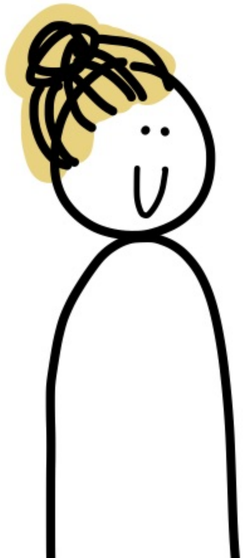
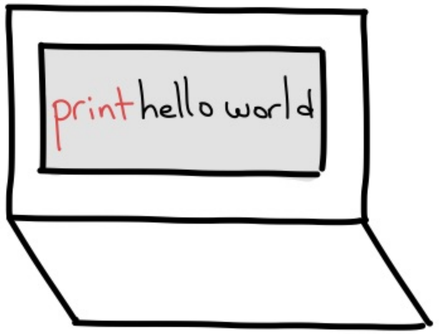
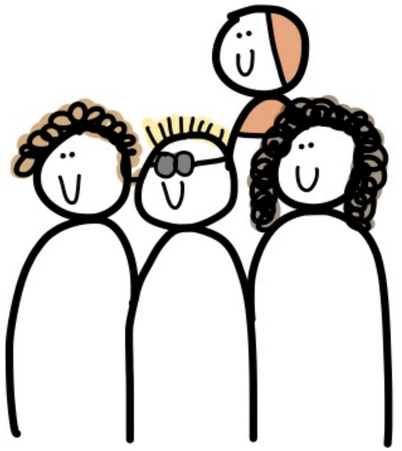
A human programming language

How to make programming languages more inclusive
and why that matters

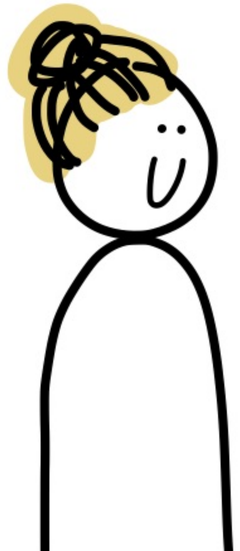




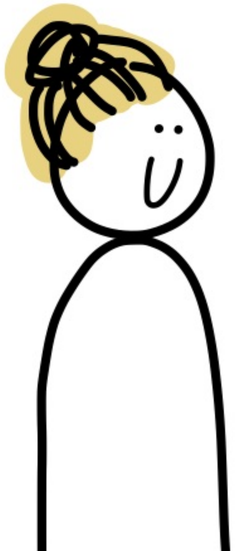


prof. dr. ir. Felienne Hermans

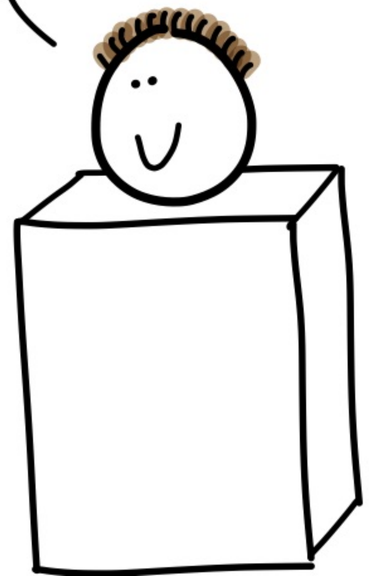
Everybody needs some programming skills!



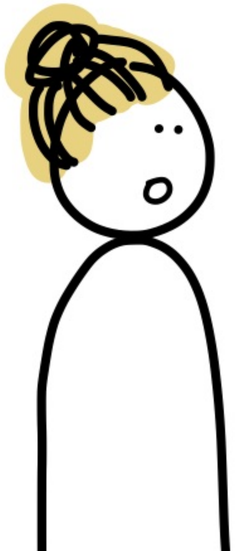
Everybody needs some programming skills!



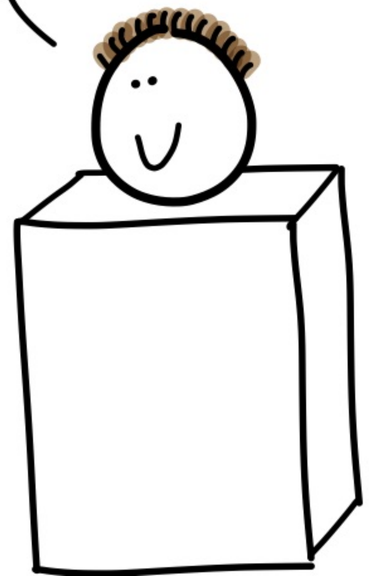
No!
We have GPT!



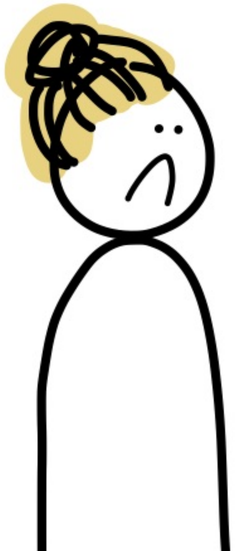
I really don't care



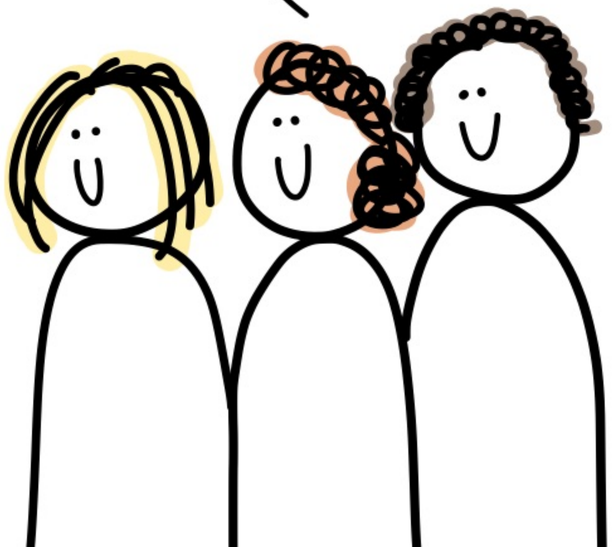
No!
We have GPT!



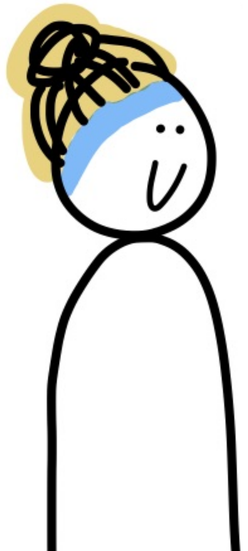
I really don't care



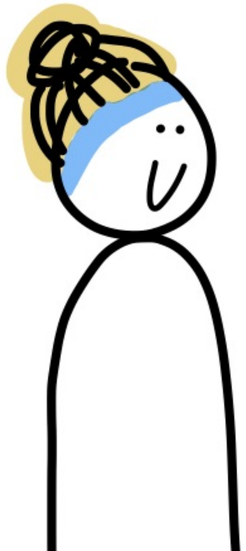
No!
We have GPT!



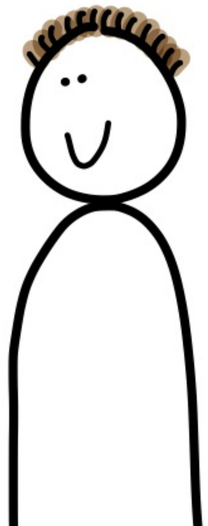
I am running a marathon!



I am running a marathon!



No!
We have cars!



I am running a marathon!

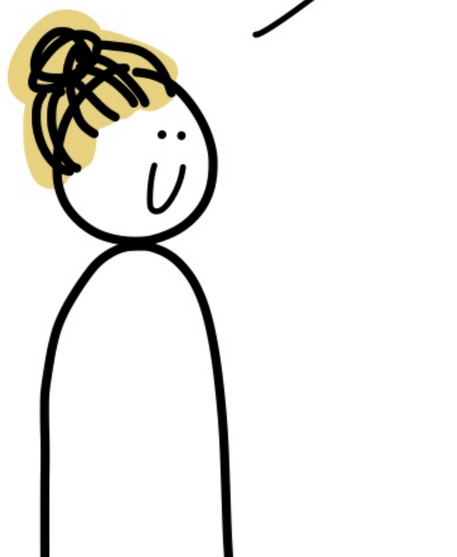





This is not it
Finish


This is it
This is not it
Finish

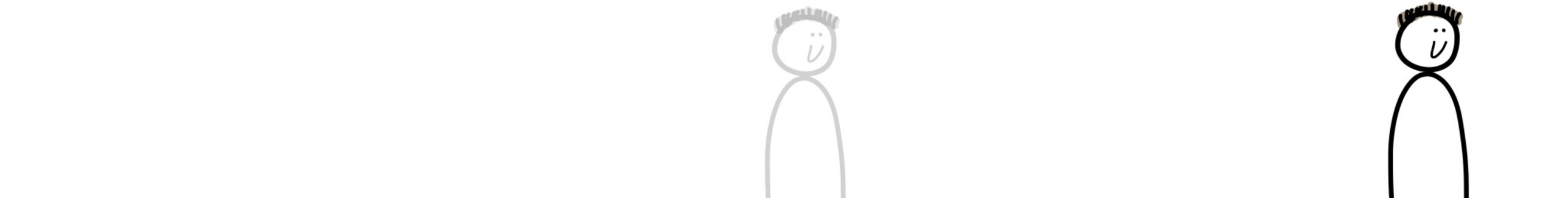
What is the goal of programming education?



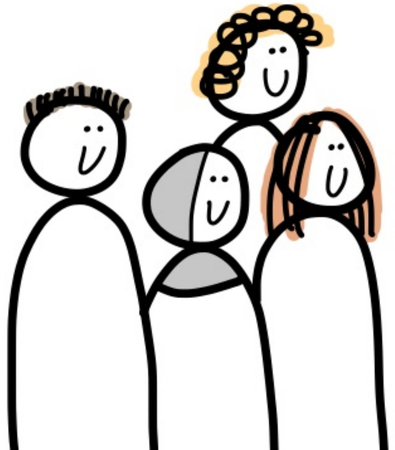
Knows what programming is



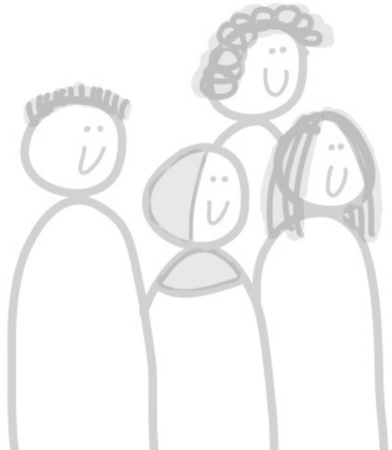
Knows programming

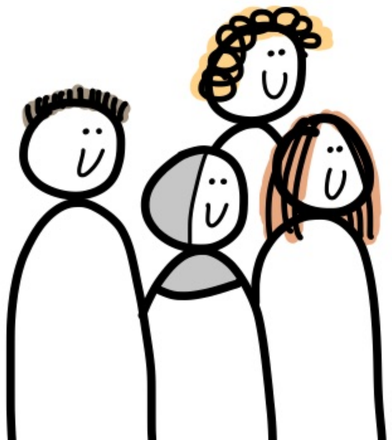


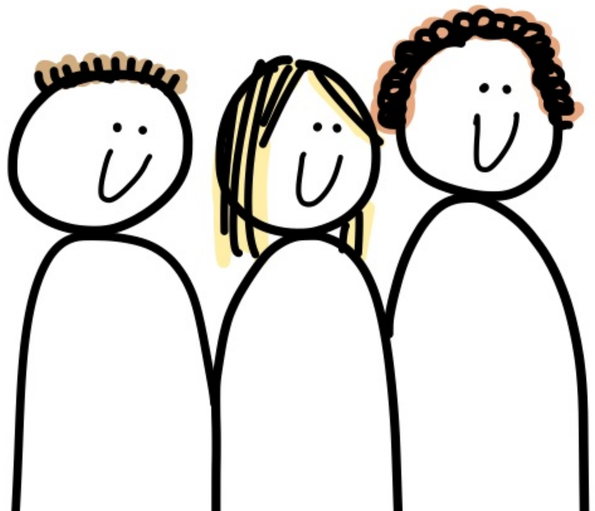
Don't know what programming is

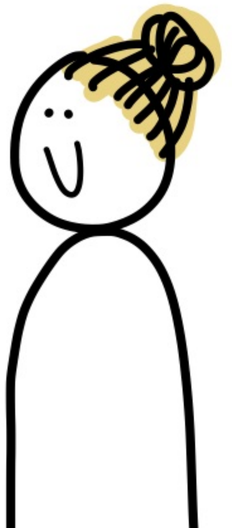


Know what programming is

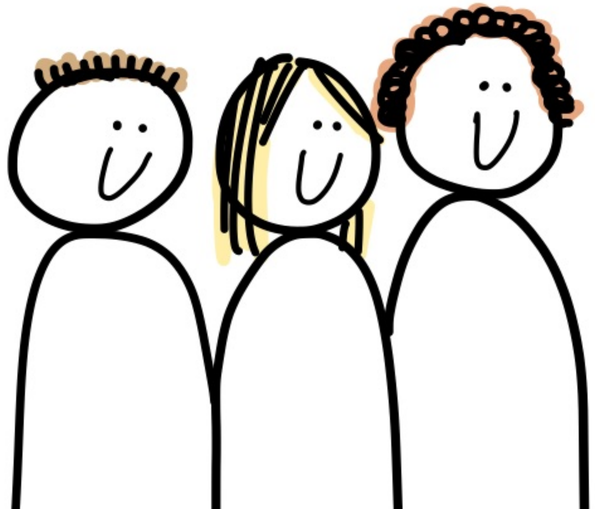


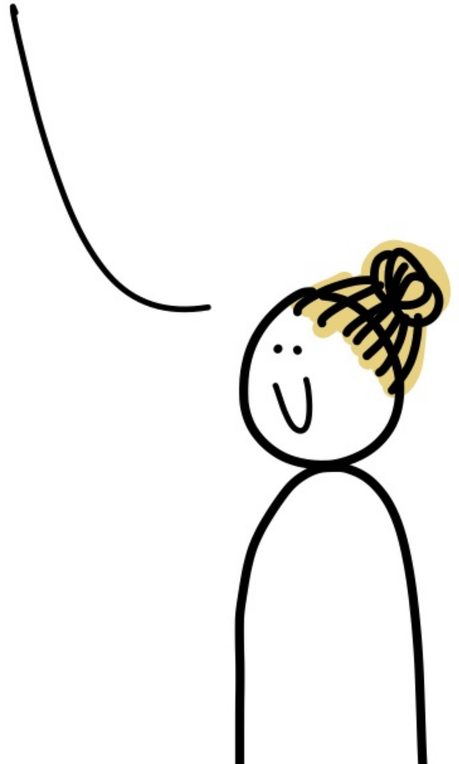




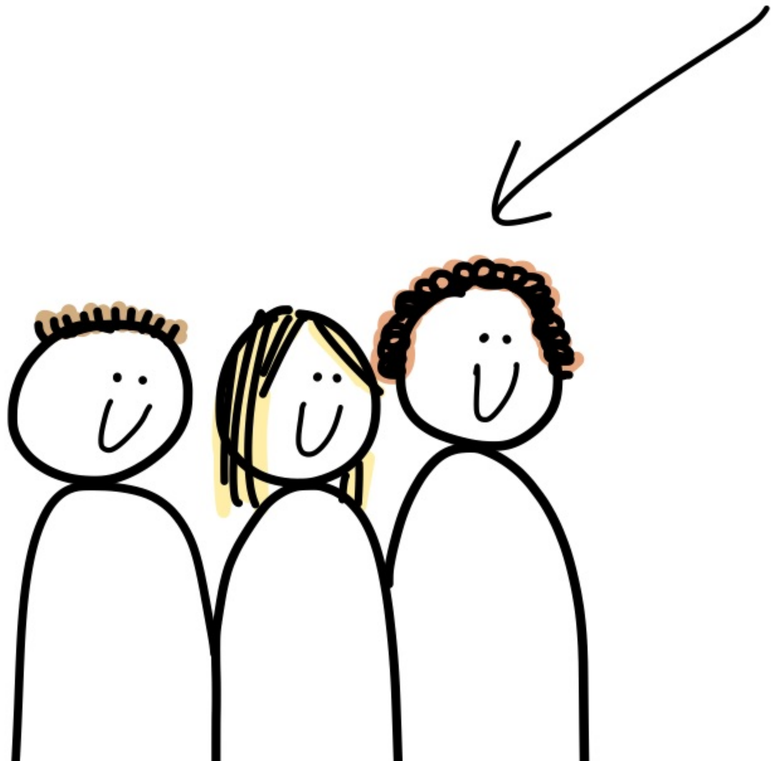


Who has ever made clothes?

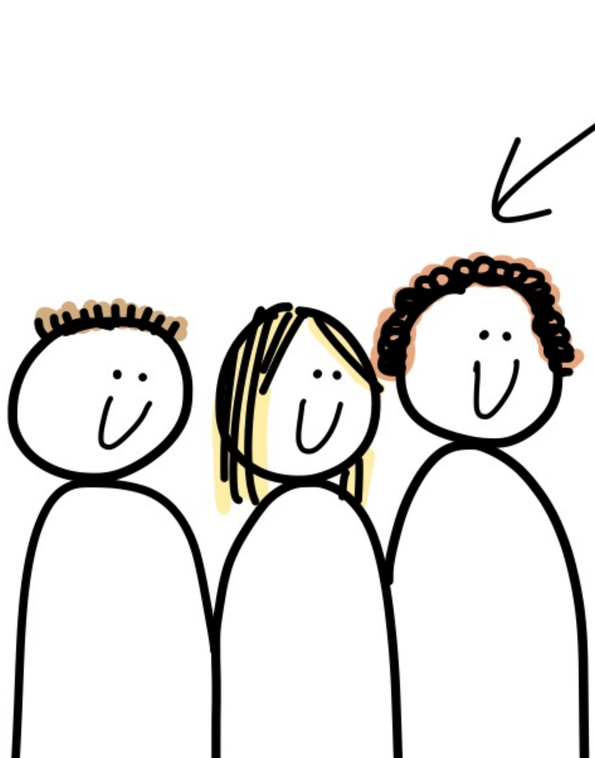




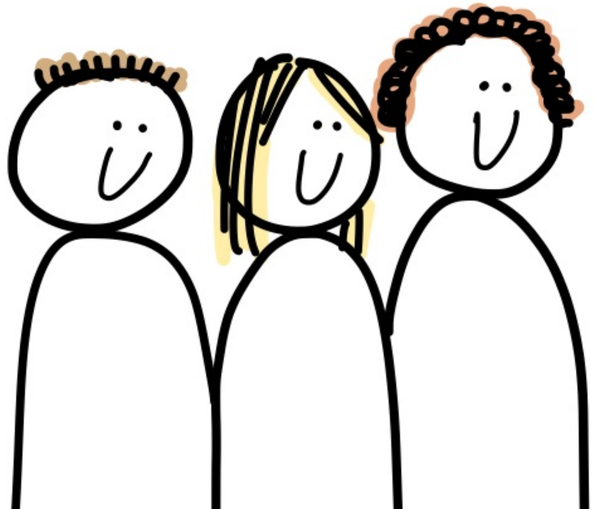
Never made clothes



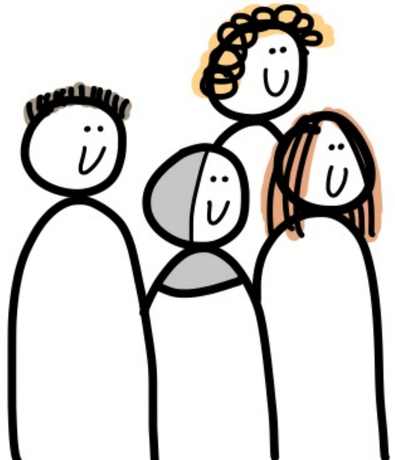
Never even considered making clothes



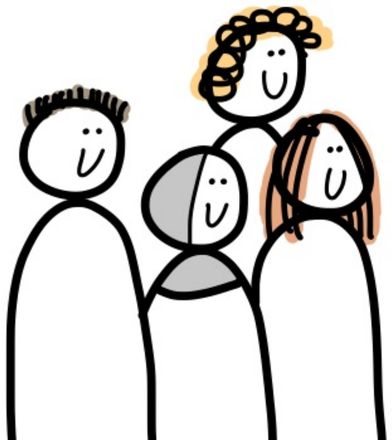
Don't know what making clothes means



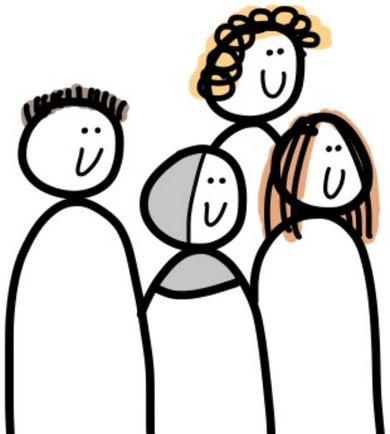
Don't know what programming is



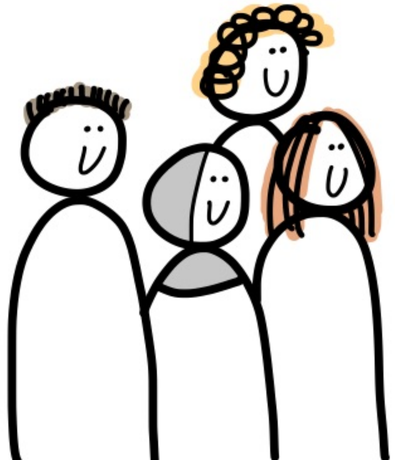
Know what programming is



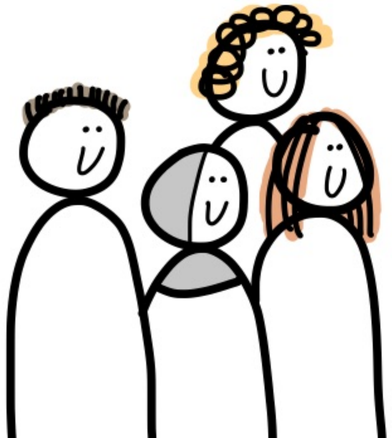
Know programming



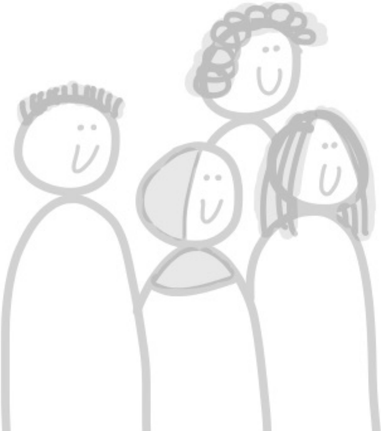
Don't know what programming is



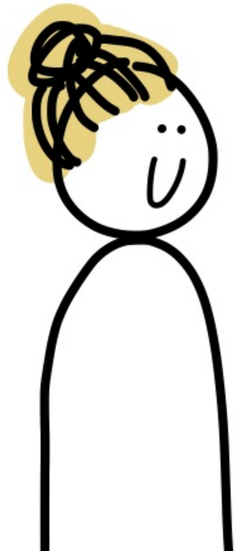
Know what programming is

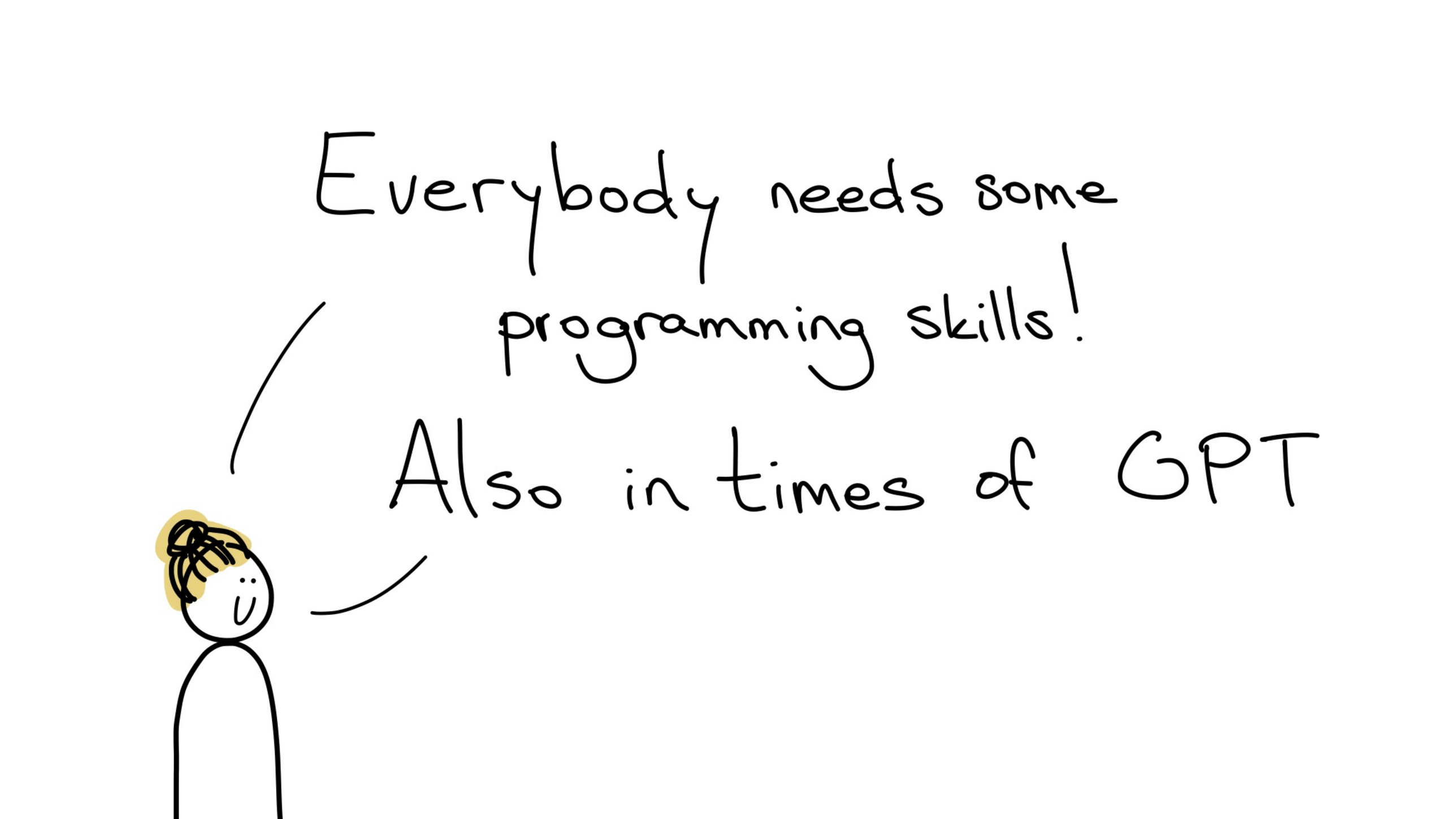


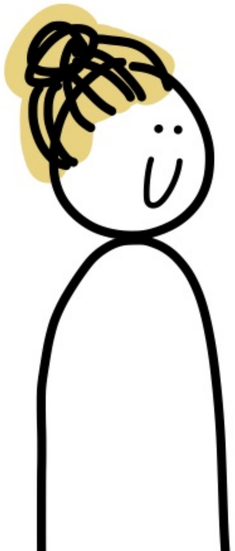
Know programming



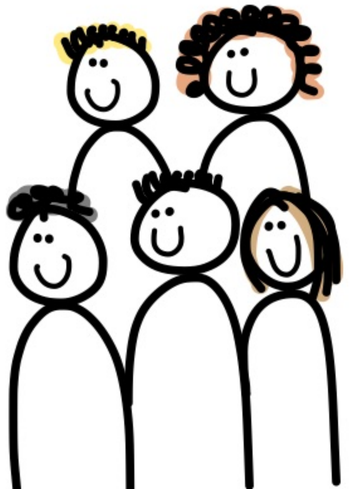
Everybody needs some programming skills!



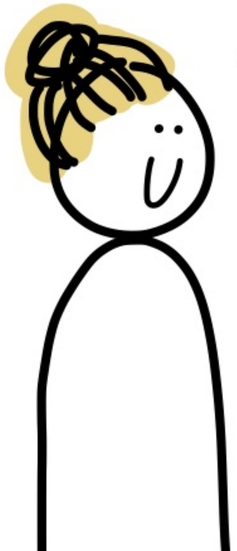

Everybody needs some programming skills!
Also in times of GPT



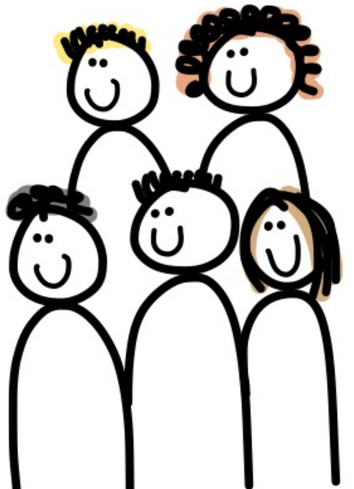
2013

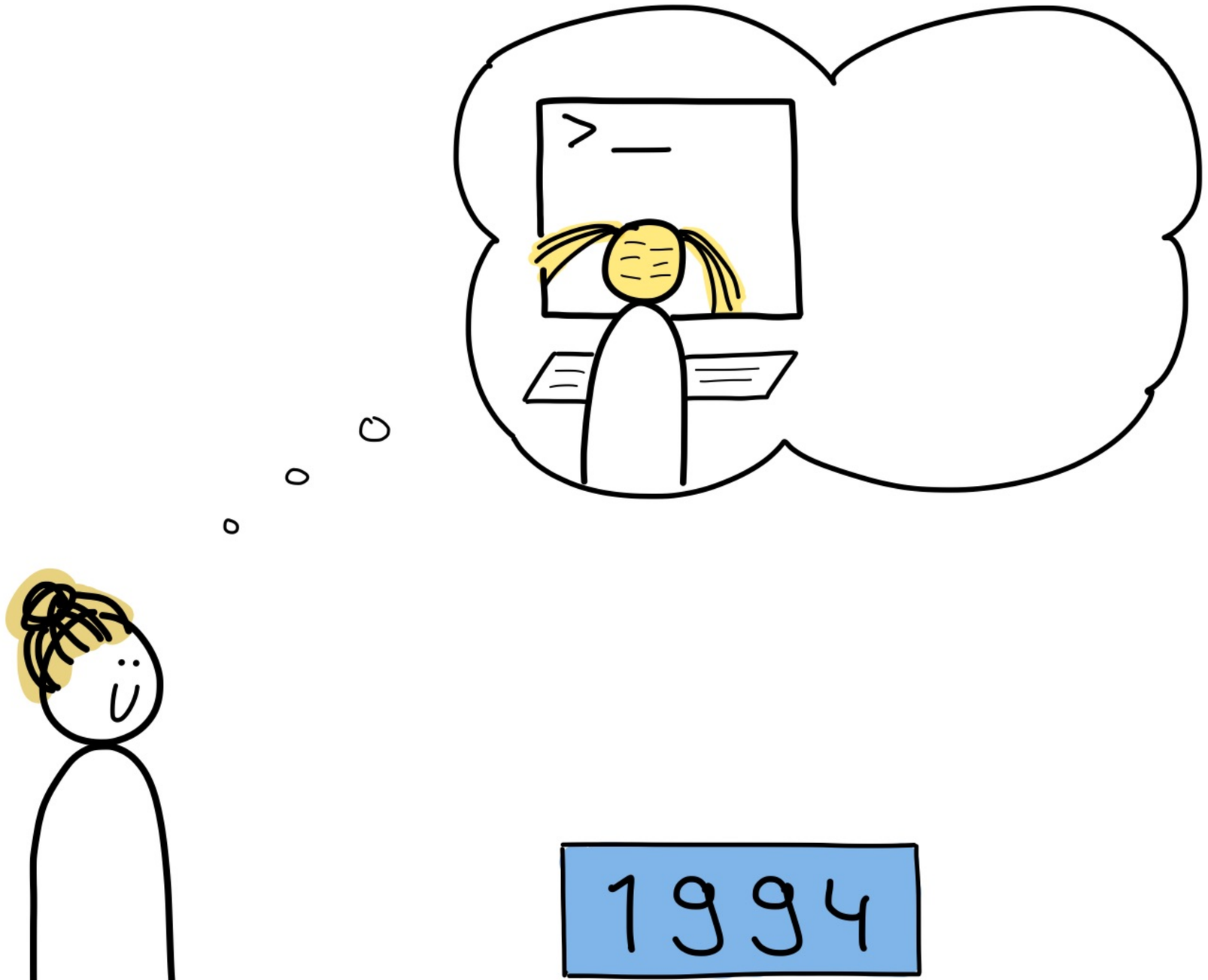


This is going to be great!



2013




1994

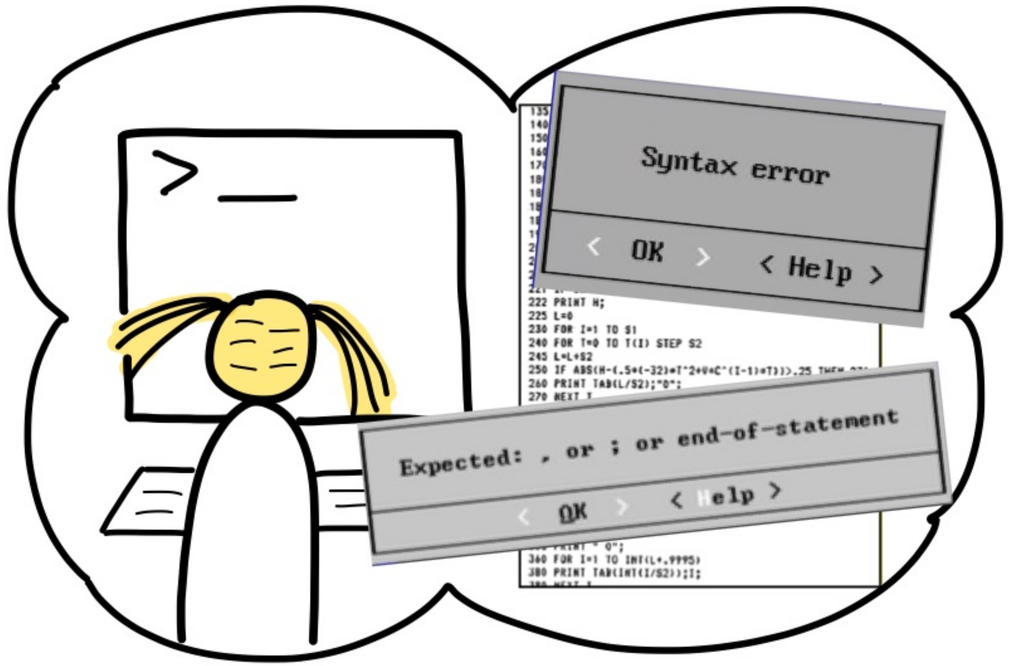


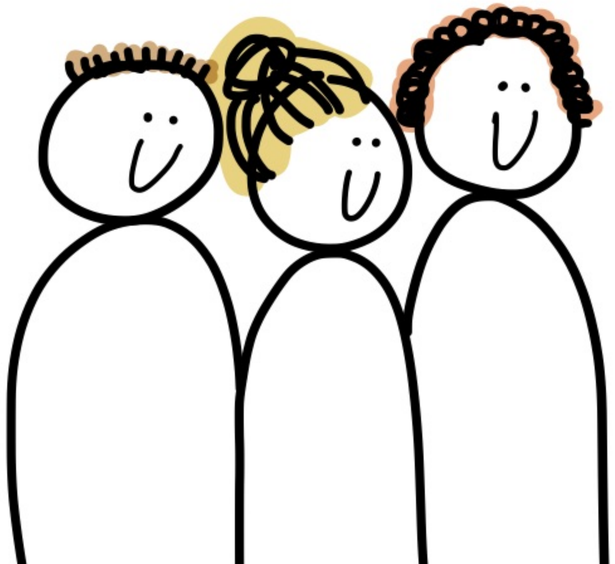

>_
BASIC
MICROCOMPUTER EDITION
COMPUTER
GAMES
101 Great Games to Play on Your Home Computer.
By yourself or with others. Each complete with
programming and sample run. Edited by David H. Ahl


>_
135 INPUT "TIME INCREMENT (SEC)";S2
140 PRINT
150 INPUT "VELOCITY (FPS)";V
160 PRINT
170 INPUT "COEFFICIENT";C
180 PRINT
182 PRINT "FEET"
184 PRINT
186 S1=INT(70/(V/(16*S2)))
190 FOR I=1 TO S1
200 T(I)=V*C^(I-1)/16
210 NEXT I
220 FOR H=INT(-16*(V/32)^2+V^2/32+.5) TO 0 STEP -.5
221 IF INT(H)<>H THEN 225
222 PRINT H;
225 L=0
230 FOR I=1 TO S1
240 FOR T=0 TO T(I) STEP S2
245 L=L+S2
250 IF ABS(H-(.5*(-32)*T^2+V*C^(I-1)*T))<.25 THEN 270
260 PRINT TAB(L/S2);"0";
270 NEXT I
275 T=T(I+1)/2
276 IF -16*T^2+V*C^(I-1)*T<H THEN 290
280 NEXT I
290 PRINT
300 NEXT H
310 PRINT TAB(1);
320 FOR I=1 TO INT(L+1)/S2+1
330 PRINT ".";
340 NEXT I
350 PRINT
355 PRINT " 0";
360 FOR I=1 TO INT(L+.9999)
380 PRINT TAB(INT(I/S2));I;


Syntax error
< OK >
< Help >
222 PRINT H;
225 L=0
230 FOR I=1 TO S1
240 FOR T=0 TO T(I) STEP S2
245 L=L+S2
250 IF ABS(H-(.5*(-32)*T^2+V*C*(I-1)*T)).25 THEN 270
260 PRINT TAB(L/S2);"0";
270 NEXT I
275 T=T(I+1)/2
276 IF -16*T^2+V*C*(I-1)*T<H THEN 290
280 NEXT I
290 PRINT
300 NEXT H
310 PRINT TAB(1);
320 FOR I=1 TO INT(L+1)/S2+1
330 PRINT ".";
340 NEXT I
350 PRINT
355 PRINT " 0";
360 FOR I=1 TO INT(L+.9999)
380 PRINT TAB(INT(I/S2));I;

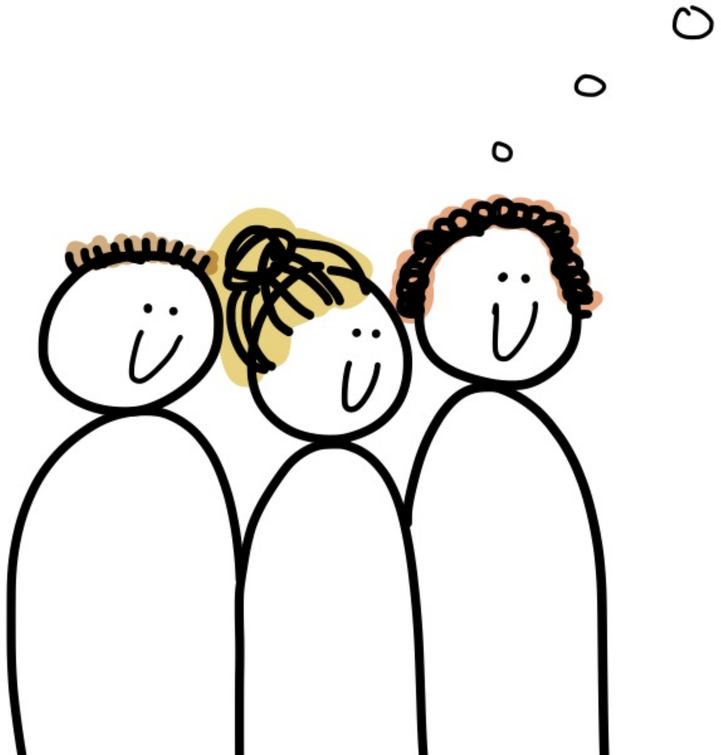

>_
Syntax error
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Expected: , or ; or end-of-statement
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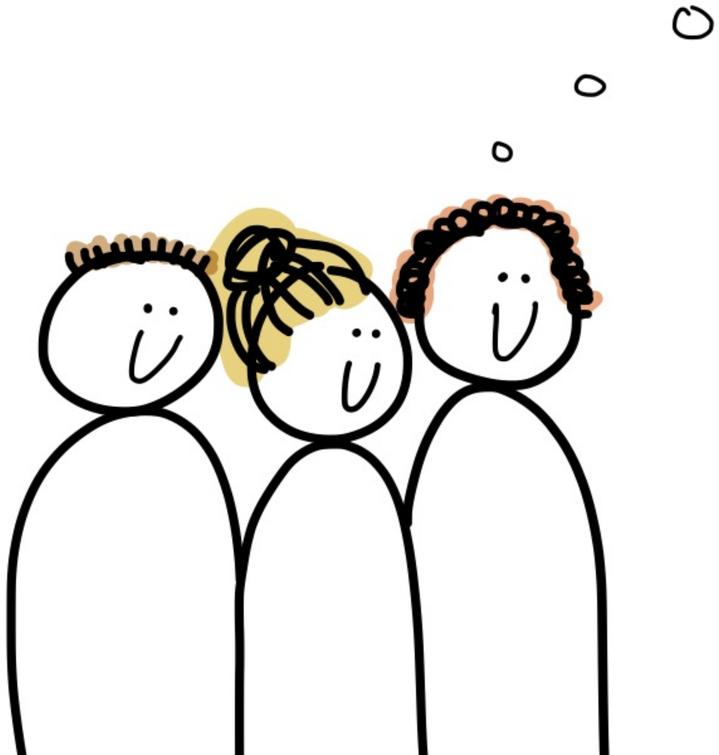

Syntax error
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Expected: , or ; or end-of-statement
< OK > < Help >



