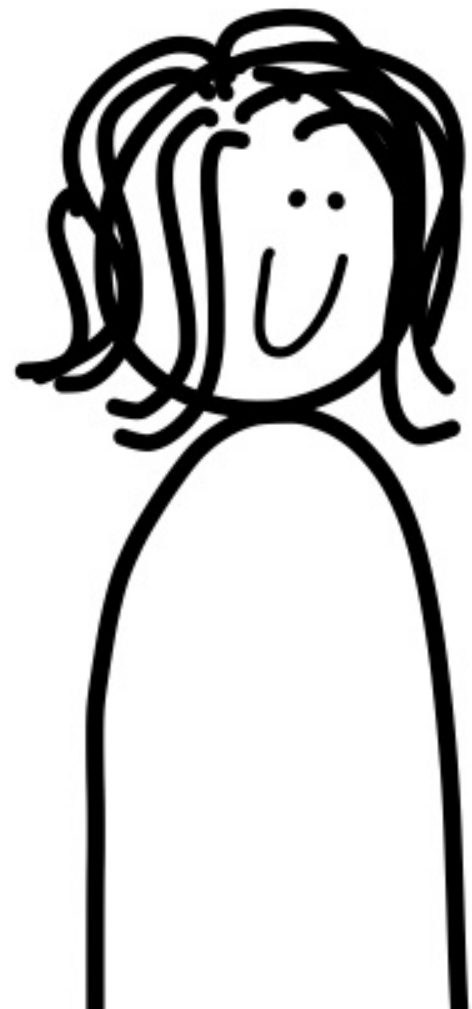
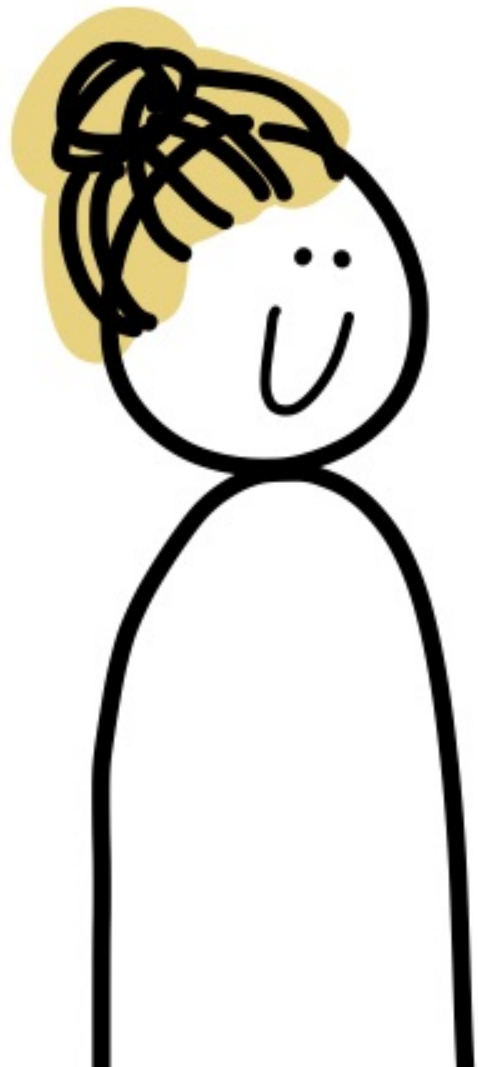


# Hedy: A gradual Programming Language



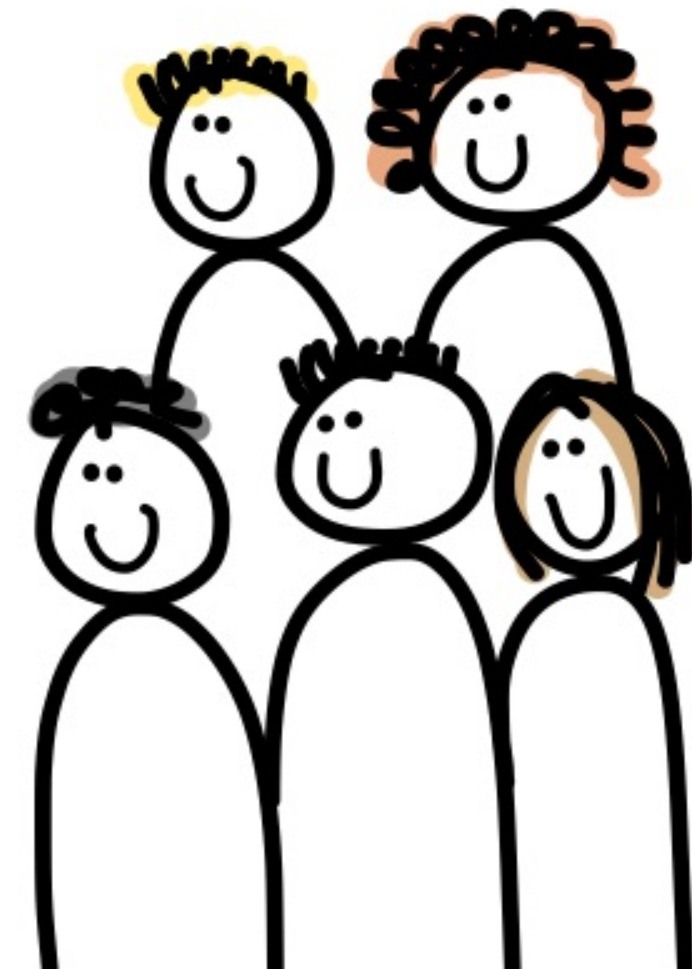
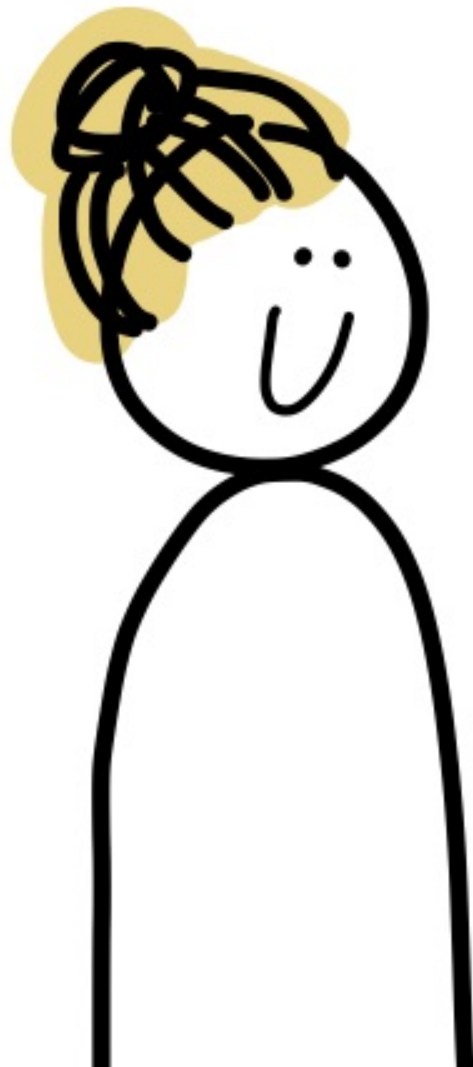
Felienne Hermans

# How to teach programming?



2013

We'd love to learn  
programming



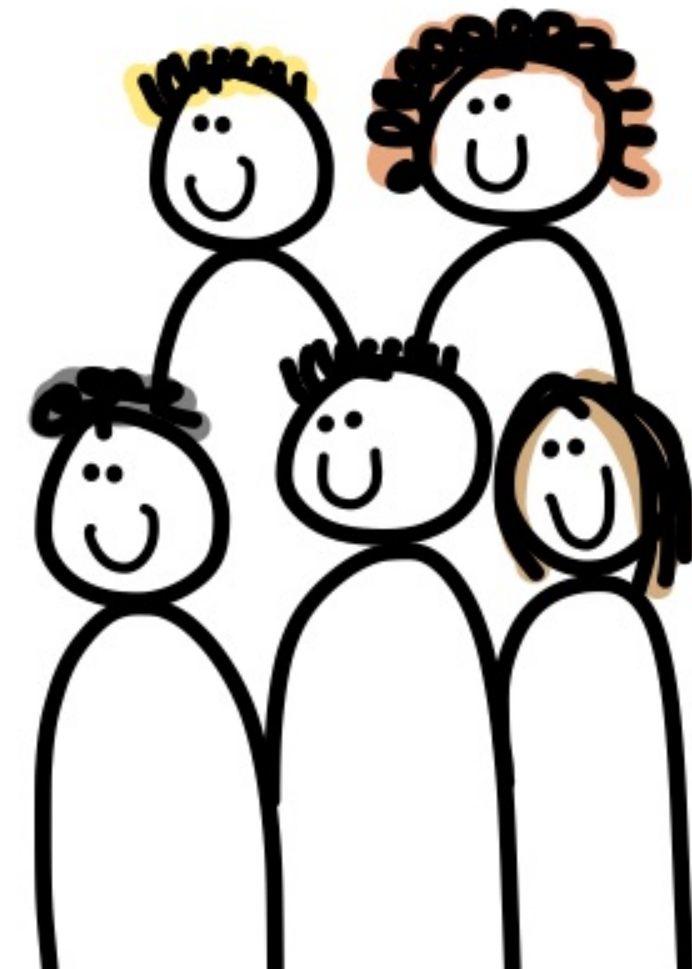
I'll teach you

/



We'd love to learn  
programming

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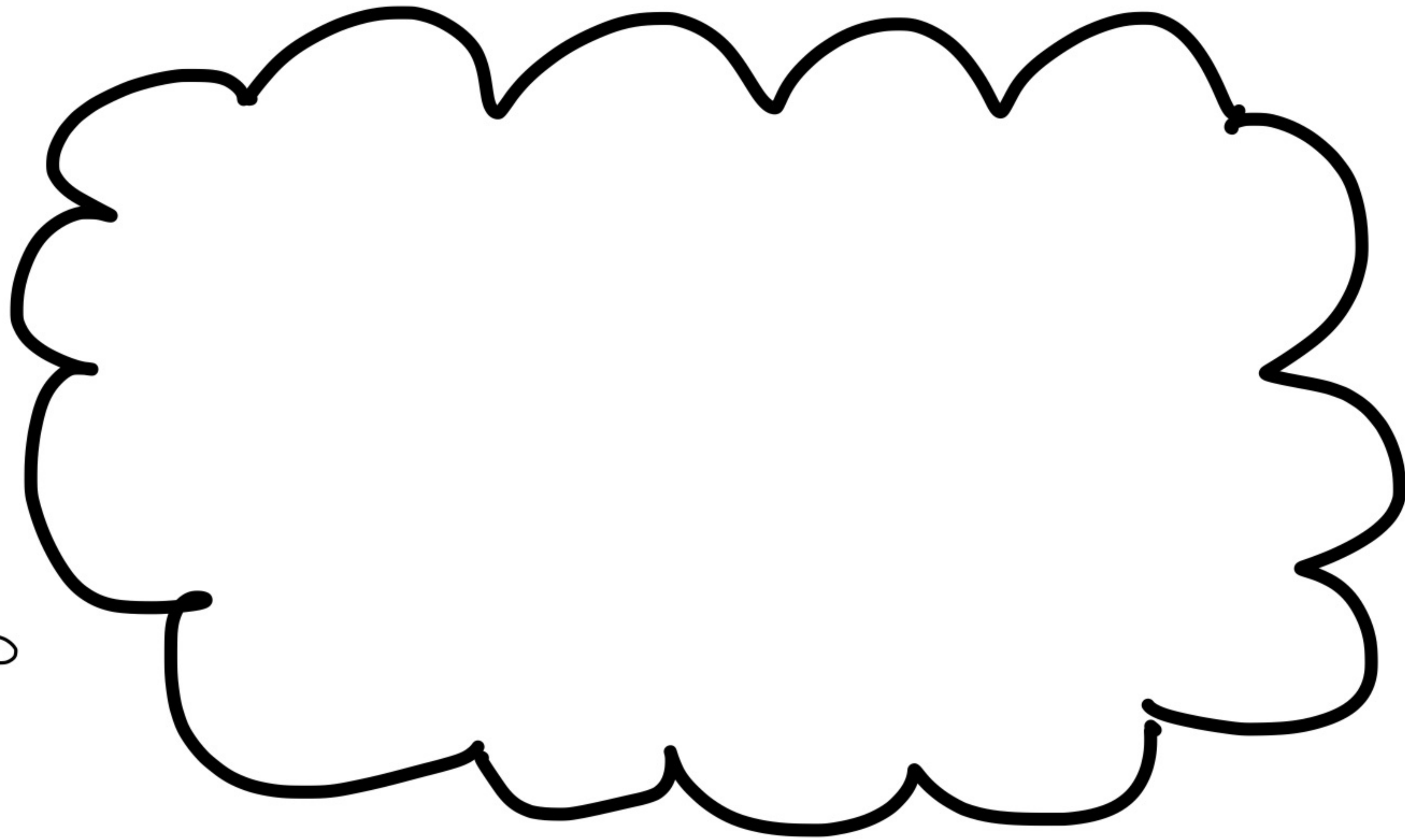




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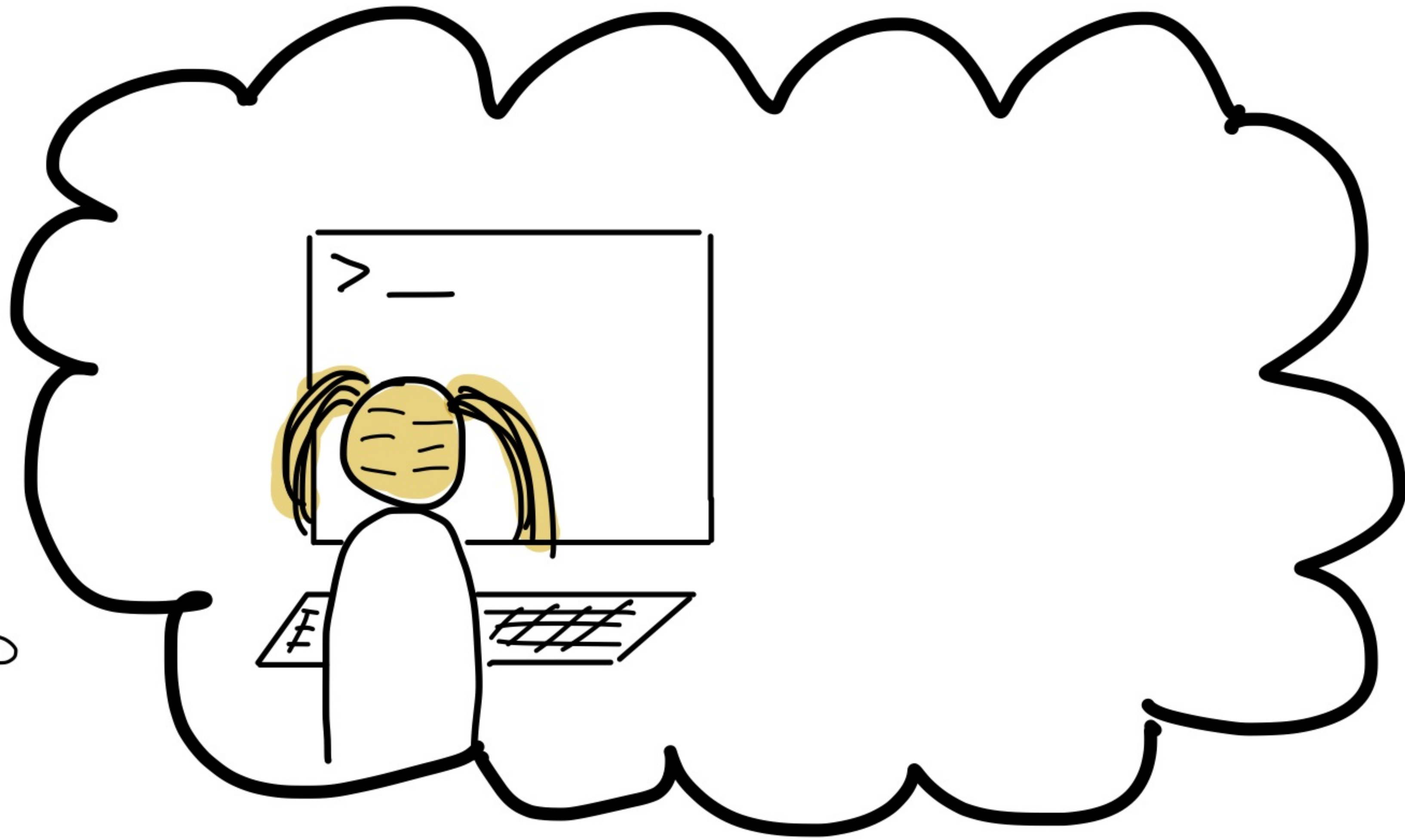




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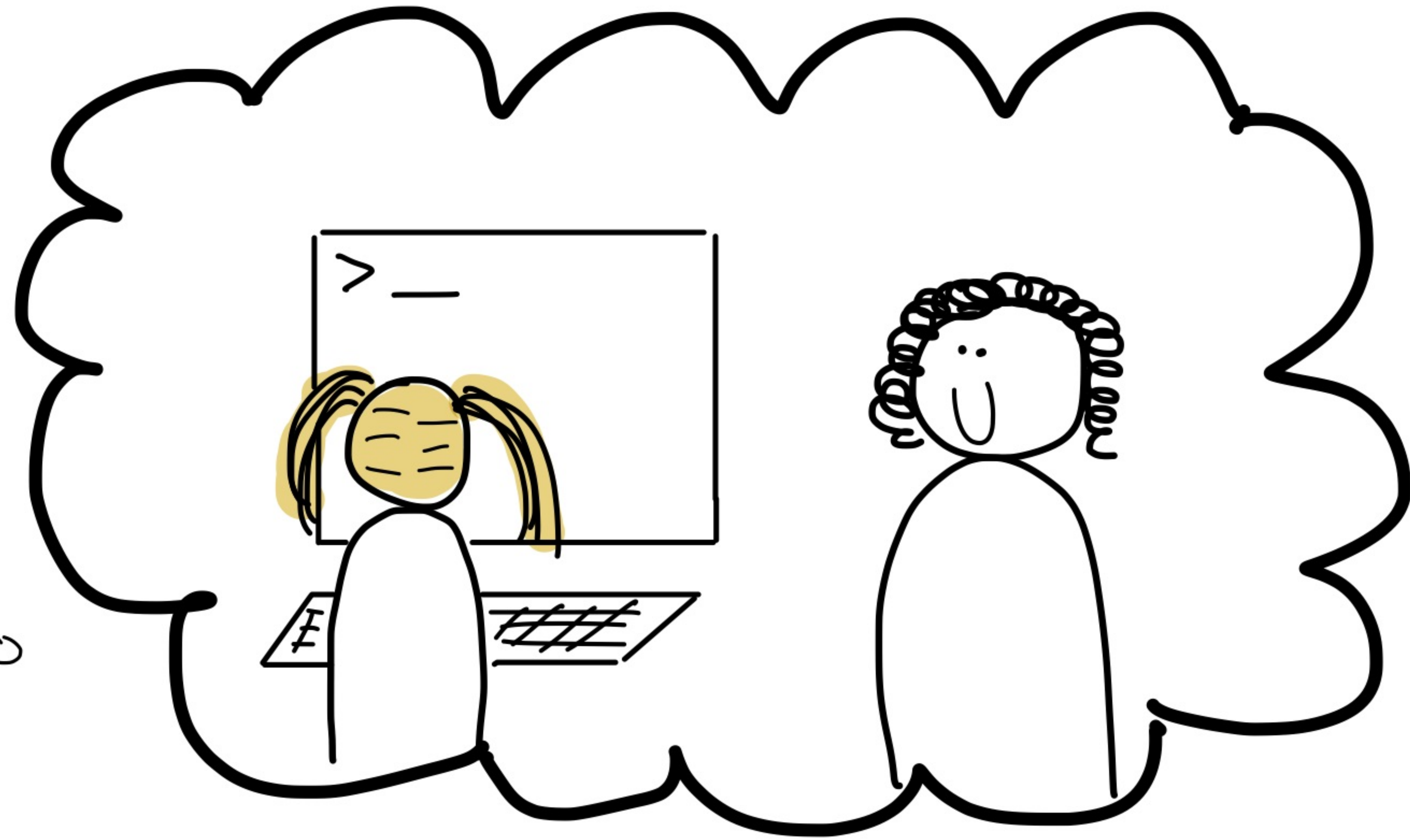




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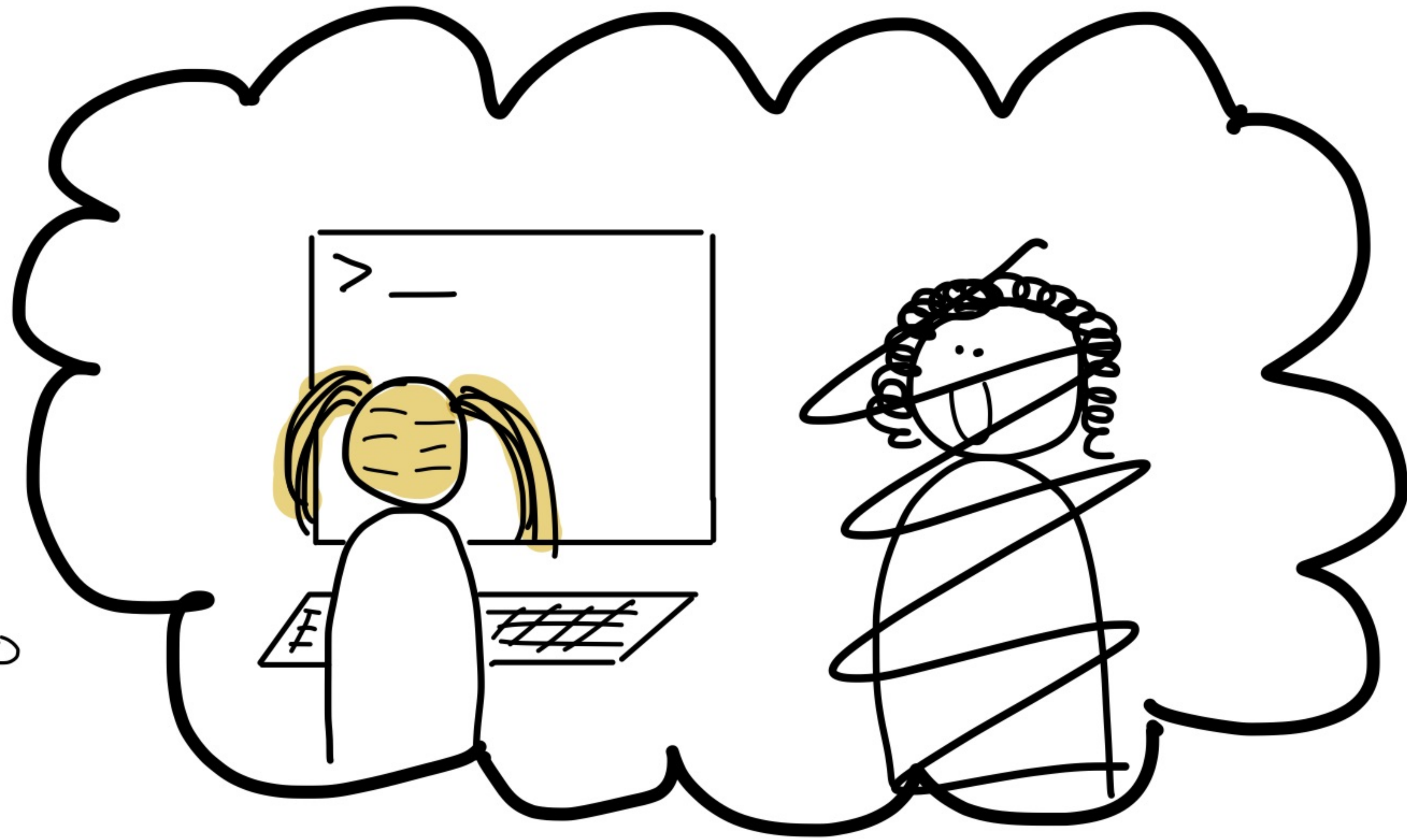




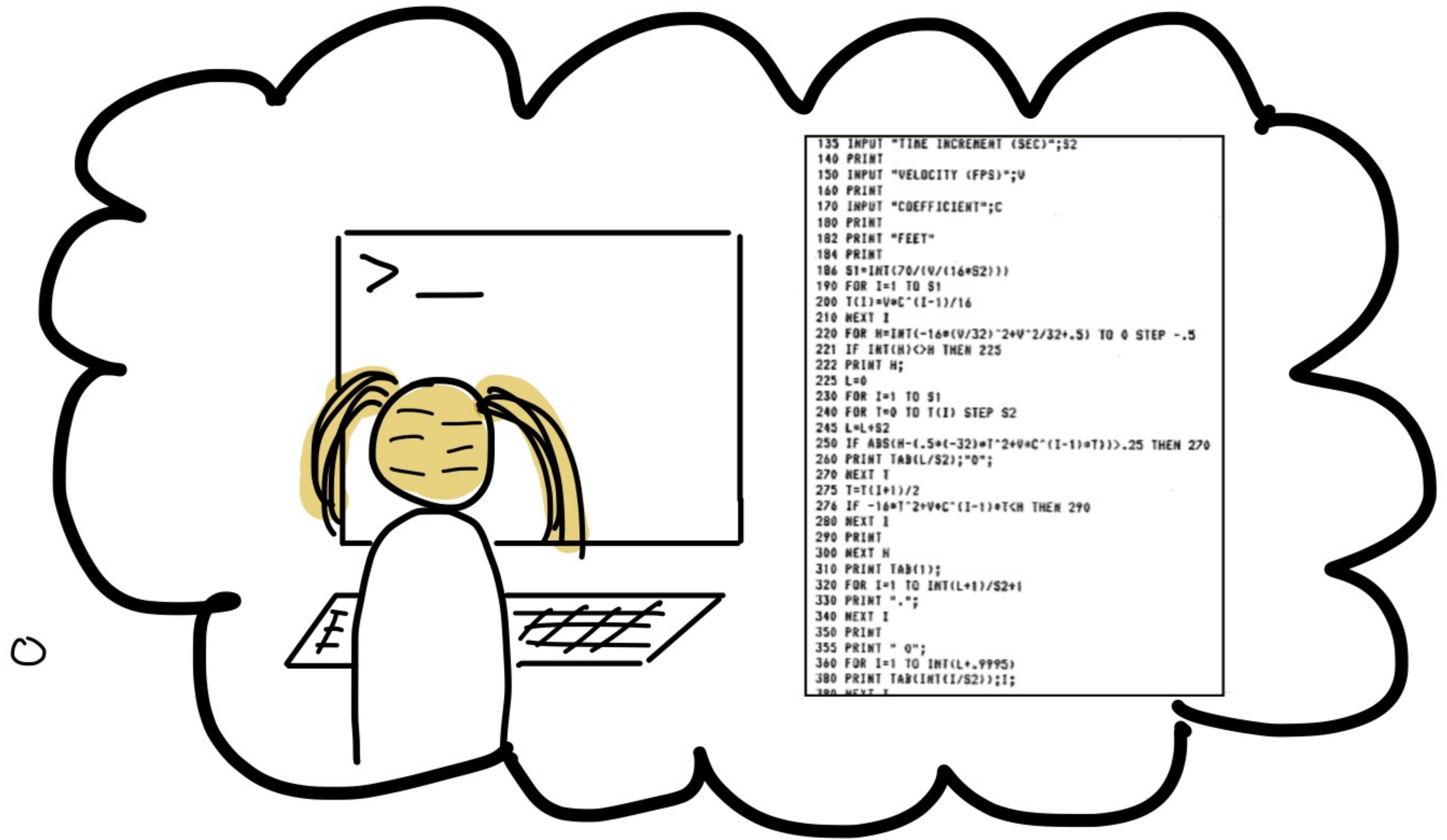
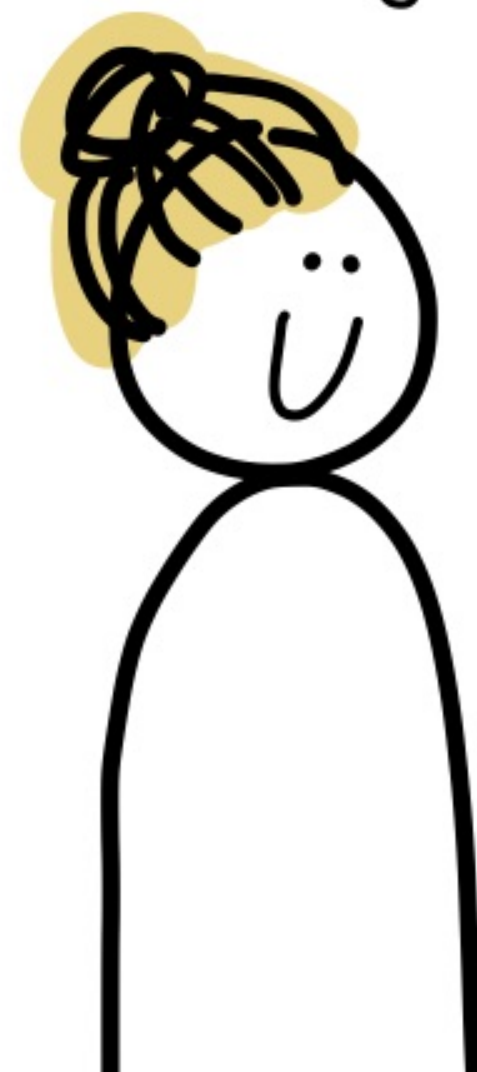
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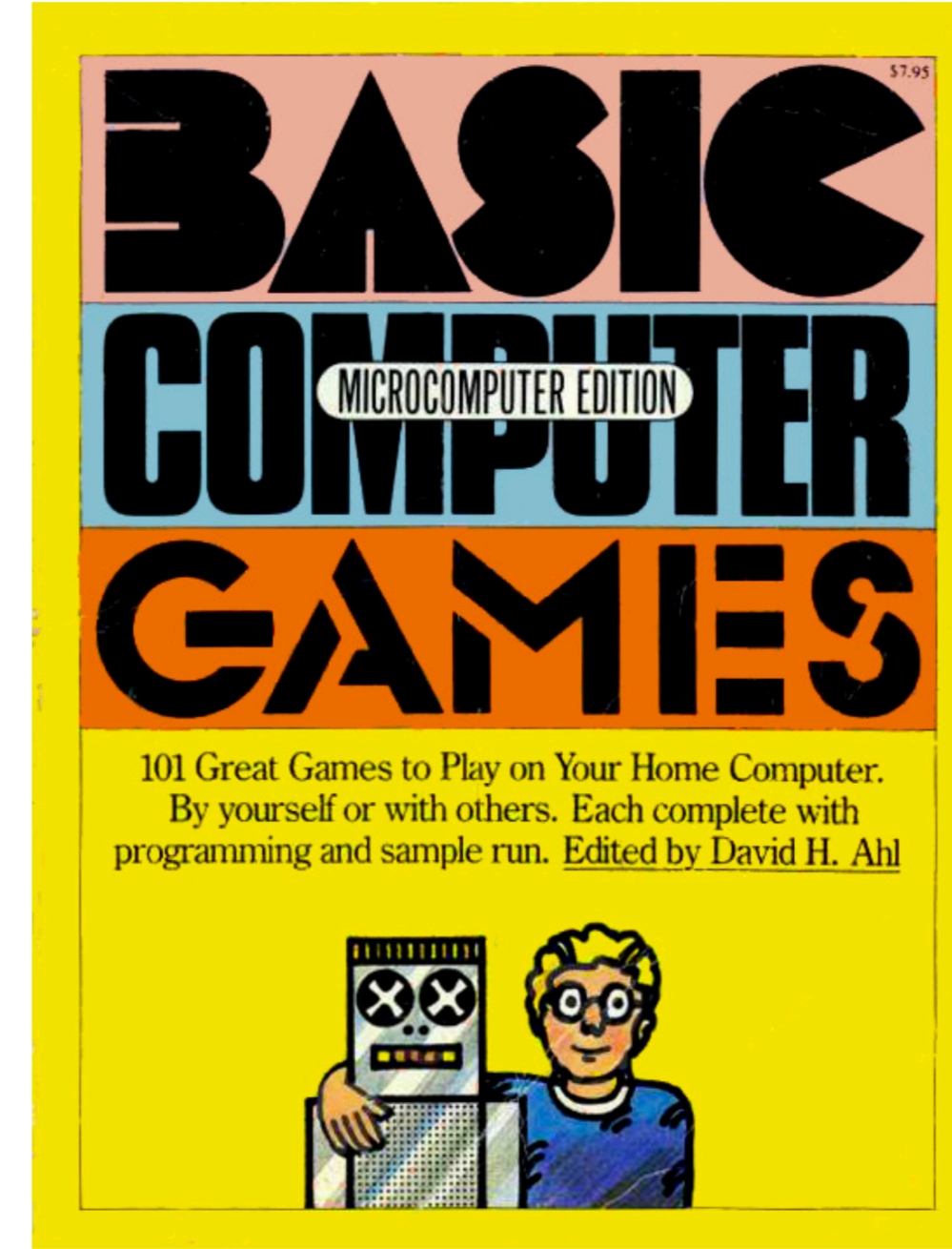
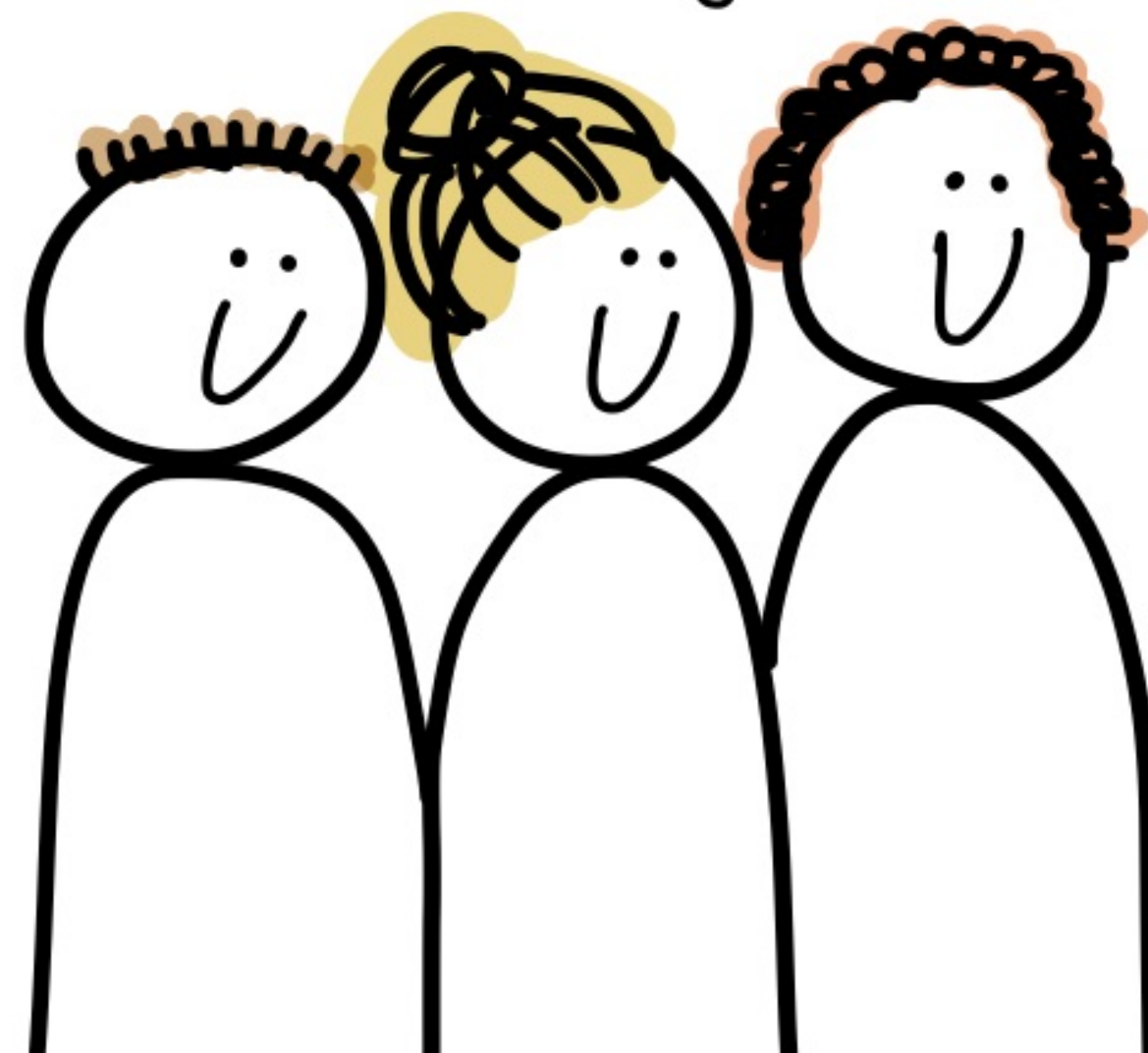
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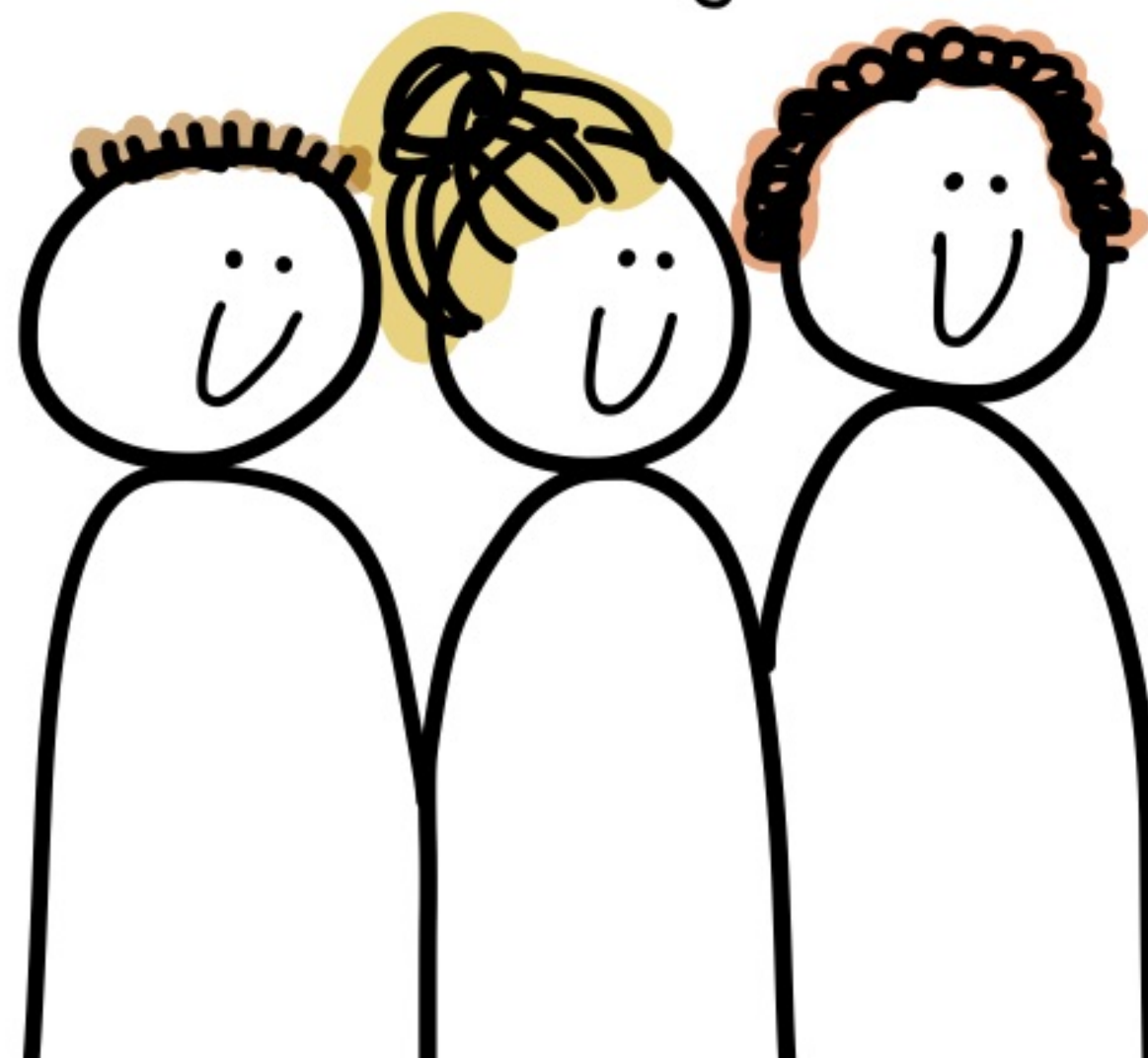






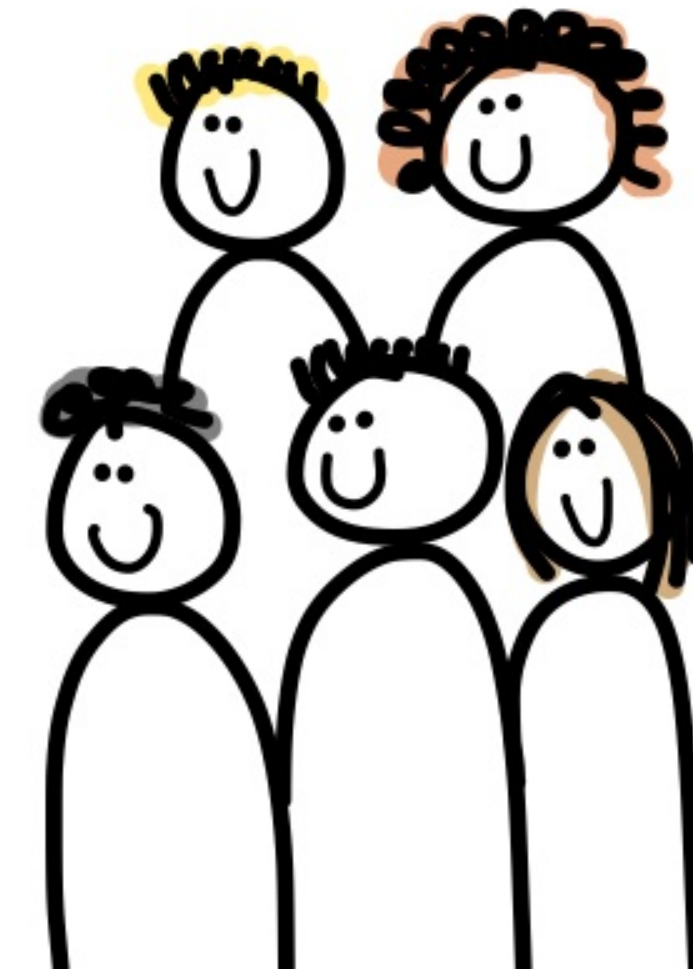
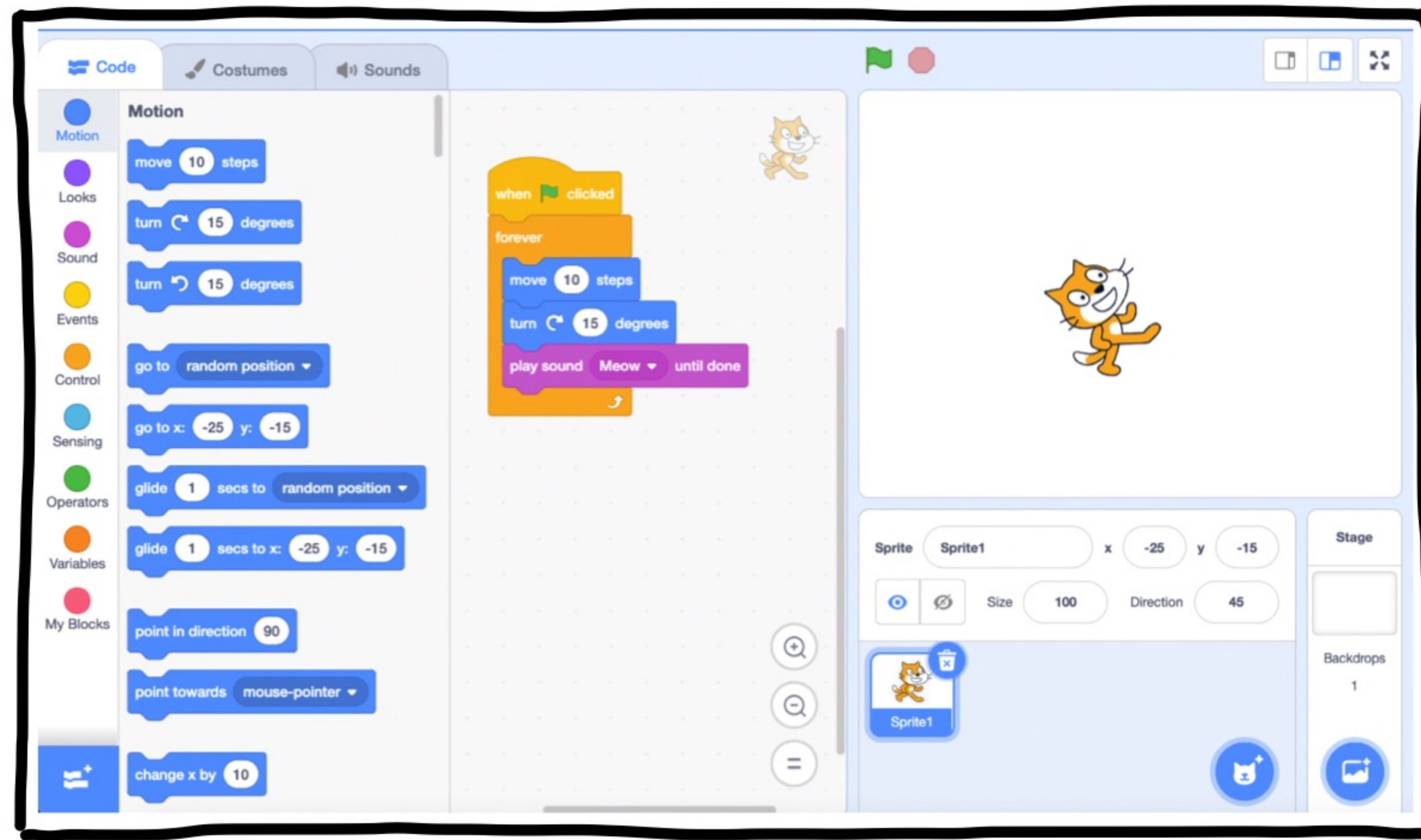


