NISE Network Online Workshop

Practices, Principles, and Programming for Engaging Blind and Low Vision Audiences

Tuesday, March 12, 2024

Today's Presenters:

Christina Leavell, Arizona State University/NISE Network, Tempe, AZ

Noreen Grice, You Can Do Astronomy, New Britain, CT

Timothy Rhue II, Space Telescope Science Institute in Baltimore, MD

Katie Wolfson, University Corporation for Atmospheric Research (UCAR) Center for Science Education in Boulder, CO

Welcome! As we wait to get started with today's discussion, please:

Introduce yourself! Type your name, institution, and location into the Chat Box

Questions? Feel free to type your questions into the Chat Box at any time throughout the webinar or use the raise your hand function in the participants list and we'll unmute your microphone.

Today's discussion will be recorded and shared on nisenet.org at: nisenet.org/events/online-workshop

Defining Blind and Low Vision Audiences

National Federation for the Blind

Encourages people to consider themselves as blind if their sight is bad enough (even with corrective lenses) that they must use alternative methods to engage in any activity that people with normal vision would do using their eyes

US Center for Disease Control

- **Vision Loss:** best corrected visual acuity 20/40 or worse
- **Blindness:** best corrected visual acuity 20/200 or worse

https://www.cdc.gov/visionhealth/vehss/estimates/vision-loss-prevalence.html
https://nfb.org/resources/blindness-statistics

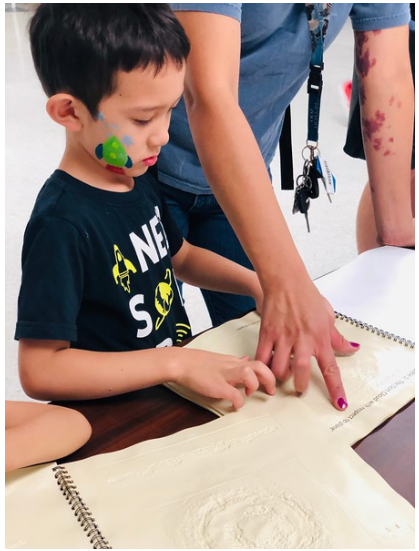
Blind and Low Vision Demographics in the US

- **Vision Loss:** best corrected visual acuity 20/40 or worse
  6 million people in US
- **Blindness:** best corrected visual acuity 20/200 or worse
  1 million people in US
- More than 1.6 million Americans who are living with vision loss or blindness are younger than age 40
- 20% of all people older than 85 years experience permanent vision loss
- More females than males experience permanent vision loss or blindness
- Hispanic/Latino and Black have a higher risk of vision loss

CDC Estimates based on 2017 population estimates. Released May 2021, revised July 2022
https://www.cdc.gov/visionhealth/vehss/estimates/vision-loss-prevalence.html

Improving Accessibility & NISE Network Resources

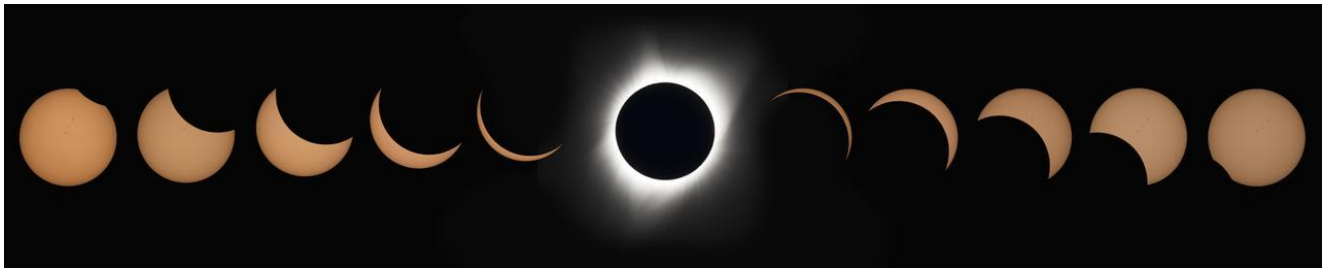
- **Best Practices, Strategies, and Guidelines**
- **Tactile, Braille, and Large Print Books**
- **Tactile Models**
- **Audio Descriptions**
- **Alt Text for Images**



Resources:

- Blind and Low Vision Audiences
  https://www.nisenet.org/blind-low-vision
- Inclusion and Accessibility Resources
  https://nisenet.org/Audiences
- Sensory Resources for Solar Eclipse
  https://nisenet.org/solareclipse#Tactile

NISE Network Solar Eclipse Resources



Compilation of Eclipse public engagement resources:

- Tactile Books & Sensory Resources
- Hands-on activities
- Maps and images
- Safe viewing & livestreams
- Cultural connections and more!

https://nisenet.org/solareclipse#Tactile

From Barriers in the Planetarium Dome to Access in the Universe: My work in Accessible Astronomy

Noreen Grice, Founder/President
You Can Do Astronomy LLC

www.youcandoastronomy.com

My work in accessible astronomy began in the planetarium…

You Can Do Astronomy®

Planetarium shows are displayed overhead

You Can Do Astronomy®

In 1984, I was a part-time planetarium presenter at the Boston Museum of Science…

You Can Do Astronomy®

One day, a group of blind students came to one of my planetarium shows.

I didn’t know what to do.

These visitors were not pleased with their experience.

I thought the planetarium was **the most wonderful place in the world.**

You Can Do Astronomy®

…but it was inaccessible for visitors who were visually impaired because the images were projected on the dome overhead and the narration was not pictorially descriptive.

I was determined to find solutions to make the planetarium and astronomy more accessible for everyone.

I took a trip to the Perkins School for the Blind Library to learn what was available in astronomy education for the blind.

In 1984, began my life's journey to create a new field of accessible astronomy.

My goal was to make the planetarium and astronomy more accessible to visitors who were blind or visually impaired.

My strategy was to create tactile images for all planetarium shows which could be available for visitors at any time.

I also began developing Touch the Stars, an astronomy book designed specifically for blind and visually impaired learners.

This book would have tactile images and descriptive text.

