Organize your research and teaching material with Git (and R, or whatever floats your boat)

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First, let's get *sooo* meta

About the slides

🌐 Will be made available on ocbe-uio/public-slides

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About this presentation

⁉️ Feel free to interrupt me with questions or comments at any time!

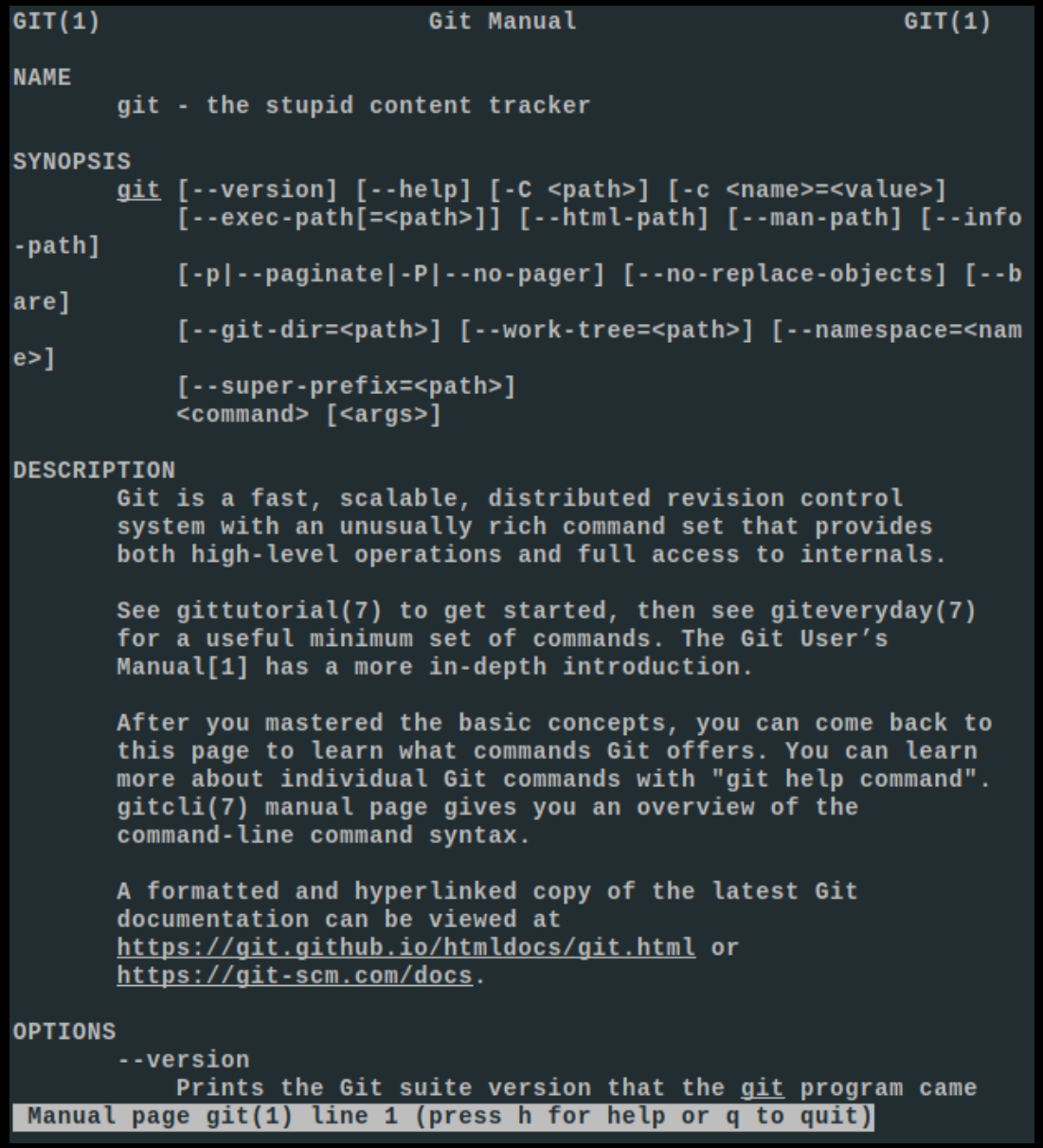
Remember Zoom's Chat is bad at letting the presenter know if someone asked them something.