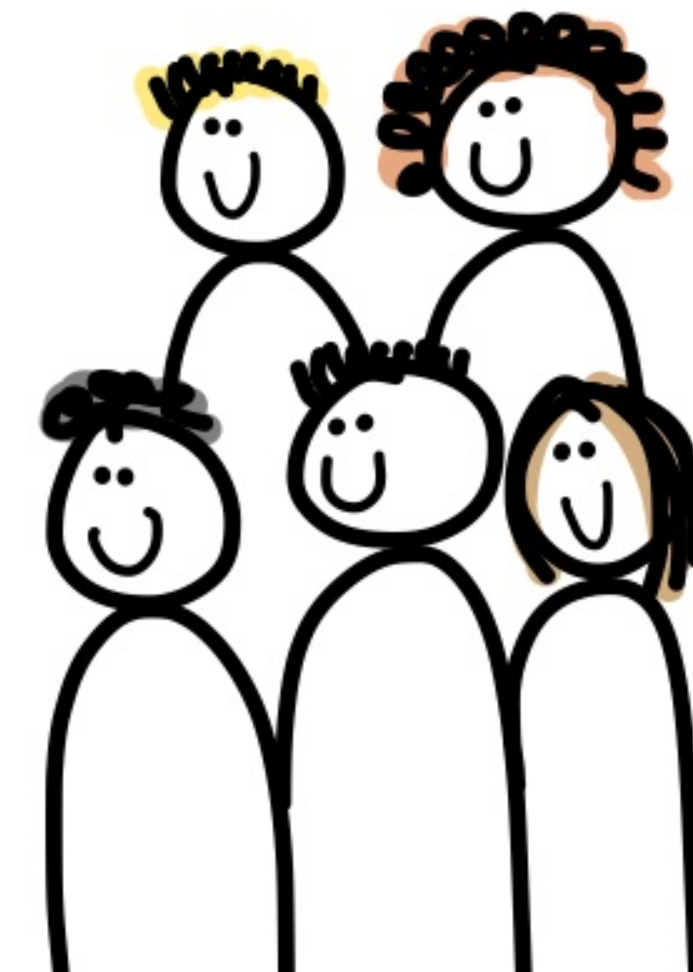
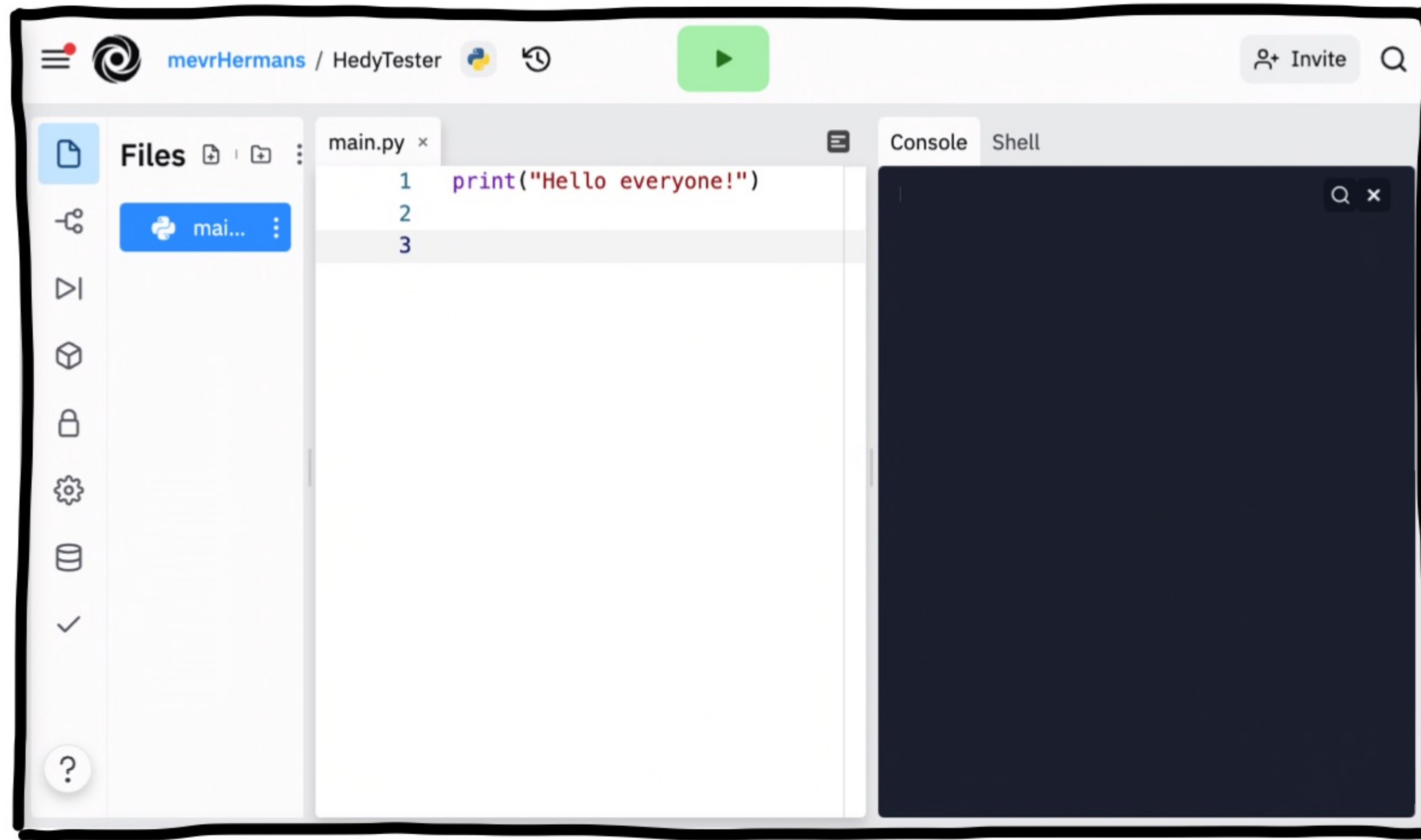
Compilers are  
lovely teachers

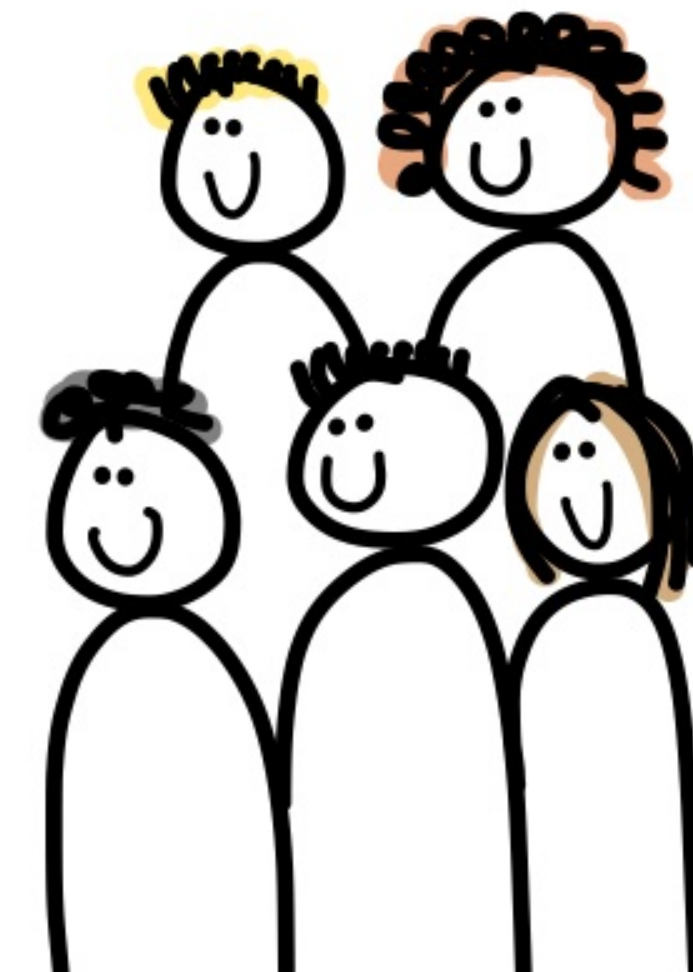
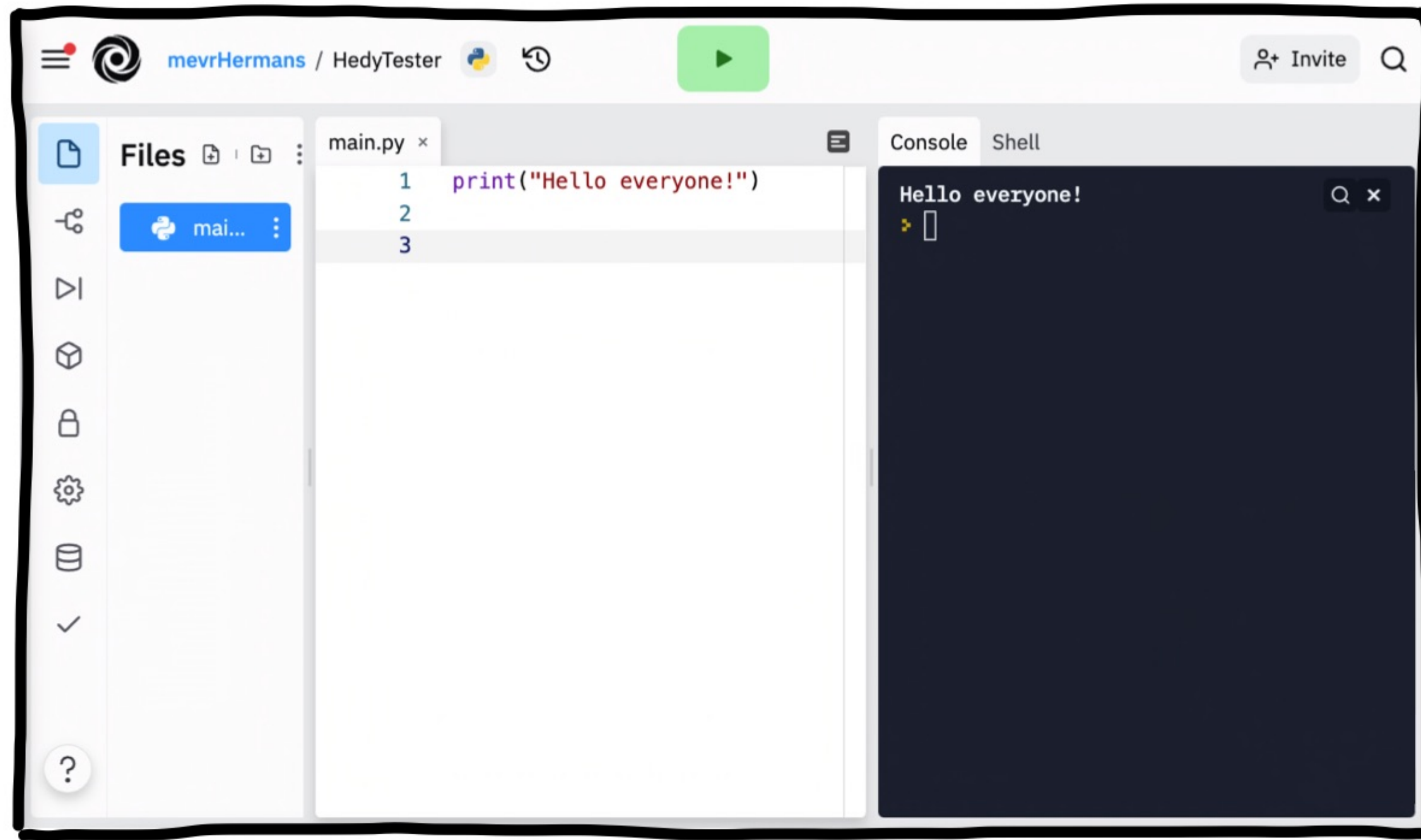


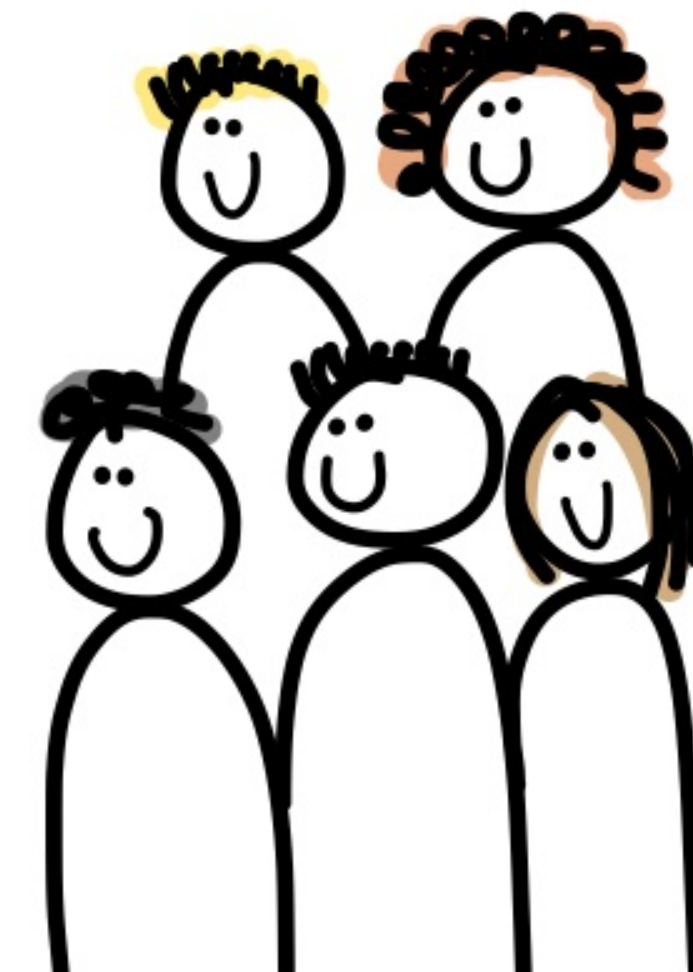
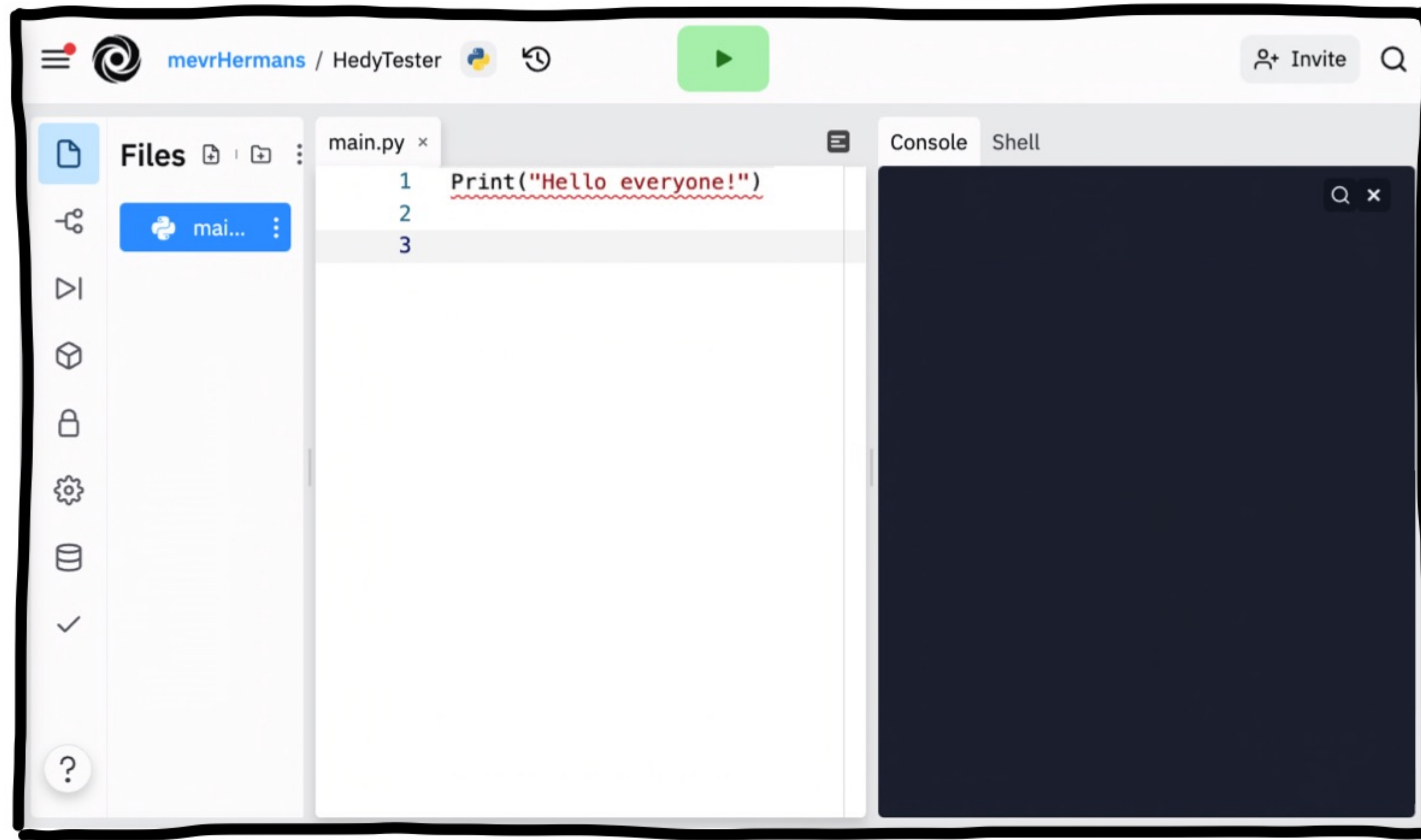
Compilers are  
lovely teachers

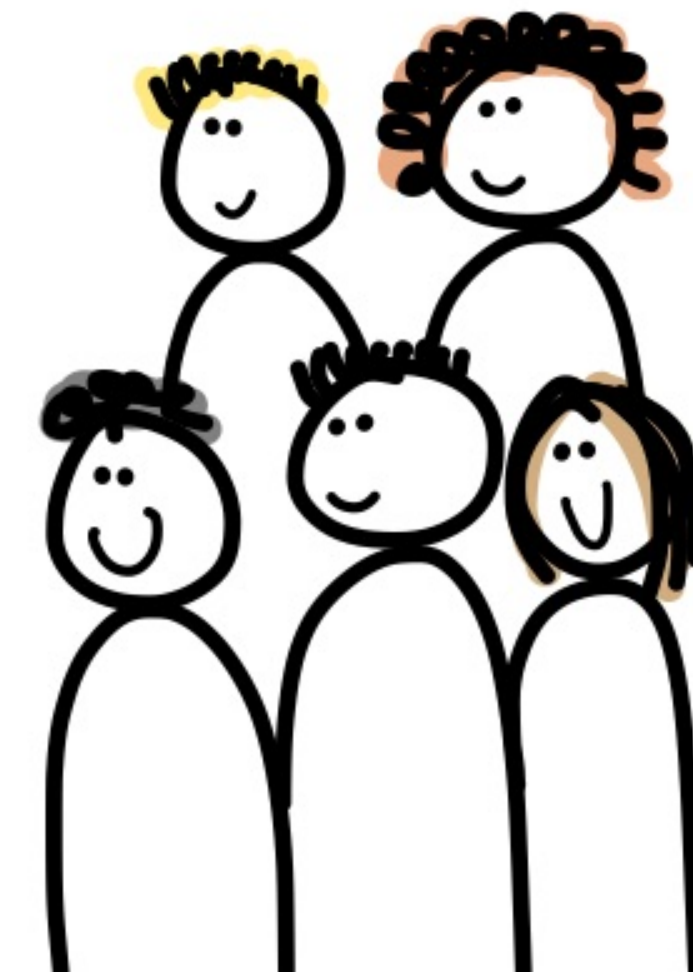
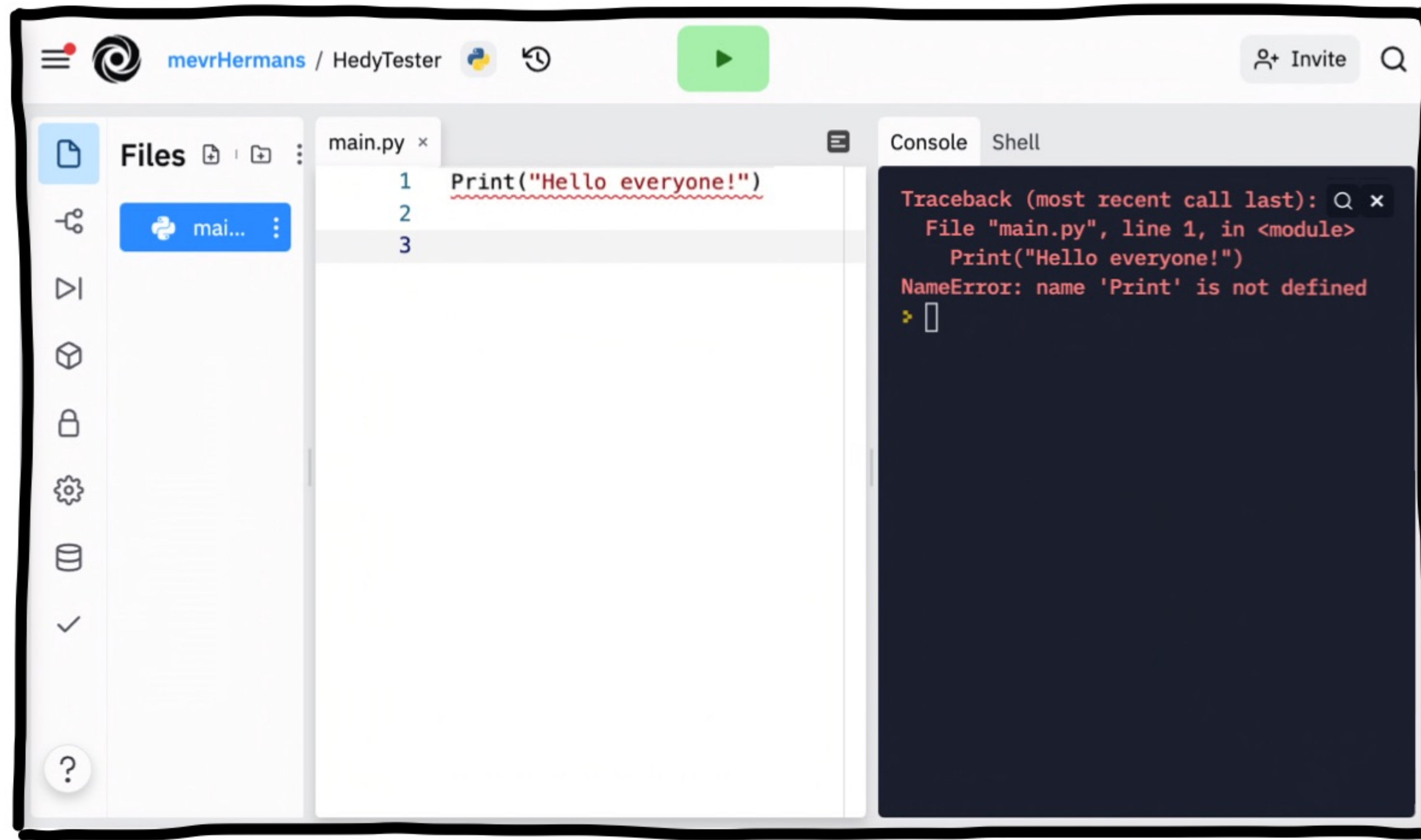


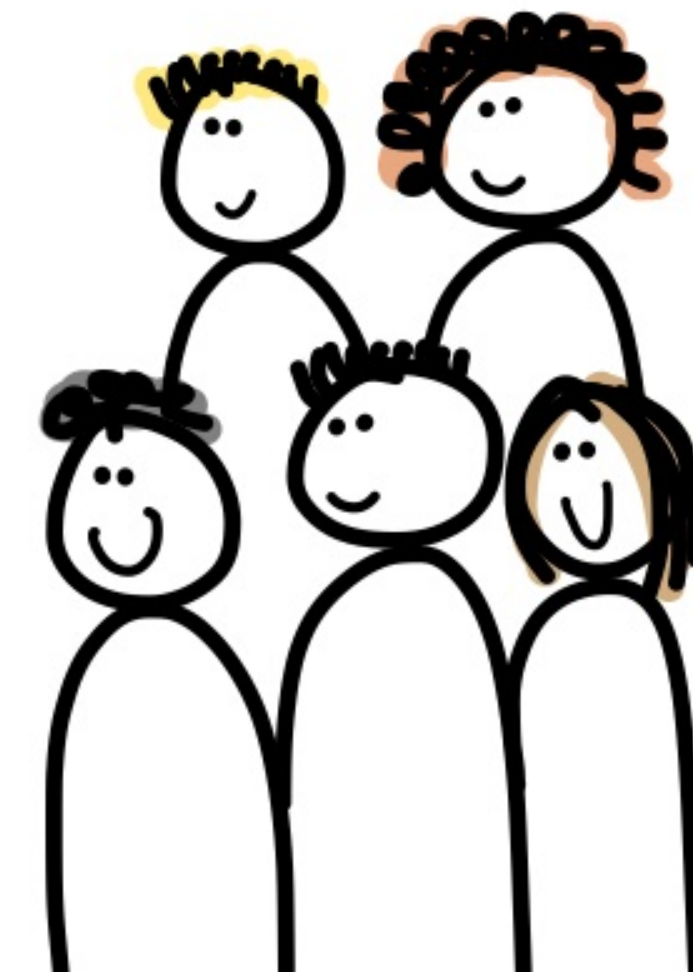
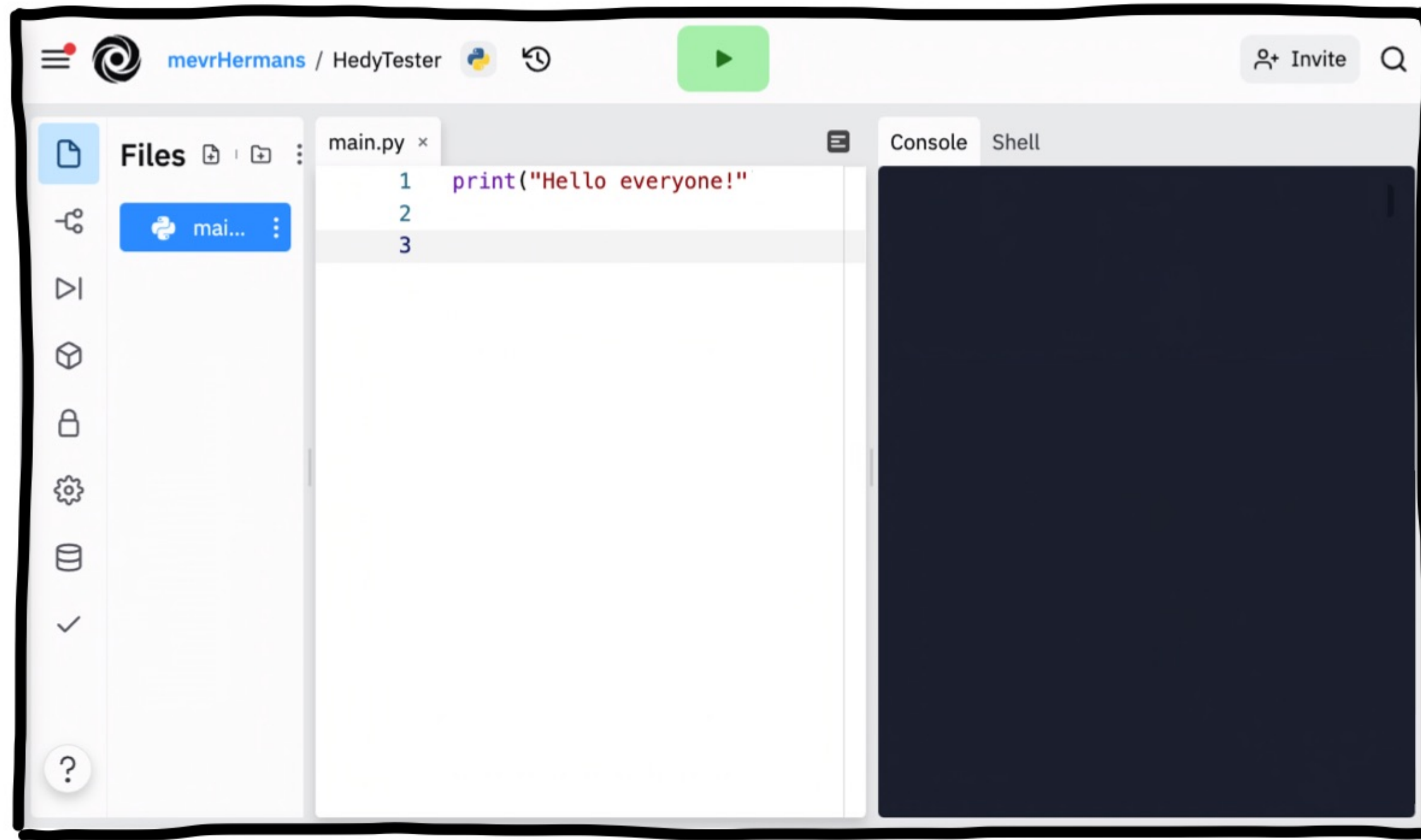


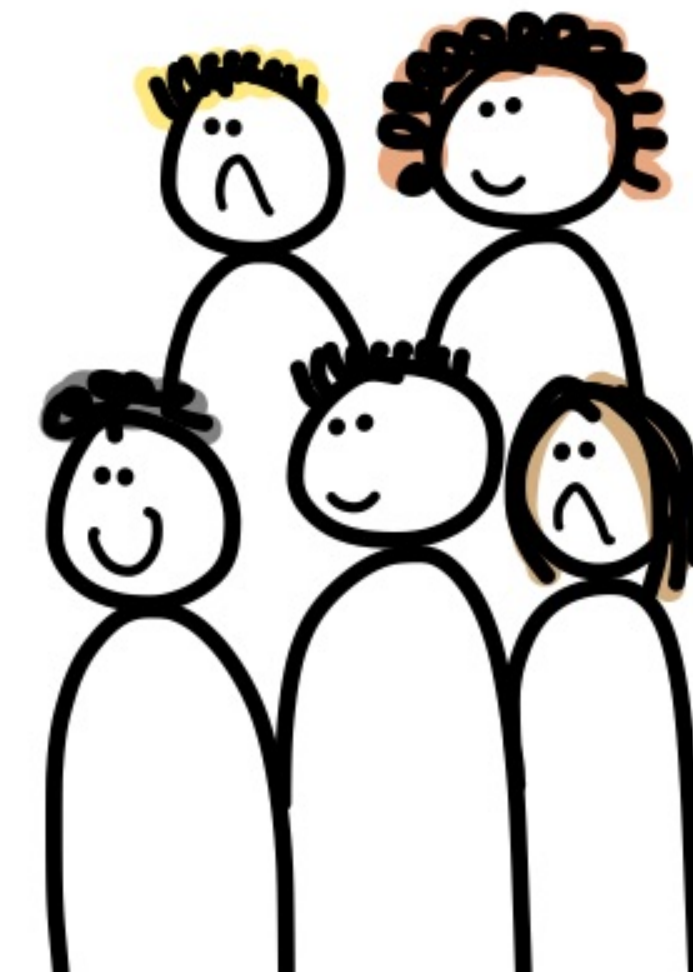
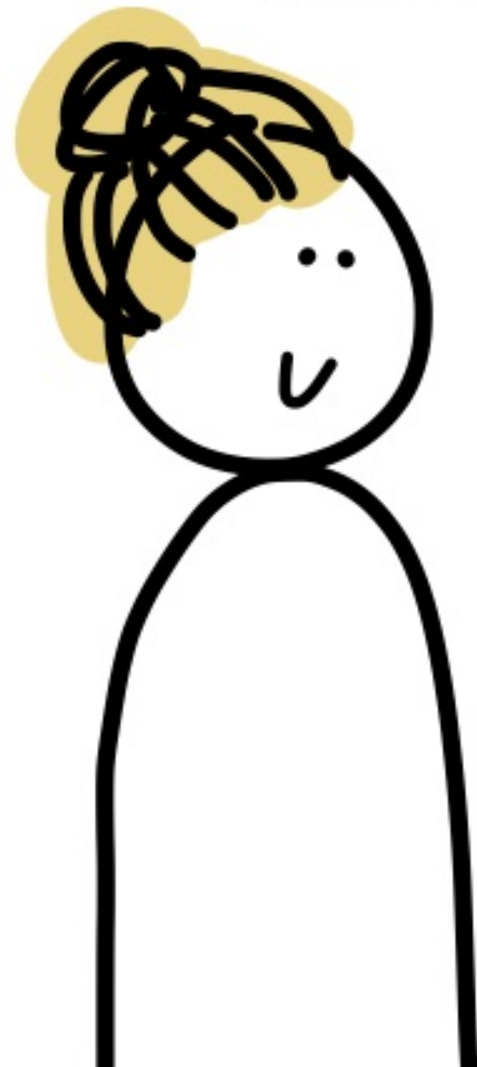
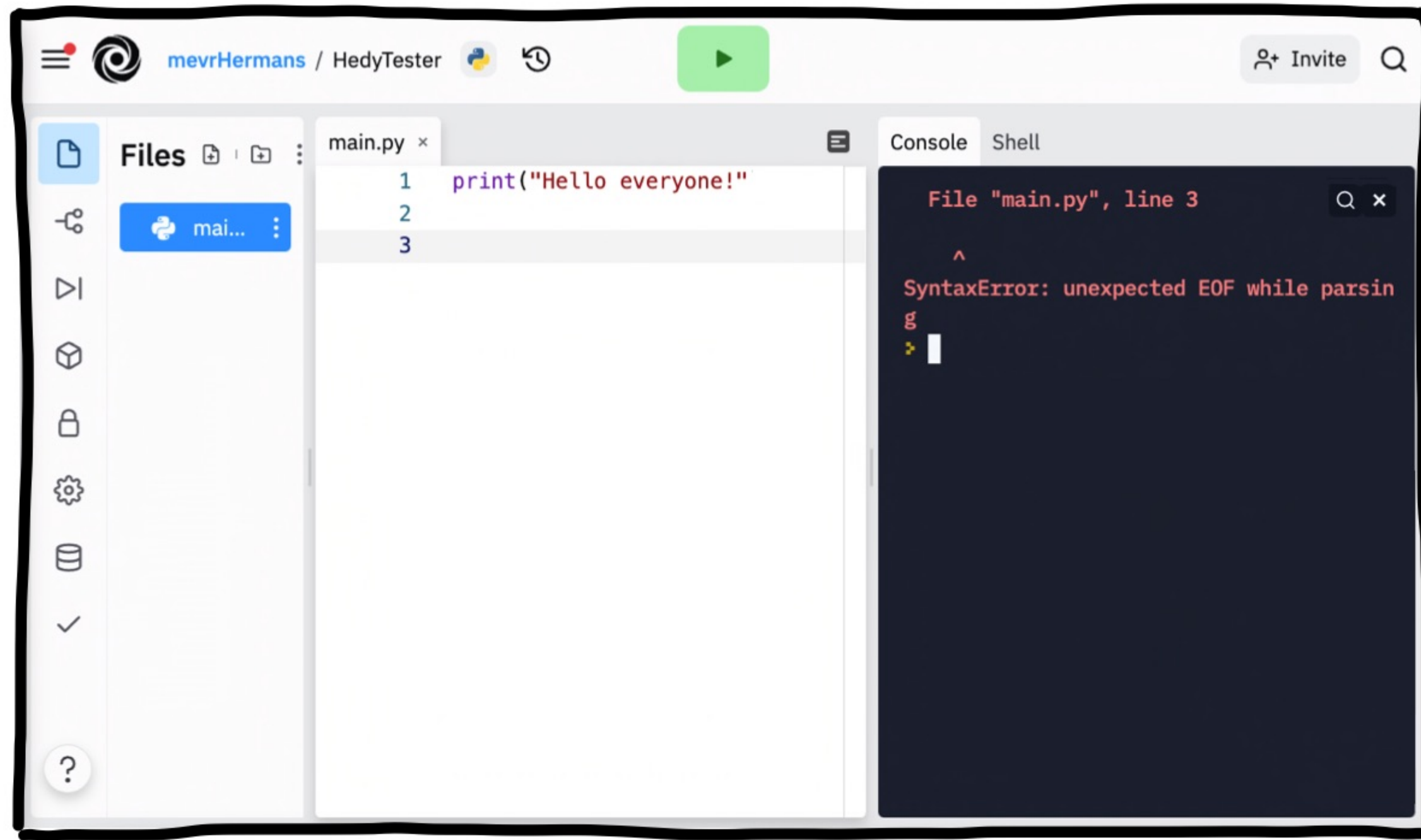


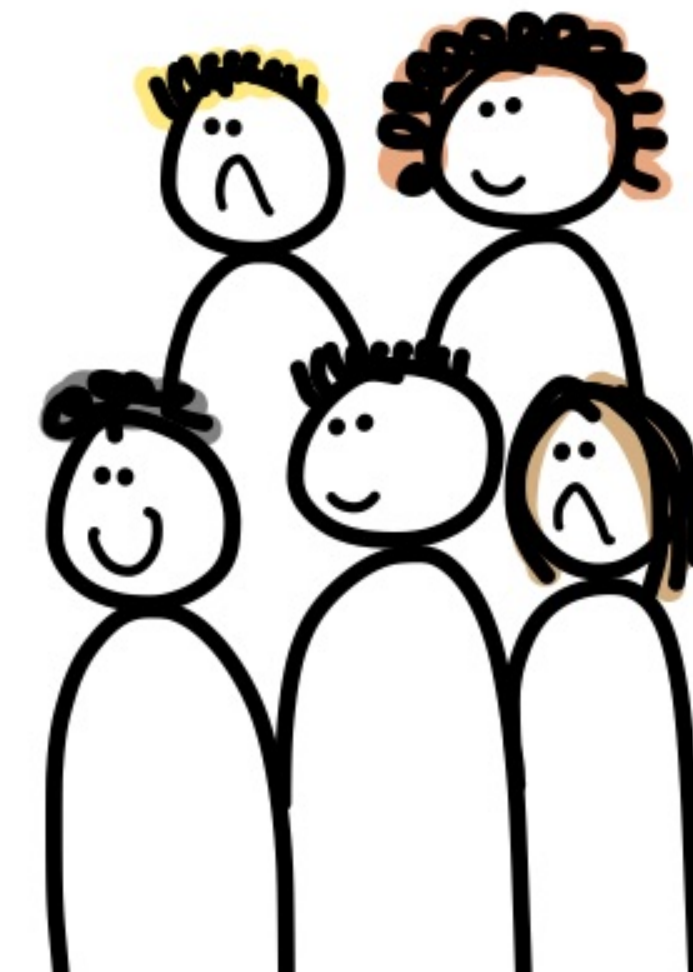
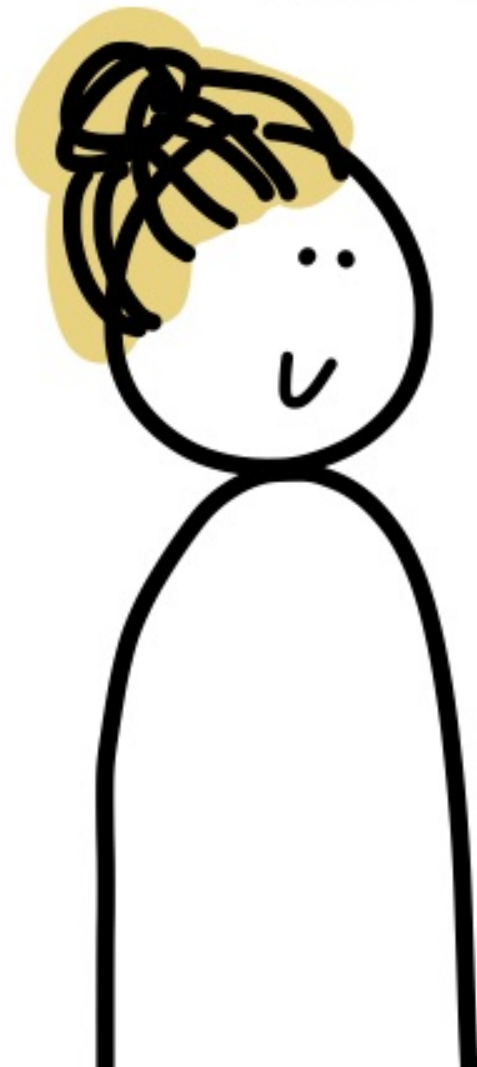
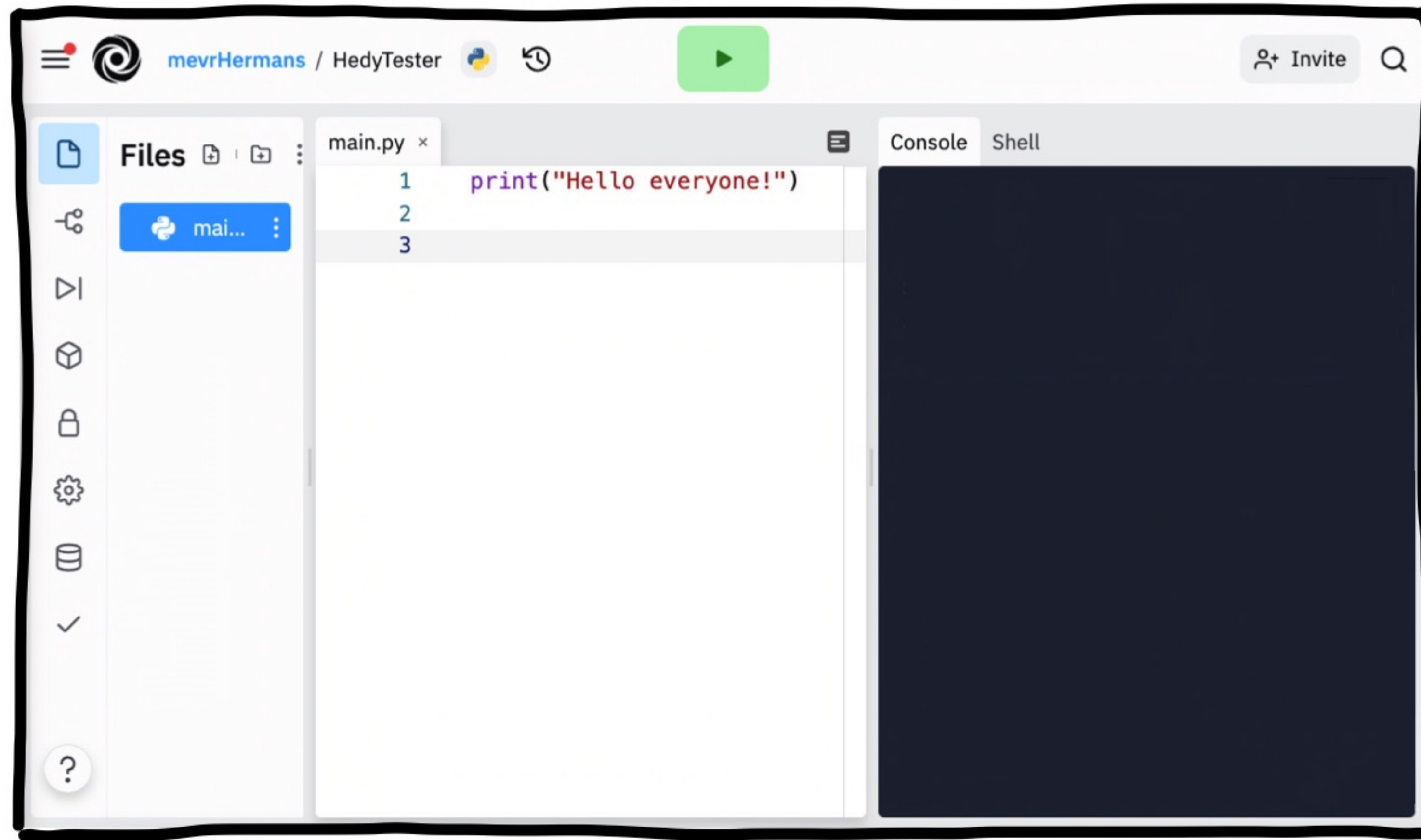


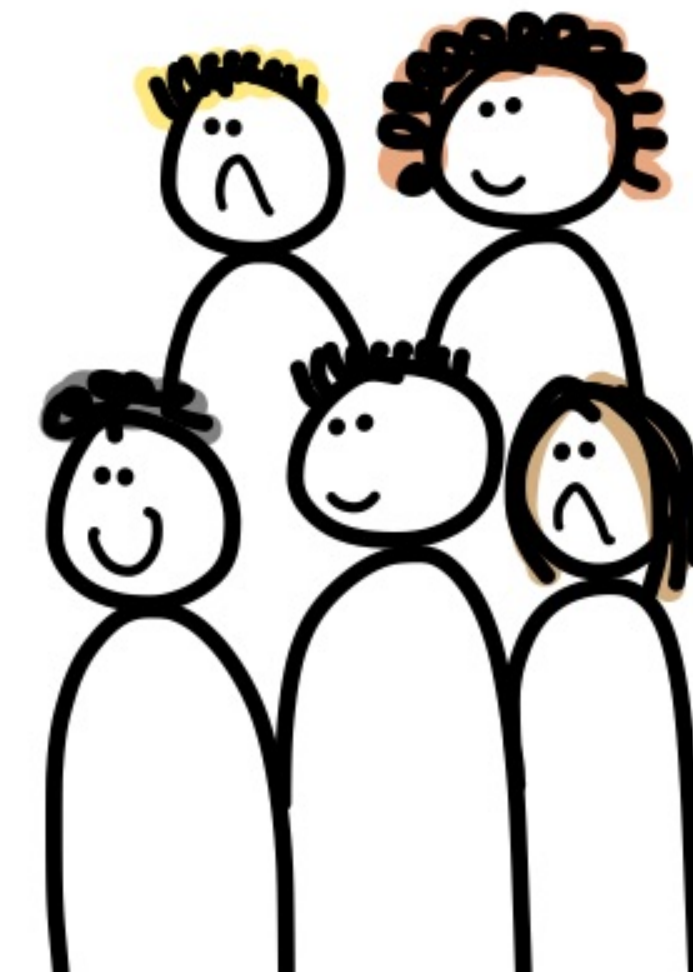
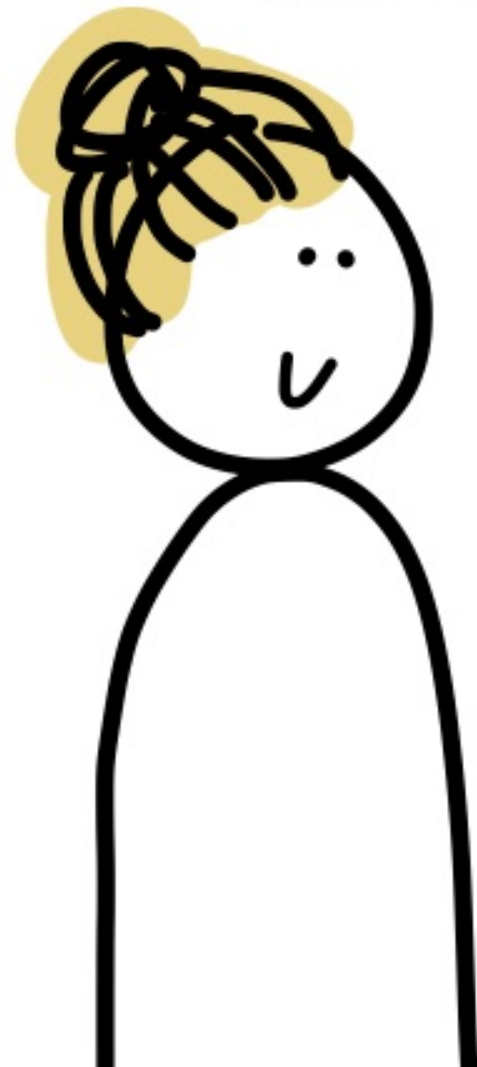
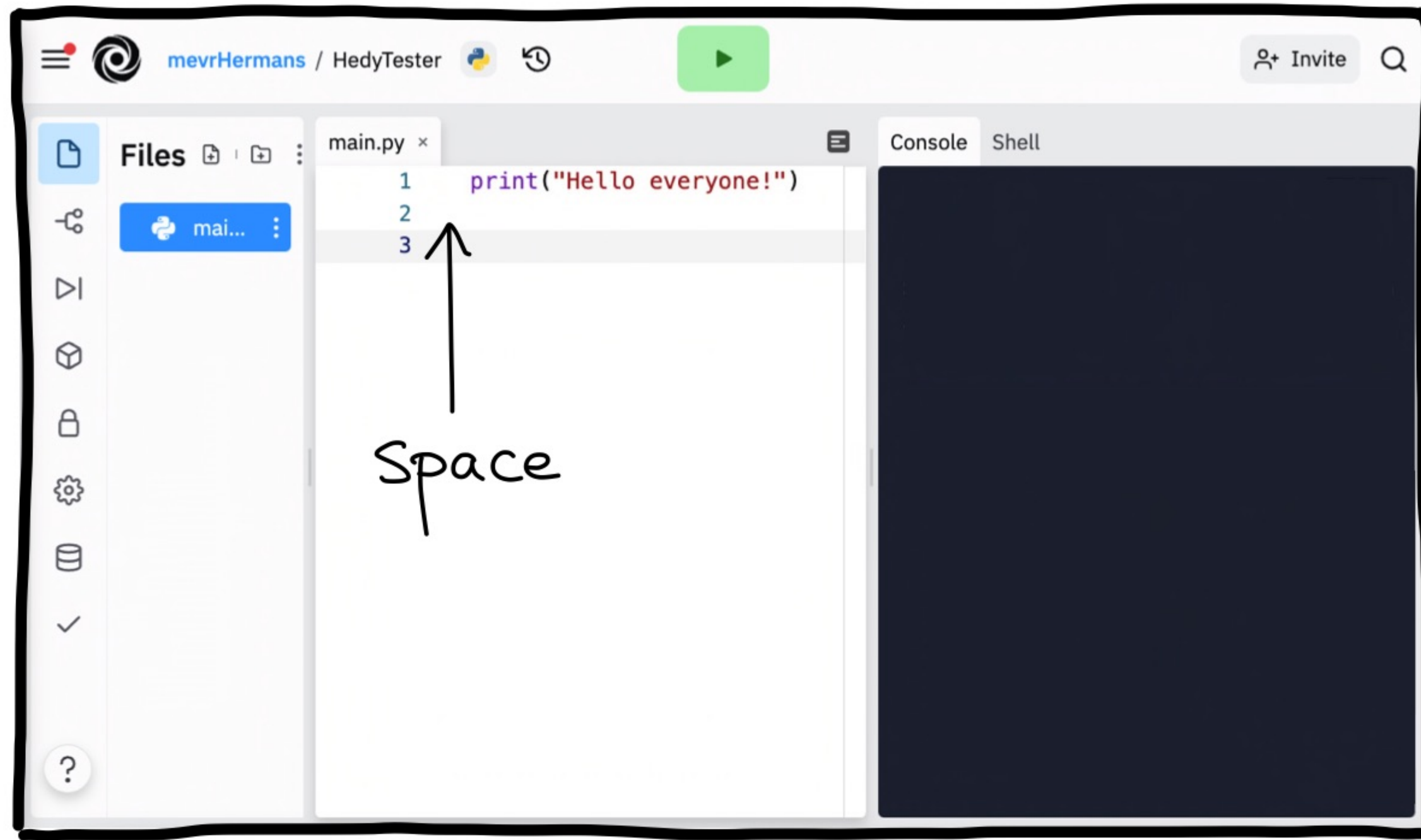