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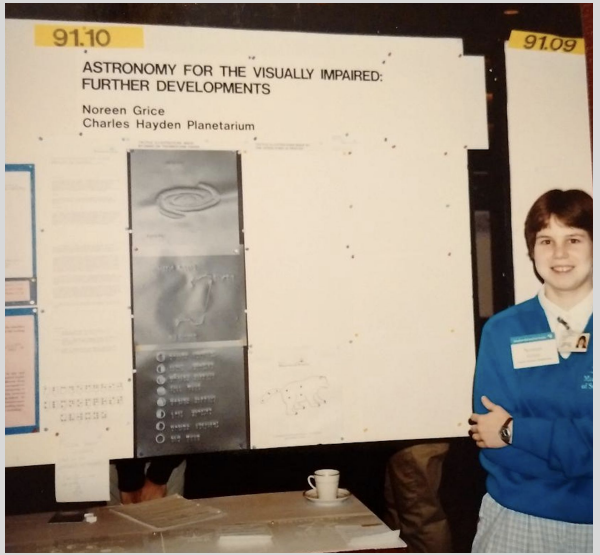
I began etching tactile astronomy images by hand and with an embosser, testing them with visually impaired learners.

I made presentations at American Astronomical Society conferences (1989, 1990)



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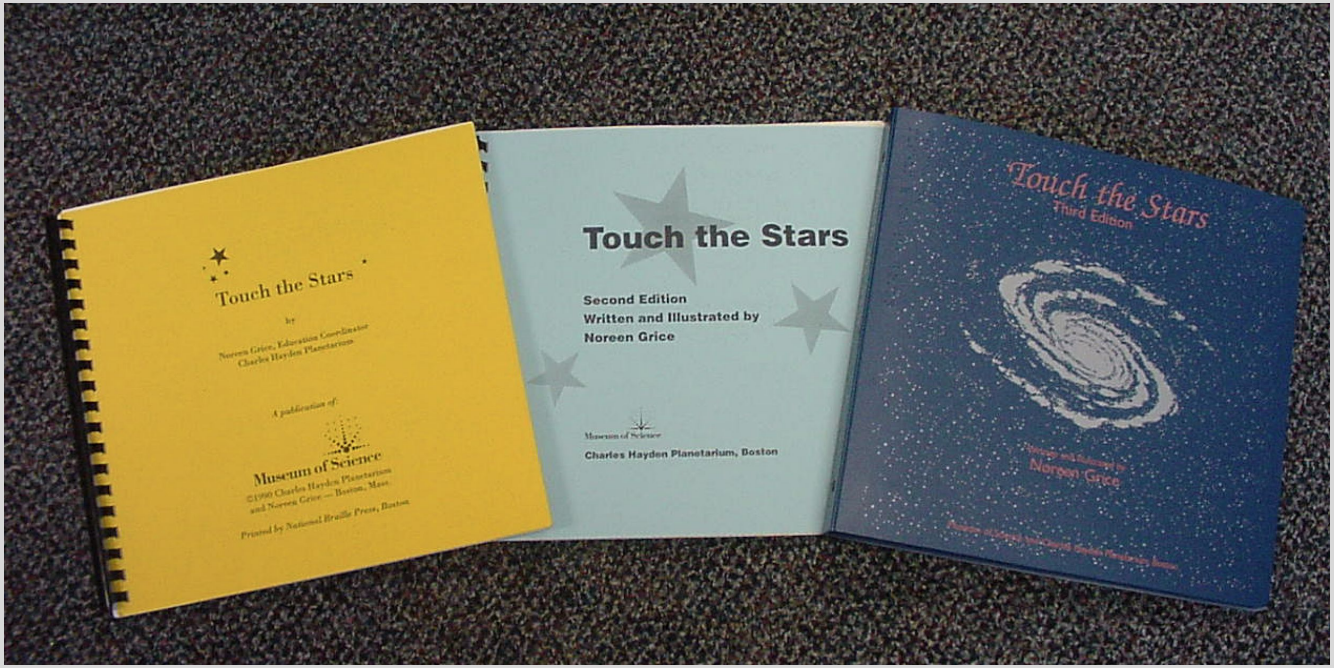
The first edition of Touch the Stars was published in 1990

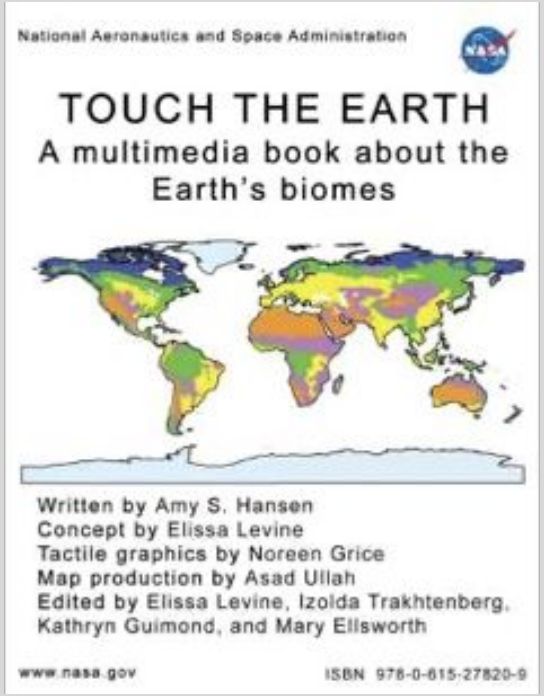


You Can Do Astronomy®

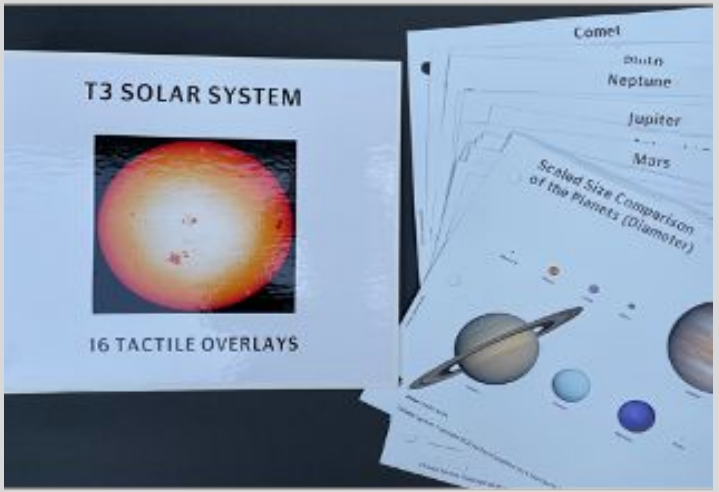
My work in creating tactile images eventually extended into a series of other accessible and tactile astronomy books.

