1 Academic Paper Template - Setup Guide

> **Note:** This file documents the template setup and installation. For research-specific information about a project using this template, see `README.md`.

A focused, user-friendly template for reproducible research using R with Quarto. This template provides a clean starting point for academic papers with strong reproducibility guarantees through R version pinning, dependency locking, and automated workflows.

1.1 Features

- **Simple & Focused**: R-only template (no multi-language complexity)
- **Reproducible**: R version pinning (`.Rversion`) + dependency locking (`renv`)
- **Well-documented**: Includes reproducibility guide and data documentation templates
- **CI/CD Ready**: Automated rendering with package caching (5-10x speedup)
- **Optional Extras**: Pre-commit hooks, Docker support, spell checking
- **Generic Template**: ~100 line starter (vs 435+ line PLOS example)
- **sessionInfo() Included**: Automatic computational environment documentation

1.2 Directory Structure

```
paper-template/
   .github/workflows/    # CI/CD pipelines
   data/
       raw/              # Original, immutable data
       processed/        # Cleaned and processed data (gitignored)
   scripts/
       R/                # R analysis scripts
       julia/            # Julia analysis scripts
   output/
       figures/          # Generated figures (gitignored)
       tables/           # Generated tables (gitignored)
   paper/
       index.qmd         # Main paper document
       index.pdf         # Rendered PDF (gitignored)
       references.bib    # Bibliography
       .wordlist.txt     # Custom spelling dictionary
   _quarto.yml           # Quarto configuration
   Project.toml          # Julia project dependencies
   renv.lock             # R dependencies lockfile
   Makefile              # Build automation
   CLAUDE.md             # AI assistant guidance
   README.md             # This file
```

1.3 Do You Need This Template?

1.3.1 Use This Template If:

- Writing an academic paper with R code/analysis

- Need version control and reproducibility
- Want automated PDF rendering
- Working with collaborators

1.3.2 Don't Use This If:

- Simple report (use basic Quarto project)
- No R code needed (use LaTeX or Markdown directly)
- Just exploring R (too much infrastructure)

1.3.3 Alternatives:

- **Journal-specific formats**: quarto-journals
- **R package for articles**: rticles
- **Simple Quarto project**: `quarto create project default my-paper`

1.4 Prerequisites

1.4.1 Required (Core Functionality)

- R 4.5.1 (or version in `.Rversion`)
- Quarto (latest version)
- LaTeX (TeXLive or MacTeX)

1.4.2 Optional (Enhanced Features)

- GNU Make - build automation
- Docker - containerized reproducibility
- pre-commit - code quality hooks (copy from `.example`)
- aspell - spell checking (CI only)

1.4.3 Installation Commands

macOS (using Homebrew):

```
brew install r quarto
brew install --cask mactex  # LaTeX distribution
```

Ubuntu/Debian:

```
sudo apt-get update
sudo apt-get install r-base quarto-cli texlive-full
```

1.5 Getting Started

1.5.1 1. Clone or Use This Template

Click "Use this template" on GitHub or clone directly:

```
git clone https://github.com/yourusername/paper-template.git my-research-paper
cd my-research-paper
```

1.5.2 2. Install R Dependencies

```
Rscript -e "install.packages('renv')"
Rscript -e "renv::restore()"
```

1.5.3 3. Start Writing

Edit `paper/index.qmd` to write your paper. The template includes example sections, code chunks, and citations to guide you.

1.6 Quick Start (5 Minutes)

For the impatient:

```
# Clone and setup
git clone https://github.com/yourusername/paper-template.git my-paper
cd my-paper

# Install R packages
Rscript -e "install.packages('renv'); renv::restore()"

# Render paper
quarto render paper/index.qmd

# View output
open paper/index.pdf  # macOS
# or xdg-open paper/index.pdf  # Linux
```

Done! Your PDF is in `paper/index.pdf`.

1.7 Documentation

This repository includes `CLAUDE.md`, which provides comprehensive guidance for AI assistants (like Claude Code) working with this codebase. It contains:

- High-level architecture and data flow
- Common development commands
- Configuration details and conventions
- CI/CD workflow patterns
- Important non-obvious implementation details

Human developers may also find this useful for understanding the project structure and workflows.

1.8 Usage

1.8.1 Building the Paper

Render the paper to PDF:

```
quarto render paper/index.qmd
```

The rendered PDF will be `paper/index.pdf` (same directory as the source file).