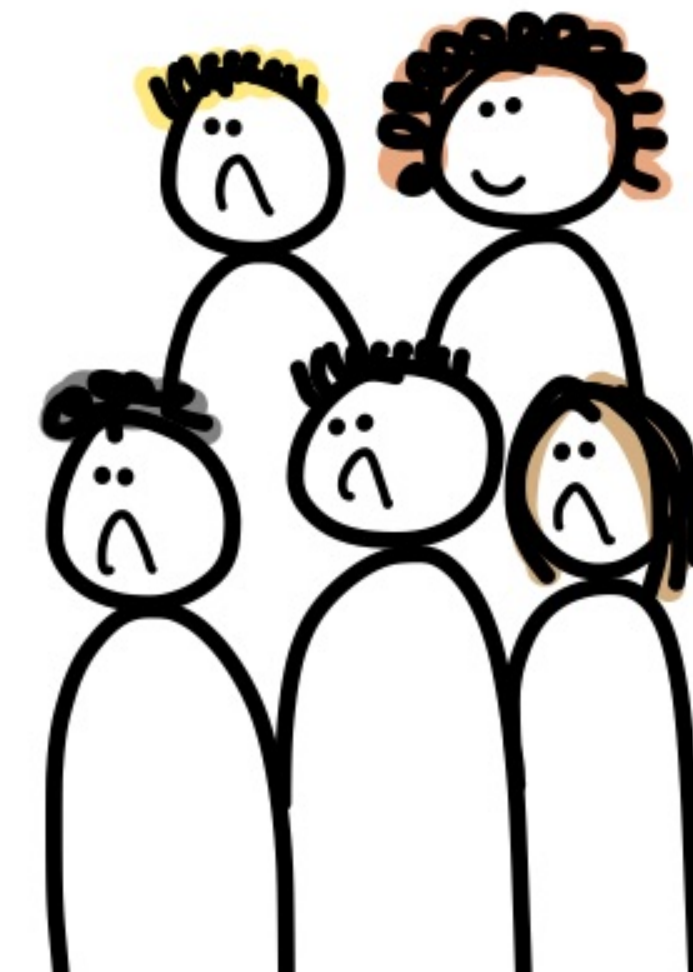
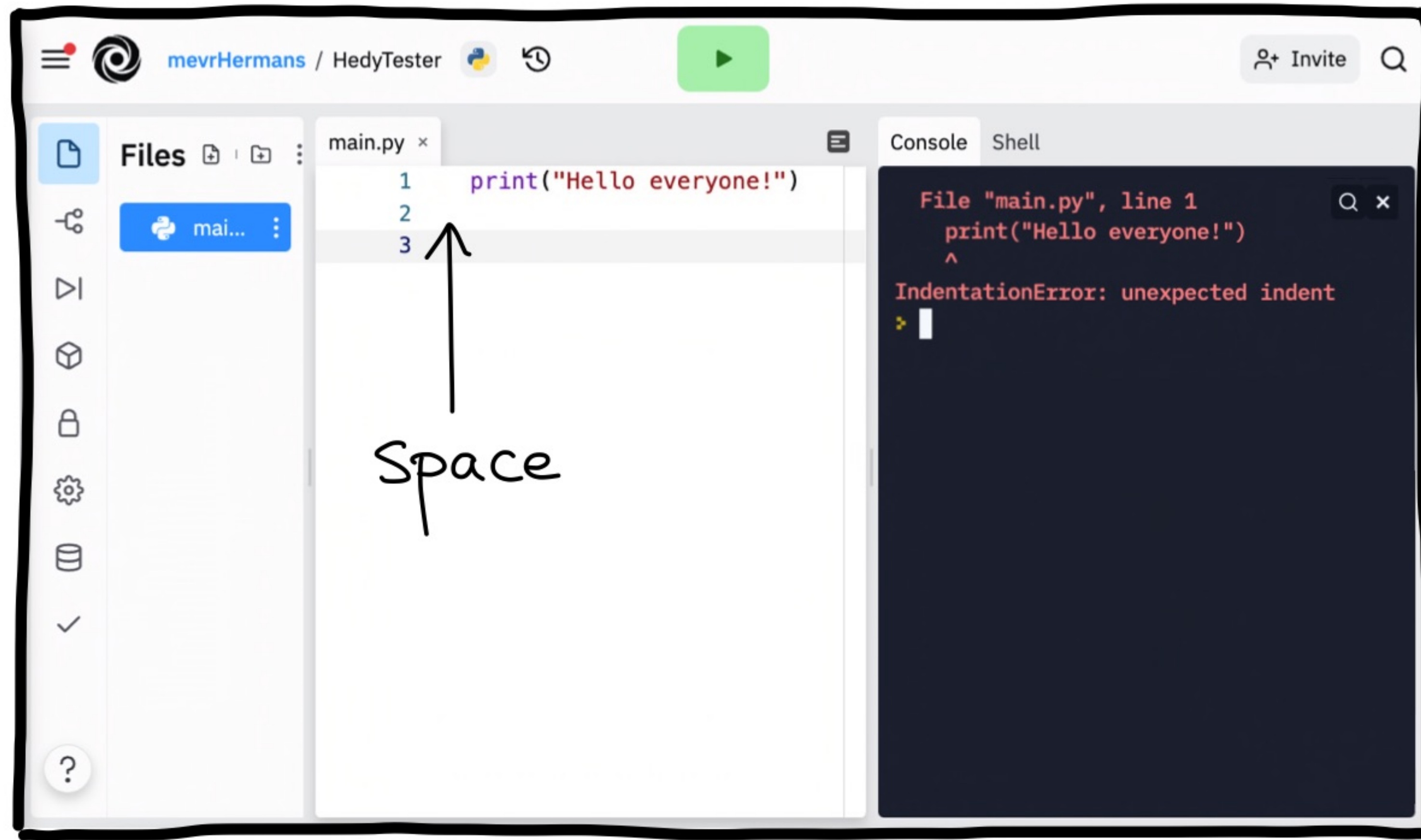




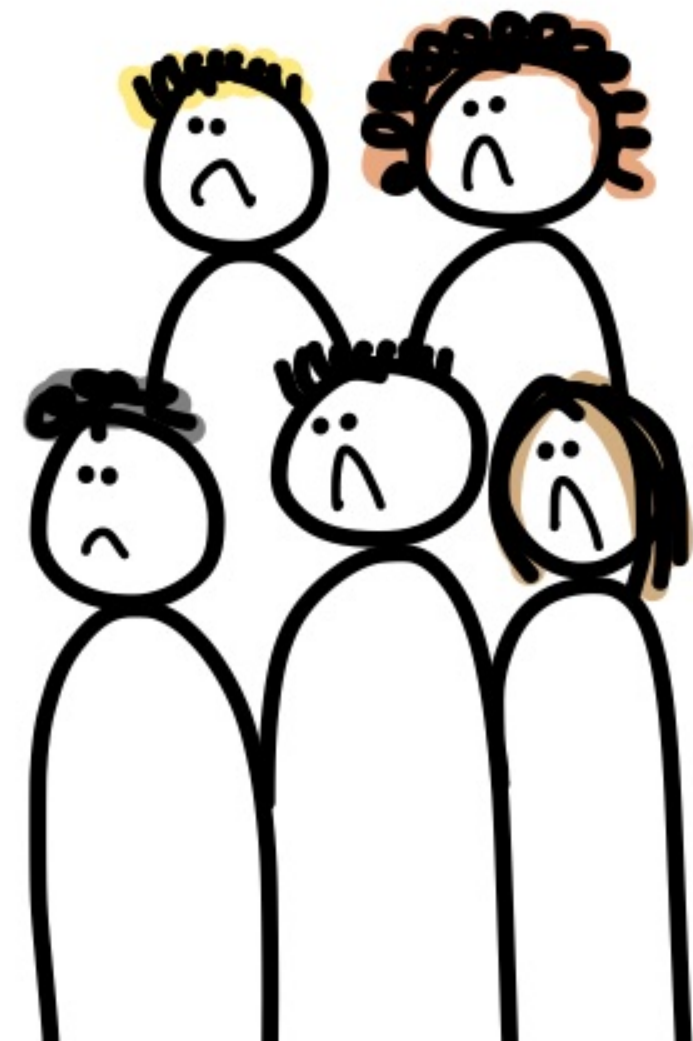






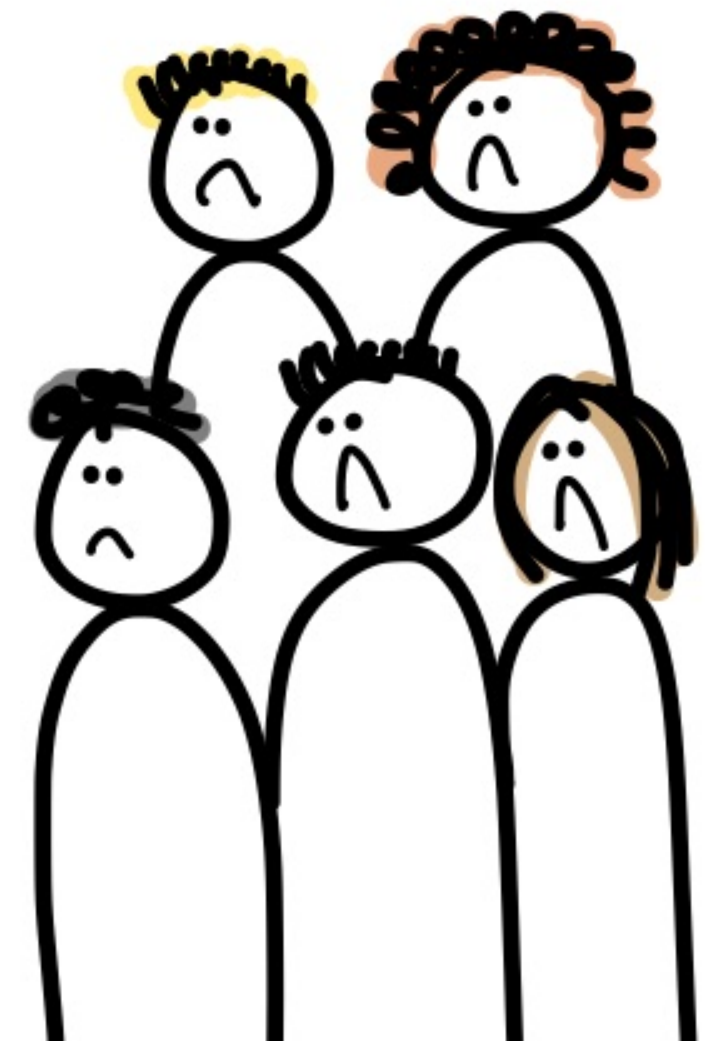


Compilers are  
not teachers



Compilers are  
not teachers

Syntax is hard!

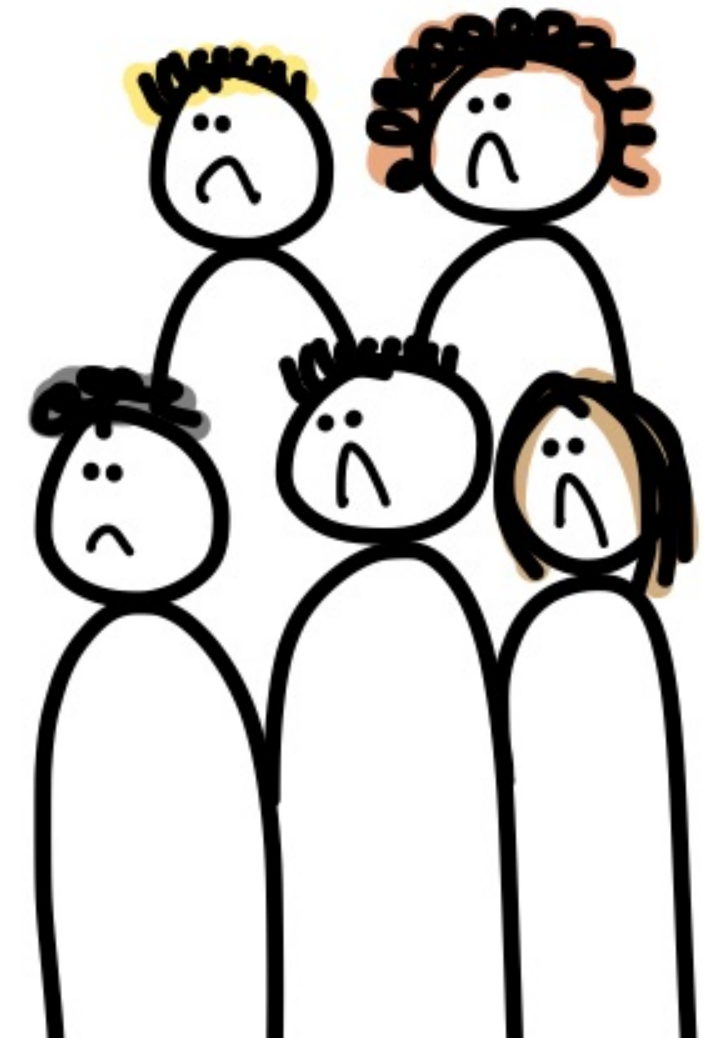


Compilers are  
not teachers

Syntax is hard!

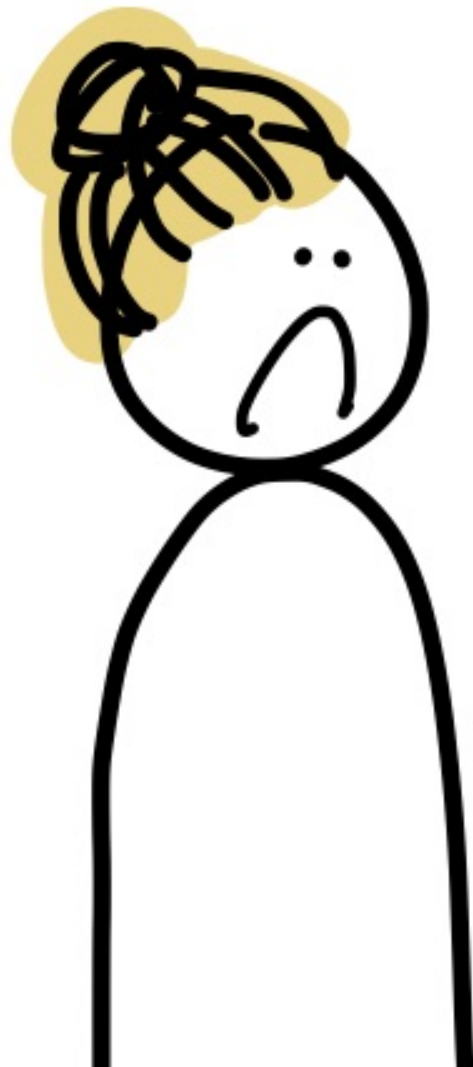


```
for i in range(4):  
    print(i)
```

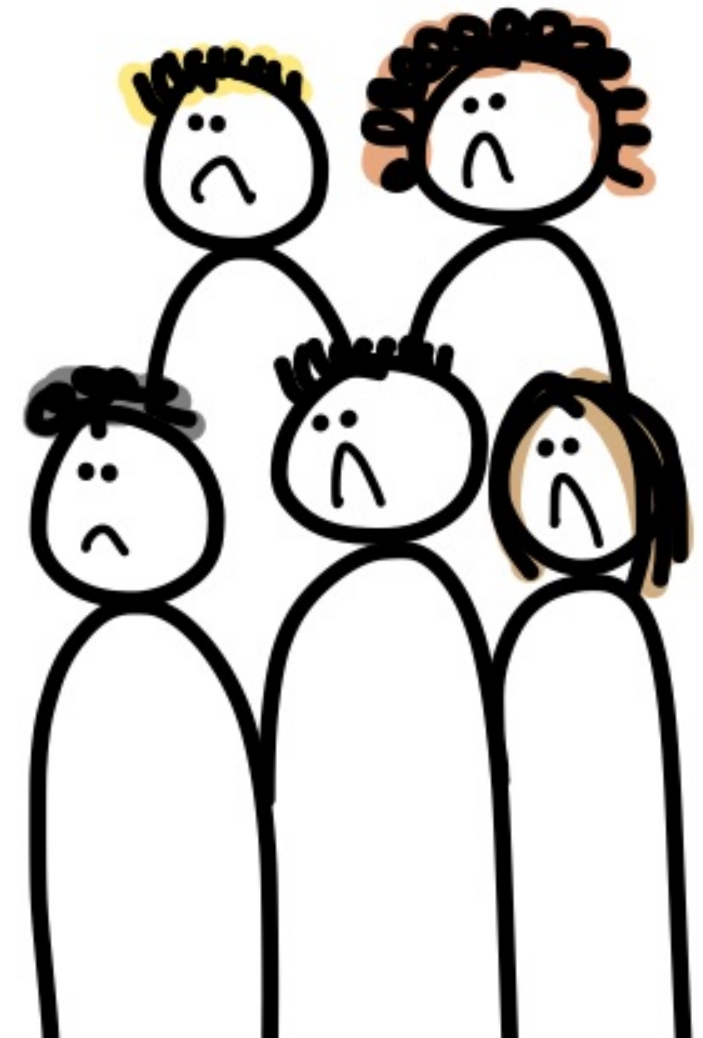


Compilers are  
not teachers

Syntax is distracting



```
for i in range(4):  
    print(i)
```



Compilers are  
not teachers

Syntax is distracting



```
for i in range(4):  
    print(i)
```



Compilers are  
not teachers

Syntax is distracting

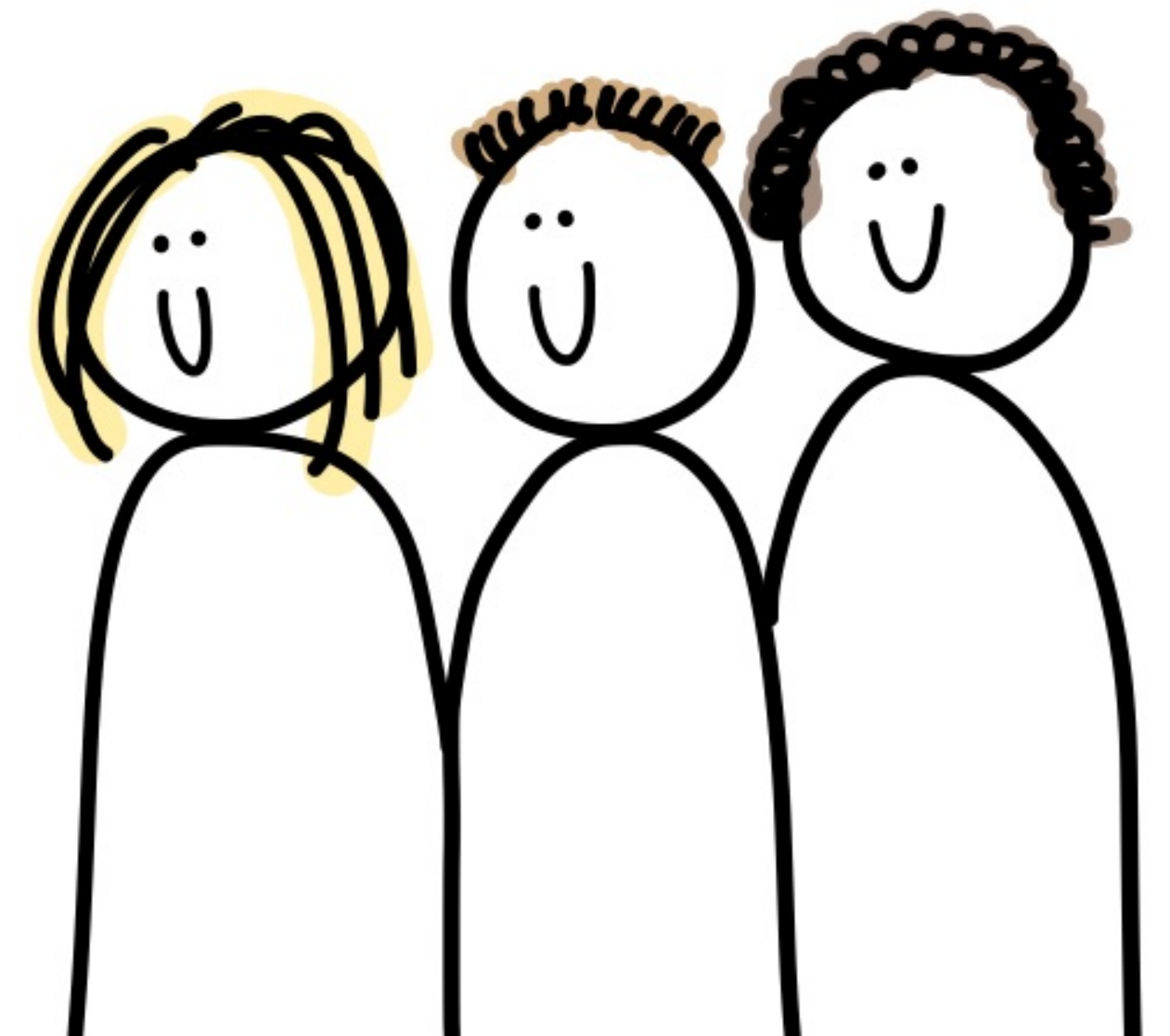
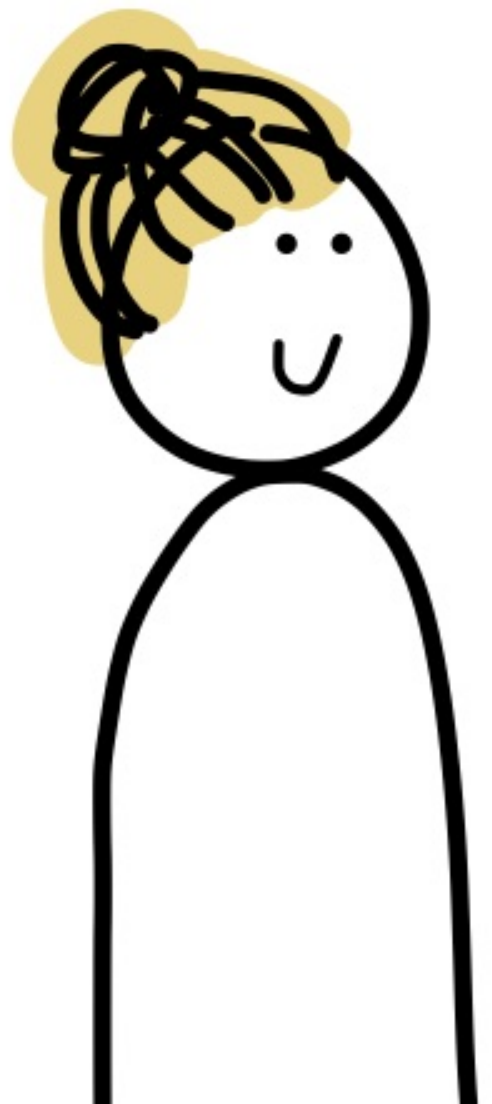


```
for i in range(4):  
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```

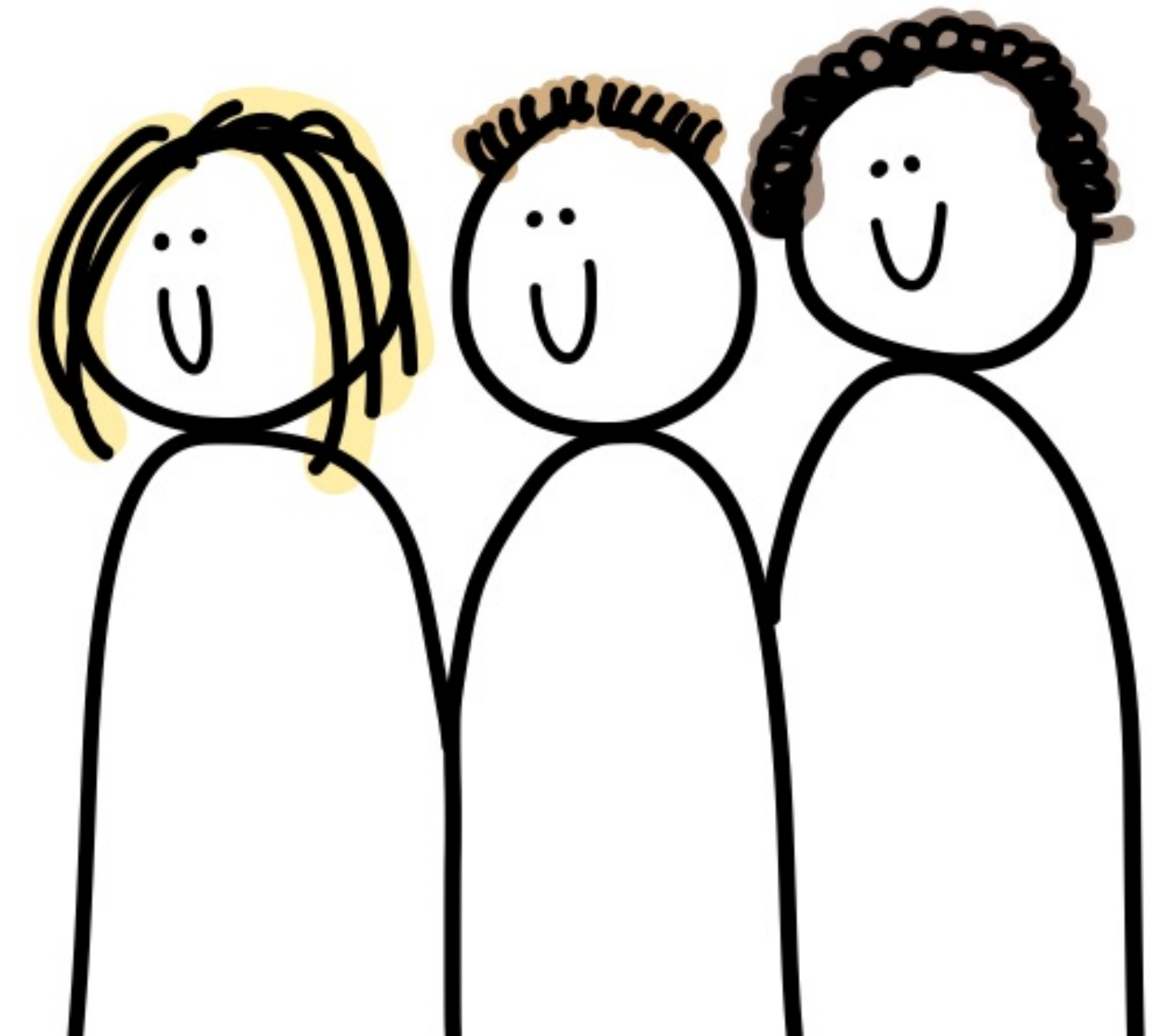
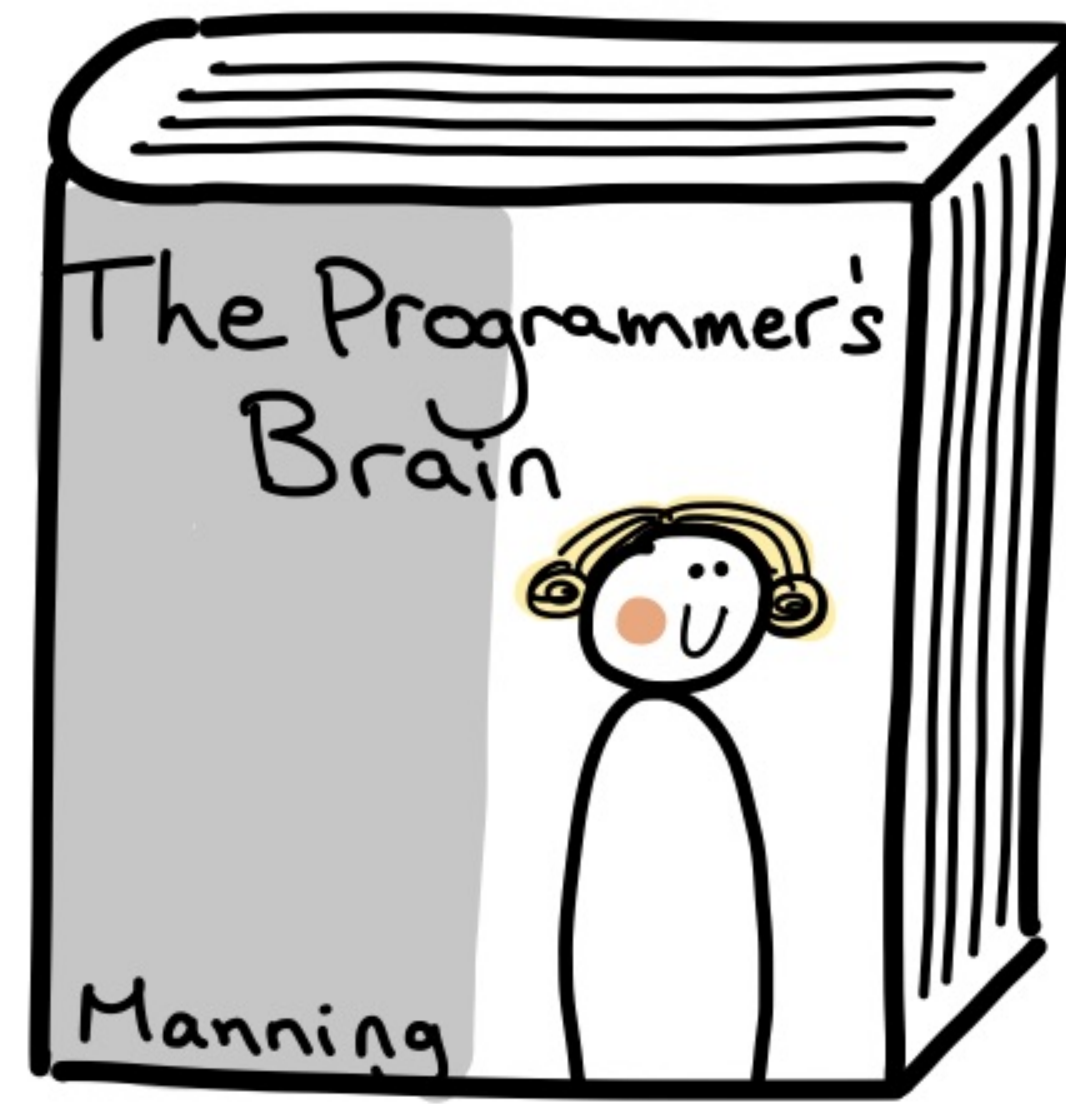
Cognitive load



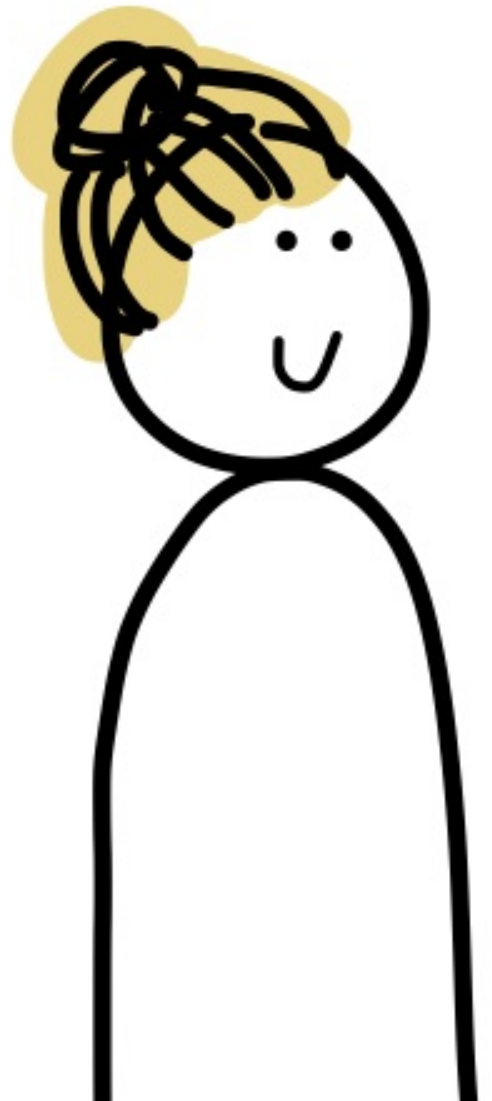
We'd love to know  
more about  
code & cognition



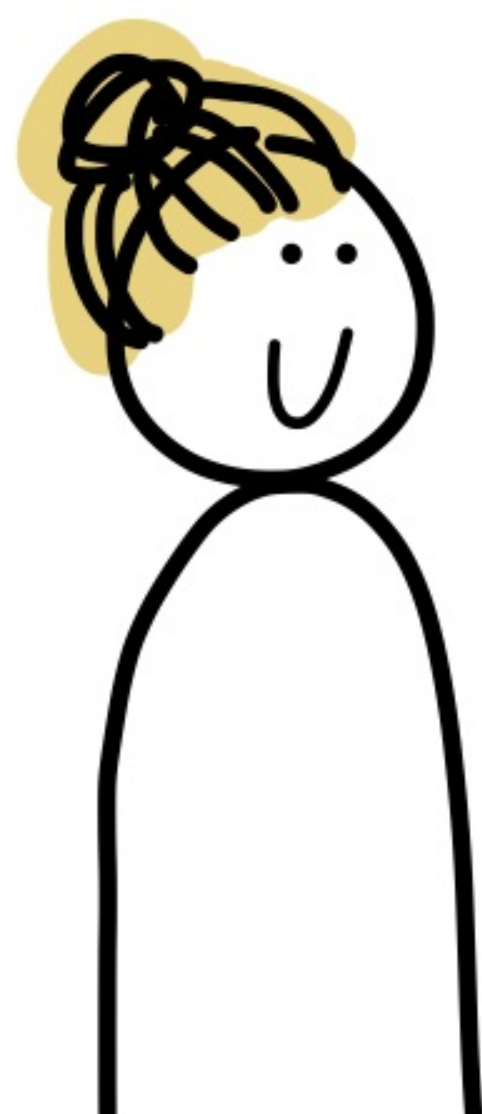
We'd love to know  
more about  
code & cognition



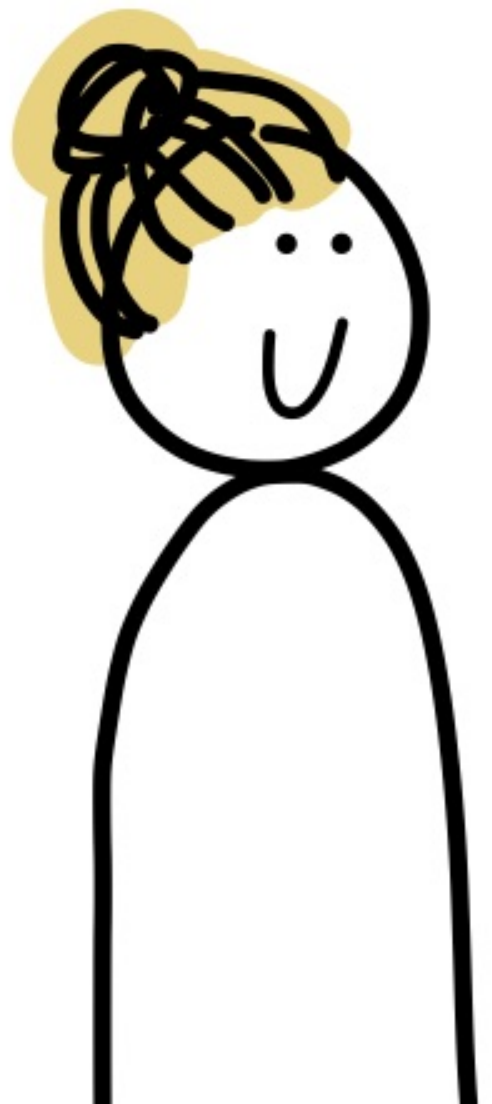
How do other fields  
manage cognitive load?



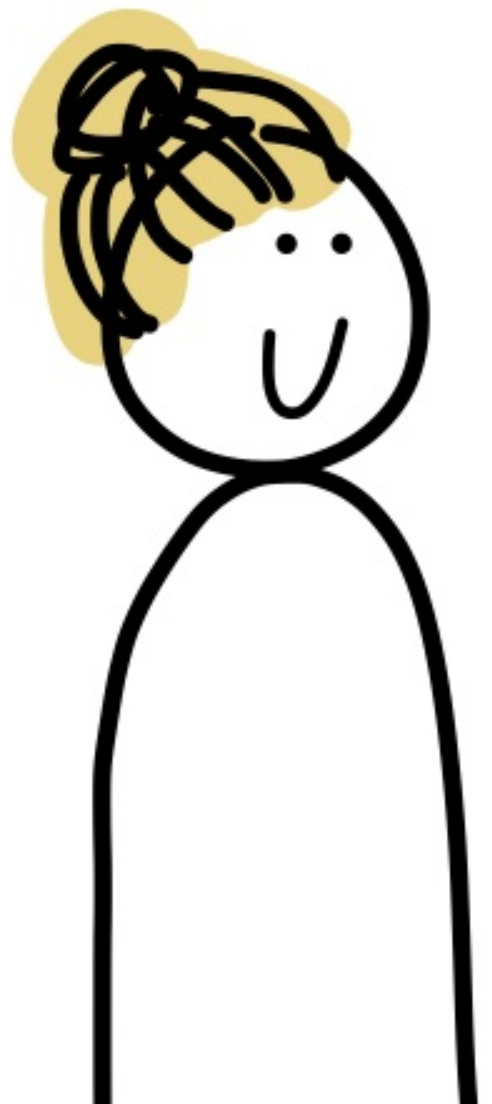
a in e



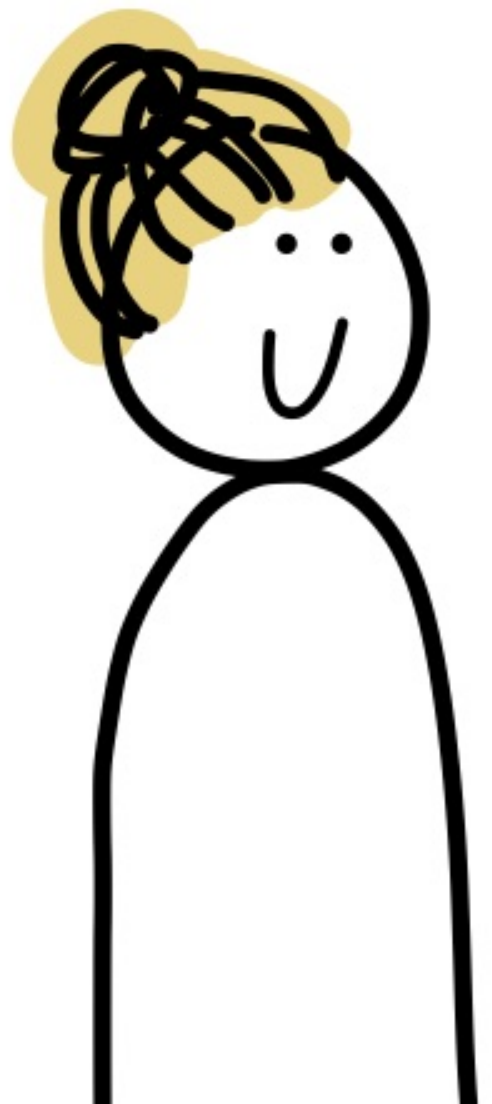
a in e  
cat in tree



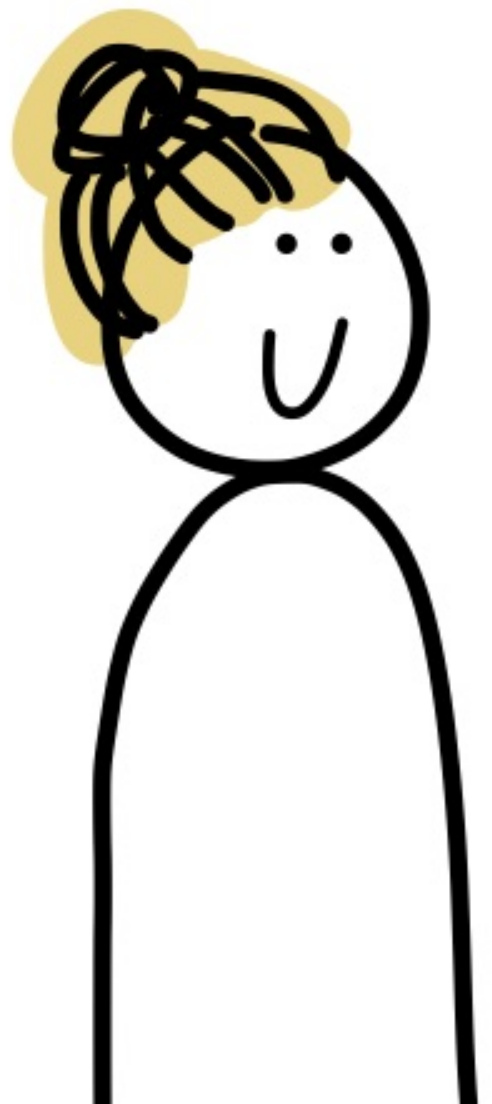
a in e  
cat in tree  
Cat in tree



a in e  
cat in tree  
Cat in tree  
Cat in tree.

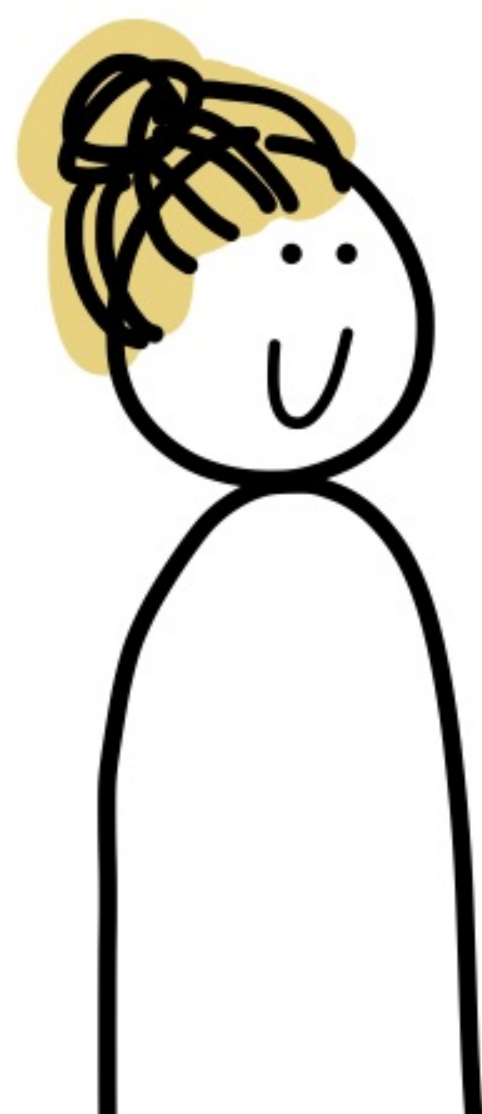


a in e  
cat in tree  
Cat in tree  
Cat in tree.  
The cat in the  
tree.

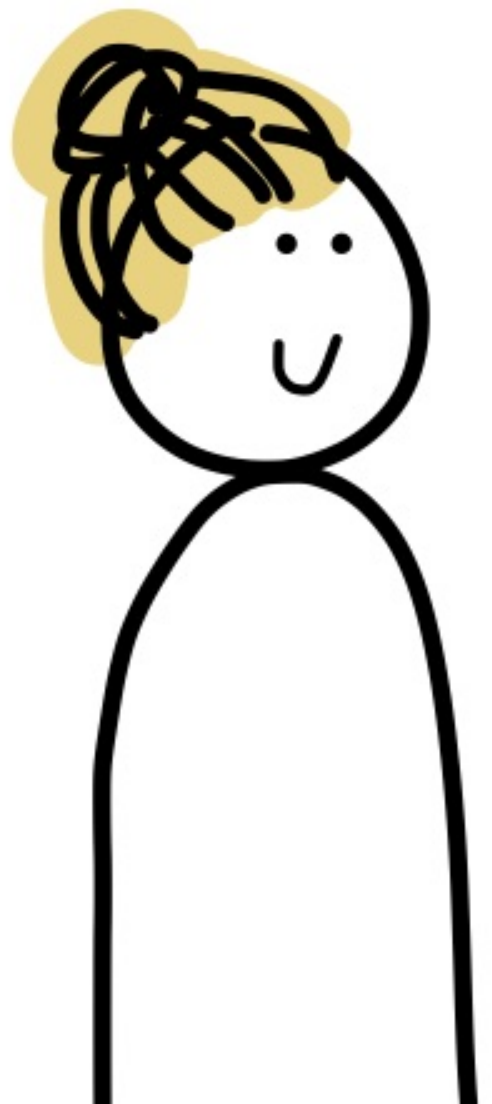


Rules gradually  
change

|                       |
|-----------------------|
| <u>a in e</u>         |
| <u>cat in tree</u>    |
| <u>Cat in tree</u>    |
| <u>Cat in tree.</u>   |
| <u>The cat in the</u> |
| <u>tree.</u>          |

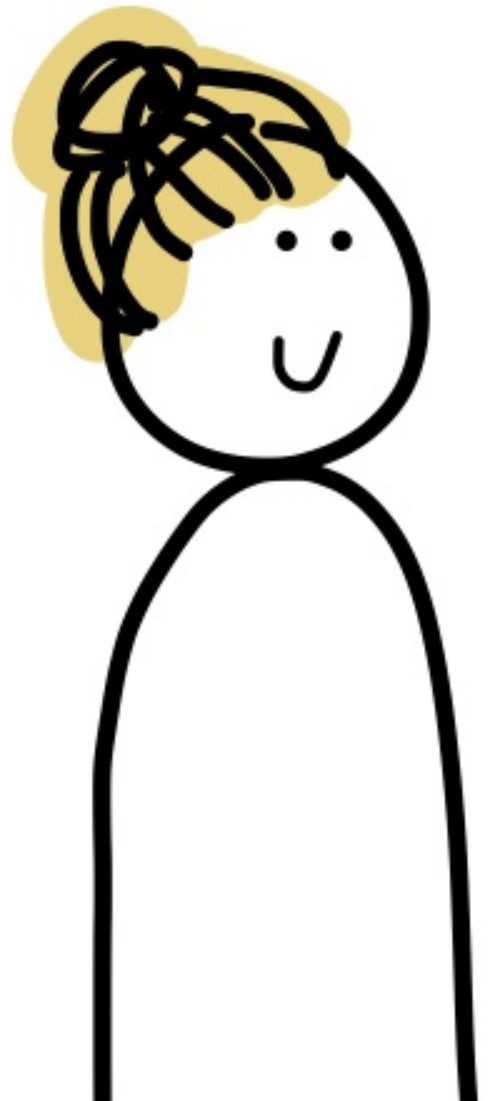


How does programming education  
manage cognitive load?



# How does programming education manage cognitive load?