You Can Do Astronomy®

Tactile graphic design for NASA's **Touch the Earth: A multimedia book about Earth's biomes** (2009)



And most recently, **Touch the Solar System digital book for the Talking Tactile Tablet (T3),**
co-authored with Dr. Heidi Hammel.



You Can Do Astronomy®

Touch the Stars is now in its 5th edition and available directly through National Braille Press.

https://shop.nbp.org/products/touch-the-stars-fifth-edition

BOOKS

NOREEN GRICE

This tactile image of the Milky Way is one of 19 such figures in *Touch the Stars* depicting celestial bodies and astronomical phenomena.

The universe at your fingertips

"Wow! That's way over my head," my mother's coworker said to me after I gleefully explained galaxies and black holes to her. I wasn't in college for astronomy (yet). I wasn't even in high school—that would come much later. I was 11 and had just finished an earlier edition of Noreen Grice's *Touch the Stars*, an introductory book about astronomy written in braille and large print specifically for the blind. I was rereading my favorite parts and trying to share the wonders of our universe with whoever would listen to me.

and scale. That meant fewer images needed to be verbally described to me.

Touch the Stars has been a constant companion throughout my career in astronomy, and it is now in its fifth edition. The updated text includes references to more recent space probes and rovers such as *New Horizons* and *Curiosity*. The diagrams depicting lunar phases and eclipses are still useful to me: As recently as the past academic quarter, one of them was an invaluable help when I tutored an astronomy student who had trouble understanding the

Touch the Stars

Noreen Grice; ill. Irma Goldberg and Shirley Keller
National Braille Press, 2019 (5th ed.). $35.00

are some of the few books with tactile graphics that are intended for the general public. Even university-level blind students who are struggling to obtain braille textbooks will find *Touch the Stars* a great place to start. It also includes descriptions of how to navigate the images, which is great for young readers discovering tactile diagrams or for readers new to braille.

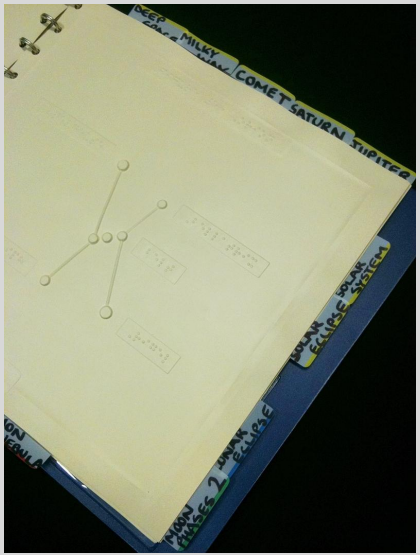
The descriptions of the illustrations also offer something unique: They make distinctions between conventions used in the book and observations of the sky. The most obvious example of that occurs when Grice describes constellations. The book helpfully explains that there are lines in the book, but no lines in the sky. To a blind reader without another frame of reference, that tidbit is crucial for understanding how observations differ from theory.

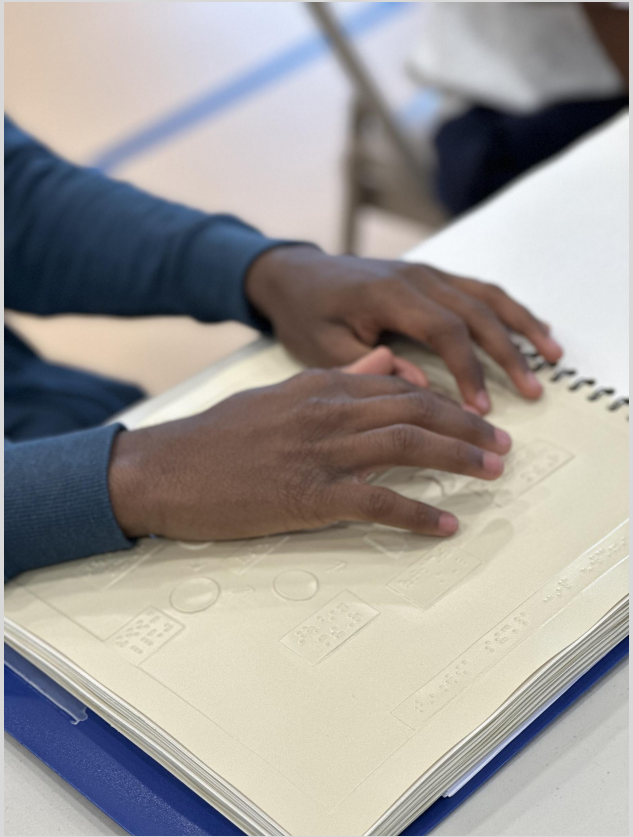
Another example occurs when Grice discusses a picture of a meteor shower: The description states that meteors may streak across the sky at a rate of one per minute, rather than the several per minute depicted in the drawing. A pocket in the back contains print versions of the included graphics so that all teachers can easily work with blind students.

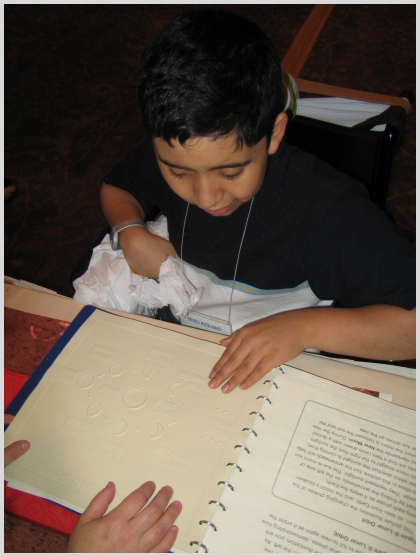
Touch the Stars does a good job of covering the breadth of topics typically mentioned in a basic astronomy course. It also throws in some extras that cater specifically to blind readers, such as a

You Can Do Astronomy®

Astronomy educators are using the tactile images in Touch the Stars with their planetarium and outreach programs!