You

show me a hacker before they started learning anything



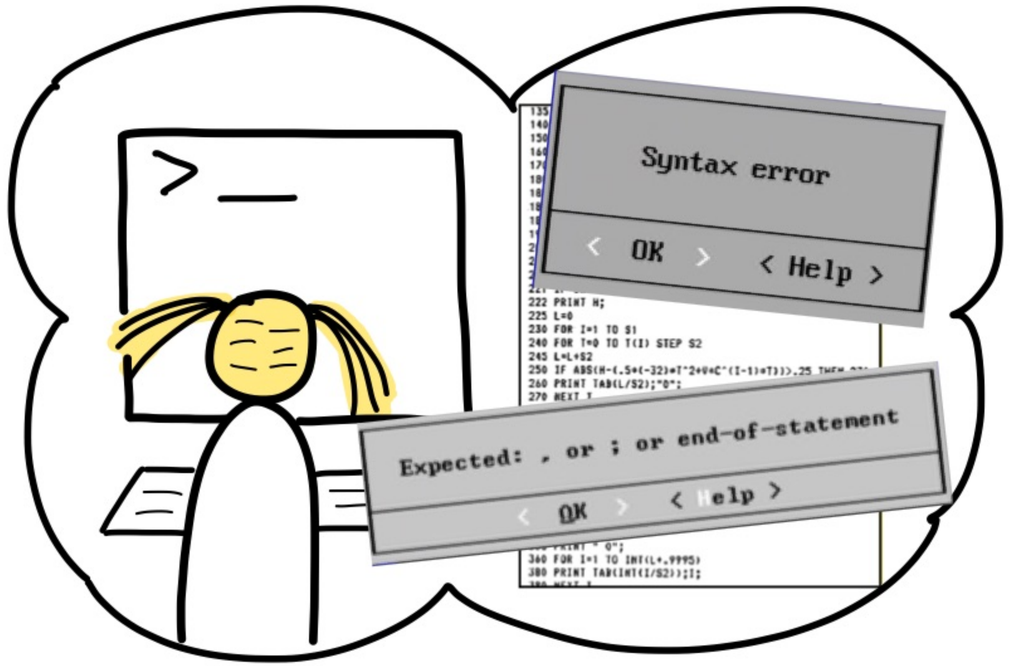


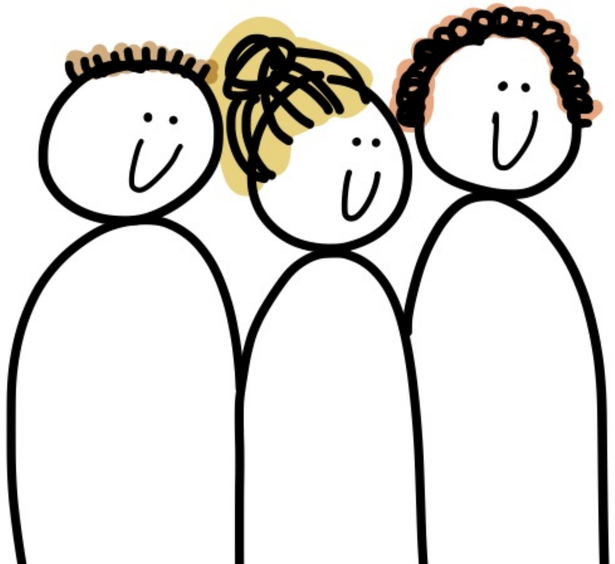
You

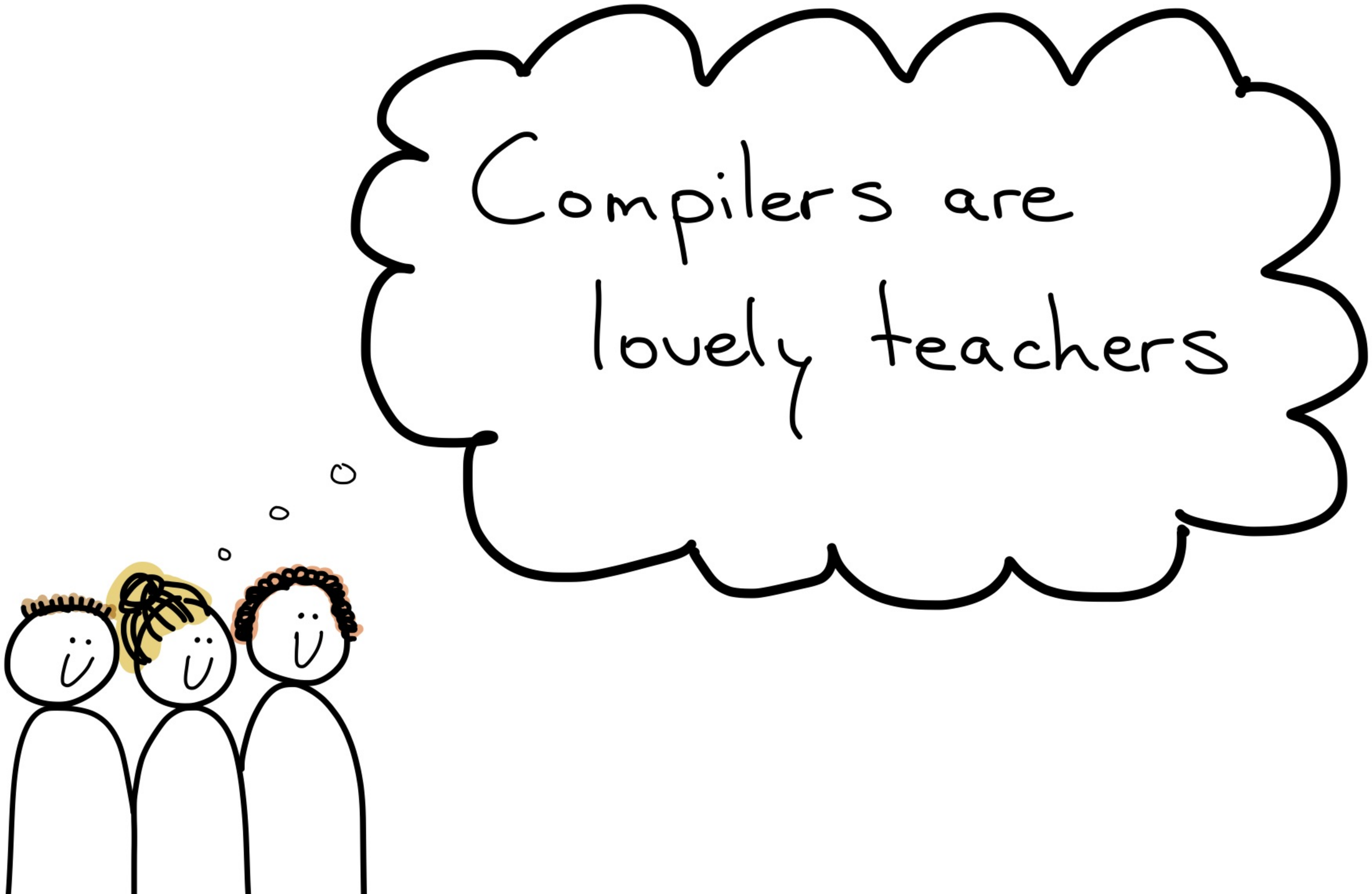
show me a hacker before they started learning anything

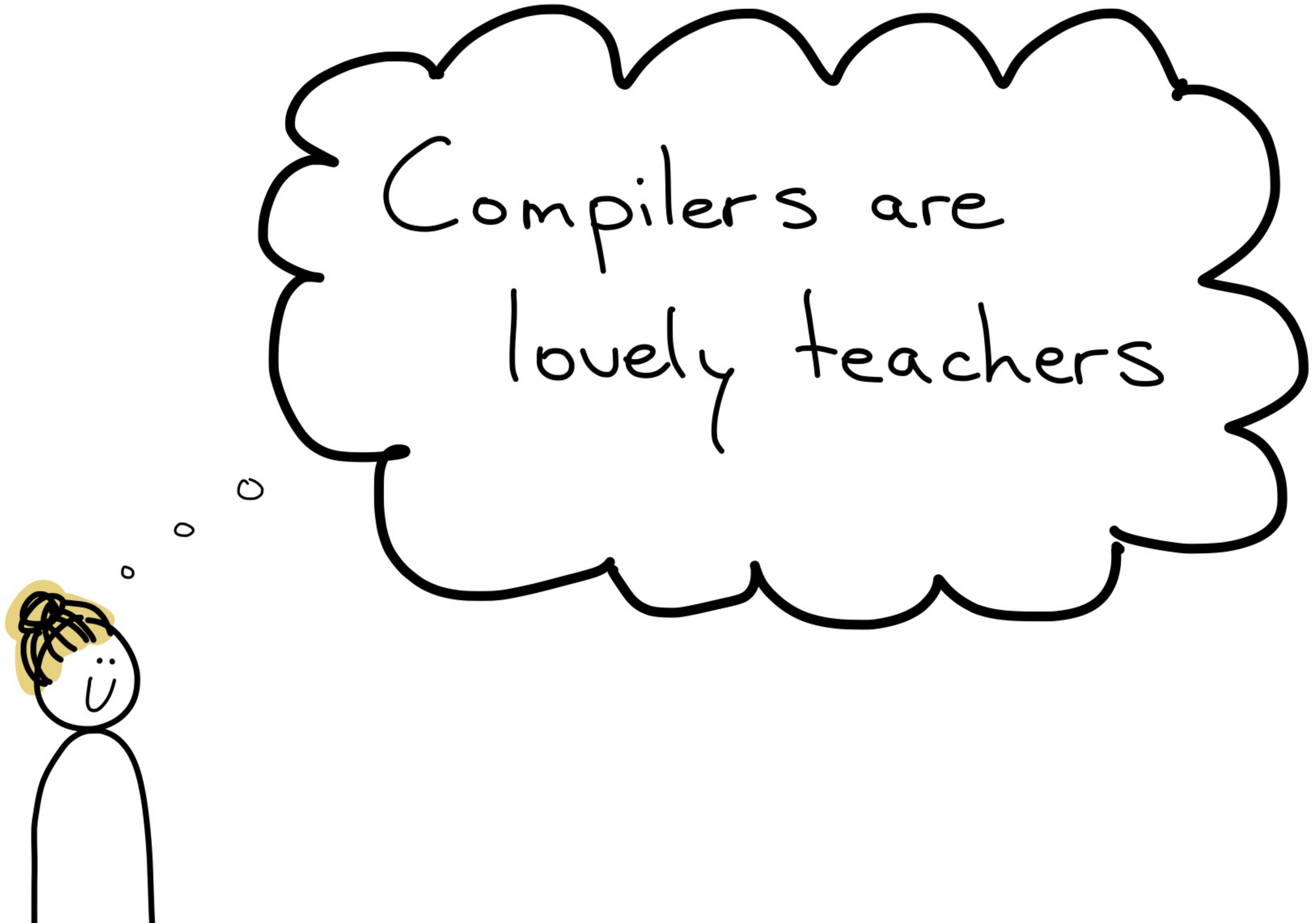
ChatGPT

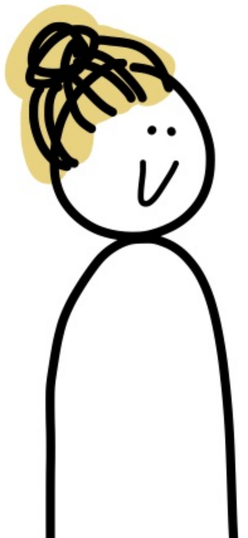


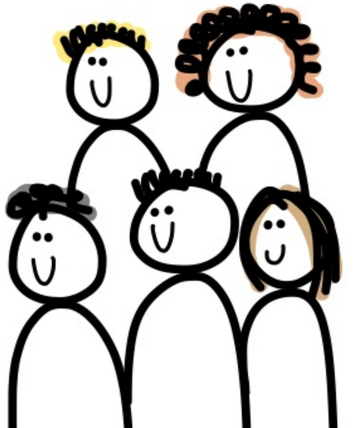

Syntax error
< OK > < Help >
Expected: , or ; or end-of-statement
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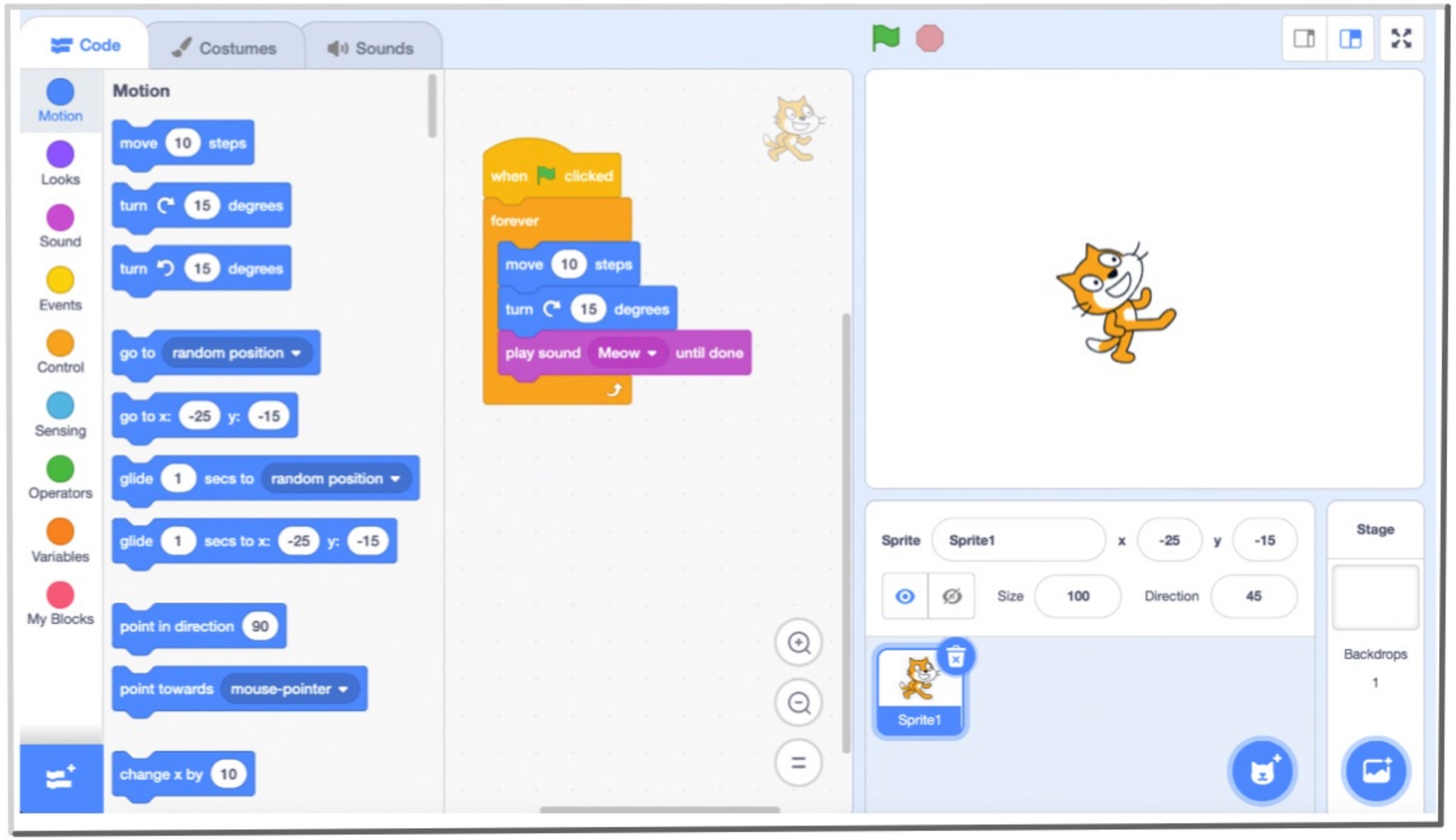


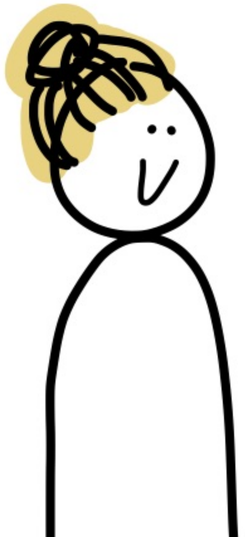

Compilers are
lovely teachers

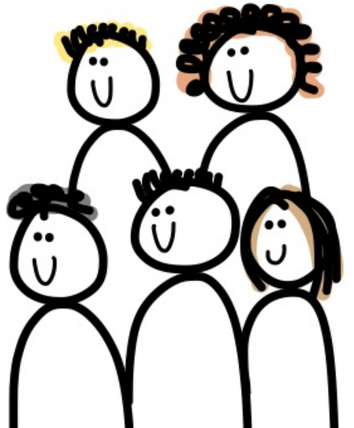

Compilers are
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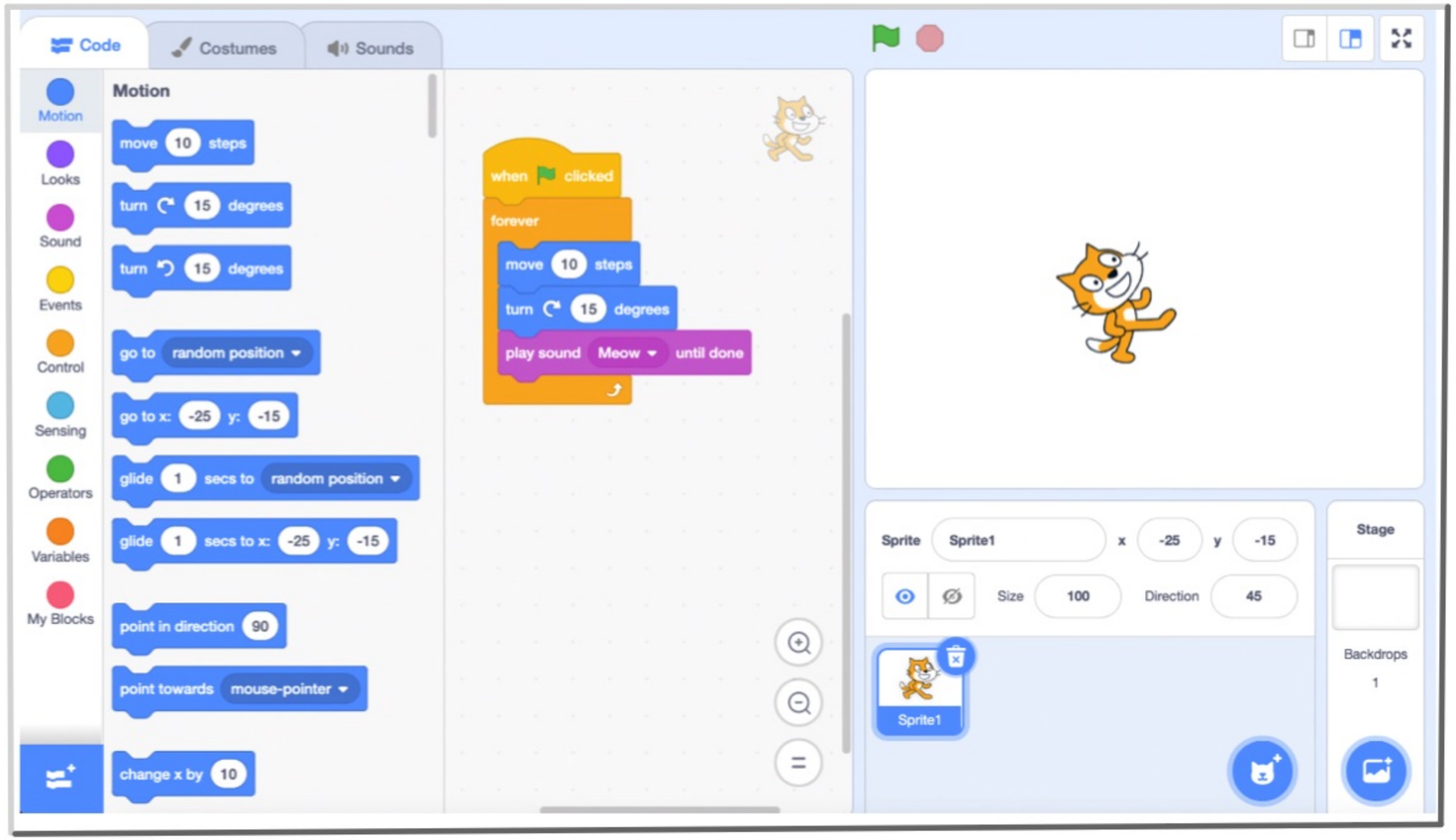


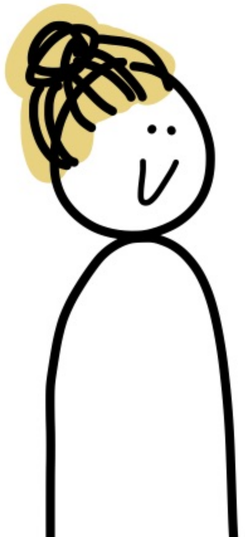



Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
go to random position
go to x: -25 y: -15
glide 1 secs to random position
glide 1 secs to x: -25 y: -15
point in direction 90
point towards mouse-pointer
change x by 10
when clicked
forever
move 10 steps
turn 15 degrees
play sound Meow until done
Sprite Sprite1 x -25 y -15
Size 100 Direction 45
Sprite1
Stage
Backdrops 1

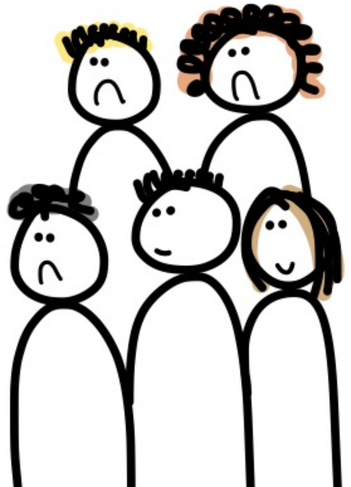




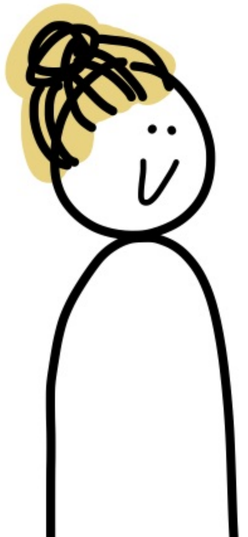




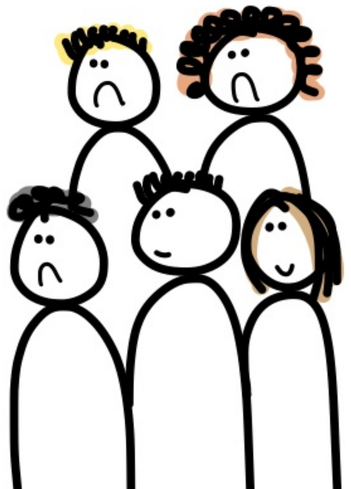
This is for kids

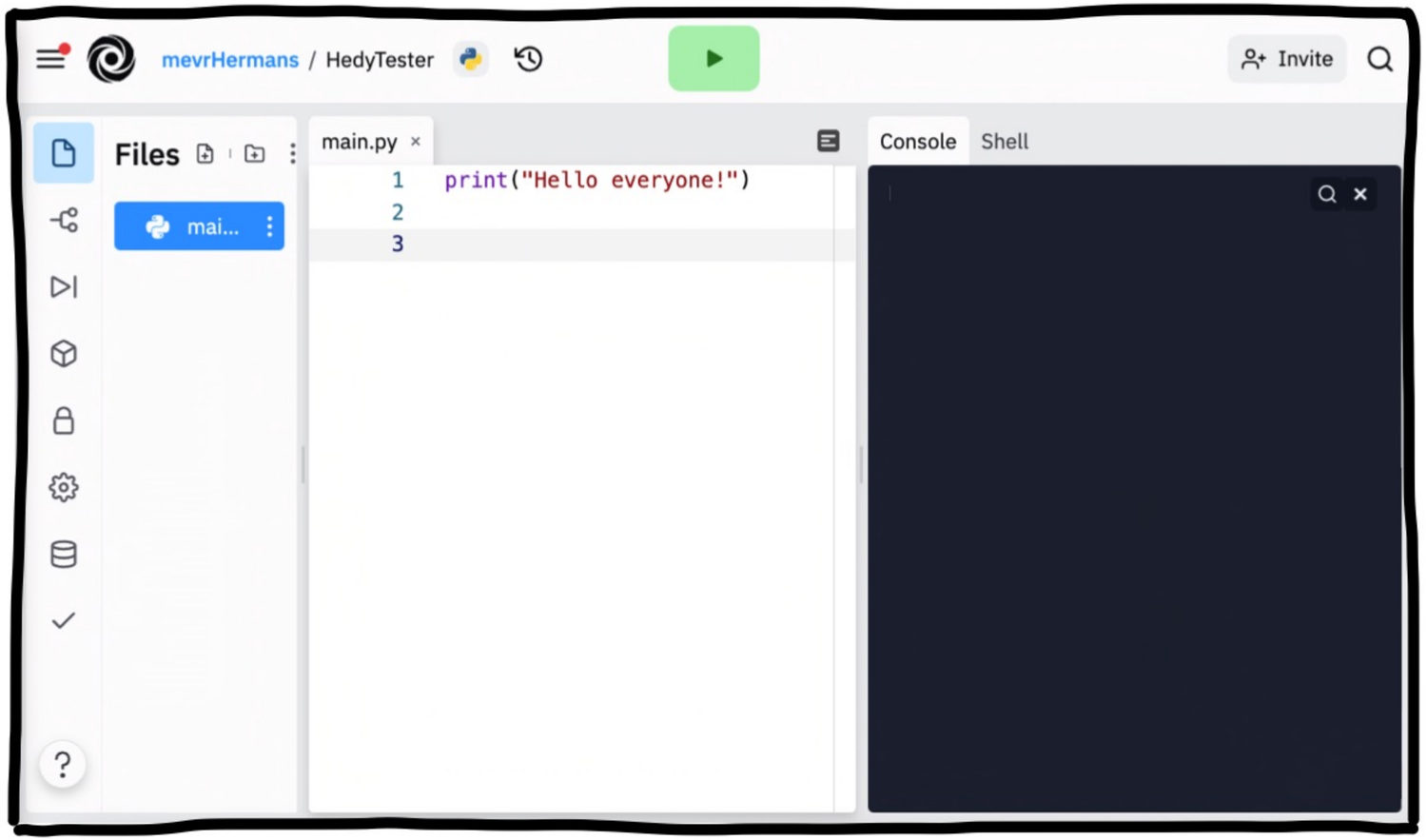


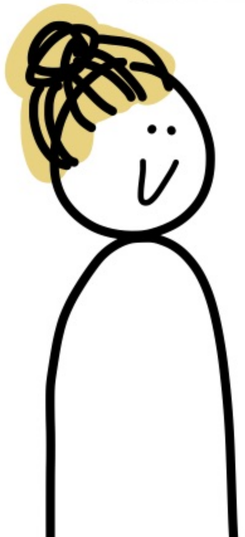
Let's do Python!

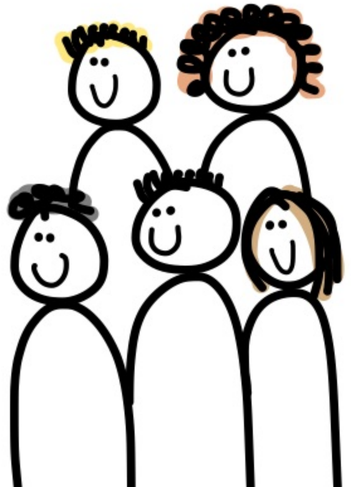


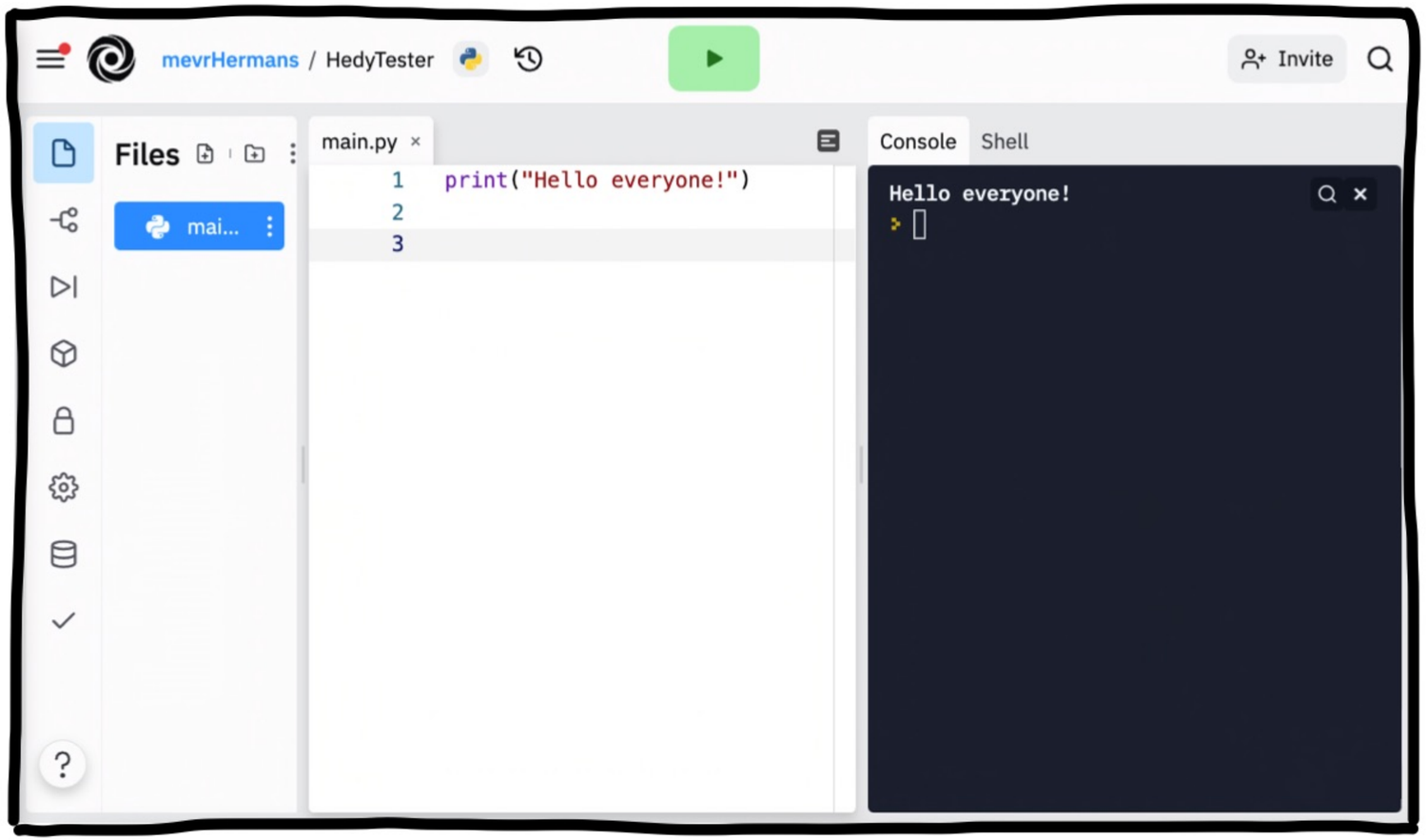
This is for kids

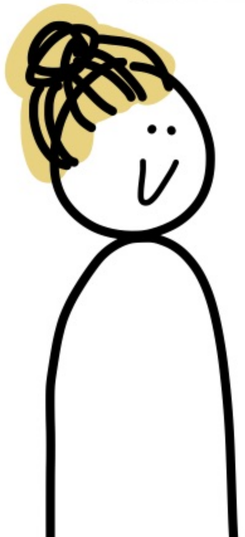


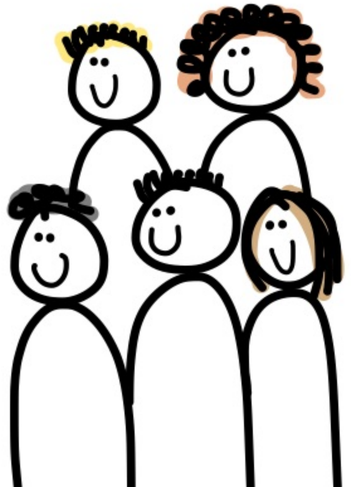

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!")
2
3
Console
Shell

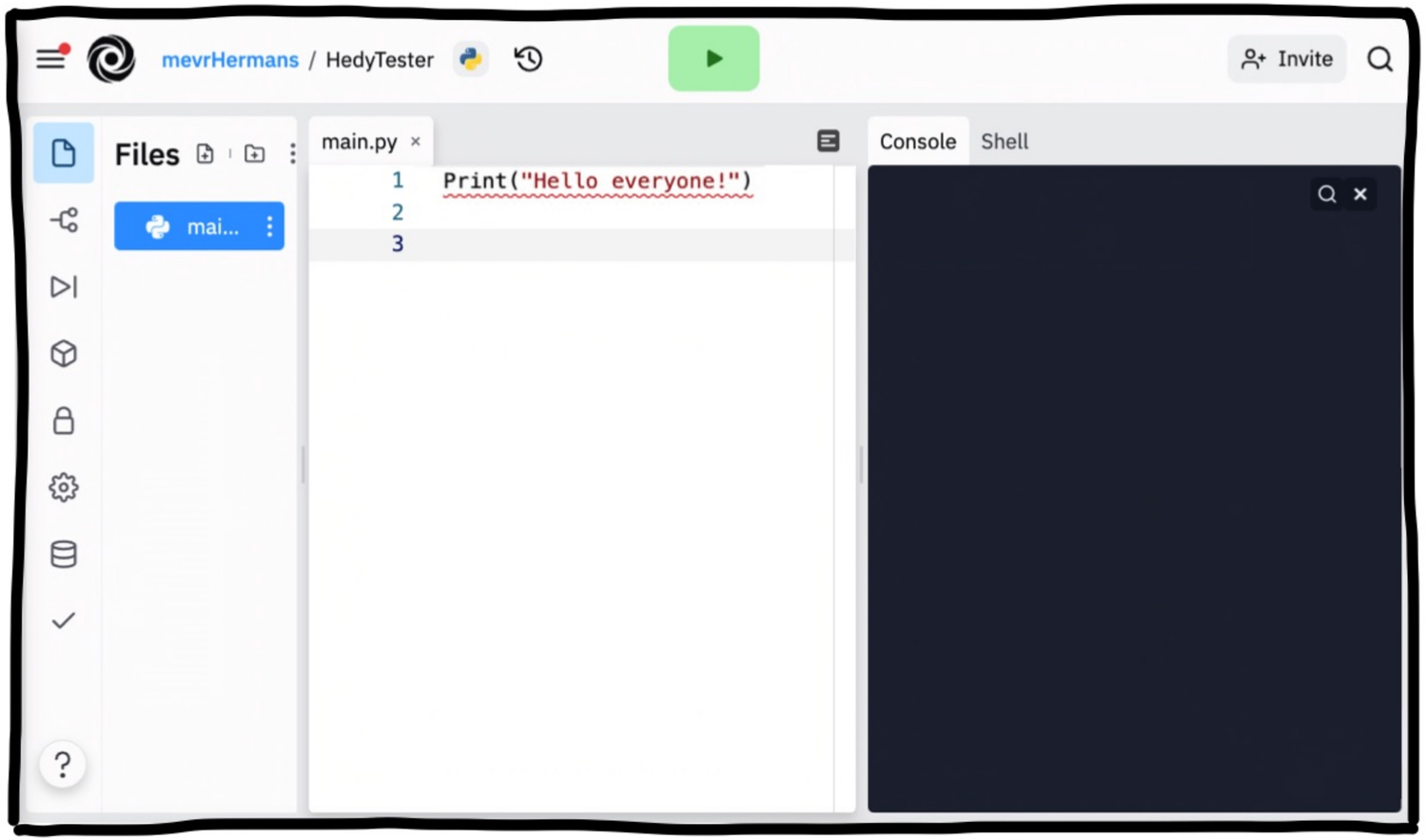


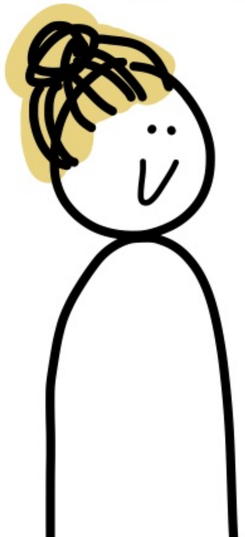


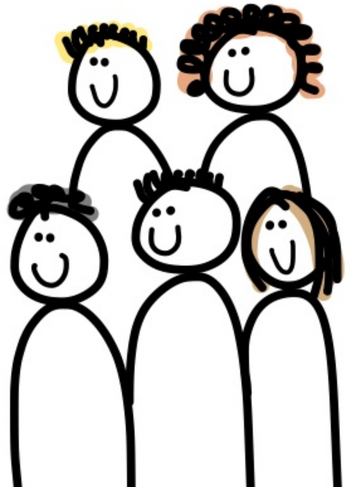

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!")
2
3
Console
Shell
Hello everyone!

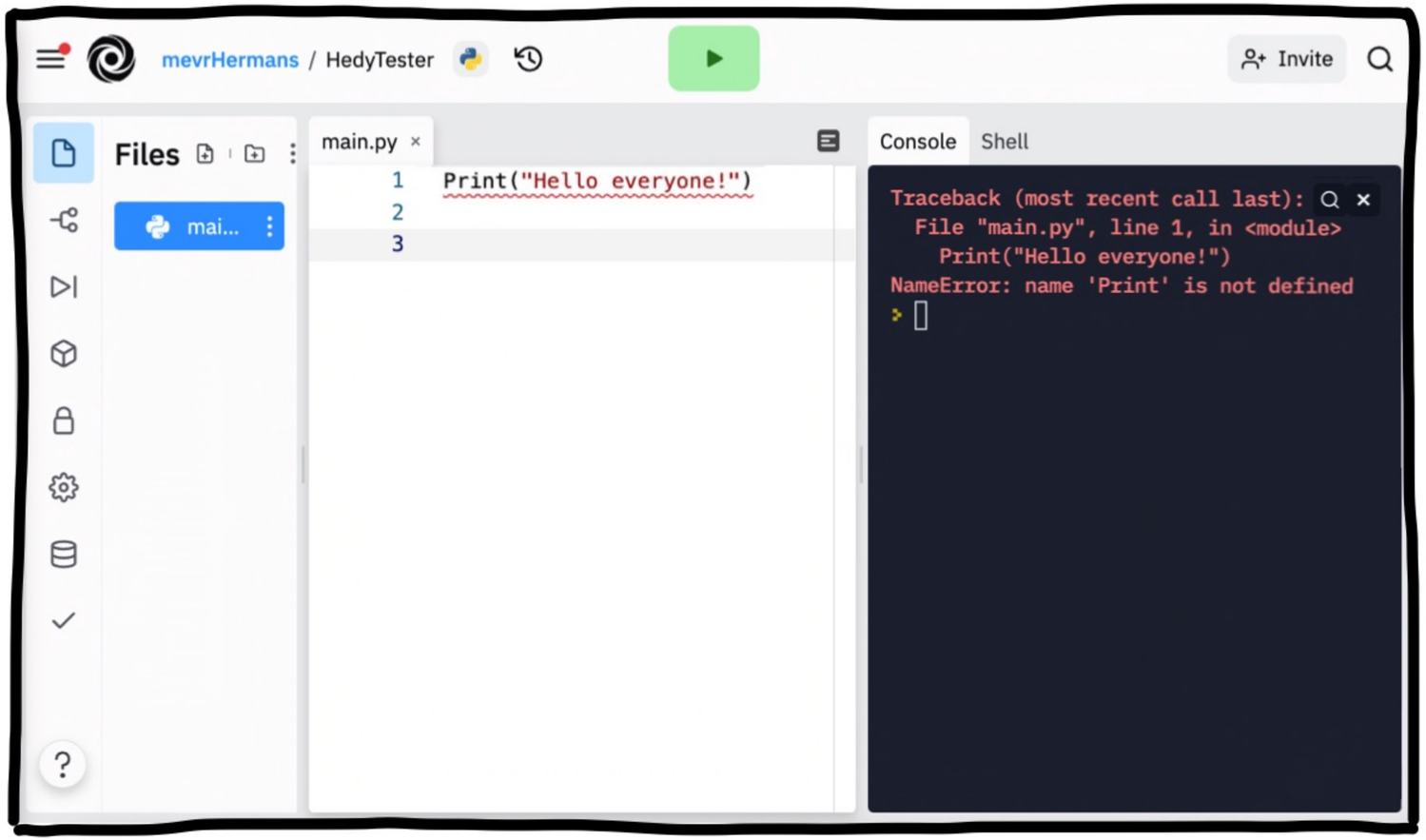


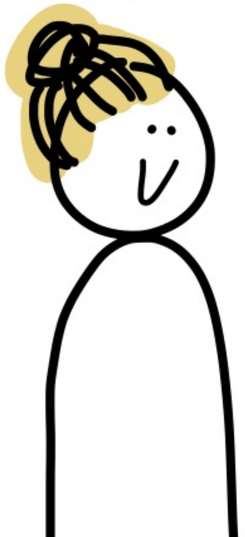


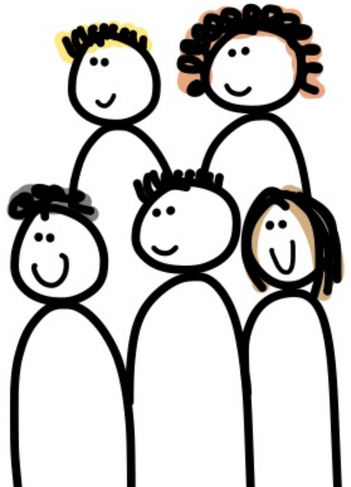

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 Print("Hello everyone!")
2
3
Console
Shell

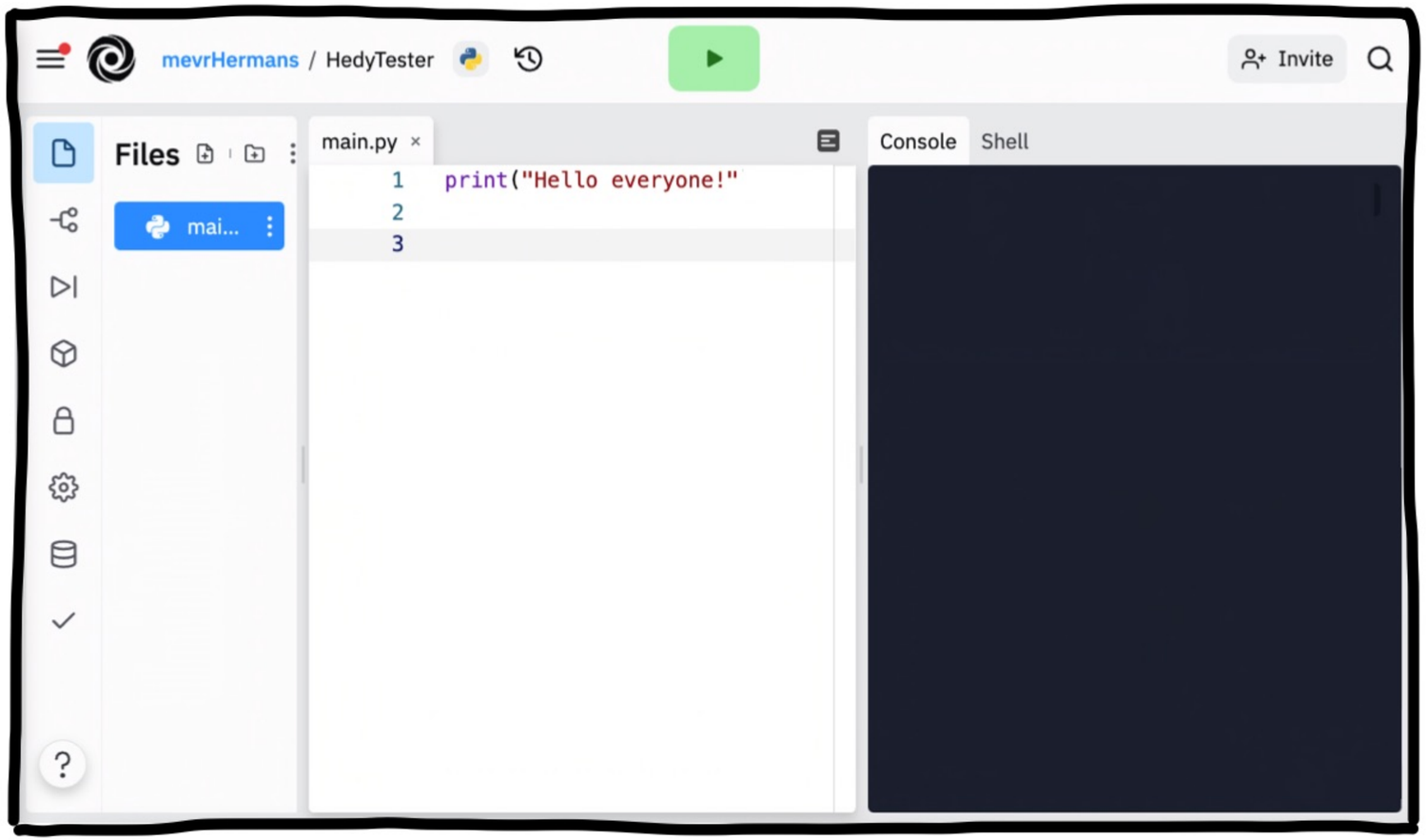


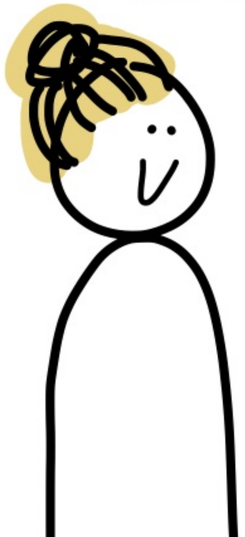


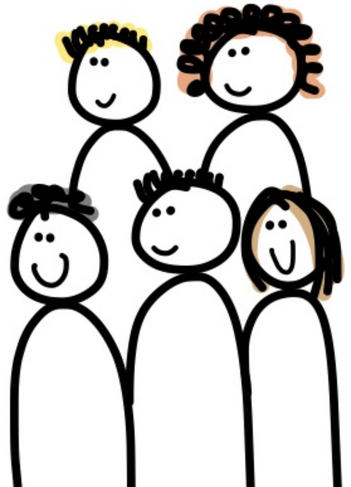

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 Print("Hello everyone!")
2
3
Console
Shell
Traceback (most recent call last):
File "main.py", line 1, in <module>
Print("Hello everyone!")
NameError: name 'Print' is not defined

