

Introduction to Git and Version Control

2020-11-18

Introduction to Git and Version Control
Lecture 1: Git ready!

Christopher Buckley

Okinawa Institute of Science and Technology

November 19, 2020

Slides by James Schloss, 2016

Overview



Introduction to Git and Version Control

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└ Overview

- Why Git? I'll tell you what my motivations are, but what are your motivations for being here?

1 Why Git?

2 What is Git

3 Terminal Talk

4 Git basics

- Local code
- Nonlocal repos / github

5 Working alone

1 Why Git?
2 What is Git
3 Terminal Talk
4 Git basics
• Local code
• Nonlocal repos / github
5 Working alone

- Version control
- Easily compare and merge changes between any version
- Organize your work items



Why Git?

- Version control
- Easily compare and merge changes between any version
- Organize your work items



Before

After

Introduction to Git and Version Control

└ Why Git?

└ Why Git?

Imagine I asked you to remove the red sharpie marker from the left hand side?

- Difficulty finding it
- Could dive right in, but might get poked by lot of sharp things on the way in
- Or you could dump everything out and start all over

Why Git?



A photograph showing a massive, sprawling pile of discarded wooden chairs stacked between two buildings. A person is visible at the bottom left, looking up at the sheer volume of chairs, which emphasizes the scale of the waste.



REPLAY

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└ Why Git?

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└ Why Git?

Imagine I asked you to remove this chair. What difficulties would you face?

- How to access it safely
- Can't remove it without fearing everything will fall

Why Git?



Christopher Buckley (OIST)

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Traditional vs. Git Versioning

- What changed when
- Not limited to file name length to inform user of changes

```
christopher@christopher-ThinkPad-W541:~/git/mythesis$ ls -gtr
total 4
-rw-rw-r-- 1 christopher 51 Nov 17 18:22 thesis
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_v1
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_v2
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_v3
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_v4
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_final
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_final1
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_final2
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_final3
-rw-rw-r-- 1 christopher 0 Nov 18 12:07 thesis_finalfinal
christopher@christopher-ThinkPad-W541:~/git/mythesis$
```

```
christopher@christopher-ThinkPad-W541:~/git/mythesis$ git log --reverse
commit 839a47e257310df071ac8290cdefc04a60b86944 (master)
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:14:52 2020 +0900

    Added empty thesis template

commit e017bf79743fa7724d4c35f430e1e78064823e1a
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:19:14 2020 +0900

    Added initial title

commit 750455880517cbdd5db25054e0e9815ed67da185
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:20:38 2020 +0900

    Added initial summary section

commit a83135a00c134372a7973a879e2431008b5a466
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:21:09 2020 +0900

    Added initial bulk of main body section

commit 98c17b7472ef14bd75804d4ddb990de92f211ba
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:21:31 2020 +0900

    Added initial conclusions

commit aa3034ff24084d3f95e37ae222f265da07d3590
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:22:03 2020 +0900

    Changed conclusions to reflect new findings on Mars

commit d918fbfe43cf474a34c6cde86ccf845f63e9cb4 (HEAD -> new_versioning)
Author: Christopher Buckley <15166572+topherbuckley@users.noreply.github.com>
Date: Tue Nov 17 18:22:31 2020 +0900

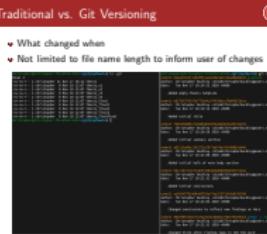
    Changed title after finding typo in teh the word
```

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└ What is Git

└ Traditional vs. Git Versioning

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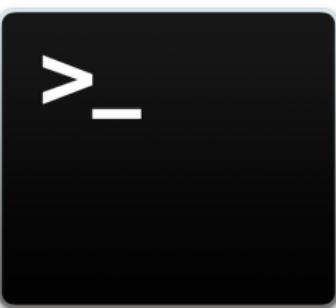


Traditional vs. Git Versioning

- What changed when
- Not limited to file name length to inform user of changes



- There are multiple GUIs available for Git, such as one from GitHub called the **GitHub Desktop**. We will not be using this for religious perfectly scientific reasons.
- These reasons primarily revolve around flexibility and improved understanding of the Git tools.
- Everything we do will be usable on Deigo.
- The **Pro Git** book is available online at git-scm.com/book
- There is a cheatsheet for Git available here: <https://www.git-tower.com/learn/cheatsheets/git>