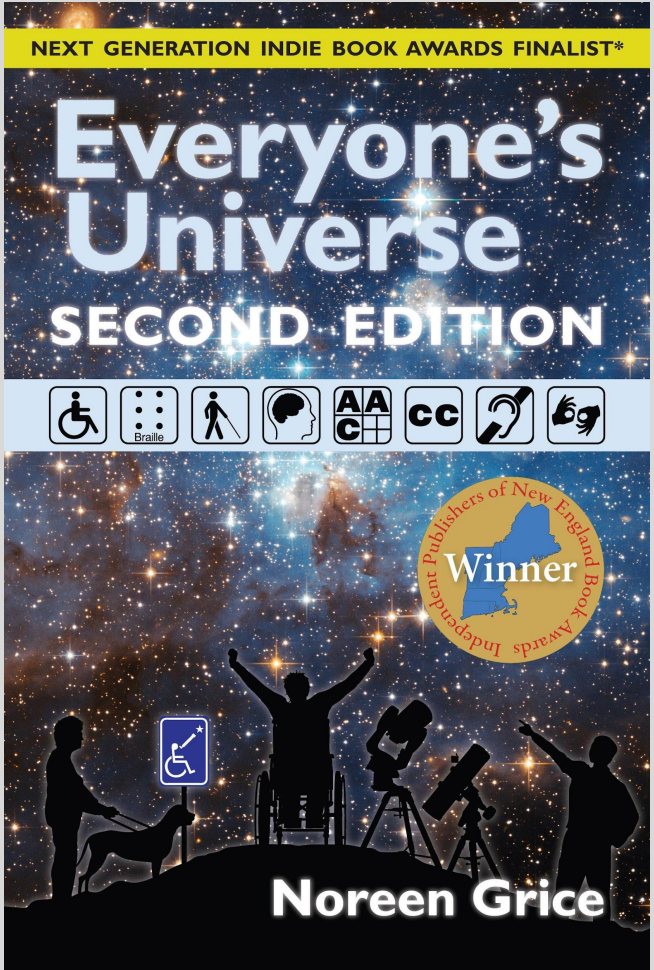






You Can Do Astronomy®

Resource on Integrated Approaches…



EDUCATION/TRAVEL

One of five Americans has a disability.

In this innovative, enabling book, Noreen Grice explores ways to provide universal access to educational science programs.

- **Mobility access** for people who use wheelchairs
- **Low vision and tactile access** for people who are blind or visually impaired
- **Specialized environments** for people with neurological disorders, including autism
- **Assistive technology** for nonverbal communication
- **Non-hearing access** for people who are deaf or hearing impaired

PLUS a visitor friendly travel guide to accessible science museums, planetariums, and observatories!

Lorraine Greenfield

Astronomy educator Noreen Grice's mission is to make astronomy accessible for everyone, and she never accepts that something is impossible!

Front cover image credits: See page 300.
Cover design: www.dmargulis.com
* Awarded to first edition, 2011

You Can Do Astronomy®

Large Print

U.S. $27.95
ISBN 978-0-9833567-3-8
52795
9 780983 356738

You Can Do Astronomy®

Touch the Stars and Everyone's Universe were included in the NISE Network Earth and Space 2020 Toolkit. *You may already have these!*

Explore Science: Earth & Space 2020 toolkit - contents list

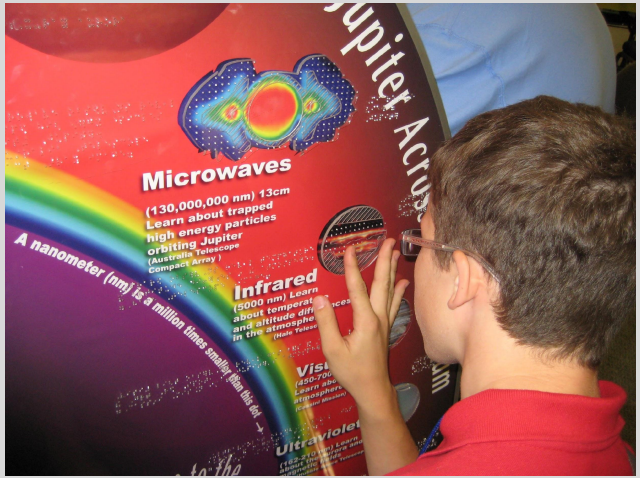
Hands-on STEM public engagement activities and professional development resources about Earth and space science.

EXPLORE SCIENCE Earth&Space

In collaboration with NASA, the NISE Network has assembled a new set of engaging, hands-on Earth and space science experiences with connections to science, technology, and society.

You Can Do Astronomy®

My work has also extended into many other types of accessible astronomy projects….including NASA Exhibit Designs…



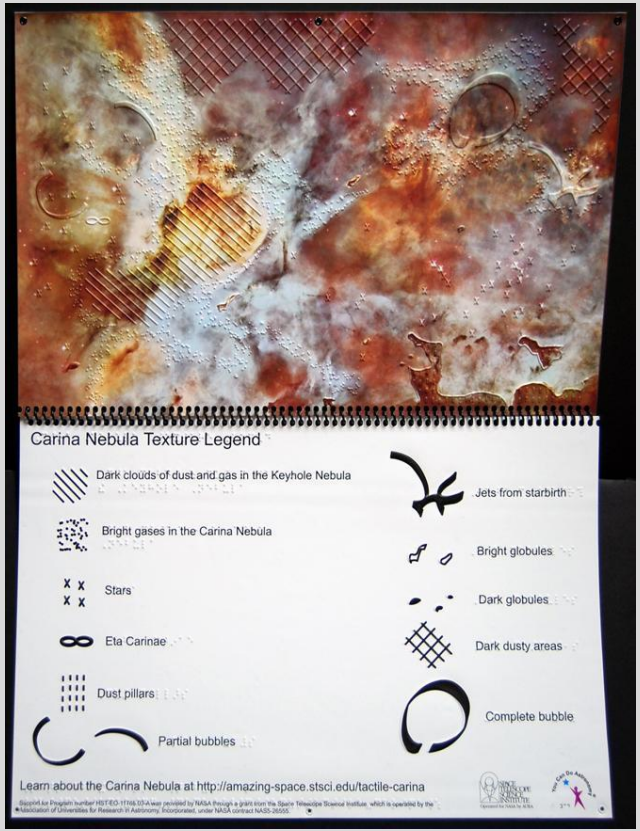
Solar System Radio Explorer Kiosk
Goddard Space Flight Visitor Center