💬 I might post some stuff on Chat (mainly links)

💻 If you haven't installed Git on your computer yet, this might be your last chance:
https://git-scm.com/download/

What Git is and what it isn't

"The Merriam-Webster dictionary defines 'git' as..."



Git is

- A version-control system
- Created in 2005 by Linus Torvalds 🇫🇮 (of Linux fame)
- Maintained by Junio Hamano and others
- At the base of a reproducible workflow (Peikert and Brandmaier, 2020)
  - Rmarkdown ➡️ **Git** ➡️ Make ➡️ Docker
- Super good at handling pure-text files
  - R, Python, MATLAB, Stata files (data analysis scripts, packages, etc.)
  - Whatever you use to write documents (especially LaTeX and Markdown)
    - notes
    - papers
    - presentations

Git is *not*

- Just for software developers
- A good place to dump
  - Large files (e.g. data)
  - Files that are generated from other files (e.g. a .pdf from a .tex or .rmd file)
  - GitHub may be an exception when used as a file-hosting page
- GitHub
  - Distributed workflows *are* a Git feature
  - ...albeit a secondary one. Git's main job is version control

Installing Git (last chance, for real this time)

- General instructions: https://git-scm.com/download/
- 🐧 Linux
  - It usually comes pre-installed (verify by running `git --version`)
  - Otherwise, use your distro's package manager (apt, dnf, pacman...)
- macOS
  - Open a terminal and type `git --version`
  - Plan B: install Xcode Command Line Tools
- Windows
  - Download and execute the file on https://git-scm.com/download/win

Git is primarily text-based software (just like R!)

😃 Perfect if you're looking for speed and/or use your keyboard a lot

😡 Not great if you like to use your mouse and/or don't care about speed

...but even if you identify with latter category, you may love using Git!

Graphical interfaces to Git

- RStudio's built-in GUI
  - 😃 Convenient if you only use RStudio
  - 😡 Very limited and freeze-prone
- VSCode's built-in GUI + Git Graph extension (+ R)
  - 😃 Great if you work in many languages (R, C++, Markdown, TEX) and/or *GitHub Codespaces*
  - 😡 Bad handling of pulls and merge conflicts (without further extending)

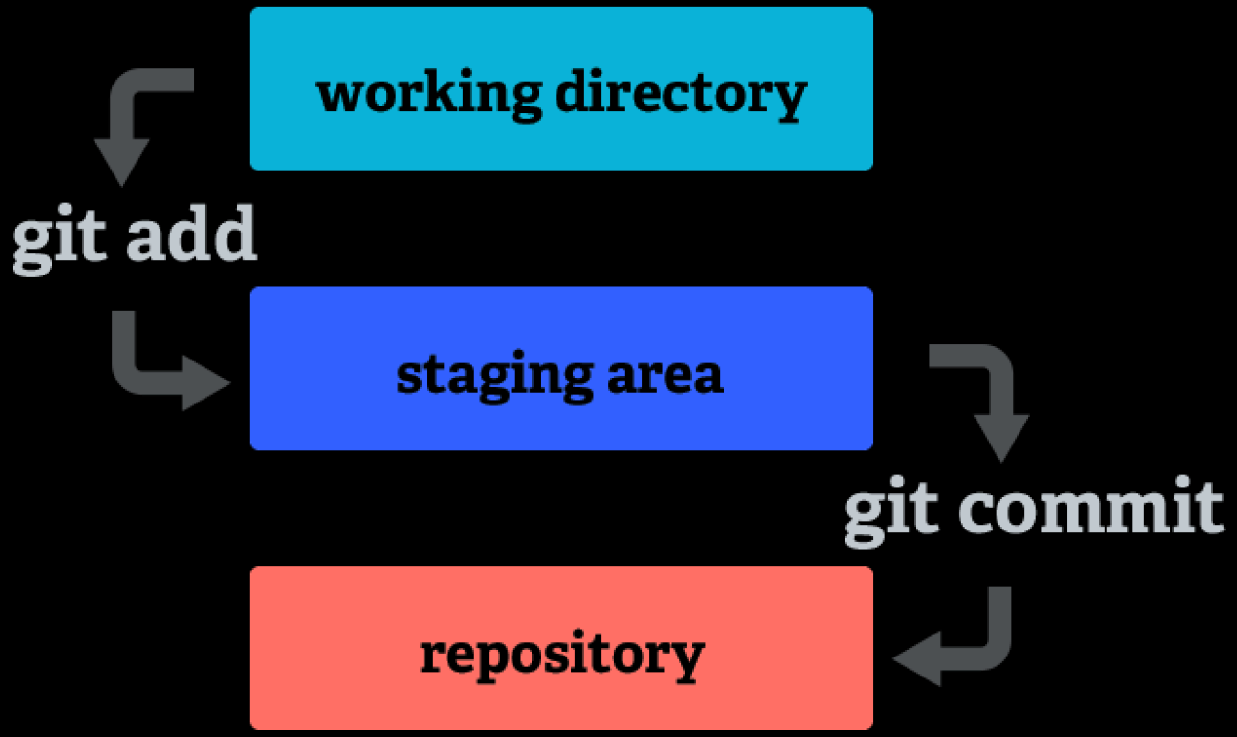
- GitKraken
  - 😃 Very robust and featureful
  - 😡 Adds another app to your workflow
  - ☑️ **Chosen tool for this talk (+ terminal)!**