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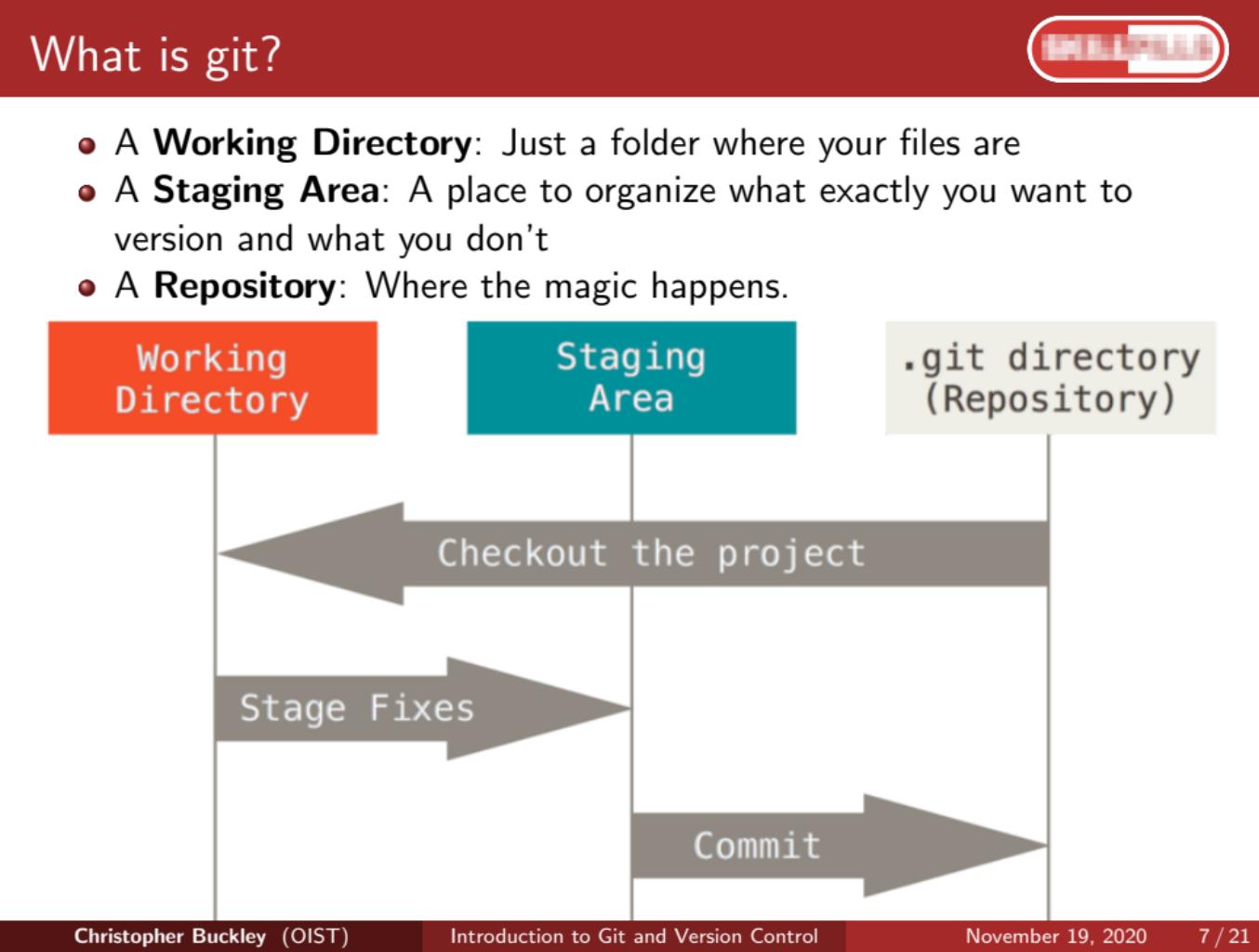
└ Terminal Talk

└ Terminal Talk

- I personally struggled with the terminal interface at first because most of the man pages use so much vocab I don't know to explain terms I don't know. Hopefully by the end of this mini-course you'll have the basic vocab down so you can help yourselves more efficiently going forward.

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Introduction to Git and Version Control
 └ Terminal Talk
 └ What is git?