```
for i in range(4):  
    print(i)
```





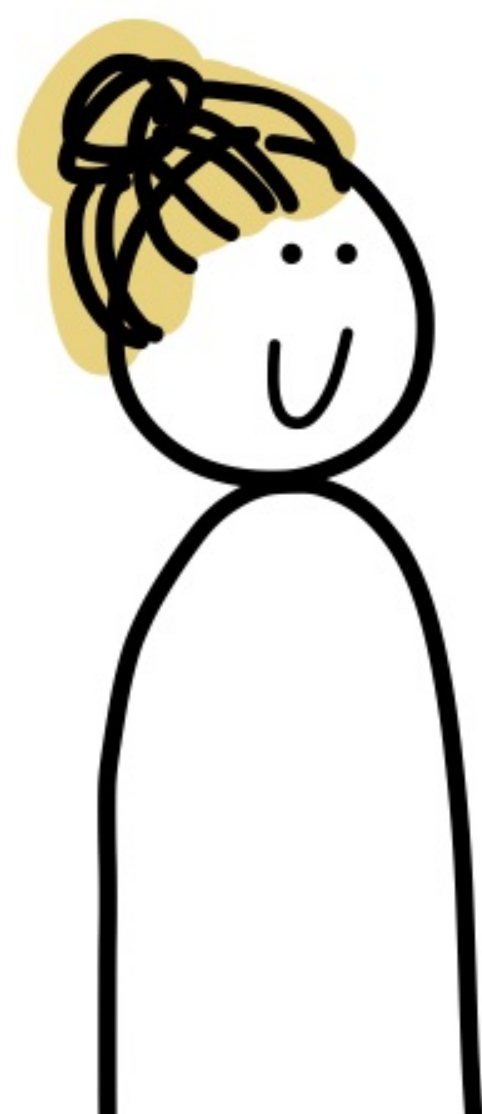
a in e  
cat in tree  
Cat in tree  
Cat in tree.  
The cat in the  
tree.

```
for i in range(4):  
    print(i)
```

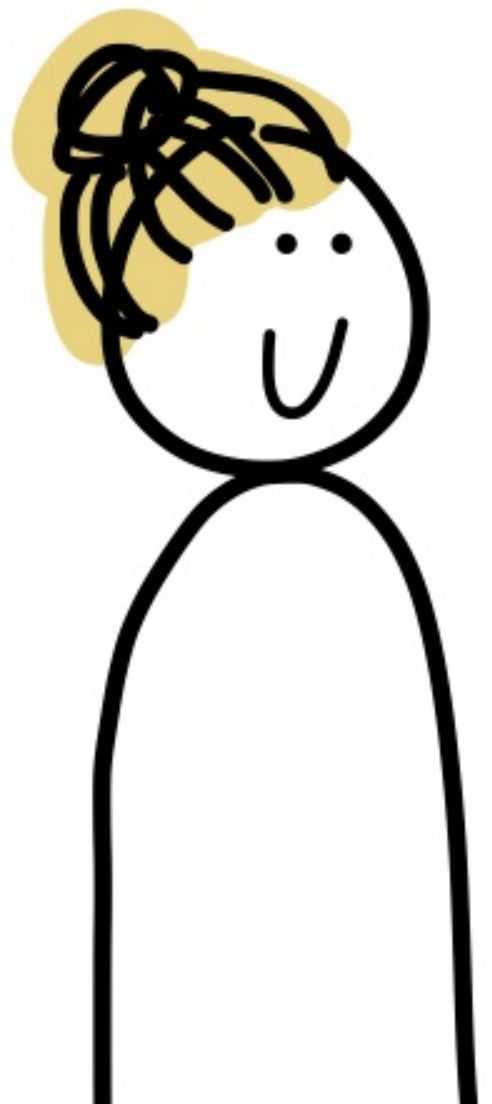
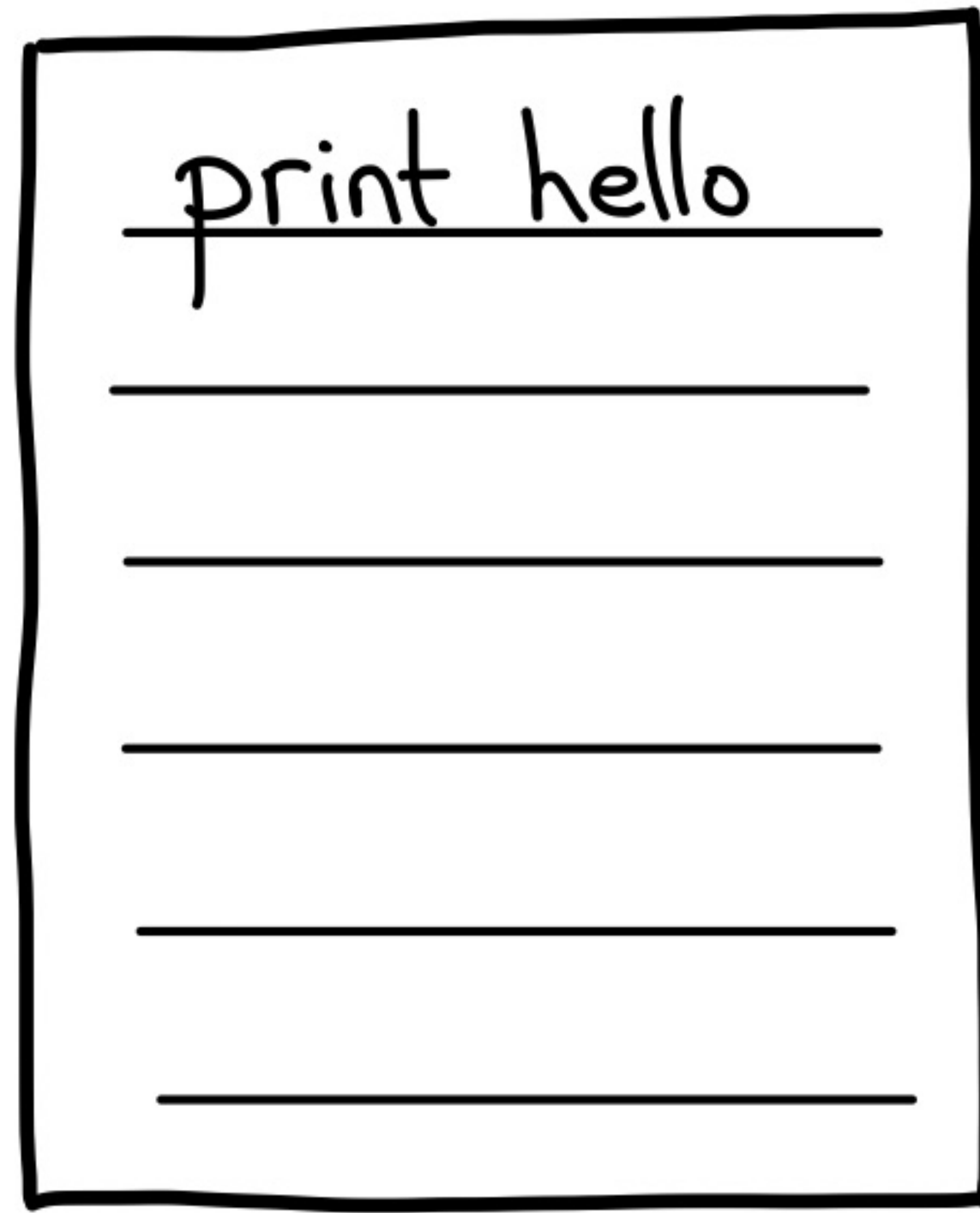


Rules gradually  
change

|                       |
|-----------------------|
| <u>a in e</u>         |
| <u>cat in tree</u>    |
| <u>Cat in tree</u>    |
| <u>Cat in tree.</u>   |
| <u>The cat in the</u> |
| <u>tree.</u>          |

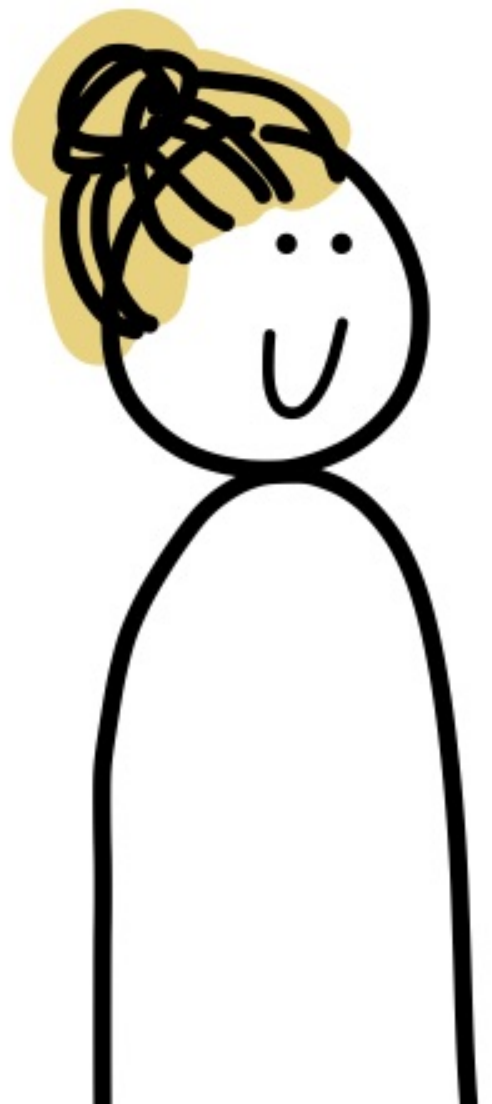


Hedy is gradual  
too!



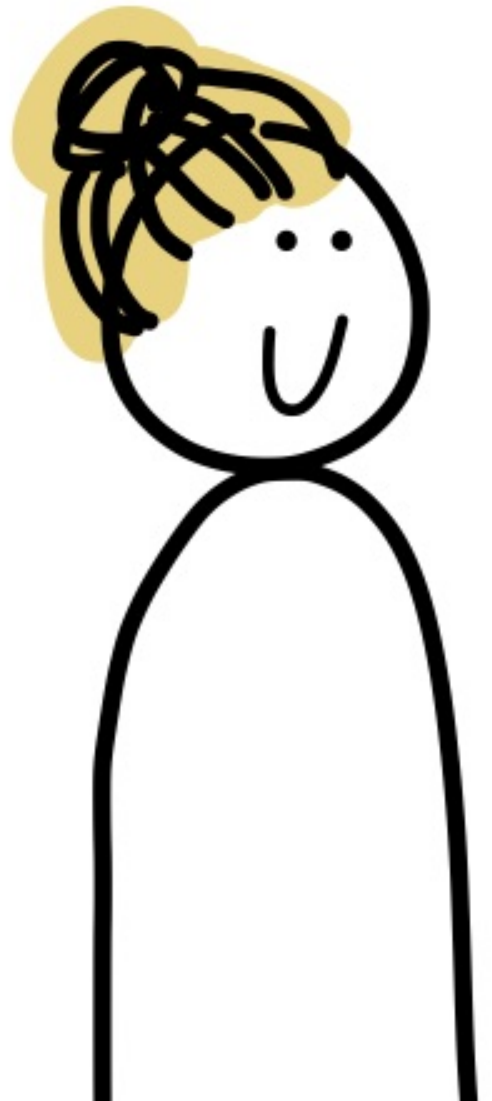
Hedy is gradual  
too!

```
print hello  
print 'hello'
```



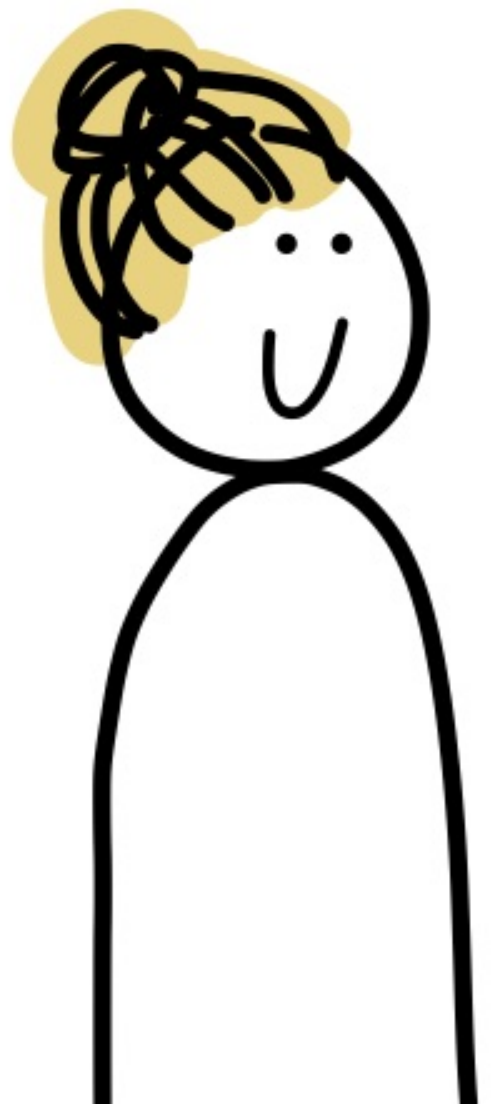
Hedy is gradual  
too!