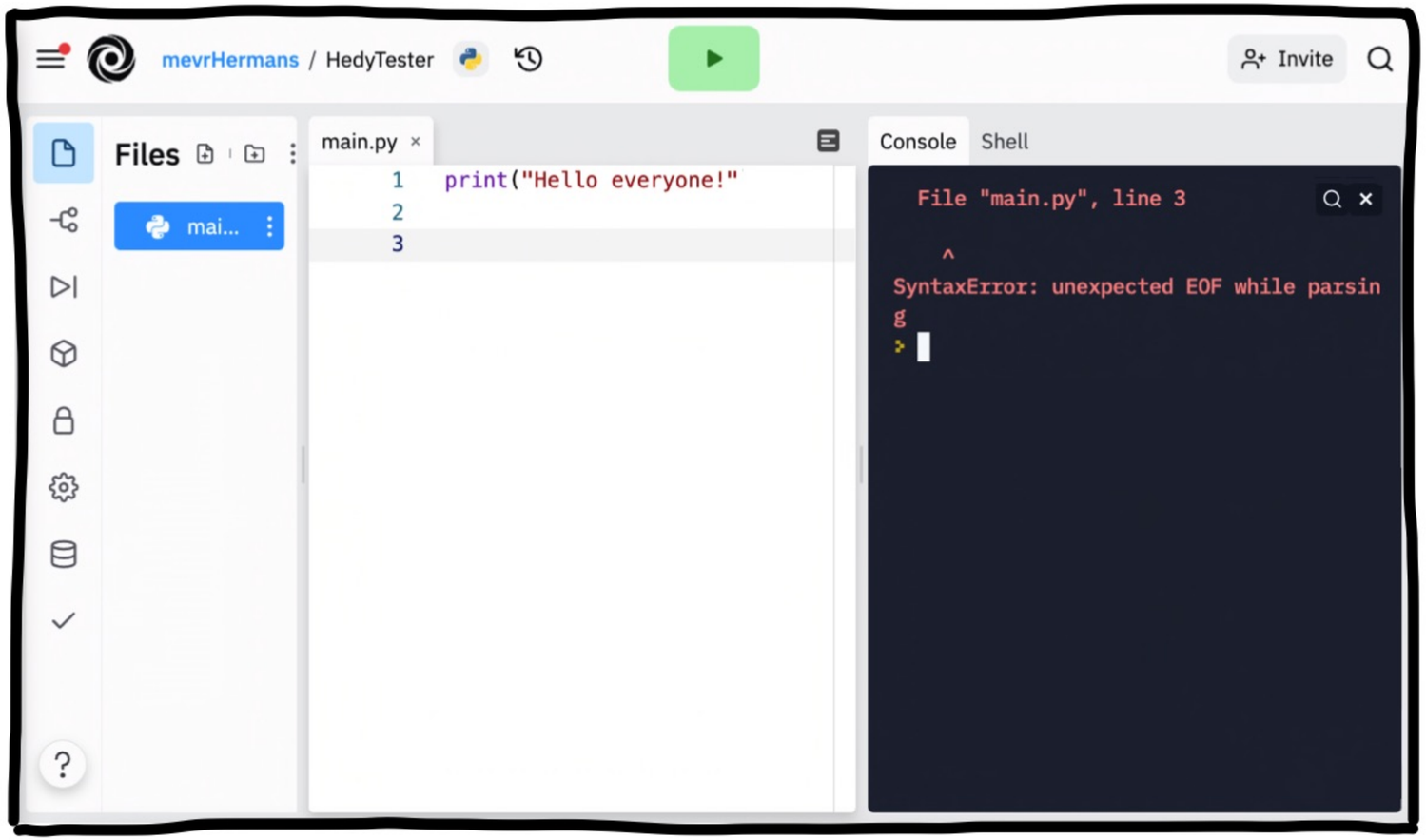


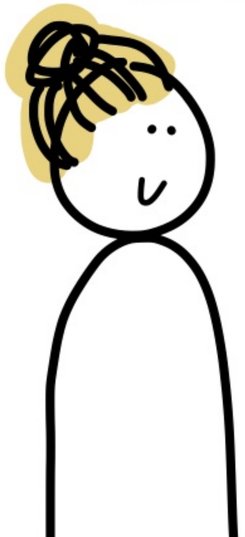


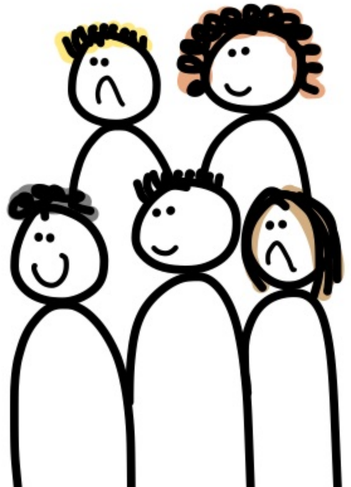

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!"
2
3
Console
Shell

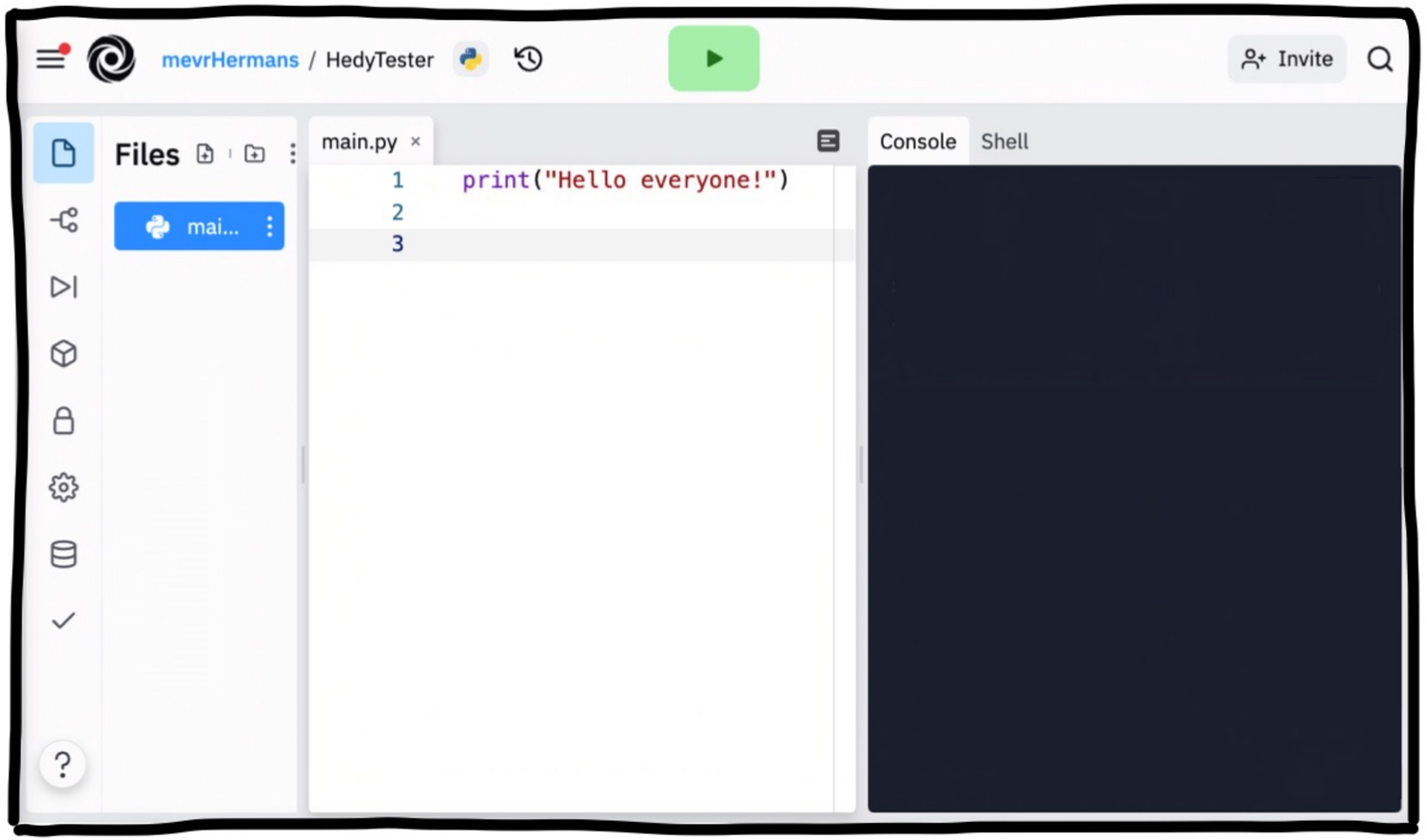


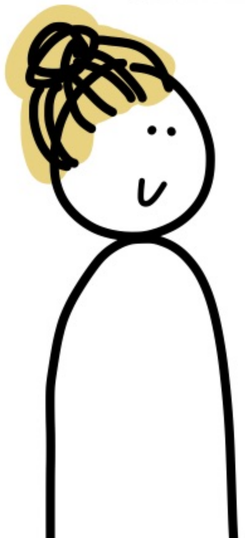


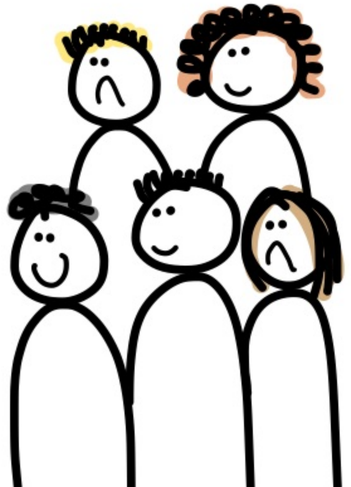

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!"
2
3
Console
Shell
File "main.py", line 3
^
SyntaxError: unexpected EOF while parsin
g

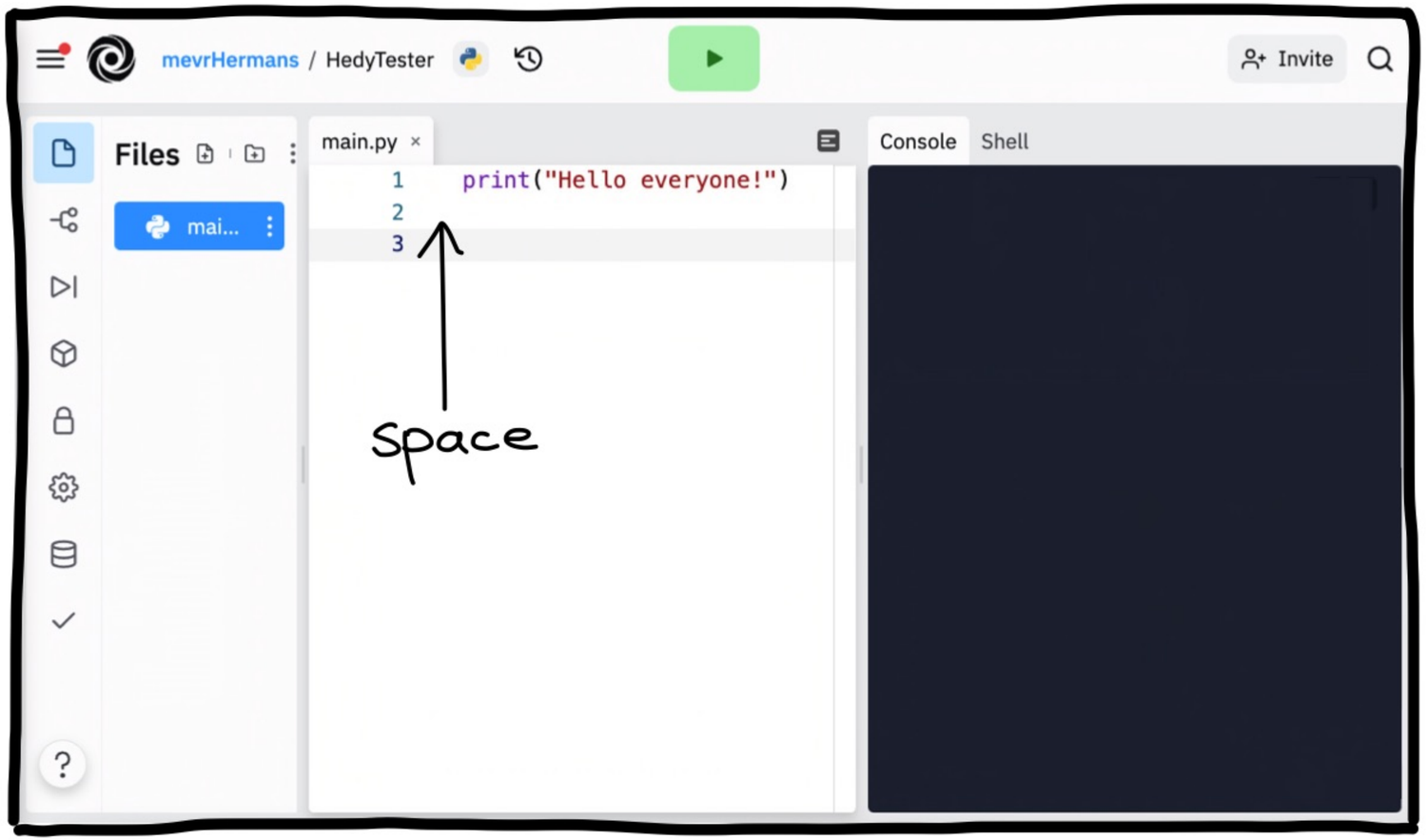




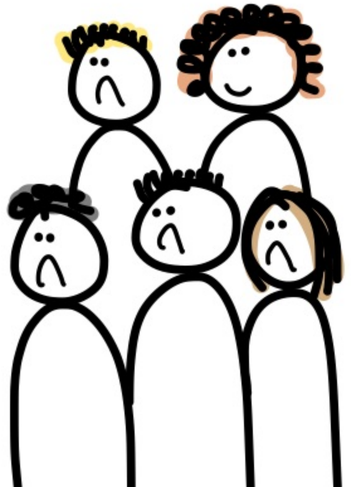

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!")
2
3
Console
Shell

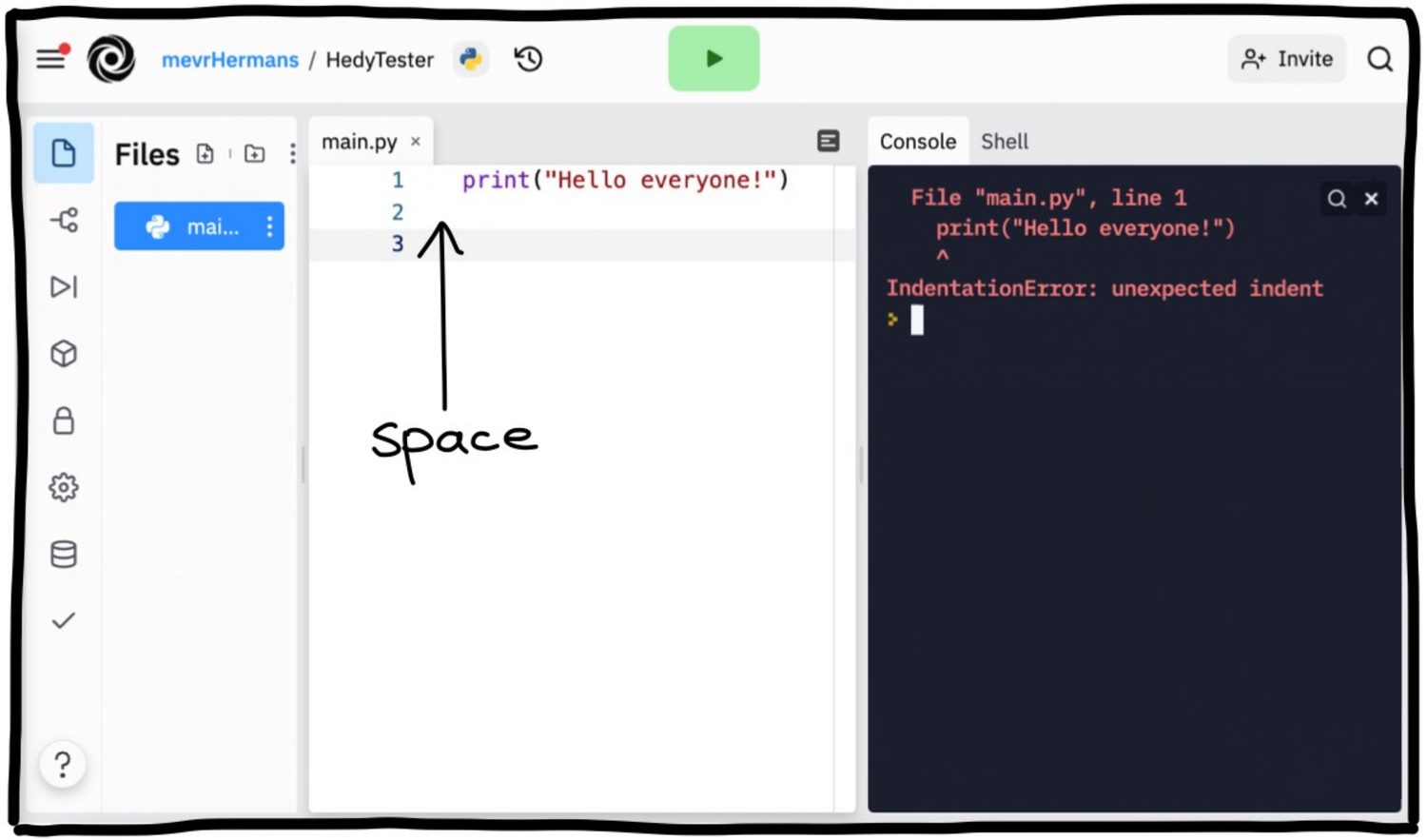




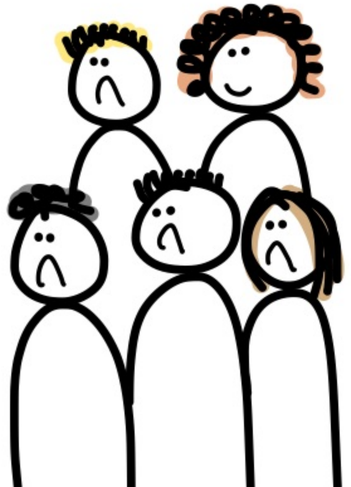

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!")
2
3
Space
Console
Shell

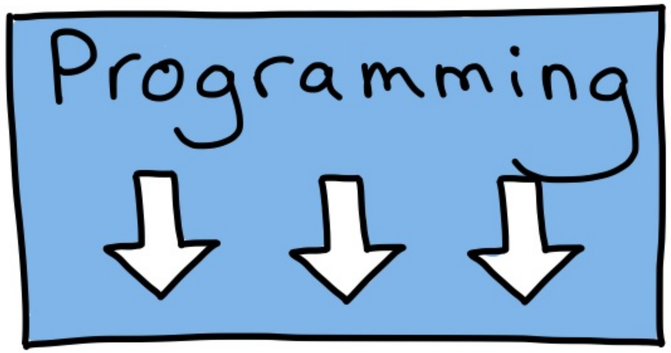


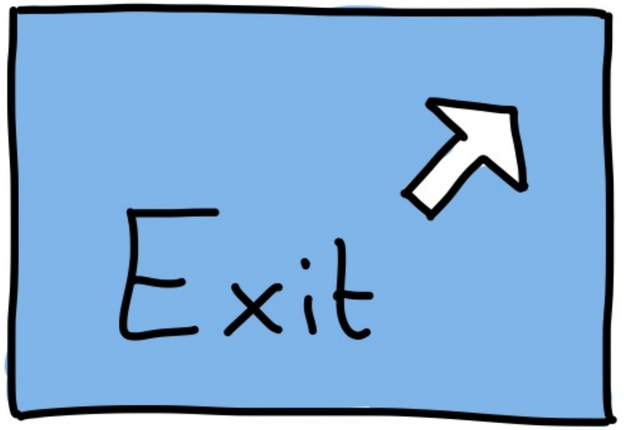


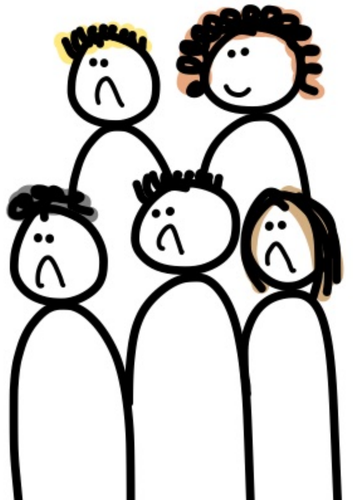

mevrHermans / HedyTester
Invite
Files
main.py
mai...
1 print("Hello everyone!")
2
3
Space
Console
Shell
File "main.py", line 1
print("Hello everyone!")
^
IndentationError: unexpected indent

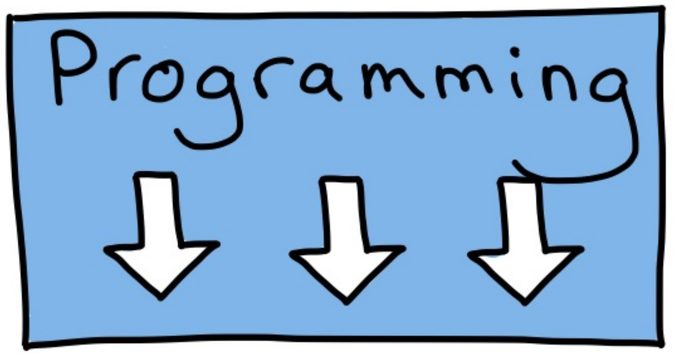


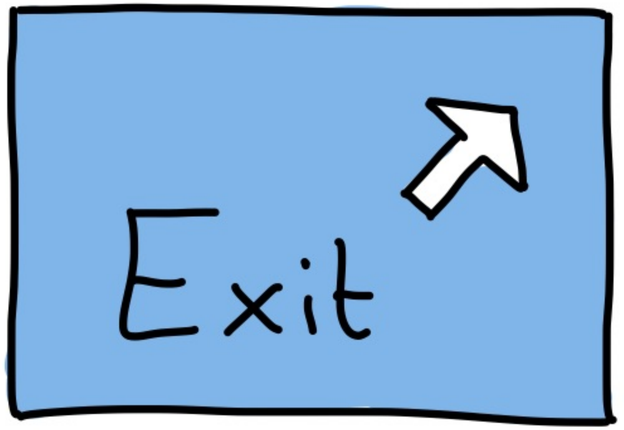


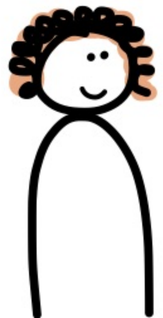

Programming

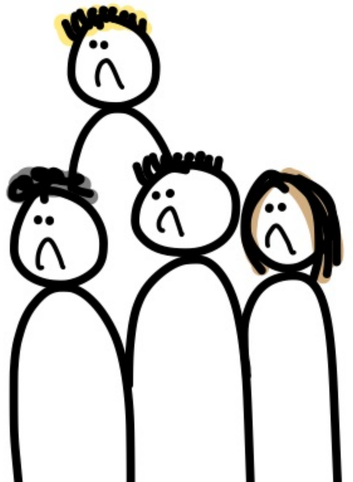

Exit

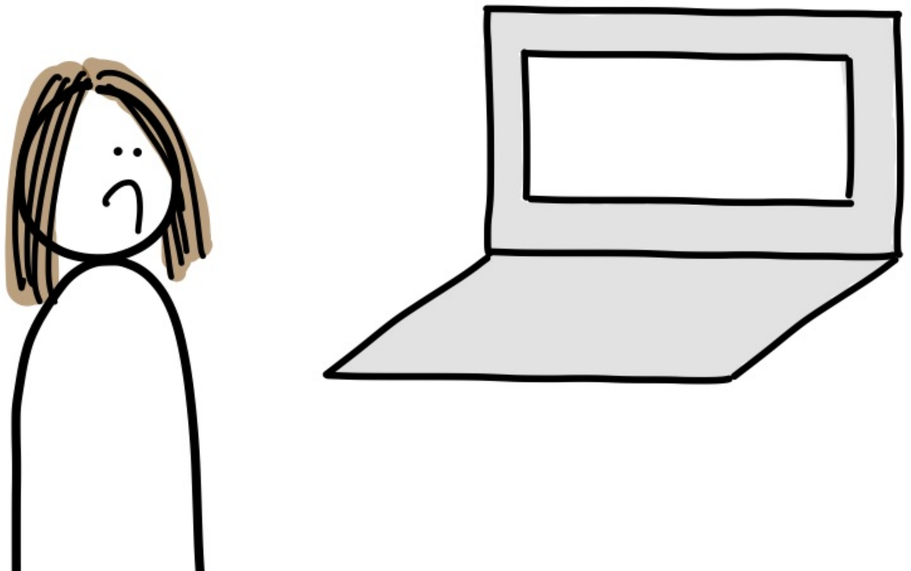


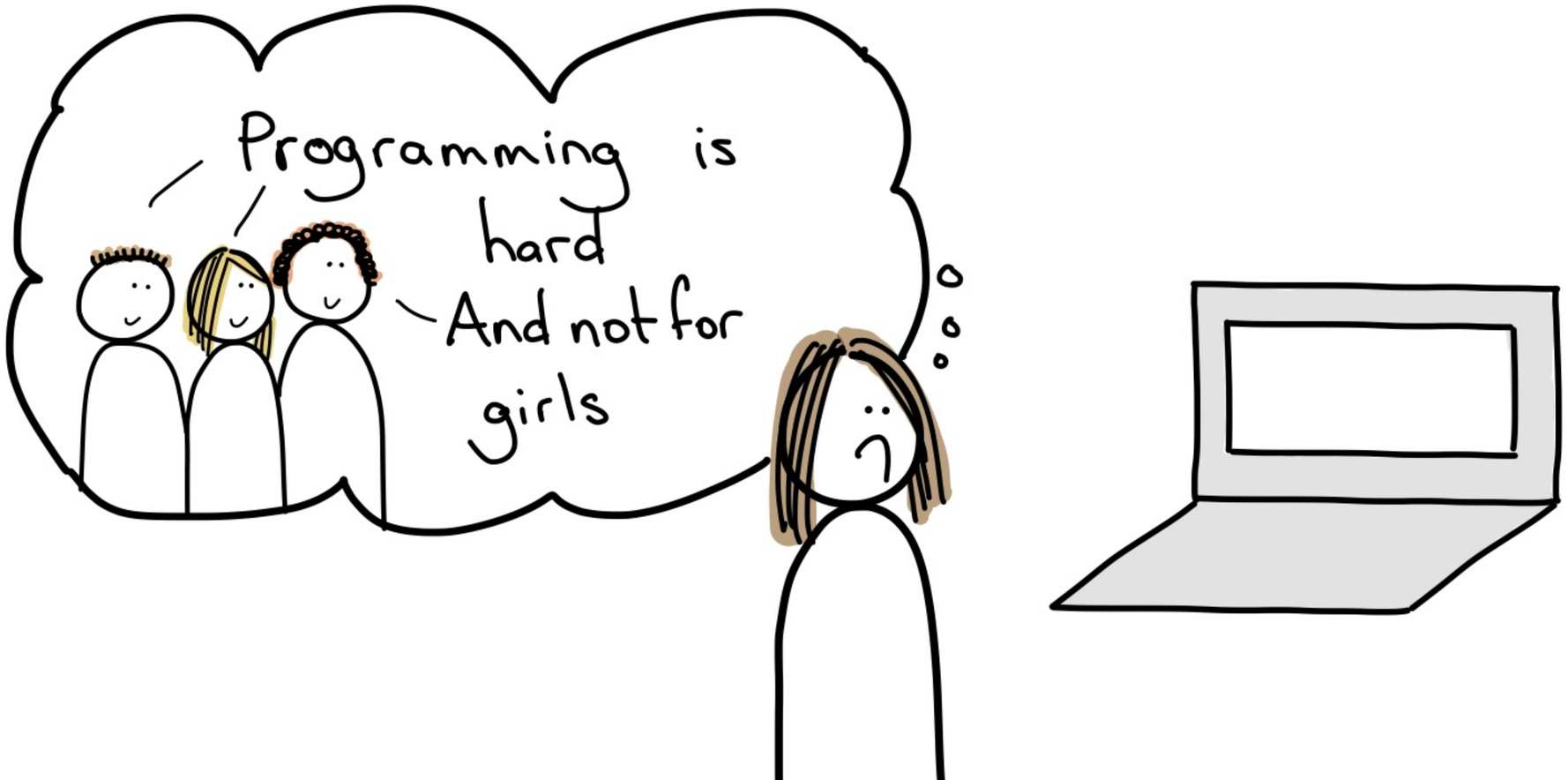

Programming

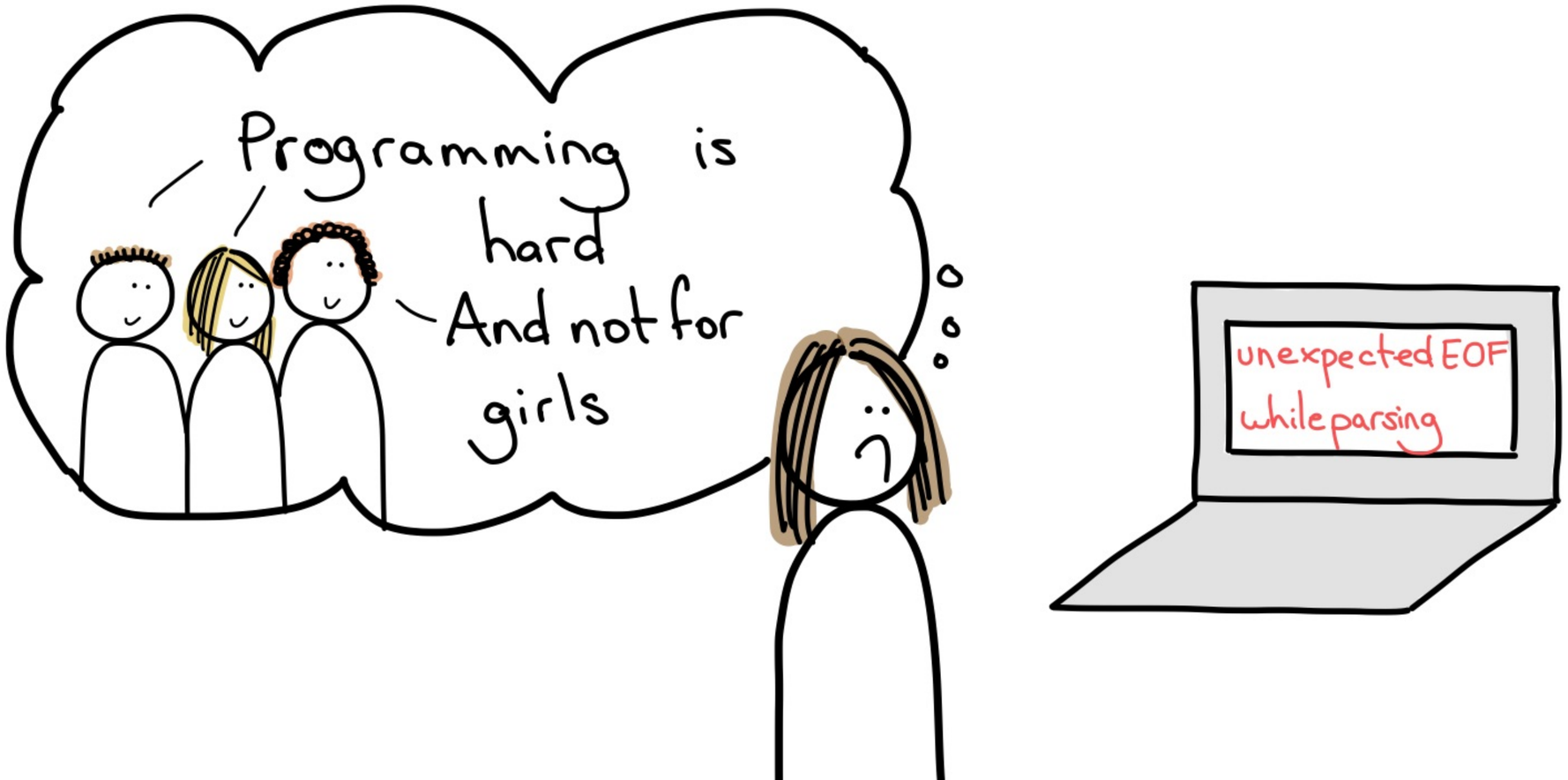

Exit








Programming is hard
And not for girls


Programming is hard
And not for girls

unexpected EOF
while parsing


They were right!
This is not for me...
Programming is hard
And not for girls
unexpected EOF
while parsing

How do people learn?



How do people learn?



How do people learn?



a i n e





cat in tree





A cat in the tree.





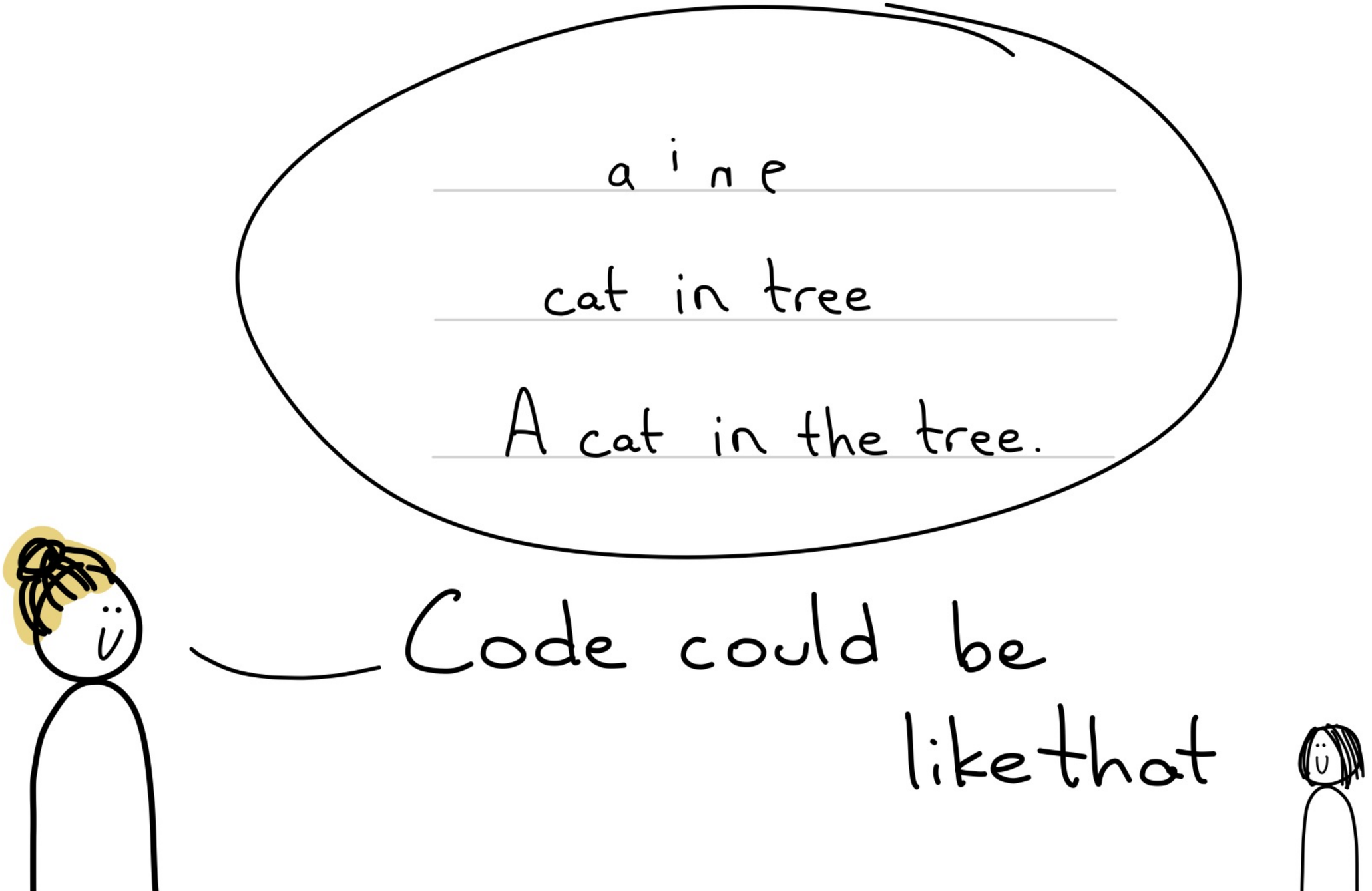
a i n e

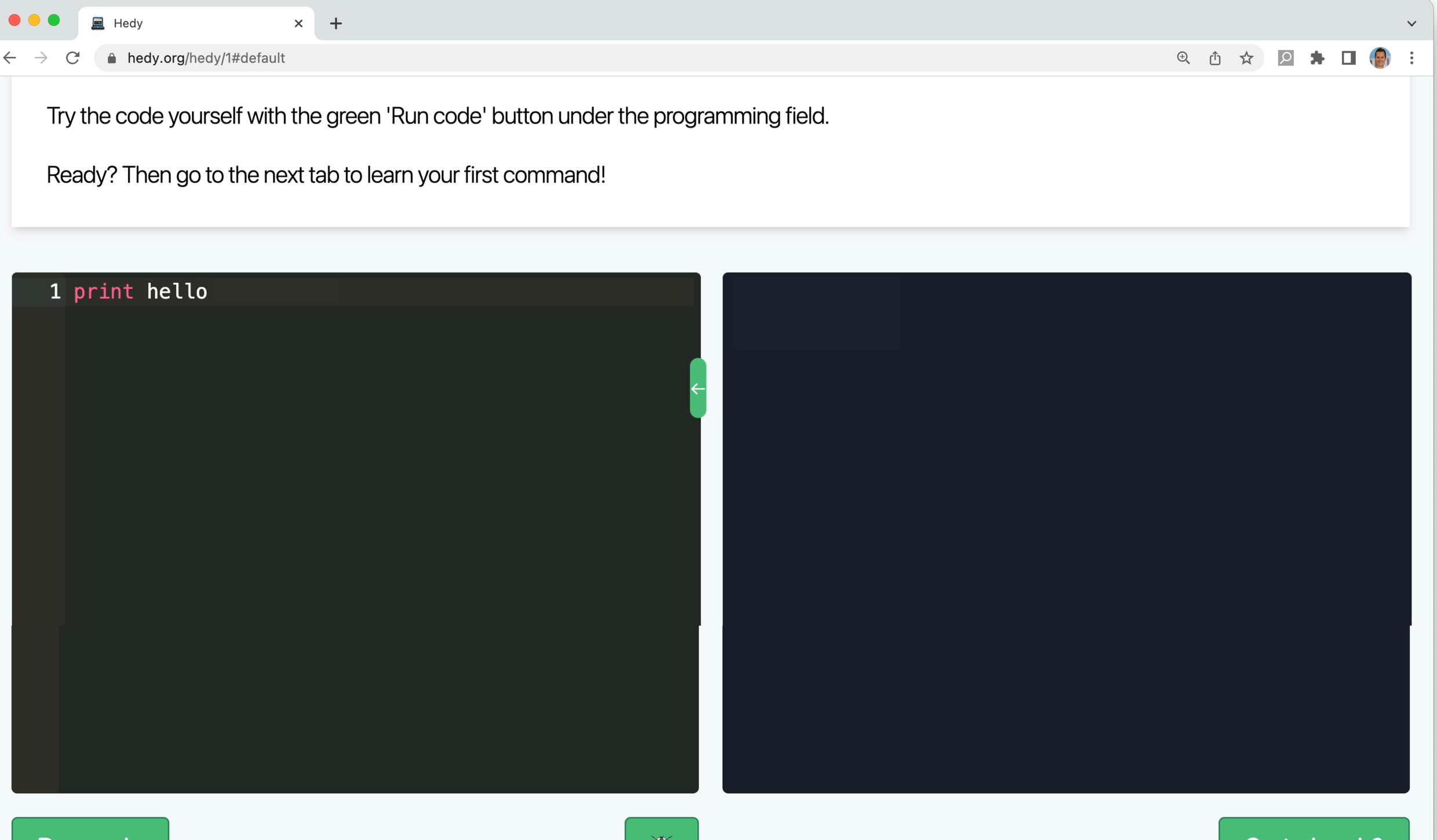
cat in tree

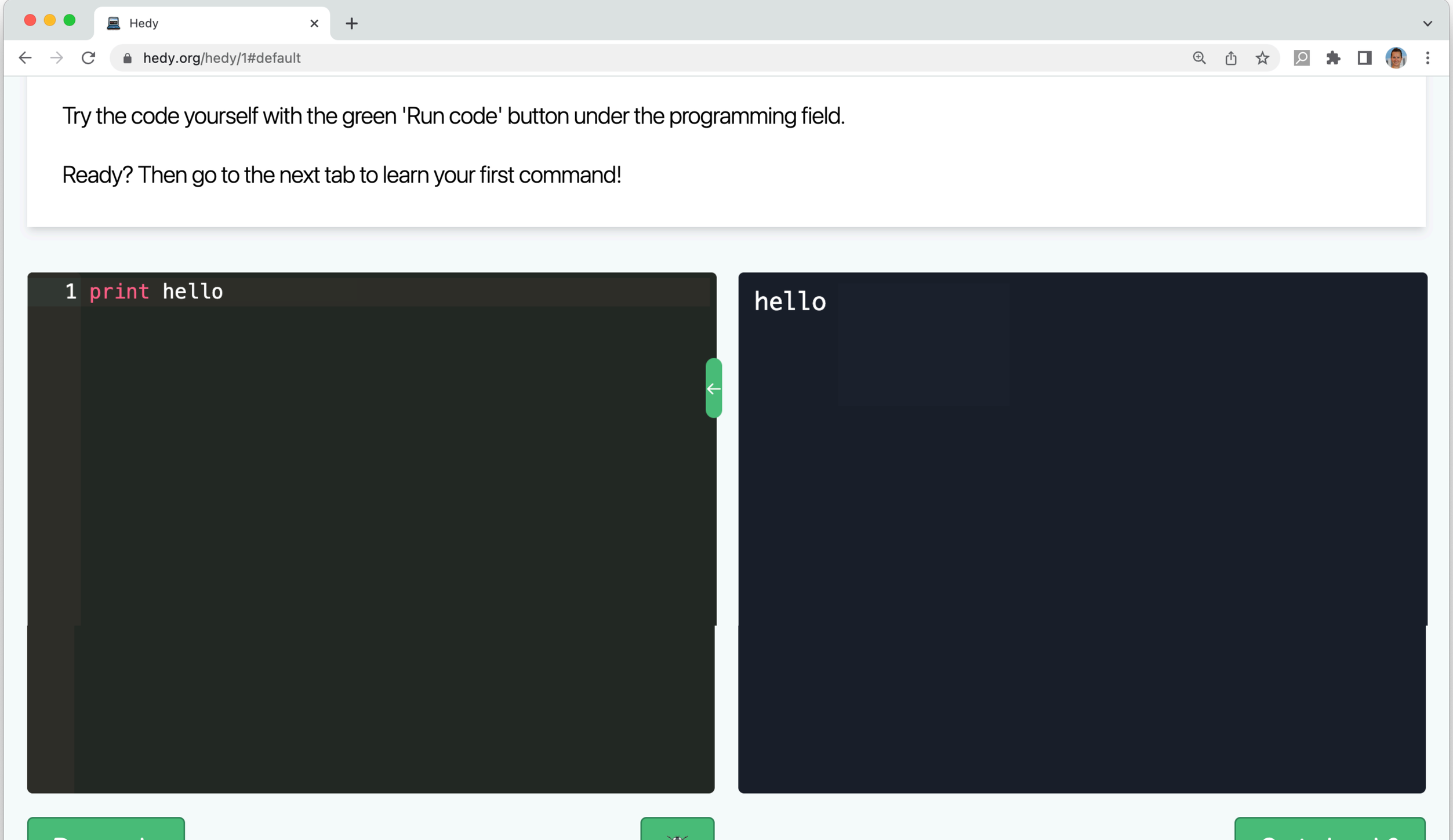
A cat in the tree.






a i n e
cat in tree
A cat in the tree.
Code could be
likethat


Hedy
hedy.org/hedy/1#default
Try the code yourself with the green 'Run code' button under the programming field.
Ready? Then go to the next tab to learn your first command!
1 print hello


Hedy
hedy.org/hedy/1#default
Try the code yourself with the green 'Run code' button under the programming field.
Ready? Then go to the next tab to learn your first command!
1 print hello
hello

Try the code yourself with the green 'Run code' button under the programming field.