NASA Chandra Traveling Exhibits:

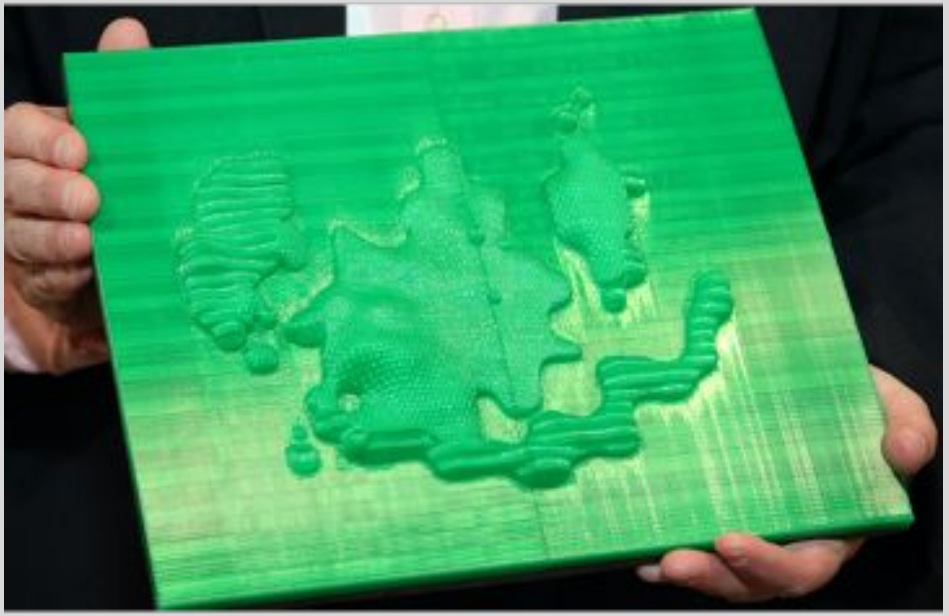
- From Earth to the Solar System
- Here, There and Everywhere
- Light Beyond the Bulb

You Can Do Astronomy®

… tactile designs for the Tactile Carina Nebula poster for The Space Telescope Science Institute



…and tactile designs of NGC 602 with The Space Telescope Science Institute



…plus creation of hands-on teacher workshops on making astronomy more accessible!

You Can Do Astronomy®

My advice to astronomy educators is:

1. **Be proactive, welcoming and prepared!**

2. Plan for accessible hands-on experiences.
People have different learning styles. Have a collection of accessible astronomy tactile images and models available for everyone. Models might include a toy model or a model you create.

3. Teach pictorially. Be descriptive. Paint a picture in the mind's eye for visually impaired and sighted learners.

You Can Do Astronomy ®

Be ready to provide access!

If you don't already have these resources:

Touch the Stars (tactile print/Braille astronomy book) – Available through National Braille Press

Everyone's Universe: A Guide to Accessible Astronomy Places – print book, available through Amazon and Barnes & Noble

Please visit:
www.youcandoastronomy.com

Thank You!

www.youcandoastronomy.com

STScI | SPACE TELESCOPE SCIENCE INSTITUTE

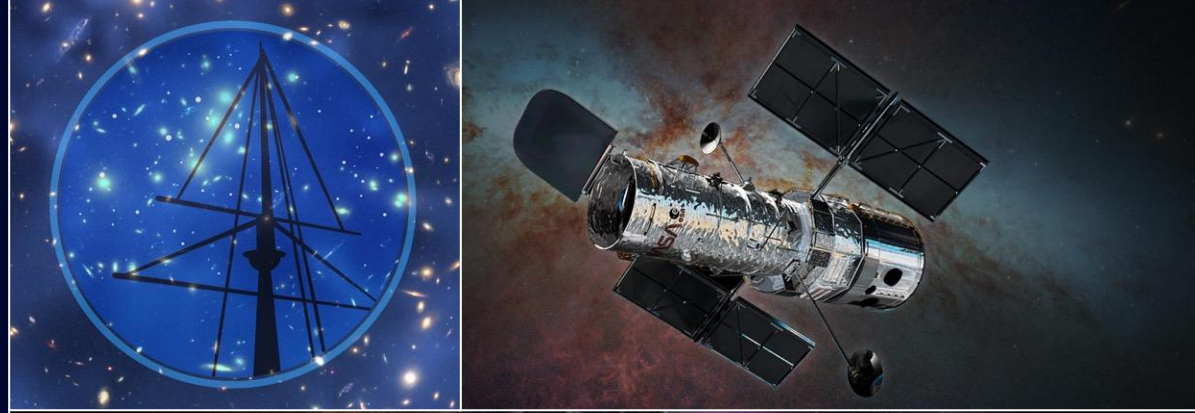
EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

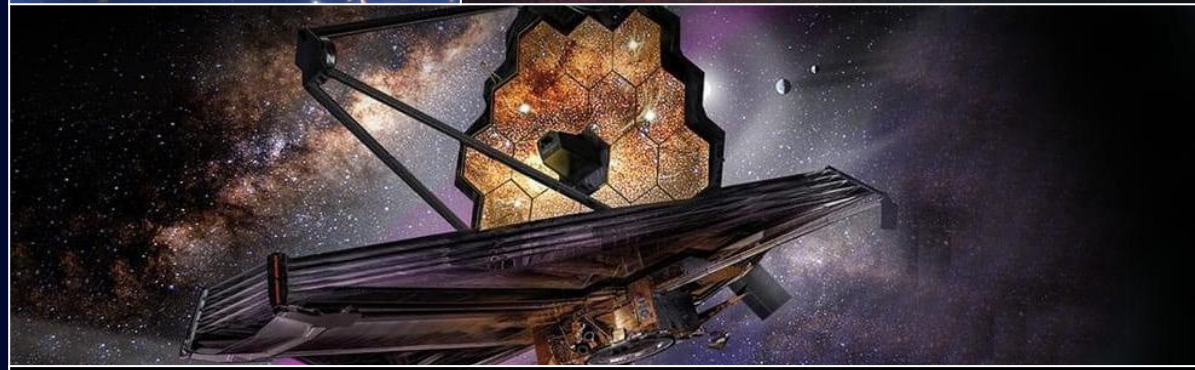
Practices, Principles, and Programming for Engaging Blind and Low Vision Audiences

