Quarto Example

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2025-01-26

Abstract

This is an example document discussing and demonstrating how to use the quarto package to create quality html and pdf documents from simple Markdown markup. Ryan Reece develops quarto-example at github.com/rreece/quarto-example.

Contents

Preface

I've always been looking for the right tool that would help technical and scholarly writing flow in a Markdown-driven way. Managing figures, tables, equations, and bibliographies. Generating html, latex, or pdf.

I had my own previous hand-rolled projects to do this: markdown-memo, which I was trying to update and trim down into markdown-easy.

Then I discovered the quarto project that is very similar in spirit and has already accomplished a lot of what I was trying to do. And they have a growing community.

Chapter 1

Introduction

Writing with quarto

1.1 What this is for

So you want to write a document. Maybe you'll share it on the web. Maybe you want a polished pdf. Maybe it's a blog, research paper, book draft, or just a set of notes. You don't want to think about typesetting details. You just want to throw your ideas in some plain text files and call `make`.

This is a starter template for using quarto, following the quarto Get Started. It seems to achieve a lot of what I was trying to do with my similar projects, markdown-memo and markdown-easy: *make technical and scholarly writing easier and more productive*.

This package makes it very easy to compile text taken in Markdown to valid xhtml or to a pdf via LaTeX. It can be used to make static webpages quickly, for example (this site): https://rreece.github.io/quarto-example/

This same document compiled to a pdf can be found here: https://rreece.github.io/quarto-example/Quarto-Example.pdf

See the README for quarto-example for how to compile this document to html or pdf.

1.2 See also

Quarto links:

- quarto.org - Guide - Reference
- quarto example using math
- quarto using bibtex and CSL
- quarto doc about github-pages
- example `_quarto.yml`

My projects:

- github.com/rreece/quarto-example
- github.com/rreece/markdown-easy
- github.com/rreece/markdown-memo

Pandoc links:

- pandoc.org/README.html
- commonmark.org
- github.com/lierdakil/pandoc-crossref

Other examples/blogs of writing with markdown:

- programminghistorian.org/lessons/sustainable-authorship-in-plain-text-using-pandoc-and-markdown
- kprussing.github.io/writing-with-markdown
- scholarlymarkdown.com
- github.com/simov/markdown-syntax
- markdownguide.org — source: github.com/mattcone/markdown-guide-book
- github.com/gabyx/Technical-Markdown
- mdBook
- MkDocs

Chapter 2

Basics

Here we review the basics of Markdown. A further reference on Markdown syntax by its creator is here.

2.1 Sections

Are markded like this:

```
Section title {#sec-put-optional-section-label-here}
==========================================================

Sub-section title {#sec-put-optional-sub-section-label-here}
----------------------------------------------------------
```

Or marked like this:

```
# Section title {#sec-put-optional-section-label-here}

## Sub-section title {#sec-put-optional-sub-section-label-here}

### Sub-sub-section title

Main text here.
```

Note the examples of labeling a section in braces with `#`, as shown above. This allows one to refer to labels in the text like:

```
The next section, @sec-lists, is about lists.
```

The next section, Section 2.2, is about lists.

2.2 Lists

Unnumbered lists like this:

```
-   Galileo Galilei
-   Robert G. Ingersoll
-   Jill Tarter
```

- Galileo Galilei
- Robert G. Ingersoll
- Jill Tarter

Numbered lists like this:

```
1.  Na&iuml;ve realists
1.  Scientific realists
1.  Constructive empiricists
1.  Positivists
1.  Relativists
```

1. Naïve realists
2. Scientific realists
3. Constructive empiricists
4. Positivists
5. Relativists

2.3 Blocks

The following is a **quote block**.

```
>   It ain't what you don't know that gets you into trouble.
>   It's what you know for sure that just ain't so.

-- Mark Twain
```

> It ain't what you don't know that gets you into trouble.
> It's what you know for sure that just ain't so.
>
> -- Mark Twain