Ready? Then go to the next tab to learn your first command!

```
1  ask How are you?
2  echo So you're...
```

Hedy

hedy.org/hedy/1#default

Try the code yourself with the green 'Run code' button under the programming field.

Ready? Then go to the next tab to learn your first command!

```
1  ask How are you?
2  echo So you're...
```

How are you?

How are you?

Enter

Try the code yourself with the green 'Run code' button under the programming field.

Ready? Then go to the next tab to learn your first command!

```
1 ask How are you?
2 echo So you're...
```

```
So you're... great
```

Hedy

hedy.org/hedy/2#default

That changes in level 2. In level 2 you'll learn to work with variables, that allow you to save multiple pieces of information and print them in any place you want. So let's go to the next tab!

```
1  name is Felienne
2  print hello name
```

Run code

Go back to level 1

Go to level 3

That changes in level 2. In level 2 you'll learn to work with variables, that allow you to save multiple pieces of information and print them in any place you want. So let's go to the next tab!

```
1  name is Felienne
2  print hello name
```

```
hello Felienne
```

Run code

Go back to level 1

Go to level 3

That changes in level 2. In level 2 you'll learn to work with variables, that allow you to save multiple pieces of information and print them in any place you want. So let's go to the next tab!

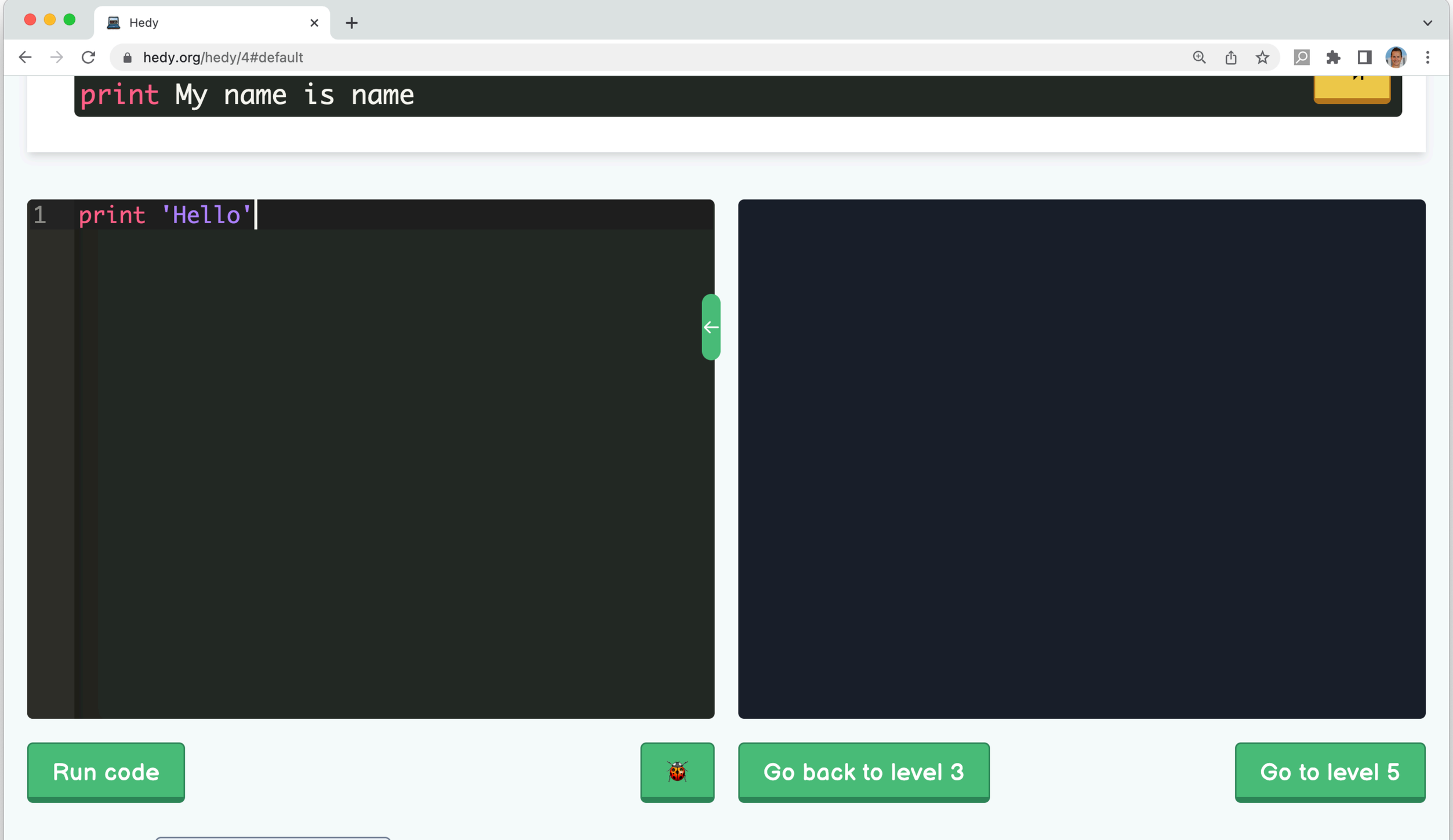
```
1  name = 'Felienne'
2  print('hello', name)
```

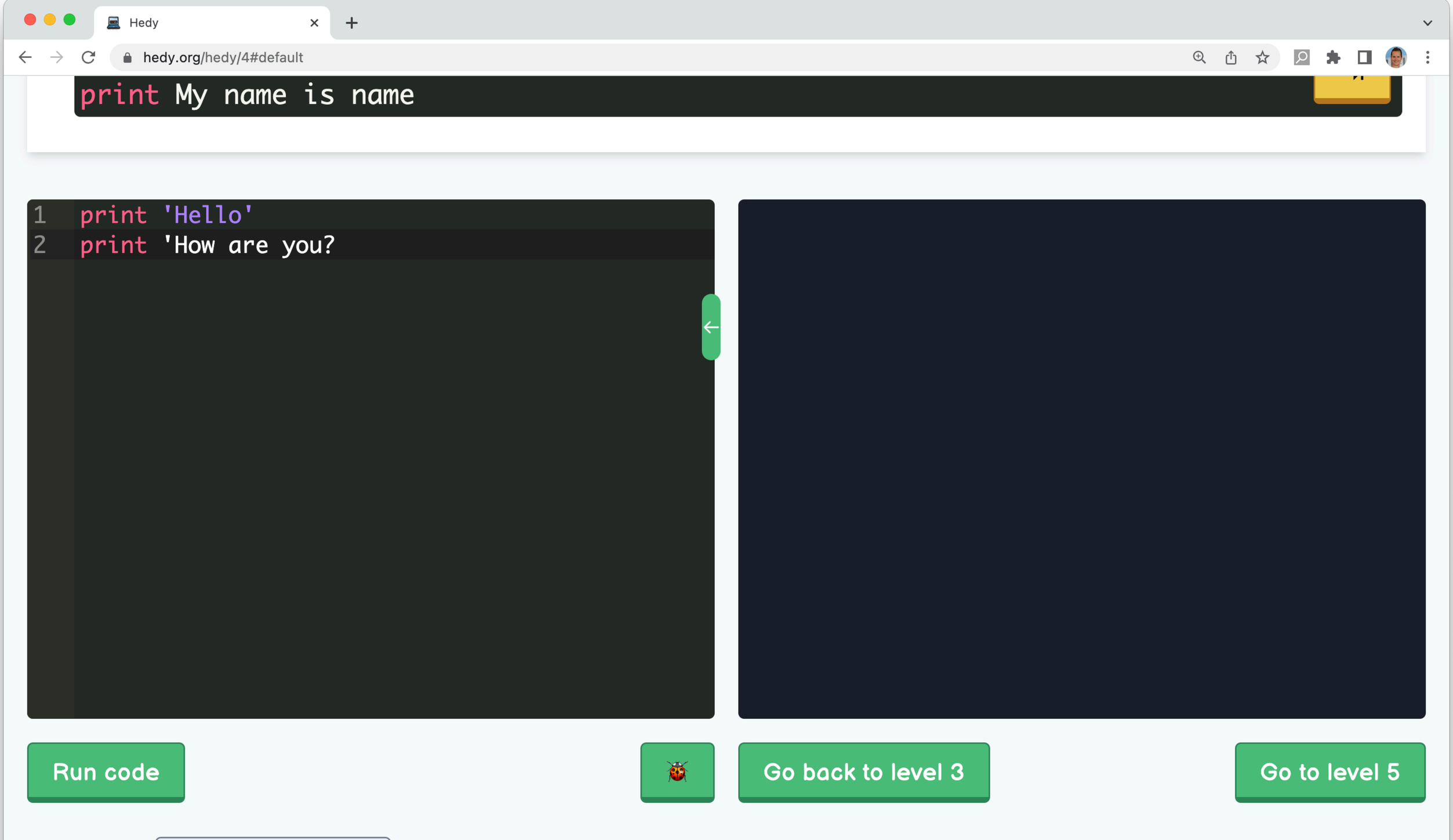
```
hello Felienne
```

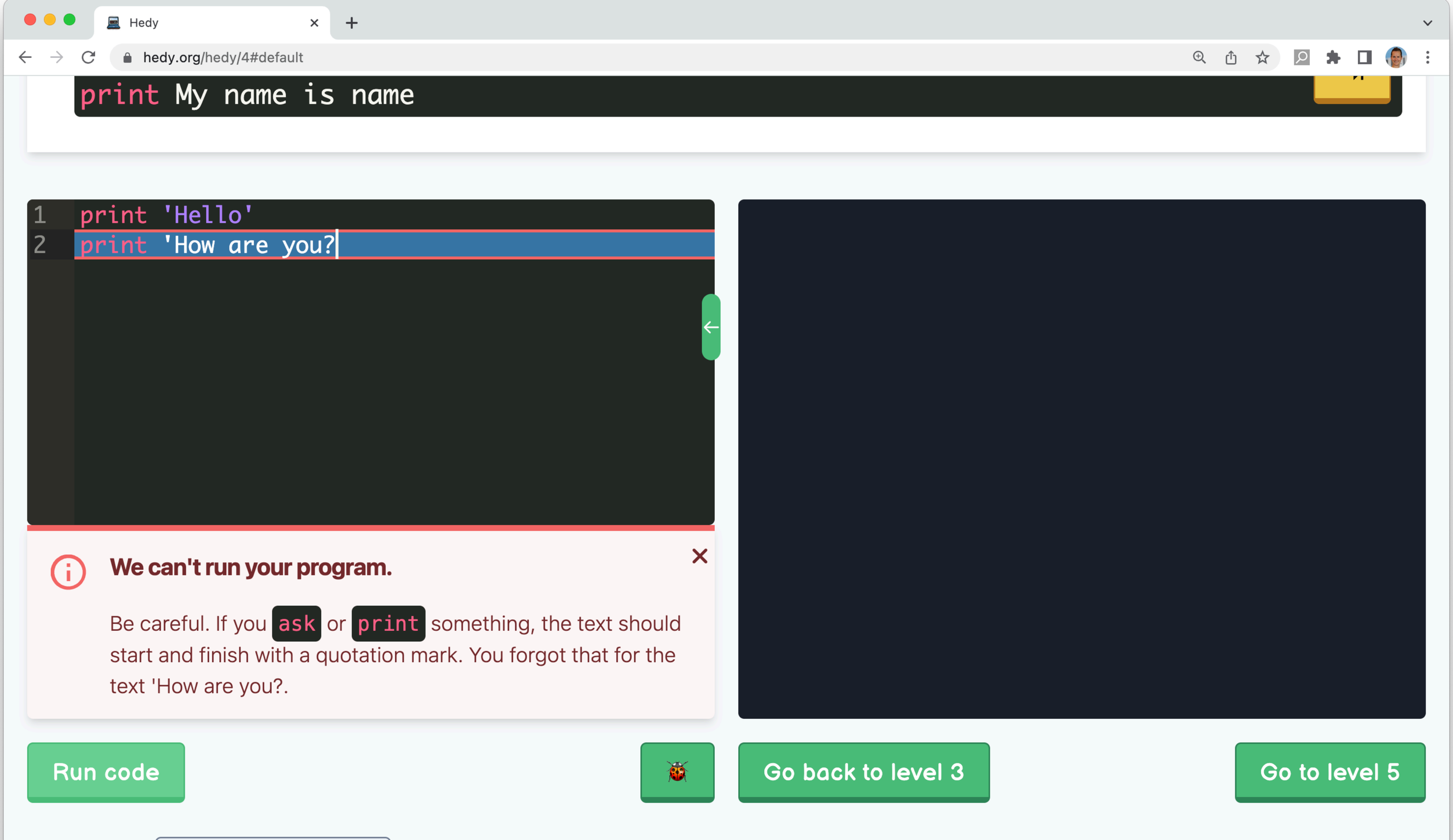
Run code

Go back to level 1

Go to level 3


Hedy
hedy.org/hedy/4#default
print My name is name
1 print 'Hello'
Run code
Go back to level 3
Go to level 5


Hedy
hedy.org/hedy/4#default
print My name is name
1 print 'Hello'
2 print 'How are you?
Run code
Go back to level 3
Go to level 5


Hedy
hedy.org/hedy/4#default
print My name is name
1 print 'Hello'
2 print 'How are you?
We can't run your program.
Be careful. If you ask or print something, the text should start and finish with a quotation mark. You forgot that for the text 'How are you?.
Run code
Go back to level 3
Go to level 5

```
print('So your name is ', name)
```

```
print('Hello!')
for i in range(1, 10):
    print('This is line ', i)
```

Run code

Go back to level 17

```
print('So your name is ', name)
```

```
1  print('Hello!')
2  for i in range(1, 10):
3      print('This is line ', i)
4
```

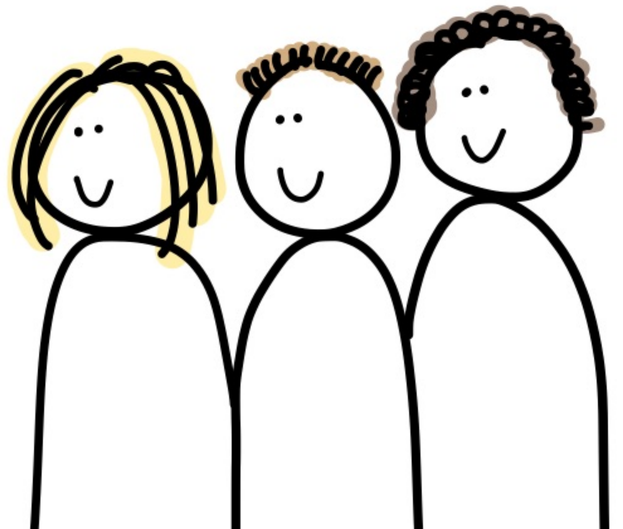
```
Hello!
This is line 1
This is line 2
This is line 3
This is line 4
This is line 5
This is line 6
This is line 7
This is line 8
This is line 9
This is line 10
```

Run code

Go back to level 17

How do you make a programming language?





Spelling

Meaning

cat at
foot

→

c·a·t·a·t
f·o·o·t

→



cat at
foot

→

Spelling

c·a·t·a·t
f·o·o·t

→

Meaning



cat at
foot

→

Syntax

c·a·t·a·t
f·o·o·t

→

Meaning



Hedy

```
print hello
turn 120
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax (Grammar)

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print hello
turn 120
```

→

Syntax

```
print letters
turn digits
```



Hedy

print hello

turn 120

Syntax

print letters

turn digits



Hedy

print hello

turn 120

Syntax

print letters

turn digits



Hedy

print kkkkk

turn 1220

Syntax

print letters

turn digits

Correct!



Hedy

```
print hello
turn ten
```

→

Syntax

```
print letters
turn digits
```



Hedy

```
print keklkp
turn ten
```

→

Syntax

```
print kekkkerp
turn digits
```



Hedy

print kekkp

turn ten

→

Syntax

print kekkers

turn digits



Hedy

print hello
turn ten

Syntax

print hello
turn digits

Incorrect!
t is not a digit



Syntax

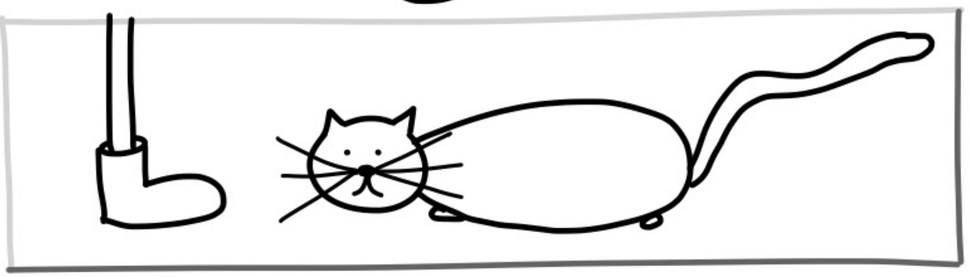
Meaning

cat at
foot

→

c·a·t·a·t
f·o·o·t

→





cat at
foot

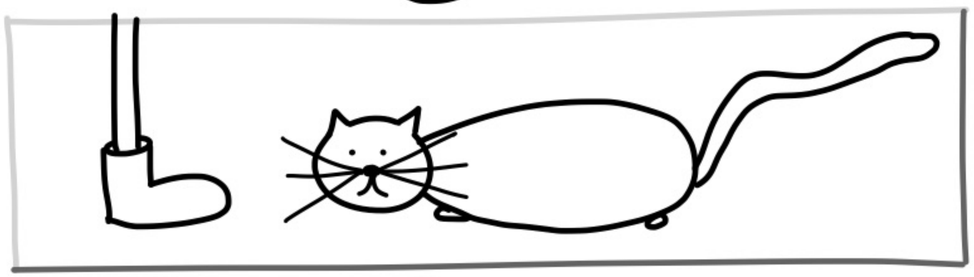
→

Syntax

c·a·t·a·t
f·o·o·t

→

Meaning



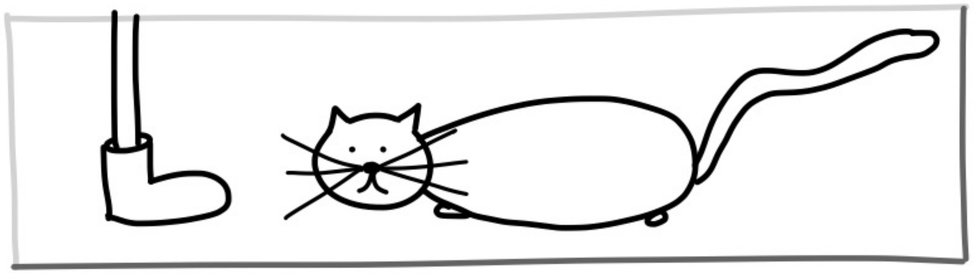


Syntax

Semantics

cat at
foot

c·a·t·a·t
f·o·o·t





Syntax

Semantics

```
print hello
turn 120
```

→

```
print letters
turn digits
```



Syntax

Semantics

```
print hello
turn 120
```

→

```
print letters
turn digits
```

→

```
print all letters
turn digits degrees
```



print hello
turn 120

→

Syntax

print letters
turn digits

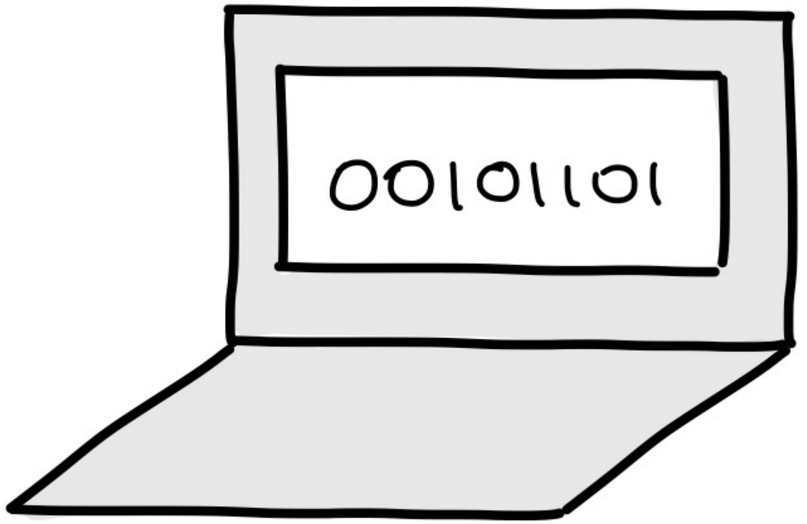
→

Semantics

print all letters
turn digits degrees

↓





Syntax

Semantics

```
print hello
turn 120
```

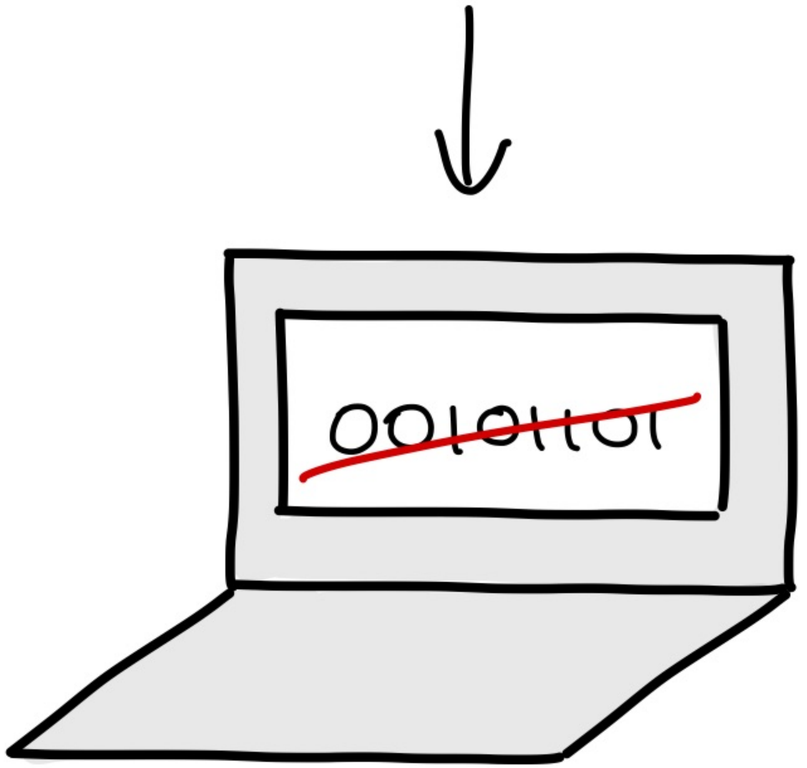
→

```
print letters
turn digits
```

→

```
print all letters
turn digits degrees
```





print hello
turn 120

→

Syntax

print letters
turn digits

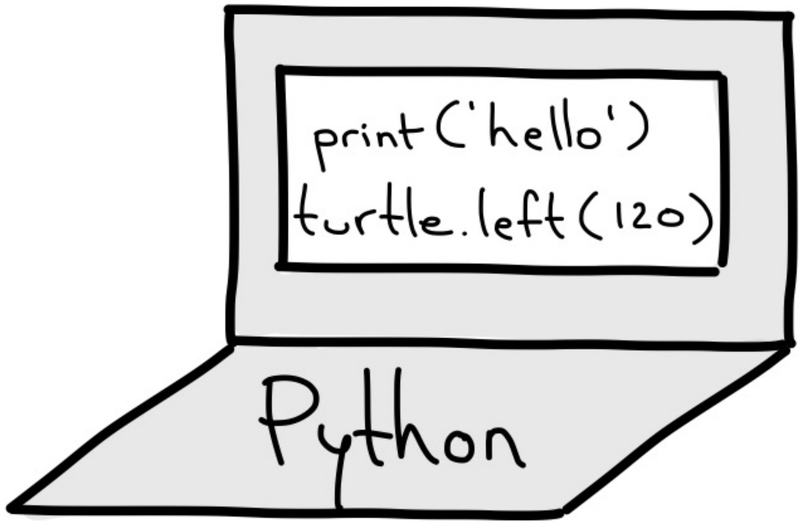
→

Semantics

print all letters
turn digits degrees

↓





print hello
turn 120

→

Syntax

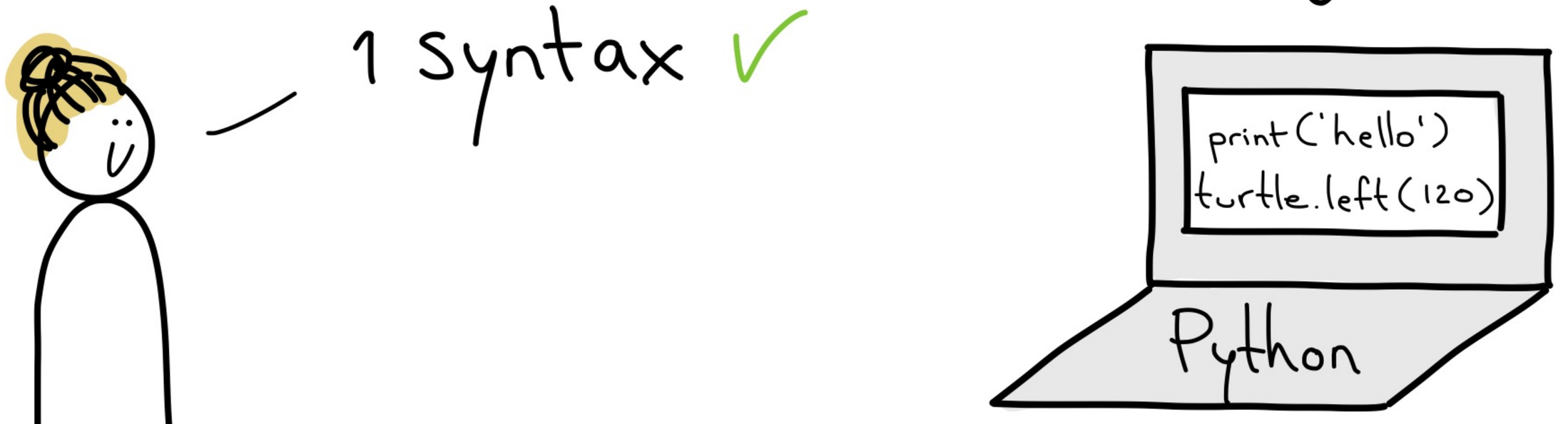
print letters
turn digits

→

Semantics

print all letters
turn digits degrees

↓



Level 2

```
print hello
turn 120
```

→

Syntax 2

```
print letters
turn digits
```

→

Semantics

```
print all letters
turn digits degrees
```

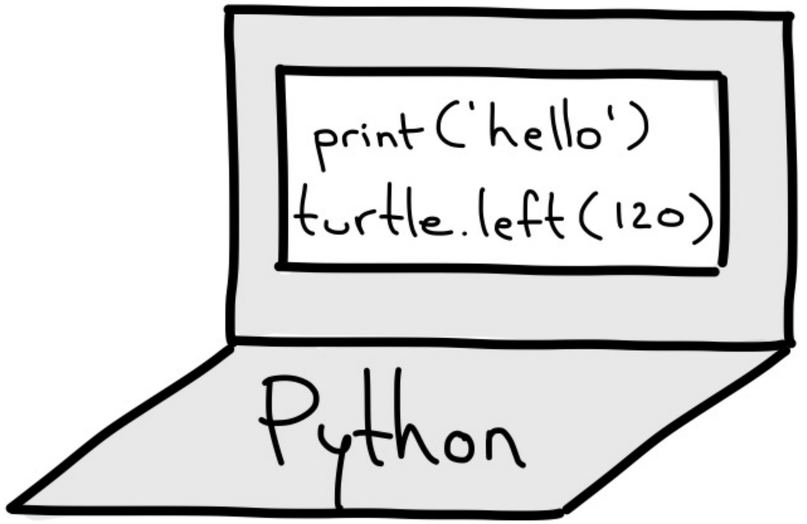
Level 4

```
print 'hello'
turn 120
```

→

Syntax 4

```
print 'letters'
turn digits
```



Level 2

```
print hello
turn 120
```

Syntax 2

```
print letters
turn digits
```

Semantics

```
print all letters
turn digits degrees
```

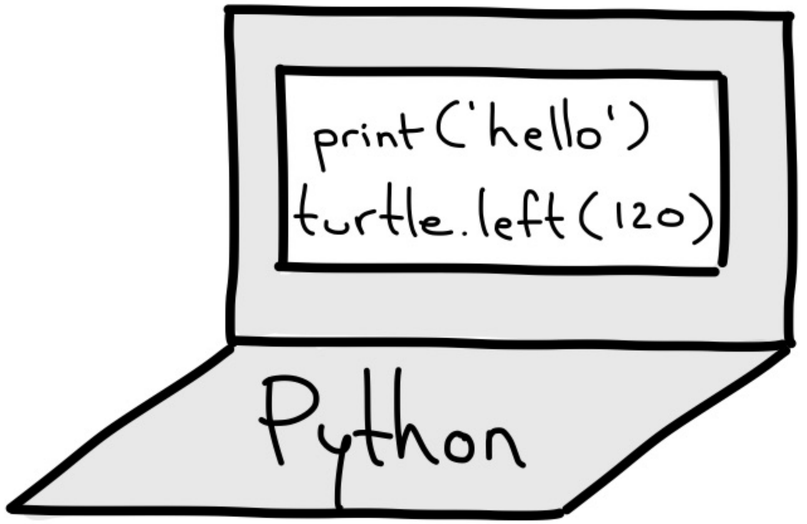
Level 4

```
print 'hello'
turn 120
```

Syntax 4

```
print 'letters'
turn digits
```

18



Level 2

```
print hello
turn 120
```

Syntax 2

```
print letters
turn digits
```

Semantics x 18

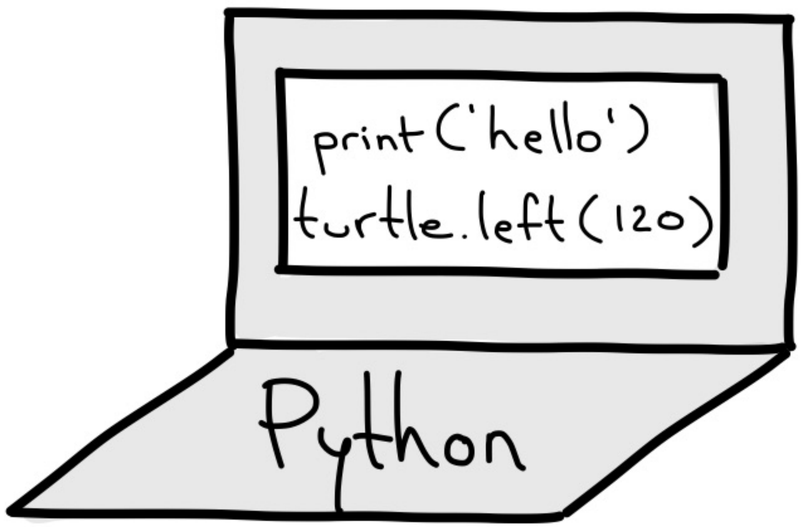
```
print all letters
turn digits degrees
```

Level 4

```
print 'hello'
turn 120
```

Syntax 4 ... 18

```
print 'letters'
turn digits
```



Level 2

```
print hello
turn 120
```

Syntax 2

```
print letters
turn digits
```

Semantics x 18

```
print all letters
turn digits degrees
```

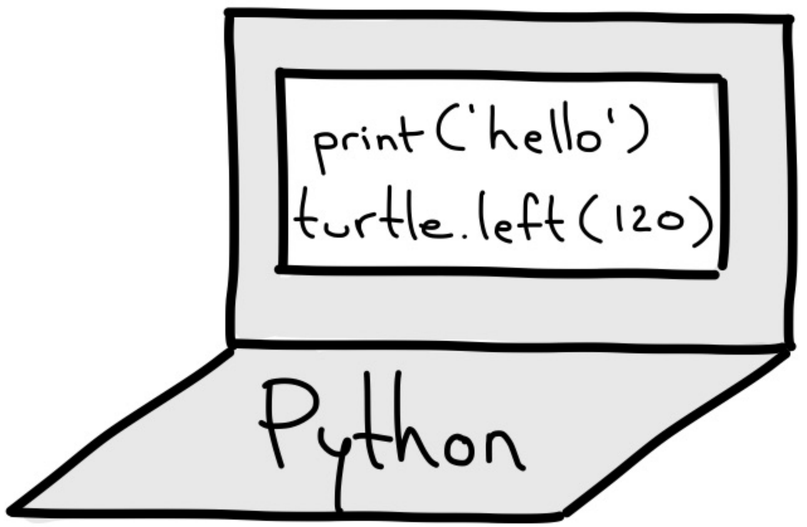
Level 4

```
print 'hello'
turn 120
```

Syntax 4 ... 18

```
print 'letters'
turn digits
```

x 18





ELSEVIER

Journal of Computer Languages

Volume 73, December 2022, 101158



Design, implementation and evaluation of the Hedy programming language

Marleen Gilsing [a], Jesús Pelay [b], Felienne Hermans [a c]

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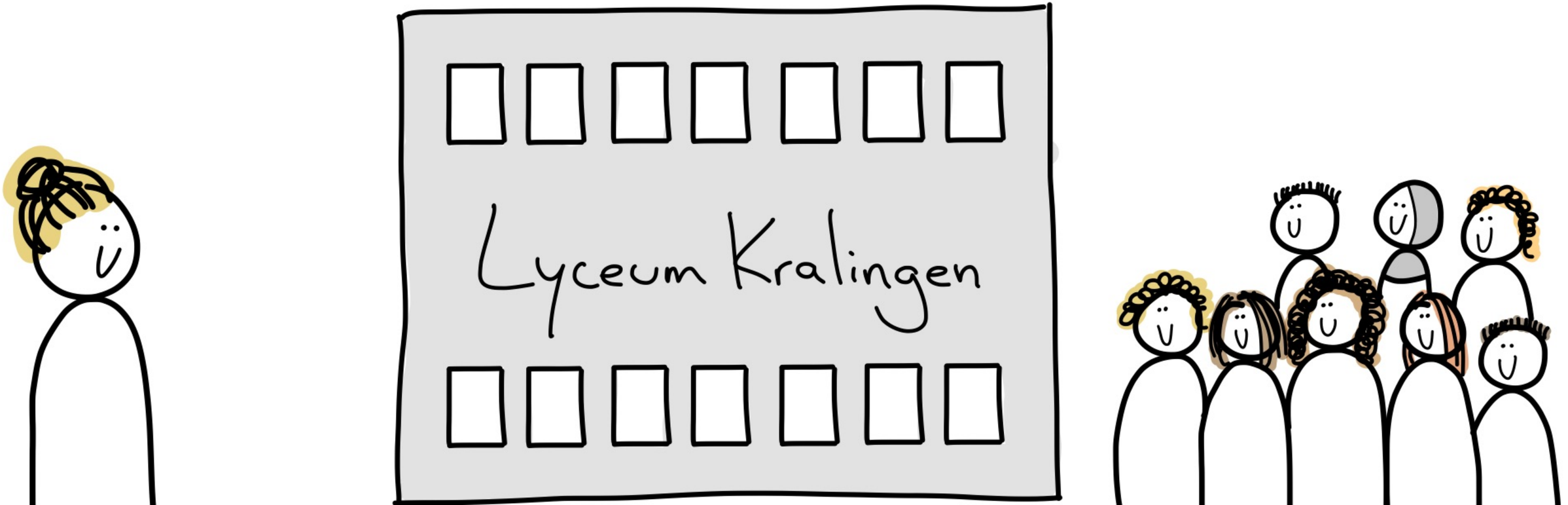
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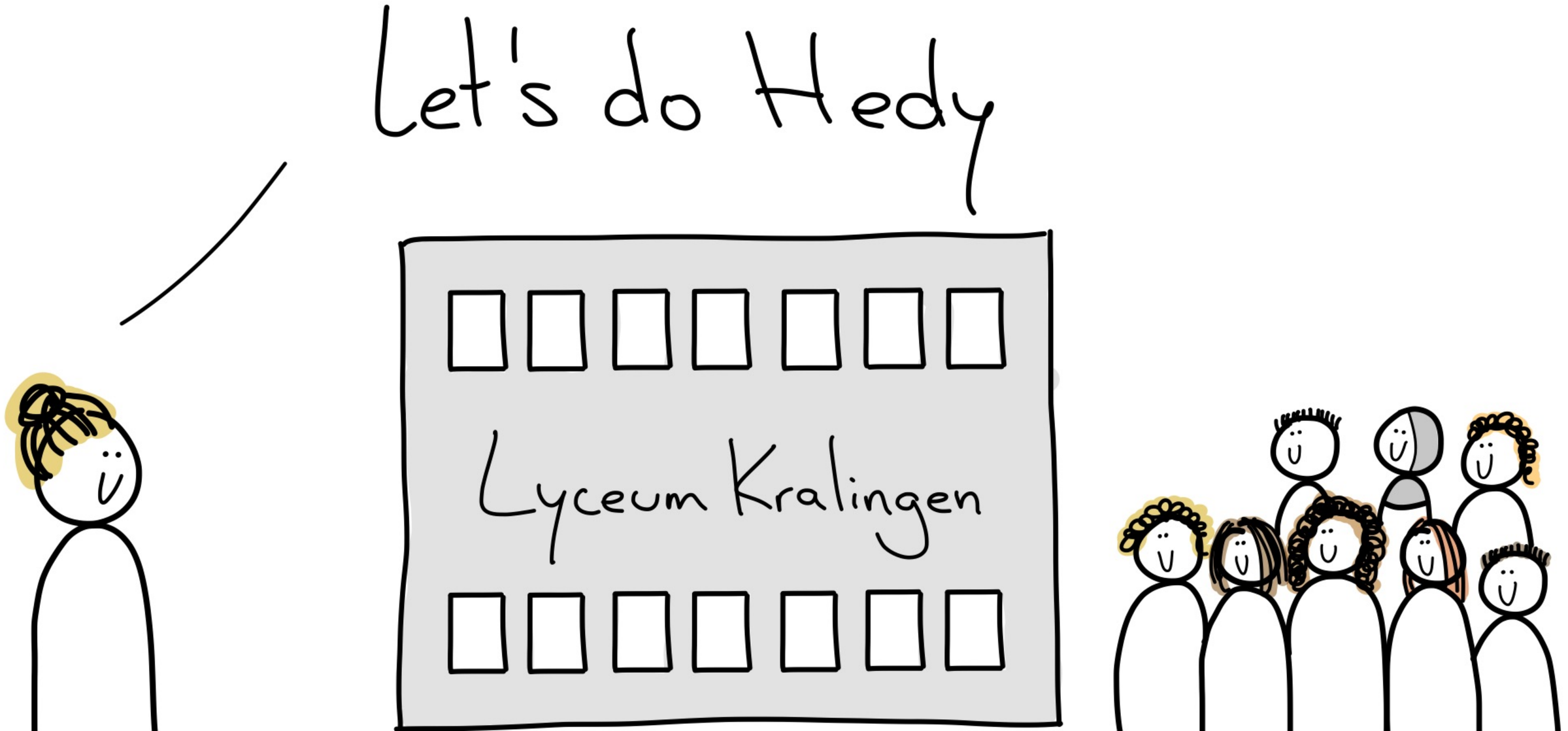
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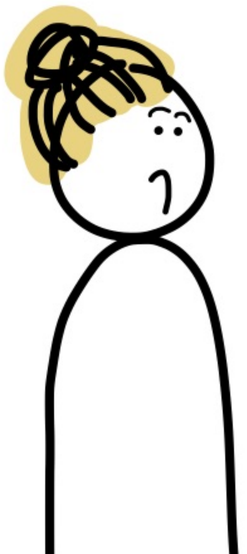
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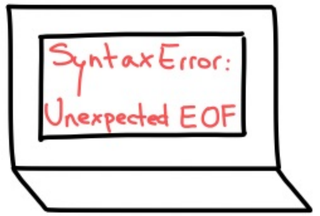
Highlights

- Details the full implementation of Hedy; the first gradual language for programming education.
- Introduces an EBNF extension used for merging partial grammars to enable gradual language implementation.