```
print hello  
print 'hello'  
print ('hello')  
_____  
_____  
_____
```

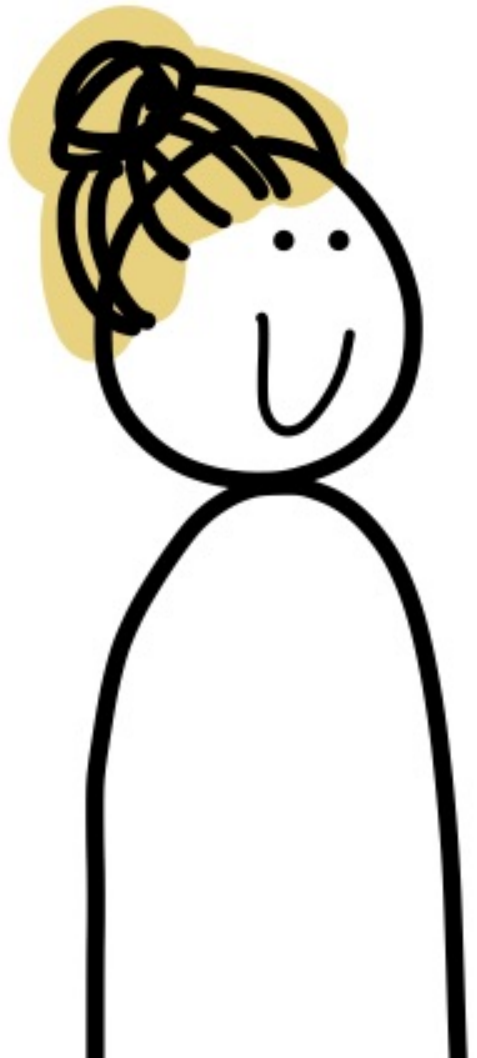


Hedy is gradual  
too!

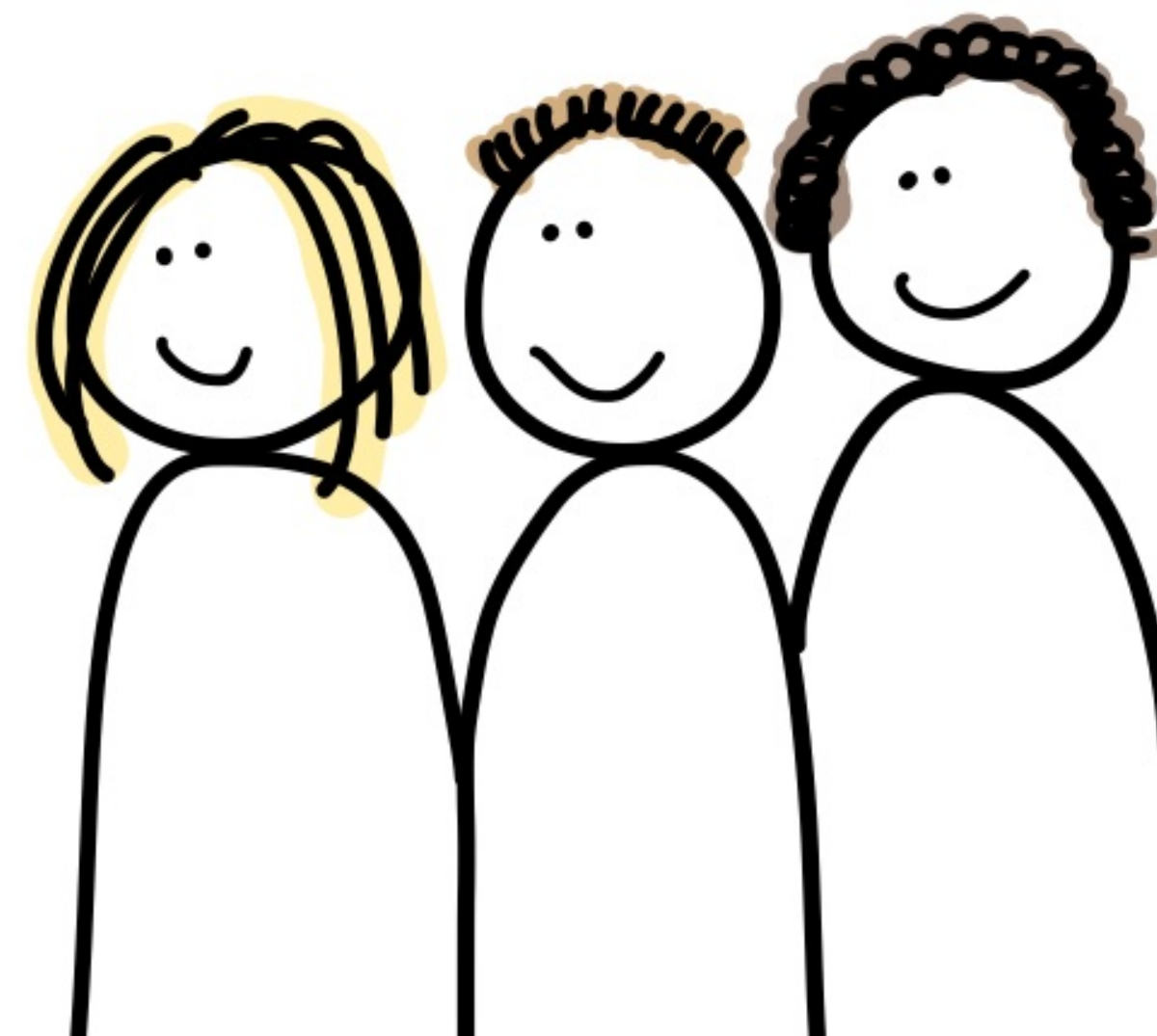
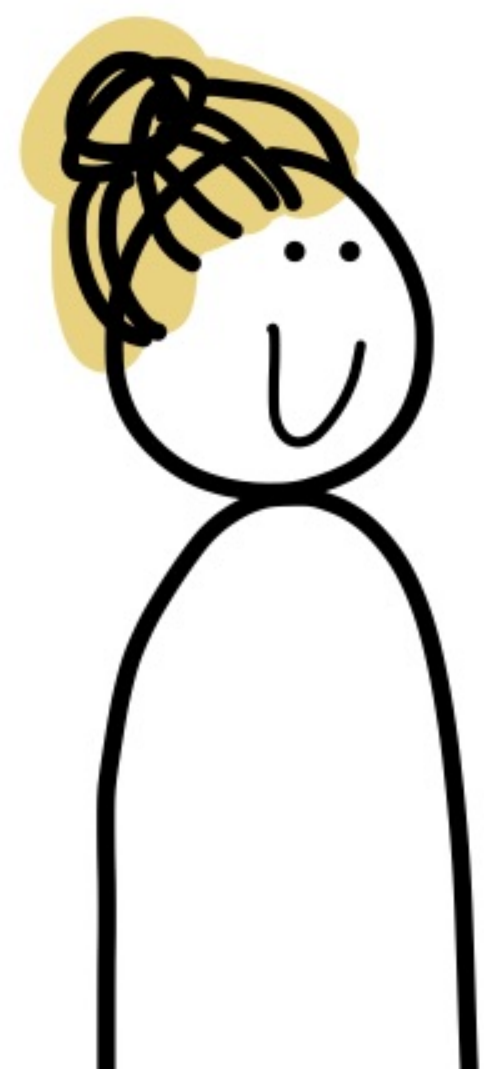
```
print hello  
print 'hello'  
print ('hello')  
repeat 4 times  
for i in range 1 to 4  
for i in range(4):
```



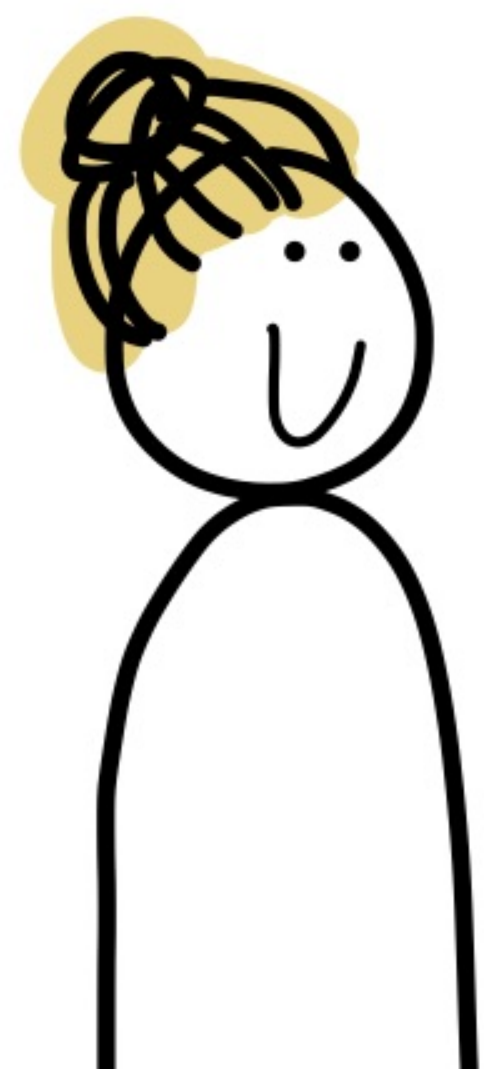
Demo time



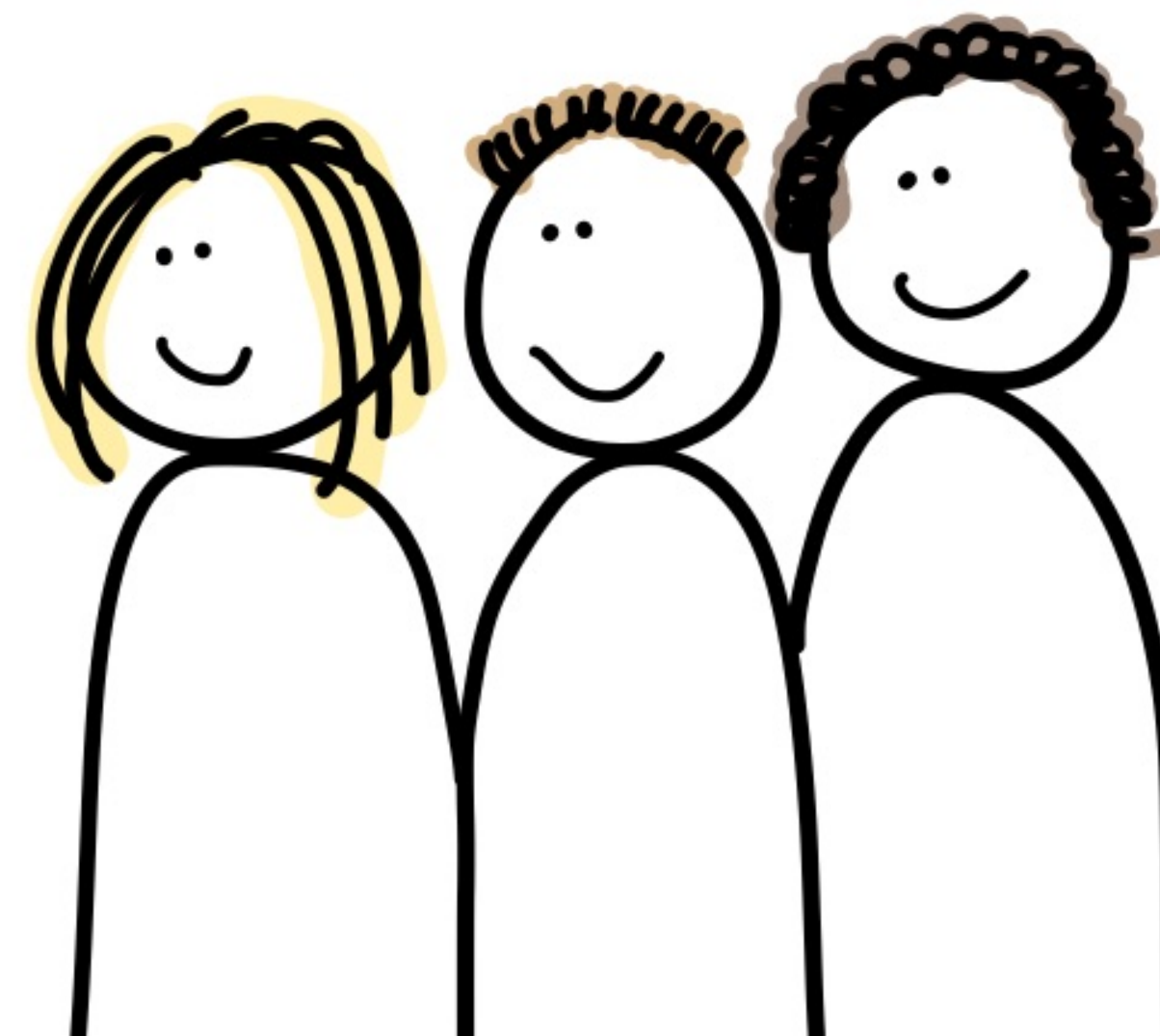
How is it going?



Not bad!



How is it going?





## Tweet



**Guido van Rossum** ✓

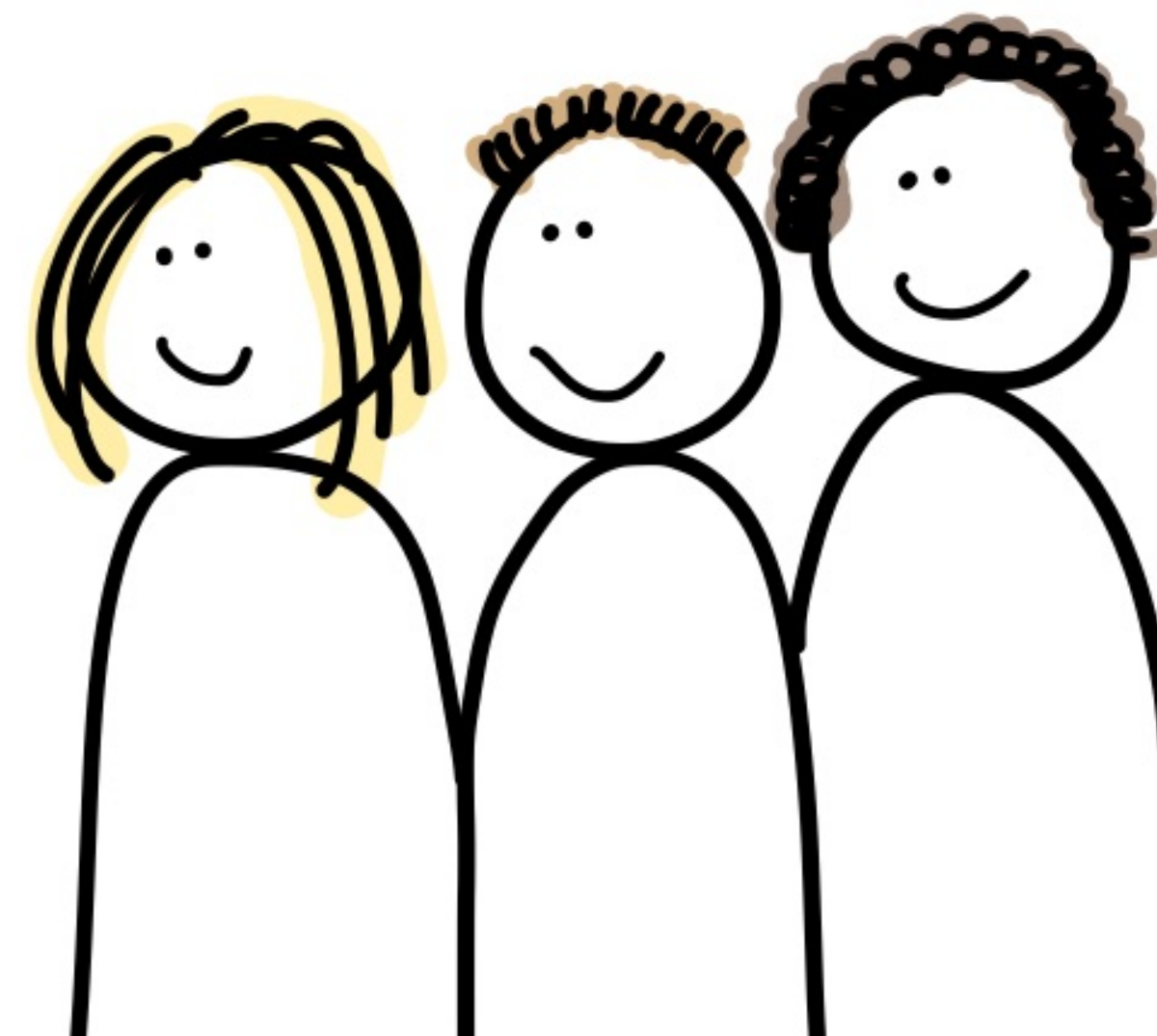
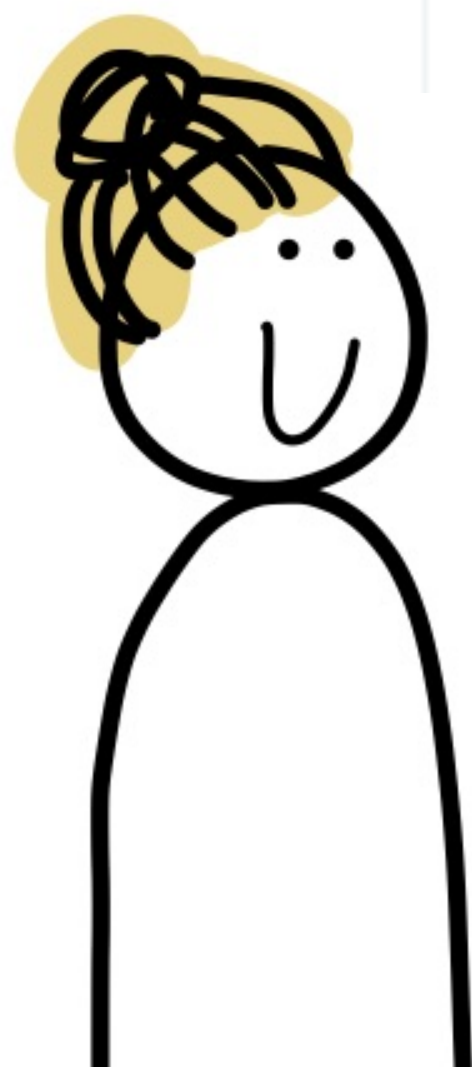
@gvanrossum



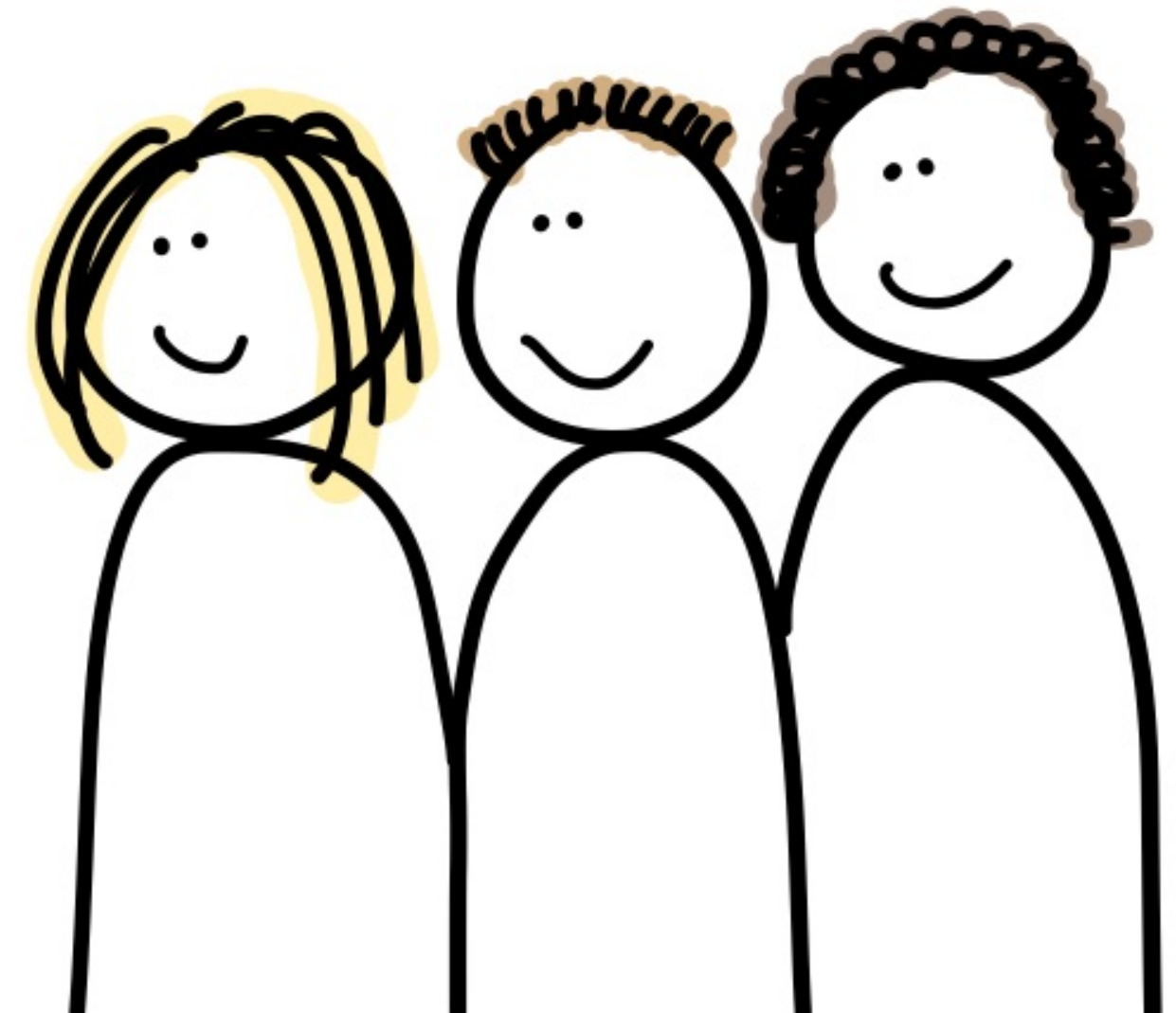
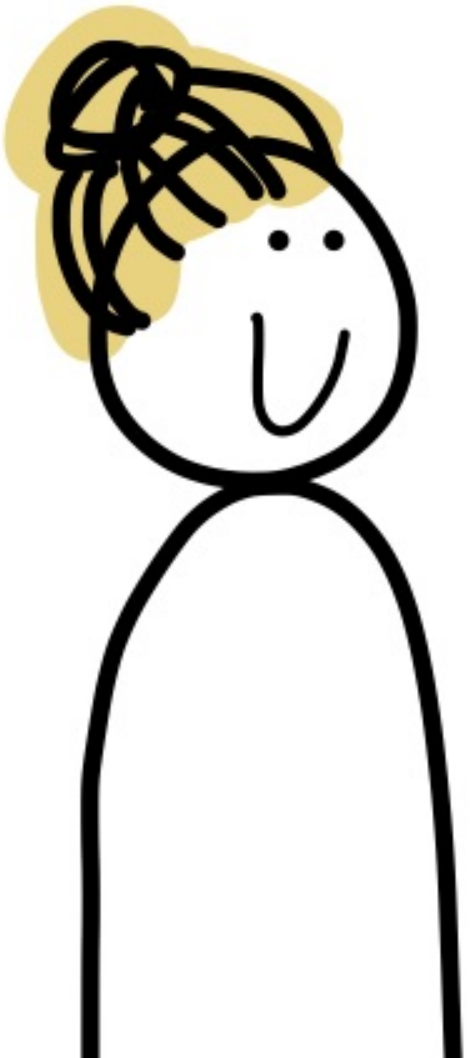
Just discovered Hedy, a gradual programming language. It's a new idea on how to teach programming to beginners. Very cool! [hedycode.com](https://hedycode.com) @hedycode

1:53 AM · Mar 30, 2022 · Twitter Web App

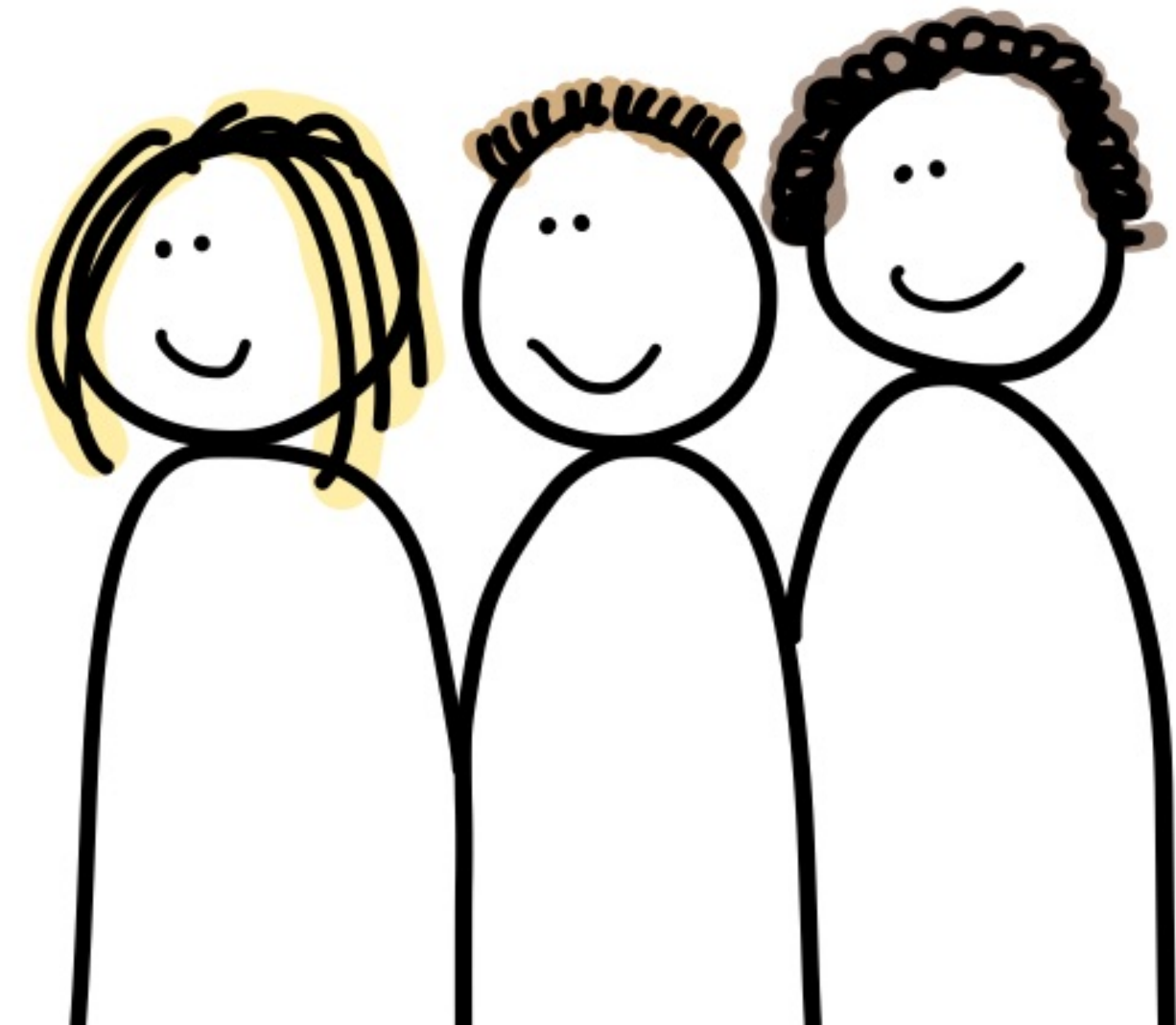
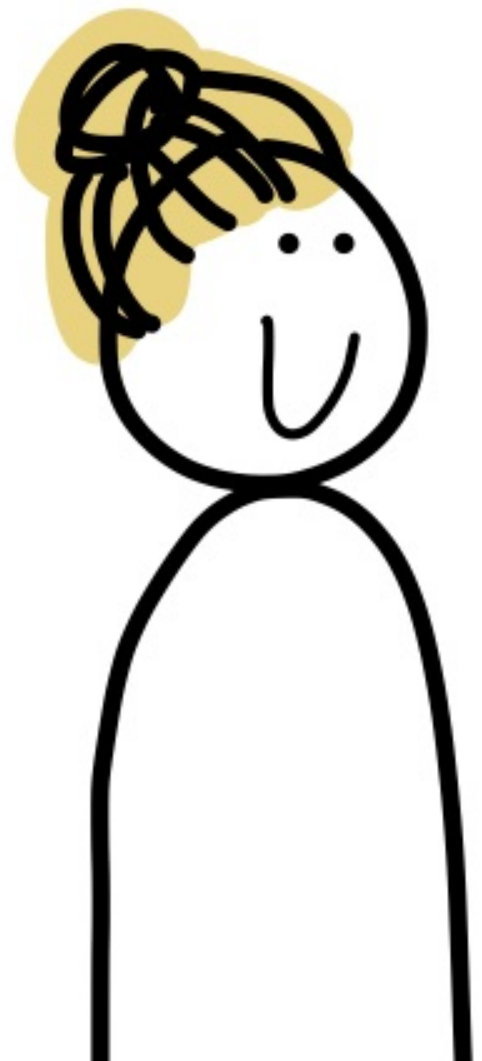
139 Retweets 14 Quote Tweets 702 Likes



# Hedy programs

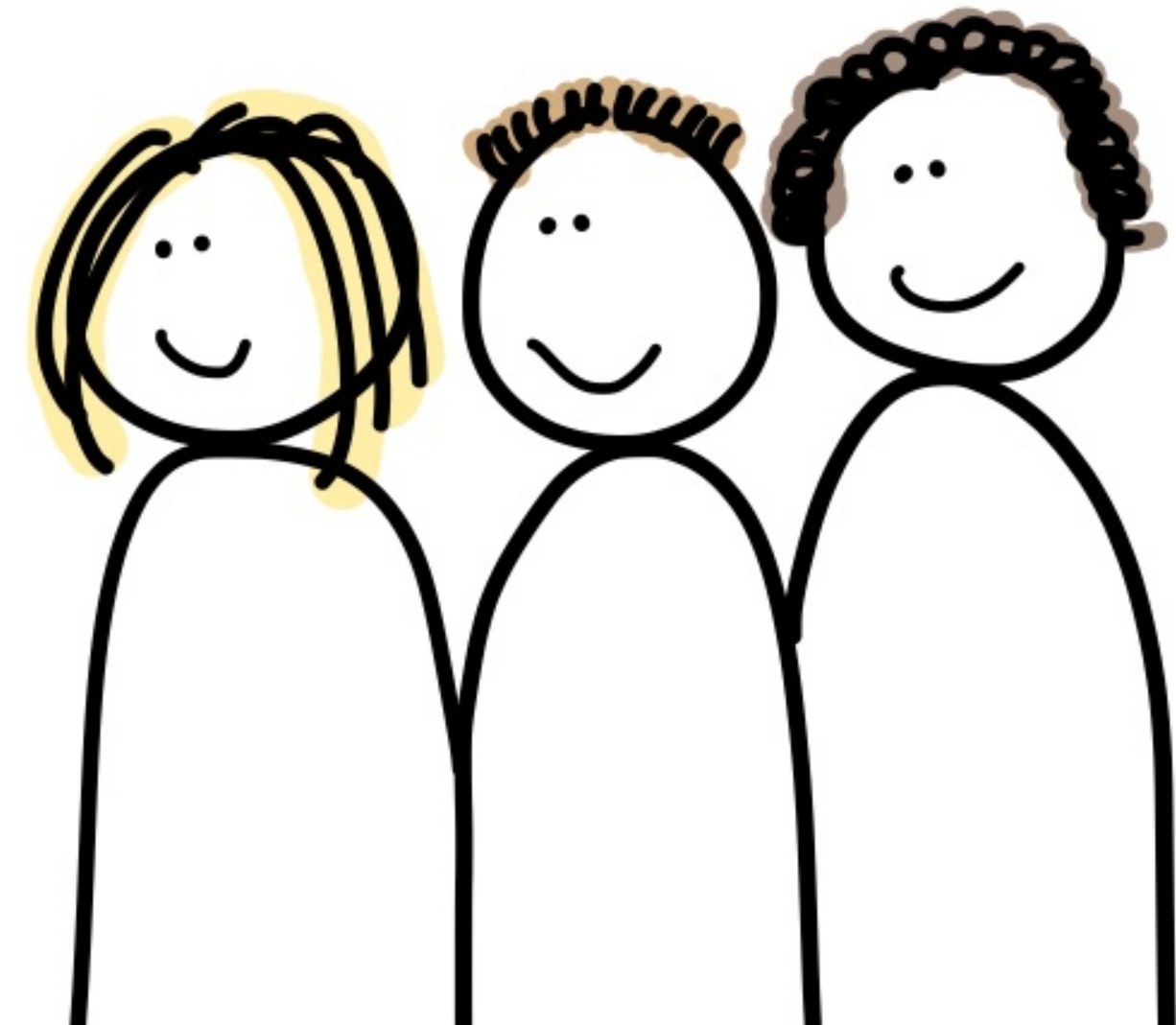
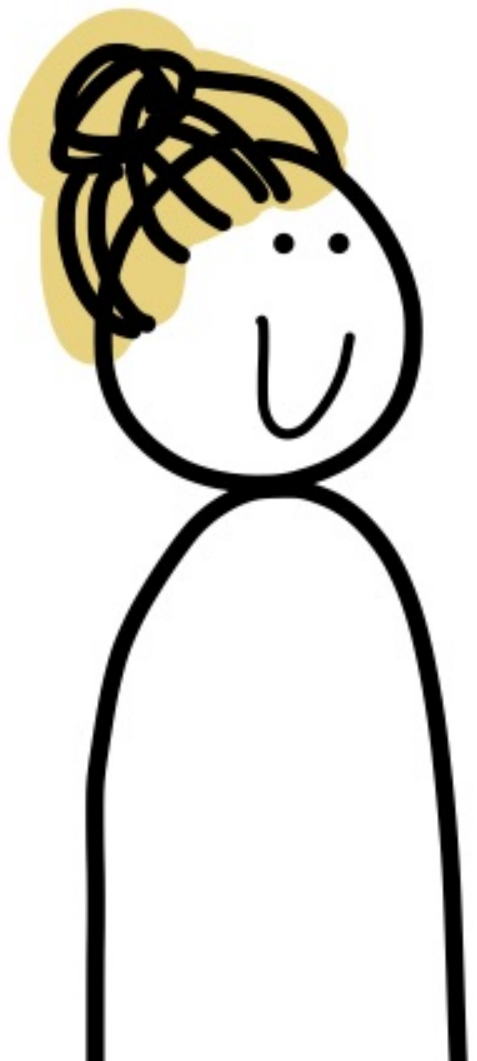


Hedy programs  
- 1.800.000 programs



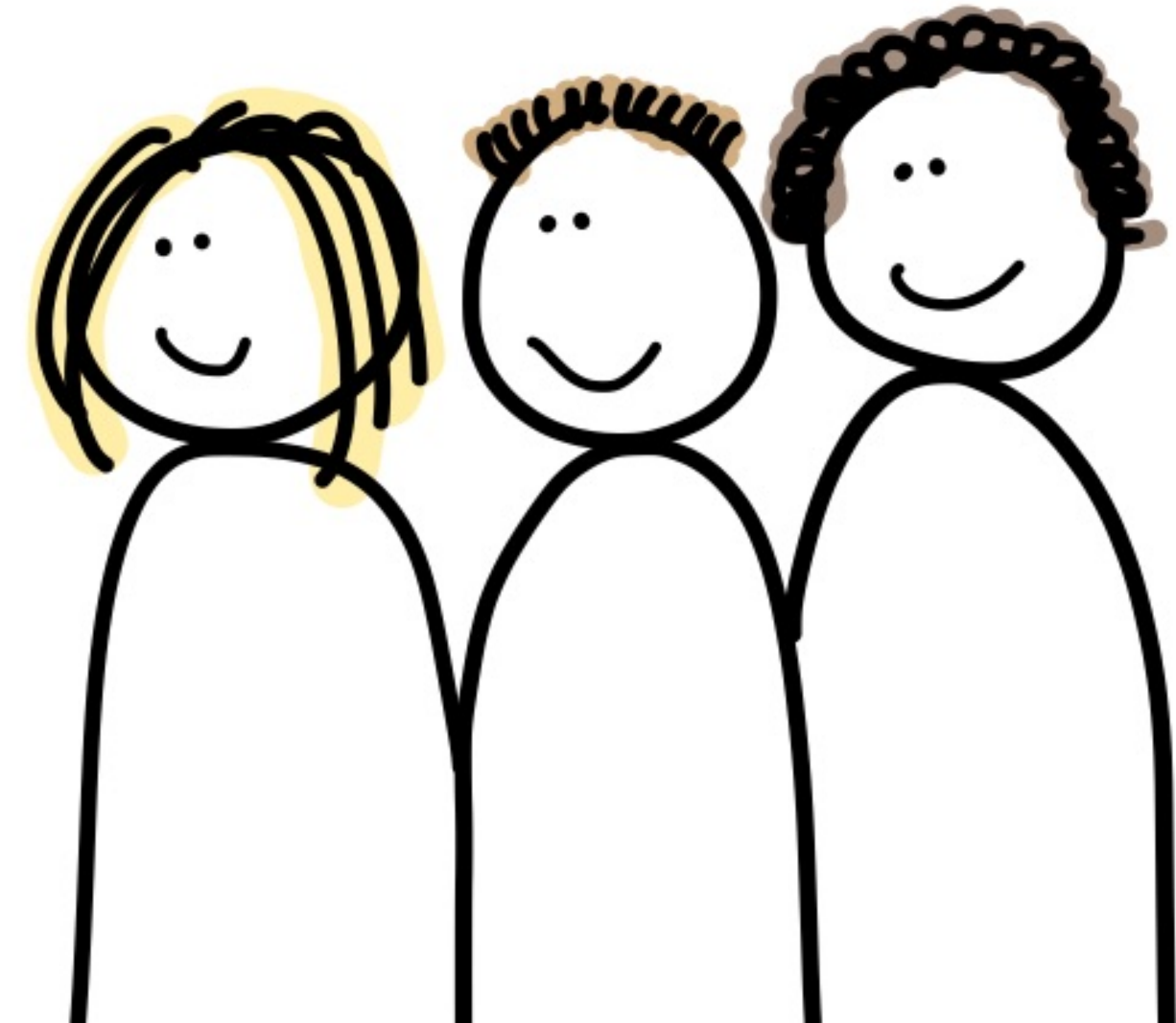
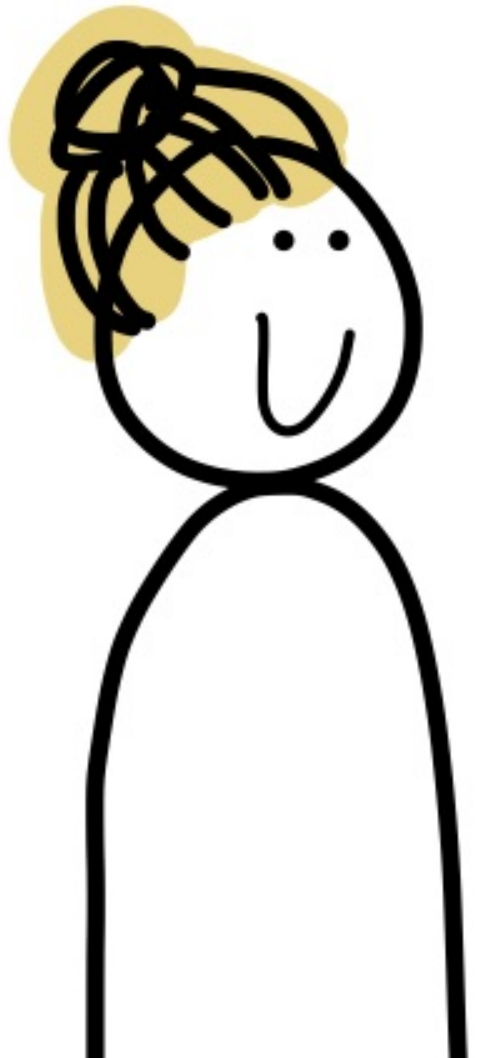
# Hedy programs

- 1.800.000 programs
- 700.000 unique



# Hedy programs

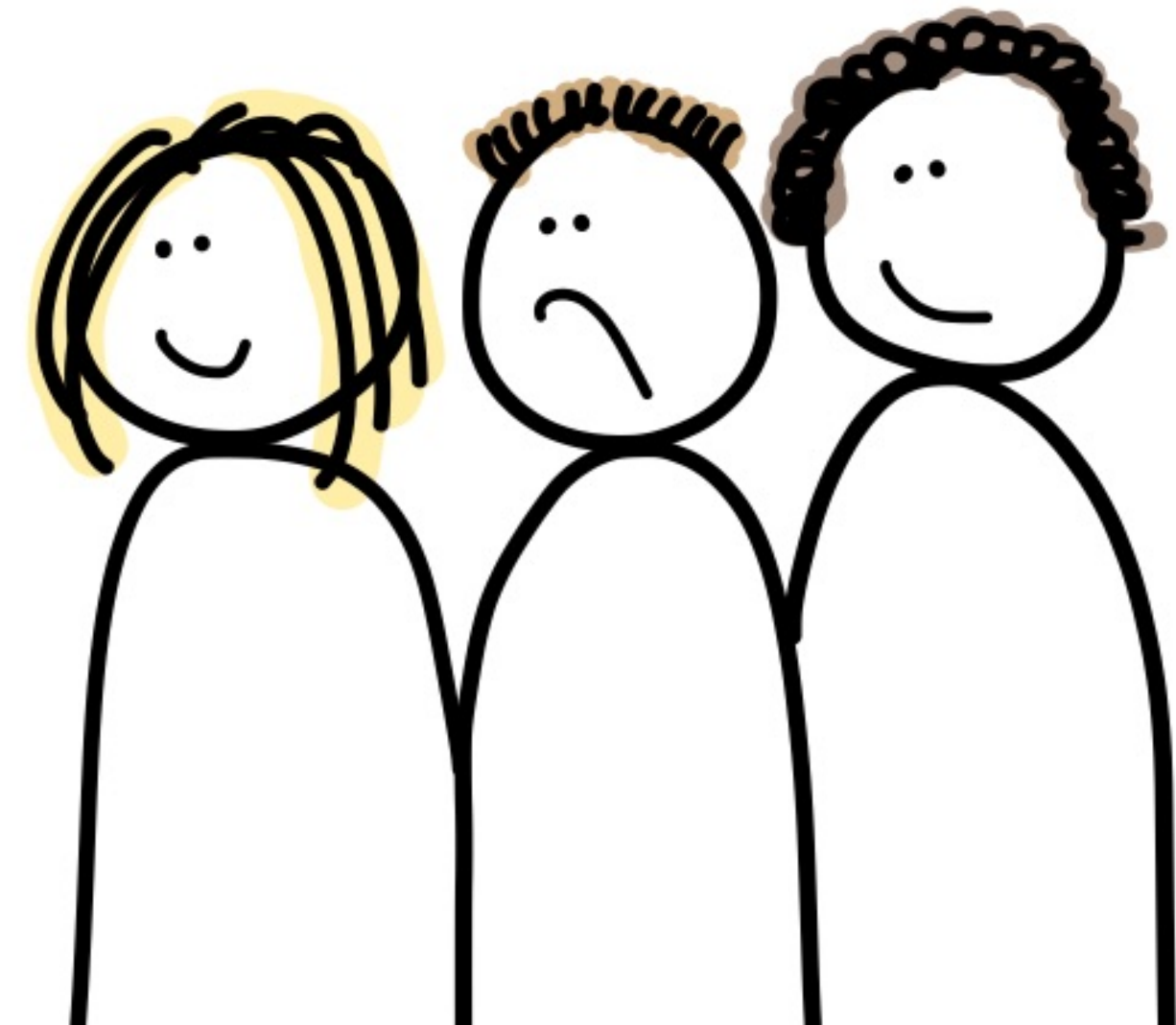
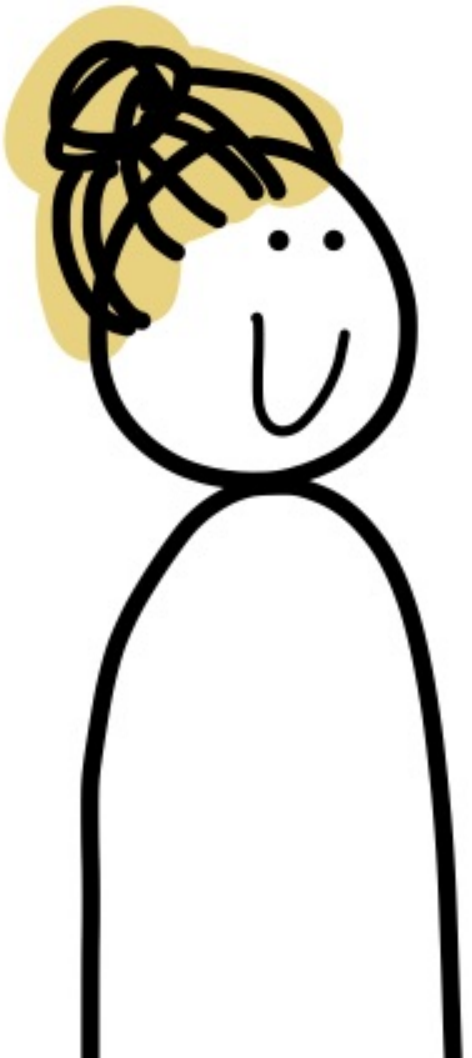
- 1.800.000 programs
- 700.000 unique
- 25 % errors



# Hedy programs

- 1.800.000 programs
- 700.000 unique
- 25% errors

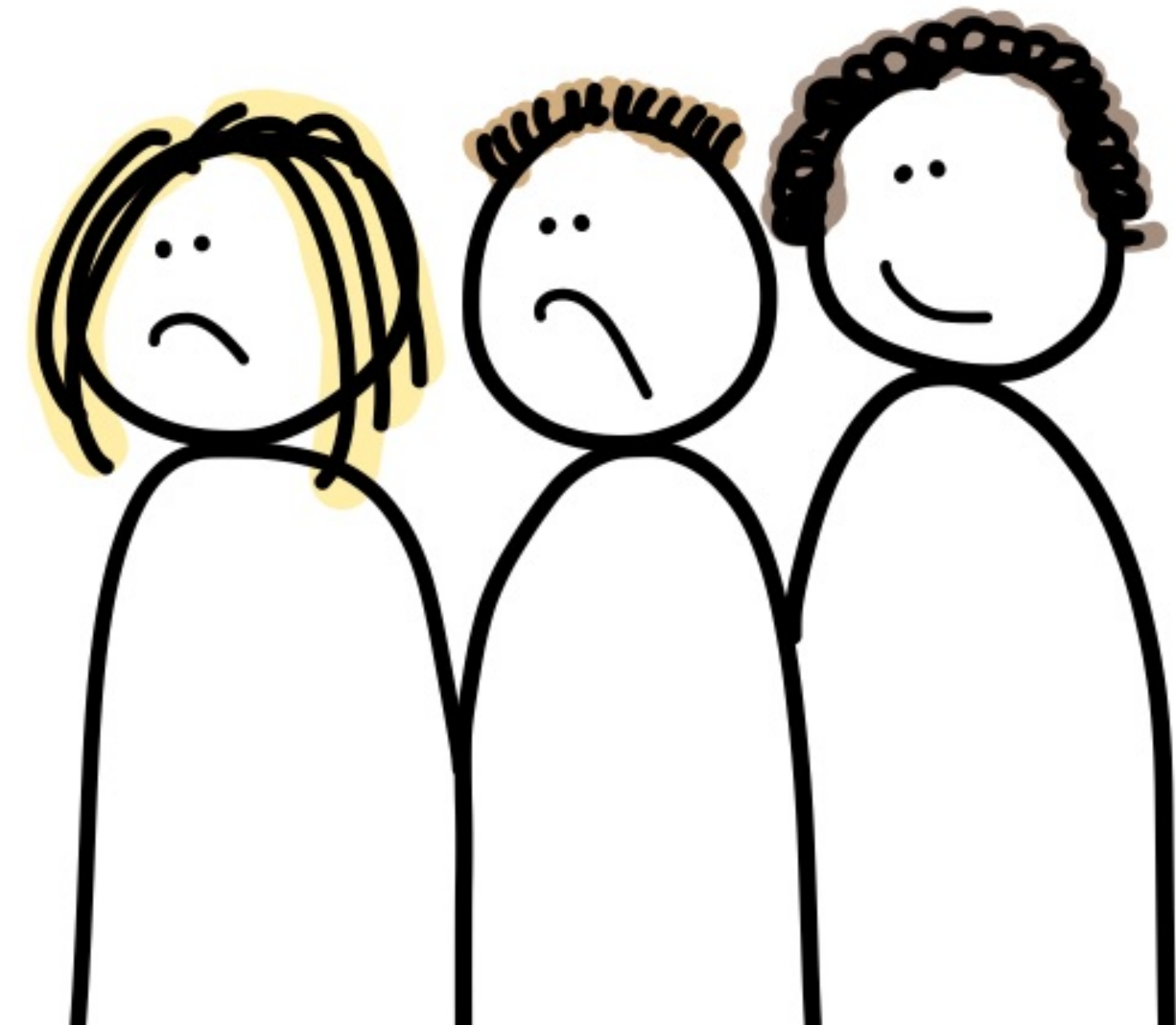
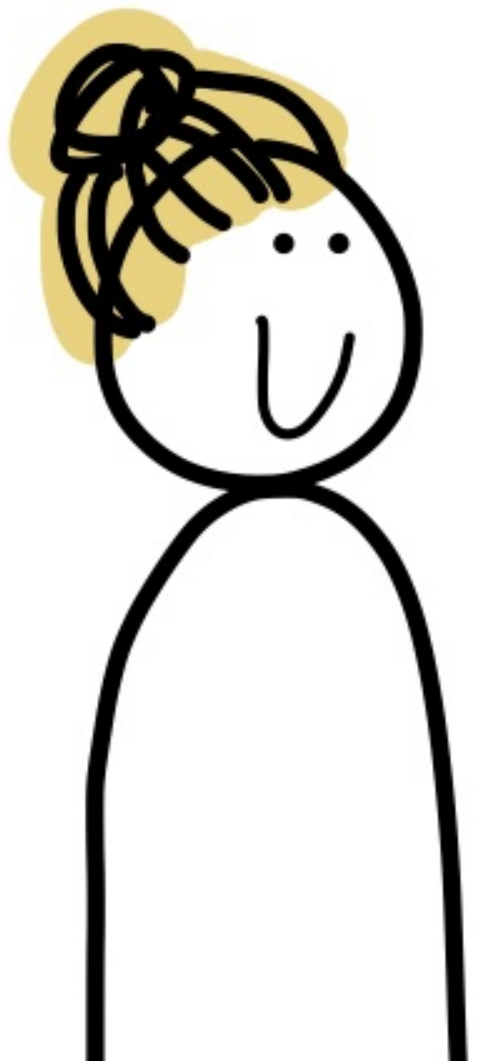
25%?



# Hedy programs

Regular languages  
have error rates  
around 50 % for  
novices

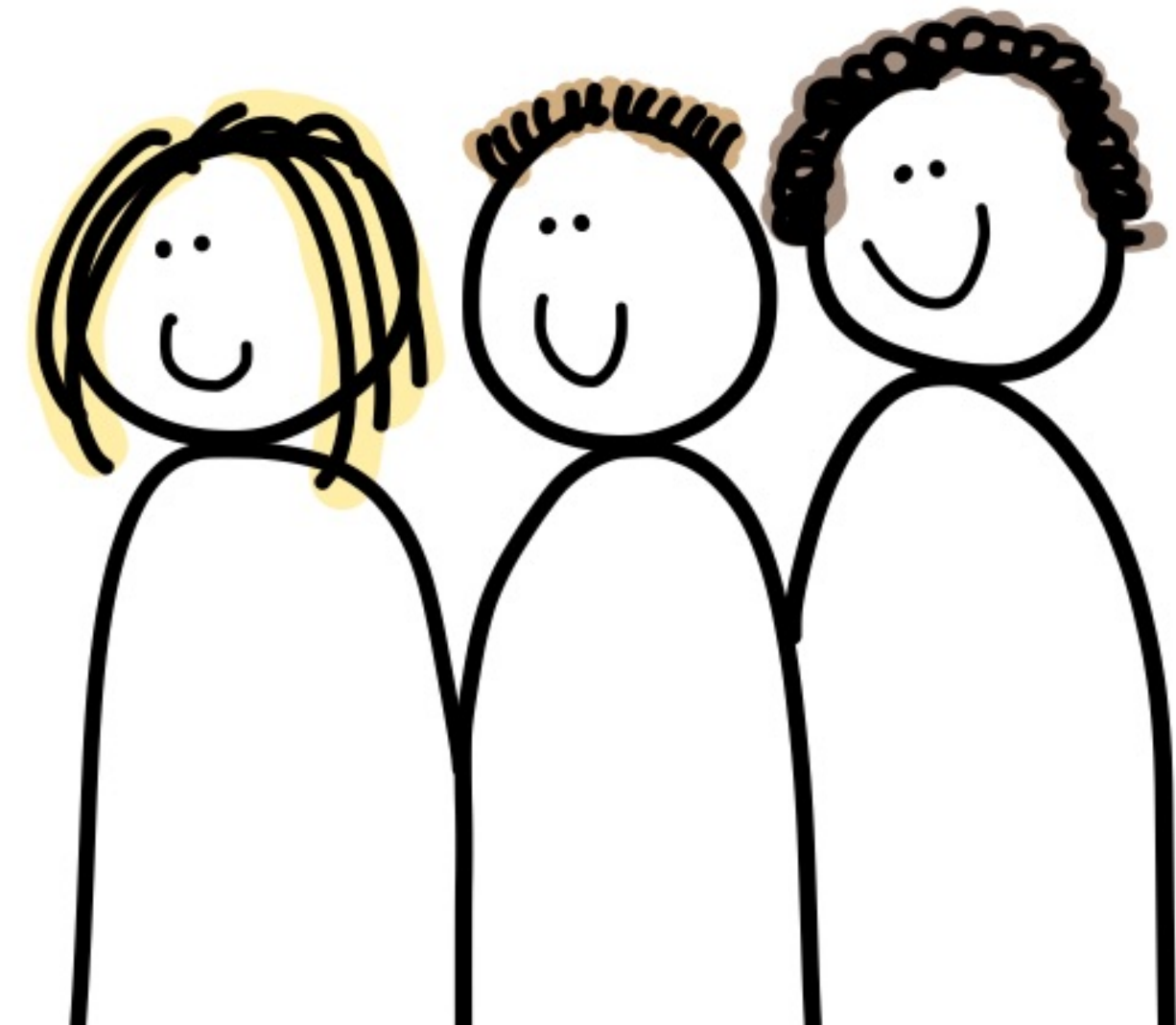
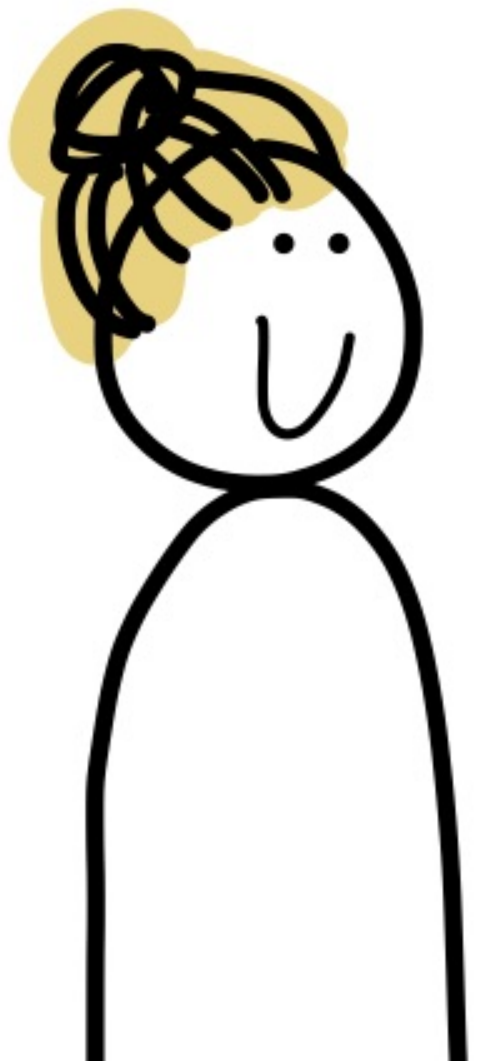
25%?



# Hedy programs

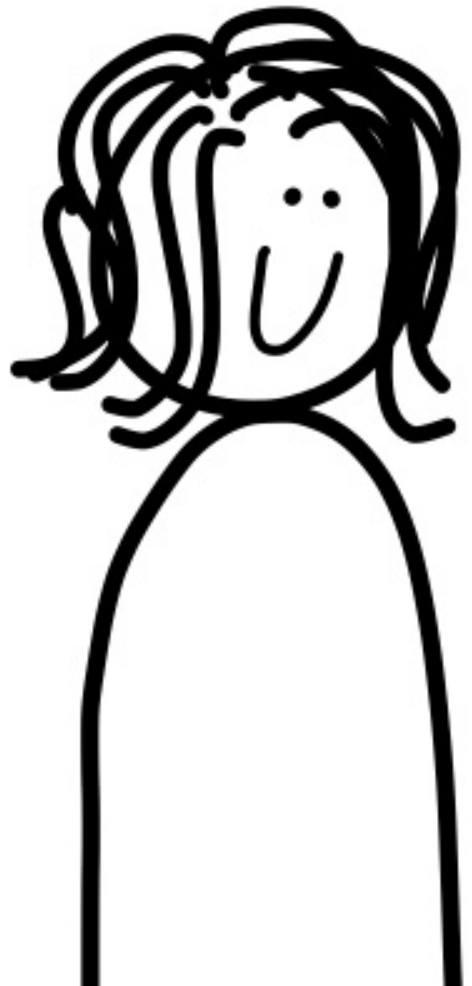
Regular languages  
have error rates  
around 50 % for  
novices

25%!





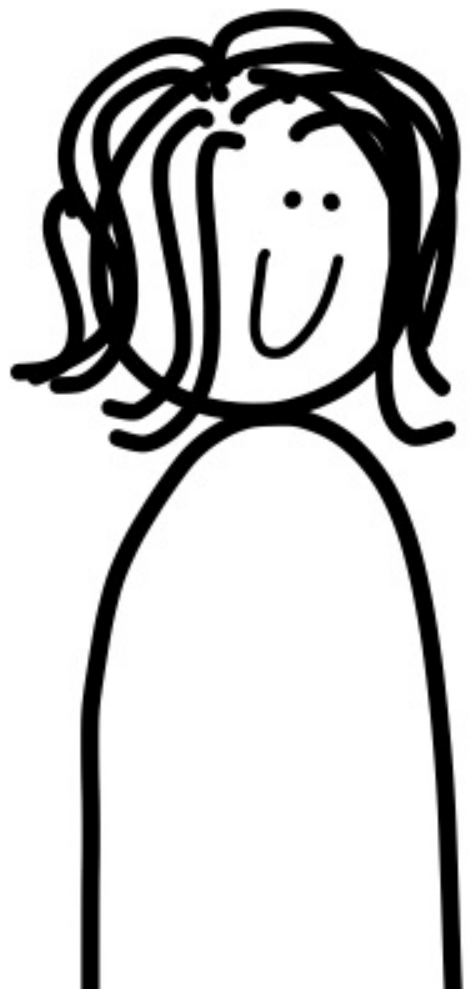
I'm named  
after  
Hedy Lamarr



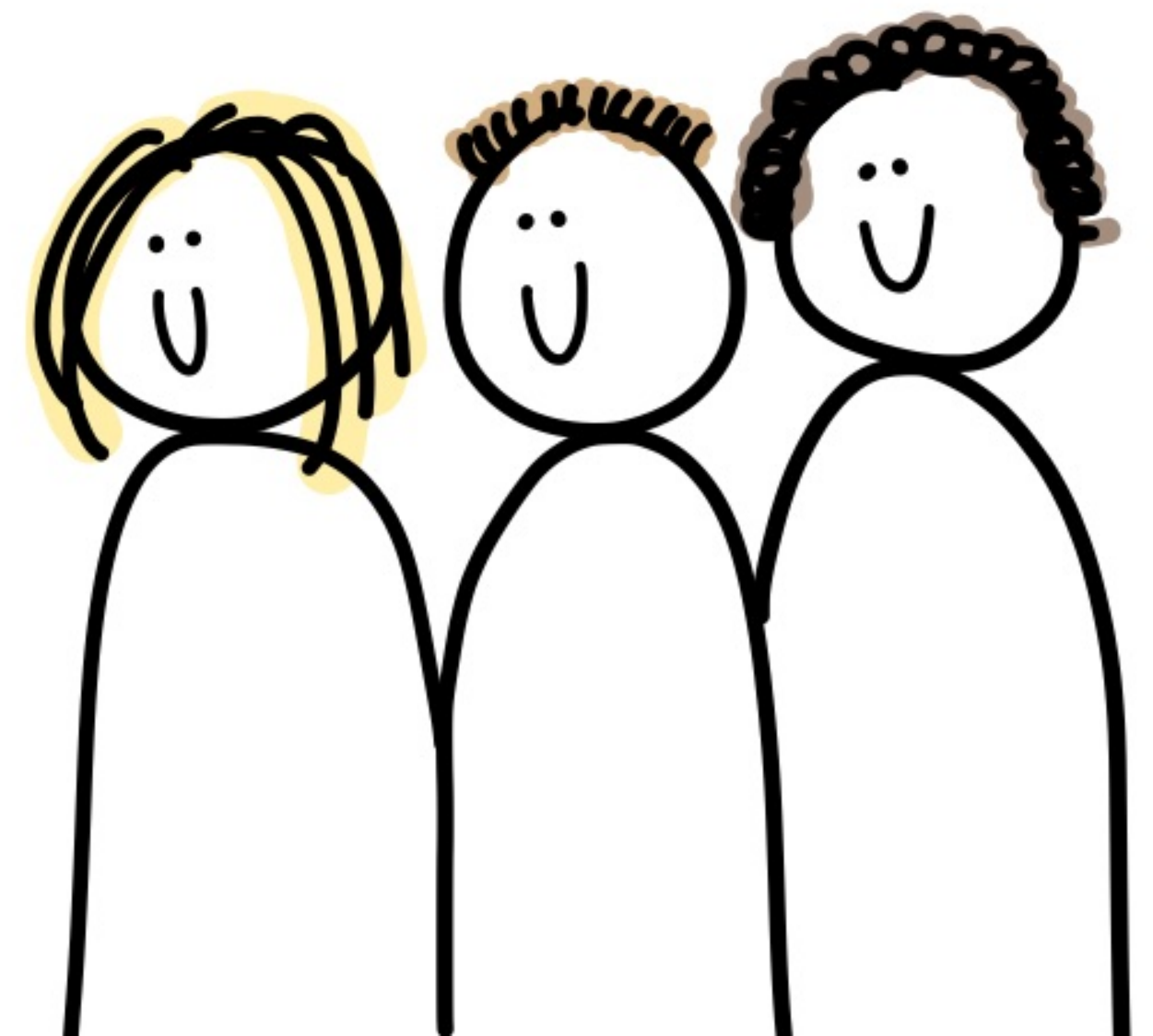
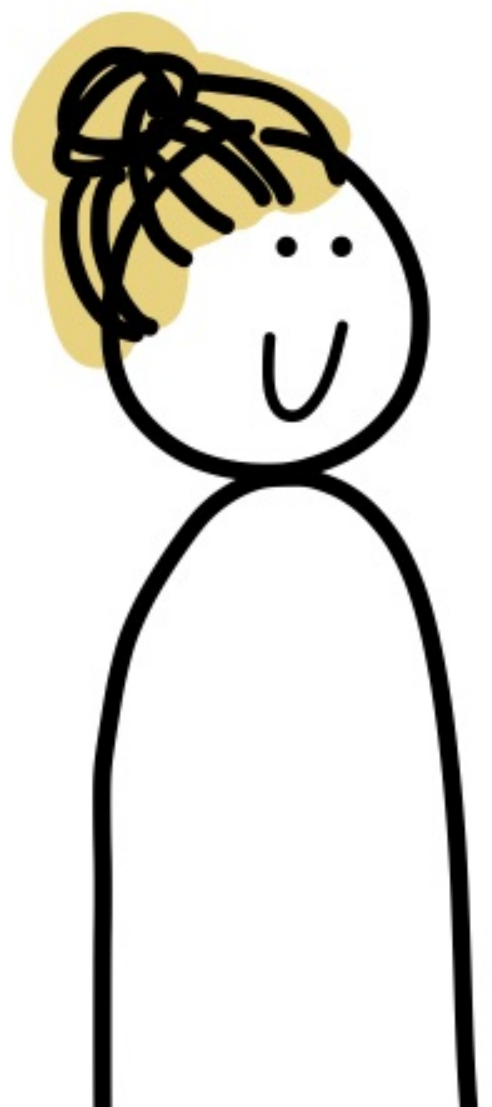


I'm named  
after  
Hedy Lamarr

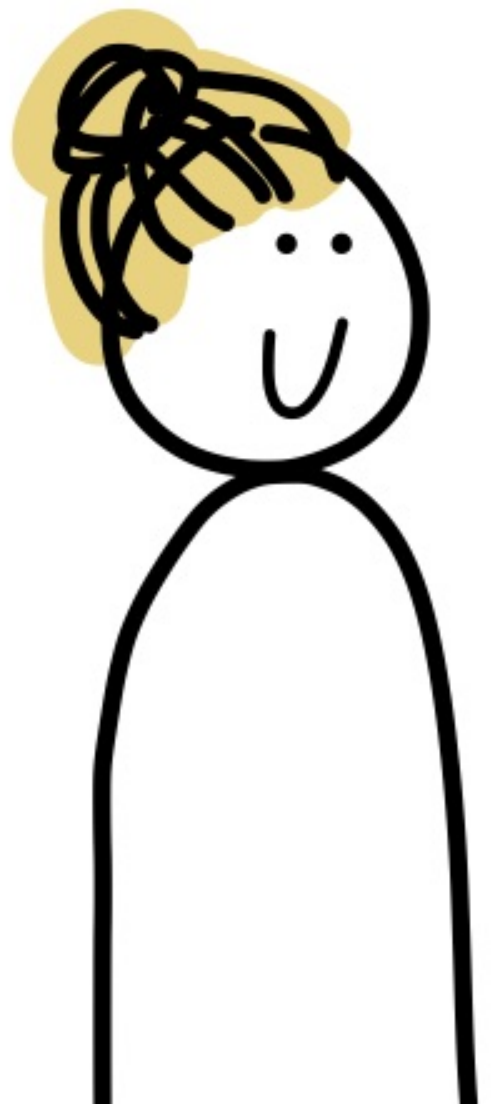
Famous actress &  
inventor



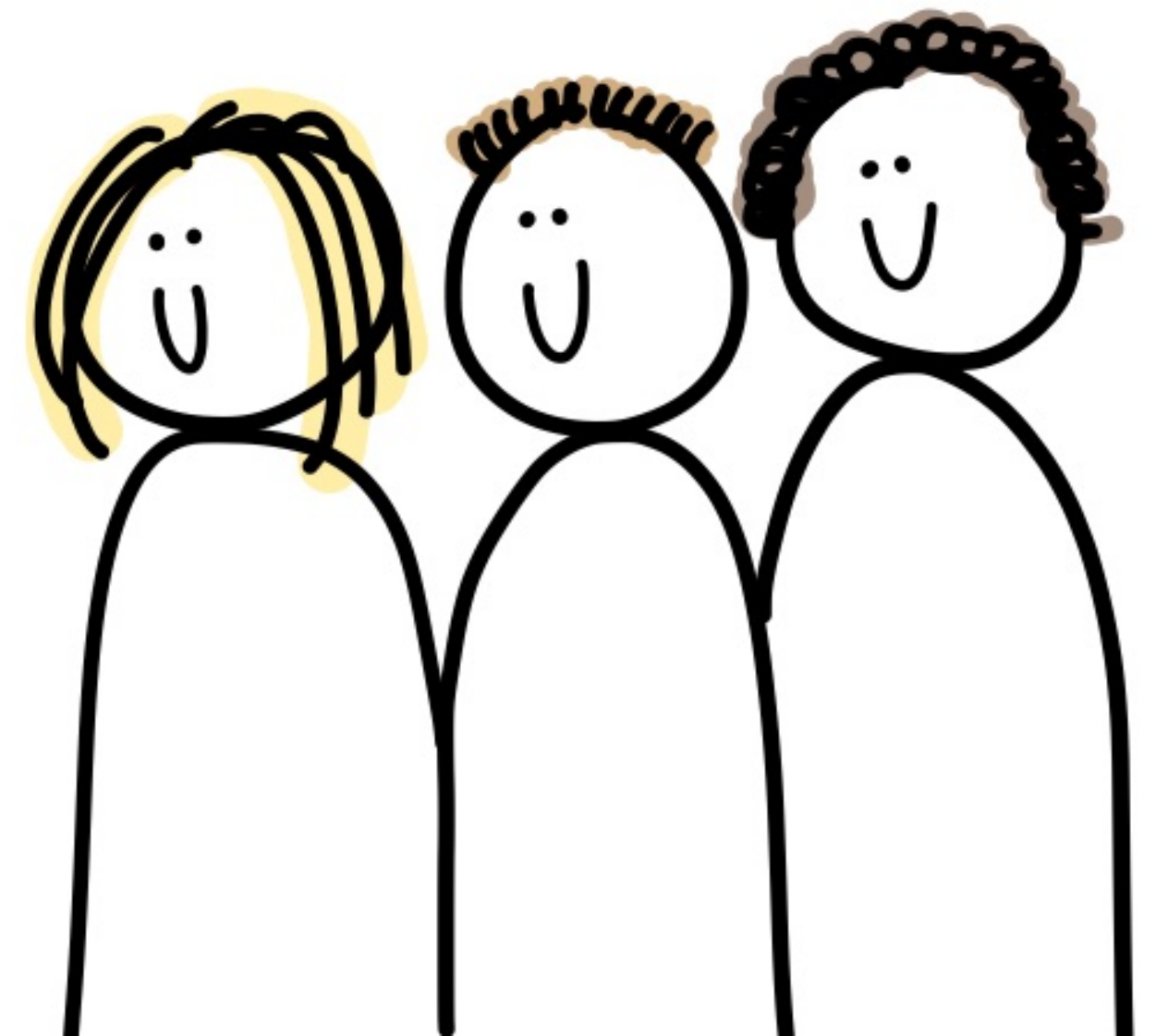
Do kids  
like Hedy?



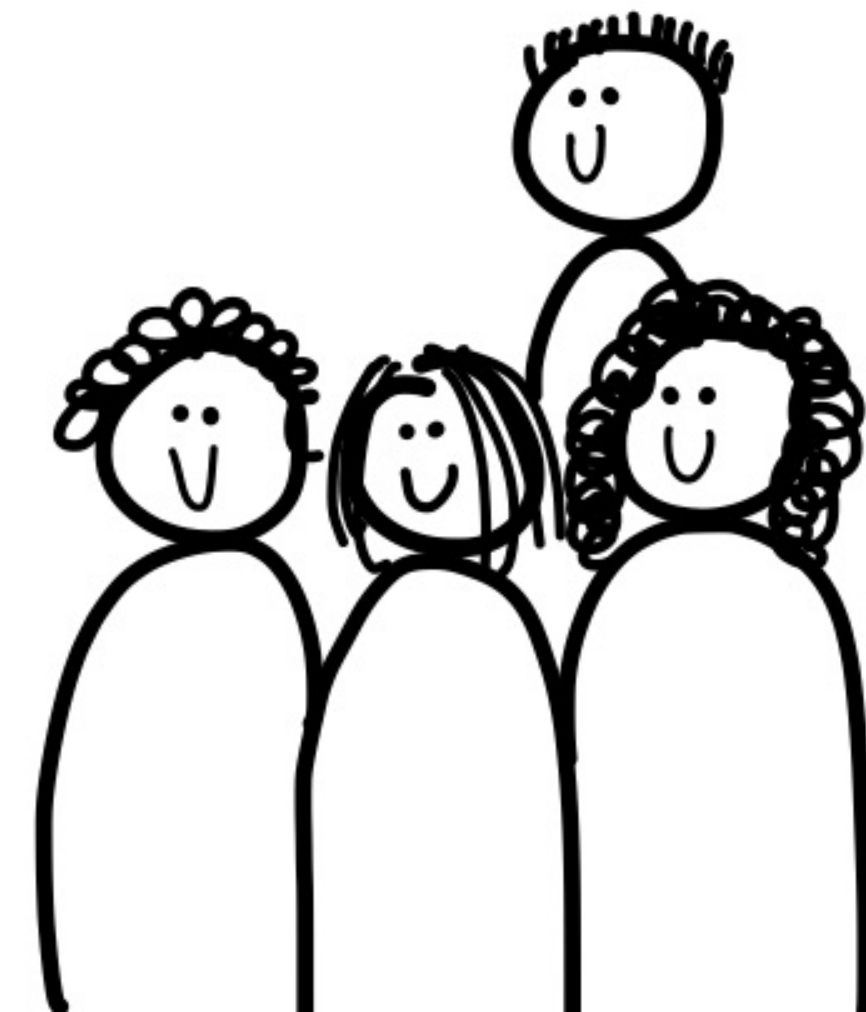
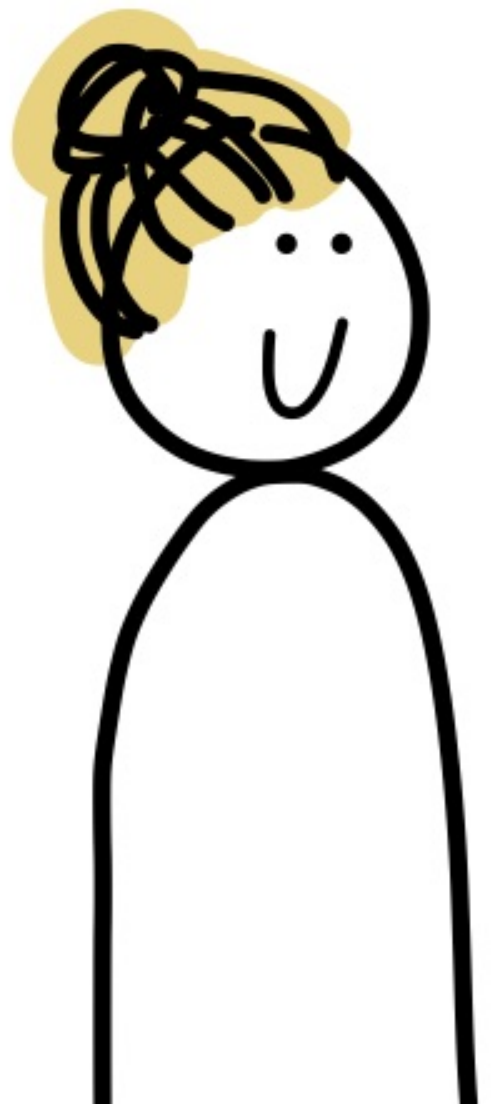
We ran a  
user study!



Do kids  
like Hedy?

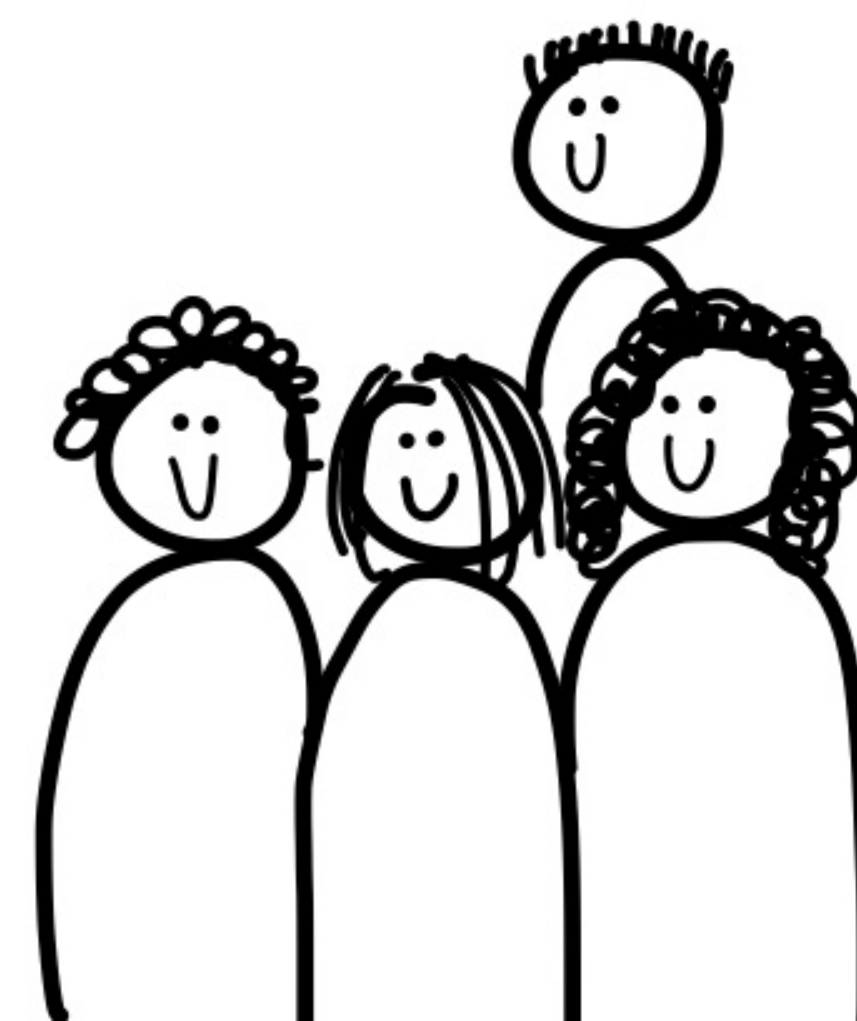
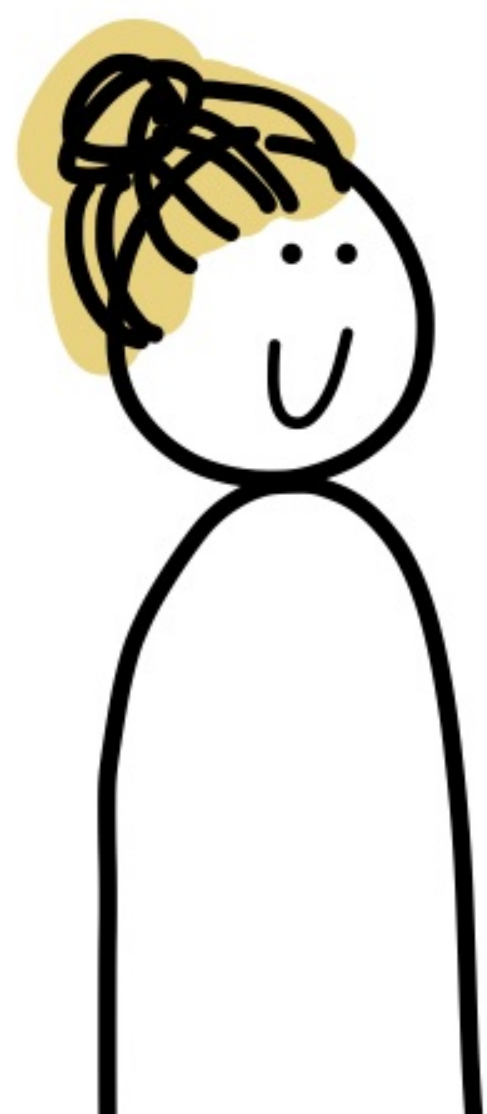


39 kids



39 kids

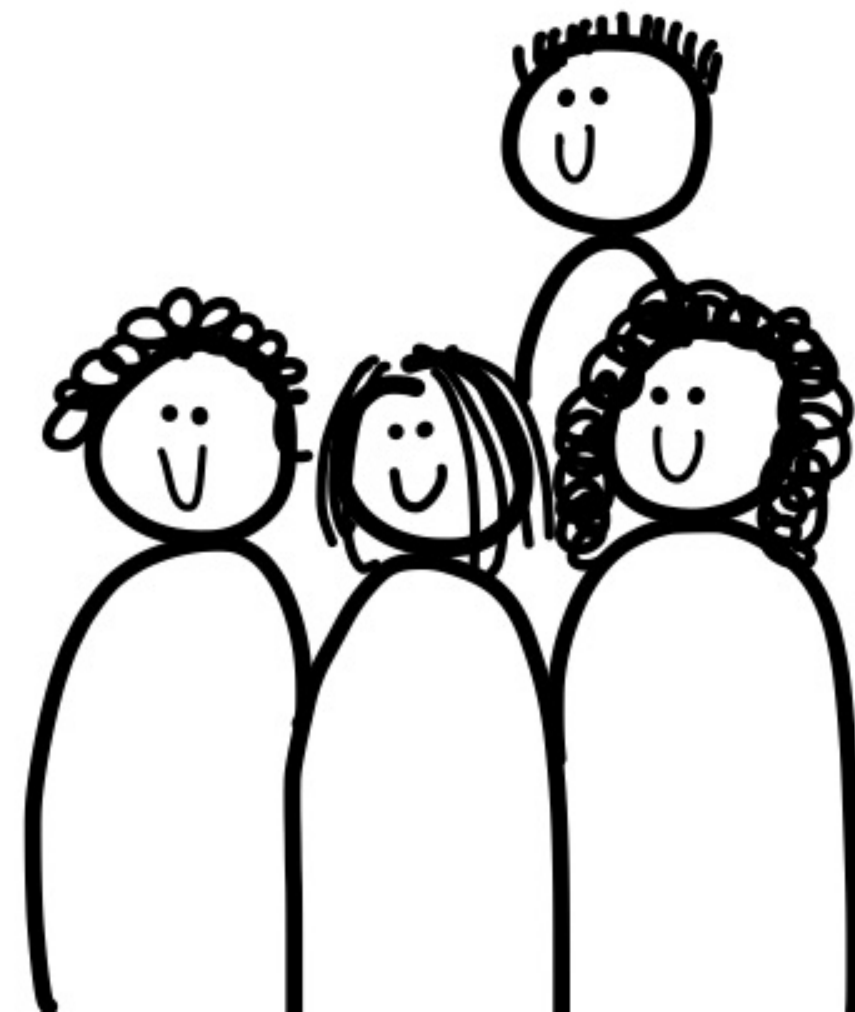
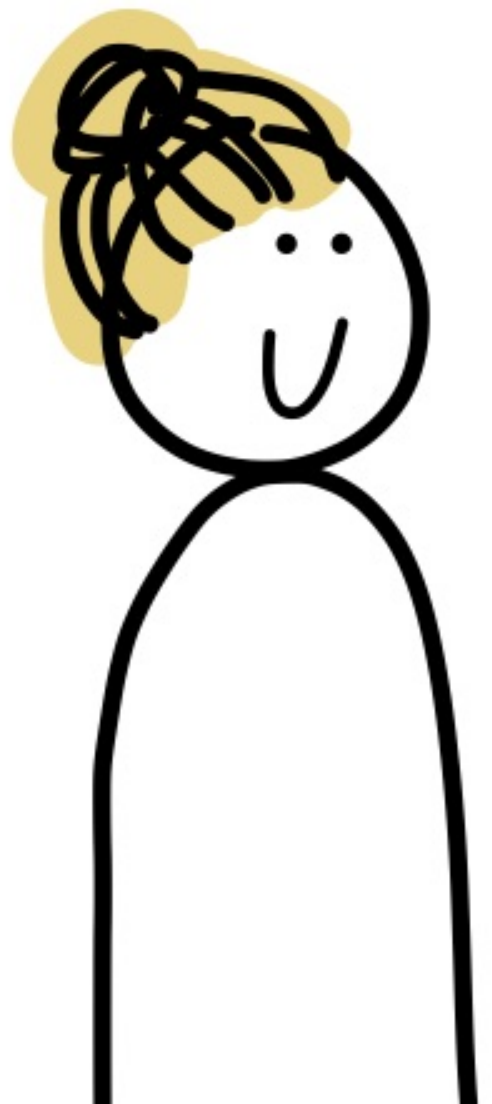
12 online  
lessons



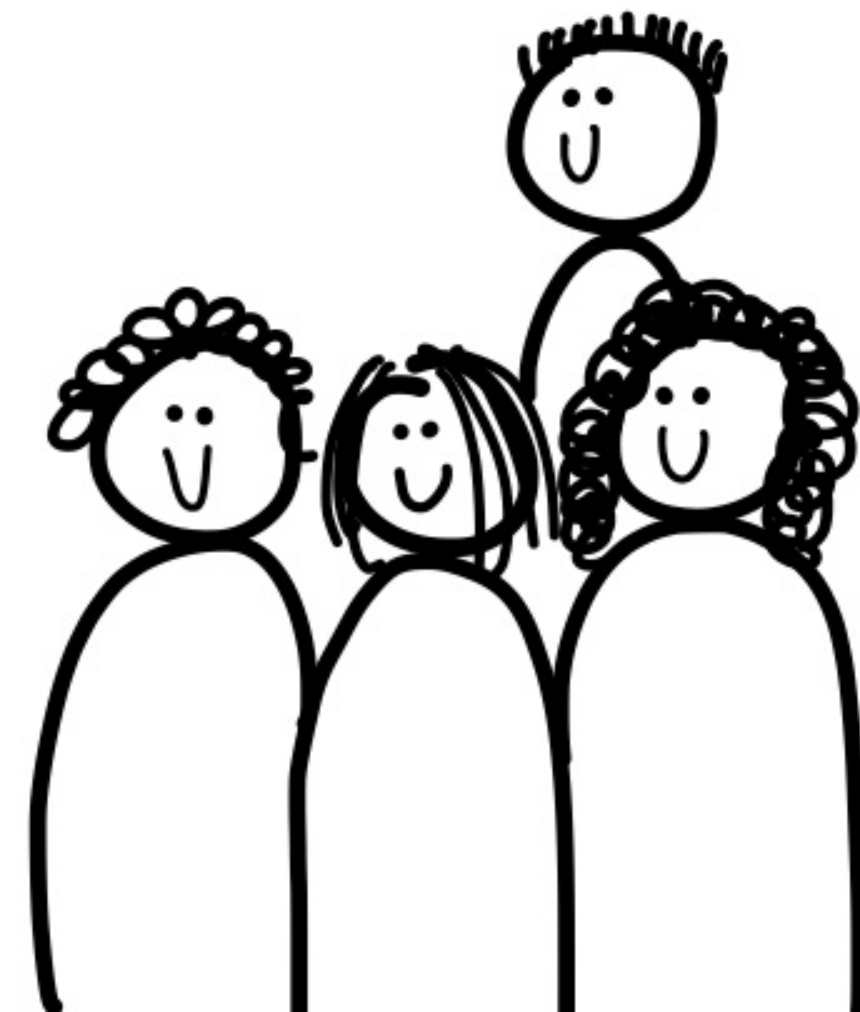
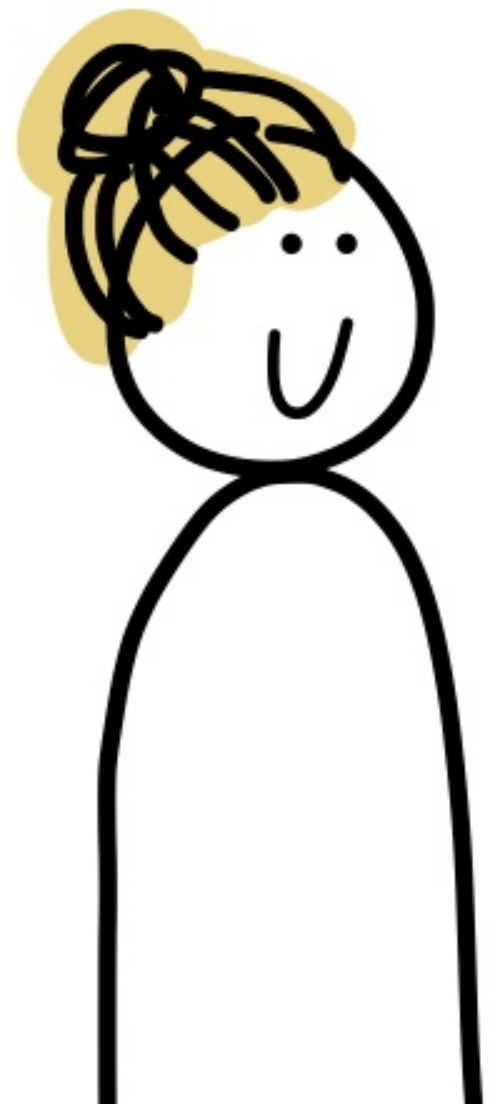
# Benefits, challenges & improvements

39 kids

12 online  
lessons

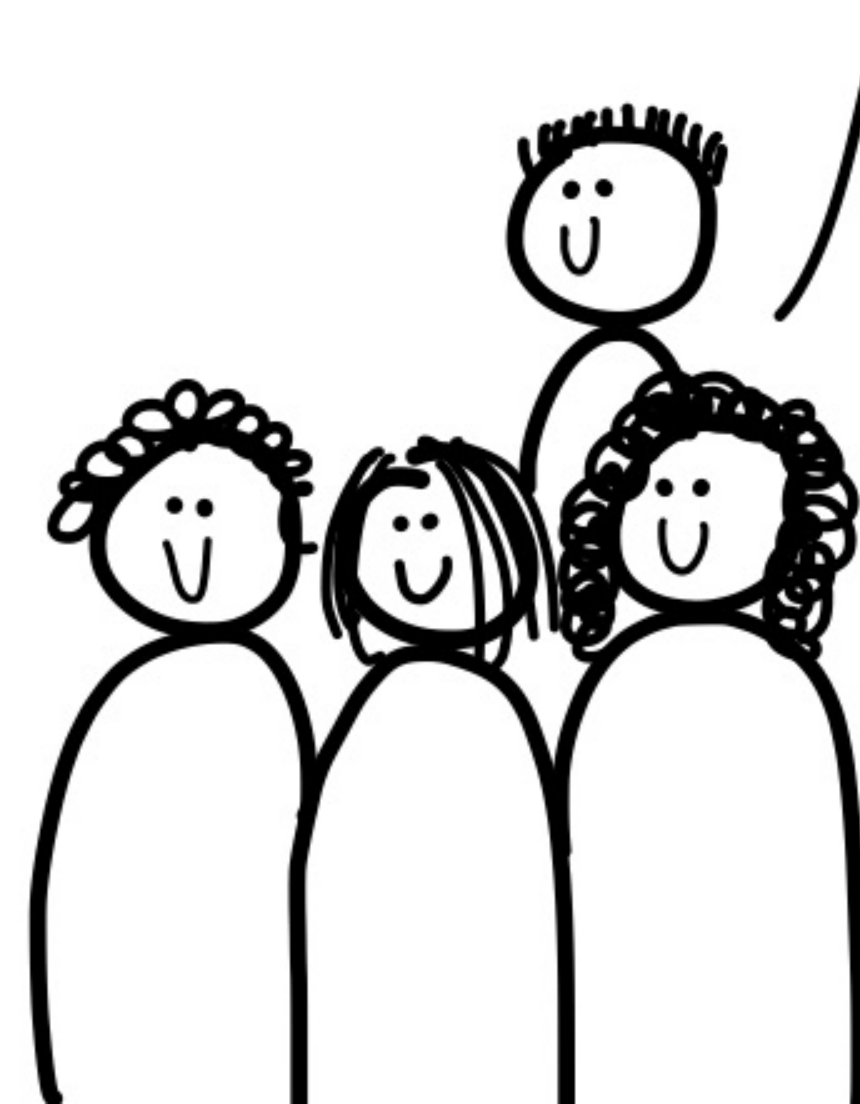
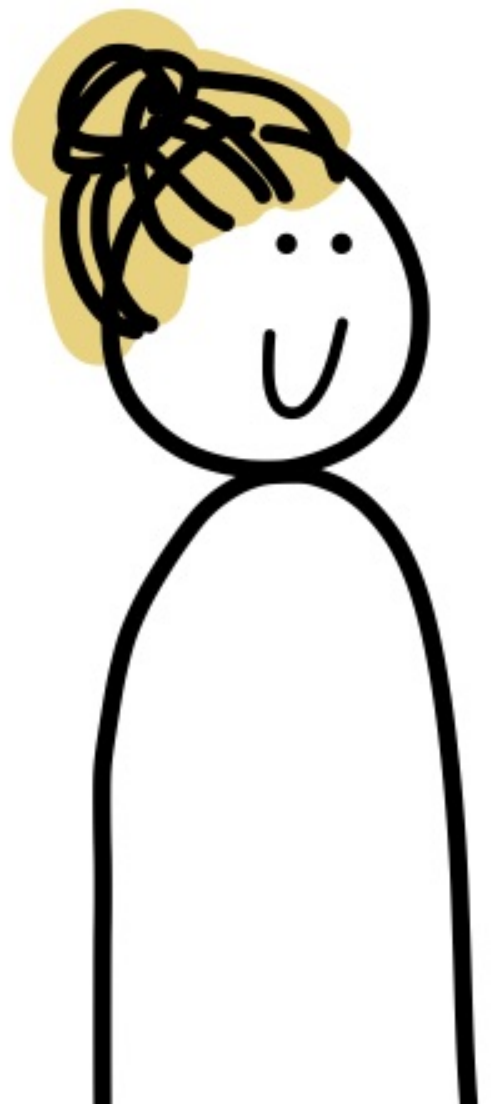


# Benefits, challenges & improvements



# Benefits, challenges & improvements

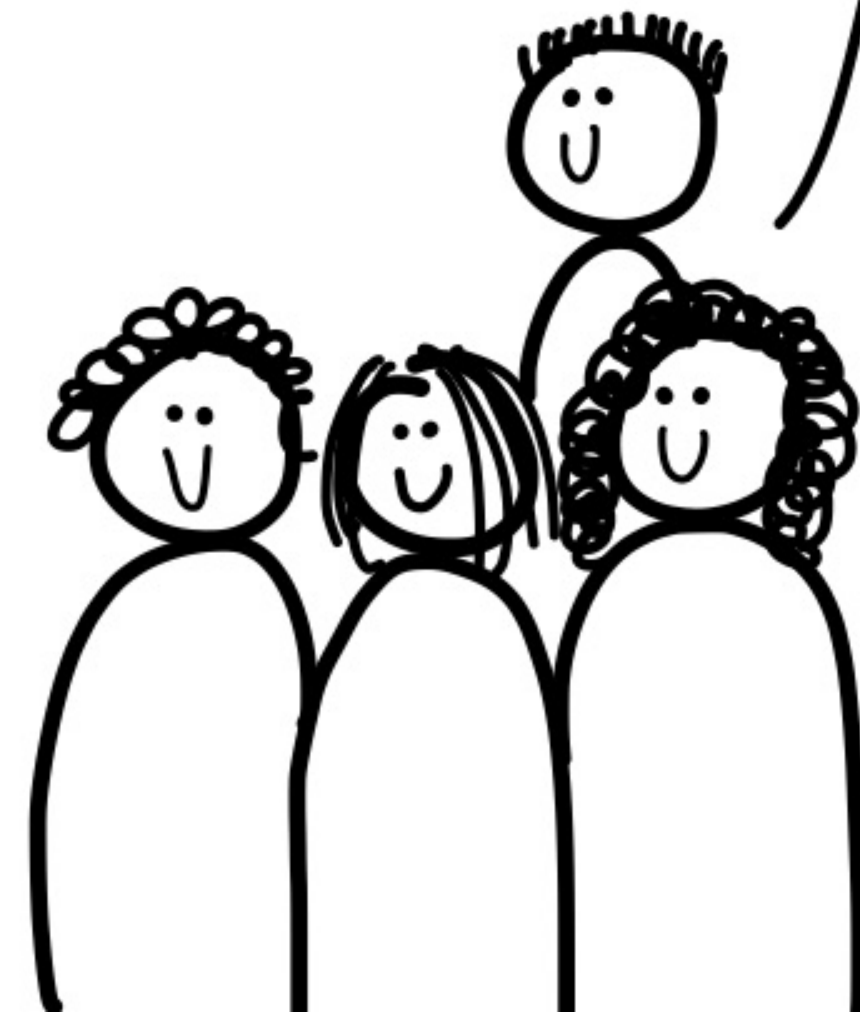
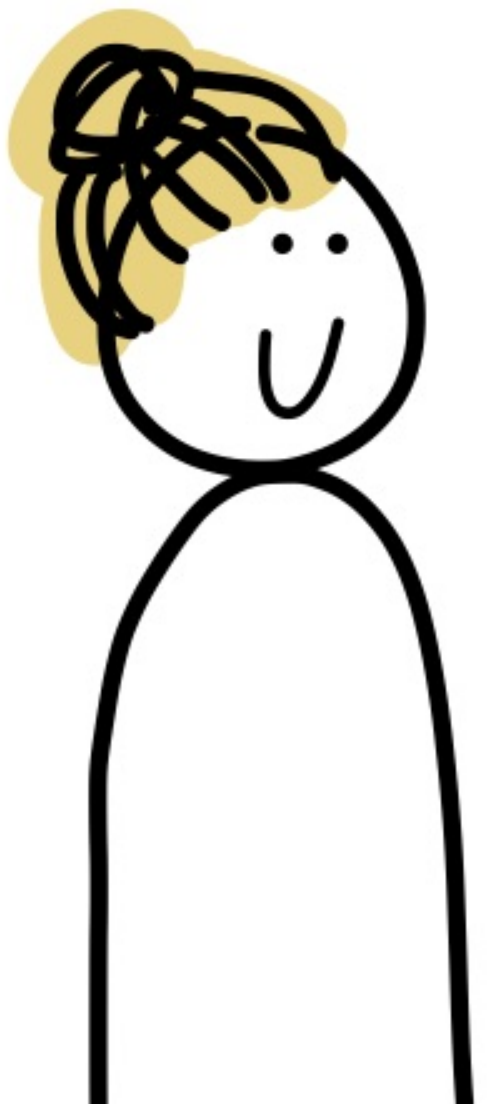
Hedy gets harder  
and becomes a  
real challenge



# Benefits, challenges & improvements

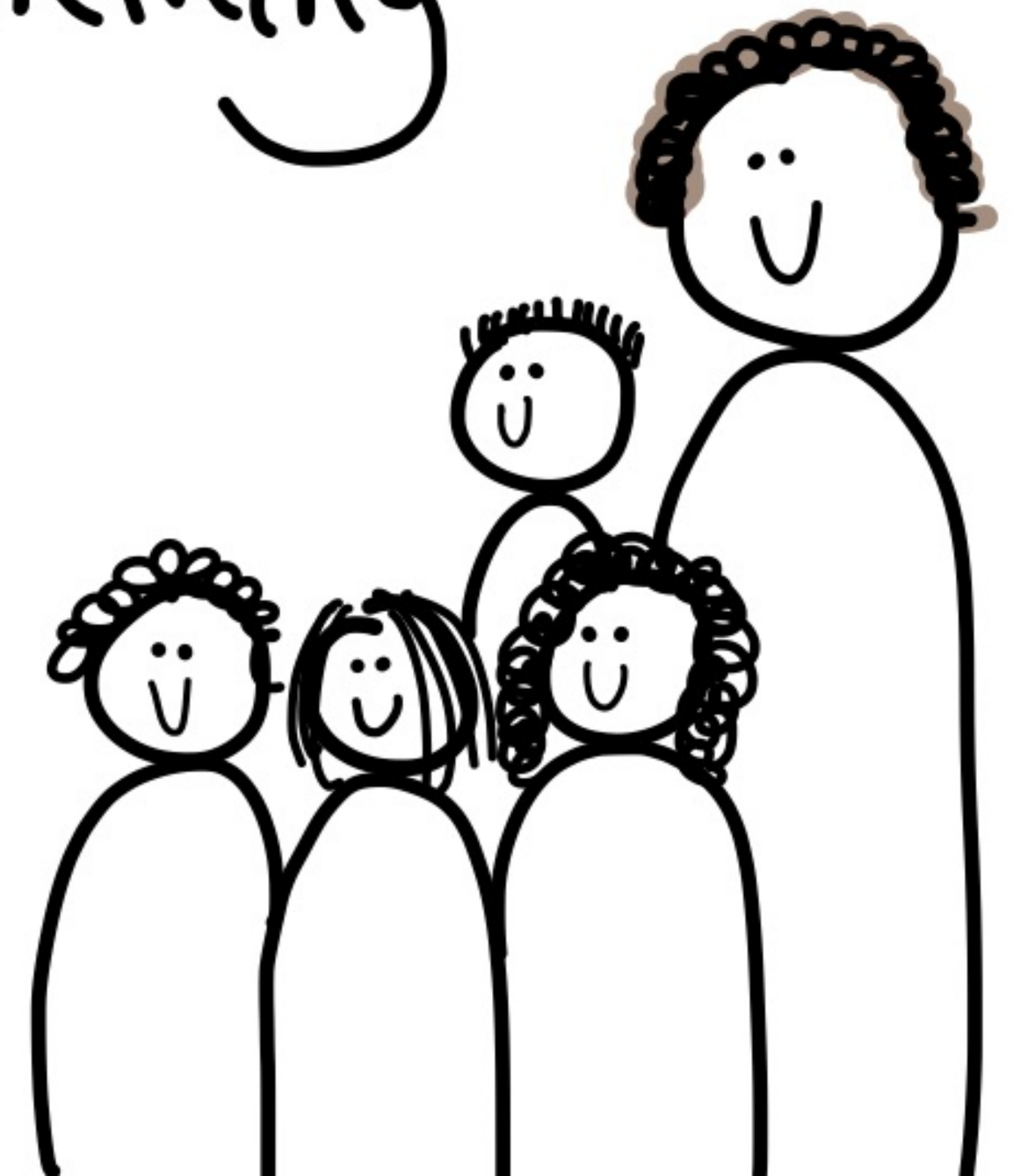
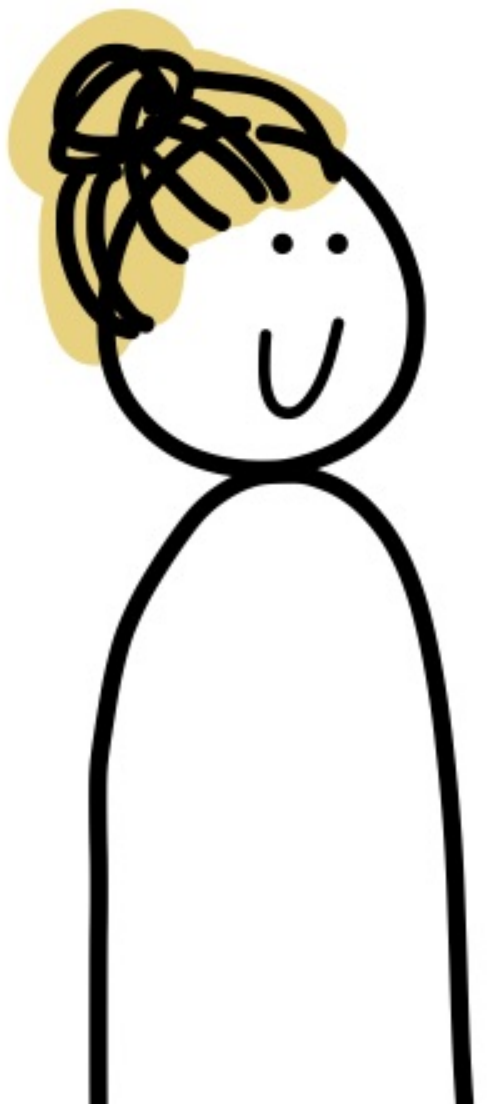
Hedy gets harder  
and becomes a  
real challenge

The levels are  
a step by step  
guide



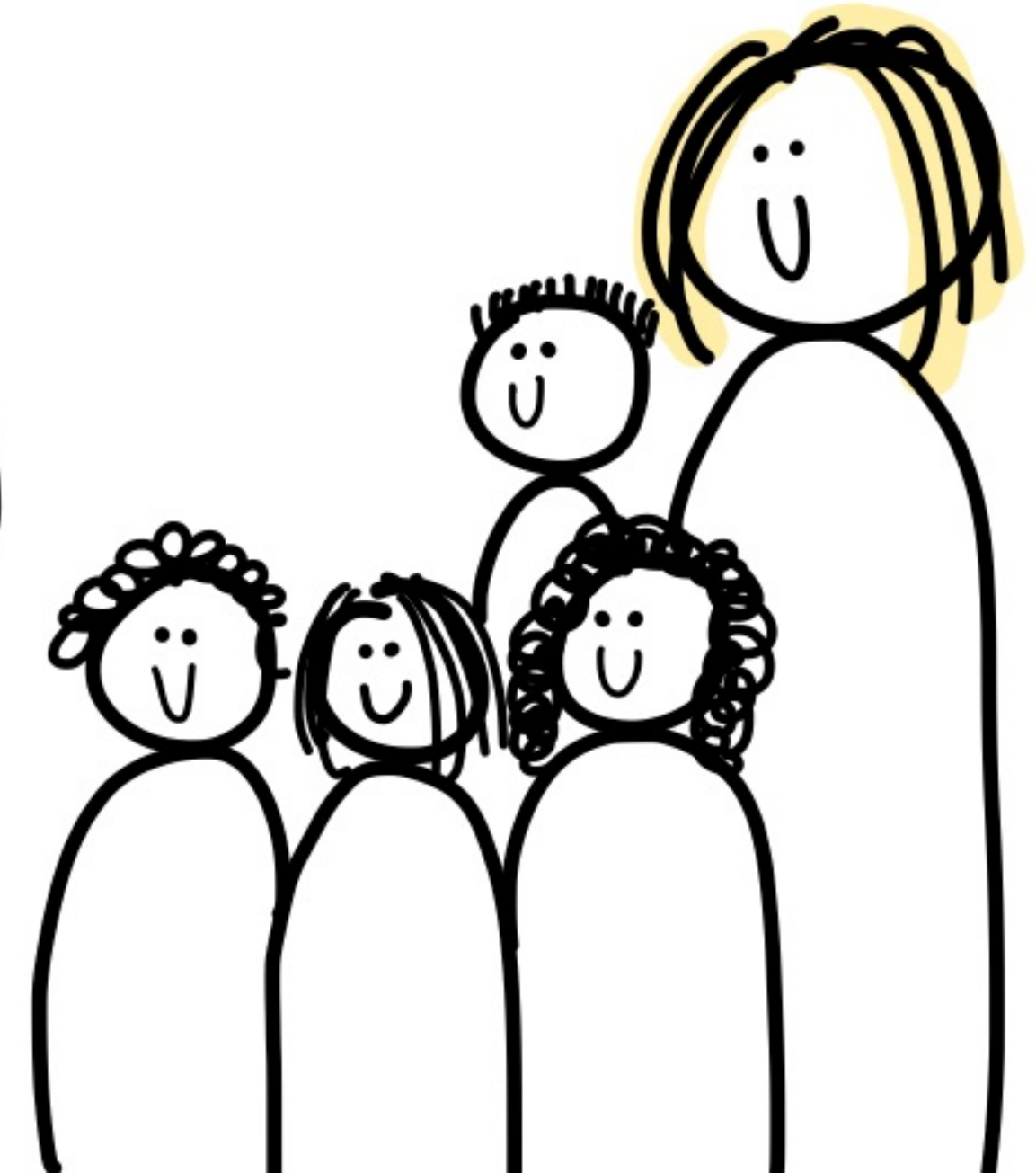
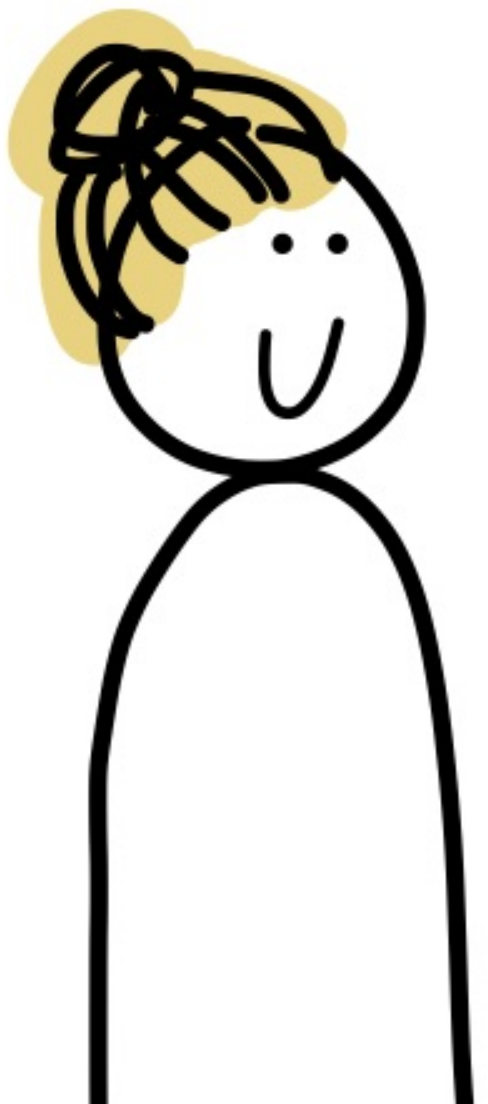
# Benefits, challenges & improvements

With Hedy all kids  
learn some programming

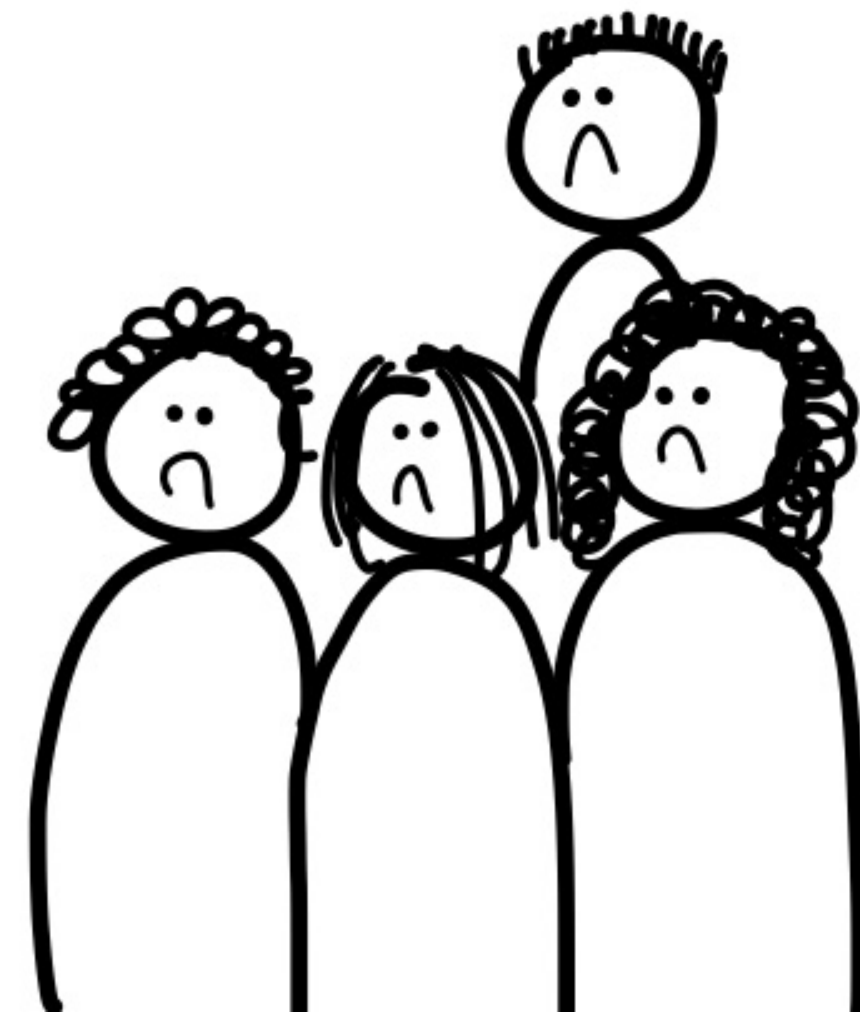
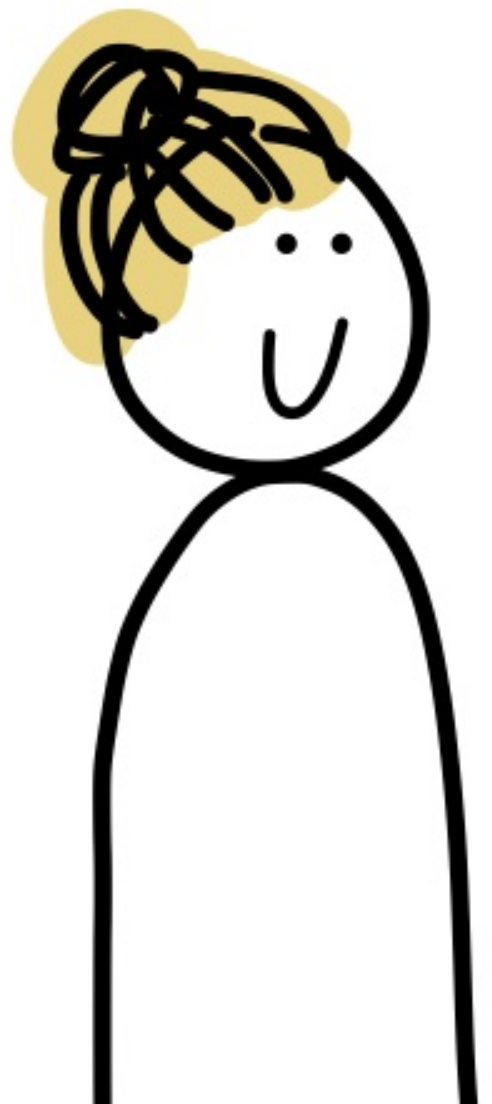


# Benefits, challenges & improvements

Hedy gives girls  
the confidence to  
learn programming

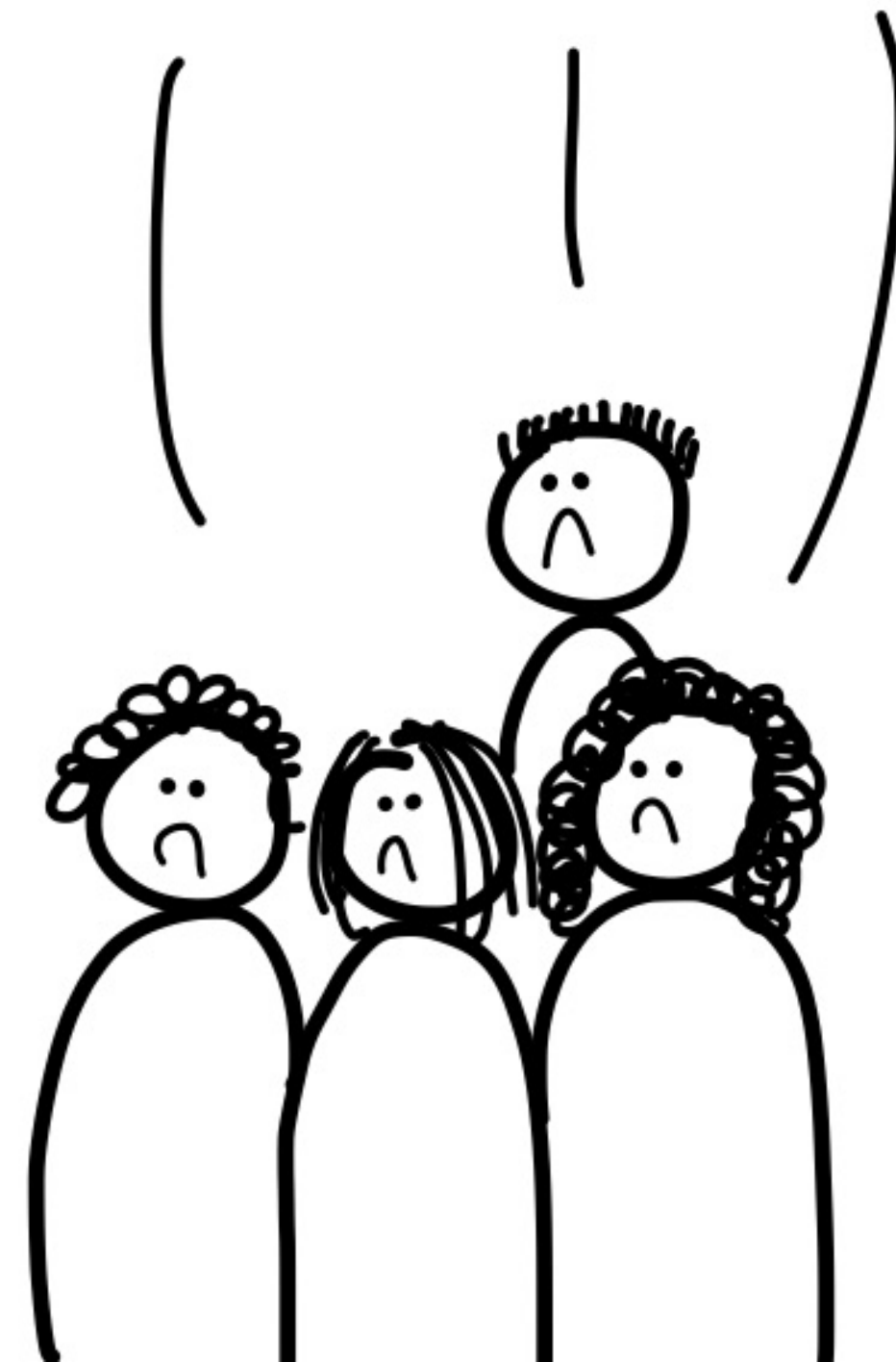
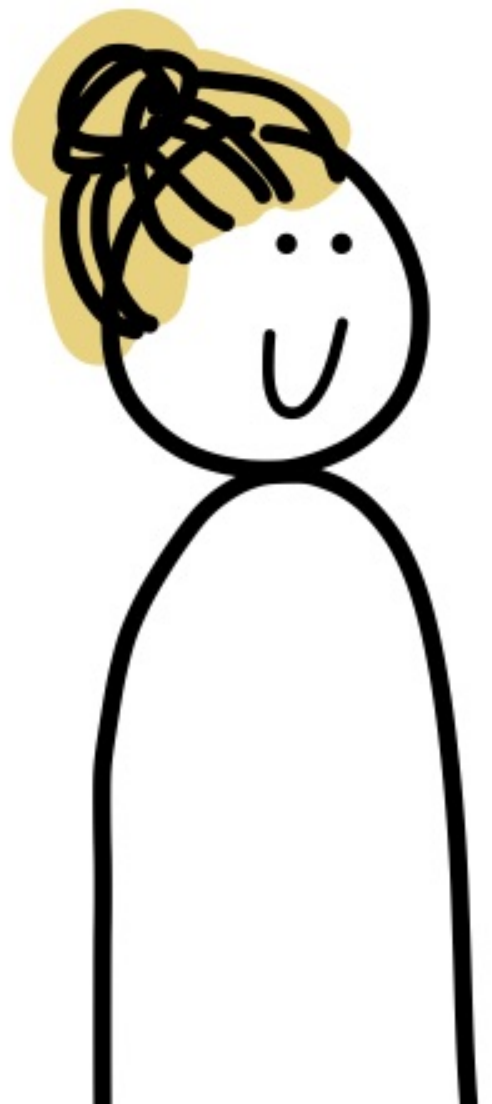


# Benefits, challenges & improvements



# Benefits, challenges & improvements

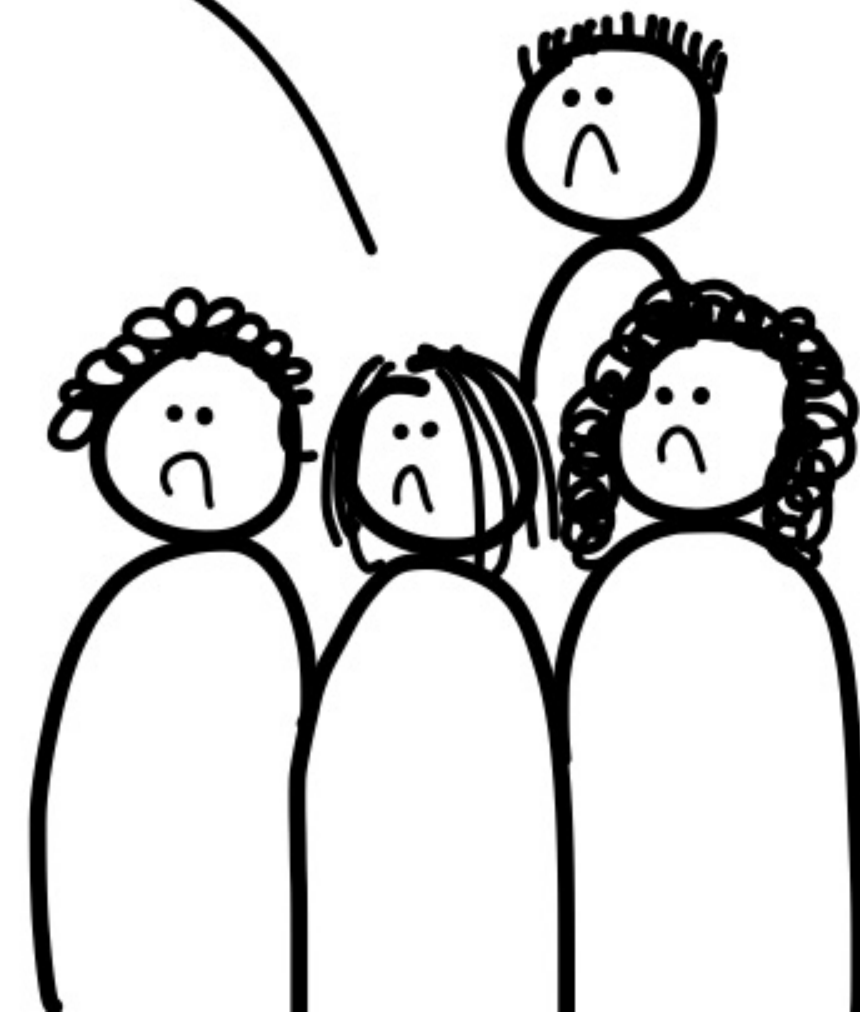
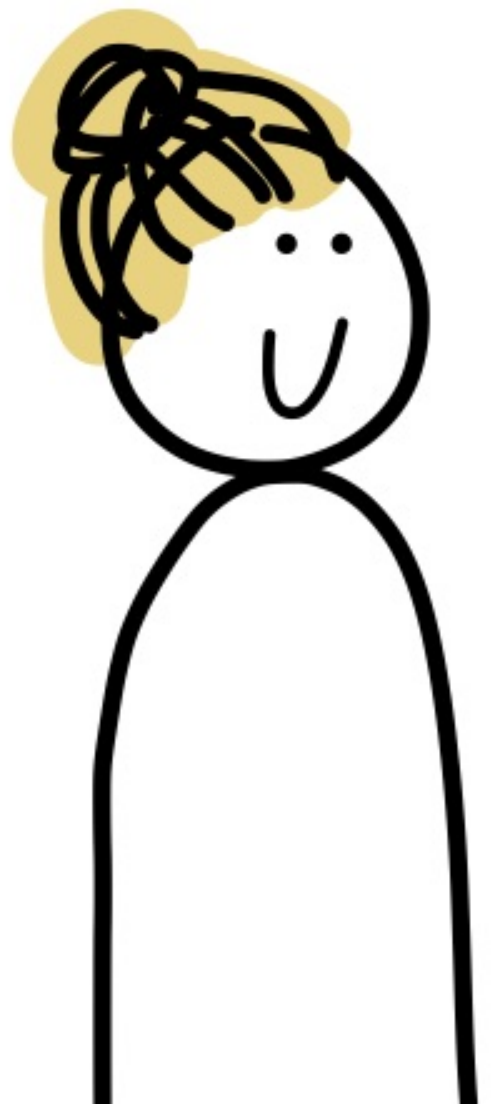
## Remembering codes



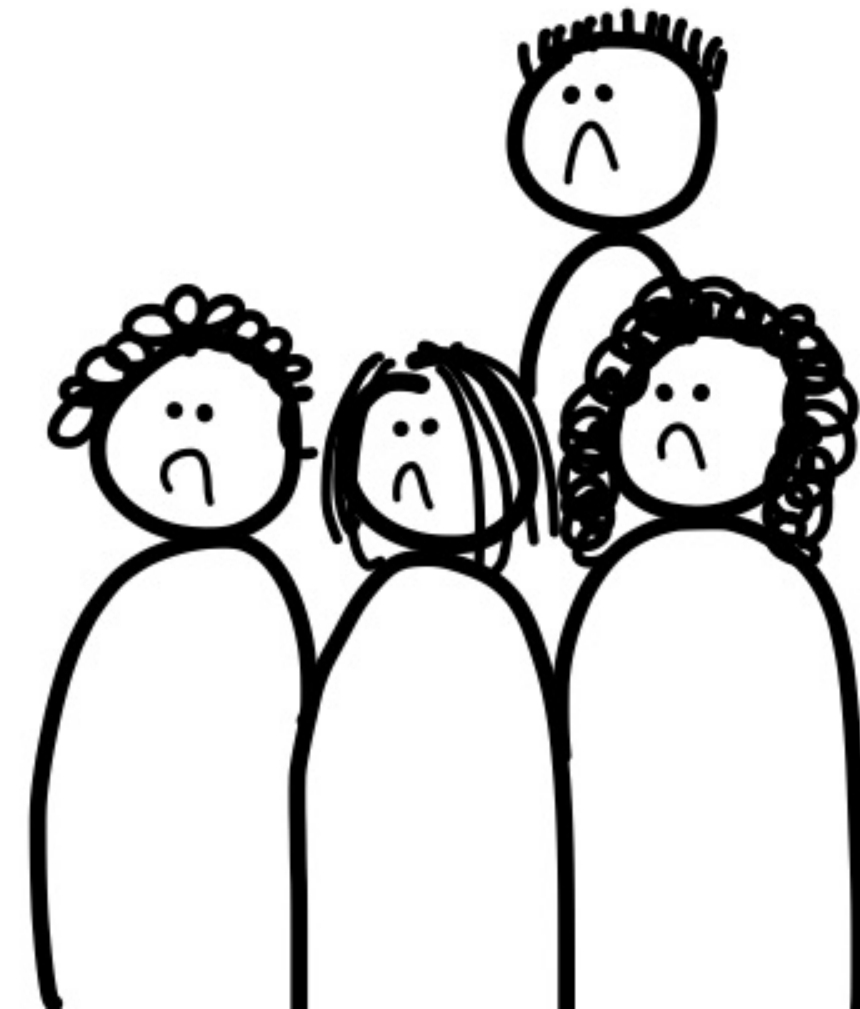
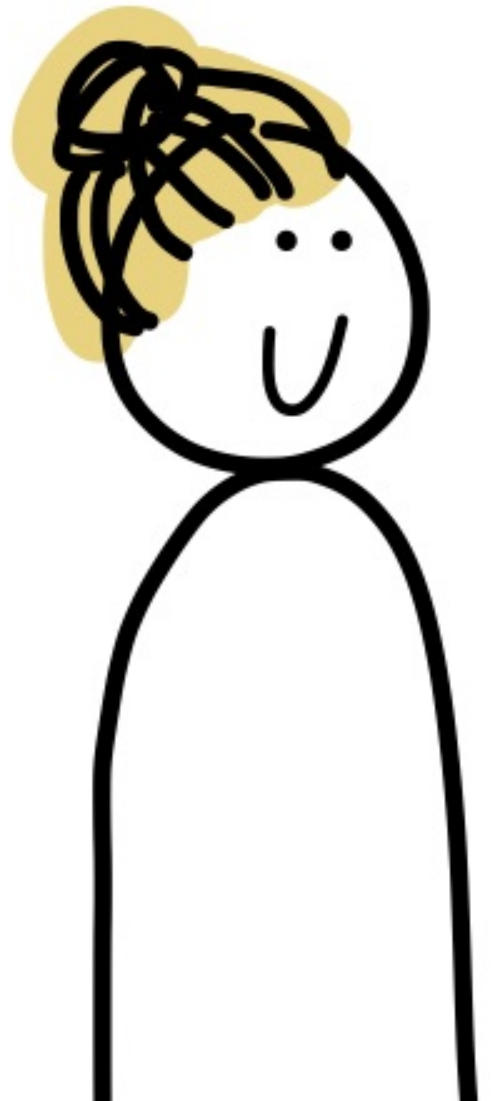
# Benefits, challenges & improvements

Remembering  
codes

Things change  
suddenly

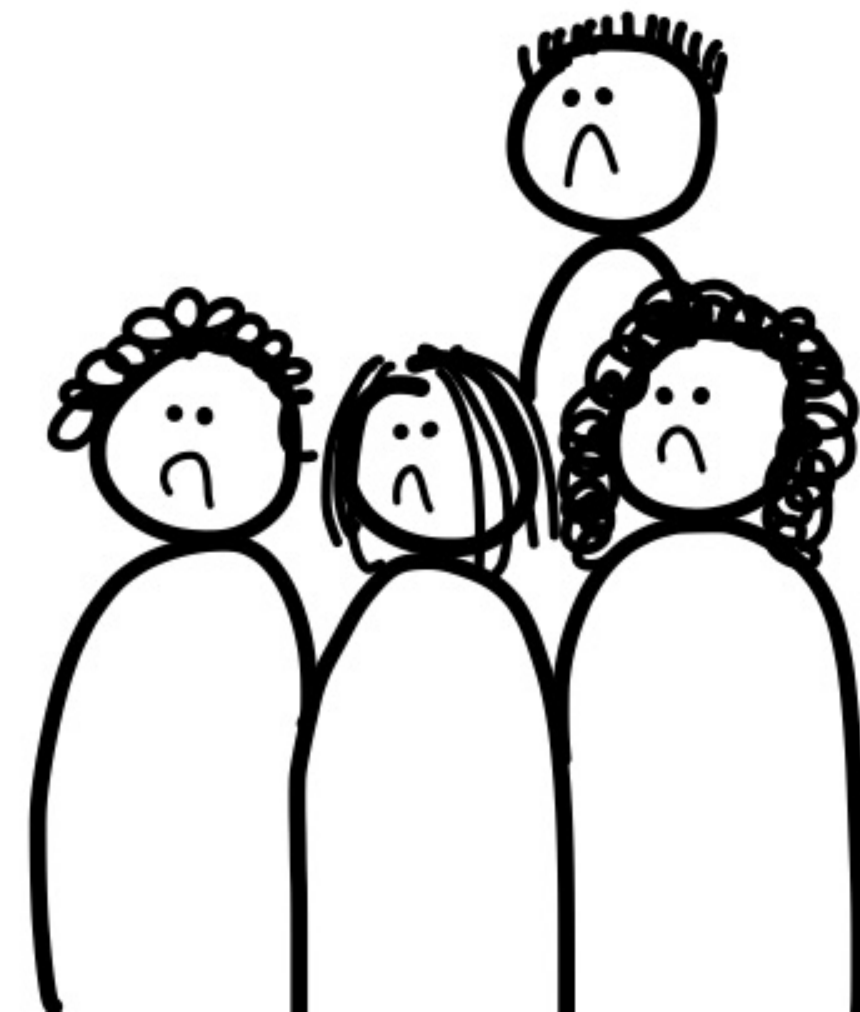
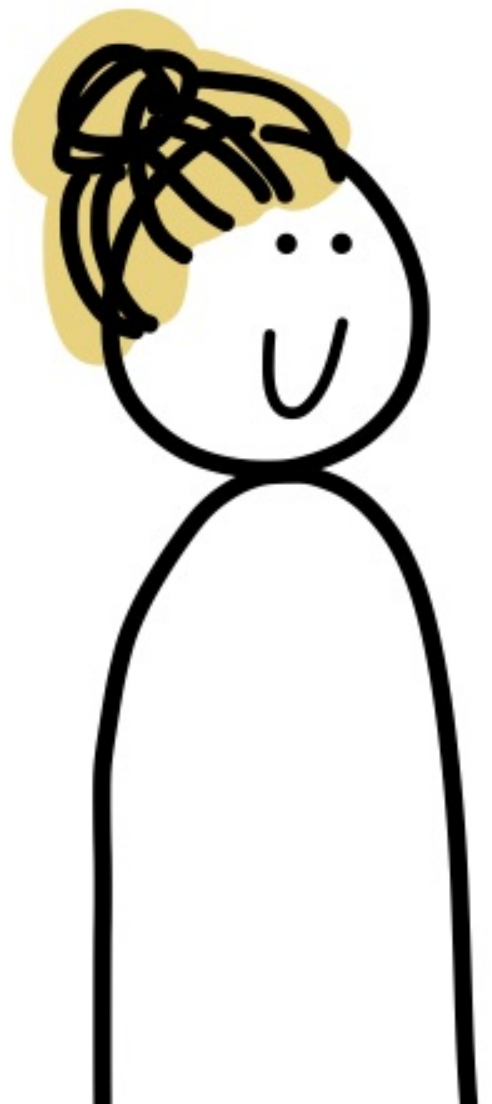


# Benefits, challenges & improvements



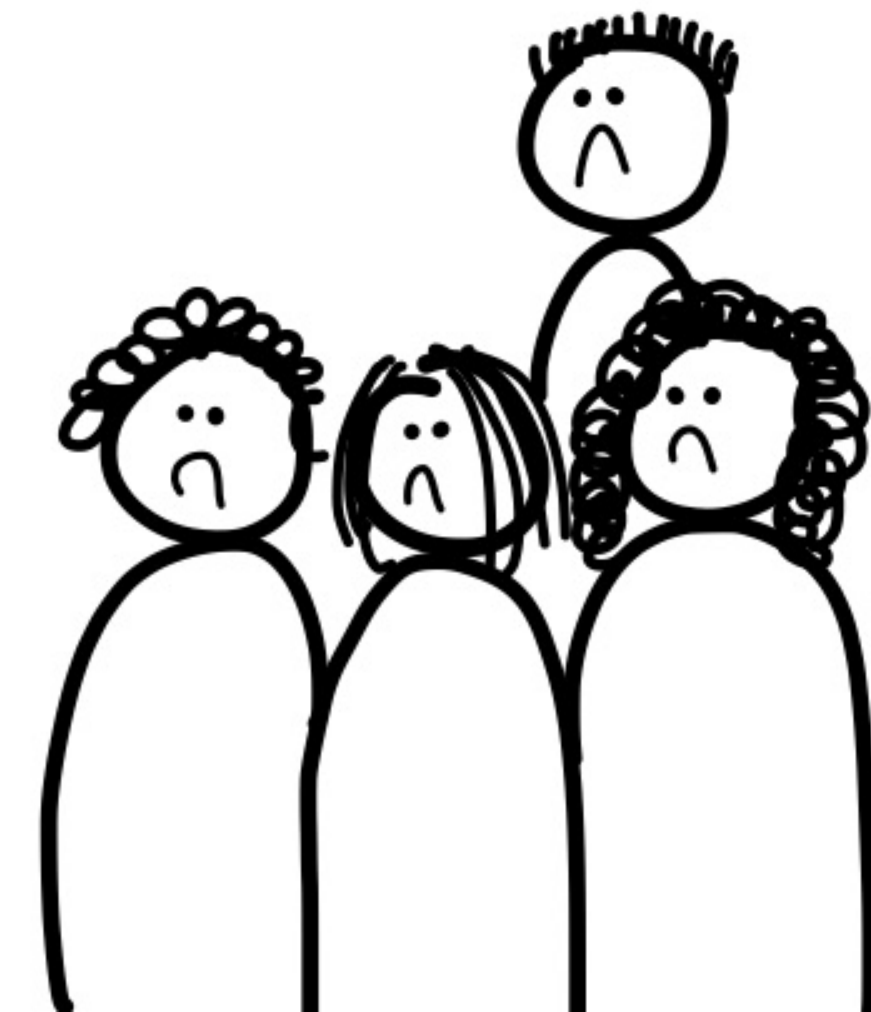
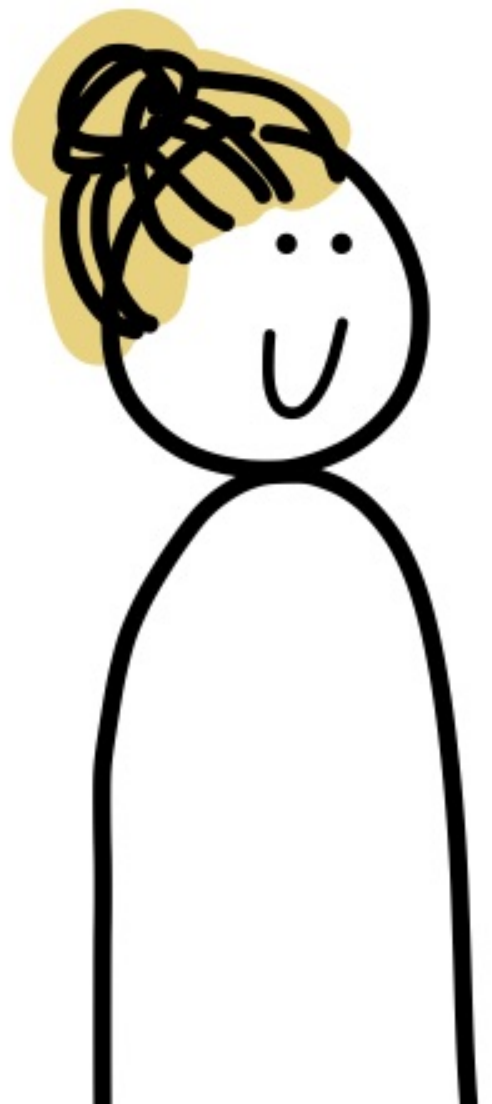
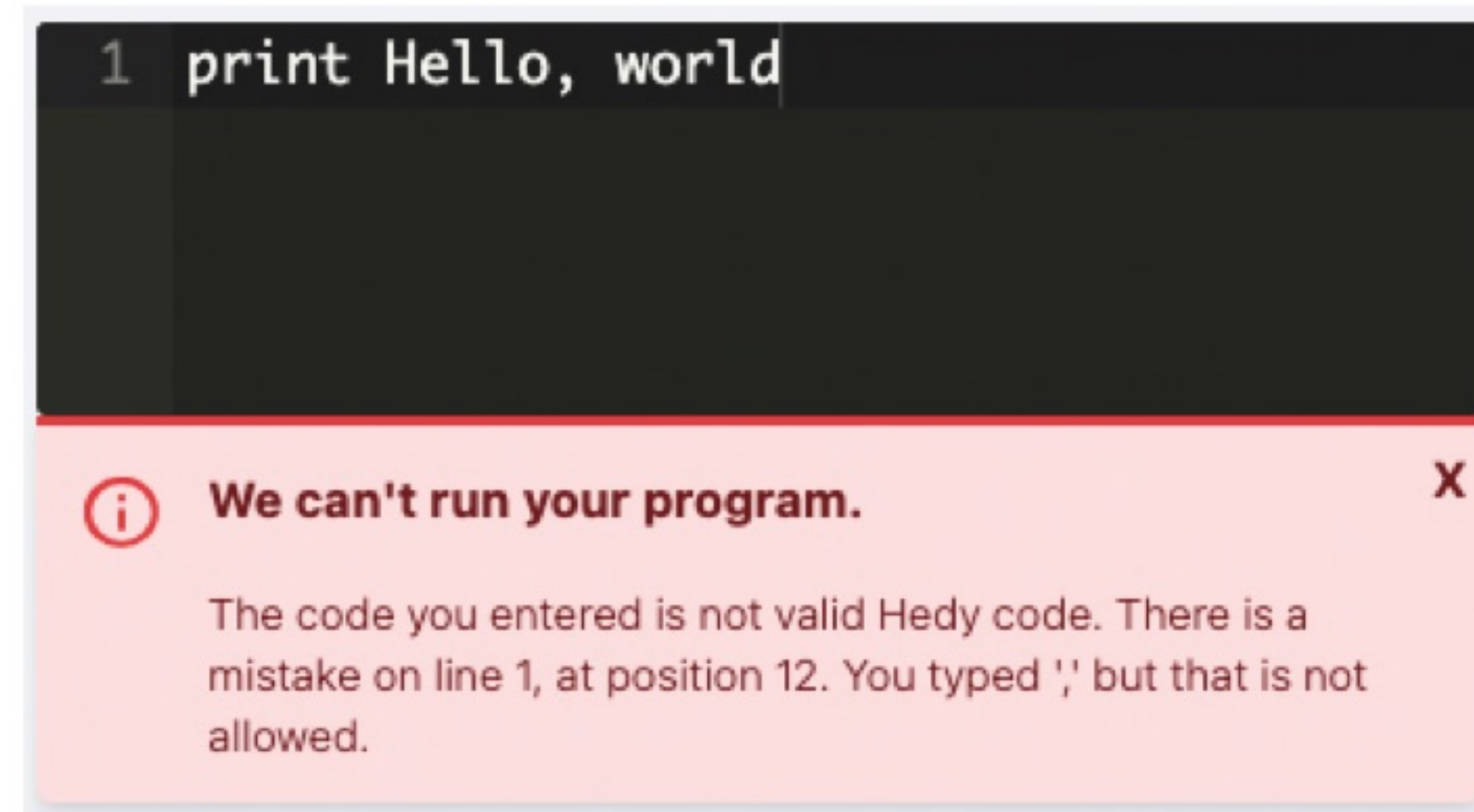
# Benefits, challenges & improvements

Better error  
messages



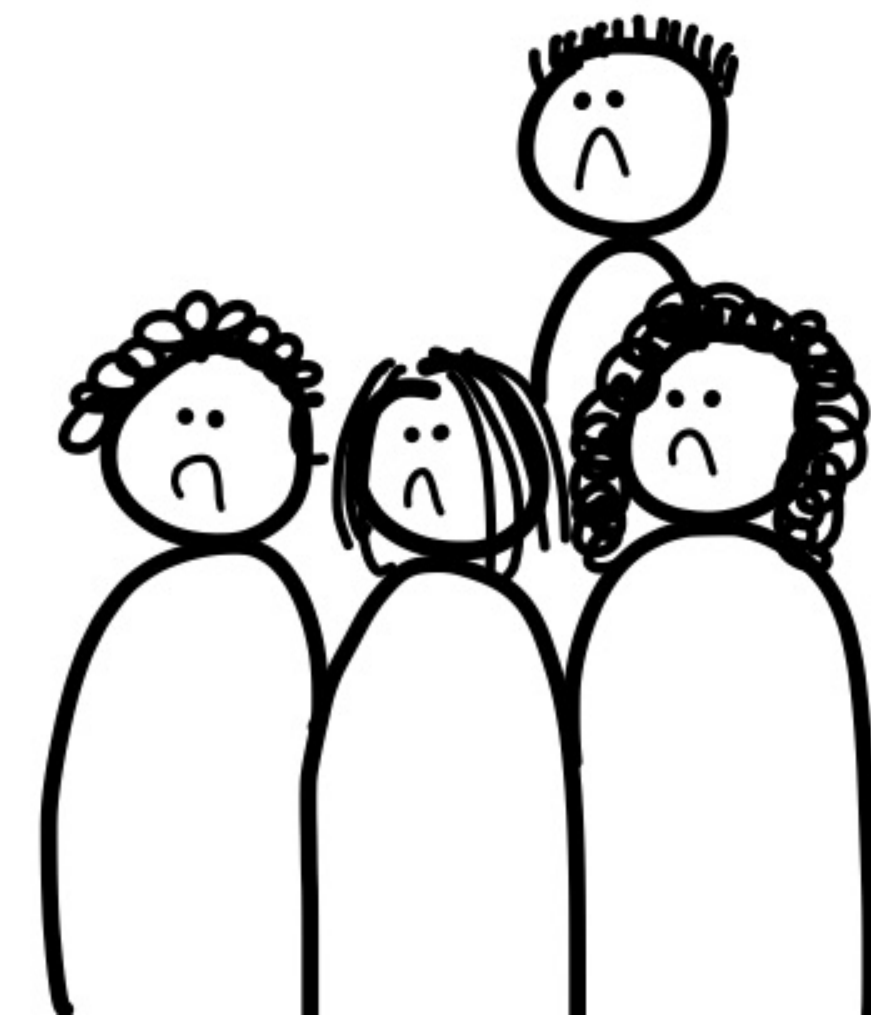
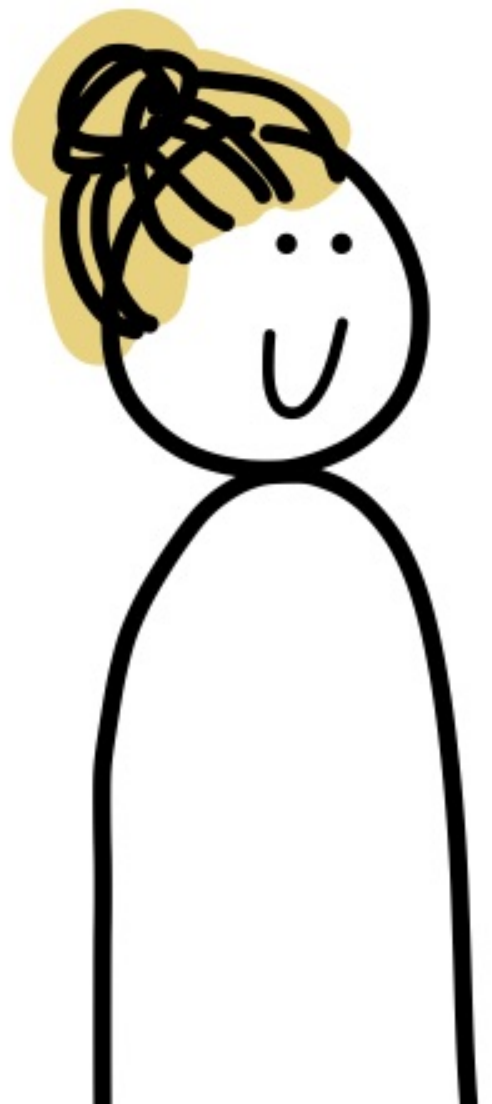
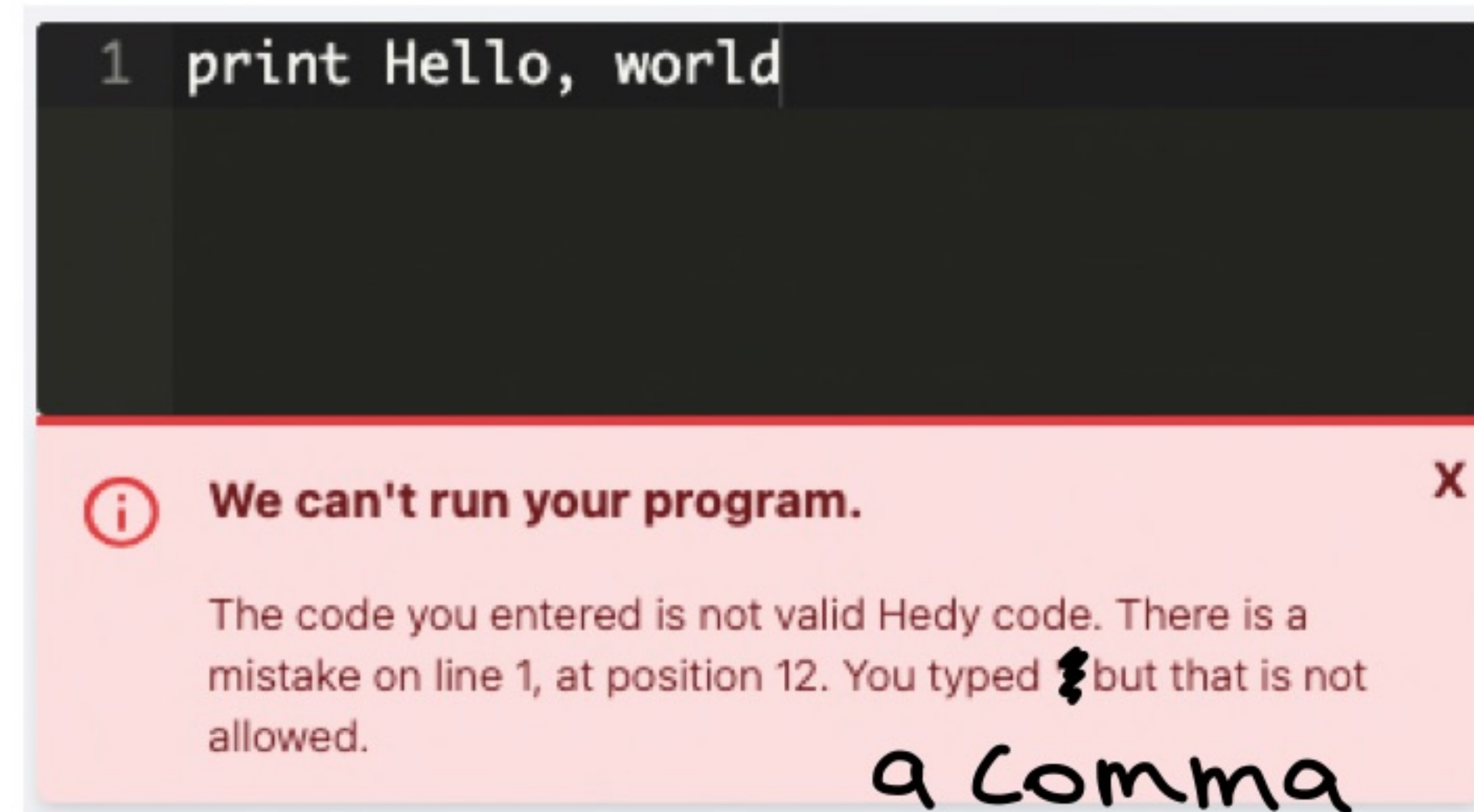
# Benefits, challenges & improvements

## Better error messages



# Benefits, challenges & improvements

## Better error messages



# Benefits, challenges & improvements

## Better error messages

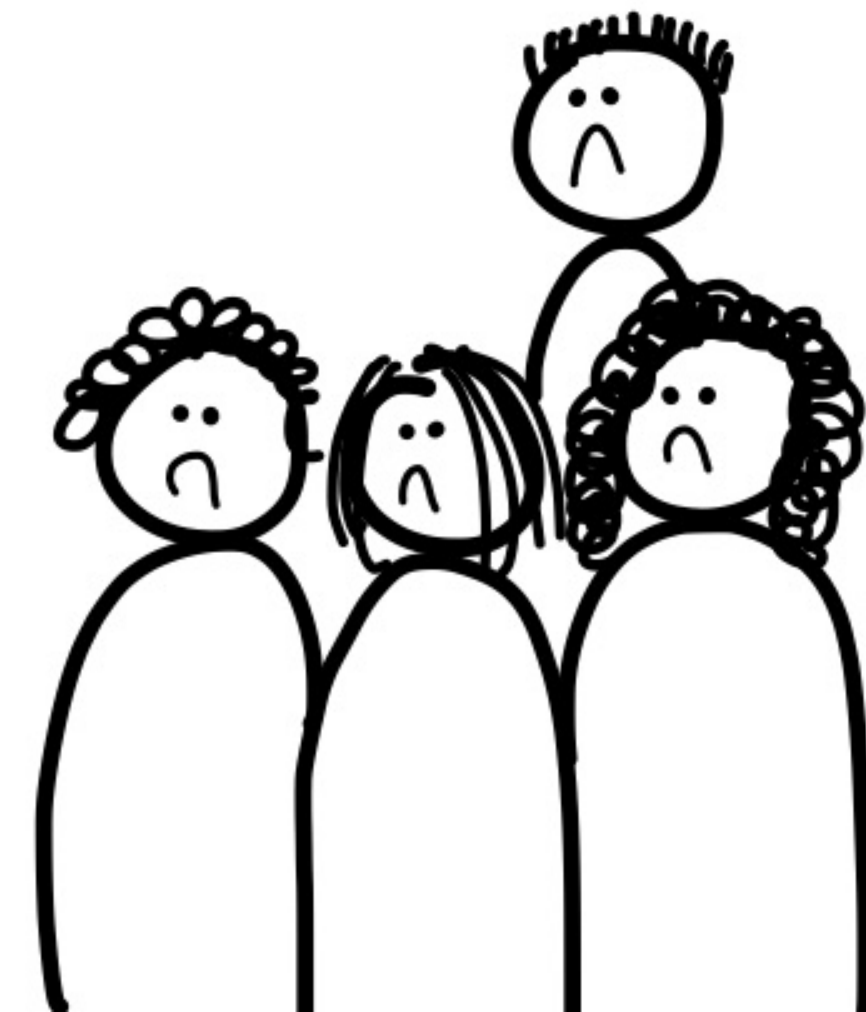
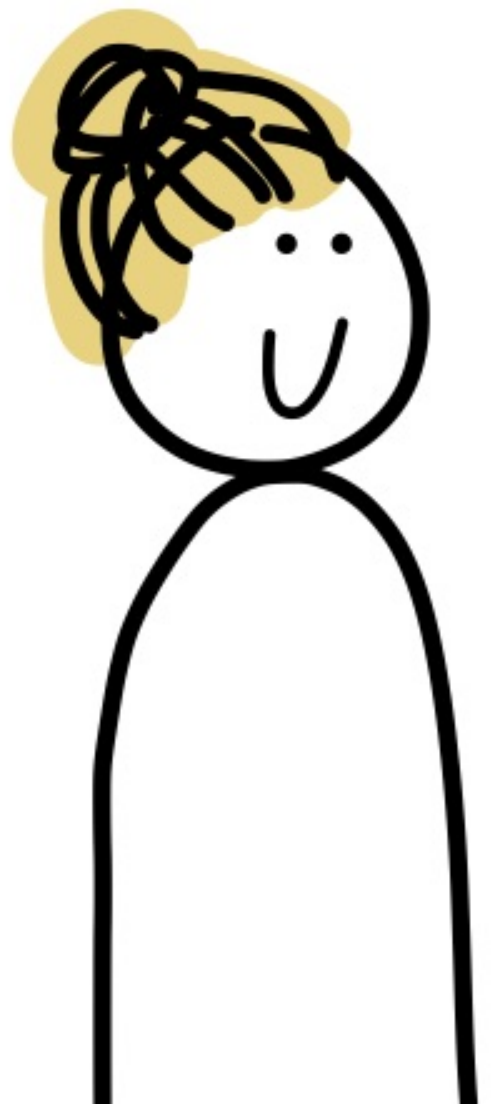
```
1 name is Hedy
2 print welcome, name
3
```



**We can't run your program.**



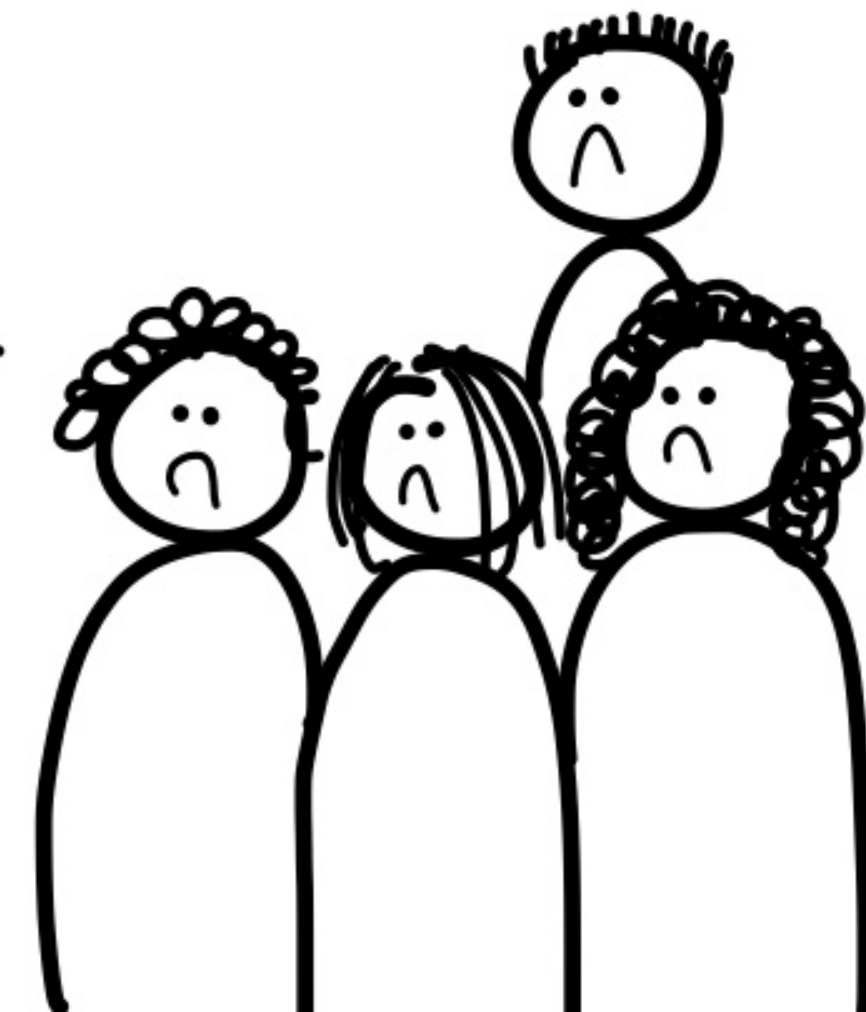
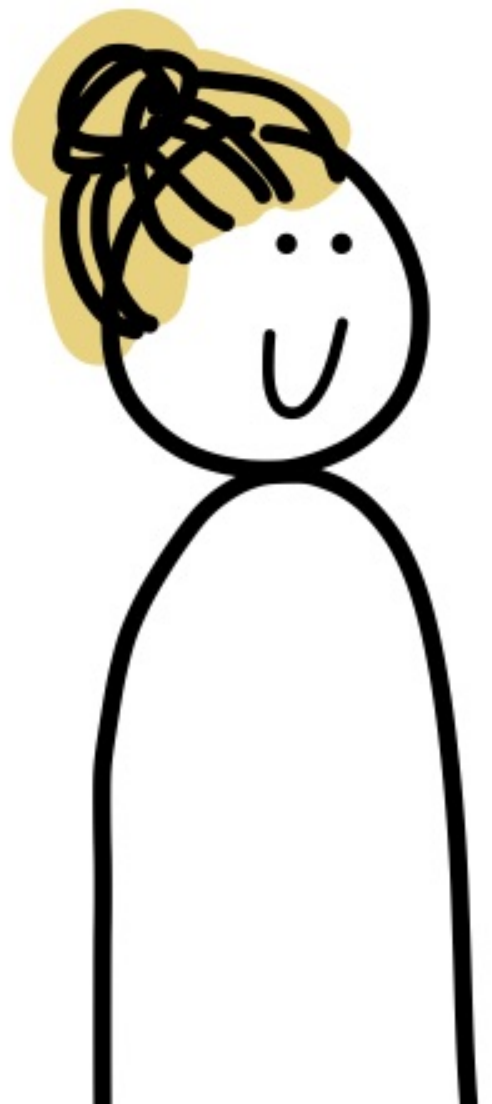
The code you entered is not valid Hedy code. There is a mistake on line 2, at position 14. You typed a comma, but that is not allowed.



# Benefits, challenges & improvements

Better error  
messages

Dutch keywords

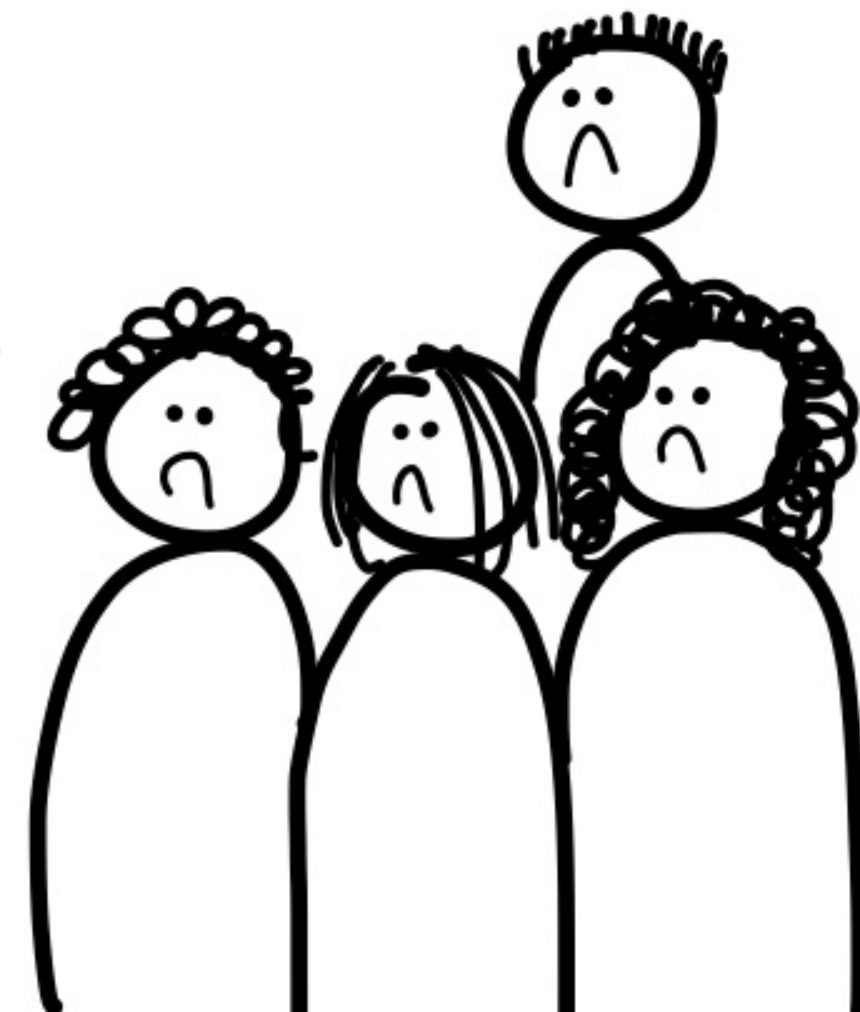


# Benefits, challenges & improvements

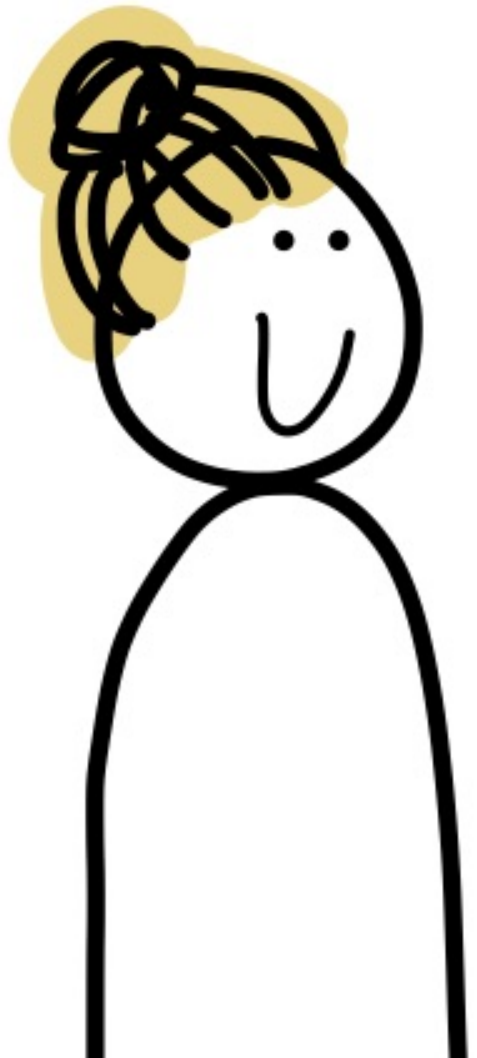
Really?

Better error  
messages

Dutch keywords



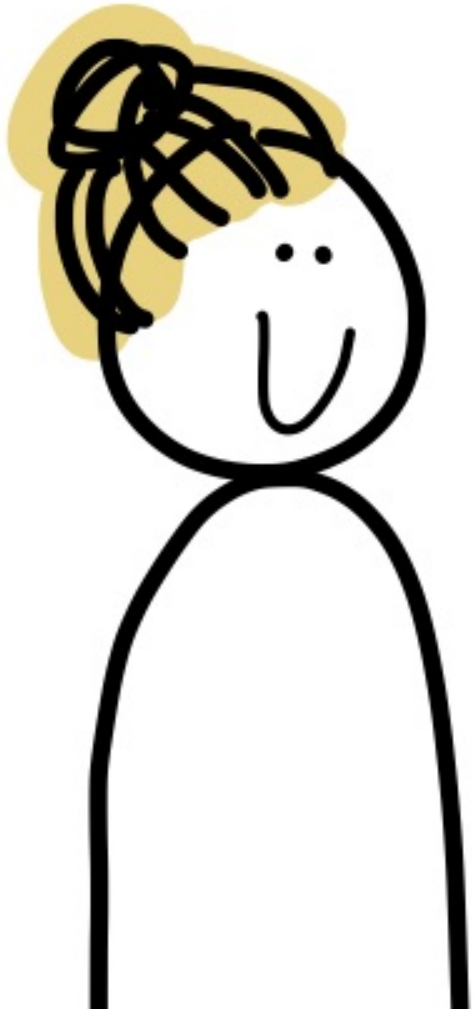
Demo time



# Architecture

Hedy code