A **code block** (used throughout these examples) is just indented with 4 spaces, like this:

```
    def bubble_sort(alist):
        exchanges = True
        passnum = len(alist)-1
        while passnum > 0 and exchanges:
           exchanges = False
           for i in range(passnum):
               if alist[i]>alist[i+1]:
                   exchanges = True
                   temp = alist[i]
                   alist[i] = alist[i+1]
                   alist[i+1] = temp
           passnum = passnum-1

    alist=[20,30,40,90,50,60,70,80,100,110]
    bubble_sort(alist)
    print(alist)
```

which makes:

```
def bubble_sort(alist):
    exchanges = True
```

```
    passnum = len(alist)-1
    while passnum > 0 and exchanges:
       exchanges = False
       for i in range(passnum):
           if alist[i]>alist[i+1]:
               exchanges = True
               temp = alist[i]
               alist[i] = alist[i+1]
               alist[i+1] = temp
       passnum = passnum-1

alist=[20,30,40,90,50,60,70,80,100,110]
bubble_sort(alist)
print(alist)
```

Or you can wrap code blocks in three backticks, without indenting:

````
```
def online_covariance(data1, data2):
    meanx = meany = C = n = 0
    for x, y in zip(data1, data2):
        n += 1
        dx = x - meanx
        meanx += dx / n
        meany += (y - meany) / n
        C += dx * (y - meany)

    population_covar = C / n
    # Bessel's correction for sample variance
    sample_covar = C / (n - 1)
```
````

which makes:

```
def online_covariance(data1, data2):
    meanx = meany = C = n = 0
    for x, y in zip(data1, data2):
        n += 1
        dx = x - meanx
        meanx += dx / n
        meany += (y - meany) / n
        C += dx * (y - meany)

    population_covar = C / n
    # Bessel's correction for sample variance
    sample_covar = C / (n - 1)
```

Maybe you want to refer to **code inline** like this with backticks:

```
Here's some inline code: `vec.push_back(3.14)`.
```

Here's some inline code: `vec.push_back(3.14)`.

For poems and the like where you want **linebreaks taken literally**, prepend lines with | and a single space. Additional spaces can be used, but will indent the output.

```
| Art is long,
| Life is short,
| Opportunity fleeting,
| Experiment dangerous,
| Judgment difficult.
```

Art is long,
Life is short,
Opportunity fleeting,
Experiment dangerous,
Judgment difficult.

Otherwise, one can put two or more spaces at the end of a line of Markdown for the linebreak to be taken literally
like
this.

A **horizontal rule** can be made by just writing some number of dashes:

```
--------------------
```

Boom.

2.4 Fonts

```
-   *This is emphasis.*
-   **This is bold.**
-   _This is also emphasis._
-   __This is also bold.__
-   _This is emphasis **and** bold._
-   __This is bold *and* emphasis.__
-   ~~This is struck-out.~~
```

produces:

- *This is emphasis.*
- **This is bold.**
- *This is also emphasis.*
- **This is also bold.**
- *This is emphasis **and** bold.*
- **This is bold *and* emphasis.**
- ~~This is struck-out.~~

Don't do these. These will work in LaTeX but may not in html.

```
-   \textsf{This should be Sans.}
-   \textsc{This Should BE SMALL caps.}
-   $\textsf{This works though!}$
-   $\textsc{But this does not!}$
```

2.5 Hyperlinks

Links to URLs are done like this:

```
[Lorem ipsum](https://en.wikipedia.org/wiki/Lorem_ipsum)
```

Lorem ipsum

or used directly like this:

```
<https://www.google.com>
```

https://www.google.com

2.6 Cross references

When referring to labeled sections/figures/tables, you do not include the literal word "Section", "Figure", or "Table", which will be included for you. These prefixes/words are configurable in the `meta.yaml` file.

Refer to labeled things like this:

- **for sections:** `See @sec-footnotes on footnotes.`
  See Section 2.7 on footnotes.
- **for figures:** `@fig-scientific-universe motivates the unity of science.`
  Figure 5.1 motivates the unity of science.
- **for tables:** `Numbers are in @tbl-atlas-channels.`
  Numbers are in Table 5.1.
- **for equations:** `The generalized Stokes' theorem, @eq-stokes, is rad.`
  The generalized Stokes' theorem, eq. 4.2, is rad.

TODO: The above references to labels on other pages unfortunately don't work in html, but they work in latex/pdf.

