sensory experience containing varying levels of information and data relevant to soundscapes. This web app will be successful based on the number and diversity of the users.

Research Insights

- Simple language works best for site
- Adaptable User Interfaces tailored to the user's unique needs (i.e. enlarging font size on page, skip to main content button)
- Quick, easy options to choose a sound recording from
- Able to choose recording from keyboard as well
- Search bar to filter results
- Voice accessible search feature

Research Insights

- High contrast images and text for readability
- Use of text input from the keyboard (alphabet keys) to navigate discover page
- Compatible with text to speech
- Interface kept simple to avoid overwhelming the user

Key Interview Insights

- Make design fun and engaging by including colors
- Make sure web application is accessible on tablets and phones
- Give users opportunity to share with friends
- High contrast images and text for readability
- Can use text input from the keyboard (alphabet keys) to navigate
- Compatible with text to speech, so the user can use a screen reader
- Interface kept minimalistic to avoid overwhelming the user
- Frustrations:
 - Websites with poor contrast, “unique” fonts or heavily italicized text
 - Feeling left out of the science community due to lack of access and resources

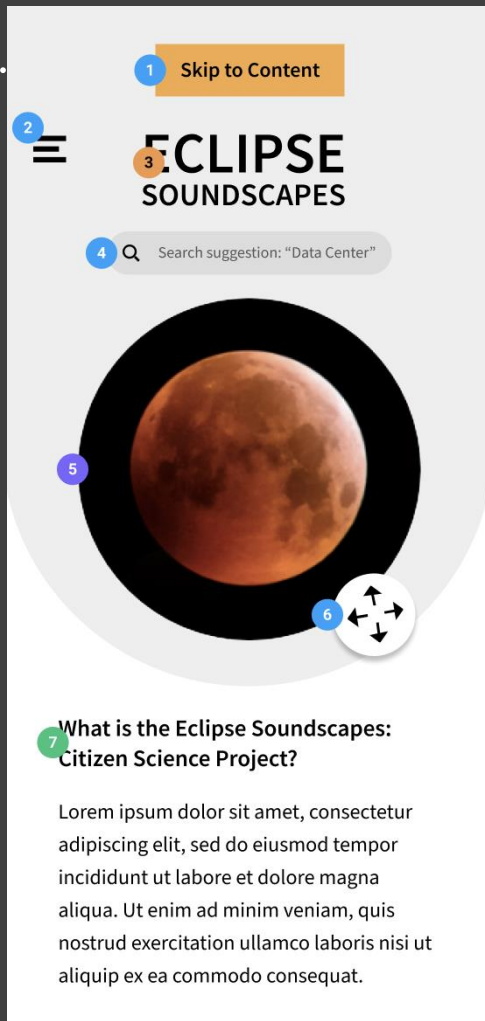
Content Model

Content Model

1.0 Main Page

Audience: Purpose: Audience Questions:	Key words: Browser title: Friendly URL:
Page Content (including title and alt tags):	
Images:	Downloads: Sidebar items:
Other Page Content:	

Wireframes



Homepage

1 Skip to Main Content Button

When pressed, button skips to main content

- What is the eclipse soundscapes..

2 Button label = Menu Bar

- Menu bar opens from the left side
- Users can also swipe from the left to open

3 Button + Link = Logo

When clicked, returns back to top of homepage

4 Search Bar

Users can search key phrases throughout the app

Search Bar will live on these pages:

Homepage
Welcome/Onboarding (not sure)
Dashboard
CS Badges (+ additional pages)
Sound Data (+ additional pages)
ex. Sound data FAQs
About (not sure)

Copy could also say:

Search suggestions: []

= Sound Data, Eclipse, Resources, FAQs, etc

5 Image Alt text

Research finding - What make a website easy to use?

- Accessibility
 - High Contrast
 - Simple and clear layout
 - Compatibility with native accessibility on Android or iOS
- Reducing blue light
- Mobile friendly format

Research Findings - What makes a website difficult to use?