```
ask name  
print hello  
echo welcome
```



# Architecture

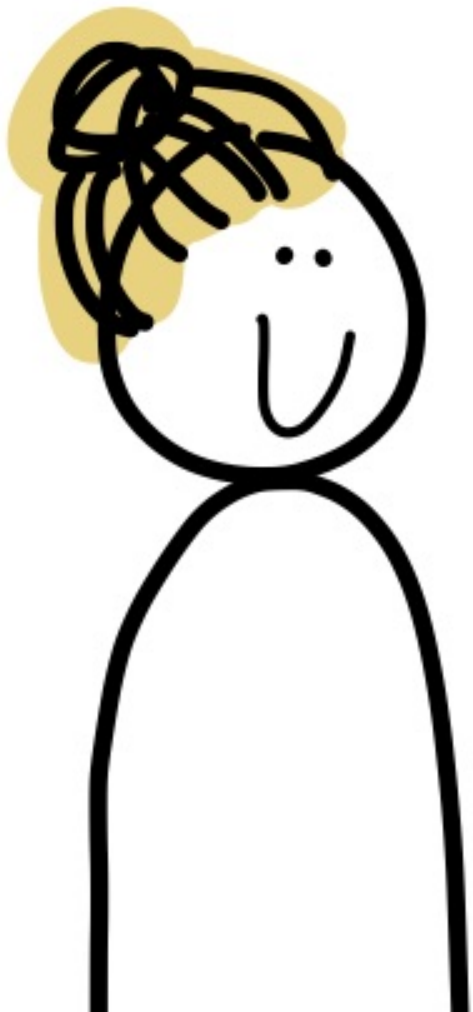
Hedy code