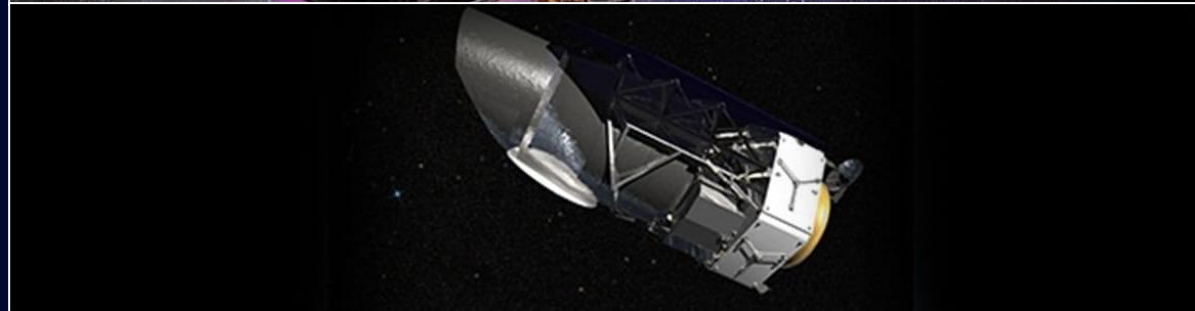
Timothy Rhue II

March 12, 2024

STScI | SPACE TELESCOPE SCIENCE INSTITUTE







Traditional Space Telescope Images

Crab Nebula – James Webb Space Telescope

Whirlpool Galaxy – Hubble Space Telescope

Central Region of the Milky Way Galaxy – Hubble Space Telescope, Spitzer Space Telescope, Chandra X-ray Observatory

L1527 and Protostar

A forming protostar surrounded by a large hourglass-shaped nebula. A bright orange object, the protostar, lies at the center of this image. In front of the protostar is a thin grey line, which is the protostar’s accretion disk. Above the protostar is an orange, triangular cloud of gas that points to the top left of the image. The area closest to the protostar is a brighter orange than the area to the top left, and has more pronounced plumes of orange gas. Below the protostar is another triangular cloud of gas that points to the bottom right of the image. The area closest to the protostar is a blend of pronounced blue and orange plumes of gas. Farther toward the bottom right, the color of the gas turns primarily blue. Stars and galaxies of many different shapes and sizes are scattered around the image, although they are noticeably more absent on the left side of the hourglass.

The unexpected star of NASA's Webb images — the alt text descriptions

FAST COMPANY

How stunning images from the James Webb Space Telescope were brought to life for the visually impaired

A small team of writers, astronomers, and curators are writing alt text of the images that contain vivid, detailed descriptions.

Kate Meyers Emery (she/her)
@kmeyersemery

If anyone ever tells you alt text isn't important, show them @NASA's alt text for the #WebbSpaceTelescope images.

They are able to convey the wonders and beauty of these in words, making these breathtaking views accessible.

NASA @NASA · Jul 12
Cosmic cliffs & a sea of stars. @NASAWebb reveals baby stars in the Carina Nebula, where ultraviolet radiation and stellar winds shape colossal walls of dust and gas. nasa.gov/webbfirstimages #UnfoldTheUniverse

Katie Mixtochtli - use alt text
@Conundrum9999

As a blind person who has had dreams of doing astronomy since I was 6 ... thank you to whoever not only remembered to write alt text for this -- but did so in such a beautiful way. I'll likely never know who you are. But you touched my heart this day, alt-text writer. 💜

NASA @NASA - Jul 11
It's here–the deepest, sharpest infrared view of the universe to date: Webb's First Deep Field.

Previewed by @POTUS on July 11, it shows galaxies once invisible to us. The full set of @NASAWebb's first full-color images & data will be revealed July 12: nasa.gov/webbfirstimages

pr

Alt text helps the visually impaired experience the James Webb Telescope images

1-Minute Listen

See how NASA describes stunning Webb telescope images for people who can't see them

Their alt text descriptions are stellar.

Exoplanet WASP-96 b Graph of Transmission Spectrum

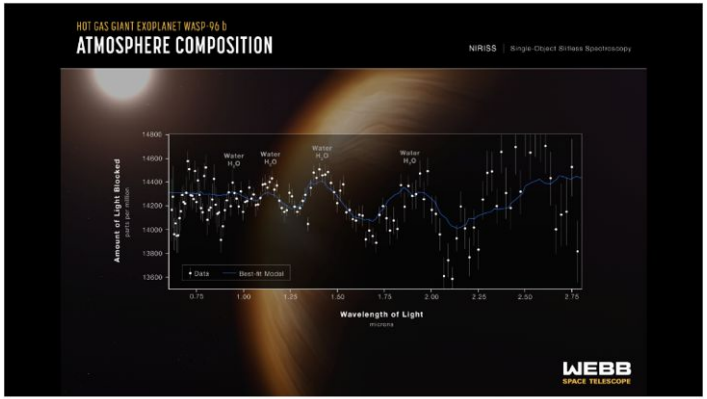
WEBB SPACE TELESCOPE

SEARCH MENU

HOME > IMAGES

Exoplanet WASP-96 b (NIRISS Transmission Spectrum)

< VIEW ALL IMAGES



View Description Zoom Image

Previous 165 of 403 Next

Exoplanet WASP-96 b Extended Description

Close

Exoplanet WASP-96 b (NIRISS Transmission Spectrum)

Extended Description

Graphic titled "Hot Gas Giant Exoplanet WASP-96 b Atmosphere Composition, NIRISS Single-Object Slitless Spectroscopy."

The graphic shows a transmission spectrum in the form of a graph of the Amount of Light Blocked by the planet's atmosphere in parts per million on the vertical *y*-axis versus Wavelength of Light in microns on the horizontal *x*-axis.

Graph

Axes

The *y*-axis ranges from 13,500 parts per million (less light blocked) at the bottom to 14,800 parts per million (more light blocked) at the top, with labeled tick marks are labeled every 200 parts per million, starting at 13,600.

The *x*-axis ranges from 0.6 microns on the left to 2.8 microns on the right, with labeled tick marks every 0.25 microns, starting at 0.75 microns.

Key

The graph includes a key showing that the solid white circles centered on gray vertical lines represent data points, and a blue solid line represents a best-fit model.