- Lack of Accessibility
- Heavy italics
- Text placed over pictures
- Unclear / ambiguous text
- Difficult to find information

Key Performance Indicators

- Percentage change in weekly visitors
- Amount of time each user spends on the site
- Increase in users
- Number of users who finish the lessons
- Social Shares

Sound Recordings...

AudioMoths



AudioMoth is a low-cost, full-spectrum acoustic logger, based on the Gecko processor range from Silicon Labs. Just like its namesake the moth, AudioMoth can listen at audible frequencies, well into ultrasonic frequencies. It is capable of recording uncompressed audio to microSD card at rates from 8,000 to 384,000 samples per second. Open Acoustic Devices

Citizen Scientist and AudioMoths



Citizen Scientist will request and receive AudioMoths to record sounds during the 2023 and 2024 solar eclipse.

ARISA Labs and Consultants



Kits contain

- One small cardboard box containing an AudioMoth audio data recorder. 3 AA batteries and a pre-programmed micro-SD memory card are already installed.
- One plastic bag
- Two 14 inch long zip ties
- One bubble envelope pre-addressed to the Eclipse Soundscapes team with postage



It was discovered that instructions were not clear for how to put together the AudioMoths. This led to the need to detail instructions of how to operate the AudioMoth.

Data Sonification

Data sonification is **the presentation of data as sound using sonification**. It is the auditory equivalent of the more established practice of data visualization. Wikipedia

An example applications of data sonification are astronomy studies of star creation, interpreting cluster analysis, and geoscience.

Sound Data - Rainforest Connection & Arbimon

 Arbimon My Projects Search projects 

RFCx Arbimon

Upload and analyze an unlimited amount of audio from your AudioMoth, SongMeter, or other recording device, with our free cloud-based analytical tool.

[Start Analyzing Now](#) [Learn More](#)


1,802
projects created

40,342,102
recordings uploaded


25,149
analyses executed

2,157
species identified


Project Showcase




Arquivo Bioacústico Catarinense
This project aims to set up the bioacoustic archive for the State of Santa Catarina, at Brazil.
46,235 recordings · 907 templates · 195 species




Birds of Balbina
This project aims to evaluate the lasting impacts of the Balbina Hydroelectric Dam on forest birds.
216,279 recordings · 266 templates · 266 species




Mangroves of Puerto Rico
Broad coverage (all day, evenly spaced) recordings of 20 one hectare mangrove sites of Puerto Rico, with a...
32,345 recordings · 245 templates · 46 species




Birds of Madeira Flooded Habitats
This project is dedicated to evaluate the (1) habitat use and (2) sensitivity to habitat disturbance, of the...
172,944 recordings · 82 templates · 185 species




BCI-Panama_2018
This is a project of Marcool Campos-Cerqueira. The objective is to record anurans, birds, and bats during...
127,819 recordings · 309 templates · 132 species




Smithsonian Morona BMAP
This is a Smithsonian Biodiversity Monitoring and Assessment Program (BMAP) in lowland rainforest L...
223,584 recordings · 218 templates · 197 species



RFCx-Guardians in Madre de Dios...
In this project, we will use recordings from the Guardians to create training data for a western...
172,944 recordings · 82 templates · 185 species




Puerto Rico Island-Wide
This is a collaboration between RFCx, DRNA, US Fish and Wildlife and Para La Naturaleza with the main...
127,819 recordings · 309 templates · 132 species



RFCx Tembé Brazil Project
This project aims to create a preliminary species list of birds, mammals, and anurans in the Tembé Indigenou...
223,584 recordings · 218 templates · 197 species

Sound Summary

 Arbimon

My Projects

Birds of Madeira Flooded Habitats

Summary

Data



Visualizer


Analysis

Jobs 85

Settings

Search projects



Birds of Madeira Flooded Habitats 

This project is dedicated to evaluate the (1) habitat use and (2) sensitivity to habitat disturbance, of the bird assemblage of flooded habitats associated to Madeira river.