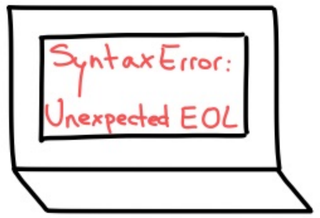

Lyceum Kralingen


Let's do Hedy
Lyceum Kralingen

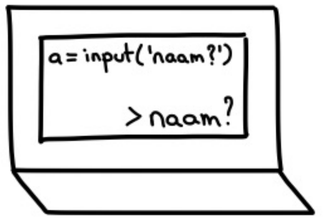



SyntaxError:
Unexpected EOF

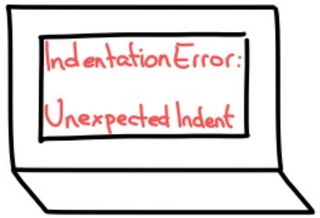



SyntaxError:
Unexpected EOL

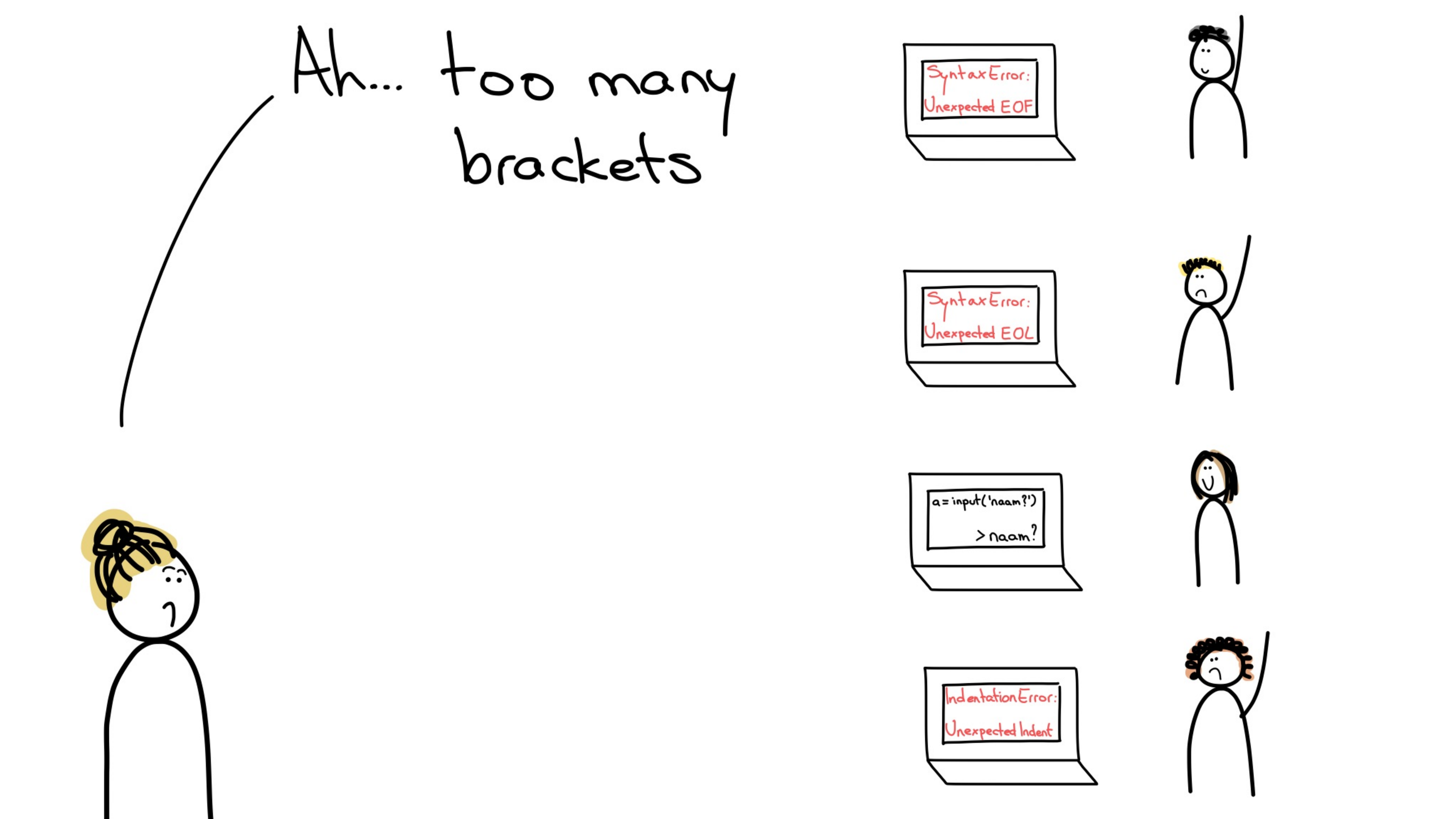



a=input('naam?')
>naam?

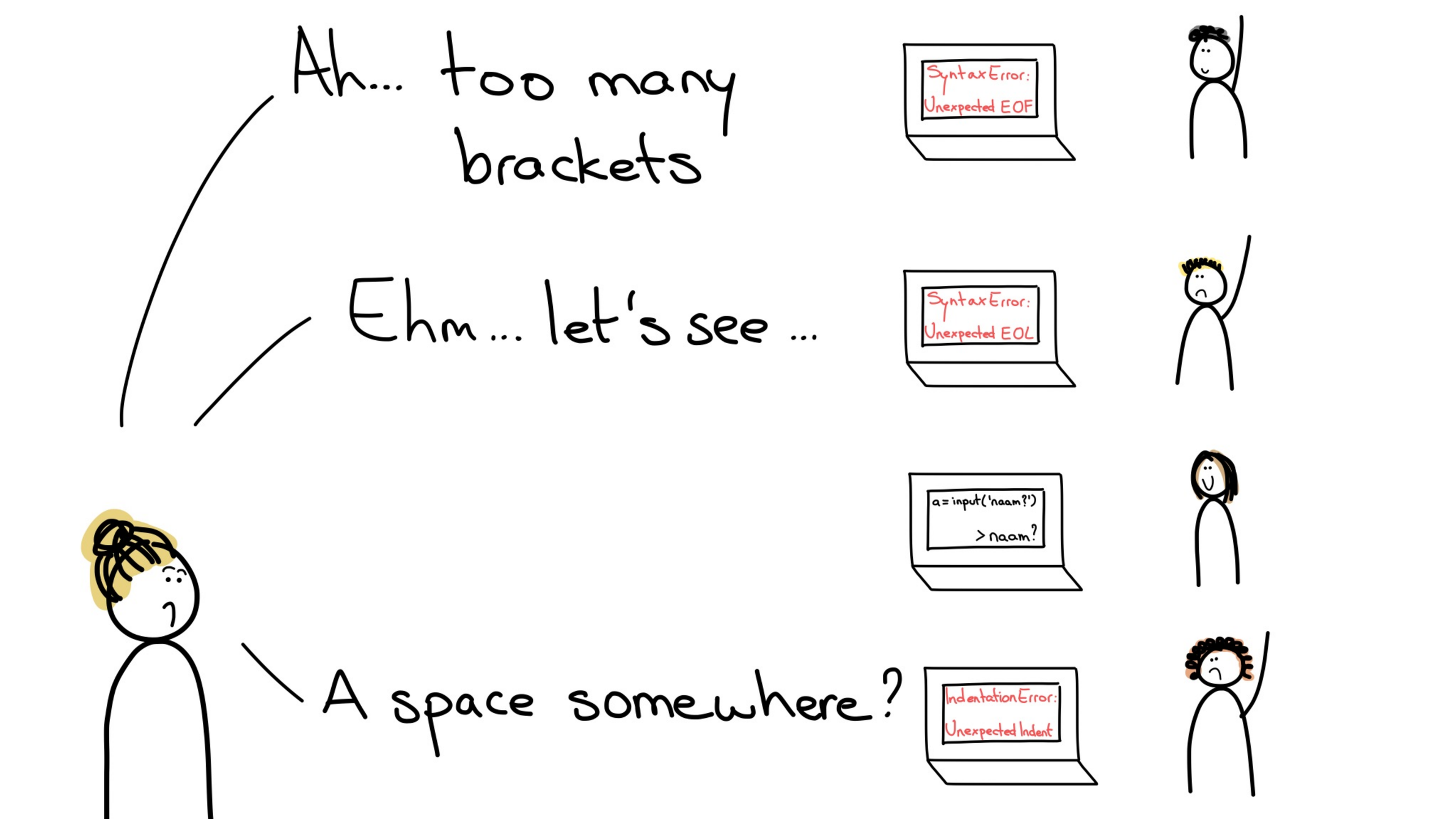


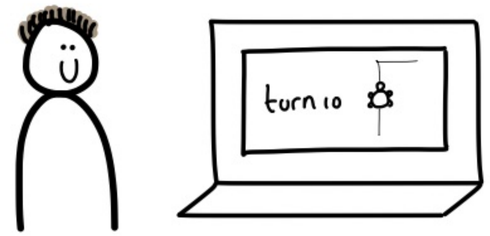

IndentationError:
Unexpected Indent




Ah... too many brackets
SyntaxError: Unexpected EOF
SyntaxError: Unexpected EOL
a=input('naam?')
>naam?
IndentationError: Unexpected Indent


Ah... too many brackets
Ehm... let's see ...
SyntaxError: Unexpected EOF
SyntaxError: Unexpected EOL
a=input('naam?')
>naam?
IndentationError: Unexpected Indent

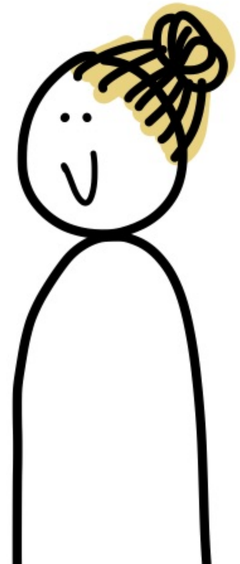

Ah... too many brackets
SyntaxError: Unexpected EOF
Ehm... let's see ...
SyntaxError: Unexpected EOL
a=input('naam?')
>naam?
A space somewhere?
IndentationError: Unexpected Indent

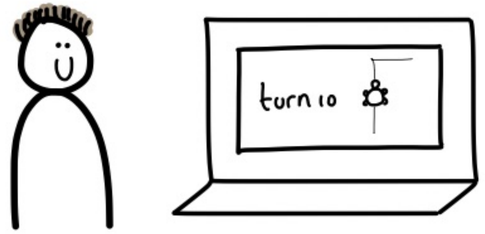

turn to


Haakje mist
op regel 4

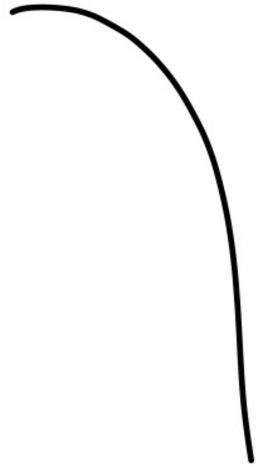

ask naam?
naam?


Komma mist
op regel 6




turn 10

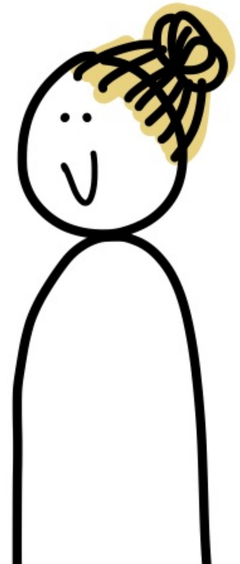
Check line 4!

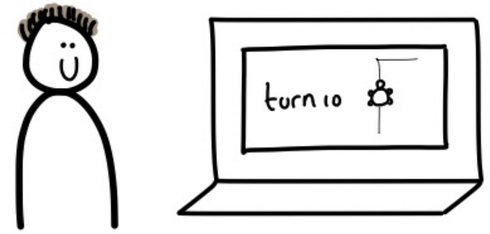



Haakje mist
op regel 4


ask naam?
naam?


Komma mist
op regel 6





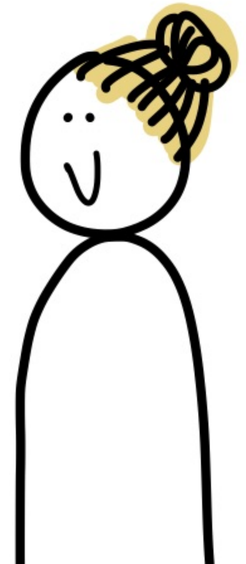
Check line 4!





Reread the error message





```
1  print Welcome, world!
```





```
1  print Welcome, world!
```

We can't run your program.

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

X

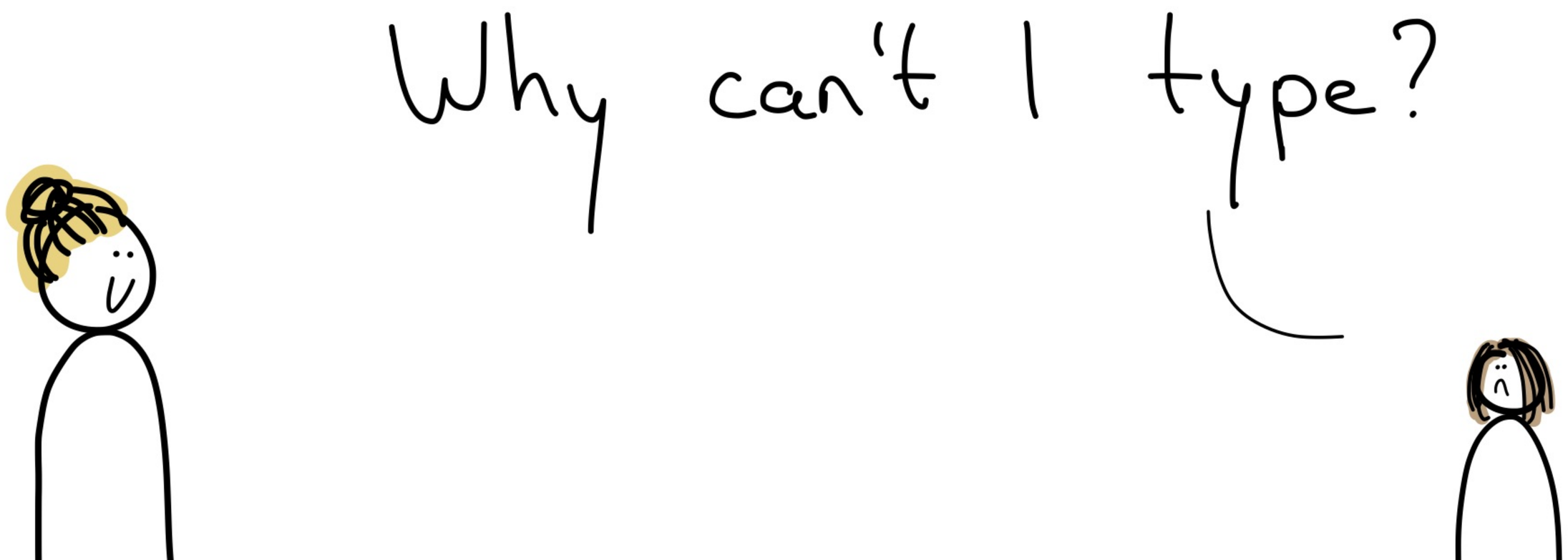




```
1  print Welcome, world!
```

We can't run your program.

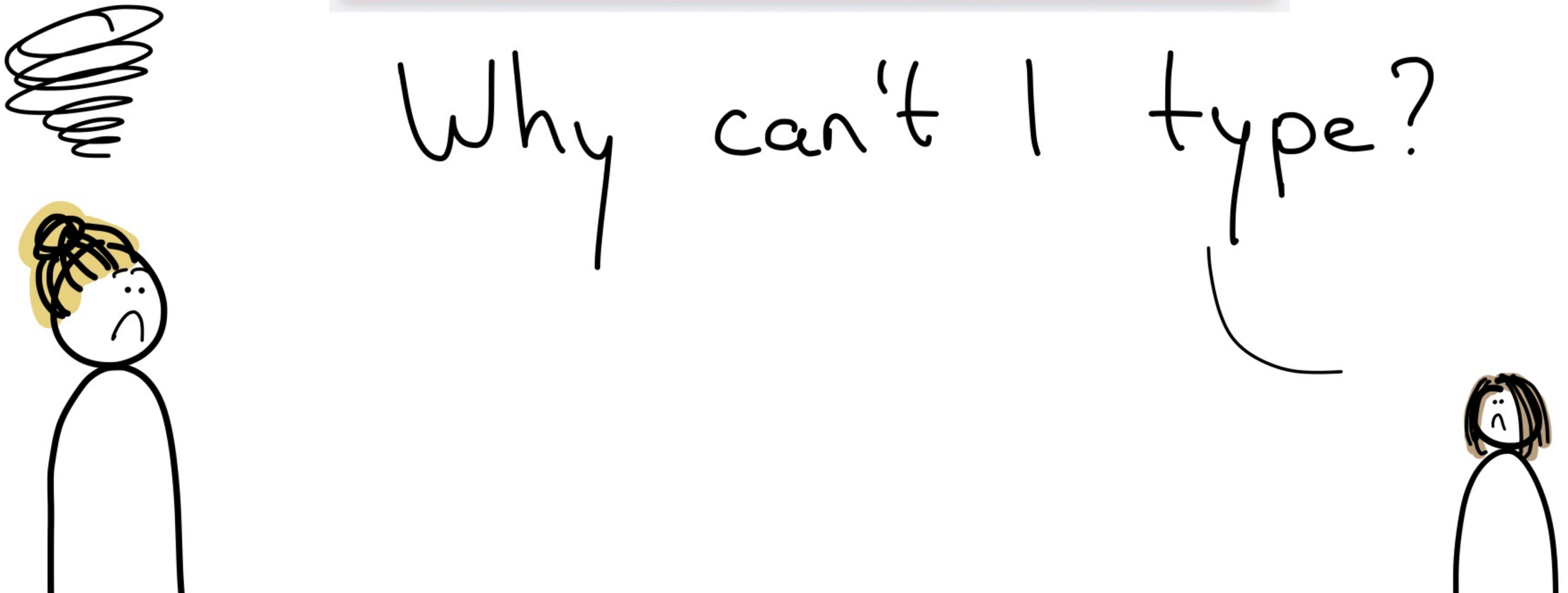
The code you entered is not valid Hedy code. There is a mistake on line 1, at position 12. You typed ',' but that is not allowed.



```
1  print Welcome, world!
```

We can't run your program.

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



```
1  print Welcome, world!
```

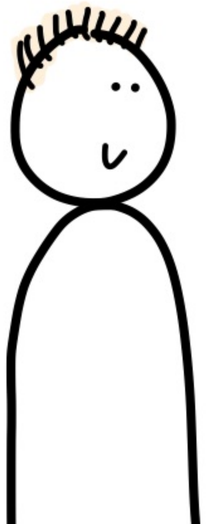
We can't run your program.

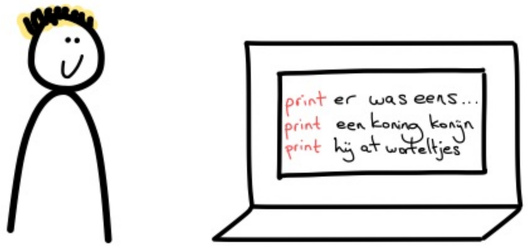
X

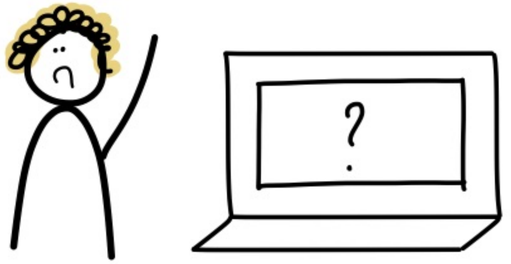
The code you entered is not valid Hedy code. There is a mistake on line 2, at position 14. You typed a comma, but that is not allowed.

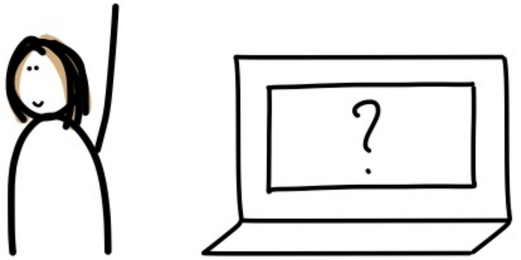


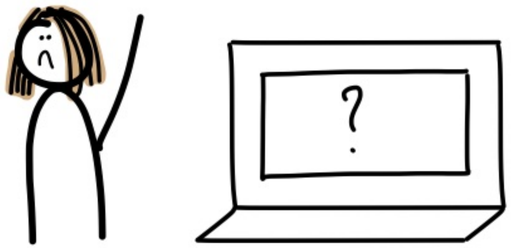


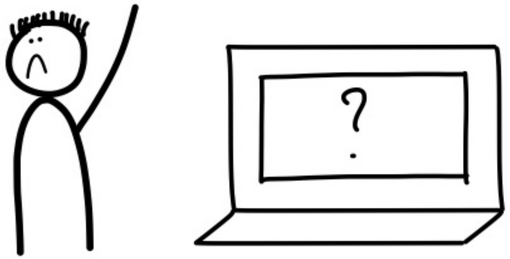


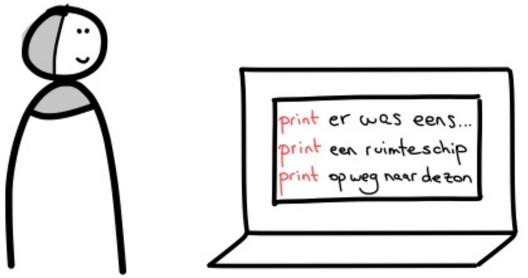

print er was eens...
print een konijn
print hij at worteltjes

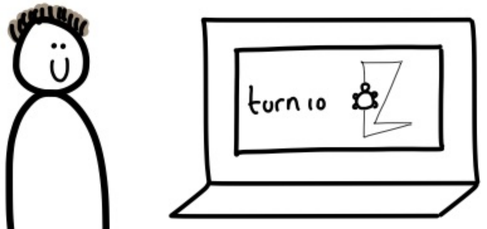

?


?

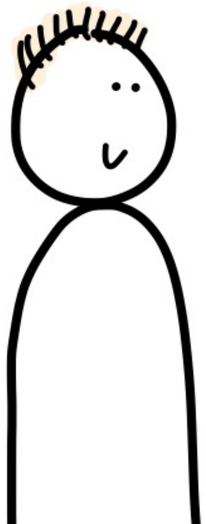

?

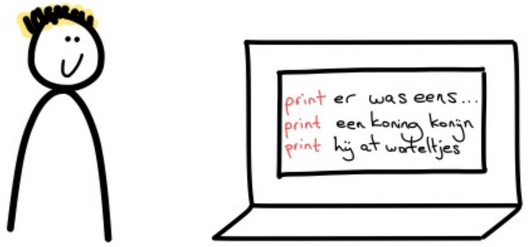

?

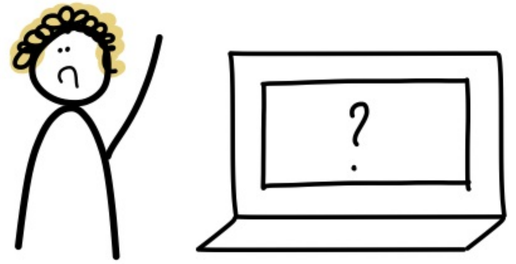

print er was eens...
print een ruimteschip
print op weg naar de zon


turn 10

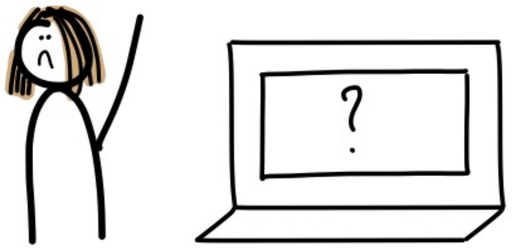
What should we build?

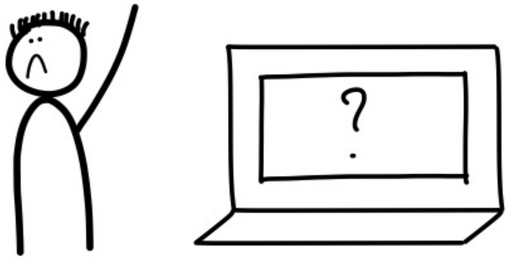


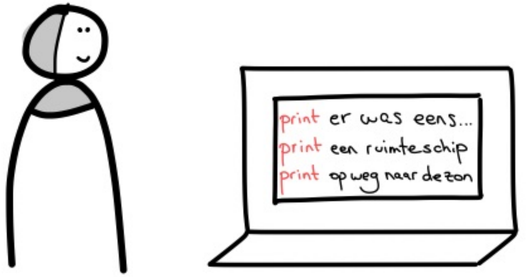


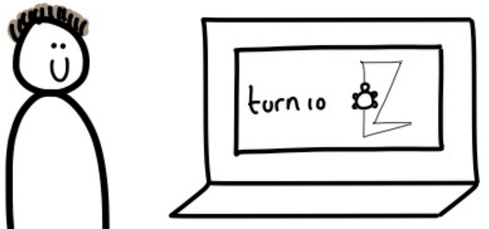


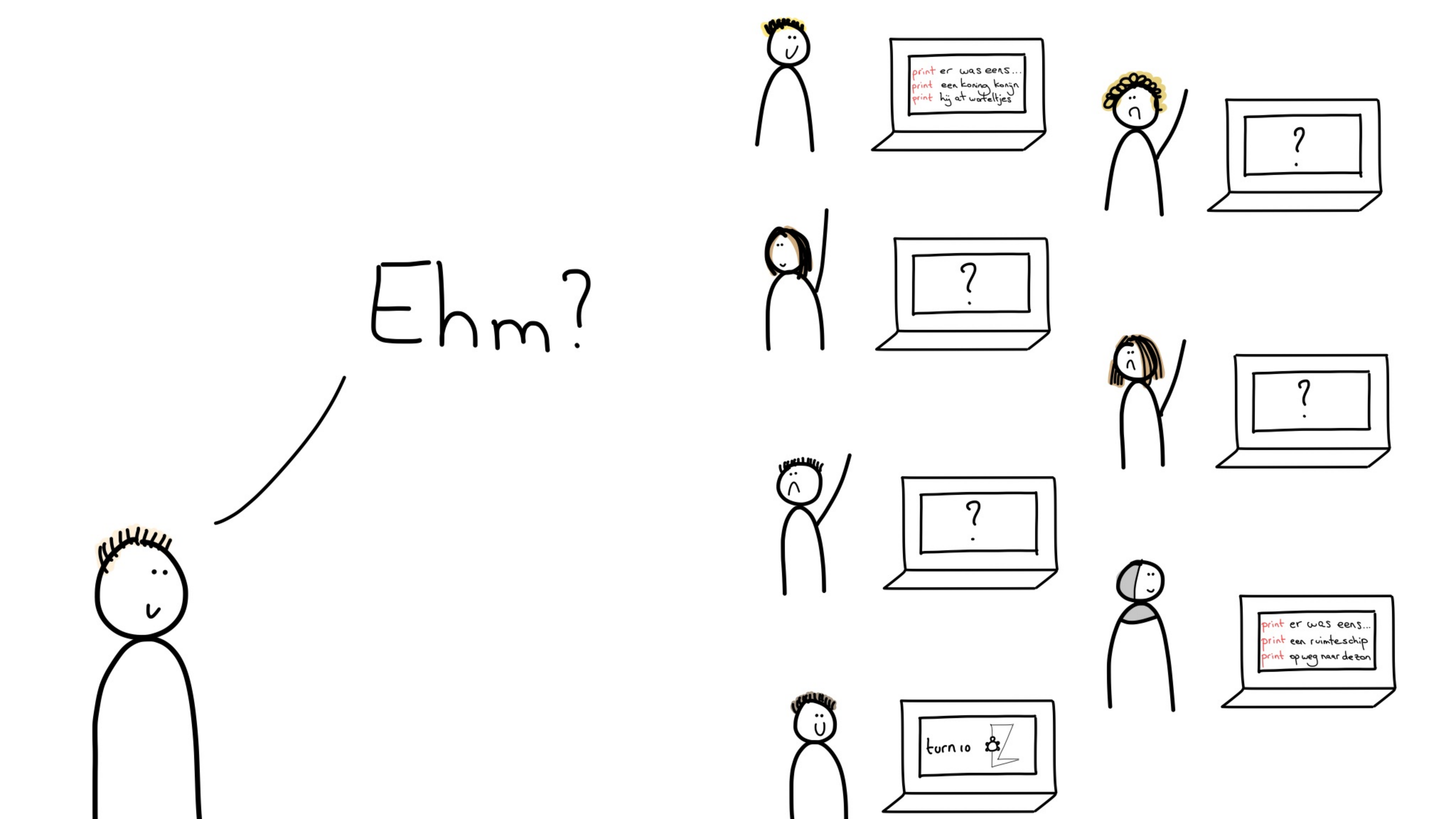


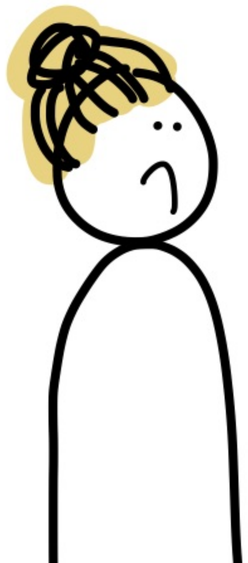


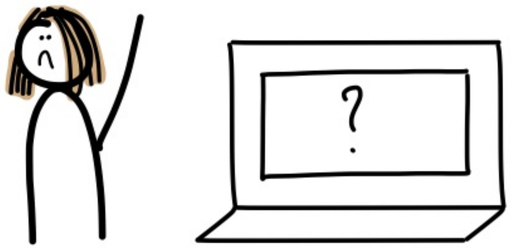




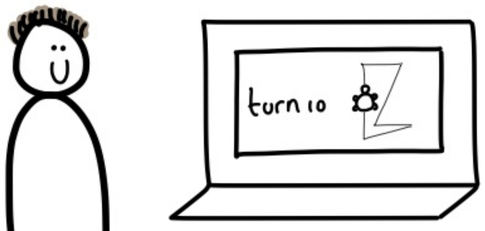


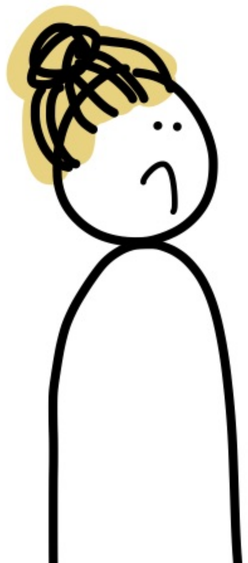

Ehm?
print er was eens...
print een konijn
print hij at wortels
?
?
?
?
turn 10
print er was eens...
print een ruimteschip
print op weg naar de zon



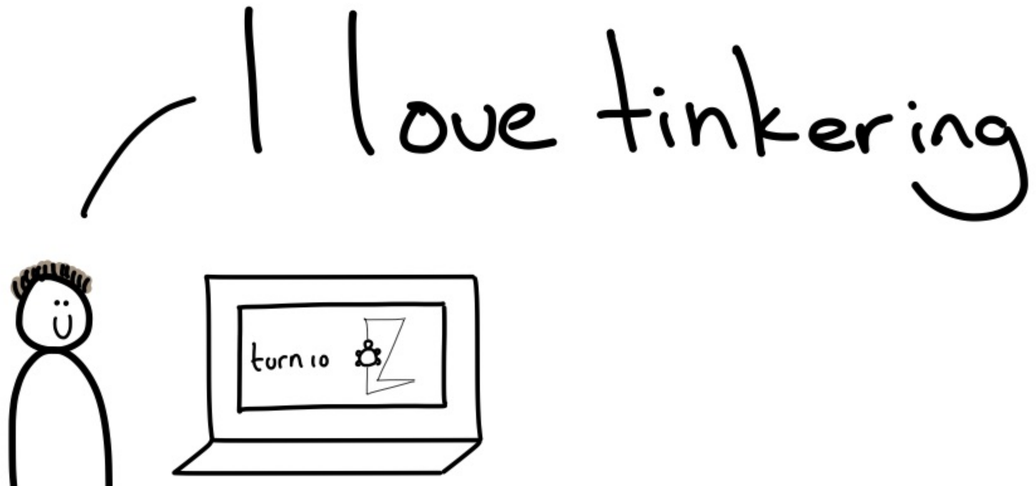


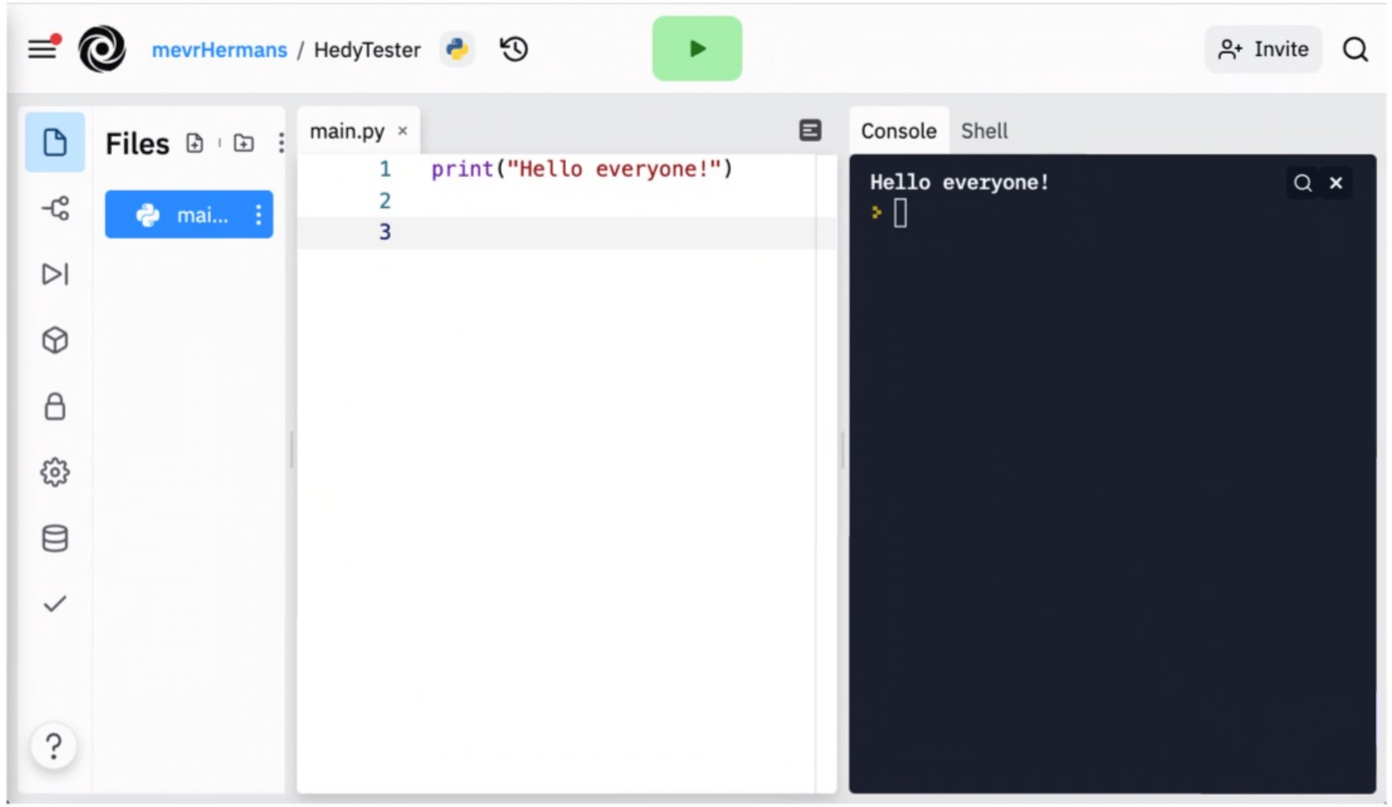
I love tinkering



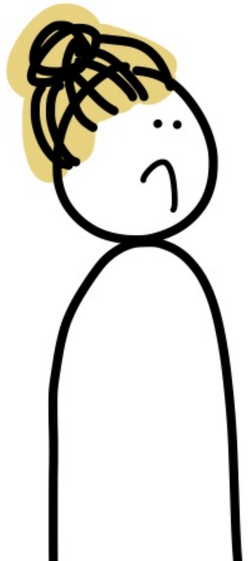


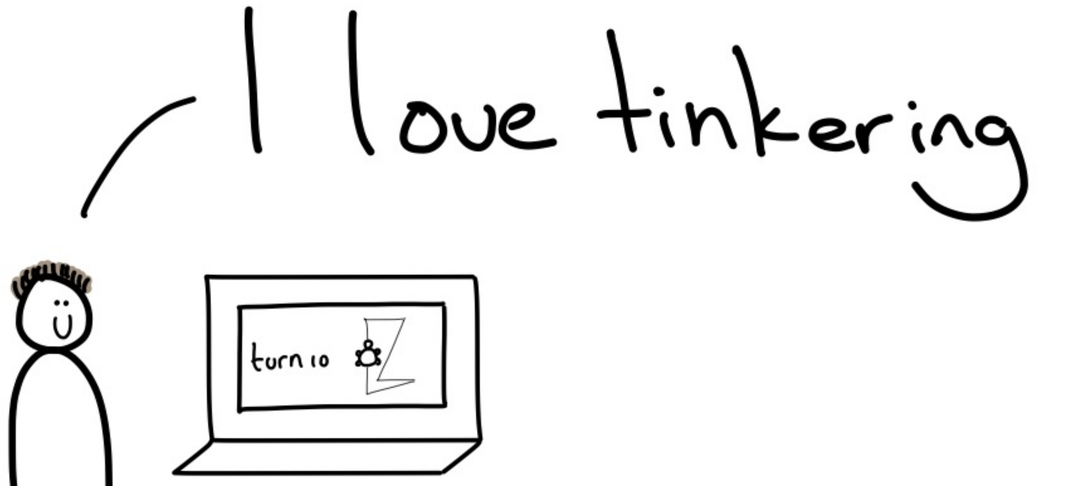

I don't
?

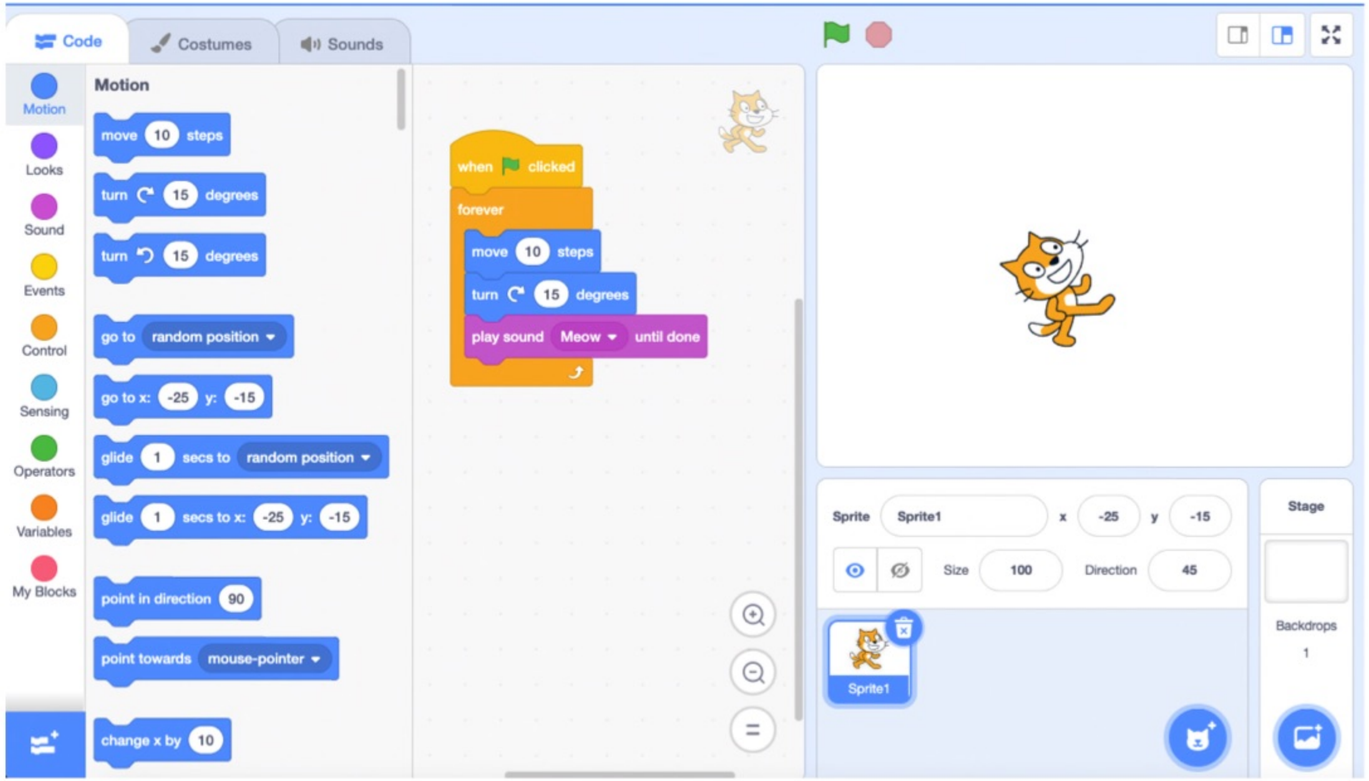

I love tinkering
turn.io


mevrHermans / HedyTester
Invite
Files
main.py
1 print("Hello everyone!")
2
3
Console
Shell
Hello everyone!


I don't
?




I love tinkering
turn 10


Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
go to random position
go to x: -25 y: -15
glide 1 secs to random position
glide 1 secs to x: -25 y: -15
point in direction 90
point towards mouse-pointer
change x by 10
when clicked
forever
move 10 steps
turn 15 degrees
play sound Meow until done
Sprite
Sprite1
x
-25
y
-15
Size
100
Direction
45
Stage
Backdrops
1
Sprite1


I don't
?


I love tinkering
turn 10

The print command

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

```
print Hi there, programmer!
print Welcome to Hedy!
```

Exercise

In Hedy you will find exercises in every adventure. An exercise allows you to practise the new commands and concepts, and lets you give your own twist to the example codes. In this exercise you will see a pink blank space. You have to fill something in the place of the blank space before the code can be ran.

Fill in the `print` command in the blank space and then add five more lines of code. Each line has to start with a `print` command. Have fun!