1.8.2 Running Analyses

1. Place raw data in `data/raw/`
2. Create analysis scripts in `scripts/R/` or `scripts/julia/`
3. Save processed data to `data/processed/`
4. Save figures to `output/figures/`
5. Save tables to `output/tables/`

1.8.3 Using R and Julia Code in Quarto

R code chunk:

```
#| label: fig-example
#| fig-cap: "Example figure"

library(ggplot2)
ggplot(data, aes(x, y)) + geom_point()
```

Julia code chunk:

```
#| label: fig-example-julia
#| fig-cap: "Julia figure"

using Plots
plot(x, y)
```

1.8.4 Managing Dependencies

R dependencies (using renv):

```
# Install a new package
install.packages("package_name")

# Update renv.lock
renv::snapshot()

# Restore packages
renv::restore()
```

1.8.5 Using Make (Optional)

The template includes a basic Makefile with examples. Customize it for your workflow:

```
make        # Show available targets
make help   # Show detailed help
make clean  # Remove generated files (.quarto/, paper/*.pdf, paper/*.tex)
```

See the Makefile for example recipes you can uncomment or customize.

1.9 Bibliography Management

Add references to `paper/references.bib` in BibTeX format:

```bibtex
@article{author2024,
  title = {Article Title},
  author = {Author, Name},
  year = {2024},
  journal = {Journal Name},
  volume = {1},
  pages = {1--10}
}
```

Cite in text: `[@author2024]` or `@author2024`

1.10 Customization

1.10.1 Changing Citation Style

Edit `_quarto.yml` to use a different CSL style:

```yaml
csl: https://www.zotero.org/styles/nature
```

Browse styles at Zotero Style Repository

1.10.2 Changing PDF Formatting

Modify the `format.pdf` section in `_quarto.yml`:

```yaml
format:
  pdf:
    documentclass: article
    fontsize: 12pt
    geometry:
      - margin=1.5in
```

1.10.3 Adding Custom LaTeX Packages

Edit the `include-in-header` section in `_quarto.yml`.

1.11 CI/CD

This template includes GitHub Actions workflows:

1.11.1 render.yml

Automatically renders the paper when you push changes to:

- Paper content (`paper/`)
- Analysis scripts (`scripts/`)
- Data files (`data/`)
- Configuration (`_quarto.yml`)
- Dependencies (`renv.lock`, `.Rprofile`)

Performance optimizations:

- R package caching via `r-lib/actions/setup-renv@v2` (5-10x speedup after first run)
- R version pinning (4.5.1) for reproducibility
- Complete LaTeX support including `texlive-bibtex-extra` for bibliographies

Rendered PDFs are available as artifacts in GitHub Actions. The workflow typically takes 2-3 minutes after caching is established (vs. 10-20 minutes without caching).

1.11.2 checks.yml

Runs spell checking with aspell using the custom dictionary in `paper/.wordlist.txt`. Generates warnings but doesn't fail the build, with errors saved as artifacts.

1.12 Docker Support (Optional)

For extreme reproducibility, use Docker:

```
# Build image
docker build -t my-paper .

# Render paper in container
docker run --rm -v $(pwd):/project my-paper

# Or run interactively
docker run --rm -it -v $(pwd):/project my-paper bash
```

The Docker image guarantees:

- Exact R version (4.5.1)
- Exact system dependencies
- Consistent LaTeX environment
- Same results across all systems

See `Dockerfile` for details.

1.13 Reproducibility

This template emphasizes computational reproducibility:

- **R Version Pinning**: `.Rversion` file + automatic checking in `.Rprofile`
- **Package Locking**: `renv.lock` with exact versions
- **sessionInfo()**: Automatically included in paper appendix
- **Data Documentation**: Template in `data/README.md`
- **Best Practices Guide**: See `REPRODUCIBILITY.md` for detailed guidance

Quick reproducibility check:

```
# Verify R version matches
cat .Rversion

# Check package synchronization
Rscript -e "renv::status()"
```

```
# Test clean render
make clean && quarto render paper/index.qmd
```

1.14 Contributing

When using this template:

1. Create a new branch for your work
2. Make your changes
3. Pre-commit hooks will automatically format your code
4. Push and create a pull request
5. CI/CD will render the paper and run checks

1.15 License

This template is licensed under the MIT License - see the LICENSE file for details.

1.16 Troubleshooting

1.16.1 Quarto not rendering

Ensure all dependencies are installed:

```
quarto check install
```

1.16.2 R package installation fails

Try updating renv:

```
Rscript -e "install.packages('renv', repos='https://cloud.r-project.org')"
Rscript -e "renv::restore()"
```

1.16.3 Julia packages not found

Instantiate the Julia environment:

```
julia --project=. -e 'using Pkg; Pkg.instantiate()'
```

1.16.4 LaTeX errors

Install the full TeXLive distribution:

- macOS: `brew install --cask mactex`
- Ubuntu: `sudo apt-get install texlive-full`

1.17 Resources

- Quarto Documentation
- R for Data Science
- Julia Documentation
- BibTeX Guide
- Pre-commit Hooks

1.18 Citation

If you use this template, please consider citing it:

```
@misc{papertemplate2025,
  title = {Academic Paper Template},
  author = {Azam, James},
  year = {2025},
  url = {https://github.com/yourusername/paper-template}
}
```