Accessibility best practices for authoring Jupyter notebooks

for SciPy 2023
Isabela Presedo-Floyd and Stephannie Jimenez Gacha | Quansight Labs

What are we talking about?

What people who write Jupyter notebook files can do to make their notebooks work better for disabled people, and probably everyone.

Who am I?

Worthwhile things aren't done alone.

Who's the team?

These recommendations are based on
- (open source) user testing and feedback
- with tens of disabled people
- across two projects
- and three organizations

Who's the team?

Notebooks For All

via Space Telescope Science Institute
- Jenn Kotler (Space Telescope)
- Erik Tollerud (Space Telescope)
- Patrick Smyth (Iota School)
- Tony Fast
- Isabela Presedo-Floyd (me!) (Quansight Labs)

Who's the team?

Inclusive and Accessible Scientific Computing in the Jupyter Ecosystem

via CZI EOSS support at Quansight Labs

- Tania Allard
- Gabriel Fouasnon
- Stephannie Jimenez Gacha
- Isabela Presedo-Floyd (me!)

Background

Why this talk?

Who cares? A lot of people on Jupyter forums, actually.

When I say accessibility, I mean supporting disabled people.

We will cover

- Actions you can take to support accessibility in the Jupyter notebook file format.
- The most frequently encountered issues and highest impact solutions.

We won't cover

- Every accessibility issue ever encountered.
- Every possible solution ever encountered.
- Issues and solutions in notebook interfaces.

Define

Disability

- Visual
- Auditory
- Motor
- Cognitive

All of these can be constant or temporary.

Define

Assistive Tech

Umbrella term for devices that support people with disabilities.

Define

WCAG

Web Content Accessibility Guidelines (WCAG) 2.1

W3C Recommendation 05 June 2018

W3C

Define

WCAG

The Web Content Accessibility Guidelines are the international standard often used to evaluate and improve web content for people with disabilities.

It covers a wide range of recommendations and it has influenced legal standards.

Speaking of WCAG, let's talk about

POUR.

Speaking of WCAG, let's talk about

POUR.

The acronym for the four principles of WCAG

- Perceivable
- Operable
- Understandable
- Robust

Breaking down the notebook with WCAG

Perceivable

WCAG Principle 1. Perceivable

> Information and user interface must be presentable to users in ways they can perceive.

People need to be able to access all content in the notebook.

Perceivable includes

text alternatives.

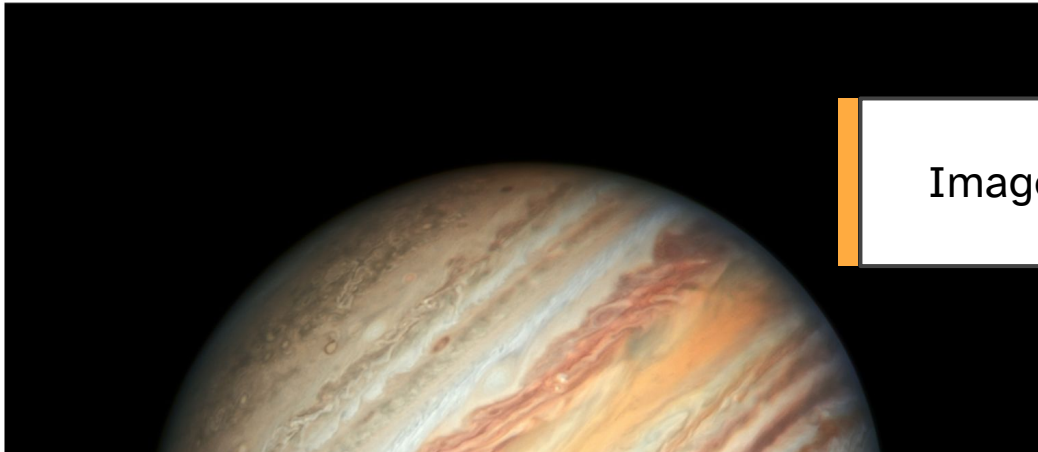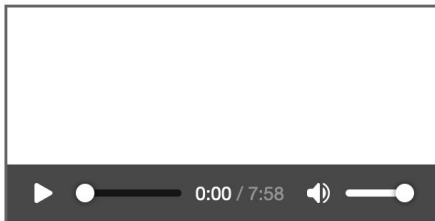Image descriptions/alt text

Perceivable includes

text alternatives.

```
[11]:  %%html
       <iframe
            id="JupiterAudio"
            title="Wolfgang Amadeus Mozart – Symphony No. 41 2nd Movement (Jupiter)"
            src="https://upload.wikimedia.org/wikipedia/commons/d/d4/Wolfgang_Amadeus_Mozart_–_Symphony_No.
       </iframe>
```

▶ ──●──────── 0:00 / 7:58 🔊 ──────●──

Audio transcription

Wolfgang Amadeus Mozart's Symphony No. 41 2nd Movement (Jupiter). The symphony is scored for
Flute, 2 Oboes, 2 Bassoons, 2 Horns in C and F, 2 Trumpets in C, Timpani in C and G, First and
Second Violins, Violas, Cellos and Double Basses.