Git lingo, simplified

1. **Repo(sitory)**: A collection of past and present versions of your working directory
    - Locally, a hidden `.git` folder in your working dir
    - *May* also be hosted online (e.g. GitHub, GitLab, Bitbucket)
2. **Commit**: One particular version/snapshot of your working directory
    - A repo is, at the top level, a collection of commits
    - Basic workflow behavior
        - Save (<kbd>Ctrl</kbd>+<kbd>S</kbd>) as much as you want between commits
        - Saves are ignored, only commits matter (unlike Dropbox)
3. **Hash**: a 40-character unique alfanumeric identifier of a commit
    - a4508a3d857eg282aced33ba75d18ede34fde99f
    - a4508a3d857eg282aced33ba75d18ede34fde99f
    - Don't worry, you won't need to know them by heart

Where on Git are your files?

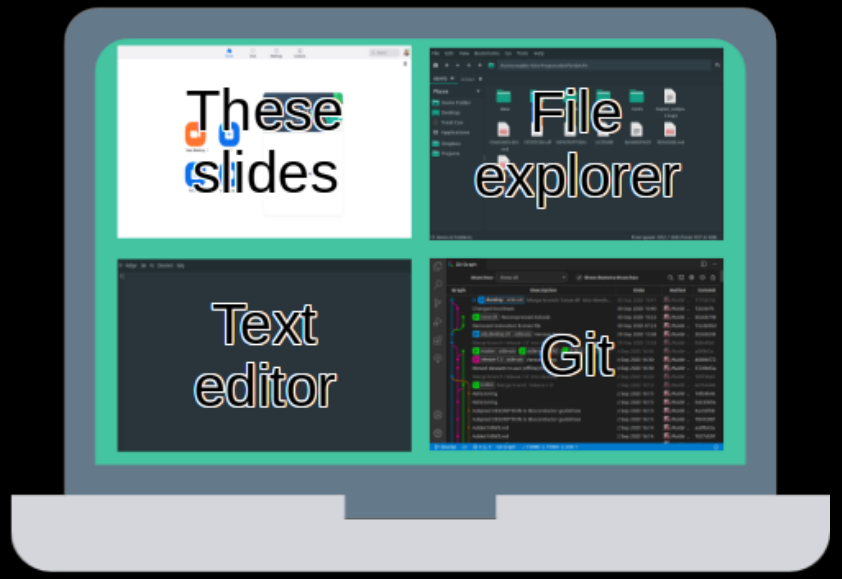
1. **Working directory**: you see the files in your file explorer
2. **Staging area**: a temporary area where files are gathered and prepared for a commit
3. **Repository**: after the commit, the files are moved from the staging into the repository for permanent storage



