

Interactive and Reproducible Reports with Quarto

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From Data to Discovery

A Bioinformatician Quarto Journey in Pharma Research

Transforming complex omics analyses
into reproducible, interactive narratives
that empower teams and accelerate
discovery.



Image generated with ideogram

The Crisis

Before Quarto



3 days

to regenerate one report

17 tools

in the pipeline

Zero

reproducibility under audit

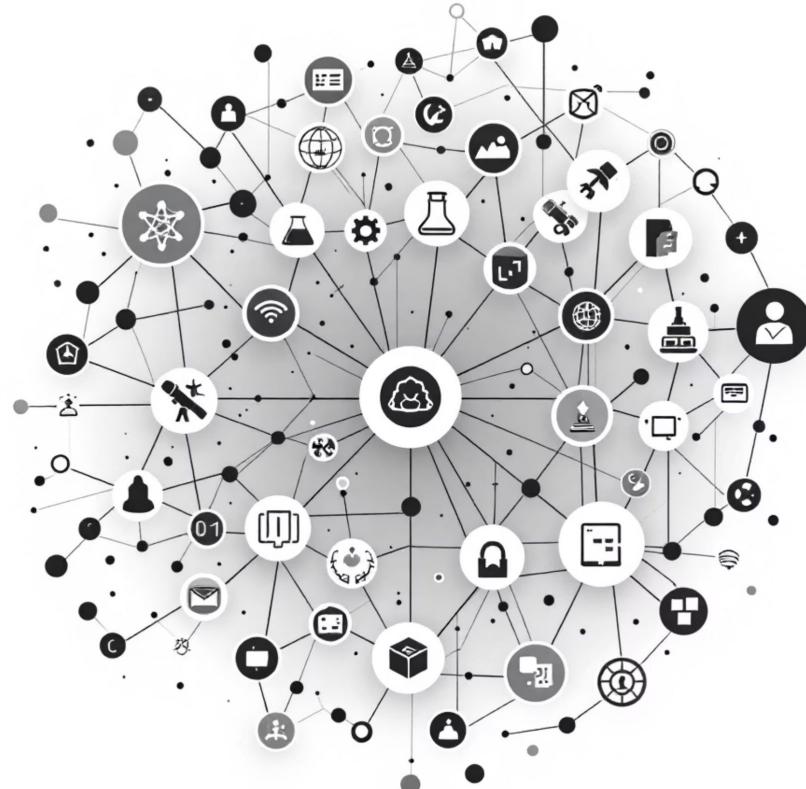


The Challenge: Bridging Tools and Teams

My Background

As a bioinformatician in pharma, I translate complex datasets into actionable insights for drug discovery teams.

- **R** for statistics
- **Python** for machine learning
- **Shiny** for exploration
- Countless file formats 😱 between pipelines