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The diagram illustrates the Git workflow with three main components: Working Directory, Staging Area, and .git directory (Repository). It shows the flow of data and commands between them:

- Working Directory** (red box): Contains the files of the project.
- Staging Area** (blue box): A temporary storage area where changes are organized before being committed.
- .git directory (Repository)** (gray box): Stores the history of changes and manages the project's version control.

Arrows indicate the process flow:

- A double-headed arrow connects the Working Directory and the Staging Area.
- An arrow points from the Working Directory to the Staging Area, labeled "Checkout the project".
- An arrow points from the Staging Area to the .git directory, labeled "Stage Fixes".
- An arrow points from the .git directory back to the Working Directory, labeled "Commit".

Text at the top right defines the components:

- A **Working Directory**: Just a folder where your files are
- A **Staging Area**: A place to organize what exactly you want to version and what you don't
- A **Repository**: Where the magic happens.

This chart might not make much sense now, but I hope it will before the end of these slides

I want to first focus on the bottom two arrows here. These are the tools we use to save exactly what changed between versions of our project.

Commits

- Conceptually similar to "versions"
- The more effort you put into crafting these using the **staging area** the more helpful they are in the future.

COMMENT	DATE
CREATED MAIN LOOP & TIMING CONTROL	14 HOURS AGO
ENABLED CONFIG FILE PARSING	9 HOURS AGO
MISC BUGFIxes	5 HOURS AGO
CODE ADDITIONS/EDITS	4 HOURS AGO
MORE CODE	4 HOURS AGO
HERE HAVE CODE	4 HOURS AGO
AAAAAAA	3 HOURS AGO
ADKFJSLKDFJSOKLFJ	3 HOURS AGO
MY HANDS ARE TYPING WORDS	2 HOURS AGO
HAAAAAAAAANDS	2 HOURS AGO

AS A PROJECT DRAGS ON, MY GIT COMMIT MESSAGES GET LESS AND LESS INFORMATIVE.

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└ Terminal Talk

└ Commits

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Show lego photos now

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AAAAAAA	3 HOURS AGO	ADKFJSLKDFJSOKLFJ
ADKFJSLKDFJSOKLFJ	3 HOURS AGO	MY HANDS ARE TYPING WORDS
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HAAAAAAAAANDS	2 HOURS AGO	

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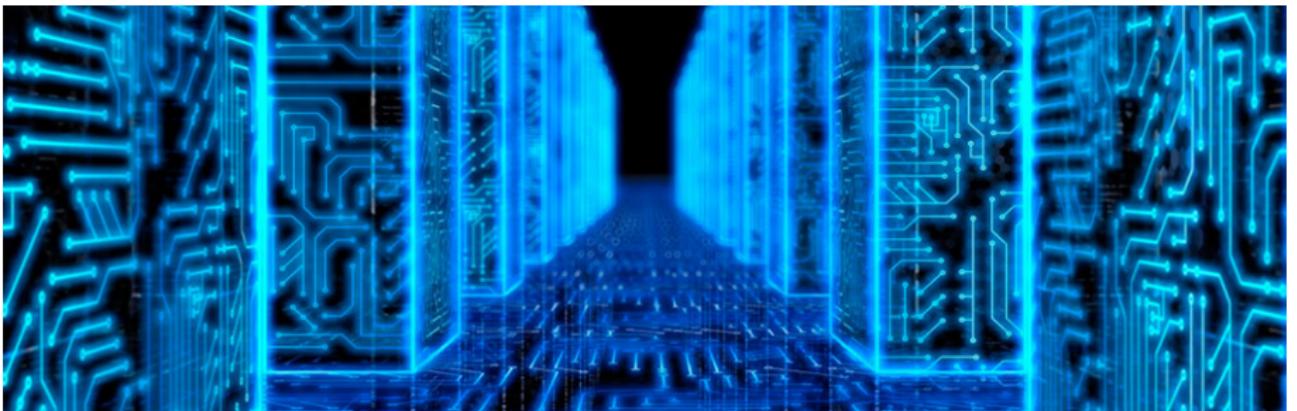
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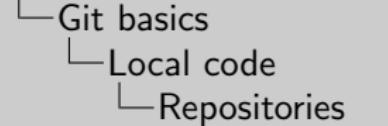
Repositories



- A **repository** is a container for both your project data and all the items that allow interactions with git commands.
 - There are many sites to host your repository on (github, bitbucket), including your own local machine.
 - All of the essential parts of your repository can be found in the `.git` directory
 - GitHub (a website hosting Git repositories) \neq Git (a set of tools for creating and managing those repositories).