One last thing before we start working

Optimize your workspace to follow this workshop

- **Slides** to follow the workshop instructions
- **Chat/notepad** to socialize and take notes
- **File explorer** to see what's going on with your files
- **Git**, which is the whole point of the workshop



👍 No overlapping window mess
👍 Front-row seats to all the action

Basic Git Commands

(yes, we're *finally* starting for good 🎉)

Configuring your user info

```
git config --global user.name "(name)"
git config --global user.email "(e-mail)" # GitHub user? use your GH e-mail
```

Initializing a repository

```
git init # within working directory
```

Doing some actual work

1. First do some science

2. Then commit—i.e. register on Git—a version of your science

```
git status
git add (file)
git commit -m "(message)"
git log
```

3. Go make more science

4. Realize what you have done

```
git status
git diff (file)
```

Taking it up a notch

Undoing changes

```
git reset (file)   # unstages file
git reset (commit) # undoes all commits thereafter, but keep the changes
git reset --hard (commit) # go nuclear (i.e., lose changes after commit)
```

Peeking at a file's history of changes (i.e., patches)

```
git log -p (file)
git show (commit):(file)  # commit or tag!
git show (commit):(file) > (file).copy  # retrieve the copy from hash
```

Tagging

```
git tag (tagname) (commit)
```

Git's greatest strength

(in my opinion)

Creating parallel versions of your files

- Think of your files as leaves on the branch of a tree (your repo)
- You can have different versions of the same file on different branches! 😮
- Expect your branches to merge back with the trunk
- Parallel versions: different branches
    i. Files start the same
    ii. Differ after some commits
    iii. Goal: merge back with trunk

Create a branch

```
git branch <branch name>
```

Check out—i.e., switch to—a branch

```
git checkout <branch name>
```

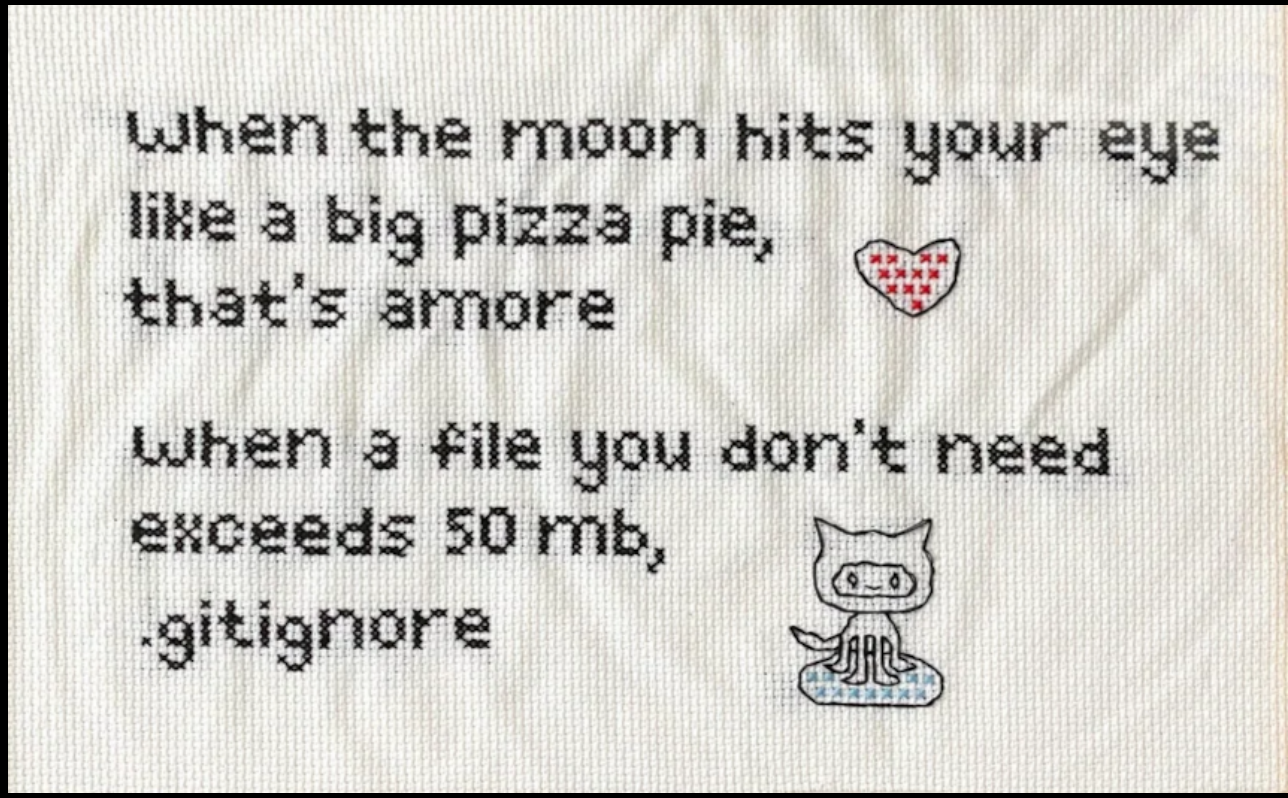
Merging back with main (master) branch

```
git checkout master
git merge (branch name) # LPT: --no-ff
git branch -d (branch name)  # recommended cleanup
```