Data and Model

The graph consists of 141 data points, each with a gray error bar. The points range in value from 13,589 to 14,883 parts per million. The data points are not connected. They follow a jagged trend from left to right, with a number of broad peaks and valleys. The lengths of the error bars vary from a minimum of plus or minus 43 to a maximum of plus or minus 314. The error bars are smallest between about 1 and 1.3 microns, generally increasing in length toward the left from 1 to 0.6 microns, and toward the right from about 1.3 to 2.8 microns.

A solid blue line with several prominent peaks and valleys represents the best-fit model. The model begins at the far left with a very slight downward slope toward the right with a small peak around 0.95 microns, and another peak at about 1.15 microns. The line then becomes more sinuous, forming a taller, broader peak centered at about 1.4 microns and a slightly shorter broad peak at 1.9 microns. Starting around 2.15 microns, the line trends back upward with a wavy slope of about 30 degrees.

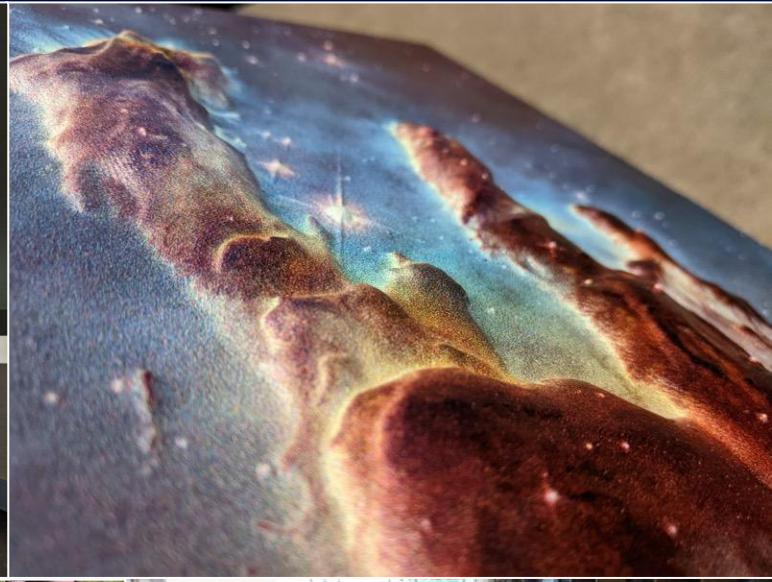
The blue best-fit model line generally follows the trend of the data. It intersects some data points, but does not match the data perfectly. The match between the model and data is clearest between about 0.9 and 1.65 microns.

The four most prominent peaks, which are visible in both the data and the model, are labeled "Water, H_2O."

Background

In the background of the graphic is an illustration of the planet and its star. The planet has a fuzzy orangish atmosphere with hints of cloud formations below. The star is bright yellowish-white.

Pillars of Creation
Small Tactile Panels



Stephan's Quintent – Full Sized Tactile Exhibit

Takeaways

Materials to use

- Alt text from the websites
  - Hubblesite.org
  - Webbtelescope.org
- Tactile Panels
  - https://outerspace.stsci.edu/display/STTI

Things to keep in mind

- Work with the community
- Experiment and try something out

Engaging Blind & Low Vision Visitors in a Science Center

Exhibits & Tours at the NSF National Center for Atmospheric Research Mesa Lab Visitor Center in Boulder, CO.

UCAR CENTER FOR SCIENCE EDUCATION

Katie Wolfson

Katie Wolfson *(she/her)*

UCAR Center for Science Education

SUSTAINABLE FUTURES

School & Public Programs Manager
wolfson@ucar.edu

NSF National Center for Atmospheric Research
Boulder, CO

UCAR Center for Science Education (SciEd)

a small science center in Boulder, Colorado

striving to engage all learners to explore and understand our changing world.

Inspire

Engage

Inform

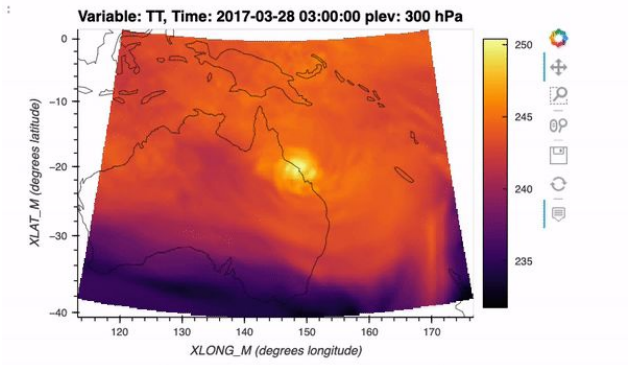
A few ways we approach accessibility…

- Accessibility Team (3-4 staff) meets monthly to discuss and prioritize list of accessibility projects across the whole department
- Do what we can, when we can. Layer accessibility over everything we do. Build out our whole team's skills as workload allows.
- Collaborate with members of the communities we serve whenever possible.

Priority	Effort level	Status
1 - High	High eff...	In Progr...
1 - High	Low effort	In Progr...
1 - High	High eff...	In Progr...
1 - High	High eff...	Paused
1 - High	Low effort	Not Star...
1 - High	Medium...	In Progr...
1 - High	High eff...	Not Star...
1 - High	High eff...	Not Star...
2 - Medi...	Medium...	In Progr...
2 - Medi...		Paused
2 - Medi...		Not Star...
2 - Medi...	High eff...	Not Star...