You can refer to multiple lables like Section 2.1, Section 2.2, Section 2.3 like this:

```
[@sec-sections;@sec-lists;@sec-blocks]
```

Automatic grouping into a range doesn't seem to be working (for latex, but does for html), so you can also try refer to Sections 2.1–2.3 in some versions like this:

```
[Sections @sec-sections]--[-@sec-blocks]
```

2.7 Footnotes

```
Here's how you do a footnote[^SomeSpecialNote].

[^SomeSpecialNote]: Lorem ipsum dolor sit amet, duo ut putant verear, nam
    ut brute utroque. Officiis qualisque conceptam te duo, eu vim soluta
    numquam, has ut aliquip accusamus. Probo aliquam pri id. Mutat
    singulis ad vis, eam euismod pertinax an, ea tale volumus vel. At
    porro soleat est. Debet facilis admodum an sed, at falli feugiat est.
```

produces:

Here's how you do a footnote[1].

[1] Lorem ipsum dolor sit amet, duo ut putant verear, nam ut brute utroque. Officiis qualisque conceptam te duo, eu vim soluta numquam, has ut aliquip accusamus. Probo aliquam pri id. Mutat singulis ad vis, eam euismod pertinax an, ea tale volumus vel. At porro soleat est. Debet facilis admodum an sed, at falli feugiat est.

Chapter 3

Bibliographies

3.1 Making a bibliography

Markdown-memo uses bibtex via pandoc to generate a bibliography for your document. We've made this even simpler by allowing the user to create a simple text file to generate the necessary bibtex `.bib` file using the `markdown2bib` script. Markdown-memo looks for any `bibs/*.txt` files and uses `markdown2bib` to combine them and create `bibs/mybib.bib` in bibtex format. This is later used by pandoc when creating tex → pdf or html.

The `bibs/*.txt` should be plain text with a single reference per line, with each reference in a style that loosely follows the American Psychological Association (APA), which is commonly used in humanities. Currently four types of references are supported: `article`, `book`, `incollection`, and `misc`. The journal or book titles need to be in markdown-style *emphasis*, meaning `*Set Within Asterixis*`. Also note that for works in a collection, you need to use the word "`In`" in the right place, like in the reference by Quine below. The rest of the syntax tries to be forgiving. If you want to add a `note` to appear at the end of the reference, put it at the end within [square brackets] like the work by Plato below.

For example, the `mybib.txt` file in this document is

```
ATLAS Collaboration. (2008). The ATLAS Experiment at the CERN Large Hadron Collider. *Journal of
ATLAS Collaboration. (2012). Observation of a new particle in the search for the Standard Model H
Feynman, R.P. (1963). *The Feynman Lectures on Physics, Volume I*. California Institute of Techno
Feynman, R.P. (1965). The Development of the Space-Time View of Quantum Electrodynamics. Nobel Le
Guest, D., Collado, J., Baldi, P., Hsu, S. C., Urban, G., & Whiteson, D. (2016). Jet flavor class
Miller, A. (2014). Realism. *Stanford Encyclopedia of Philosophy*. http://plato.stanford.edu/entr
Plato. (2000). *The Republic*. (G. Ferrari, Ed. & T. Griffith, Trans.). Cambridge University Pres
Quine, W.V.O. (1960). Carnap and logical truth. *Synthese*, 12, 350--374.
Quine, W.V.O. (1969). Natural kinds. In *Ontological Relativity and Other Essays* (pp. 114--138)
van Fraassen, B. (1980). *The Scientific Image*. Oxford University Press.
```

If you do not want to use simplified txt files to generate bibtex, and you want to write your own bibtex, then simply remove any `bibs/*.txt` files and write a file called `bibs/mybib.bib`.

3.2 Doing citations

Citations start with an `@`-sign, and can be used inline, like:

```
@Miller_2014_Realism argues that we should get real.
```

which produces:

Miller (2014) argues that we should get real.

Inside a caption, you may want to end it with the citation in parentheses like this:

```
Blah blah blah [@Feynman_1963_The_Feynman_Lectures_on_Physics_Volume_I]\.
```

which produces:

Blah blah blah (Feynman, 1963).