```
ask name  
print hello  
echo welcome
```



Grammar

```
command=  
print | ask | echo  
  
print = print text  
ask = ask text  
echo = echo text?
```



# Architecture

Hedy code

```
ask name  
print hello  
echo welcome
```



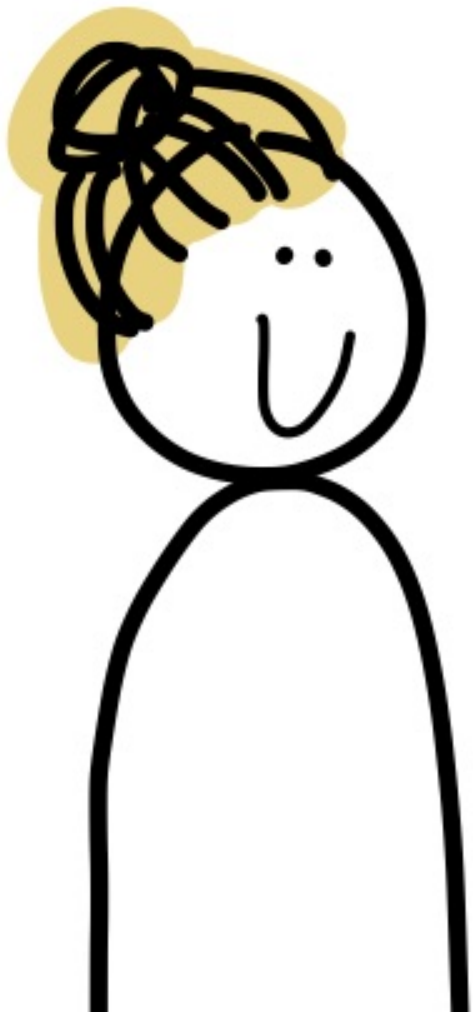
Grammar

```
command=  
print | ask | echo  
  
print = print text  
ask = ask text  
echo = echo text?
```



AST  
program

```
  /  |  \  
ask print echo  
 |   |   |  
name hello welcome
```



# Architecture

Hedy code

```
ask name  
print hello  
echo welcome
```



Grammar

```
command=  
print | ask | echo  
  
print = print text  
ask = ask text  
echo = echo text?
```



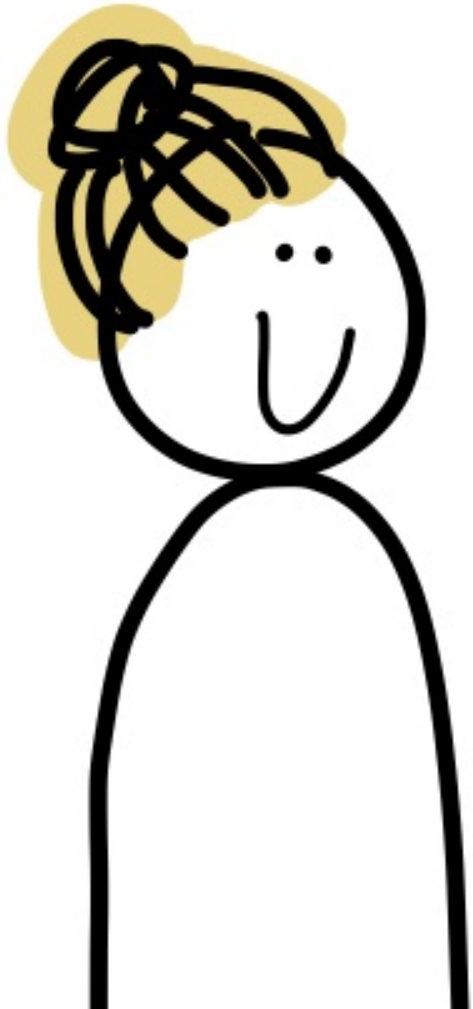
AST  
program

```
  /  |  \  
ask  print  echo  
 |    |    |  
name hello welcome
```



Python

```
answer = input('name?')  
print('hello')  
print('welcome', answer)
```



# Architecture

Hedy code

```
ask name  
print hello  
echo welcome
```

Grammar

```
command=  
print | ask | echo  
  
print = print text  
ask = ask text  
echo = echo text?
```

AST  
program

```
  /  |  \  
ask print echo  
|    |    |  
name hello welcome
```

Python

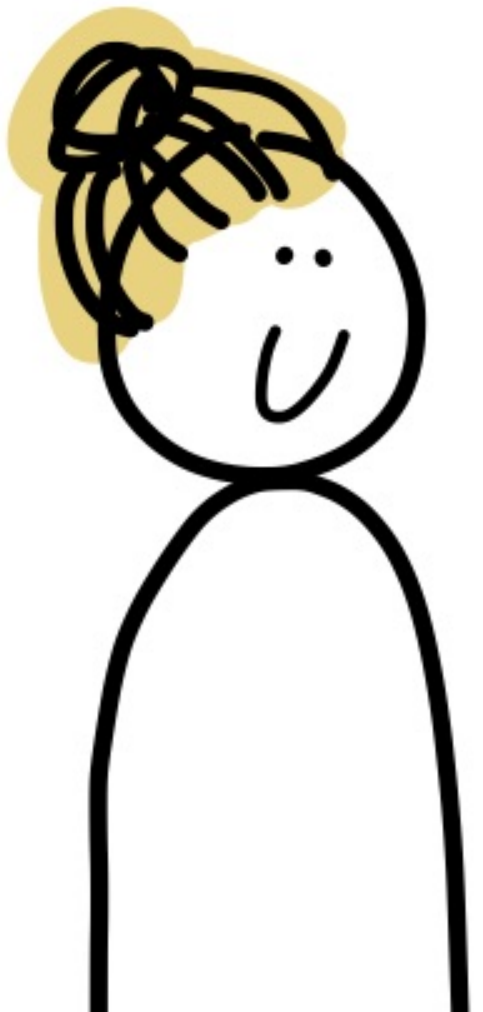
```
answer = input('name?')  
print('hello')  
print('welcome', answer)
```



We use Lark (as parser generator)

# Challenges

— Data driven  
language design



# Challenges



## Adds loop over list as new level 8 #1003

[Merged](#) Felienne merged 8 commits into `main` from `new-level-8` 7 days ago

Conversation 0

Commits 8

Checks 1

Files changed 61

+2,273 -1,807

Changes from all commits File filter Conversations Jump to 0 / 61 files viewed [Review changes](#)

Type to filter files

coursedata

grammars

level10-Additions.lark 21

level11-Additions.lark 9

level12-Additions.lark 18

level13-Additions.lark 17

level14-Additions.lark 10

level15-Additions.lark 11

level16-Additions.lark 8

level17-Additions.lark 7

level18-Additions.lark 6

level19-Additions.lark 12

coursedata/adventures/en.yaml

@@ -891,7 +891,7 @@ adventures:

891 ## Challenge

892 Of course, this code can be expanded with

more items on the menu, offering drinks, and/or multiple

courses, so feel free to add as many options as you like!

893 start\_code: ""

894 - 8:

895 story\_text: |

896 ## Restaurant

897 We can use the `for i in range 1 to 5` to

print the orders from multiple customers in an orderly manner.

@@ -1219,7 +1219,7 @@ adventures:

891 ## Challenge

892 Of course, this code can be expanded with

more items on the menu, offering drinks, and/or multiple

courses, so feel free to add as many options as you like!

893 start\_code: ""

894 + 9:

895 story\_text: |

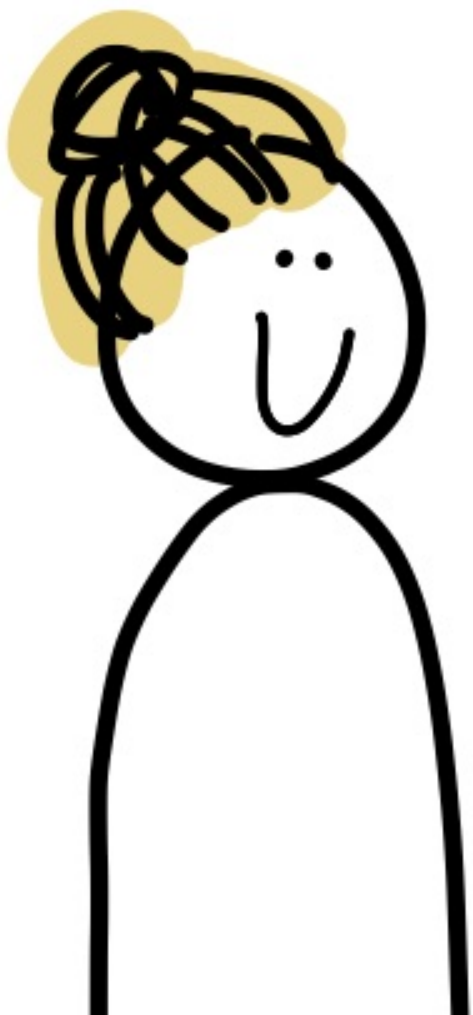
896 ## Restaurant

897 We can use the `for i in range 1 to 5` to

print the orders from multiple customers in an orderly manner.

# Challenges

17  
languages!



The screenshot shows the Hedy programming website. The top navigation bar includes links for Home, Hedy, Learn more, My profile, and My programs. A language dropdown menu is open on the right, showing 17 languages: English, Nederlands, Español, Français, Português(pt), Português(br), Deutsch, Italiano, Swahili, Magyar, Ελληνικά, 简体中文, Čeština, বাংলা, हिंदी, Bahasa Indonesia, and Frysk. The main content area is for Level 1 challenges. On the left, a sidebar lists commands: print, ask, echo, forward, and turn, each with a 'Try' button. The main area displays a welcome message and a code editor with the text '1 print hello world!'. At the bottom, there are buttons for 'Run code' and 'Go to level 2'.

# Challenges

17  
languages!



## Adds loop over list as new level 8 #1003

[Open](#) Felienne wants to merge 2 commits into `main` from `new-level-8`

Conversation 0

Commits 2

Checks 1

Files changed 61

Edit Open with

+2,212 -1,795

Changes from all commits File filter Conversations Jump to

0 / 61 files viewed

Review changes

Type to filter files

▼ coursedata

▼ adventures

en.yaml 6

hu.yaml 6

id.yaml 6

nl.yaml 12

▼ level-defaults

cs.yaml 71

de.yaml 55

el.yaml 55

en.yaml 73

fr.yaml 31

fy.yaml 71

hu.yaml 73

id.yaml 71

nl.yaml 71

pt\_br.yaml 73

pt\_pt.yaml 73

sw.yaml 37

zh.yaml 55

6 coursedata/adventures/en.yaml

Viewed

@@ -891,7 +891,7 @@ adventures:

```
891         ## Challenge
892         Of course, this code can be expanded with
more items on the menu, offering drinks, and/or multiple
courses, so feel free to add as many options as you like!
893         start_code: ""
894 -         8:
895         story_text: |
896             ## Restaurant
897             We can use the `for i in range 1 to 5` to
print the orders from multiple customers in an orderly manner.
```

@@ -1219,7 +1219,7 @@ adventures:

```
1219
1220         start_code: "print 'Escape from the haunted
house!'"
1221
1222 -         8:
1223         story_text: |
1224             ## Haunted House
1225             In level 8 we've changed the repeat
command and we've added a line to our haunted house that tells
```

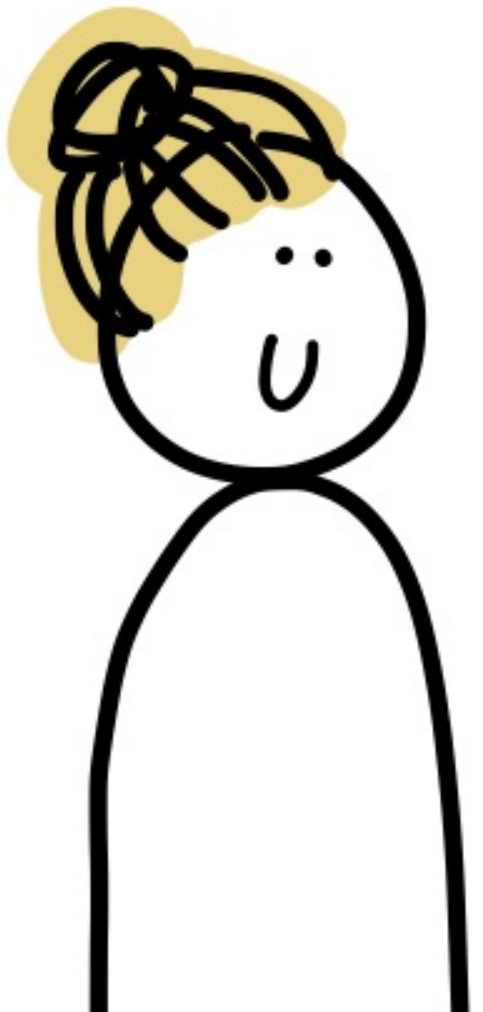
```
891         ## Challenge
892         Of course, this code can be expanded with
more items on the menu, offering drinks, and/or multiple
courses, so feel free to add as many options as you like!
893         start_code: ""
894 +         9:
895         story_text: |
896             ## Restaurant
897             We can use the `for i in range 1 to 5` to
print the orders from multiple customers in an orderly manner.
```

```
1219
1220         start_code: "print 'Escape from the haunted
house!'"
1221
1222 +         9:
1223         story_text: |
1224             ## Haunted House
1225             In level 8 we've changed the repeat
command and we've added a line to our haunted house that tells
```

# Challenges

We also have more

✓ fundamental challenges



# Challenges

Code

```
ask name  
print hello  
echo welcome
```

Grammar

```
command=  
print|ask|echo  
  
print = print text  
ask = ask text  
echo = echo text?
```



AST  
program

```
  /  |  \  
ask print echo  
|   |   |  
name hello welcome
```



...



# Challenges

Exactly what  
parser frameworks  
are for!



Code

```
ask name  
print hello  
echo welcome
```

Grammar

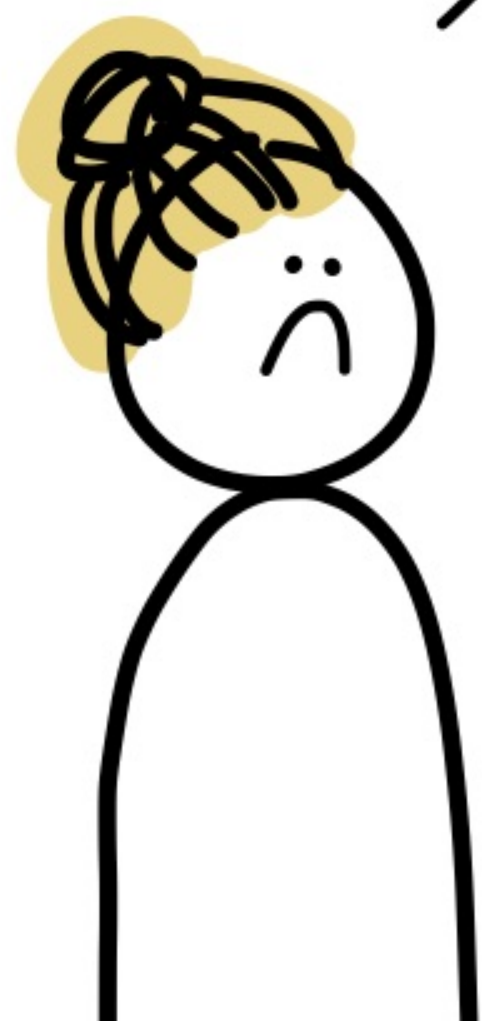
```
command=  
print|ask|echo  
  
print = print text  
ask = ask text  
echo = echo text?
```



→ ...

# Challenges

Not what  
parser frameworks  
are for!



Code