Goal: Make the NSF NCAR Mesa Lab Visitor Center more accessible for blind and low vision visitors

Text-heavy, data-heavy, and graph-heavy exhibits

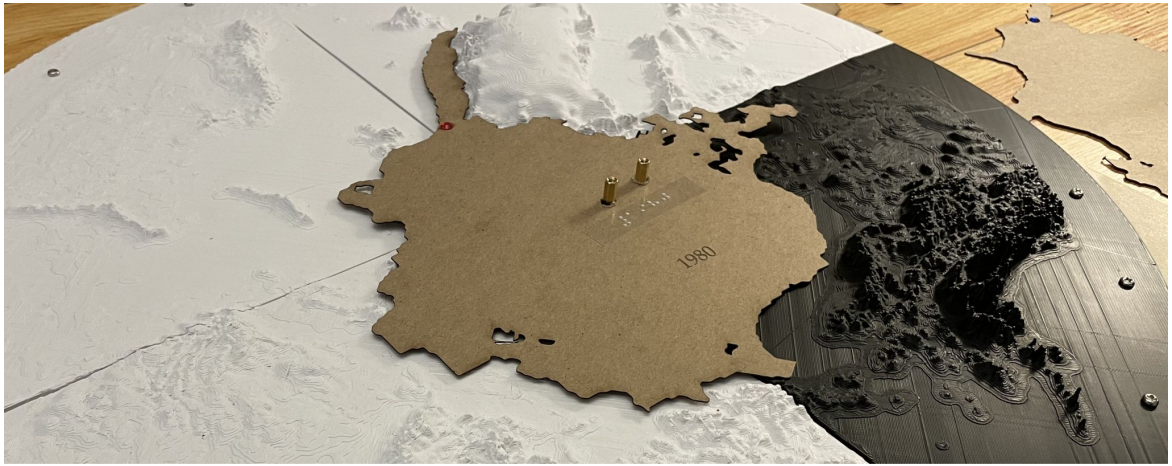


intangible data, digital visualizations, and computer modeling

Many hands-on exhibits still require vision to fully engage with

Making Data Tangible

- Prototyped tactile objects, such as NCAR climate model data of declining arctic sea ice
- Partnered with Colorado Center for the Blind
- Created items at local makerspace & public libraries

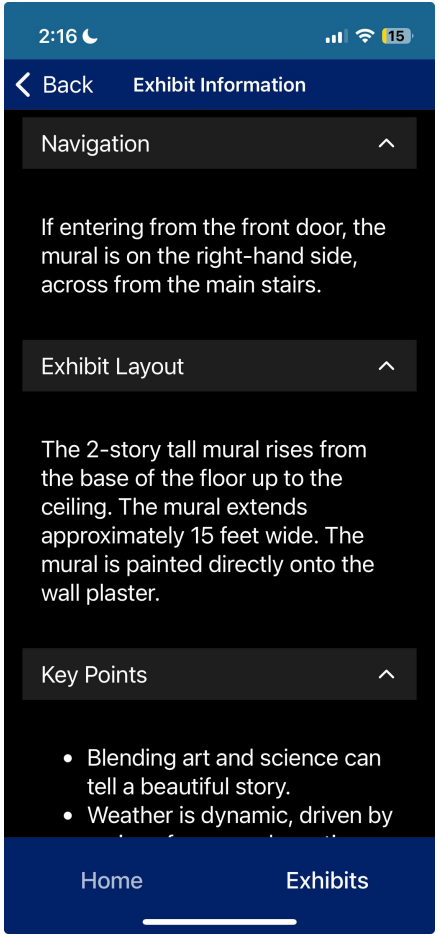


Guided Sensory Tour for Blind & Low Vision Visitors

- Partnered with Colorado Center for the Blind for onsite tour prototyping
- Added tactile objects (sea ice prototype & 3D printed models of our building)
- Selected hands-on demos that didn't require vision to experience
- Made select graphs accessible with tactile graphics tool kit and old transparency sheets
- Incorporated other senses & changed up locations

Wayfinding App for Blind & Low Vision Visitors

- *In Development:* web-based app to allow blind and low-vision visitors to wayfind and experience our exhibits independently
- On Location User Testing: lots to learn!
  - Compensate users for their time and transportation arrangements
  - Double the expected time for testing
  - Consider the entire experience (transportation, paperwork, location, individual needs) to reduce complications



Top Lessons Learned (so far) for Creating Program and Exhibit Materials for Blind and Low Vision Visitors

1. **Partnerships, collaborations, and feedback from the community you're designing for are key!**
2. Relationships matter.
3. Don't try to convert exact content or include everything if you can't create a meaningful experience for blind guests
4. New tools: tactile graphics kit
5. Local makerspaces are a powerful resources and partnerships
6. Be sure to remember to share resources after you make them!

Do what you can, when you can.

Resources & Opportunities

Learn more and access the NISE Network's online digital resources:
nisenet.org/browse-topic

NISE NETWORK NEWSLETTER

Read our monthly newsletter
nisenet.org/newsletter

NISE NETWORK ONLINE WORKSHOPS

Past Recordings of Online Workshops
nisenet.org/online-workshop-recordings-list

Follow NISE Net on social networking
nisenet.org/social

Next Online Workshop…

Wildfires & Air Quality - Providing a Relevant Portal to Get Audiences Invested in the Conversation

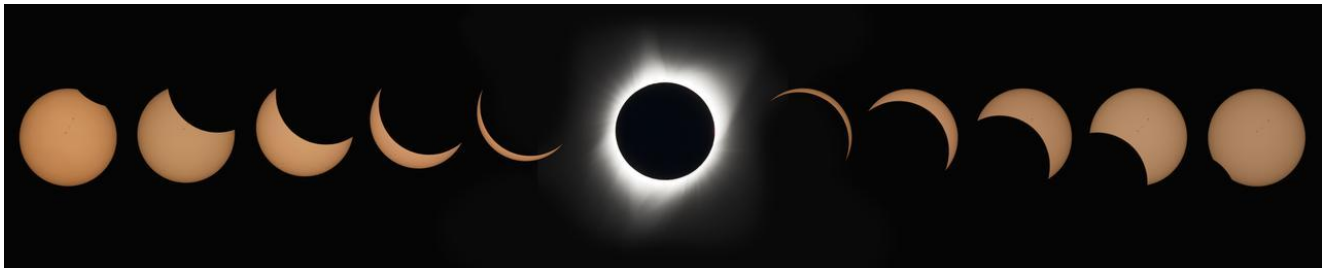
Tuesday, April 30, 2023
2pm-3pm Eastern / 11am-12pm Pacific

Register today:
nisenet.org/events/online-workshop/online-workshop-wildfires-air-quality

NISE NETWORK
ONLINE WORKSHOPS

nisenet.org/events

NISE Network Solar Eclipse Resources



Compilation of Eclipse public engagement resources:

- Tactile Books & Sensory Resources
- Hands-on activities
- Maps and images
- Safe viewing & livestreams
- Cultural connections and more!

https://nisenet.org/solareclipse#Tactile

Thank You

NISE
NATIONAL INFORMAL STEM EDUCATION NETWORK

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Q&A

Use the raise hand feature or type your question in the chat