Typically, I find it better to leave citations[1] in footnotes to keep from cluttering the main text. Let's try citing various kinds of references. Feynman said some important things[2]. But everything is a footnote to Plato[3]. Van[4] is a cool cat too. A reference with more than 4 authors should be automatically shortened with *et al.*[5]

[1] Quine (1969).
[2] Feynman (1965).
[3] Plato (2000).
[4] van Fraassen (1980).
[5] Guest, D. et al. (2016).

Chapter 4

Mathematics

4.1 Typesetting math

You can do latex inline like this:

```
Euler's formula is remarkable: $e^{i\pi} + 1 = 0$.
```

Euler's formula is remarkable: $e^{i\pi} + 1 = 0$.

You can use `$$` to make an equation block like this:

```
$$ \frac{\partial \rho}{\partial t} + \nabla \cdot \vec{j} = 0 \,. $$ {#eq-continuity}
```

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \vec{j} = 0 \,. \tag{4.1}$$

Stokes' theorem is pretty cool:

```
$$ \int_{\partial\Omega} \omega = \int_{\Omega} \mathrm{d}\omega \,. $$ {#eq-stokes}
```

$$\int_{\partial\Omega} \omega = \int_{\Omega} \mathrm{d}\omega \,. \tag{4.2}$$

You can also refer to labeled equations, such as eq. 4.2, with the syntax:

```
... such as @eq-stokes,
```

The `align` environment can also be used. Maxwell's equations, **?@eq-maxwell**, are also tough to beat:

```
$$
\begin{align}
    \nabla \cdot  \vec{E} &= \rho \nonumber \\
    \nabla \cdot  \vec{B} &= 0    \nonumber \\
    \nabla \times \vec{E} &= - \frac{\partial \vec{B}}{\partial t} \\
    \nabla \times \vec{B} &= \vec{j} + \frac{\partial \vec{E}}{\partial t} \nonumber \,.
\end{align}
$$ {#eq-maxwell}
```

NOTE: The above equation with nested `$$` and `align` environments does not work when making a pdf. See this issue. Instead, for pdf we use `align` directly in the following with quarto conditional content:

```
::: {.content-visible when-format="pdf"}
\begin{align}
    \nabla \cdot  \vec{E} &= \rho \nonumber \\
    \nabla \cdot  \vec{B} &= 0    \nonumber \\
    \nabla \times \vec{E} &= - \frac{\partial \vec{B}}{\partial t} \label{eq-maxwell} \\
    \nabla \times \vec{B} &= \vec{j} + \frac{\partial \vec{E}}{\partial t} \nonumber \,.
\end{align}
:::
```

$$
\begin{aligned}
\nabla \cdot \vec{E} &= \rho \\
\nabla \cdot \vec{B} &= 0 \\
\nabla \times \vec{E} &= -\frac{\partial \vec{B}}{\partial t} \\
\nabla \times \vec{B} &= \vec{j} + \frac{\partial \vec{E}}{\partial t} \,.
\end{aligned}
\tag{4.3}
$$

FIXME: But notice that the previous time we refrenced Maxwell's equations (**?@eq-maxwell**), and this time, the references work for html but are broken in pdf.

4.2 Mathjax

When doing md $\rightarrow$ tex $\rightarrow$ pdf, LaTeX takes care of the math, but to render the math in html, we use MathJax.

Note that our `_quarto.yml` has set `html-math-method: mathjax`.

Chapter 5

Figures and Tables

5.1 Figures

To add a figure, use the following basic syntax:

```
![caption](img/image-path.png){#fig-scientific-universe}
```

For example,

```
![The scale of the universe mapped to the branches of science and the hierarchy
    of science. CC BY-SA 3.0 (2013) [Wikimedia Commons](https://en.wikipedia.org/wiki/Science#/me
    ](img/1024px-the-scientific-universe.png){#fig-scientific-universe}
```

produces Figure 5.1.

Lorem ipsum dolor sit amet, duo ut putant verear, nam ut brute utroque. Officiis qualisque conceptam te duo, eu vim soluta numquam, has ut aliquip accusamus. Probo aliquam pri id. Mutat singulis ad vis, eam euismod pertinax an, ea tale volumus vel. At porro soleat est. Debet facilis admodum an sed, at falli feugiat est.

