Quarto (Part II): Reproducible research reports

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Open Scholarship Bootcamp

Workshop Overview

- My Quarto story

- How I've used Quarto in my research

- Examples of reproducible research reports
    - Internal facing
    - External facing

- Next steps to "level up" research reports

- Other Quarto applications

My Quarto story

- R background in grad school
- Old workflow: Run analyses in R scripts > save workspace > execute output > copy results into manuscript > re-load workspace each session

R Workspace workflow - Disadvantages

- Re-loading workspace creates dependency issues
- Possibility of human error due to loading workspaces and copying Results manually
- Emphasis on output rather than inputs (code and data)
- Not very transparent or reproducible
- Difficult to handle changes in underlying data
- Difficult to share with collaborators

A better way: Quarto

- With Quarto, you can generate reproducible research reports using a variety of languages (e.g., R, bash, JavaScript, mysql, octave, ruby, sas, stata, fortran, python)

- New workflow: Run analyses in a Quarto qmd document with "fresh" data each session > Render document with dynamically generated Results > Disseminate document, or keep internally for records

R Workspace workflow - Disadvantages	Quarto document workflow – Advantages
• Re-loading workspace creates dependency issues • Possibility of human error due to loading workspaces and copying Results manually • Emphasis on output rather than inputs (code and data) • Not very transparent or reproducible • Difficult to handle changes in underlying data • Difficult to share with collaborators	• Rendering "from the ground up" eliminates dependency issues • Automating input handling and Results generation minimizes human error • Emphasis on "real" inputs (code and data) rather than outputs • Transparent and reproducible • Easily handles changes in underlying data • Easier to share with collaborators

How I've used Quarto in my research

- Two general use cases
  - Inward facing reports (e.g., preprocessing of sensitive data, standalone documents to produce outputs for use in other documents)
  - Outward facing reports (e.g., data manipulation, analysis output, figures)
- Outward facing reports can be disseminated via formal mechanisms (e.g., OSF) or sent to colleagues as standalone documents
  - **Tip:** When disseminating a project, zip the entire directory to ensure file path references work

Quarto Document Demo

Outward facing example adapted from
Quarto project available at:
https://osf.io/tz7nb/files/osfstorage#

Next steps to "level up" research reports

- Consider linking to published Quarto html documents in text
  - **Pro:** Allows you to direct the reader to a given analysis
  - Quarto has many website publishing options, including Quarto Pub, Netlify, and GitHub Pages
    https://quarto.org/docs/publishing/
  - If multiple output styles are specified, all will be available on the published site to download
    e.g., https://quarto-ext.github.io/manuscript-template-jupyter/
  - **Note:** In my experience with the first two options, webpages tend to be slow if the page has many figures, so some optimization may be necessary

Next steps to "level up" research reports

- Use the *renv* R package to create a portable "copy" of R project environments, allowing others who want to render your Quarto project to do so with the same package versions as in the original project
https://rstudio.github.io/renv/articles/renv.html

Next steps to "level up" research reports

- Get fancy with author info with Quarto's YAML schema, and include info such as author email, URL, ORCID, affiliations, etc. https://quarto.org/docs/journals/authors.html
    - Some attributed may not be supported for every html theme or output type
- Try different html output themes! https://quarto.org/docs/output-formats/html-themes.html
    - Quarto has a lot of "out of the box" themes, but custom themes can also be created
- Use reference managers like Zotero to insert citations https://quarto.org/docs/visual-editor/technical.html#inserting-citations

Other Quarto applications

- In addition to creating reproducible research reports as shown here, Quarto can let you create…
  - Interactive dashboards
    https://quarto.org/docs/dashboards/
  - Blog posts
  - Professional and course websites
  - Presentations
    https://quarto.org/docs/presentations/
  - Scholarly manuscripts!
    https://quarto.org/docs/manuscripts/