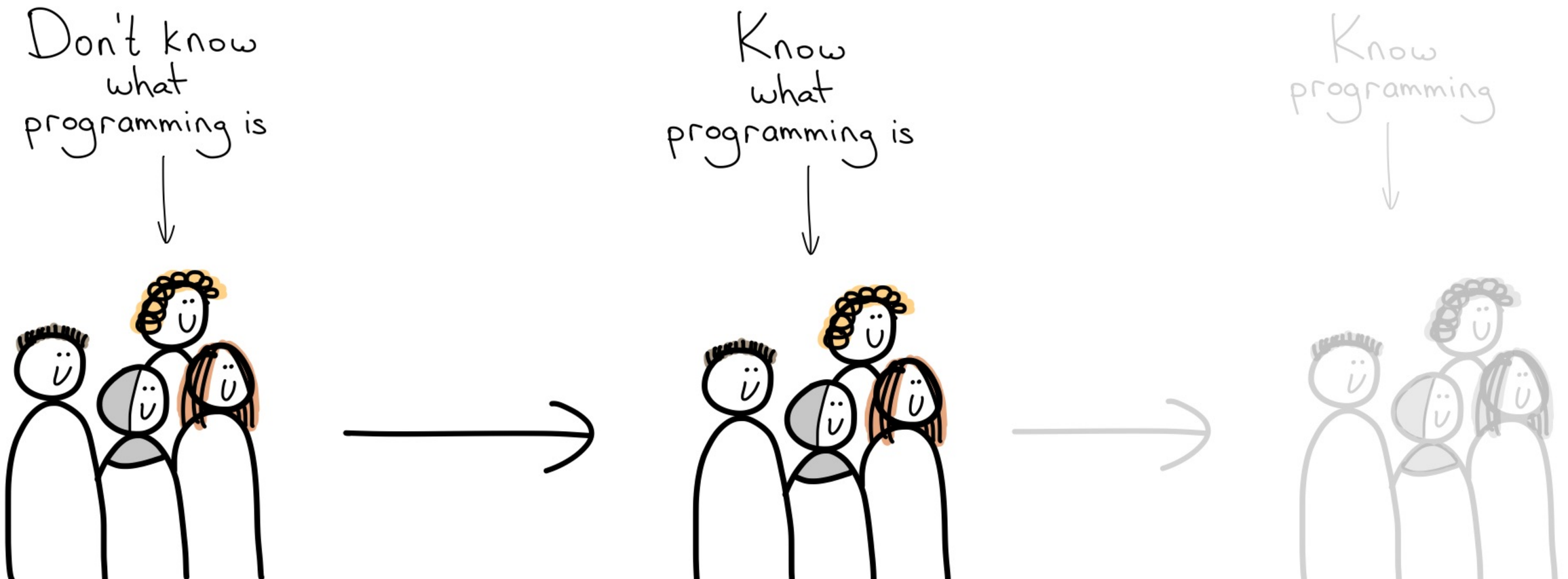
```
_ Hello!
```

```
1 print Welcome to Hedy!
2
```

Run code

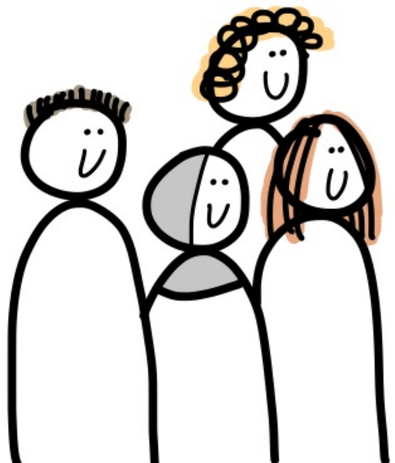
Introduction

ask

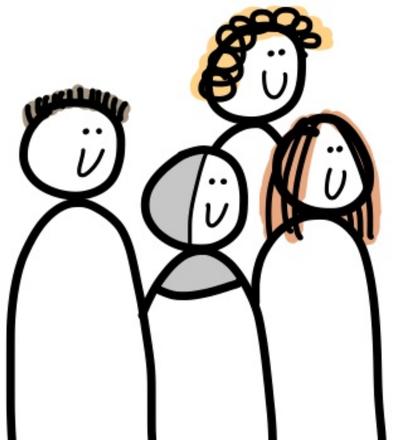

Don't know what programming is
Know what programming is
Know programming

Where explanation matters most

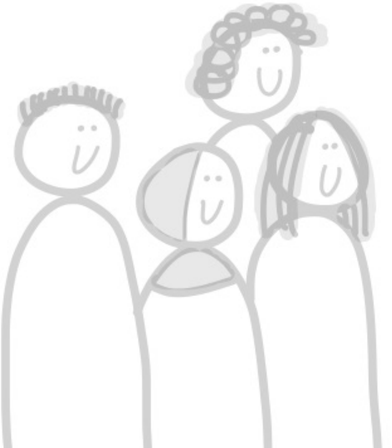
Don't know what programming is

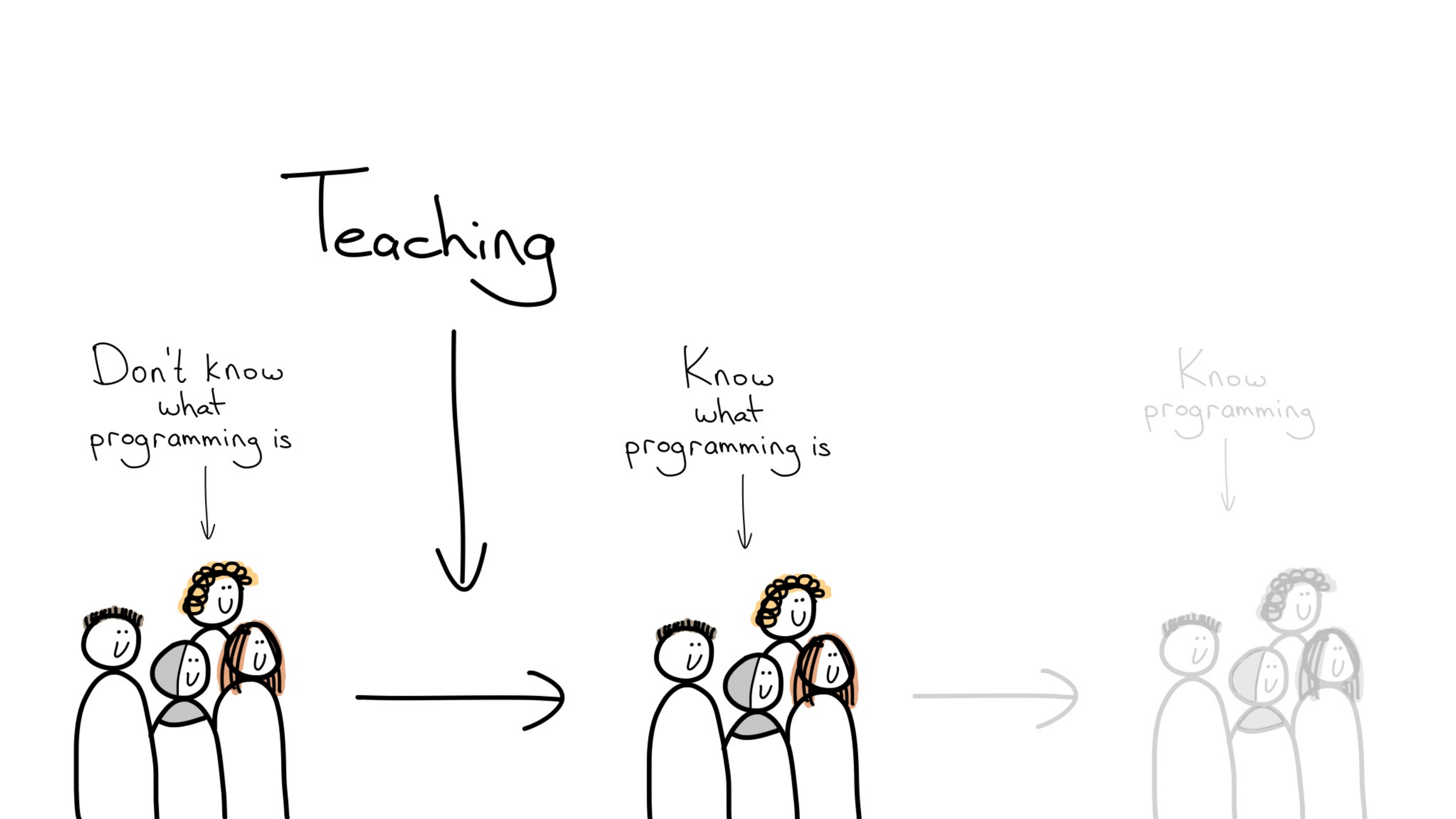


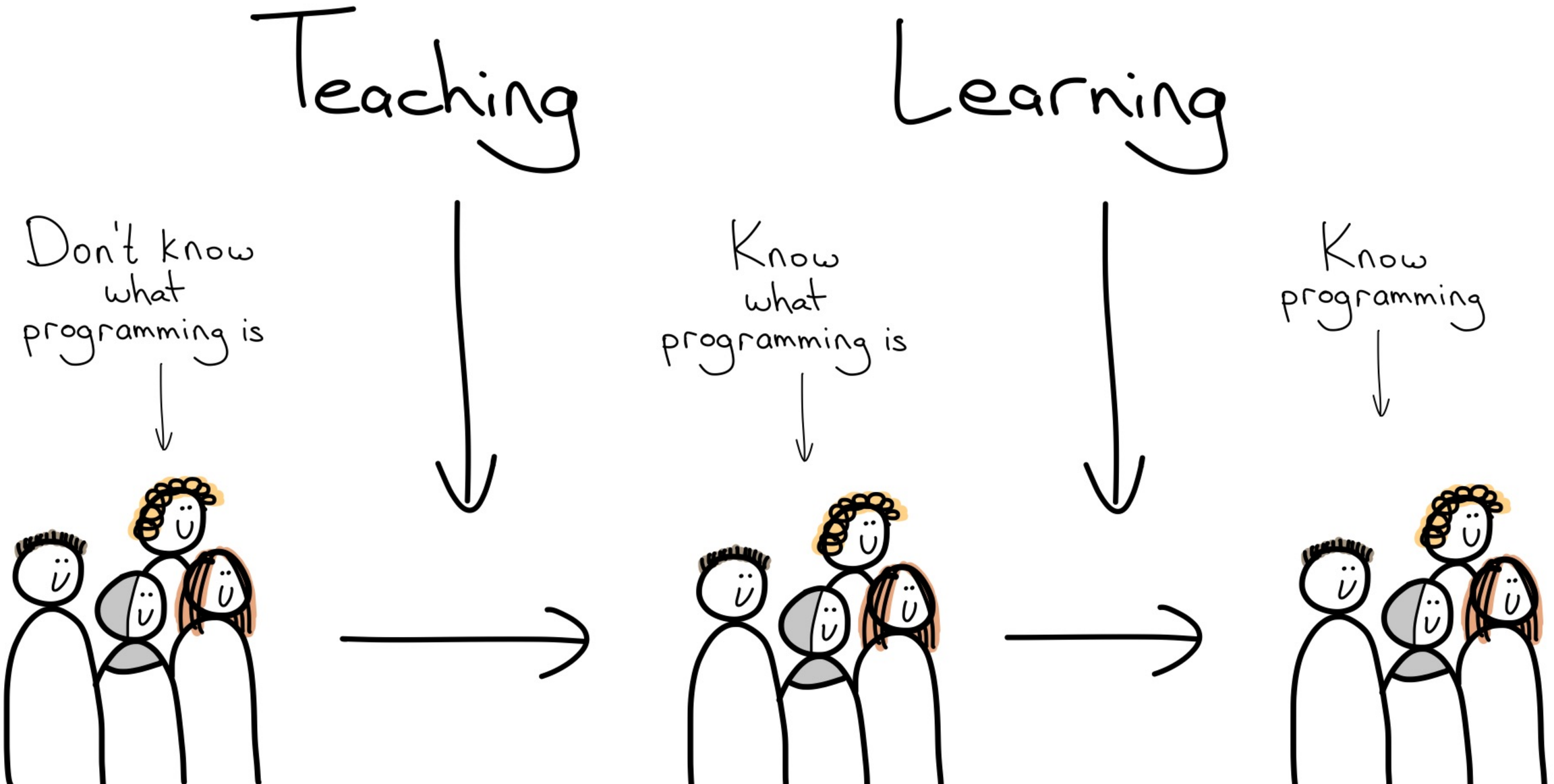
Know what programming is



Know programming

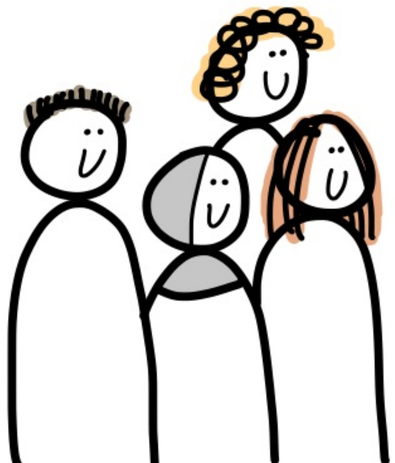



Teaching
Don't know what programming is
Know what programming is
Know programming

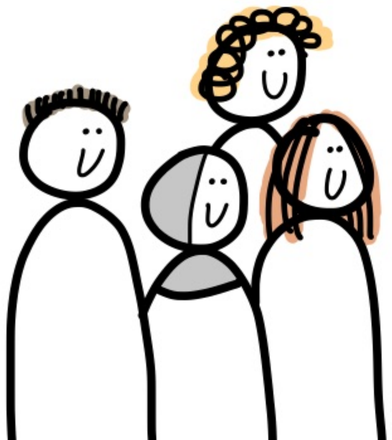

Teaching
Learning
Don't know what programming is
Know what programming is
Know programming

Tools for Teaching ≠ Tools for Learning

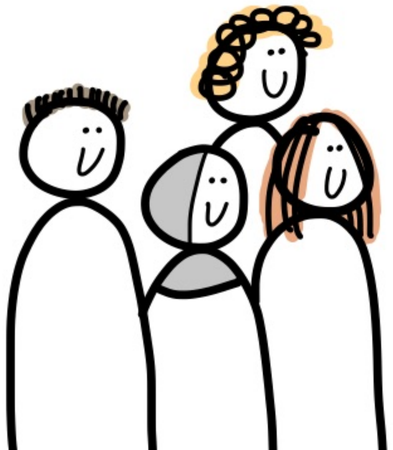
Don't know what programming is



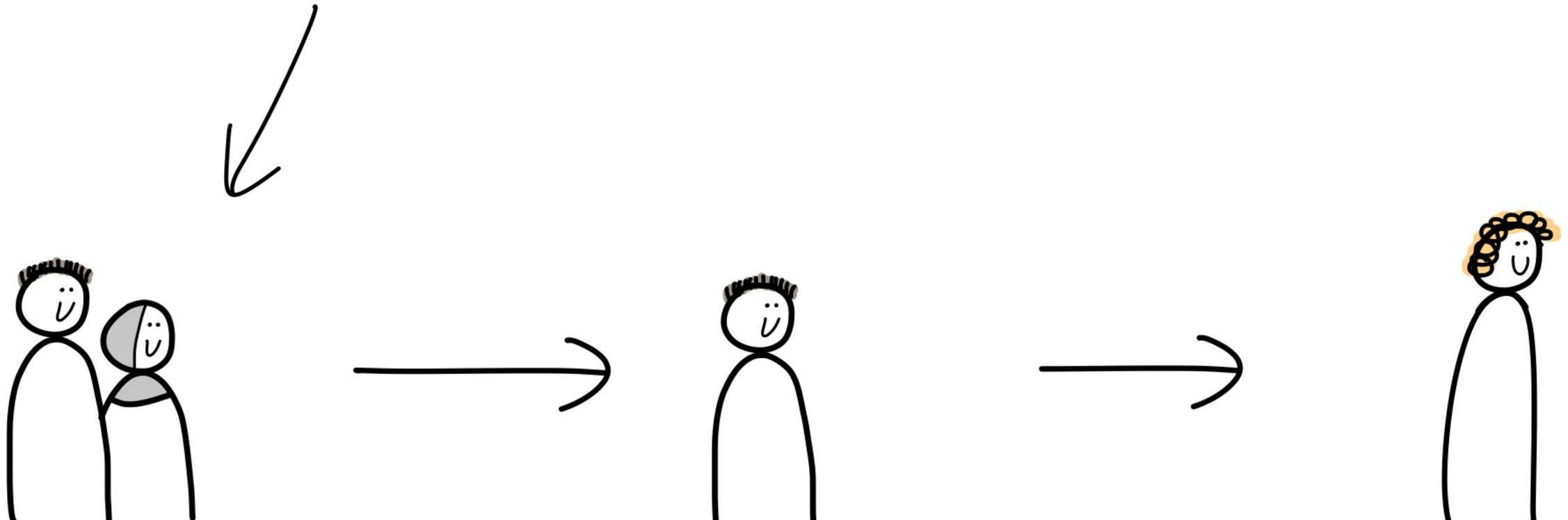
Know what programming is



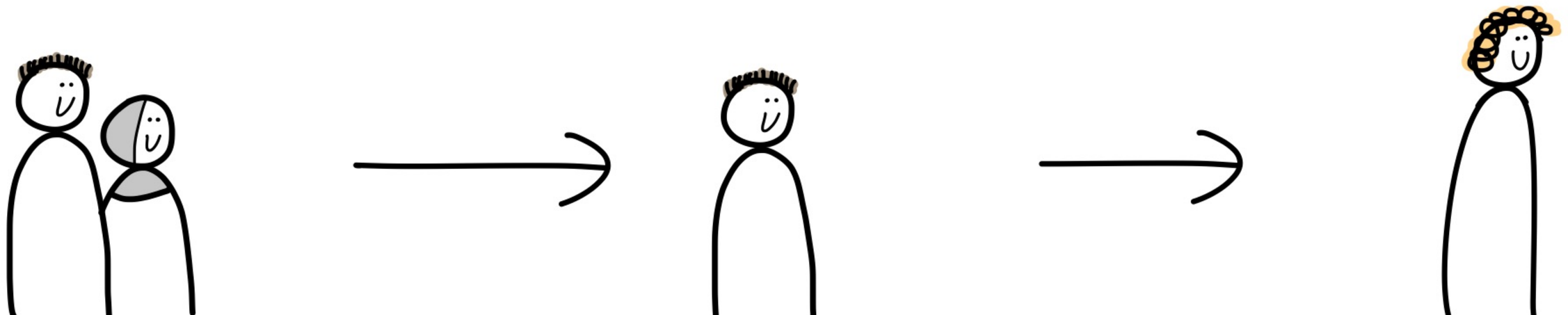
Know programming



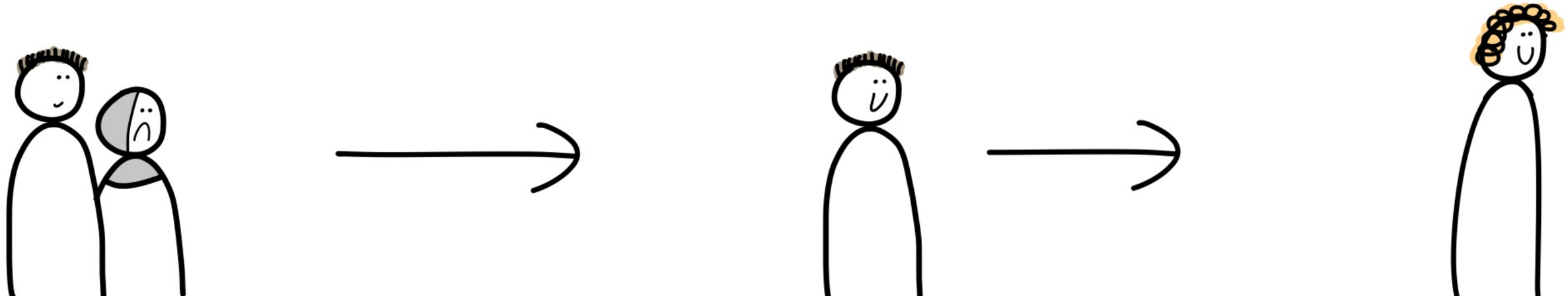
Tools for Teaching

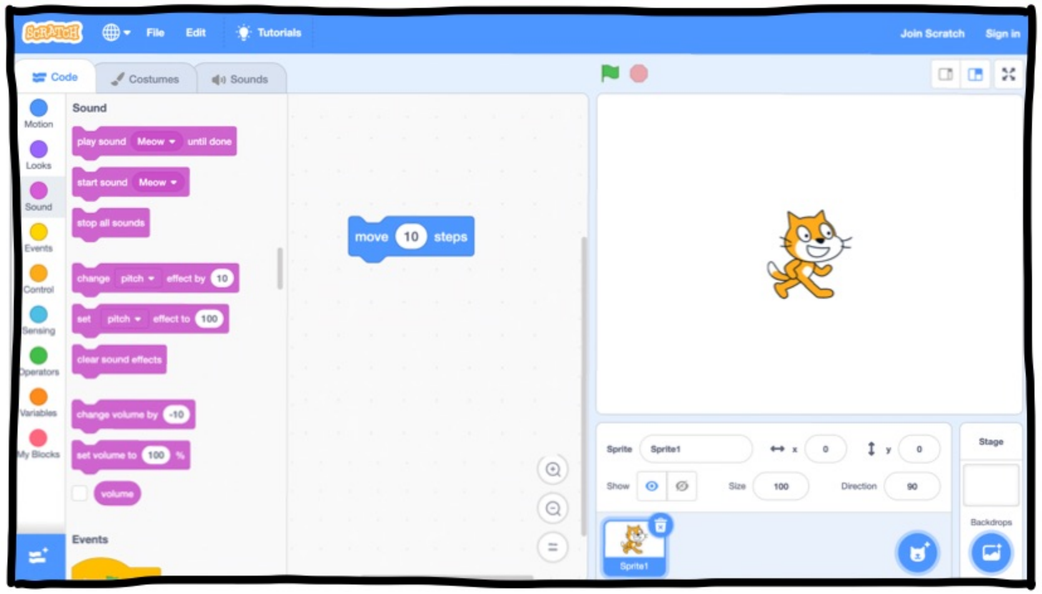


Tools for Learning

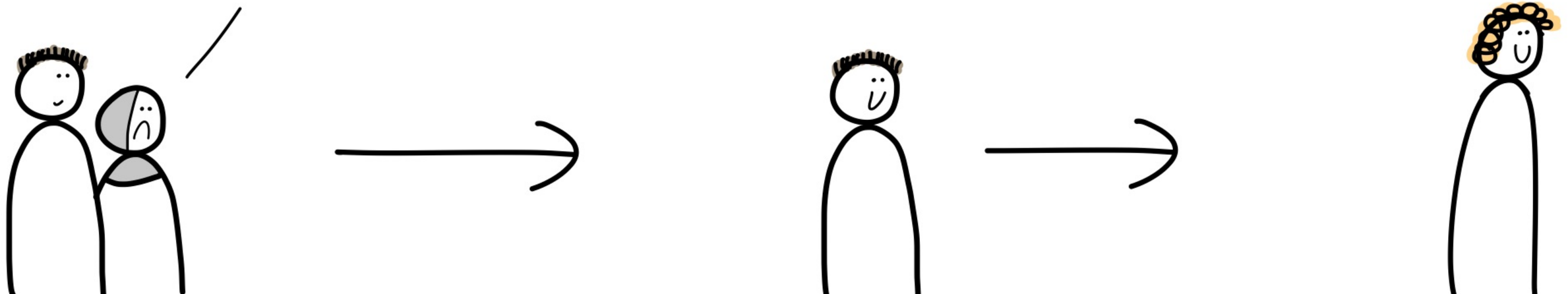


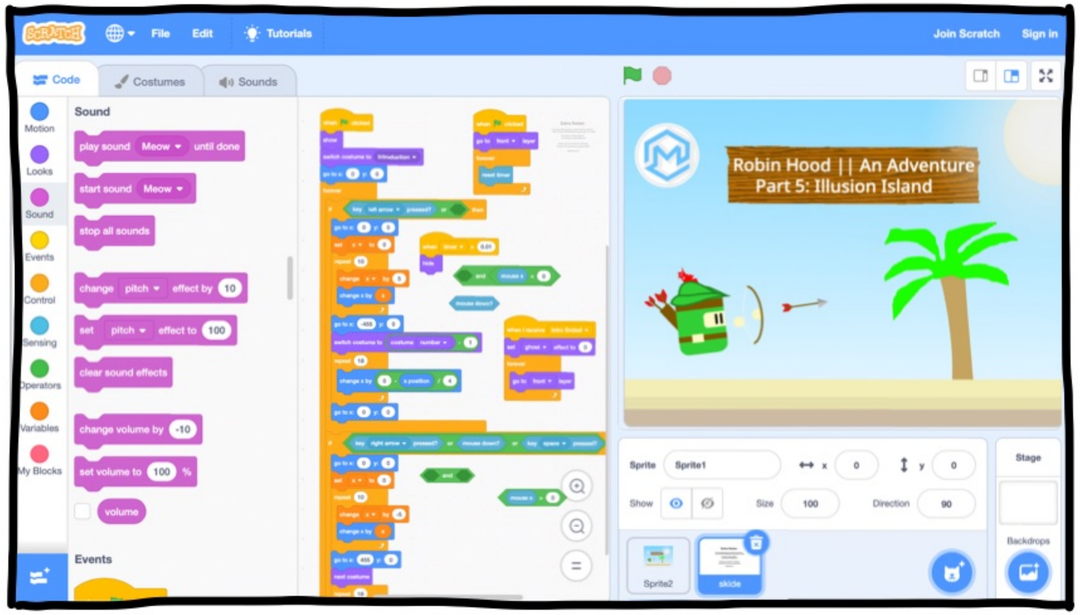
Tools for Learning



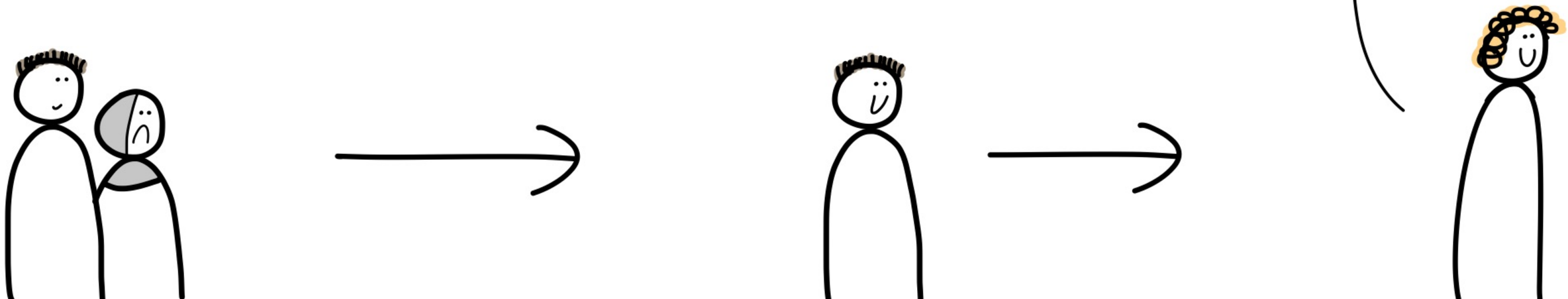

File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
Sound
play sound Meow until done
start sound Meow
stop all sounds
change pitch effect by 10
set pitch effect to 100
clear sound effects
change volume by -10
set volume to 100 %
volume
Events
move 10 steps
Sprite
Sprite1
x 0
y 0
Show
Size 100
Direction 90
Stage
Backdrops

What to do?




File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
play sound Meow until done
start sound Meow
stop all sounds
change pitch effect by 10
set pitch effect to 100
clear sound effects
change volume by -10
set volume to 100 %
volume
Events
Robin Hood || An Adventure
Part 5: Illusion Island
Sprite
Sprite1
Show
Size
100
Direction
90
Stage
Backdrops
Sprite2
skide

I made this!



The print command

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

```
print Hi there, programmer!
print Welcome to Hedy!
```

Exercise

In Hedy you will find exercises in every adventure. An exercise allows you to practise the new commands and concepts, and lets you give your own twist to the example codes. In this exercise you will see a pink blank space. You have to fill something in the place of the blank space before the code can be ran.

Fill in the `print` command in the blank space and then add five more lines of code. Each line has to start with a `print` command. Have fun!

```
_ Hello!
```

```
1 print Hey, programmeur!
2 print Welkom bij Hedy!
3
```

Use the turtle to create a Santa Claus drawing!

Don't forget the turtle code: `forward` and `turn`

Use this code to get started

```
forward 10
turn left
```





Run code

Turtle

Puzzle

Read aloud:

Programmer's mode

Level 1

print 1

This level is locked

Level 2

Level 3

Level 4

Level 5

Level 6

Level 7

Level 8

Level 9

Level 10

Level 11

Level 12

Level 13

Level 14

Level 15

Level 16

Level 17

rtle | Draw Santa | Puzzle | Quiz

mmand

o the screen using the `print` command.

d exercises in every adventure. An exercise allows you to practise the
d concepts, and lets you give your own twist to the example codes. In
ill see a pink blank space. You have to fill something in the place of the
the code can be ran.

command in the blank space and then add five more lines of code. Each
h a `print` command. Have fun!

```
print Hi there, programmer!
print Welcome to Hedy!
```

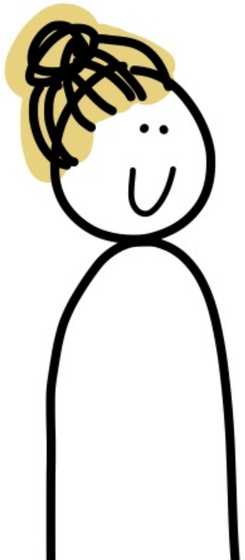
```
Hello!
```

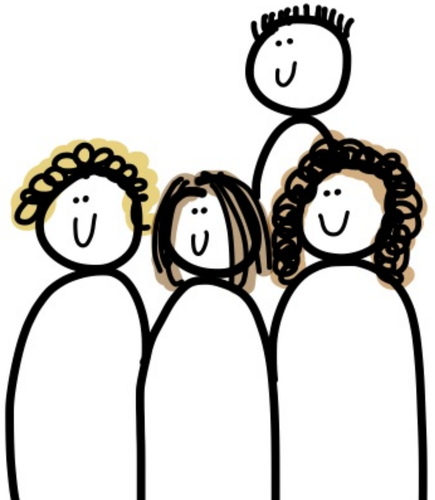
```
rogrammeur!
bij Hedy!
```

Run code

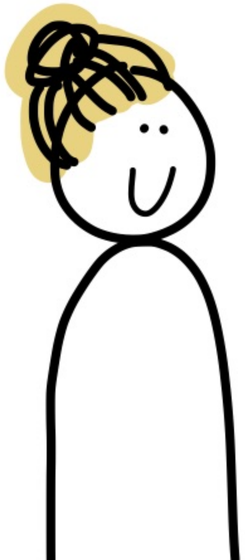
ask

How to make Hedy better?

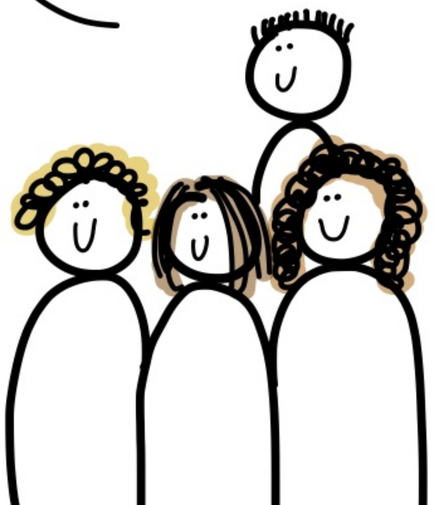




How to make Hedy better?



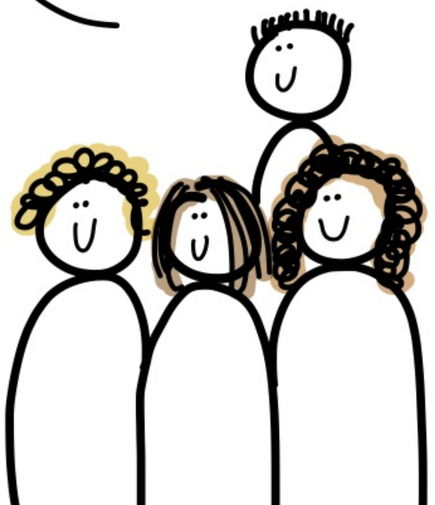
Hedy in Dutch!



Really?

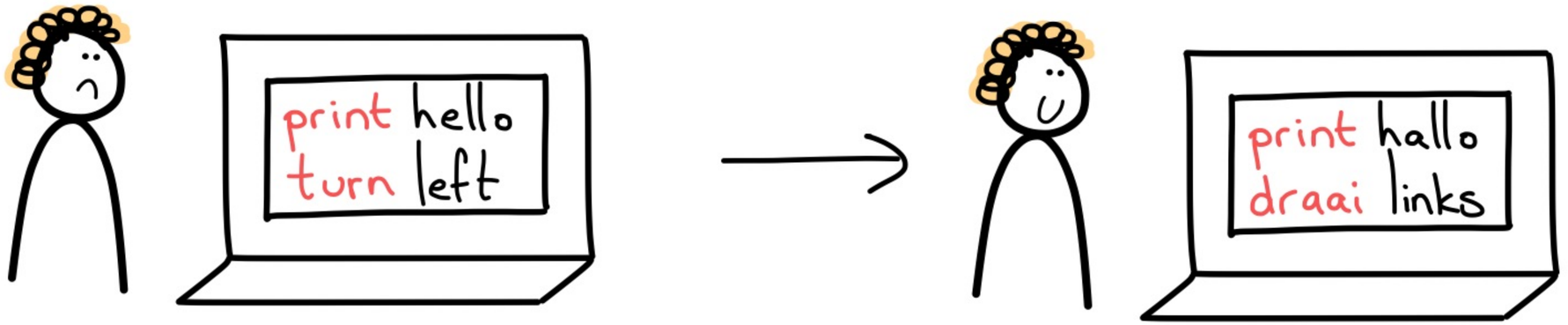


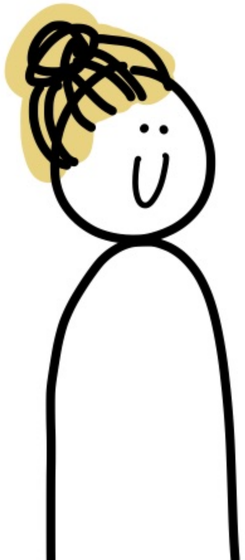
Hedy in Dutch!

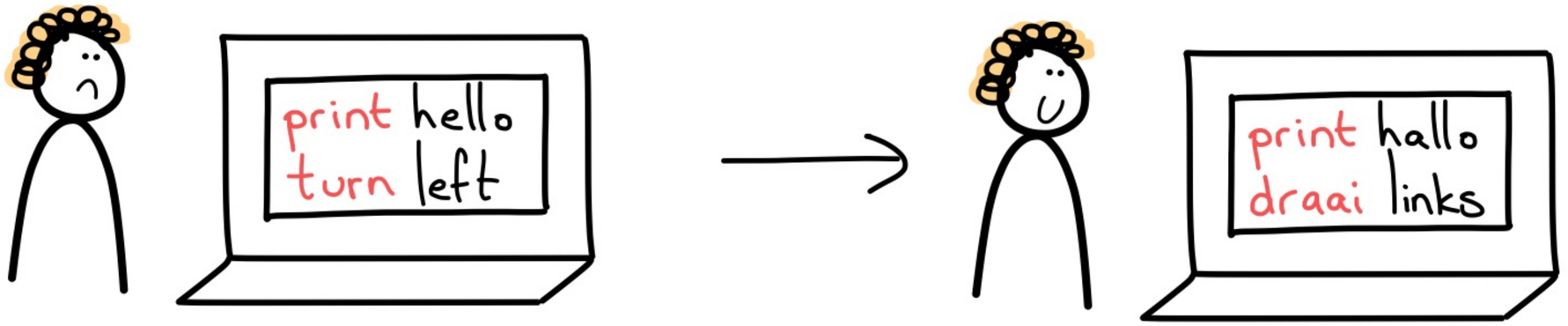


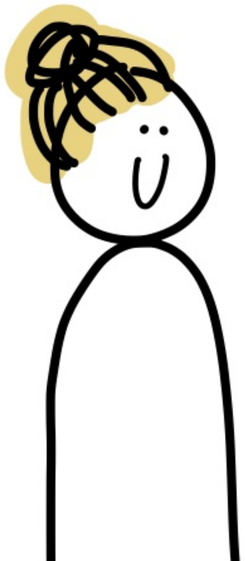

Looks good to me!
turn 10


Looks good to me!
turn 10
döndür 10
?
sväng 10


print hello
turn left
print hallo
draai links





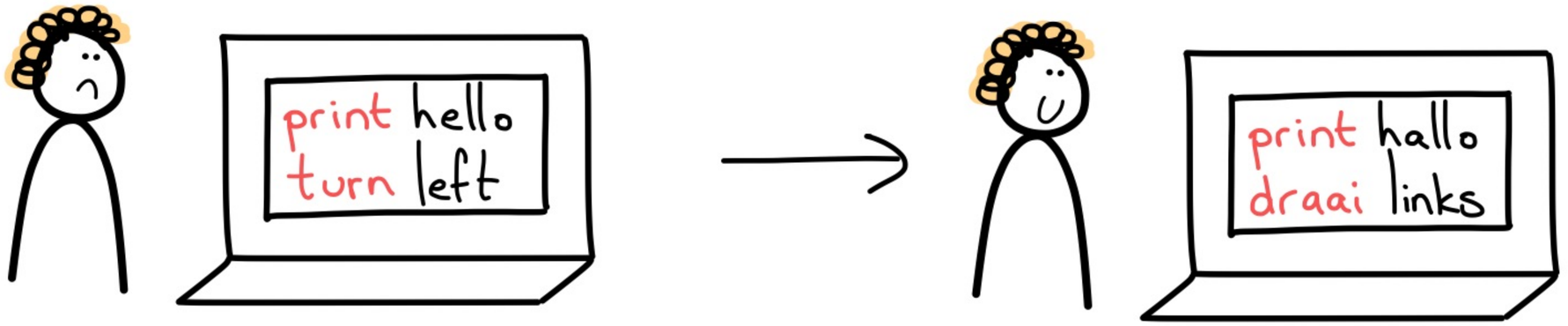


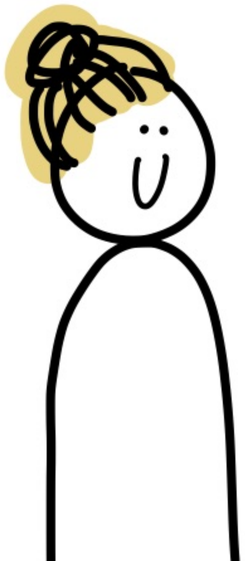
Hedy

```
print hello
draai 120
```

Syntax

```
print letters
turn cijfers
```





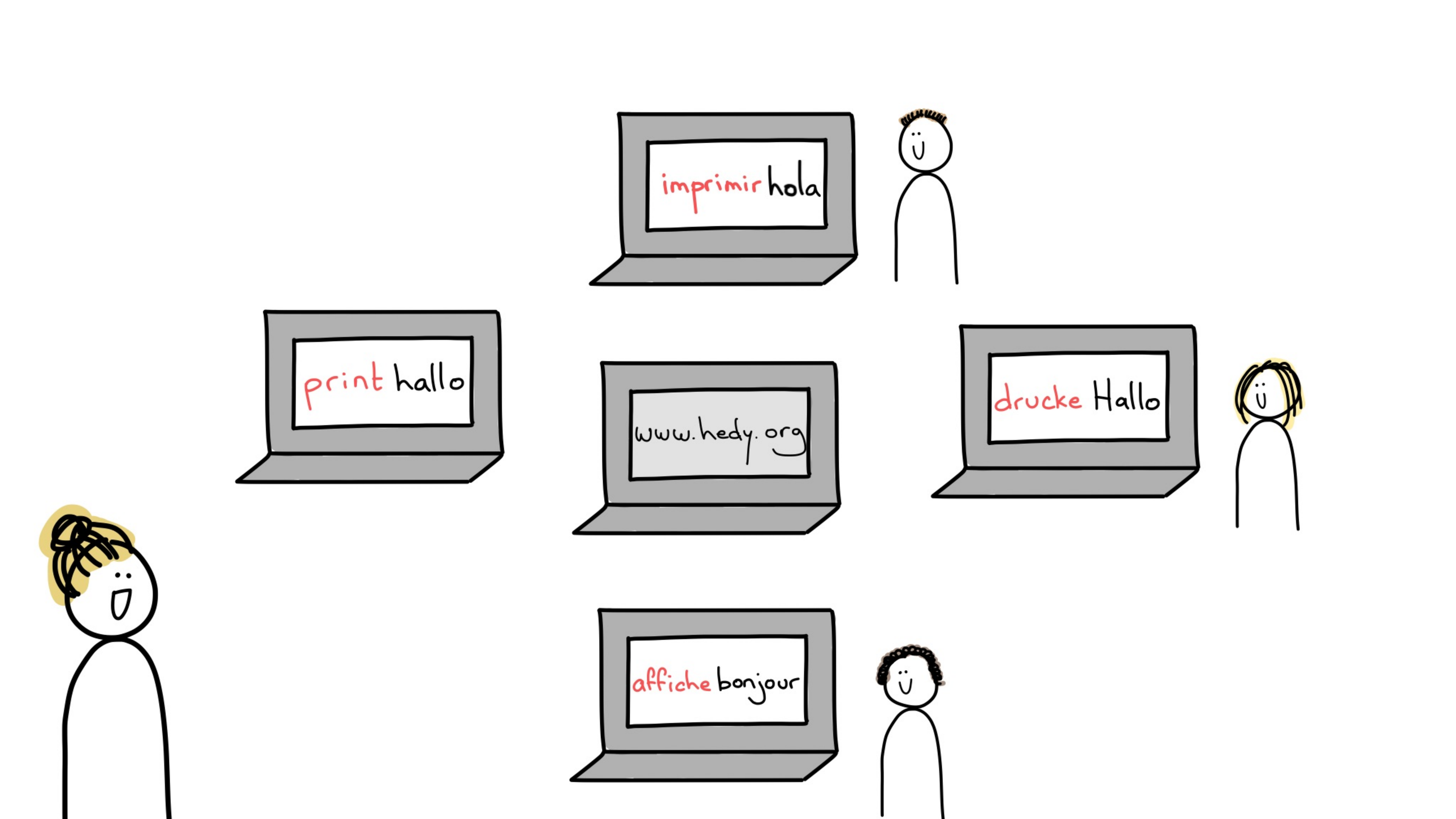
Hedy

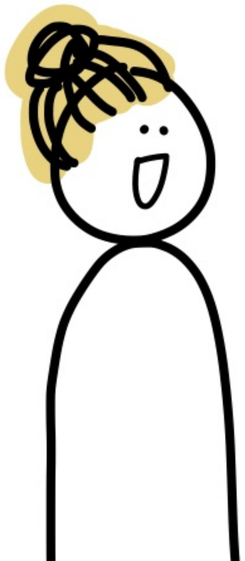
```
print hello
draai 120
```

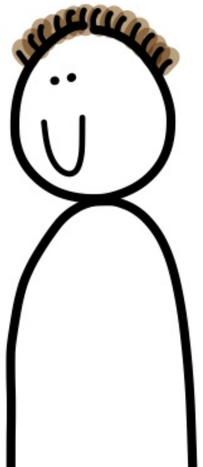
Syntax

```
print letters
draai cijfers
```

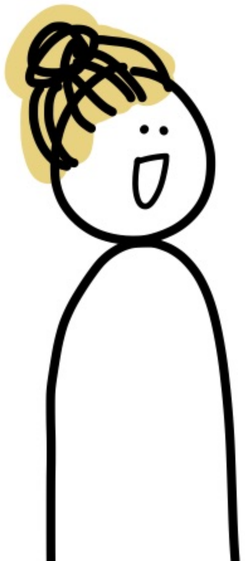

print hallo
www.hedy.org

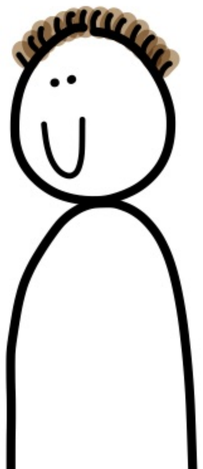

imprimir hola
print hallo
www.hedy.org
drucke Hallo
affiche bonjour



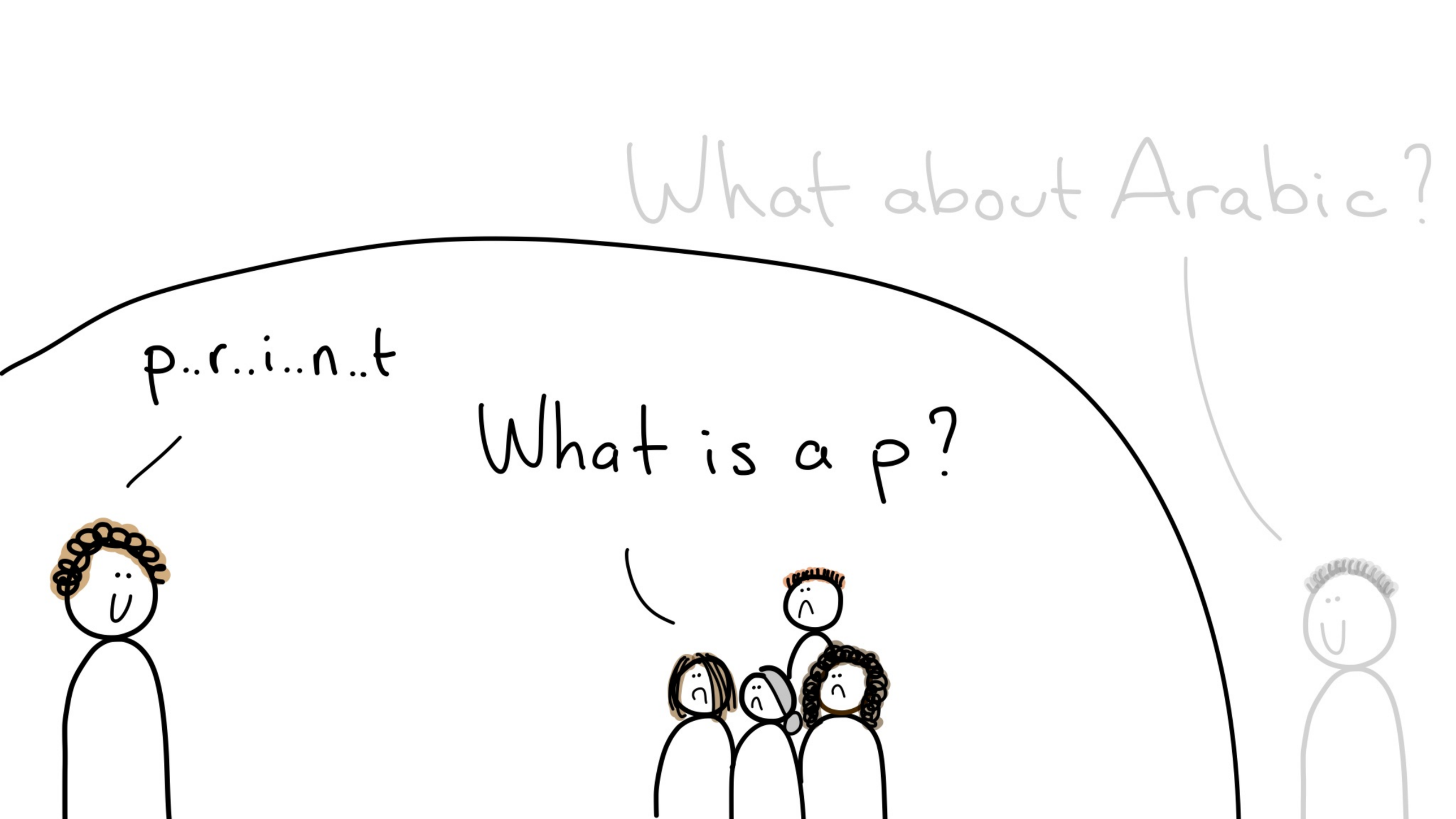


What about Arabic?