Ne nonumy quodsi petentium vix, mel ad errem accusata periculis. Porro urbanitas consetetur mei eu, his nisl officiis ei. Ei cum fugit graece, ne qui tantas qualisque voluptaria. Vis ut laoreet euripidis, vix aeque omittam at, vix no cetero volumus. Per te omnium volutpat torquatos, cu vis sumo decore. Eirmod hendrerit an pri.

Another example:

```
![The observed (solid) local $p_{0}$ as a function of $m_{H}$ in the low mass range.
    The dashed curve shows the expected local $p_{0}$ under the hypothesis of a
    SM Higgs boson signal at that mass with its $\pm{}1\sigma$ band.
    The horizontal dashed lines indicate the $p$-values corresponding to significances
    of 1 to 6$\sigma$\ [@ATLAS_2012_Observation_of_a_new_particle_in_the_search]\.
    ](img/ATLAS-local-p0-vs-mH){#fig-ATLAS-local-p0-vs-mH}
```

produces Figure 5.2.

Note that by leaving the file suffix implied, `img/ATLAS-local-p0-vs-mH`, quarto will automatically pick the available png or jpg when producing html output, but will prefer an

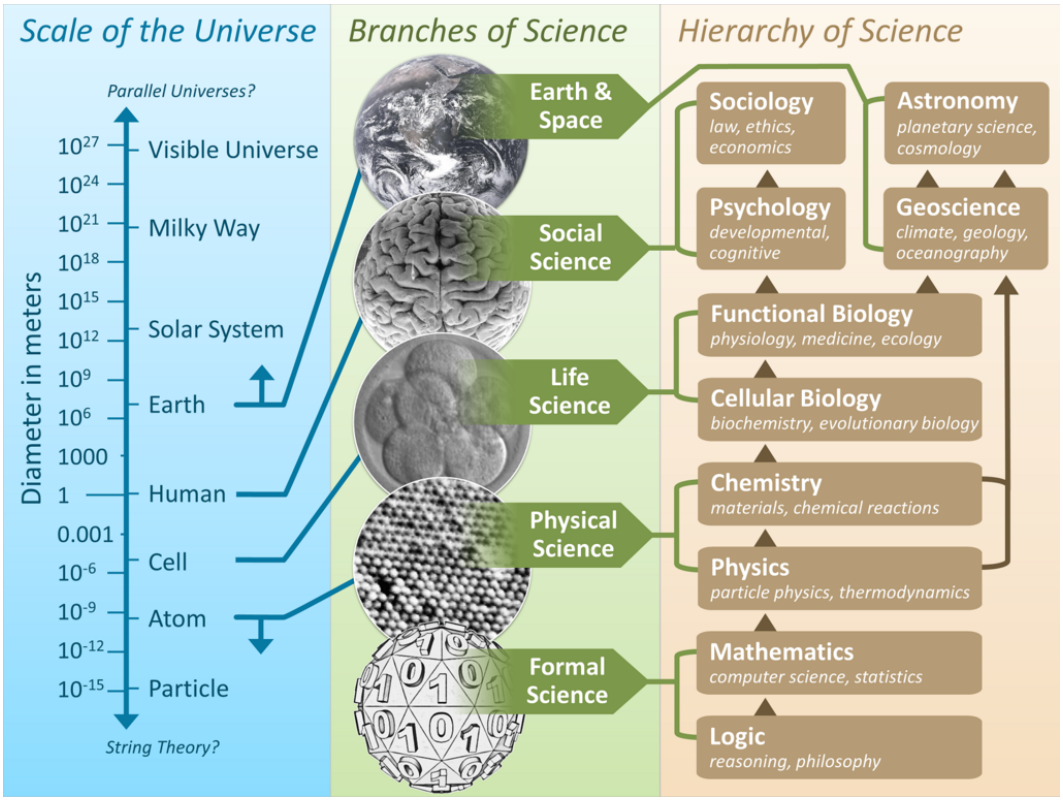

Figure 5.1: The scale of the universe mapped to the branches of science and the hierarchy of science. CC BY-SA 3.0 (2013) Wikimedia Commons.