Why Reporting Integration Matters

The Problem

Statistician uses R 

Data scientist uses Python 

Final report? Copy-paste PDF 

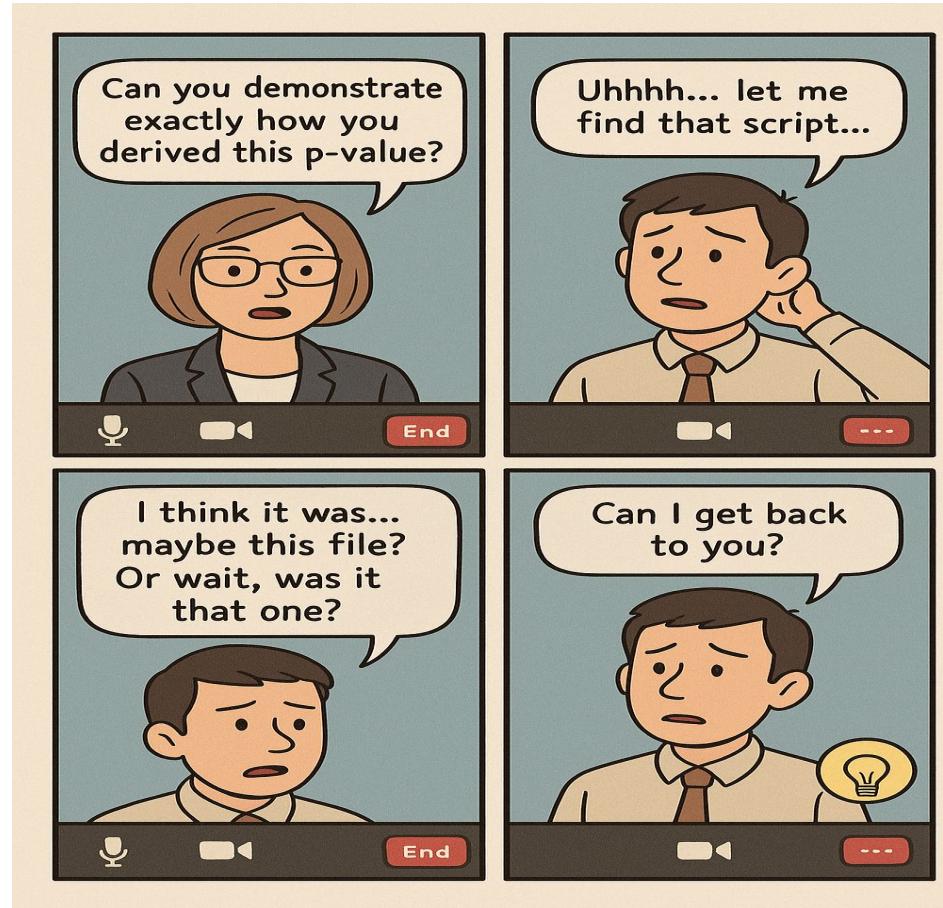
Manual Assembly



Lost Traceability



FDA Nightmares



The Discovery

Quarto: The Unified Framework

The Solution I Didn't Know I Needed

1

Multi-Language Support

Built to work with R, Python, Observable JS, Markdown & LaTeX in **ONE document**

2

Versatile Outputs

Create reproducible reports, dashboards, presentations, and documentation from the same source

3

Executable Documents

Every result originates from **real code**, ensuring scientific integrity throughout the study lifecycle

```
surroundingTemperature = 28F;

surfaceArea;
heatingFactor = 10f;
coolingFactor = 1f;
rayAmount = 3000;

t VisualTemperature;

start()

.GetComponent<Renderer>().material.color = VisualTemperature.Evaluate();

controller = GameObject.FindGameObjectWithTag("GameController");
e = GameController.GetComponent<gameController>();
e.StartingTemperature;
gTemperature = GameController.GetComponent<gameController>().StartingTemperature;

the Amount of rays emmitet to calculate the heating factor
= GameObject.Find("Rayemmitter").GetComponent<Raycast>().RayAmount;
Amount: " + rayAmount);

Update()

);
erature();

coloring()

t.GetComponent<Renderer>().material.color = VisualTemperature.Evaluate(te

adaptTemperature()

Tempdif = temperature - surroundingTemperature;
re = Tempdif * coolingFactor * Time.deltaTime;
heatingUp()

erature < maxTemperature)

erature == RayCycle.RaytimeMultiplier * heatingFactor / surfaceArea / rayA
```

The Implementation

My First Quarto Win 🎉

COVID-19 Metabolomics Analysis

Challenge: **847** features, 3 visualization types, 2 programming languages

Old way:

2-3 days per report 😞

Quarto way:

30 minutes ⚡

Building Dynamic Metabolomics Workflows

Metabolomics = Thousands of chemical features.

Each needs QC + Statistics + Interpretation

Traditional static reports? **✗ Can't handle exploration**



Raw Data Ingestion

Mass spec peaks, retention times, sample metadata from multiple instruments



R-Based Processing

Quality filtering, normalization, batch correction, and statistical modeling



Shiny Dashboards

Interactive PCA plots, pathway enrichment, and feature-level drill-downs



The Quarto Solution

- Raw data → R processing → Shiny dashboards
- All in **ONE** Quarto document
- Parameterized for batch processing



Discovery - Quarto Can Bridge This Gap

I discovered Quarto could do what I needed:

- **Multi-language:** My metabolomics pipeline used R for stats, Python for ML feature selection
- **Interactive in HTML**
- **Multiple outputs:** Same source → HTML (interactive), PDF (archives), Word (reports)
- **Reproducible:** All data embedded, parameters documented

My first success:

Our team realized scientists needed control over their reports.

So we built this:  Converted metabolomics report from static R Markdown to interactive Quarto.