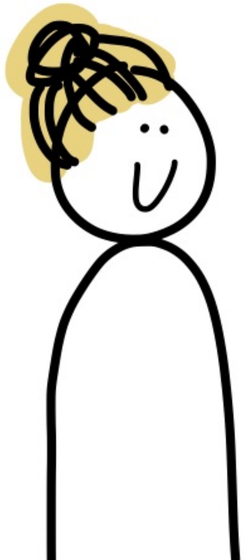




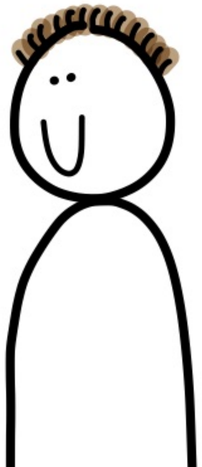

What about Arabic?
p..r..i..n..t

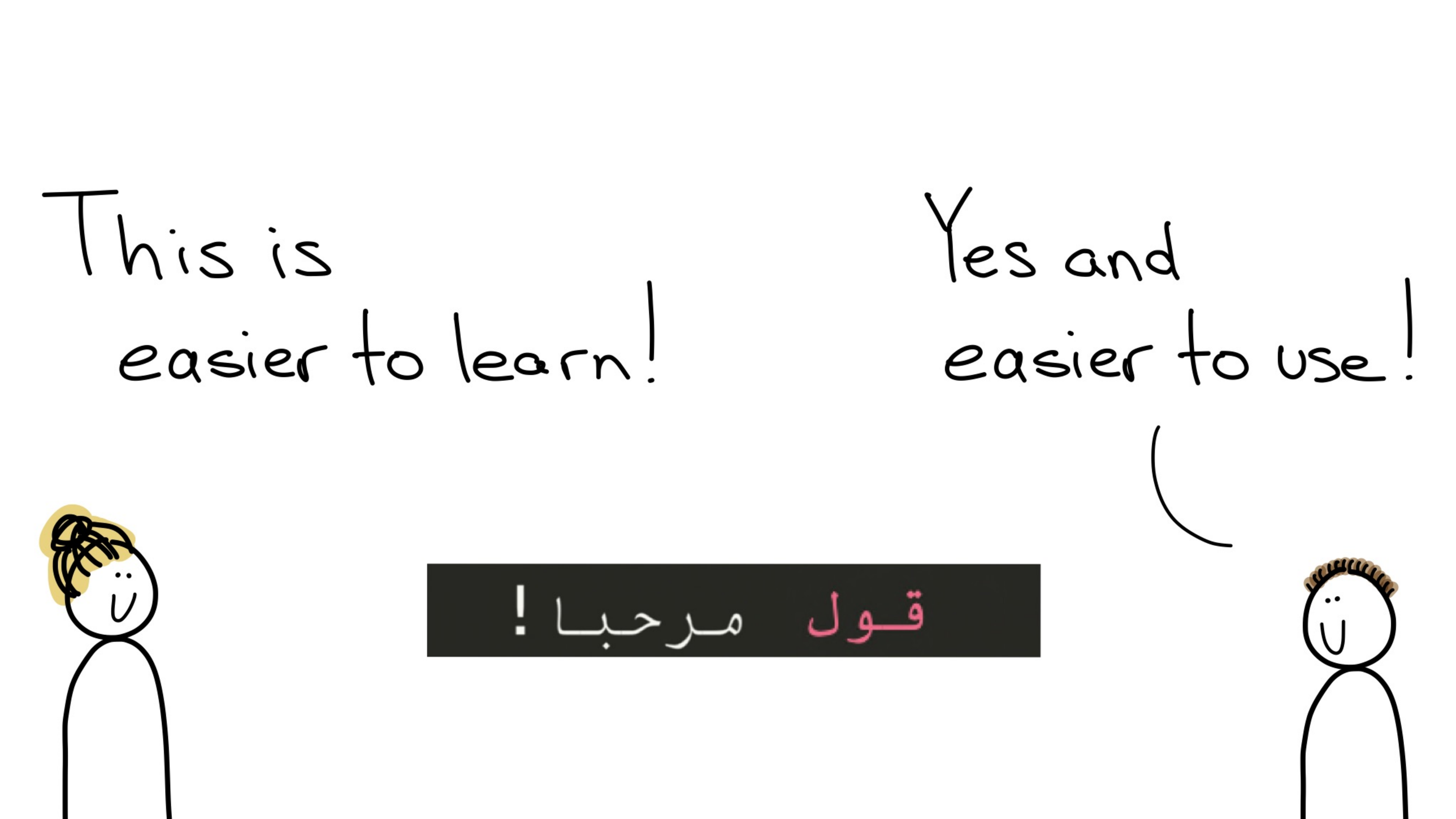

What about Arabic?
p..r..i..n..t
What is a p?

This is
easier to learn!



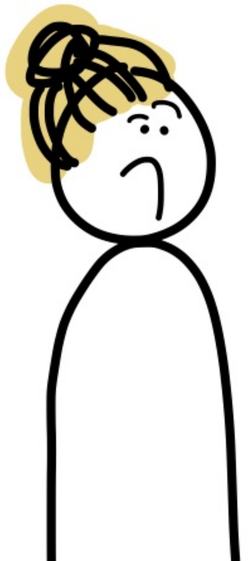
قـول مـرحبـا !



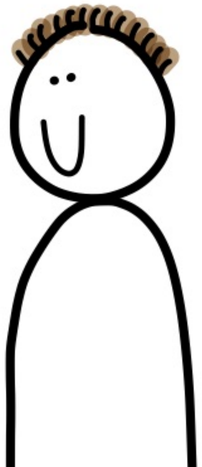

This is
easier to learn!
Yes and
easier to use!
قـول مـرحبـا !

This is
easier to use ?

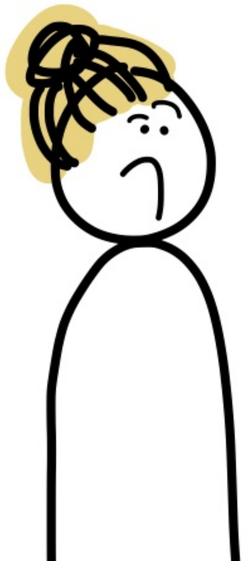
Yes and
easier to use !



قـول مـرحبـا !

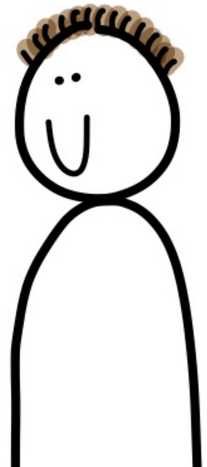


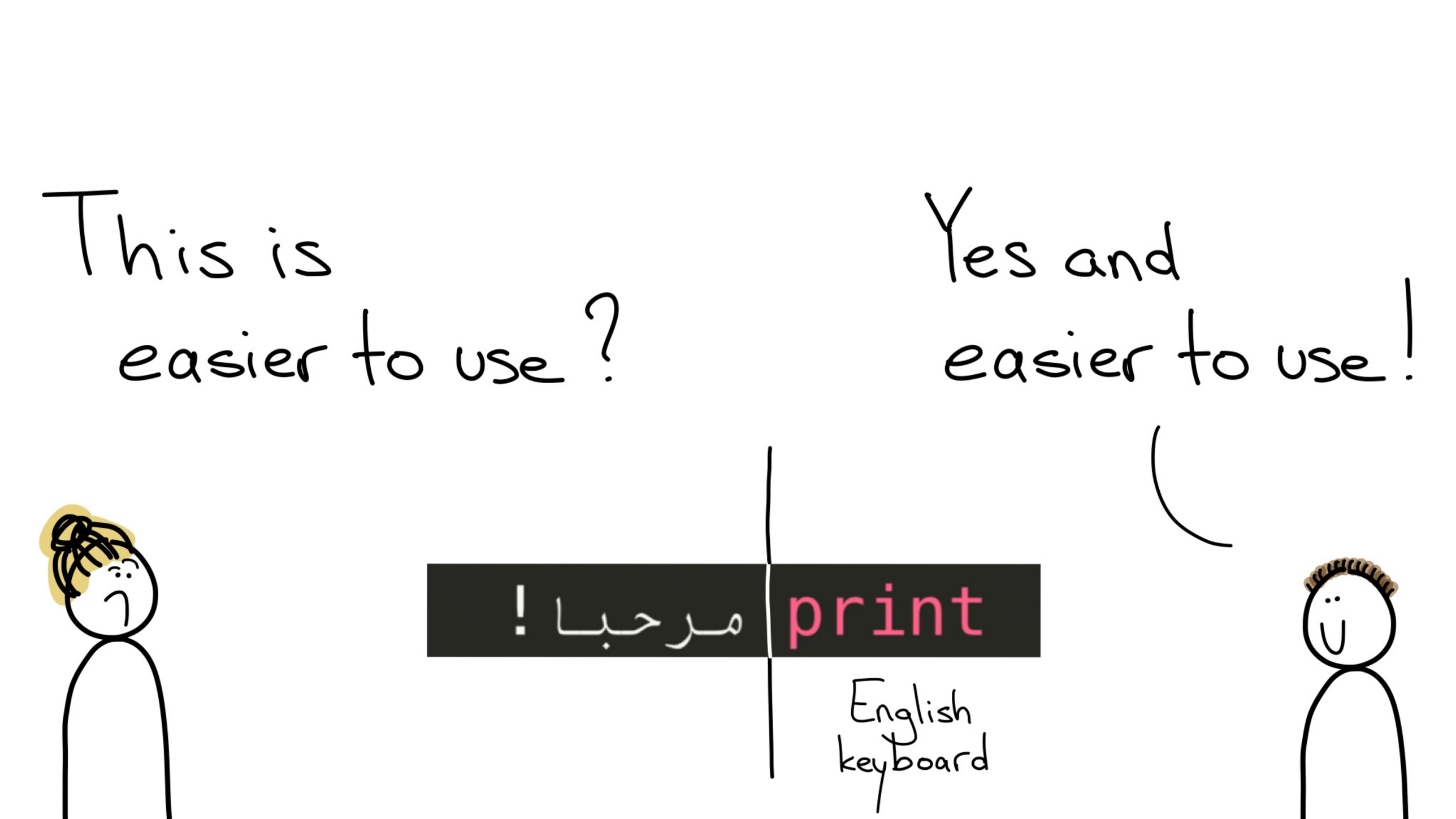
This is
easier to use?

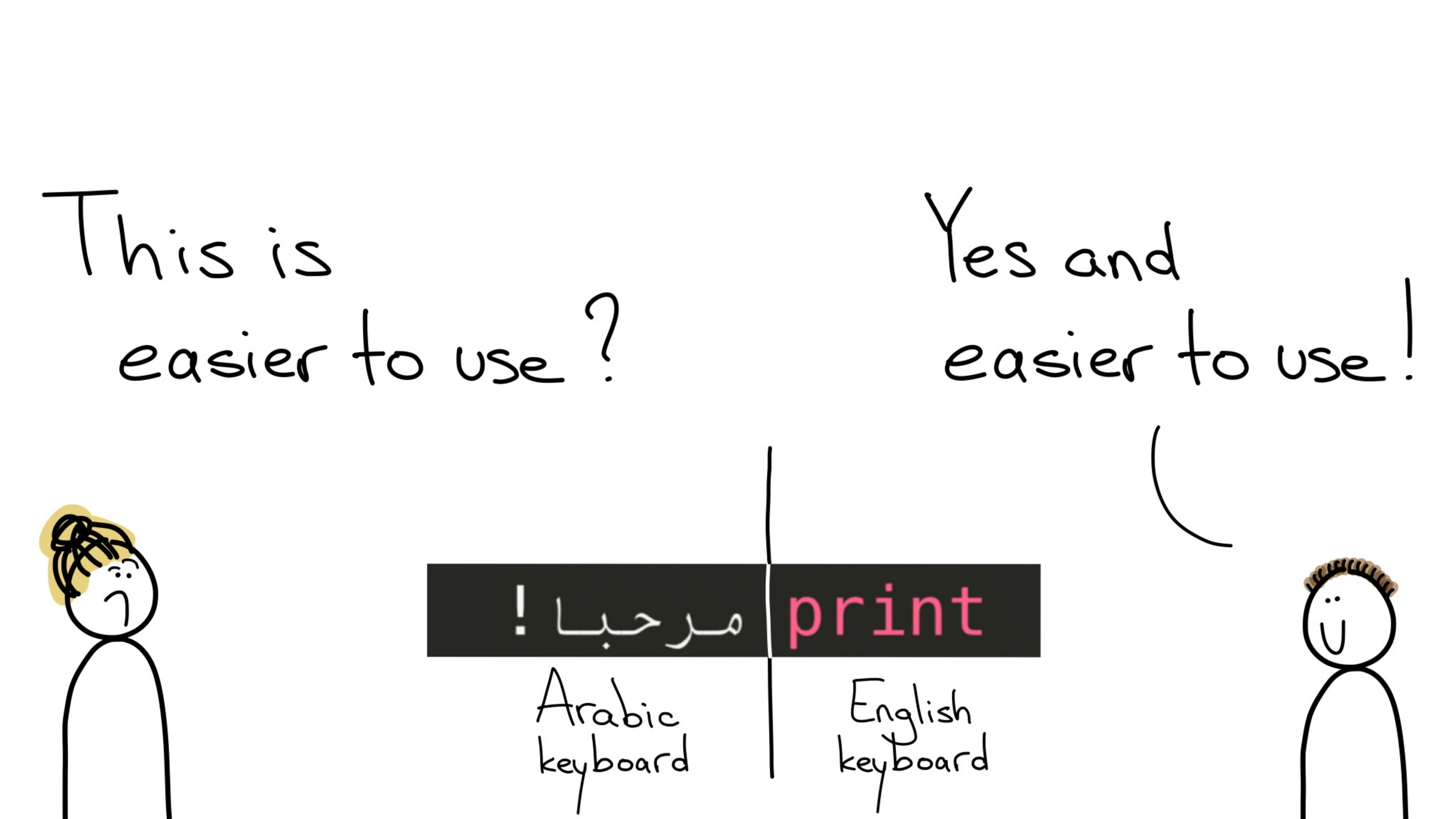


```
print مرحبا!
```

Yes and
easier to use!

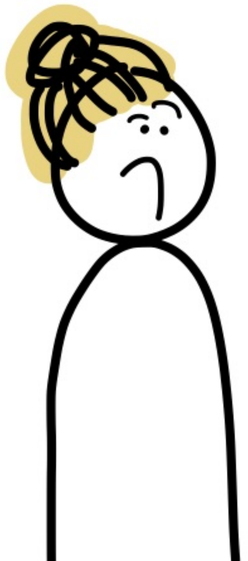



This is easier to use ?
Yes and easier to use !
print
مرحبا !
English keyboard

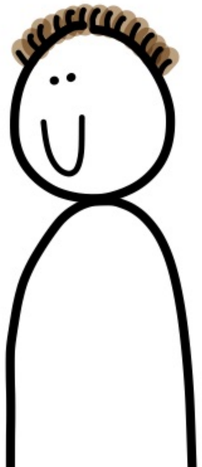

This is easier to use ?
Yes and easier to use !
print
مرحبا !
Arabic keyboard
English keyboard

This is
easier to use?

Yes and
easier to use!



```
if اسمك is هيدي print "واو هذا رائع!"
```



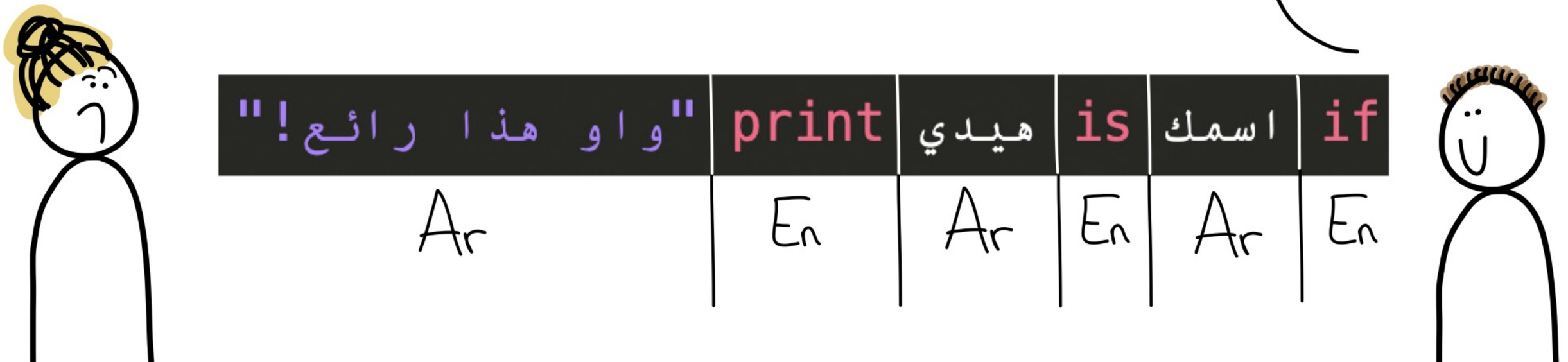
This is
easier to use ?

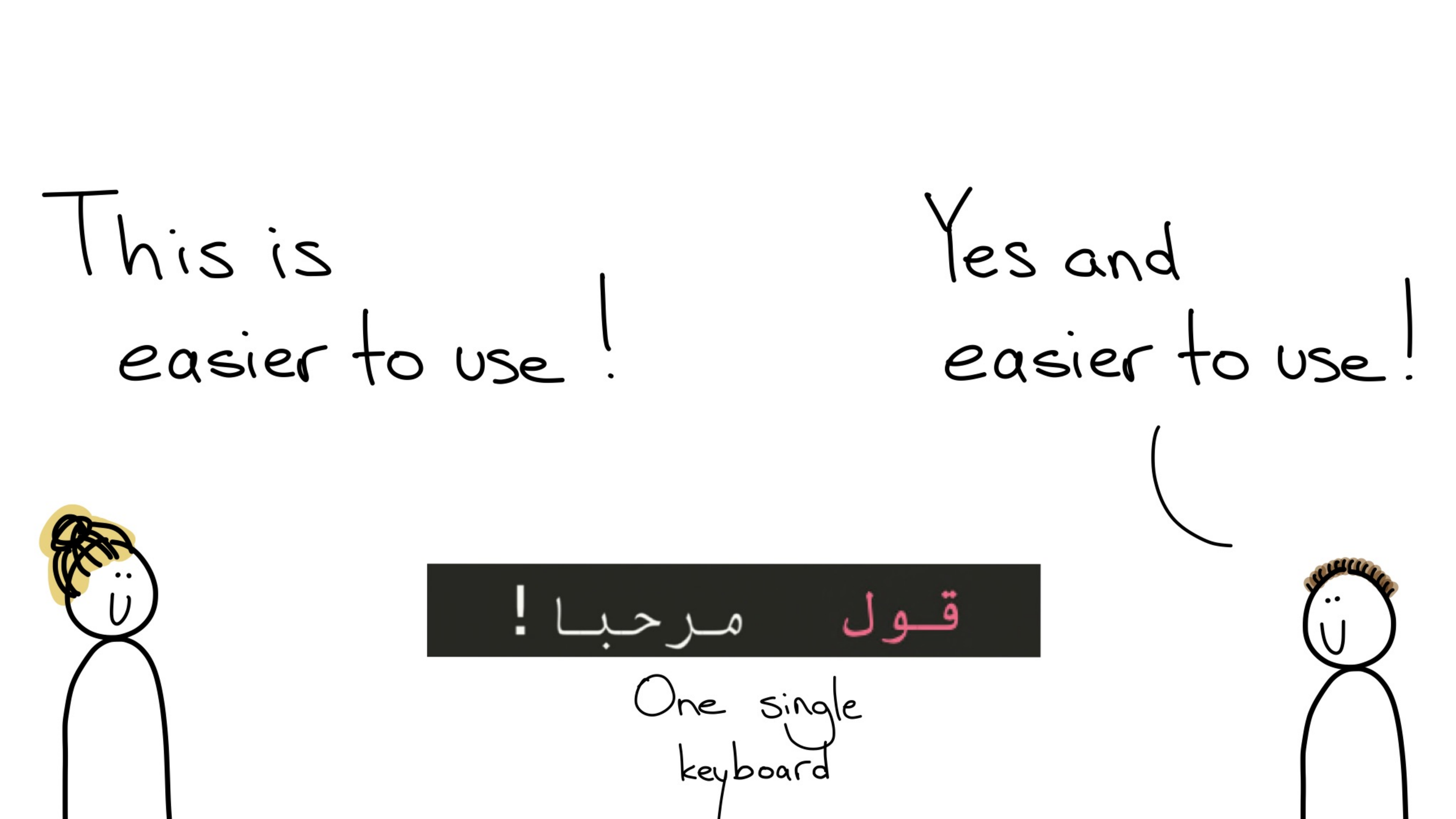
Yes and
easier to use !



This is easier to use?

Yes and easier to use!



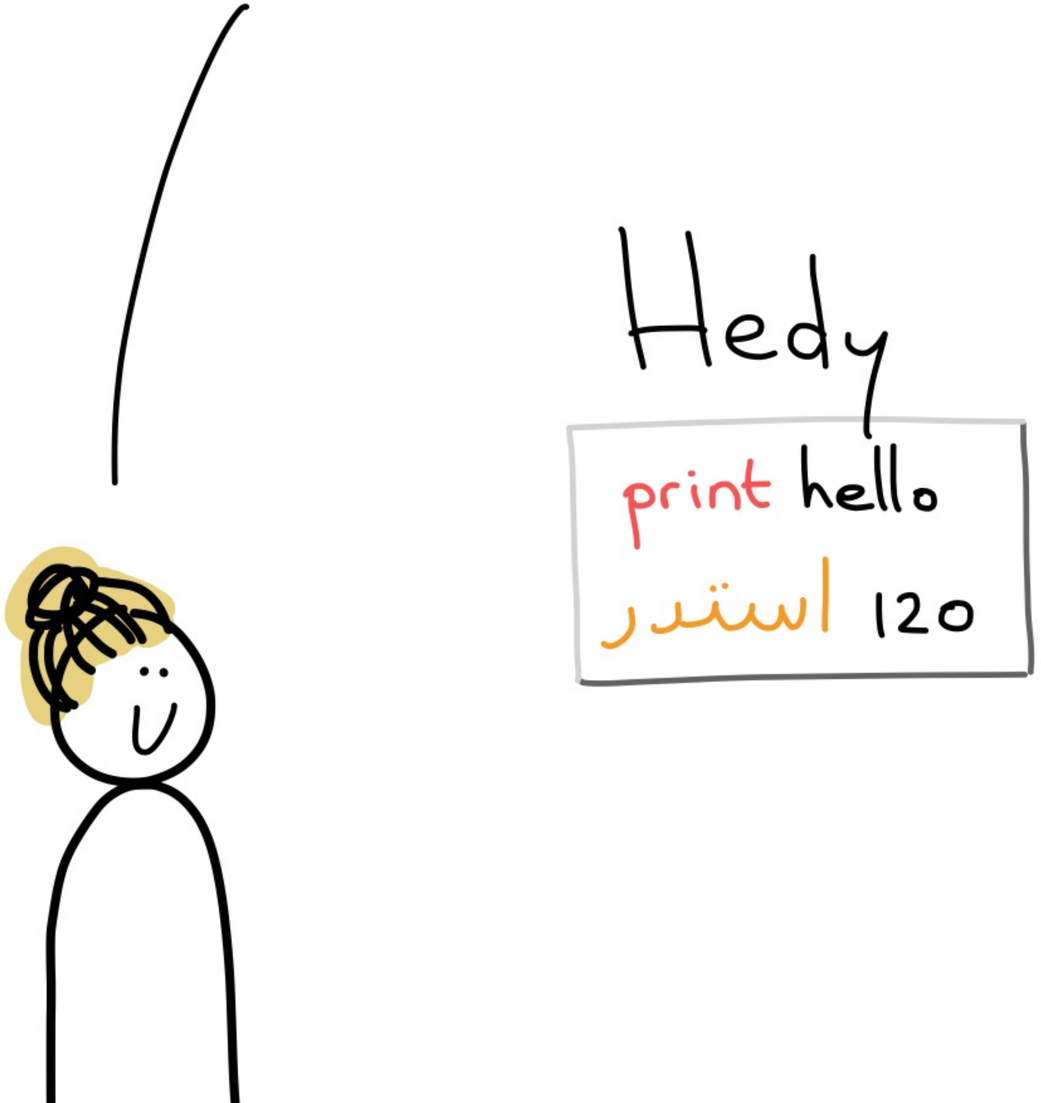

This is easier to use !
Yes and easier to use !
قـول مـرحبـا !
One single keyboard


Argument in favor of local keywords
قـول مـرحبـا !
One single keyboard

Arabic letters?



Arabic letters!



Arabic letters!



Hedy

```
print hello
استدر 120
```



Syntax

```
print letters
turn digits
```

Arabic letters!



Hedy

```
print hello
استدر 120
```



Syntax

```
print letters
استدر
turn digits
```

Arabic letters !



```
1
2  استدر 90
3  تقدم 100
4  استدر 90
5  تقدم 100
6
```

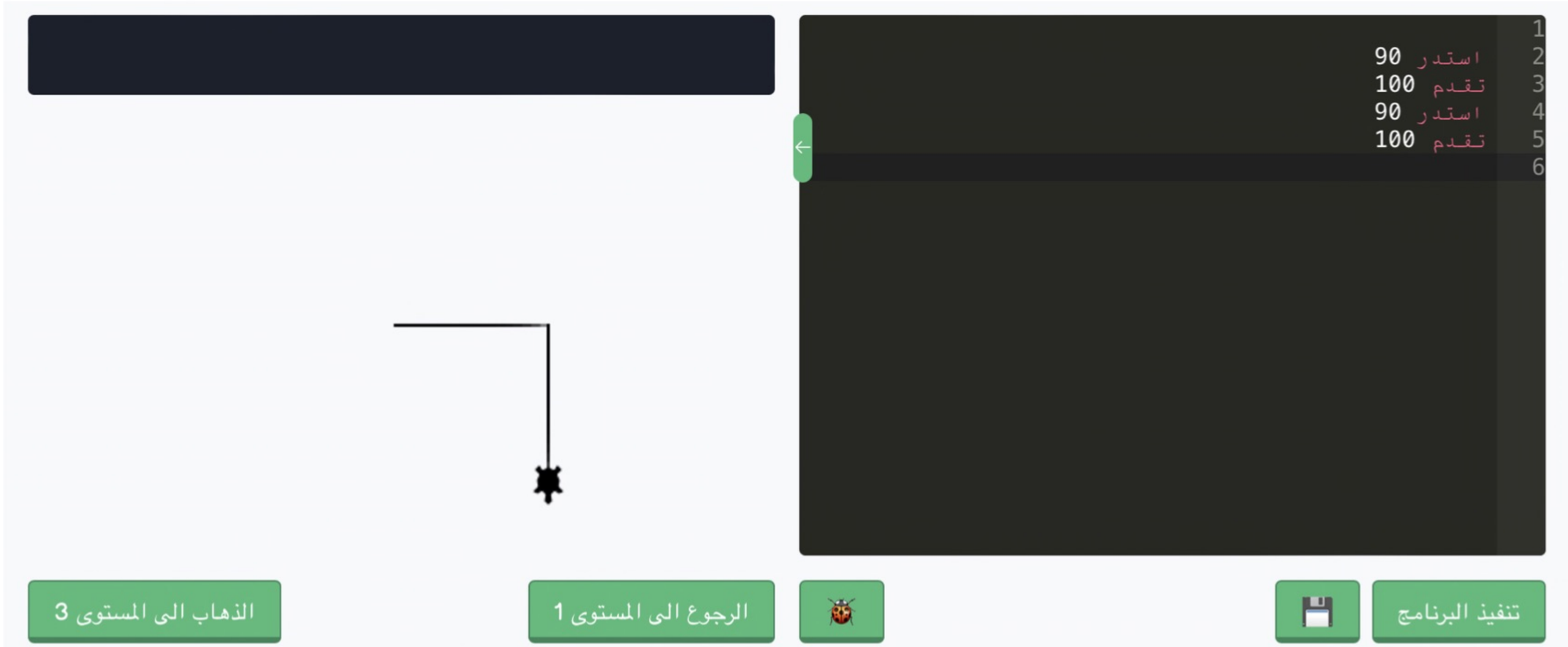
تنفيذ البرنامج

الرجوع الى المستوى 1

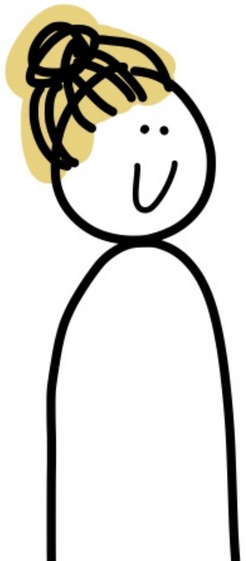
الذهاب الى المستوى 3

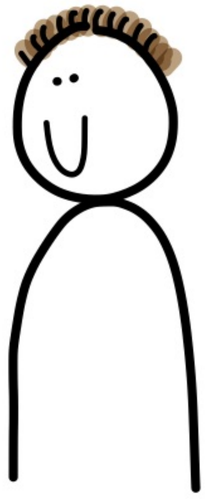
Arabic letters !





Can we add Arabic numerals?

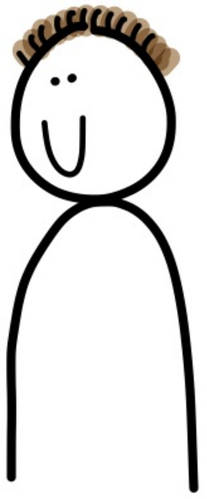




Can we add Arabic numerals?

0 1 2 3 4 5 6 7 8 9

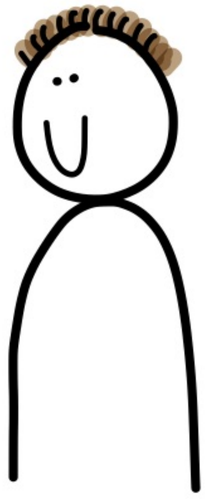


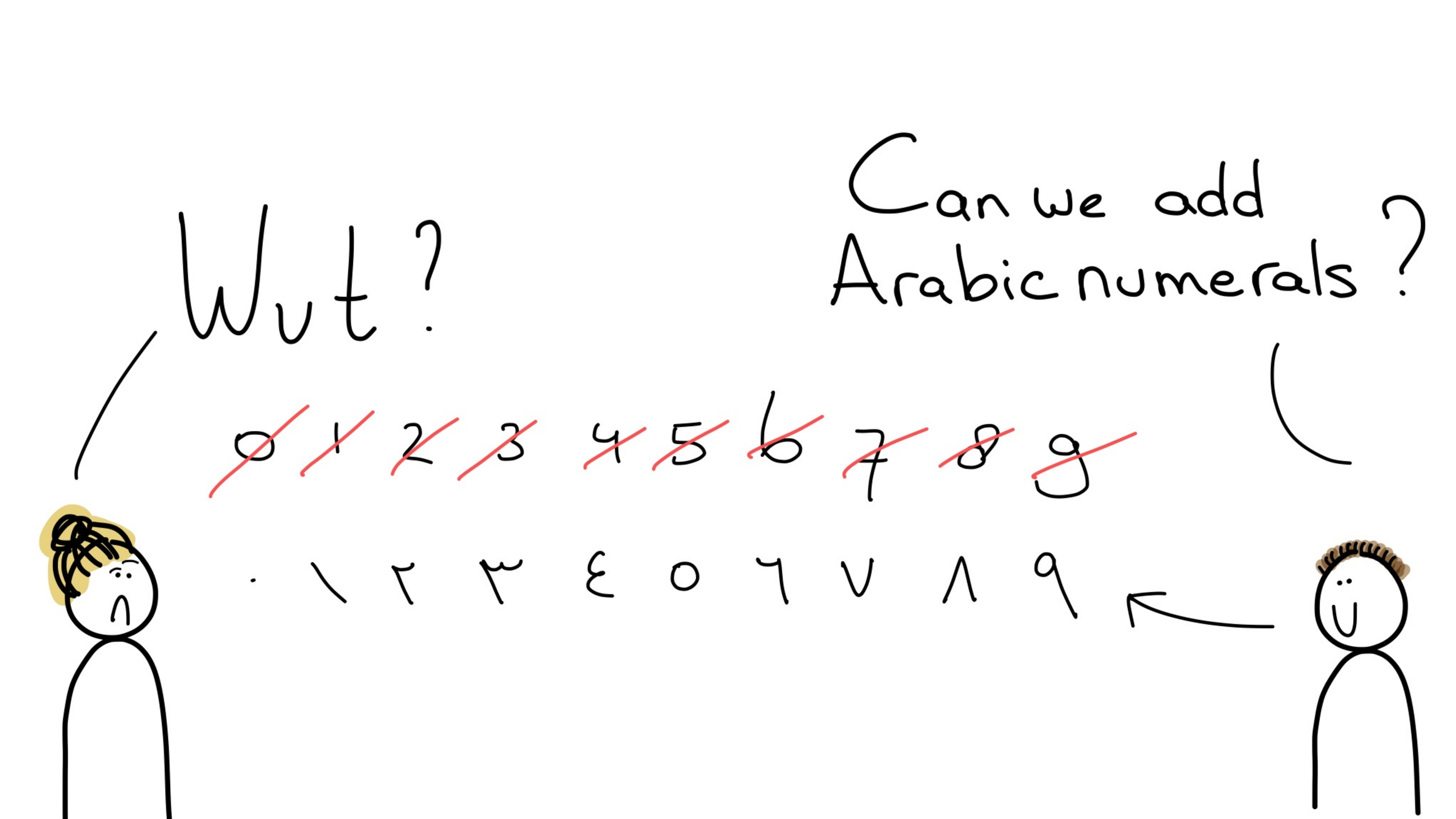


Can we add Arabic numerals?