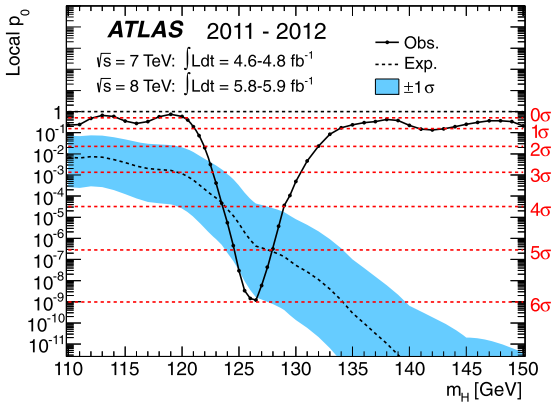

Figure 5.2: The observed (solid) local p_0 as a function of m_H in the low mass range. The dashed curve shows the expected local p_0 under the hypothesis of a SM Higgs boson signal at that mass with its $\pm 1\sigma$ band. The horizontal dashed lines indicate the p-values corresponding to significances of 1 to 6σ (ATLAS Collaboration, 2012).

available pdf figure when producing pdf. [1]

You can refer to labeled figures like this:

```
@fig-ATLAS-local-p0-vs-mH shows the $p_{0}$ value as a function of the reconstructed
Higgs mass from the ATLAS experiment.
```

Figure 5.2 shows the p_0 value as a function of the reconstructed Higgs mass from the ATLAS experiment.

5.2 Tables

The basic syntax for a table is:

```
Table: Approximate number of readout channels per sub-detector in ATLAS for the primary sub-detec

| System                | Subsystem     |  Approx. channels |
|:----------------------|:--------------|------------------:|
| Inner detector        | Pixels        |             80 M  |
|                       | SCT           |            6.3 M  |
|                       | TRT           |            350 k  |
| EM Calorimeter        | LAr barrel    |            110 k  |
|                       | LAr end-cap   |             64 k  |
| Hadronic Calorimeter  | Tile barrel   |            9.8 k  |
|                       | LAr end-cap   |            5.6 k  |
|                       | LAr forward   |            3.5 k  |
| Muon spectrometer     | MDTs          |            350 k  |
|                       | CSCs          |             31 k  |
|                       | RPCs          |            370 k  |
|                       | TGCs          |            320 k  |
| Total                 |               |             88 M  |
```

which produces:

Table 5.1: Approximate number of readout channels per sub-detector in ATLAS for the primary sub-detectors (ignoring the minbias trigger system, luminosity monitors, and DCS sensors) (ATLAS Collaboration, 2008).

System	Subsystem	Approx. channels
Inner detector	Pixels	80 M
	SCT	6.3 M
	TRT	350 k
EM Calorimeter	LAr barrel	110 k
	LAr end-cap	64 k
Hadronic Calorimeter	Tile barrel	9.8 k
	LAr end-cap	5.6 k
	LAr forward	3.5 k
Muon spectrometer	MDTs	350 k
	CSCs	31 k
	RPCs	370 k

[1] This allows us to include vector graphics images in pdf format when producing pdf output, whereas when producing html, we use rasterized formats: jpg or pdf.

System	Subsystem	Approx. channels
	TGCs	320 k
Total		88 M

Refer to tables like this:

`@tbl-atlas-channels shows some cool things too.`

Table 5.1 shows some cool things too.

5.3 Callout blocks

This shows how to write callout blocks.

For example:

> **Pale grey lore**
>
> The lore of our fathers is a fabric of sentences. In our hands it develops and changes, through more or less arbitrary and deliberate revisions and additions of our own, more or less directly occasioned by the continuing stimulation of our sense organs. It is a pale grey lore, black with fact and white with convention. But I have found no substantial reasons for concluding that there are any quite black threads in it, or any white ones. [2]

And collapsed versions:

> **Expand To Learn About Collapse**
>
> This is an example of a 'folded' caution callout that can be expanded by the user. You can use `collapse="true"` to collapse it by default or `collapse="false"` to make a collapsible callout that is expanded by default.
> Lorem ipsum dolor sit amet, duo ut putant verear, nam ut brute utroque. Officiis qualisque conceptam te duo, eu vim soluta numquam, has ut aliquip accusamus. Probo aliquam pri id. Mutat singulis ad vis, eam euismod pertinax an, ea tale volumus vel. At porro soleat est. Debet facilis admodum an sed, at falli feugiat est.

[2] Quine (1960), p. 374.