Perceivable includes

text alternatives.

Video closed caption and transcription

Why's it all about text?

And what about the pros
and cons?

Perceivable includes

color.

Foreground Color

#F36B16

Lightness

Background Color

#FFFFFF

Lightness

Contrast Ratio

3.03:1

```
<iframe
    id="JupiterAudio
    title="Wolfgang
    "https://up
>
```

Color contrast
(You can check these in one of
many free contrast checkers.)

Perceivable includes

color.

Information cannot be given only by color

```
import somethingorother
```

```
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
<ipython-input-12-b8ab637482a1> in <module>
----> 1 import somethingorother

ModuleNotFoundError: No module named 'somethingorother'
```

Perceivable includes

data visualizations.

- Color contrast, color coding, and image descriptions still apply.
- Don't slack on the basics. Make sure you have a title, all axes labeled with units, and a key.
- Link sources for your data or analysis.
- Summarize why you included this visualization.

Perceivable includes

data visualizations.

Once more:
- Summarize why you included this visualization.

What else fits under Perceivable?

Operable

WCAG Principle 2. Operable

User interface components and navigation must be operable.

People need to be able to move around and use everything in that notebook.

Operable includes
headings.

```
# What a beautiful title

Wouldn't you agree? Now the only
thing we need is an equally elegant…

## Subheading
```

Use Markdown headings and use them in descending order. Use only one heading level 1. Don't skip heading levels!

Operable includes

clear link text.

The most recent W3C recommendation for web accessibility is the
[Web Content Accessibility Guidelines 2.1](https://www.w3.org/TR/WCAG21)

Descriptive link text tells
people where the link will take
them before they click.

Operable includes

no flashing content.

> Nothing in the notebook should flash <u>more than three times</u> <u>per second</u>.

Why do these changes impact Operability?

Understandable

> WCAG Principle 3. Understandable
>
> Information and the operation of the user interface must be understandable.

People need to have explicit context for everything in that notebook.

Understandable includes

plain language.

> Plain language includes limiting jargon, defining specialized terms (even if only with a link), and defining acronyms from the start.

Understandable includes

explaining code.

And now, for my next trick, I'll demonstrate a syntax error!

```
[gibberish goes here]
```

```
  File "<ipython-input-16-bb52c37a
    [gibberish goes here]
                        ^
SyntaxError: invalid syntax
```

Tell people what your code cells are going to do before they do it.

Understandable includes

table of contents.

Whether manually created or a part of the notebook interface, tables of contents help people navigate your notebook.

Understandable includes

info in the first cell.

In a cell at the top of the notebook, include
- A title (your heading 1, or one #)
- A 1–2 sentence summary of the notebook
- Authors and affiliations
- Date written or updated
- Links to sources (if relevant)

Understandable includes

info in the first cell.

```
# My cool notebook

This notebook defines cool before guiding you
through a series of interactive exercises aimed
at personal coolness discovery.

By Isabela P-F (Quansight Labs) on 13 July 2023

For more information, visit [Wikipedia's
discussion of cool](https://en.wikipedia.org
/wiki/Cool_(aesthetic)).
```

Providing context in the first cell helps people know if they are where they mean to be.

Adopting a notebook accessibility checklist

Uh oh.
A checklist?

Yes. But a checklist could mean

your test suite.

Some checks were not successful

1 failing and 1 successful checks

✕ Check Links / build (pull_request)   Failing after 3m

✓ docs/readthedocs.org:jupyter-accessibility — Read the Docs build succeeded!

Yes. But a checklist could mean

a notebook template.

Yes. But a checklist could mean

talking to a friend.

Yes. But a checklist could mean

peer review.

The point: stick with it.

Commit to a process and hold yourself accountable.

What you can do

Try at least one recommendation from this talk.

On your journey

- Don't go alone. Find allies and listen to wider disability and accessibility communities.
- Keep writing thoughtful notebooks and encourage others to do the same.
- Commit to your checklist.

Accessibility is here to stay.

Related links

- <u>These slides</u>: bit.ly/accessible-notebook
- <u>jupyter/accessibility on GitHub</u>
- <u>isabela-pf on GitHub</u> (that's me)

Special thanks to <u>Stephannie Jimenez Gacha</u>