Sites: 20


Recordings: 172,944

Templates: 53

Pattern Matchings: 82

Validated species: 185

Map Satellite



Google

Keyboard shortcuts | Imagery ©2011 NASA, TerraMetrics | Terms of Use

Sound Data - Latitude, longitude, and altitude

Arbimon

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Settings

Search projects

Sites

Species

Soundscape

Composition

Classes

Uploads

Recordings

Training sets

Templates

Playlists

Create

Import

Edit

Delete

Search

Name	No. of recordings	Latitude	Longitude	Altitude	Last updated
Xeno-canto <small>ARBIMON ONLY</small>	1	8.601	-63.787	100.00	Sep 26, 2017 10:37 AM
Montante 8 <small>ARBIMON ONLY</small>	8449	-9.183	-64.524	80.00	Sep 26, 2017 10:37 AM
Montante 4 <small>ARBIMON ONLY</small>	8170	-9.186	-64.619	75.00	Sep 26, 2017 10:37 AM
Jusante 10 <small>ARBIMON ONLY</small>	7467	-8.595	-63.571	62.00	Sep 26, 2017 10:37 AM
Jusante 8 <small>ARBIMON ONLY</small>	12991	-8.593	-63.578	82.00	Sep 26, 2017 10:37 AM
Jusante 6 <small>ARBIMON ONLY</small>	8147	-8.594	-63.586	65.00	Sep 26, 2017 10:37 AM
Jusante 5 <small>ARBIMON ONLY</small>	9602	-8.594	-63.589	73.00	Sep 26, 2017 10:37 AM
Jusante 3 <small>ARBIMON ONLY</small>	11403	-8.565	-63.650	63.00	Sep 26, 2017 10:37 AM
Jusante 4 <small>ARBIMON ONLY</small>	10697	-8.565	-63.646	63.00	Sep 26, 2017 10:37 AM
Jusante 2 <small>ARBIMON ONLY</small>	5074	-8.575	-63.631	69.00	Sep 26, 2017 10:37 AM
Montante 10 <small>ARBIMON ONLY</small>	10819	-9.181	-64.513	76.00	Sep 26, 2017 10:37 AM
Montante 9 <small>ARBIMON ONLY</small>	9941	-9.184	-64.515	72.00	Sep 26, 2017 10:37 AM
Montante 7 <small>ARBIMON ONLY</small>	10000	-9.185	-64.519	78.00	Sep 26, 2017 10:37 AM
Montante 5 <small>ARBIMON ONLY</small>	8414	-9.198	-64.629	71.00	Sep 26, 2017 10:37 AM
Montante 3 <small>ARBIMON ONLY</small>	10666	-9.180	-64.618	74.00	Sep 26, 2017 10:37 AM
Montante 2 <small>ARBIMON ONLY</small>	5608	-9.177	-64.616	72.00	Sep 26, 2017 10:37 AM
Montante 1 <small>ARBIMON ONLY</small>	10117	-9.176	-64.613	72.00	Sep 26, 2017 10:37 AM
Jusante 9 <small>ARBIMON ONLY</small>	8006	-8.595	-63.575	63.00	Sep 26, 2017 10:37 AM
Jusante 7 <small>ARBIMON ONLY</small>	8596	-8.593	-63.582	73.00	Sep 26, 2017 10:37 AM
Jusante 1 <small>ARBIMON ONLY</small>	8776	-8.582	-63.626	64.00	Sep 26, 2017 10:37 AM

Location

Map

Satellite

Keyboard shortcuts | Imagery ©2021 NASA, TerraMetrics | Terms of use

Challenges of Data and Sounds + Screen Readers

- Organization of Data must be keyboard navigable
- Data comparison needs to be simplified for screen reader use
- Metadata is included sounds - can be a lot of information
- Key information for sounds need to be determined by individuals

Example of Sound Data - Arbimon



Recommendations from research

- Data Interactivity
 - Fully interactive graph
 - Can select any point along a line, and it will tell you the Time, Frequency, Site, etc
 - Potentially a Tooltip or a Separate Table
 - Filter data lines by site
 - Differentiate between site lines using pattern and color