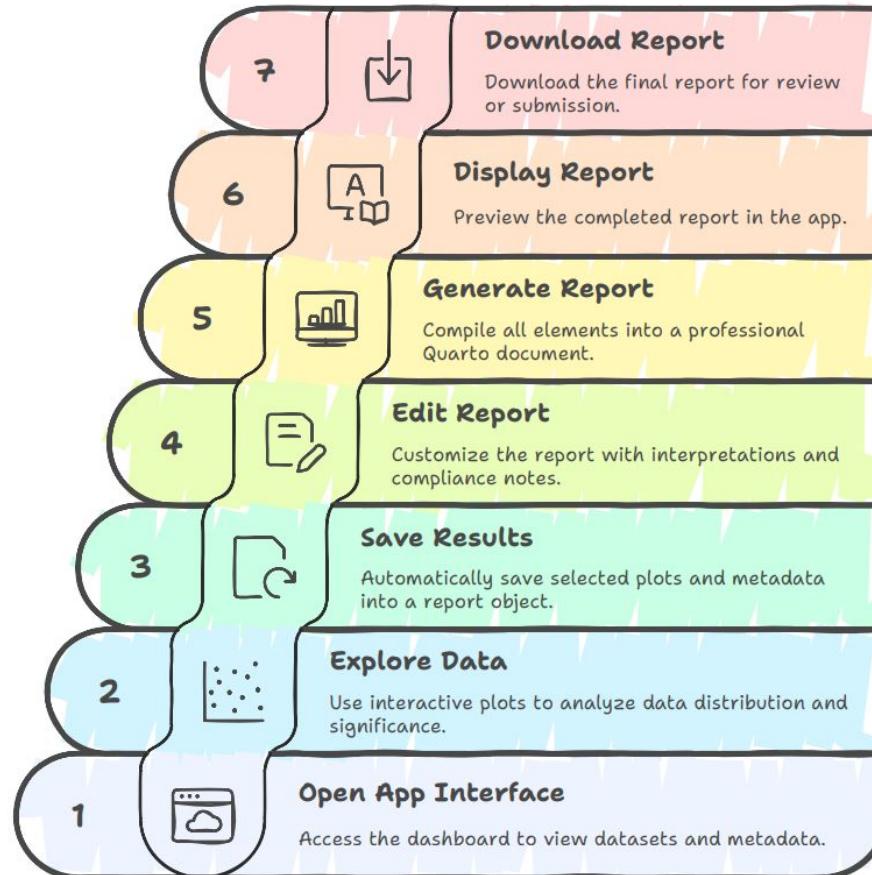
Discovery - Quarto Can Bridge This Gap (Feature Users Actually Love ❤)

- 👉 User views table/plot/parameter
- 👉 Clicks "**Add to Report**" button
- 👉 Everything queues in a .qmd file
- 👉 Adds their logo and details
- 👉 Clicks "Preview" → sees the report
- 👉 Clicks "**Generate Report**" → Done!

Most used feature:

Scientists became report creators.

Building Dynamic Metabolomics Workflows



Real Use Case- Metabolomics Analysis Report

Context:

- Untargeted metabolomics for COVID-19 patients vs healthy controls
- Plots: PCA, ANOVA, Heatmaps etc.
- Users: Biologists and pharmacologists

My Demo Quarto Implementation: [Link](#)



What Actually Changed?



Time Savings

Reports are generated 70% faster.

Reproducibility

Provides 100% audit-ready traceability.

Collaboration

Scientists can explore data independently.

Trust

Regulators can see our methods clearly.

BEYOND STATIC



Closeread & Observable JS: Interactive Storytelling in Quarto

Image generated with ideogram

OBSERVABLE JS - THE PROTOTYPE MAKER



Transform Static Reports into Discovery Tools

Need interactive viz for stakeholders?

Building full Shiny app takes days... 😞

Observable JS = Prototype in minutes! ⚡

✨ Perfect for "Can we see this colored by age?" requests

✨ If they love it → Then build the full app

✨ Think of it as your interactive **sketch pad**

Observable Demo Link: <https://quarto.org/docs/interactive/ojs/>

No Backend Required

Interactive features run entirely in the browser without Shiny apps or server infrastructure

Lightweight Exploration

Perfect for management reviews and scientific discussions where stakeholders need to investigate data themselves

Enhanced Understanding

Users can dynamically filter, zoom, and explore alternative scenarios in real-time

Closeread: Scrollytelling for Quarto

Make Your Reports Tell Stories

Traditional reports = Boring text → Figure 3 →

More text 😴

Closeread = Scroll through narrative + figures

transform live ✨

👉 Readers **stay engaged** (not checking email!)

👉 Data visualization guides the story

👉 Perfect for executive summaries

👉 Think NYT-style data journalism for pharma

"Your reports become experiences, not documents."



Closeread: Scrollytelling for Quarto

Live Examples to Explore

Example gallery: <https://closeread.dev/gallery/>

Notable Examples:

- 1.) Learn Closeread Website:

<https://www.gastonsanchez.com/learn-closeread/>

- 2.) Pictures of Pensions:

<https://calcwithdec.dev/posts/pictures-pensions/>

START SMALL WIN BIG

Your homework this week:

- 1 Pick **ONE** report you dread updating (You know which one 😅)
- 2 Convert it to Quarto (block some time)
- 3 Add **ONE** interactive element
- 4 Share with one colleague
- 5 Wait for the "**Whoa, how'd you do that?!**"

Supporting Sources

Quarto Documentation

www.quarto.org

PMC (2017)

"The reproducibility challenge in modern research."

Observable JS

<http://quarto.org/docs/interactive/ojs/>

Metaboanalyst

<https://www.metaboanalyst.ca/>

Napkin AI

<http://napkin.ai/>

CloseRead

<https://closeread.dev/>

Learn More...