```
ask name  
print hello  
echo welcome
```

Grammars

```
command=  
print|ask|echo  
  
print = print text  
ask = ask text  
echo = echo text?
```

AST  
program

```
graph TD
    program[AST program] --> ask[ask]
    program --> print[print]
    program --> echo[echo]
    ask --> name[name]
    print --> hello[hello]
    echo --> welcome[welcome]
```

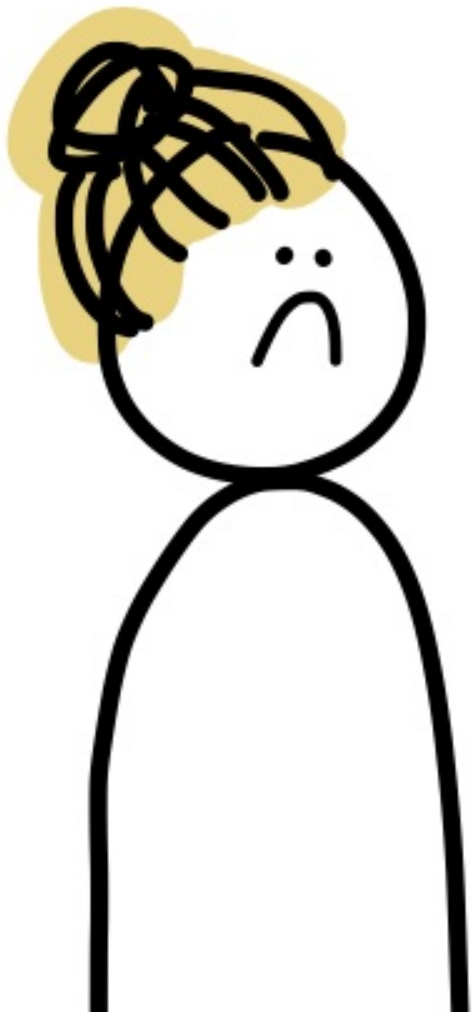
ask    print    echo  
|       |       |  
name   hello   welcome

→ ...

# Challenges

```
1 for i in range 1 to 10:  
x 2 repeat 10 times  
3     print i 'x 5 =' i * 5  
4 print 'Ready!'  
5  
6  
7  
8
```

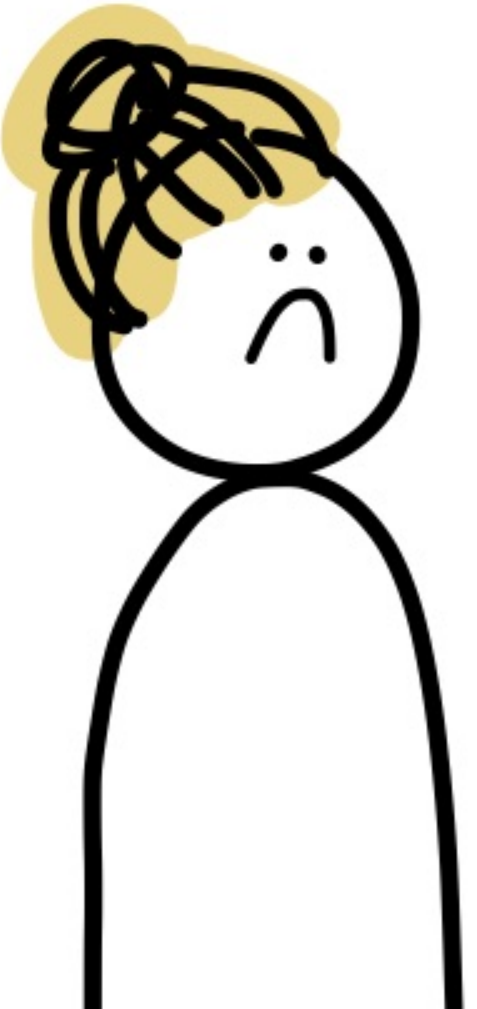
← Code at level 9



# Challenges

```
1 for i in range 1 to 10:  
x 2 repeat 10 times  
3     print i 'x 5 =' i * 5  
4 print 'Ready!'  
5  
6  
7  
8
```

← Code at level 7



# Challenges

```
1 for i in range 1 to 10:  
x 2 repeat 10 times  
3     print i 'x 5 =' i * 5  
4 print 'Ready!'  
5  
6  
7  
8
```

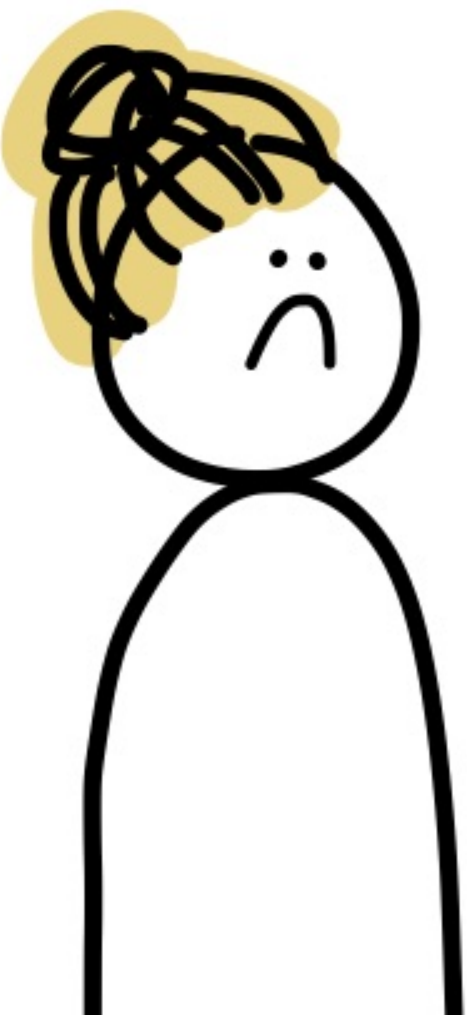
← Code at level 7



**We can't run your program.**

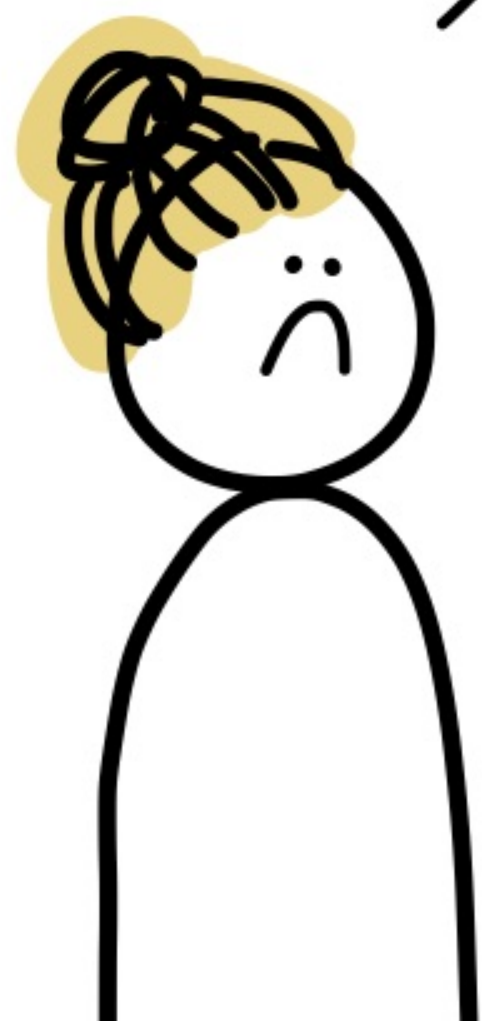


The code you entered is not valid Hedy code. There is a mistake on line 2, at position 12. You typed 1, but that is not allowed.



# Challenges

Not what  
parser frameworks  
are for!



Code

```
ask name  
print hello  
echo welcome
```

Grammars

```
command=  
print|ask|echo  
  
print = "print" text  
ask = "ask" text  
echo = "echo" text?
```

AST  
program

```
graph TD
    program[AST program] --> ask[ask]
    program --> print[print]
    program --> echo[echo]
    ask --> name[name]
    print --> hello[hello]
    echo --> welcome[welcome]
```

ask    print    echo  
|       |       |  
name    hello    welcome

→ ...

# Challenges

Certainly not what  
parser frameworks  
are for!



Code

```
ask name  
print hello  
echo welcome
```

Grammars

```
command=  
print|ask|echo  
  
print = "print" text  
ask = "ask" text  
echo = "echo" text?
```

AST  
program

```
graph TD
    program[AST program] --> ask[ask]
    program --> print[print]
    program --> echo[echo]
    ask --> name[name]
    print --> hello[hello]
    echo --> welcome[welcome]
```

ask    print    echo  
|       |       |  
name   hello   welcome

→ ...

# OS & Academia

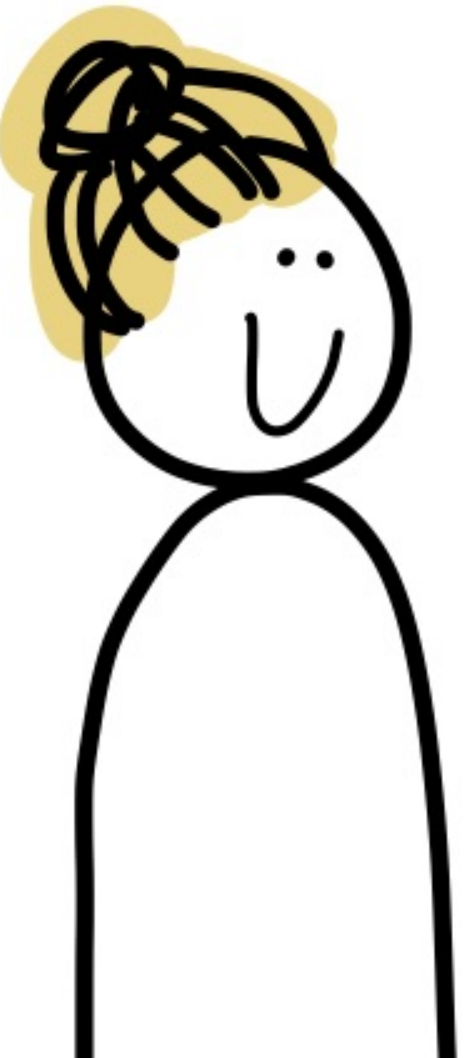


/Fay-lee-nuh/ ✓  
@Feliene

I was away for just 6 days!

I mean I am loving the fact that people are helping make [@hedycode](#) better, but also... it is a lot of work keeping an eye on things!!!

🔗 Pull requests 21



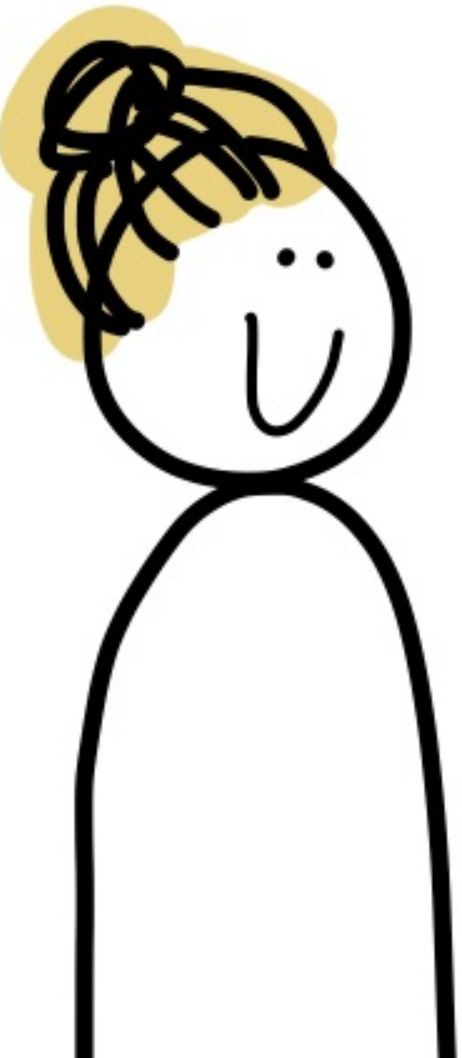
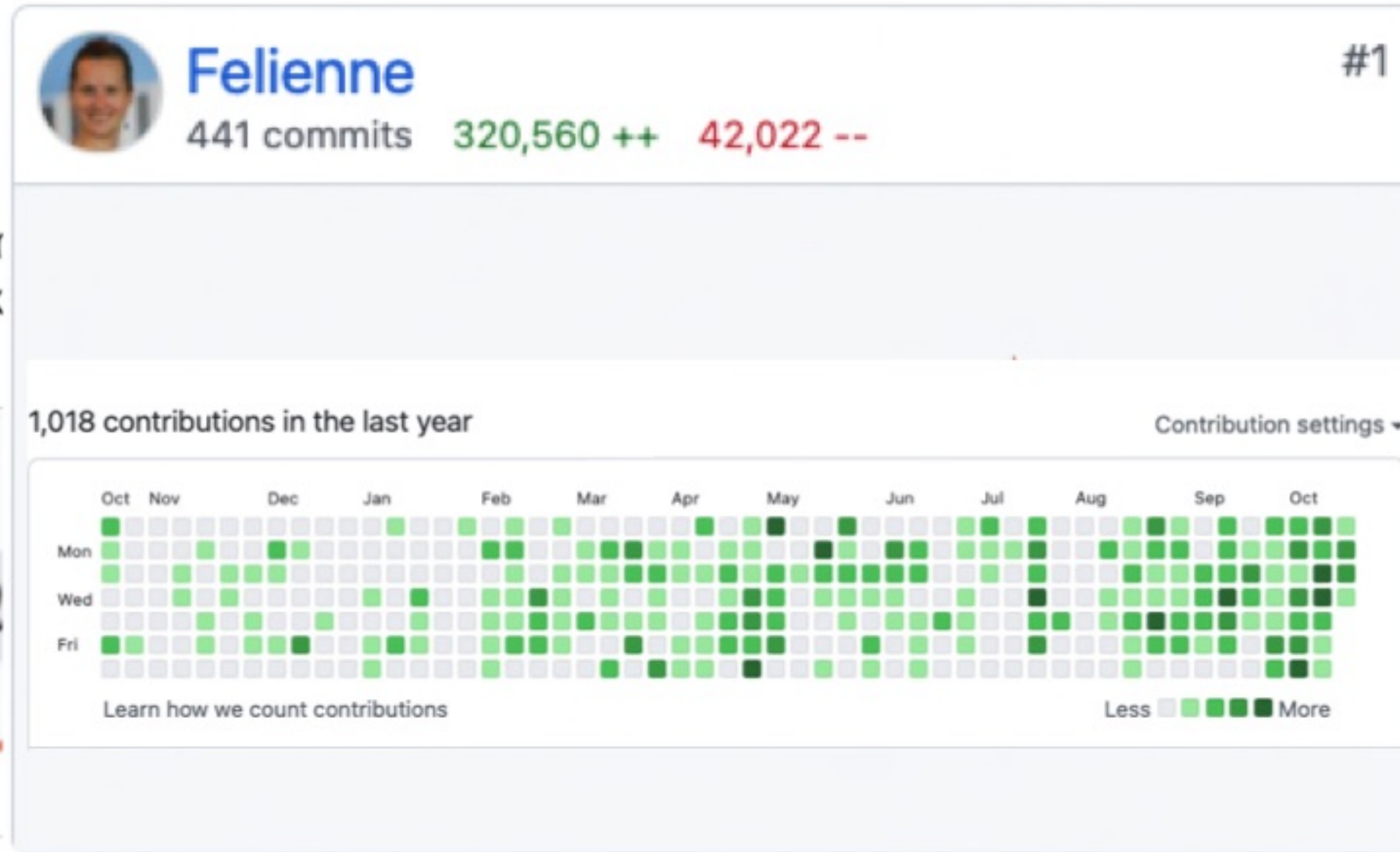
# OS & Academia



I was away for just 6 days!

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[@hedycode](#) better, but also... it is a lot of work keeping  
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🔗 Pull requests 2



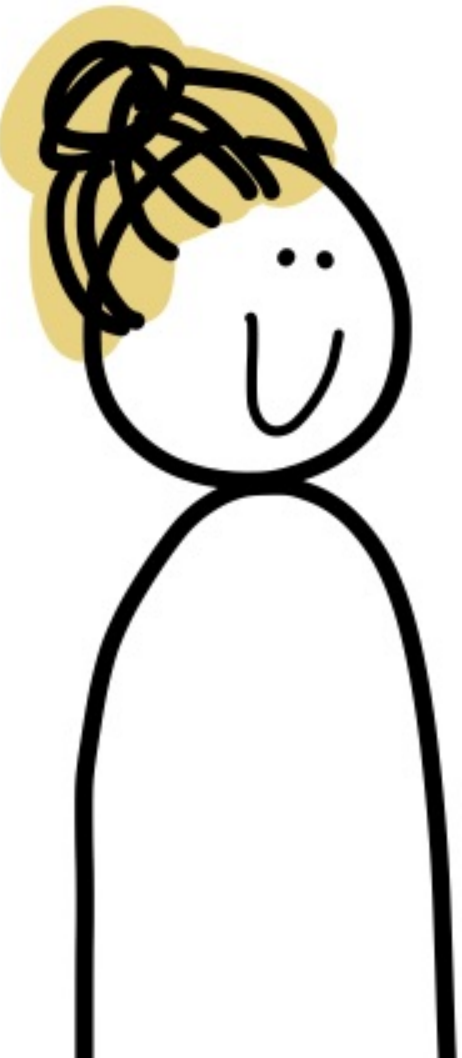
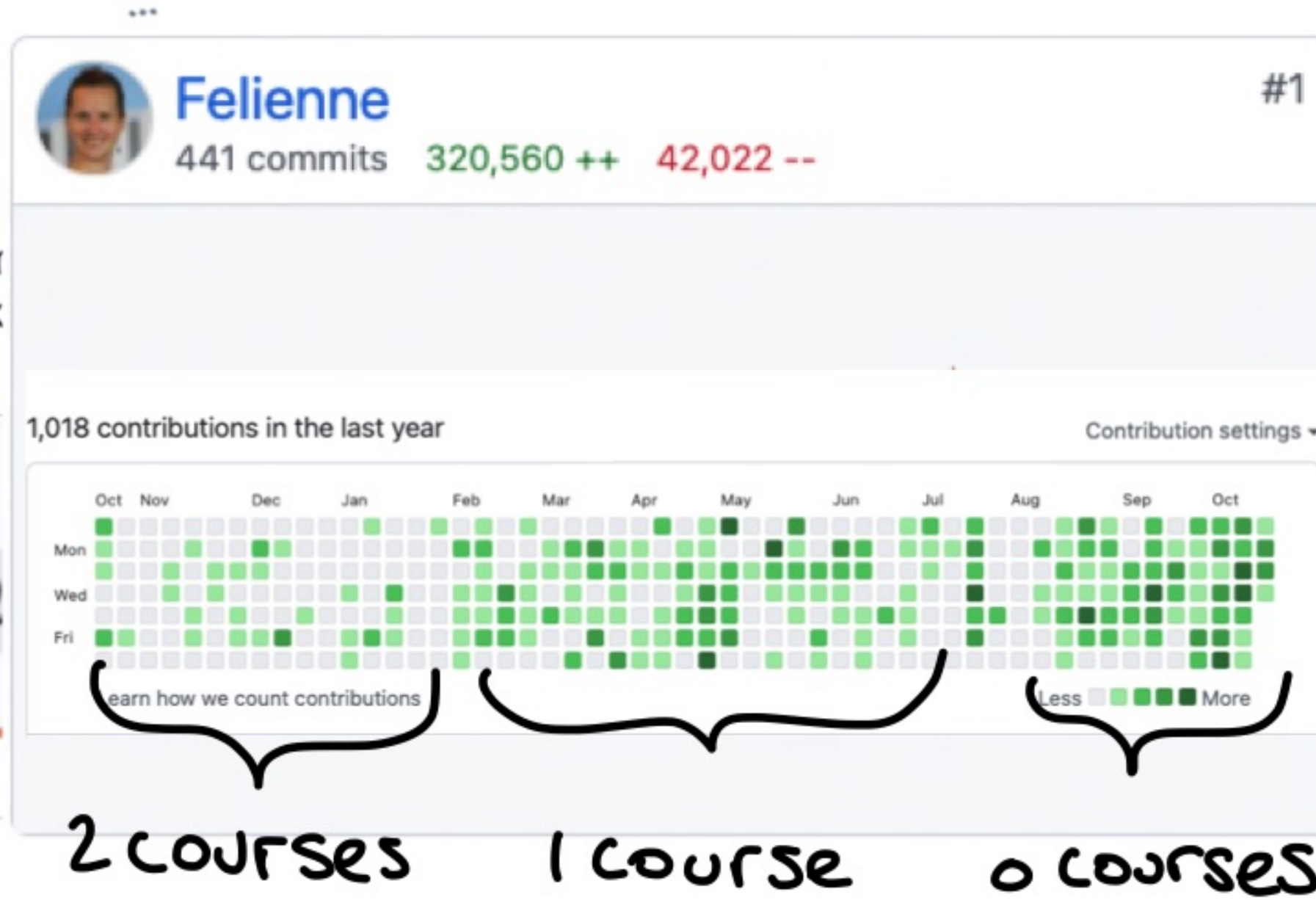
# OS & Academia



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🔗 Pull requests 2



# OS & Academia

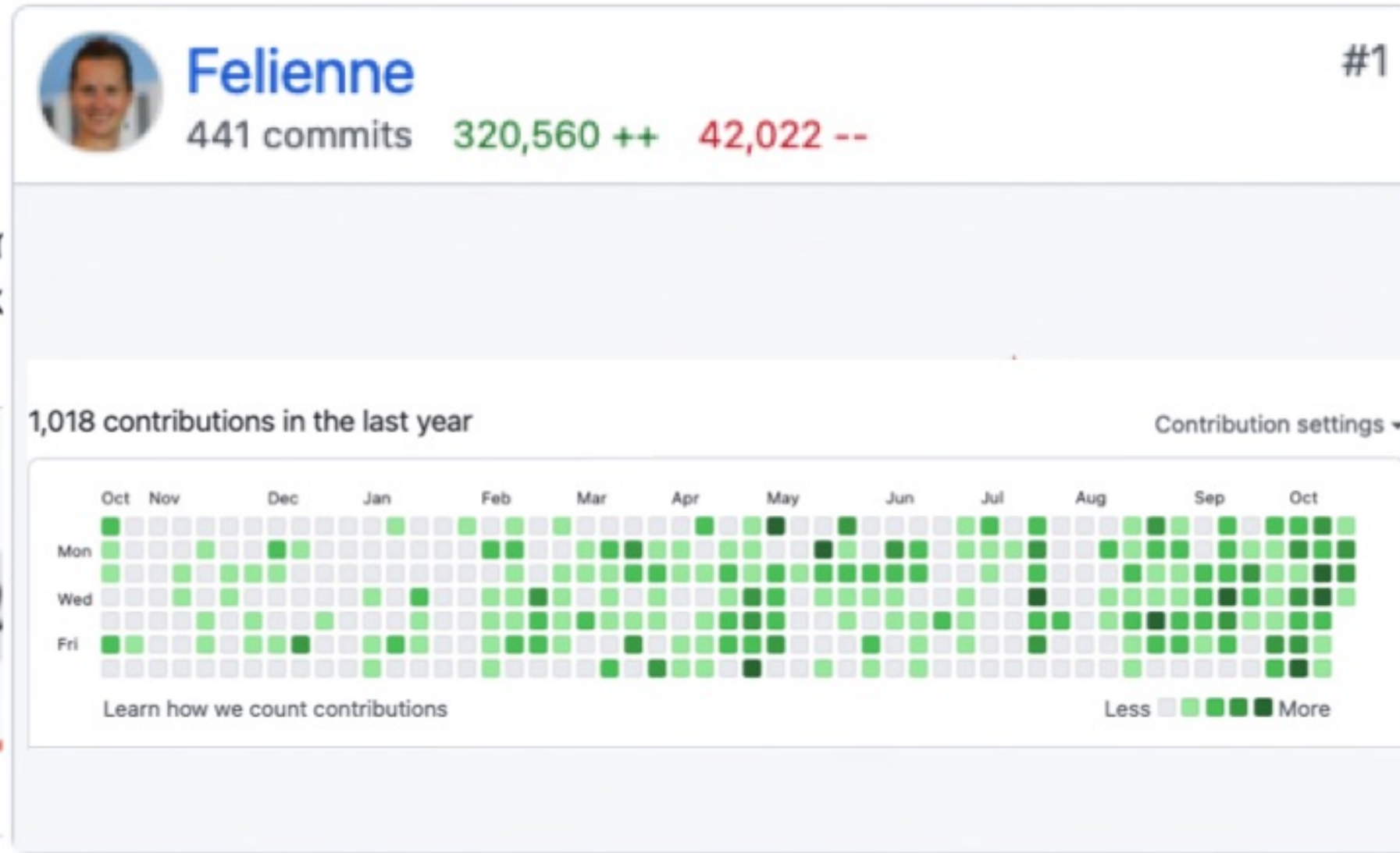


/Fay-lee-nuh/  
@Feliene

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🔗 Pull requests 2



# OS & Academia

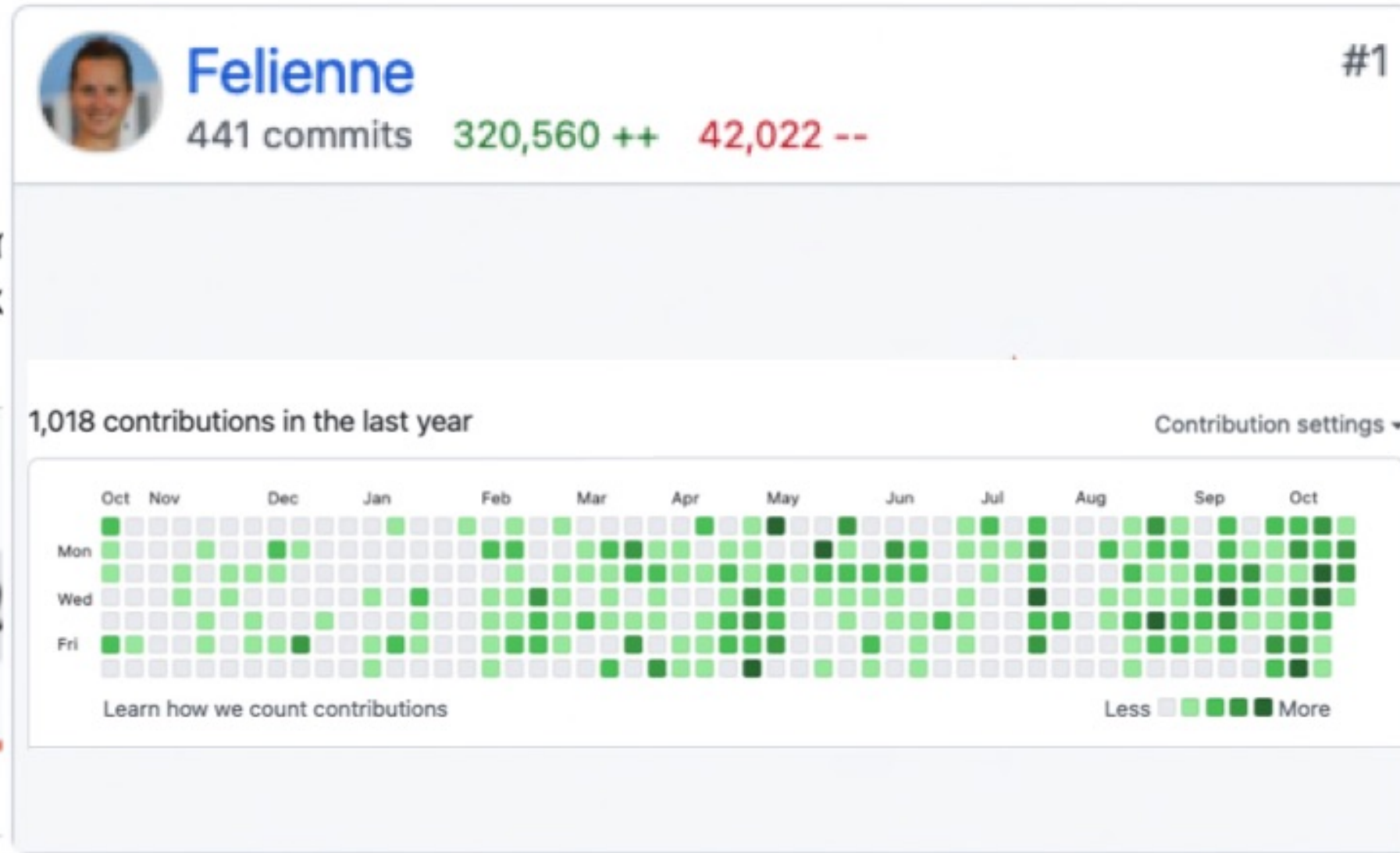


/Fay-lee-nuh/  
@Fay-lee-nuh

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🔗 Pull requests 2



Is this research?



# OS & Academia

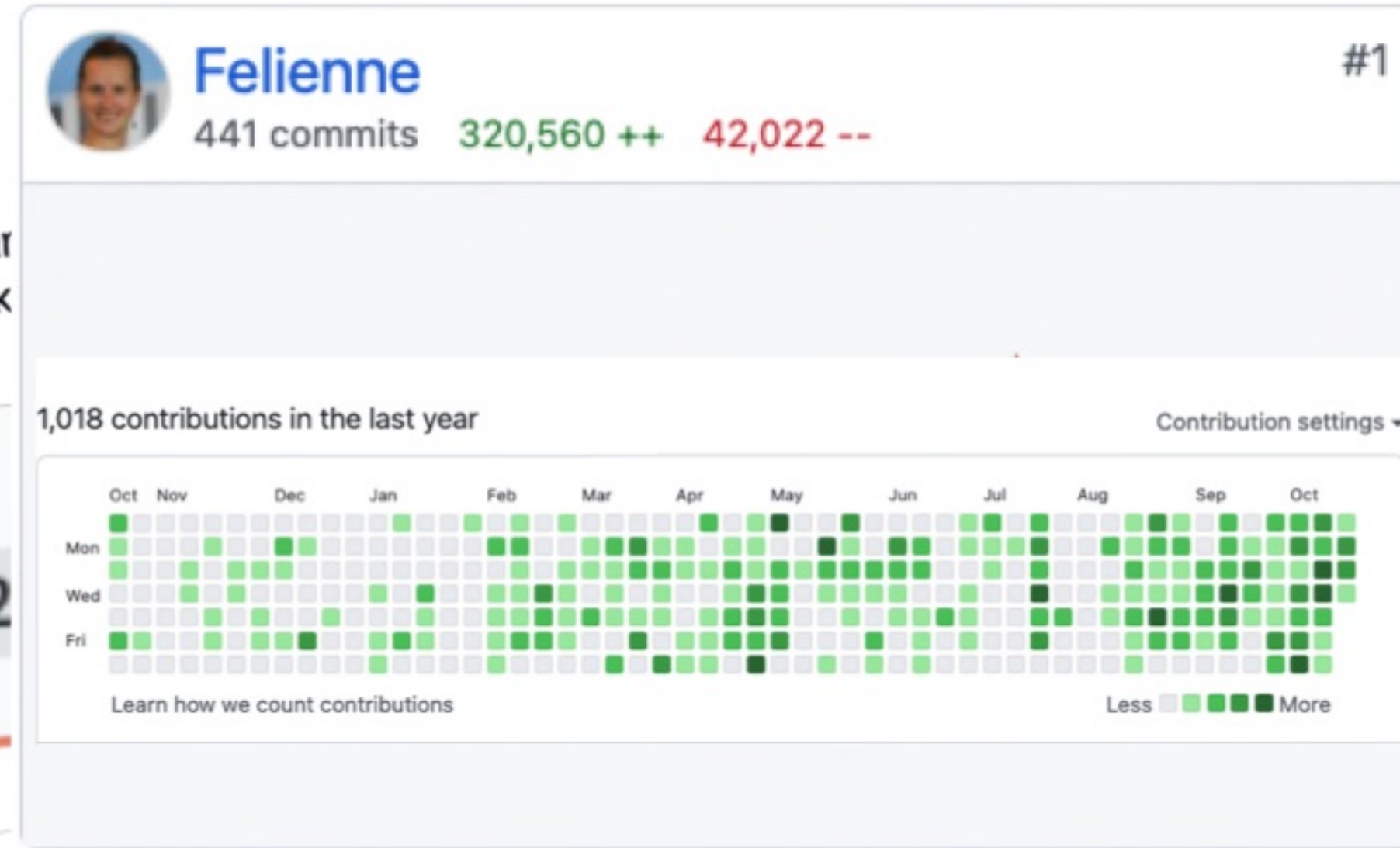


/Fay-lee-nuh/  
@Feliene

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 Pull requests 2



Is this outreach?



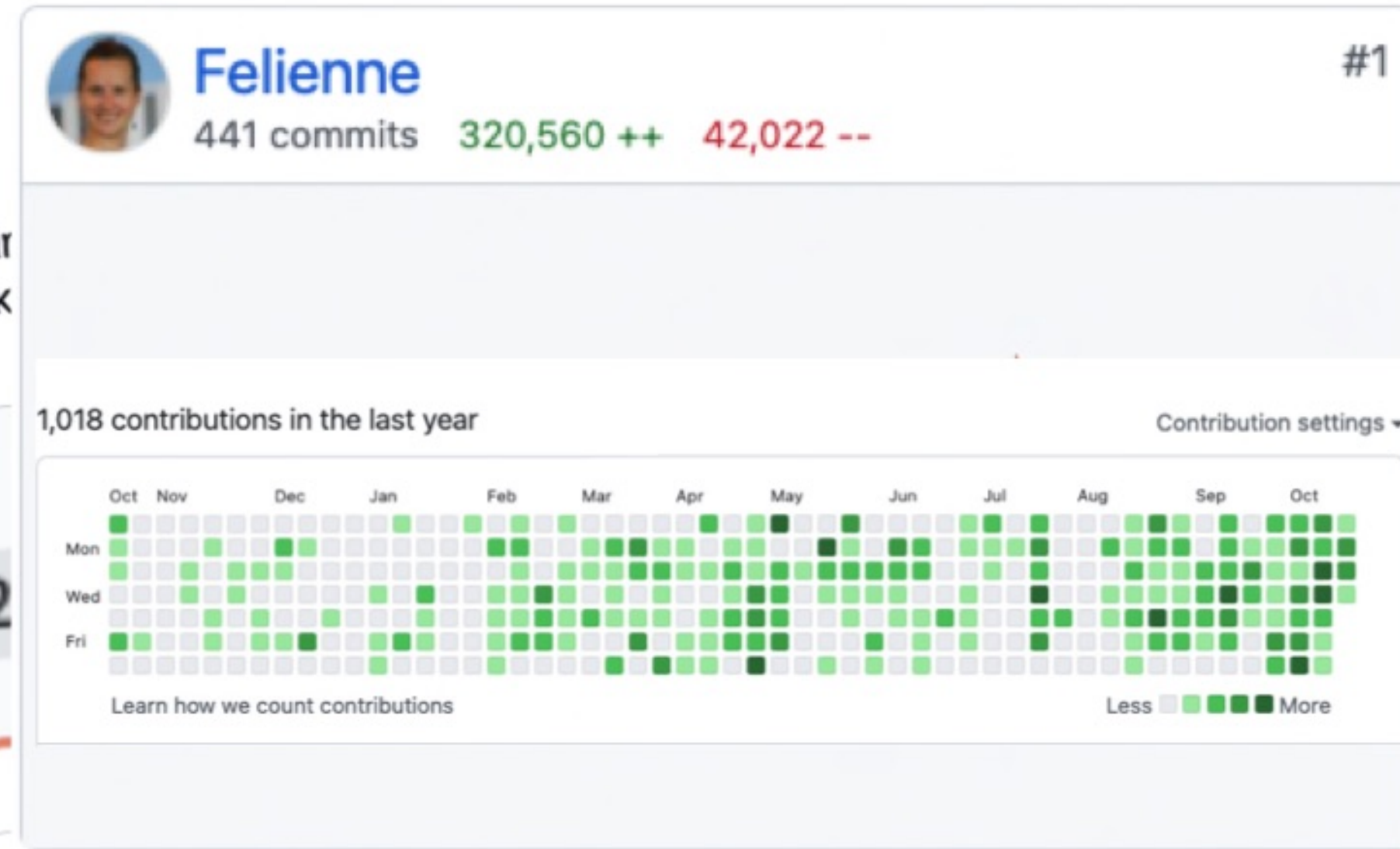
# OS & Academia



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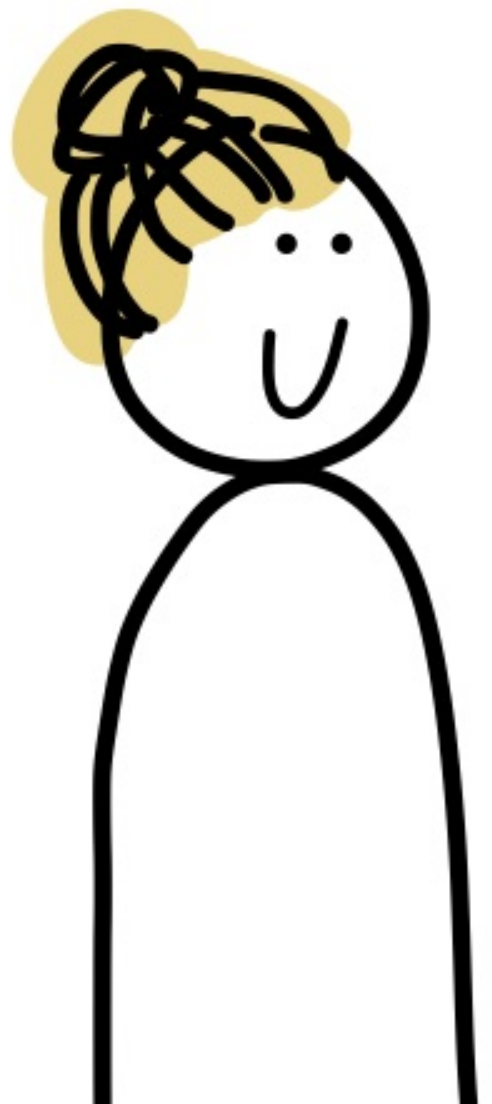
 Pull requests 2



Is this professional development?



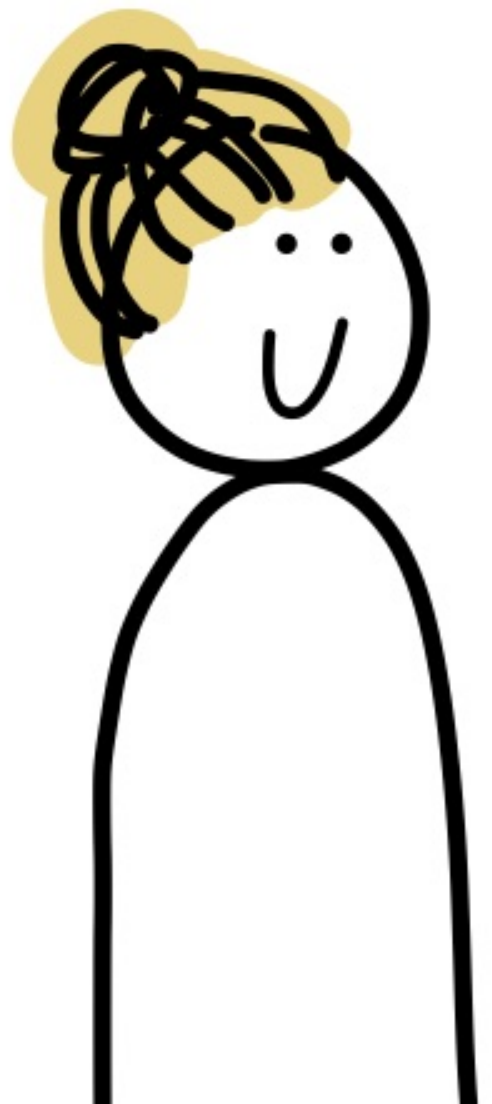
Hedy is free  
and open source!



The screenshot shows the Hedy website interface. At the top, there's a navigation bar with links for Home, Hedy, Explore, Learn more, and Log in. Below this, a level selector shows 'Level 1' with buttons for 'Save code' and 'Save &amp; share code'. A horizontal menu lists various topics: Level 1, Story, Parrot, Turtle, Rock, paper, scissors, Restaurant, Fortune teller, Haunted House, What's next?, and End. The main content area is divided into two columns. The left column has a 'Welcome to Hedy!' section explaining the commands 'print', 'ask', and 'echo'. It includes instructions on how to use the programming field and a green 'Run code' button. The right column shows 'Example code' blocks with sample code like 'print Hello!', 'print Welcome to Hedy!', and 'ask What is your name?'. At the bottom, there's a 'Run code' button, a 'Go to level 2' button, a 'Read aloud' feature with a speech bubble icon, and a 'Programmer's mode' toggle switch.

Hedy is free  
and open source!

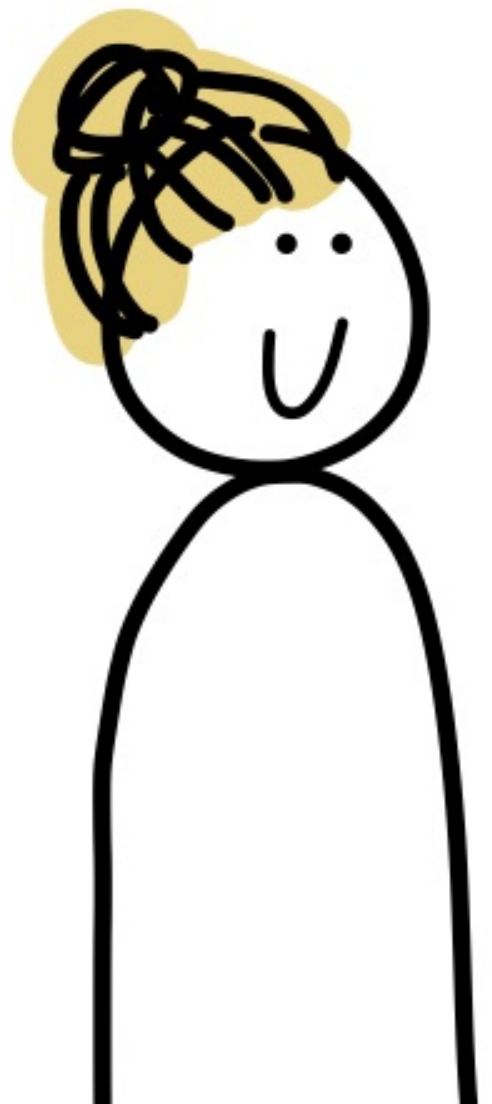
We support  
20  
languages



The screenshot shows the Hedy website interface. The browser address bar displays 'hedycode.com'. The website has a blue header with navigation links: Home, Hedy, Explore, Learn more, and Log in. A language dropdown menu is open on the right side, showing a search bar and a list of 20 languages: Nederlands, Español, Français, Português(pt), Português(br), Deutsch, Italiano, Swahili, Magyar, Ελληνικά, 简体中文, Čeština, Български, বাংলা, हिंदी, Bahasa Indonesia, Frysk, العربية, and Türk. The main content area is titled 'Welcome to Hedy!' and provides instructions for using the commands 'print', 'ask', and 'echo'. It includes a 'Level 1' tab and a 'Run code' button. The bottom of the page features a 'Read aloud' button and a 'Programmer's mode' toggle.

Hedy is free  
and open source!

We support  
25  
languages



The screenshot shows the Hedy website interface. The browser address bar displays "hedycode.com". The navigation bar includes links for Home, Hedy, Explore, Learn more, and Log in, along with a language dropdown menu set to "English". The main content area is titled "Level 1" and features a "Save code" button. Below the title, there are tabs for different topics: Level 1, Story, Parrot, Turtle, Rock, paper, scissors, Restaurant, Fortune teller, Haunted House, and What's next?. The "Level 1" tab is active, displaying a "Welcome to Hedy!" message. The text explains that in Level 1, users can use the commands `print`, `ask`, and `echo`. It instructs users to type their code in the programming field or press the green button in the example code block. The example code block shows `print Hello!` and `print Welcome to Hedy!`. Below this, there is a section for "Example code" with `ask What is your name?`. The programming field contains the code `1 print hello world!` and `2`. A "Run code" button is located below the programming field. At the bottom, there is a "Read aloud" section with a speech bubble icon and a "Programmer's mode" toggle switch.

Level 1

Save code

Search...

Nederlands

Español

Français

Português(pt)

Português(br)

Deutsch

Italiano

Swahili

Magyar

Ελληνικά

简体中文

Čeština

Български

বাংলা

हिंदी

Bahasa Indonesia

Frysk

عربي

Türk

GO to level 2

Welcome to Hedy!

In Level 1 you can use the commands `print`, `ask` and `echo`. Type your code in the programming field. Or press the green button in the example code block, and the code will be typed for you! Try the code yourself with the green 'Run code' button under the programming field.

You can print text to the screen using the `print` command.

You can also ask for input with `ask` and repeat it back with an `echo` command.

Example code

```
print Hello!
print Welcome to Hedy!
```

Example code

```
ask What is your name?
```

```
1 print hello world!
2
```

Run code

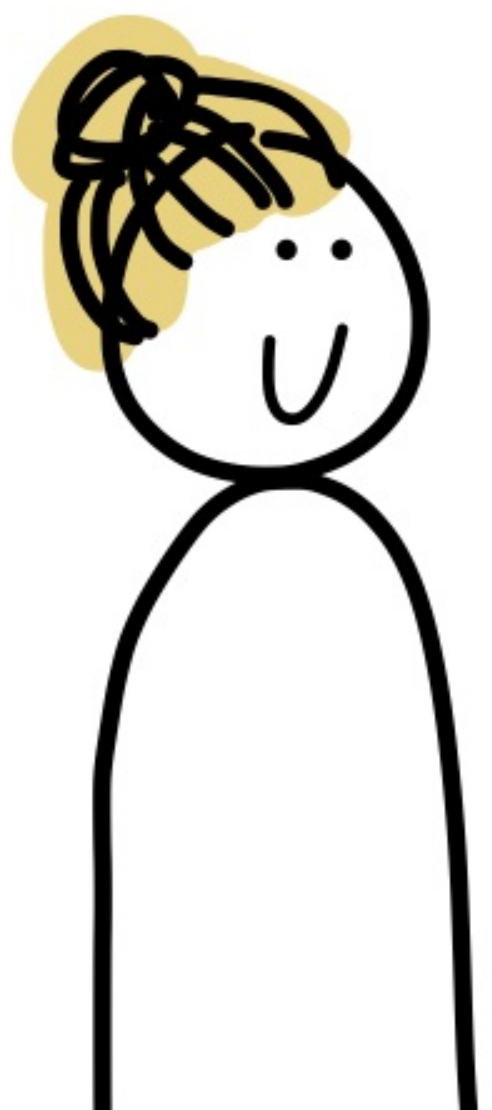
Read aloud: 🗣️

Programmer's mode

Hedy is free  
and open source!

We support  
25  
languages

We'd  
love  
more!



Browser tabs: Hedy/Achievements — Hungari x +

Address bar: hosted.weblate.org/zen/hedy/achievements/hu/?offset=1&q... ☆ + Update

Hosted Weblate Dashboard Projects Languages Checks

Hedy / Achievements / Hungarian / Zen translated 0%

134 strings Unfinished strings state:<translated × Exit Zen

Position and priority

hedy\_achievements

English  
Hedy Achievements

Hungarian  
Hedy Achievements  
Needs editing 17/170 · 17

general

English  
General

Hungarian  
General  
Needs editing 7/100 · 7

THE END



# THE END

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felienne.com



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/Book



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