Recommendations from research

- Select Eclipse Phase to automatically jump to that part of the recording
- Click on phase icons to automatically move to that part of the recording
- Keyboard Shortcut for Field Guide
- Tutorials for Rainforest Connection

Data Comparison and Screen Readers

“There is a difference between keyboard and screen reader navigation. Although most screen reader users use a keyboard not a mouse, they are not restricted to the same limited set of keyboard commands as other keyboard users.” Leonie Watson

In order to provide an accessible experience, data needs to be created in a way that works with a screen reader. For example, tables with data need to clearly state what is in each column and row.

Ways to make Sound Data Accessible

- Use an SVG format instead of an HTML Image for screen reader use as it allows for users to access individual elements on graphs.
- Label Axis and each tick mark for accessible technology use
- Label each data point instead of using colors
- Visuals need descriptive alternative text .

Ways to make Sound Data Accessible

- Provide proper titles to indicate the major insights
- Associate data cells with appropriate headers
- Identify rows and columns
- Summarize the story of the information

Storytelling & Data

Citizen Science Data can tell stories of...

The changes since the last eclipse

Impacts of climate change on sounds

Unexpected Changes in nature during the eclipse

Lessons Learned



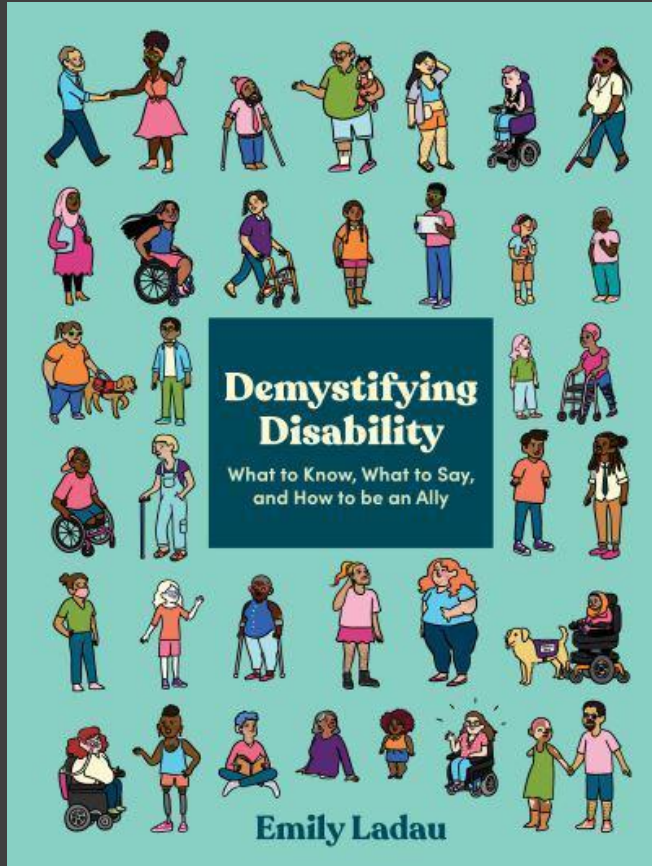
What didn't work

- Surveys (very few responses)

What worked

- Interviews
- Content Modeling
- Participatory Design of AudioMoth
- Working with National Association of Accessible Media

Recommendation for all designers toolkit



Learn about Ableism and Accessibility
Disability Etiquette
Disability in the media
How to be an ally

Next Steps

- Co-design of comparative data analysis
- Usability Testing with the National Federation of the blind
- Adding Accessibility features → field guide testing, column format testing, modal testing
- Implement more gamification components
- Content Creation for lessons - Certification and badges

Get Involved! We need Citizen Scientists!

ARISA

Advanced

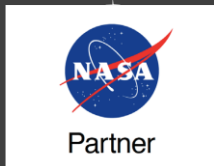
Research in

Inclusion &

STEAM

Accessibility

Lab



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Thank you!

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