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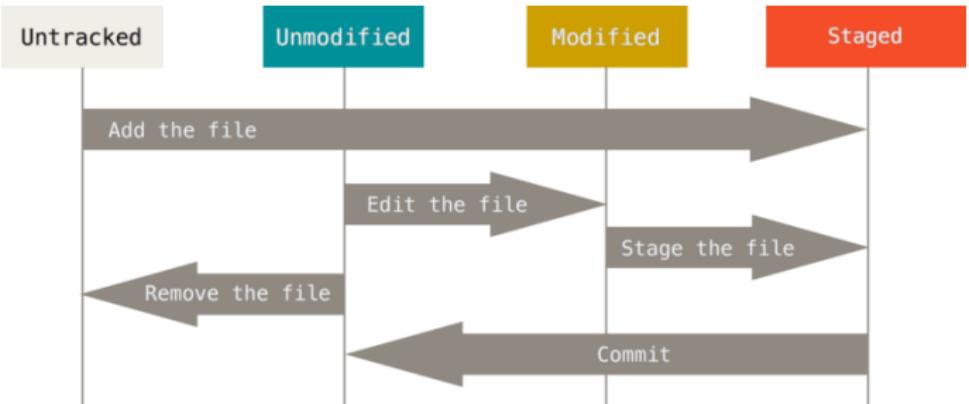


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- A new file is initially **untracked**
- When you use **git add**, it moves to the staging area and becomes **staged**
- After being committed (using **git commit**), a file is up-to-date and considered **unmodified**
- Changing a file makes it modified, but doesn't add it to the staging area

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- └ Git basics
 - └ Local code
 - └ File Lifecycle

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Cleaning the stage

Finally, what is actually happening with your commits under the hood?

- Git has a staging area before commits that can be checked with **git status**. Anything in **green** is staged.
- If you wish to unstage the commit, simply type **git reset**.
- git reset** will work for individual files and you may go back to any commit in the history.

`git reset HEAD~1`

- If you wish to undo a commit entirely, use the **git revert** command.
- git clean** (with appropriate flags!) will remove any untracked files.



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- Git basics
 - Local code
 - Cleaning the stage

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Cleaning the stage

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EXERCISE

- ① Stage a commit
- ② Unstage the commit
- ③ Make a commit
- ④ Undo the commit (**DON'T DO THIS AFTER YOU PUSH!!!!!!11111!!!11!!**)

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- └ Git basics
 - └ Local code
 - └ Quick Exercise

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EXERCISE

- ① Stage a commit
- ② Unstage the commit
- ③ Make a commit
- ④ Undo the commit (**DON'T DO THIS AFTER YOU PUSH!!!!!!11111!!!11!!**)



The local repo

Let's **git** started.

- To initialize a git repository, simply type **git init** in a directory (preferably empty for now)
- This creates a folder **.git/**, where all your repository information is held.
- Git tracks **commits**. Check these commits with **git log**.
- **git status** checks any changes since the last commit.
- **git add** adds new files.
- **git commit** commits anything in the *staging area* - git status shows these files in **green** by default.



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- └ Git basics
 - └ Local code
 - └ The local repo

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Quick Exercise



EXERCISE

- ① Open a terminal
- ② Create a new directory and run **git init**
- ③ Create a file and run **git status**
- ④ Use a combination of **git add** and **git commit** to add a new file to the git repository.
- ⑤ Check the **git log**.

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- └ Git basics
 - └ Local code
 - └ Quick Exercise