Ignoring files

- Datasets
- References/Literature
- Files generated from other files
- Files that will never change

Create a file called `.gitignore` and chuck all that in it.



Example:

```
~/UiO/Projects/contingencytables cat .gitignore
# History files
.Rhistory
.Rapp.history

# Session Data files
.RData

# User-specific files
.Ruserdata

# Example code in package build process
*-Ex.R

# Output files from R CMD build
/*.tar.gz

# Output files from R CMD check
/*.Rcheck/

# RStudio files
.Rproj.user/

# produced vignettes
vignettes/*.html
vignettes/*.pdf

# OAuth2 token, see https://github.com/hadley/httr/releases/tag/v0.3
.httr-oauth

# knitr and R markdown default cache directories
*_cache/
/cache/

# Temporary files created by R markdown
*.utf8.md
*.knit.md

# R Environment Variables
.Renviron
```

Lightning round?

Stashing and popping (one "O", two "P"s)

```
git stash  # 1. Sweep a temporary version under the rug
git pop    # 2. Retrieve it when you switch back
```

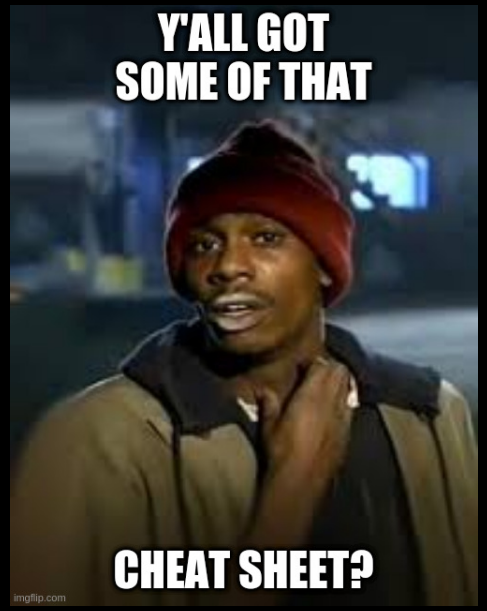
Useful if Git refuses to change branches!

Working with remote repositories (e.g. GitHub, GitLab)

```
git clone  # 1. create a local copy of the remote repo
git pull   # 1. (if previously cloned, copy latest version of remote)
           # 2. do your sciency thing
git push   # 3. Copy your local branch to remote
```

Supplementary material

- Your terminal
  - `git --help`
  - `man git`
- (Very well-curated) official documentation: https://git-scm.com/doc



- Yes.

Software used in this presentation

- Marp: Markdown Presentation Ecosystem
  https://marp.app/
- VSCodium: compiled, telemetry-free VSCode
  https://vscodium.com/
- GitKraken: Free Git GUI for Windows, Mac, Linux
  https://www.gitkraken.com/

Reference

📄 Peikert, A., & Brandmaier, A. M. (2019). A Reproducible Data Analysis Workflow with R Markdown, Git, Make, and Docker (p. 45). p. 45. DOI:10.31234/osf.io/8xzqy

Credits

OS icons made by Freepik from www.flaticon.com

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