Chapter 6

Jupyter

This is a subtitle

For a demonstration of a line plot on a polar axis, see Figure 6.1.

```
```{python}
#| label: fig-polar
#| fig-cap: A line plot on a polar axis

import numpy as np
import matplotlib.pyplot as plt

r = np.arange(0, 2, 0.01)
theta = 2 * np.pi * r
fig, ax = plt.subplots(
  subplot_kw = {'projection': 'polar'}
)
ax.plot(theta, r)
ax.set_rticks([0.5, 1, 1.5, 2])
ax.grid(True)
plt.show()
```
```

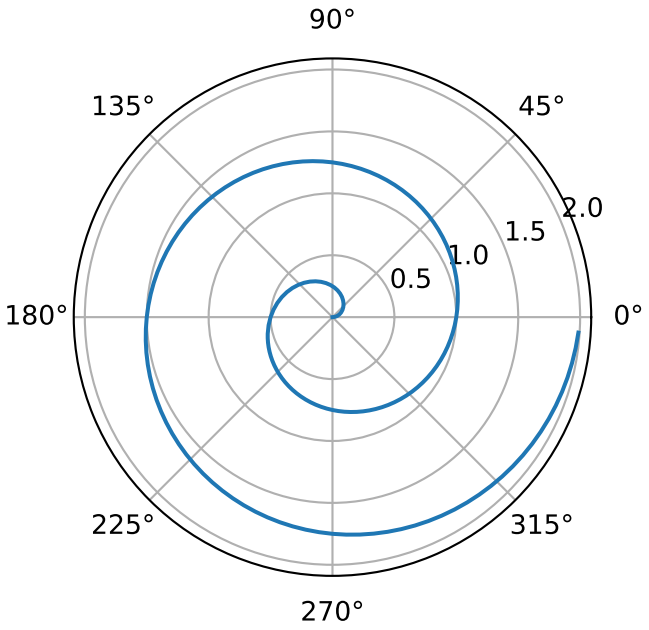

Figure 6.1: A line plot on a polar axis

This is executable code above, actually executed to generate Figure 6.1 on the fly when building the document!

Chapter 7

Conclusion

This project is meant to make writing easier and more productive.

quarto-example is developed by Ryan Reece.

Let me know what you think at github.com/rreece/quarto-example or Twitter @Ryan-DavidReece.

References

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———. (2012). Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC. *Physics Letters B*, *716*, 1–29. https://arxiv.org/abs/1207.7214

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Quine, W. V. O. (1960). Carnap and logical truth. *Synthese*, *12*, 350–374.

———. (1969). Natural kinds. In *Ontological Relativity and Other Essays* (pp. 114–138). Columbia University Press.

van Fraassen, B. (1980). *The Scientific Image*. Oxford University Press.

Appendix A

GitHub Actions

A.1 How to build your document with GitHub Actions

Make sure you have setup Pages for your GitHub repo. In the web UI, got to repo > Settings > Pages, and set

> Build and deployment: GetHubActions

Then create a `.github/workflows/pages.yml` file with:

```
name: "quarto build & gh-pages deploy"

on:
  workflow_dispatch:
  push:
    branches: main

# Sets permissions of the GITHUB_TOKEN to allow deployment to GitHub Pages
permissions:
  contents: read
  pages: write
  id-token: write

jobs:
  build-deploy:
    runs-on: ubuntu-latest
    environment:
      name: github-pages
      url: ${{ steps.deployment.outputs.page_url }}
    steps:
      - name: Check out repository
        uses: actions/checkout@v4

      - name: Set up Quarto
        uses: quarto-dev/quarto-actions/setup@v2

      - name: Quarto install tinytex
```

```
      run: quarto install tinytex

    - name: Install Python and Dependencies
      uses: actions/setup-python@v4
      with:
        python-version: '3.10'
        cache: 'pip'

    - run: pip install jupyter

    - run: pip install -r requirements.txt

    - run: quarto render --to html

    - name: Setup Pages
      uses: actions/configure-pages@v5

    - name: Upload artifact
      uses: actions/upload-pages-artifact@v3
      with:
        # Upload this directory
        path: '_site/'

    - name: Deploy to GitHub Pages
      id: deployment
      uses: actions/deploy-pages@v4
```

See also:

- quarto doc about github-pages