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EXERCISE

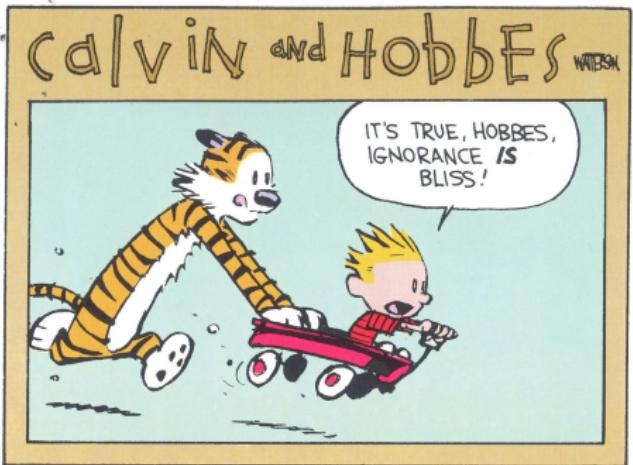
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- Keep your repository clean! Do your best to commit as few images and data files as possible!
- You can do this by ignoring certain file extensions in a **.gitignore** file.
- Great templates for projects of many types found at
<https://github.com/github/gitignore>

Example gitignore configuration

```
*.log  
*.tar  
*.gz  
*.exe  
*.dat  
*.lvp
```



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- └ Git basics
 - └ Local code
 - └ Ignorance is bliss

Ignorance is bliss

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A small version of the Calvin and Hobbes comic strip from the previous slide, showing Hobbes leaning over Calvin's toy car with the text "IT'S TRUE, HOBBIEST, IGNORANCE IS BLISS!"



EXERCISE

- ① Touch multiple files with various extensions, one of which should be **.dat**.
- ② Ignore the **.dat** file, but commit all the others.
- ③ Be sure to write a clear message describing what you did.
- ④ Check the **git log**

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- └ Git basics
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EXERCISE

- Touch multiple files with various extensions, one of which should be **.dat**.
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git with it!



Now we move to the fun* stuff: working with **online repositories**.

- For this, we will be using **github**.
- We'll begin by creating a GitHub repository using the website.
 - If we're working on a project that's already hosted on a remote Git server, we can skip this step.
- Next, we use **git clone** to download a copy.
- From here, you can do the following:
 - **git push** to push any changes you may have to the online repository.
 - **git pull** to take any changes from the repository.

*Here, the word *fun* is subject to interpretation.



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└ Git basics
 └ Nonlocal repos / github
 └ **git with it!**

git with it!

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EXERCISE

- ① Create a new GitHub repository using a browser.
- ② Clone the new repository* to our local disk:

```
git clone git@github.com:oist/skillpill-git.git
```

or

```
git clone https://github.com/oist/skillpill-git.git
```

- ③ Make some simple commits and test the process of **pushing** and (with the help of a partner) **pulling** stuff from that repo.

*The examples here show cloning the SkillPill Git repository - replace the links as appropriate!

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- └ Git basics
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 - └ Quick Exercise

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What it will feel like...

- git is not intuitive to start with, but it's a powerful tool for storing and restoring history, and working collaboratively with other people.
- The more you use it, the more you will like it. Think Stockholm syndrome.
- Operations that you use frequently will become easy.
- Operations you use infrequently, you can Google!



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- └ Git basics
- └ Nonlocal repos / github
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Checking out your versions



We now know how to work with both local and online repositories, but what about using different versions?

- **git checkout** allows you to view the repository at any commit (found with **git log**).
- You may also checkout specific files like so:

```
git checkout a1e8fb5 hello.py
```

- Note that the most recent commit is **HEAD** and the one just before that is **HEAD~1**
- This command will be used later, so keep it in mind!

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- └ Git basics
 - └ Nonlocal repos / github
 - └ Checking out your versions

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Checking out your versions

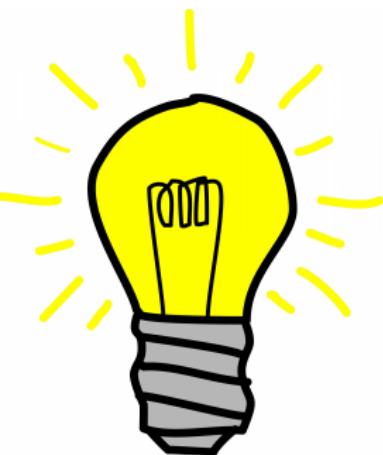
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- git is weird. It's not intuitive, but it's the best way to collaborate with people on open projects.
- It's also great even if you don't collaborate!
- Whenever you are using git, think about other people and how they will perceive your comments. **Would you be able to understand your own cryptic commit messages?**
- You will make mistakes. Don't worry about it. Your entire history is backed up already. Learn from your mistakes and don't make them again!
- Read error messages carefully - they can be useful/informative/instructive.



└ Working alone

└ Final Comments

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