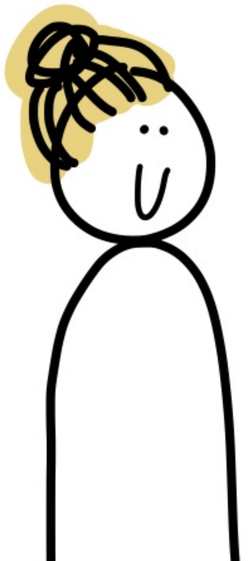
~~٠~~ ١ ~~٢~~ ~~٣~~ ٤ ~~٥~~ ~~٦~~ ٧ ~~٨~~ ~~٩~~



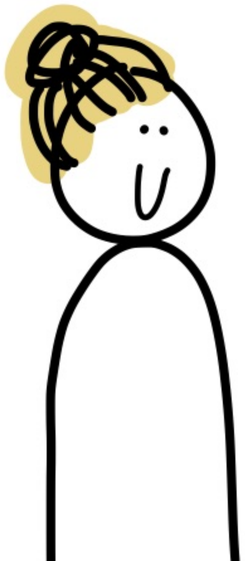


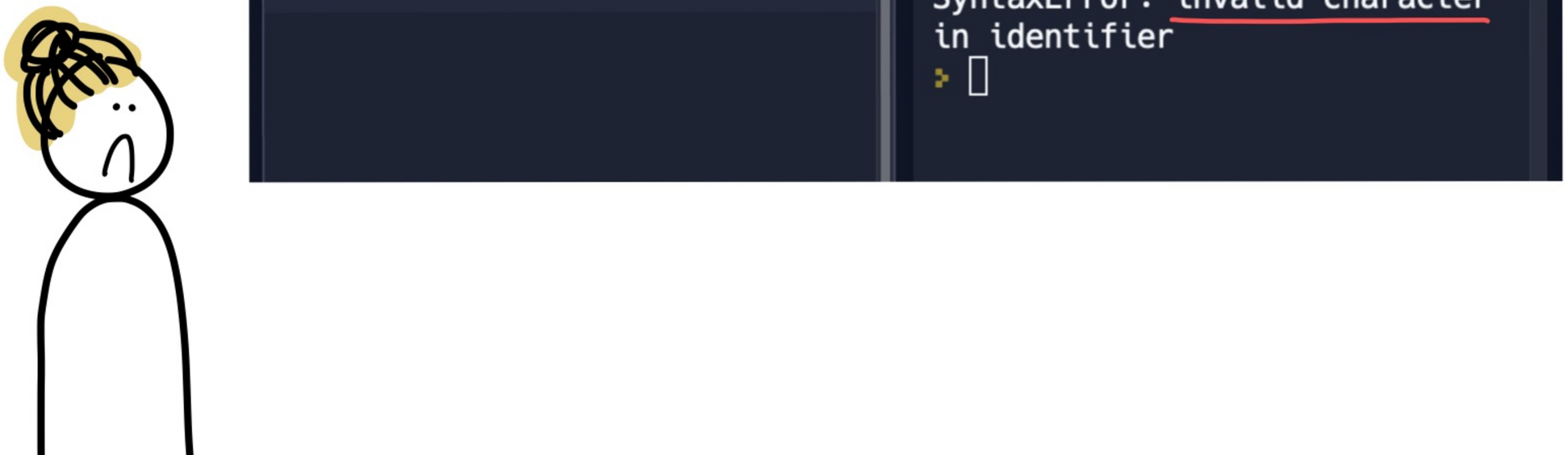

Wut?
Can we add Arabic numerals?
٠ ١ ٢ ٣ ٤ ٥ ٦ ٧ ٨ ٩


main.py
Console
Shell
main.py
1 print(2+9)
2
11

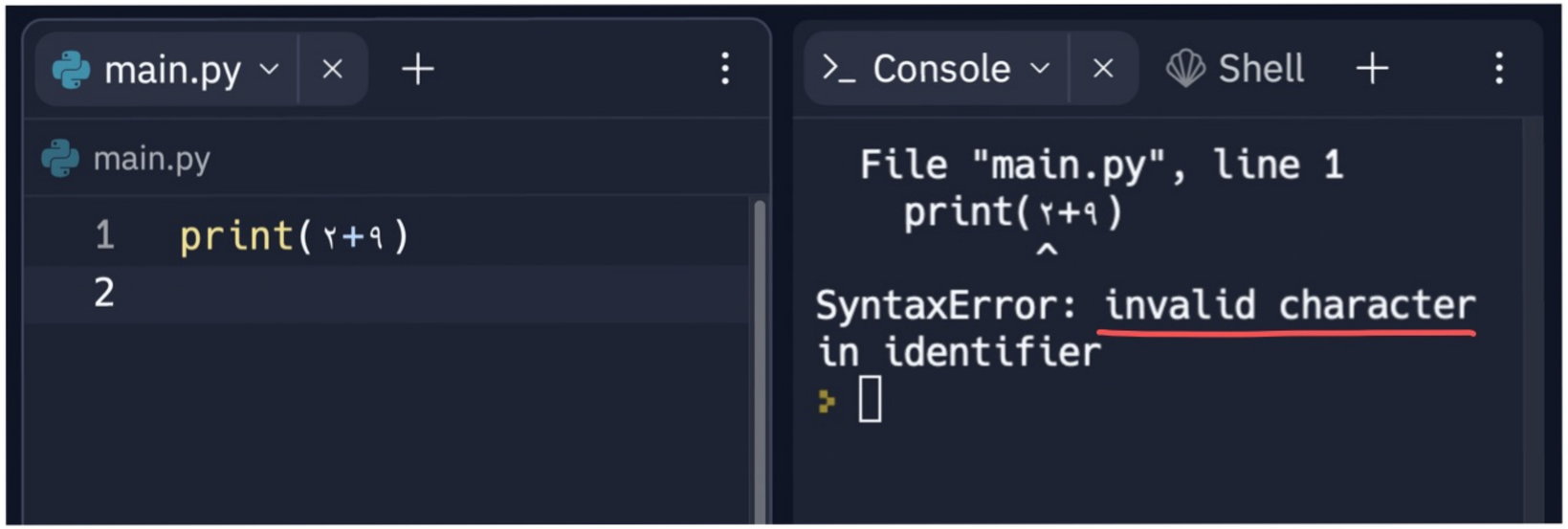



main.py
Console
Shell
main.py
1 print(۲+۹)
2
11

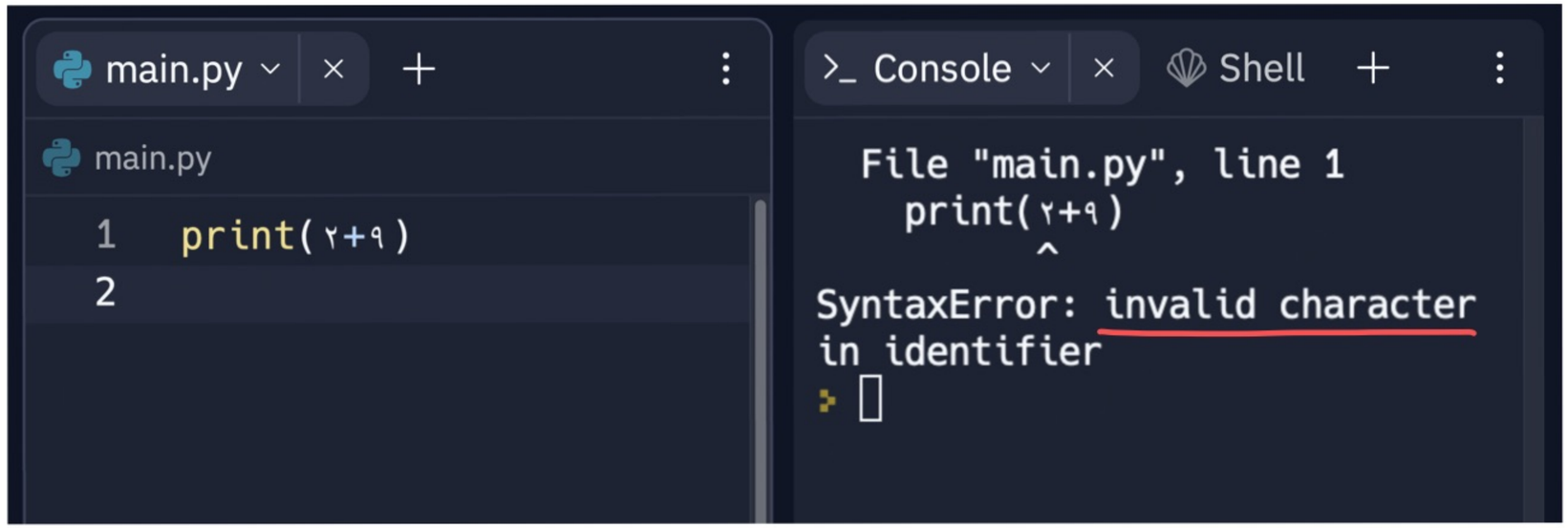



main.py
main.py
1 print(٢+٩)
2
Console
Shell
File "main.py", line 1
print(٢+٩)
^
SyntaxError: invalid character
in identifier

Miranda Fricker



This is epistemic injustice



main.c - Arabic_numerals_c -

replit.com/@Felienne/Arabicnumeralsc#main.c

Finish update

Arabic_numerals_c

Deploy

main.c

```
1  #include <stdio.h>
2
3  int main(void) {
4    printf(٩+٢);
5    return 0;
6  }
```

2. C

Console

Shell

Run 676ms on 12:22:00, 10/24

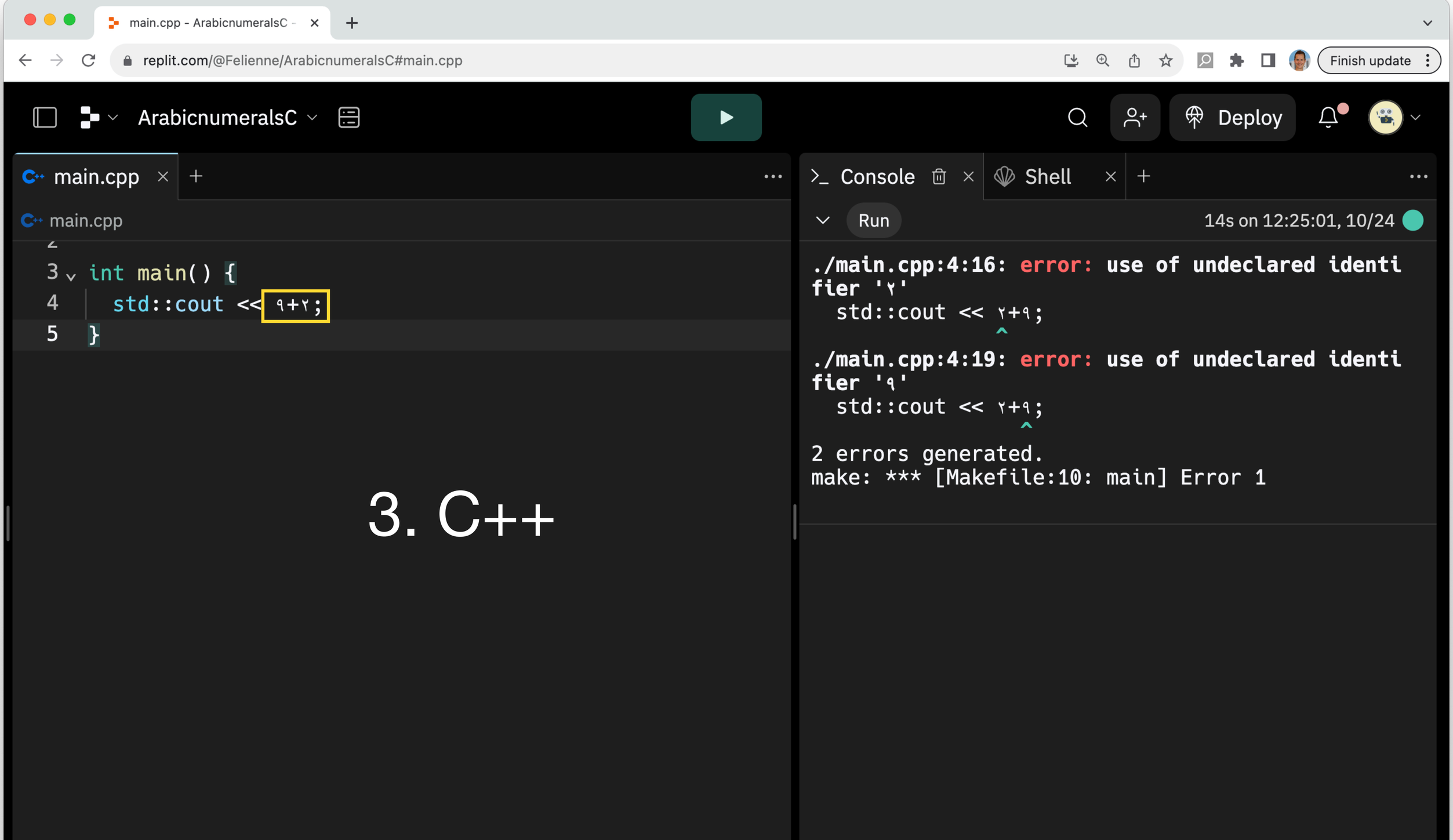
```
٢+٩
```

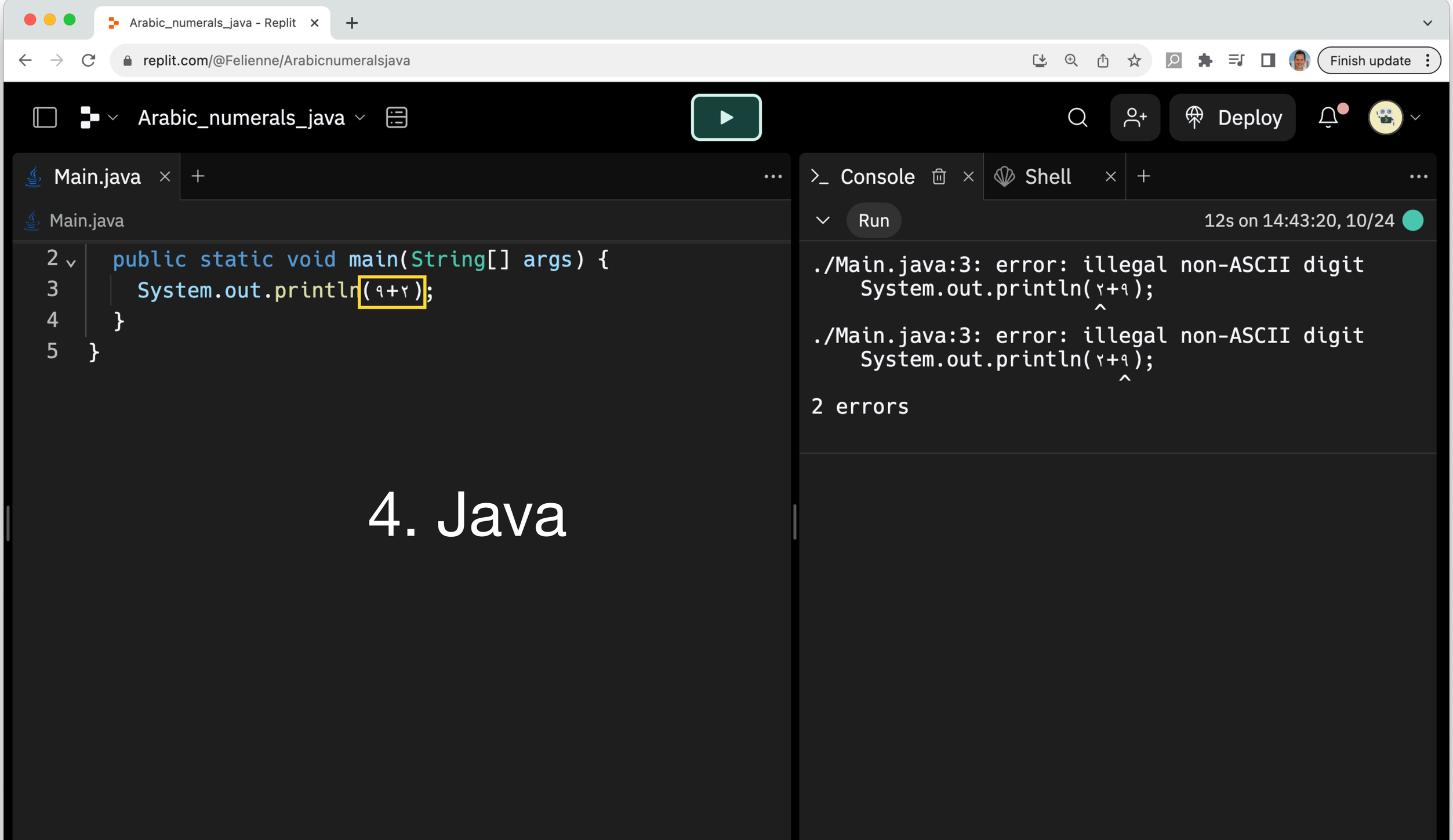
Run 15s on 12:22:07, 10/24

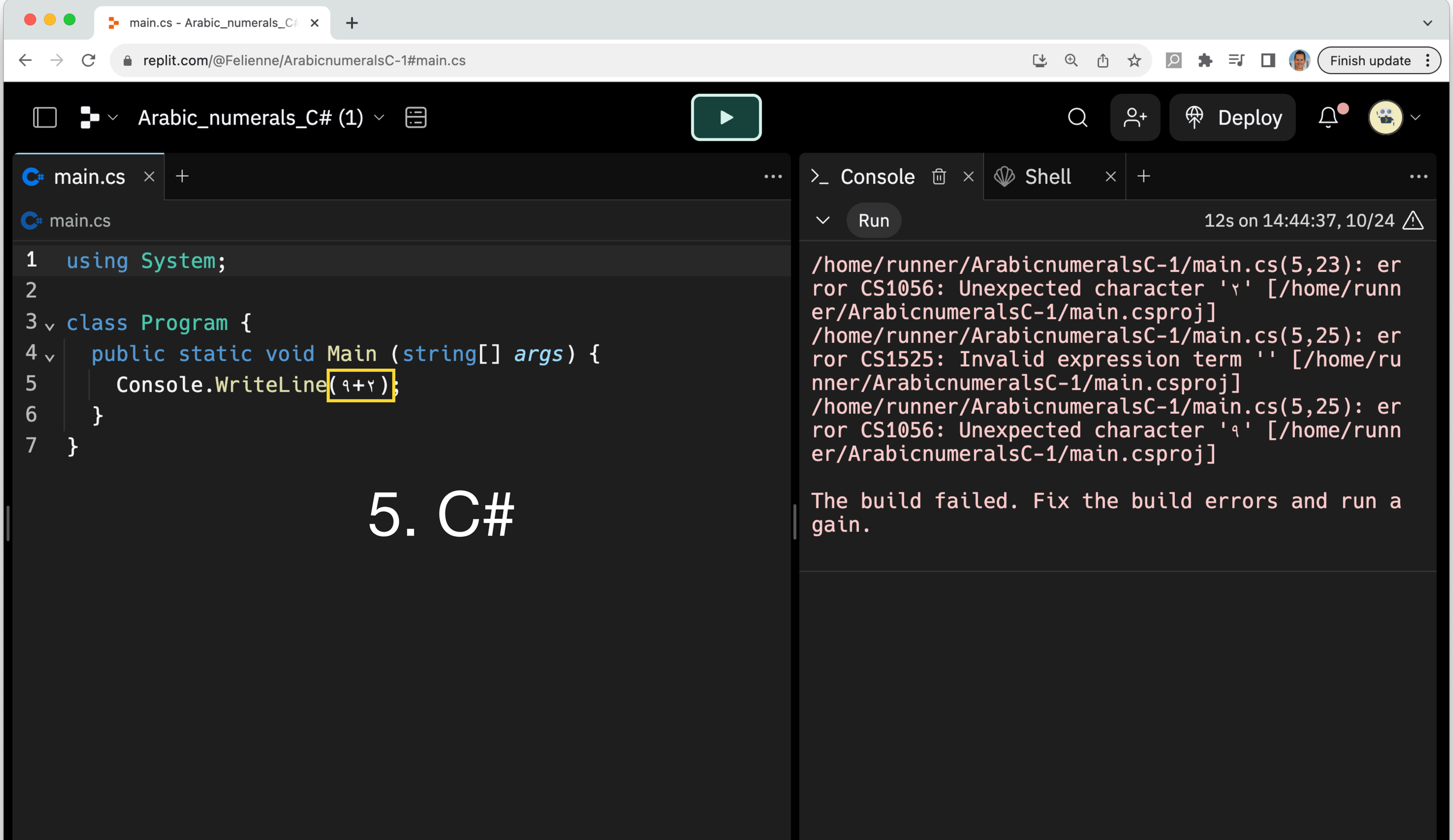
```
./main.c:4:10: error: use of undeclared identifier '٢'
  printf(٢+٩);
         ^

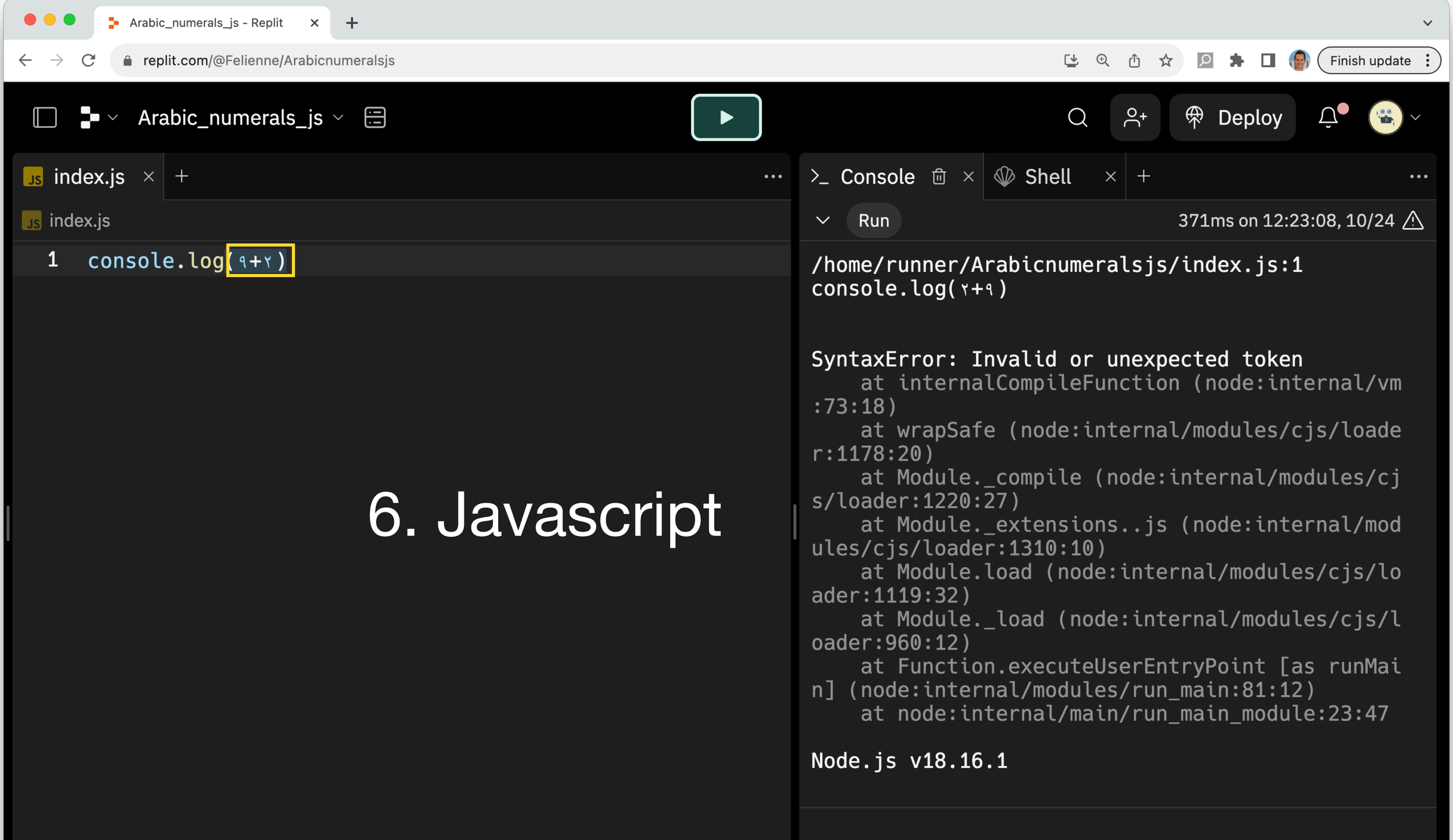
./main.c:4:13: error: use of undeclared identifier '٩'
  printf(٢+٩);
            ^

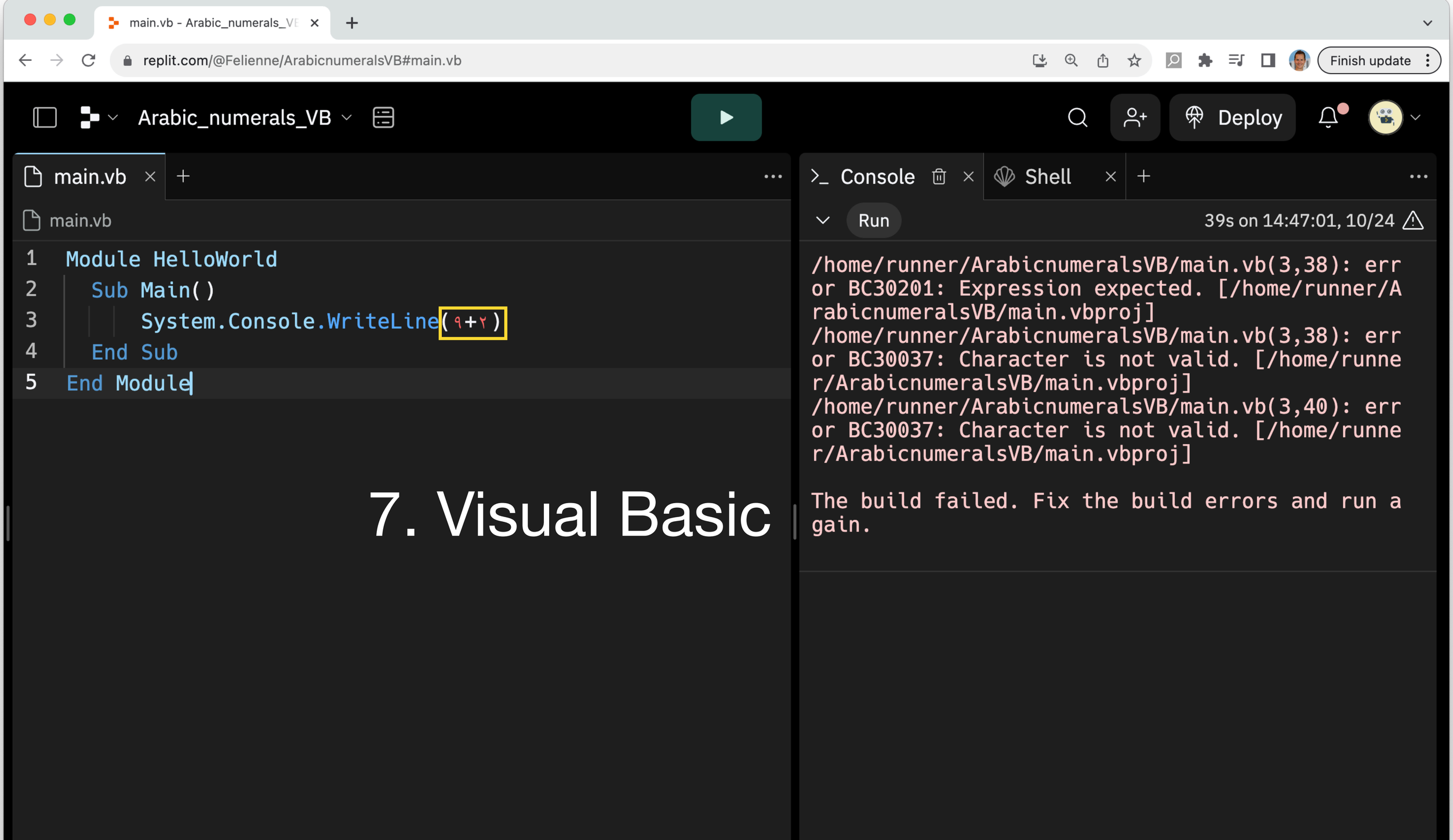
2 errors generated.
make: *** [Makefile:10: main] Error 1
```

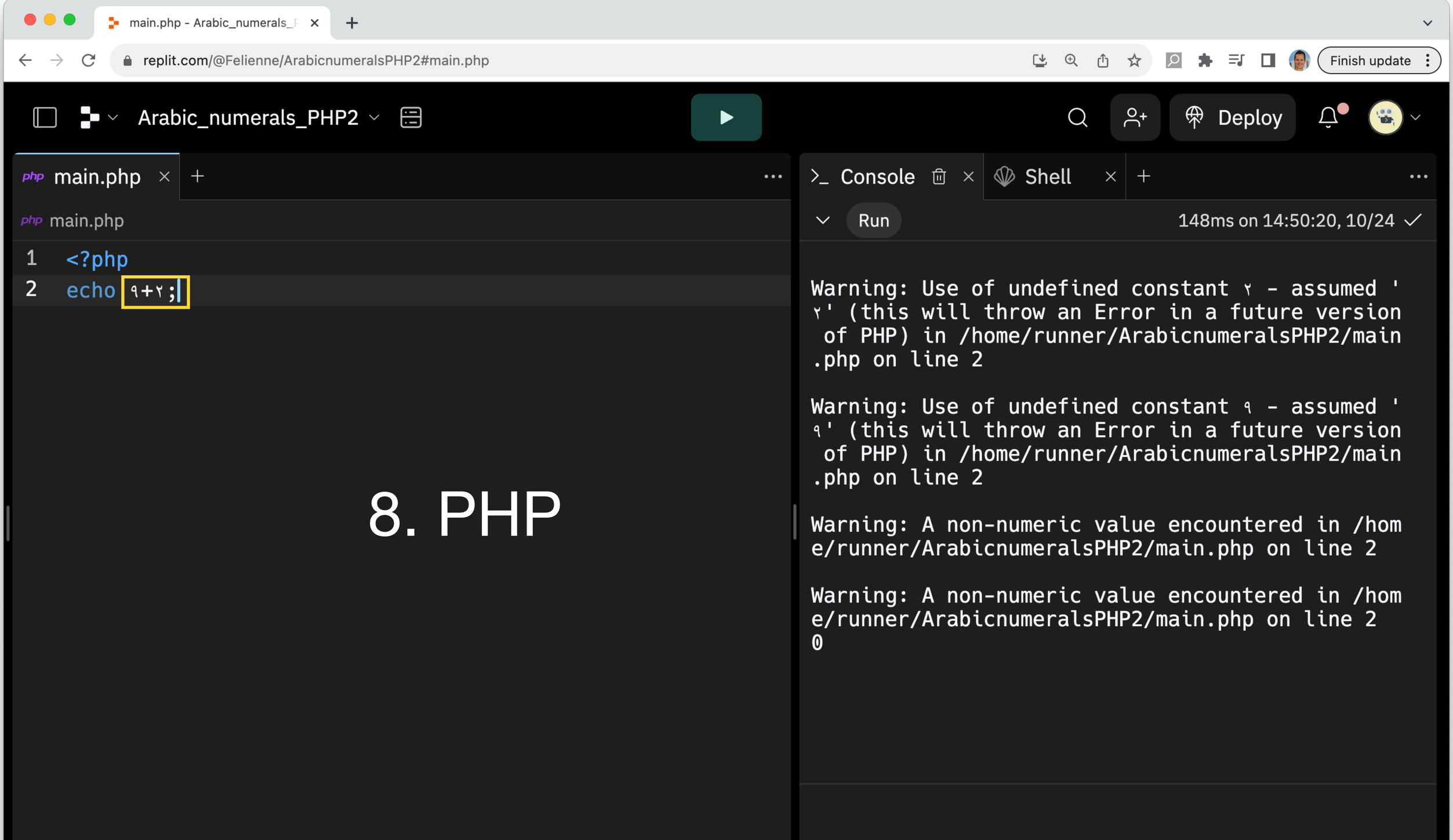

main.cpp - ArabicnumeralsC
replit.com/@Felienne/ArabicnumeralsC#main.cpp
Finish update
ArabicnumeralsC
Deploy
main.cpp
main.cpp
int main() {
std::cout << ٩+٢;
}
Console
Shell
Run
14s on 12:25:01, 10/24
./main.cpp:4:16: error: use of undeclared identifier '٢'
std::cout << ٢+٩;
./main.cpp:4:19: error: use of undeclared identifier '٩'
std::cout << ٢+٩;
2 errors generated.
make: *** [Makefile:10: main] Error 1
3. C++

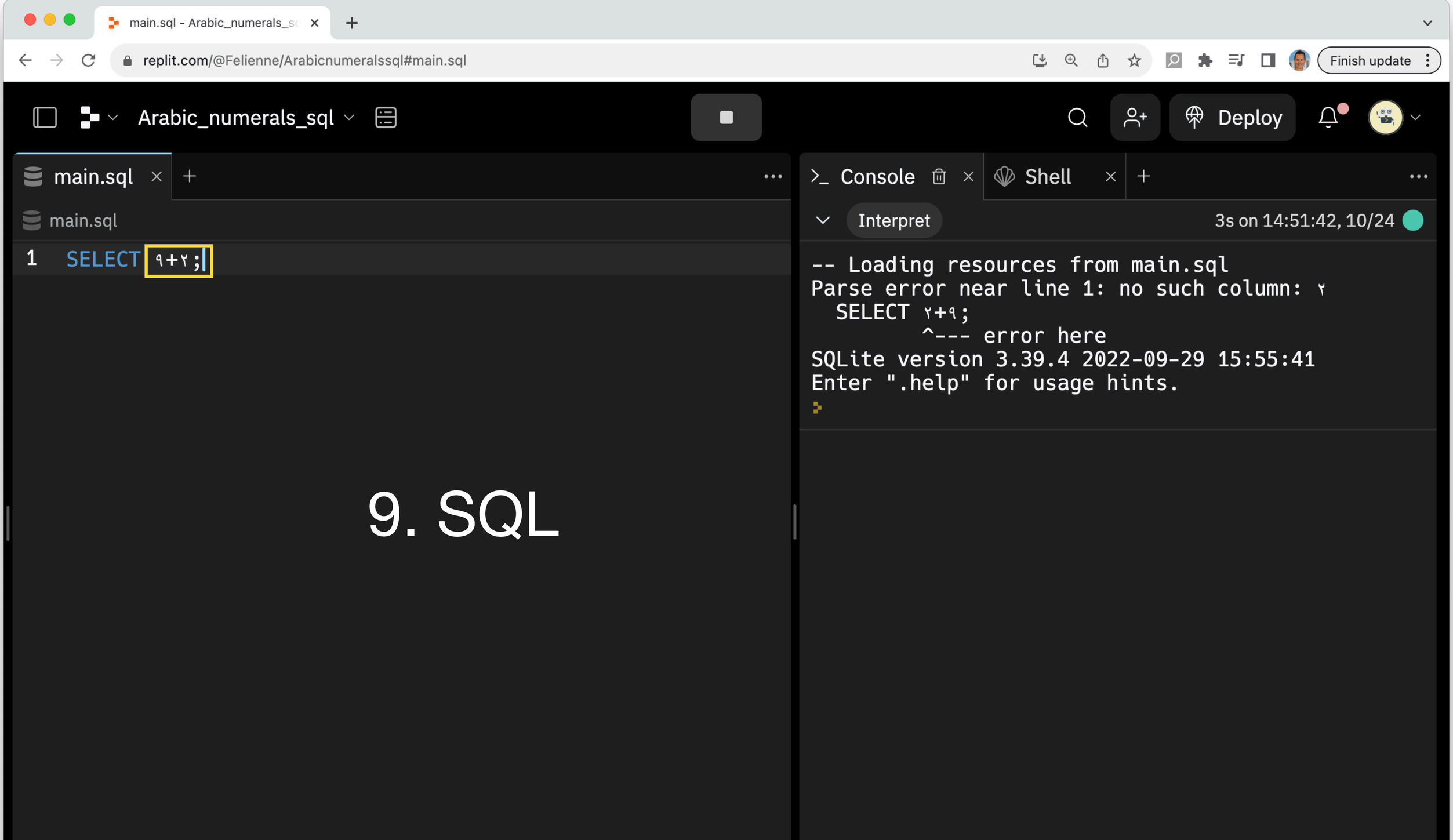

Arabic_numerals_java - Replit
replit.com/@Felienne/Arabicnumeralsjava
Finish update
Arabic_numerals_java
Deploy
Main.java
Main.java
2 public static void main(String[] args) {
3 System.out.println(٩+٢);
4 }
5 }
Console
Shell
Run
12s on 14:43:20, 10/24
./Main.java:3: error: illegal non-ASCII digit
System.out.println(٢+٩);
^
./Main.java:3: error: illegal non-ASCII digit
System.out.println(٢+٩);
^
2 errors
4. Java

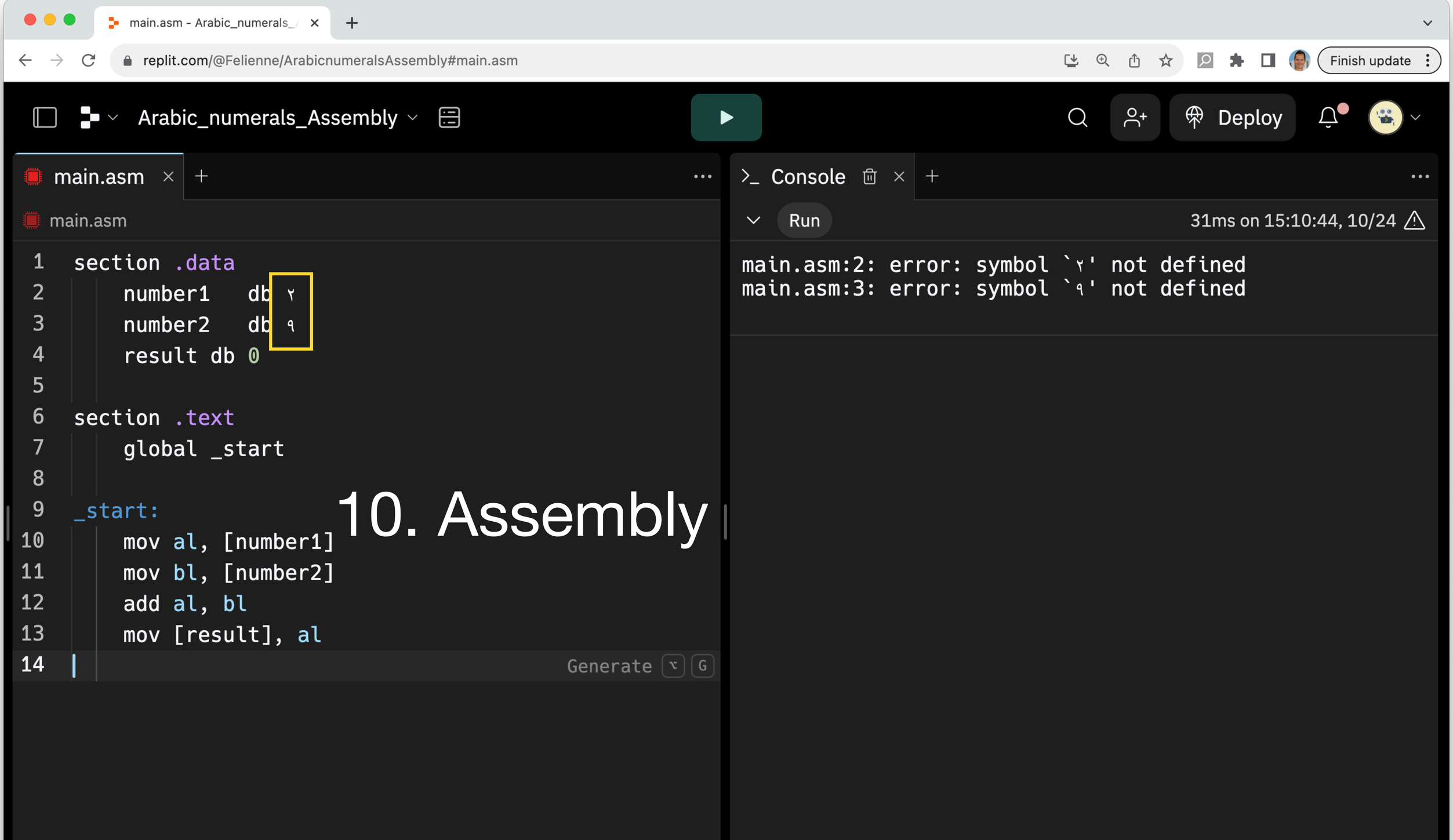

main.cs - Arabic_numerals_C#
replit.com/@Felienne/ArabicnumeralsC-1#main.cs
Finish update
Arabic_numerals_C# (1)
Deploy
main.cs
main.cs
1 using System;
2
3 class Program {
4 public static void Main (string[] args) {
5 Console.WriteLine(٩+٢);
6 }
7 }
5. C#
Console
Shell
Run
12s on 14:44:37, 10/24
/home/runner/ArabicnumeralsC-1/main.cs(5,23): error CS1056: Unexpected character '٢' [/home/runner/ArabicnumeralsC-1/main.csproj]
/home/runner/ArabicnumeralsC-1/main.cs(5,25): error CS1525: Invalid expression term '' [/home/runner/ArabicnumeralsC-1/main.csproj]
/home/runner/ArabicnumeralsC-1/main.cs(5,25): error CS1056: Unexpected character '٩' [/home/runner/ArabicnumeralsC-1/main.csproj]
The build failed. Fix the build errors and run again.


Arabic_numerals_js - Replit
replit.com/@Felienne/Arabicnumeralsjs
Finish update
Arabic_numerals_js
Deploy
index.js
index.js
1 console.log(٩+٢)
Console
Shell
Run
371ms on 12:23:08, 10/24
/home/runner/Arabicnumeralsjs/index.js:1
console.log(٢+٩)
SyntaxError: Invalid or unexpected token
at internalCompileFunction (node:internal/vm:73:18)
at wrapSafe (node:internal/modules/cjs/loader:1178:20)
at Module._compile (node:internal/modules/cjs/loader:1220:27)
at Module._extensions..js (node:internal/modules/cjs/loader:1310:10)
at Module.load (node:internal/modules/cjs/loader:1119:32)
at Module._load (node:internal/modules/cjs/loader:960:12)
at Function.executeUserEntryPoint [as runMain] (node:internal/modules/run_main:81:12)
at node:internal/main/run_main_module:23:47
Node.js v18.16.1
6. Javascript


main.vb - Arabic_numerals_VB
replit.com/@Felienne/ArabicnumeralsVB#main.vb
Finish update
Arabic_numerals_VB
Deploy
main.vb
main.vb
1 Module HelloWorld
2 Sub Main()
3 System.Console.WriteLine(٩+٢)
4 End Sub
5 End Module
Console
Shell
Run
39s on 14:47:01, 10/24
/home/runner/ArabicnumeralsVB/main.vb(3,38): error BC30201: Expression expected. [/home/runner/ArabicnumeralsVB/main.vbproj]
/home/runner/ArabicnumeralsVB/main.vb(3,38): error BC30037: Character is not valid. [/home/runner/ArabicnumeralsVB/main.vbproj]
/home/runner/ArabicnumeralsVB/main.vb(3,40): error BC30037: Character is not valid. [/home/runner/ArabicnumeralsVB/main.vbproj]
The build failed. Fix the build errors and run again.
7. Visual Basic


main.php - Arabic_numerals_
replit.com/@Felienne/ArabicnumeralsPHP2#main.php
Finish update
Arabic_numerals_PHP2
Deploy
main.php
main.php
1 <?php
2 echo ٩+٢;
8. PHP
Console
Shell
Run
148ms on 14:50:20, 10/24
Warning: Use of undefined constant ٢ - assumed '٢' (this will throw an Error in a future version of PHP) in /home/runner/ArabicnumeralsPHP2/main.php on line 2
Warning: Use of undefined constant ٩ - assumed '٩' (this will throw an Error in a future version of PHP) in /home/runner/ArabicnumeralsPHP2/main.php on line 2
Warning: A non-numeric value encountered in /home/runner/ArabicnumeralsPHP2/main.php on line 2
Warning: A non-numeric value encountered in /home/runner/ArabicnumeralsPHP2/main.php on line 2
0


main.sql - Arabic_numerals_sc
replit.com/@Felienne/Arabicnumeralssql#main.sql
Finish update
Arabic_numerals_sql
Deploy
main.sql
main.sql
1 SELECT ٩+٢;
Console
Shell
Interpret
3s on 14:51:42, 10/24
-- Loading resources from main.sql
Parse error near line 1: no such column: ٢
SELECT ٢+٩;
^--- error here
SQLite version 3.39.4 2022-09-29 15:55:41
Enter ".help" for usage hints.
9. SQL


main.asm - Arabic_numerals_
replit.com/@Felienne/ArabicnumeralsAssembly#main.asm
Finish update
Arabic_numerals_Assembly
Deploy
main.asm
main.asm
section .data
number1 db ٢
number2 db ٩
result db 0
section .text
global _start
_start:
mov al, [number1]
mov bl, [number2]
add al, bl
mov [result], al
Generate ⌥ G
Console
Run
31ms on 15:10:44, 10/24
main.asm:2: error: symbol `٢' not defined
main.asm:3: error: symbol `٩' not defined
10. Assembly

Hedy!

```
1 قـول ٢+٩
2
```

```
قـول ٢+٩
```

```
١١
```

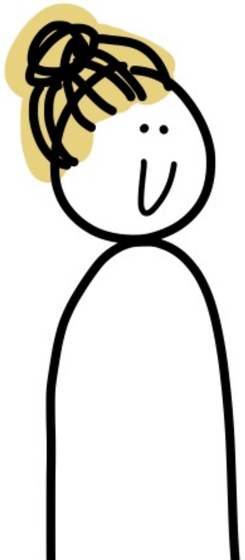
```
لكل دورة في نطاق ١ الى ٥
    قول دورة

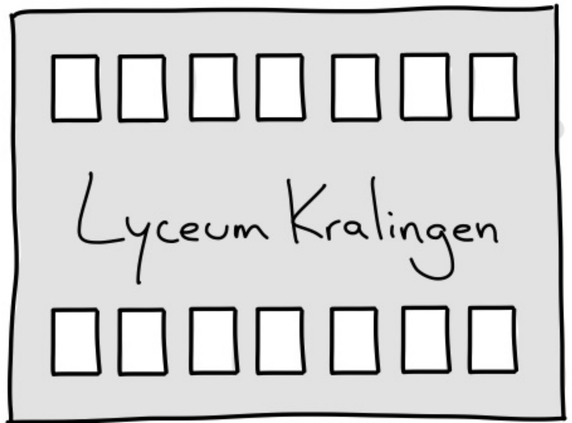
```

```
لكل دورة في نطاق ١ الى ٥
    قول دورة

```

```
١
٢
٣
٤
٥
```




Lyceum Kralingen



print hello world

skriv Hej!

drucke Hallo

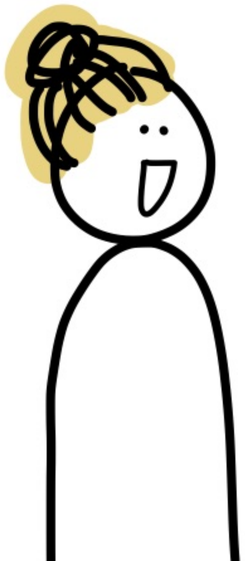
affiche bonjour

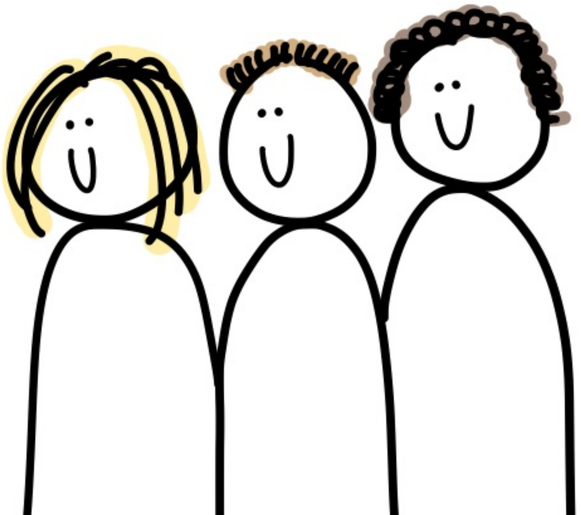
imprima olá

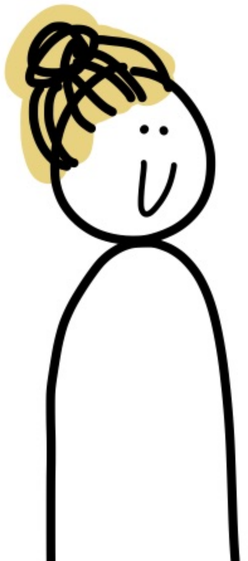
xuất Xin chào

imprimirhola

gatisa dumela







RESEARCH-ARTICLE OPEN ACCESS

A Framework for the Localization of Programming Languages

Authors: Alaaeddin Swidan, Felienne Hermans Authors Info & Claims

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Published: 19 October 2023 Publication History

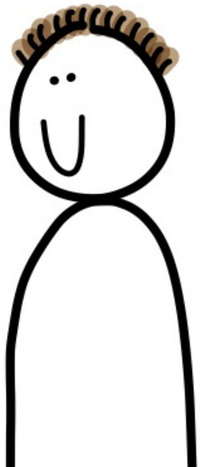
Check for updates

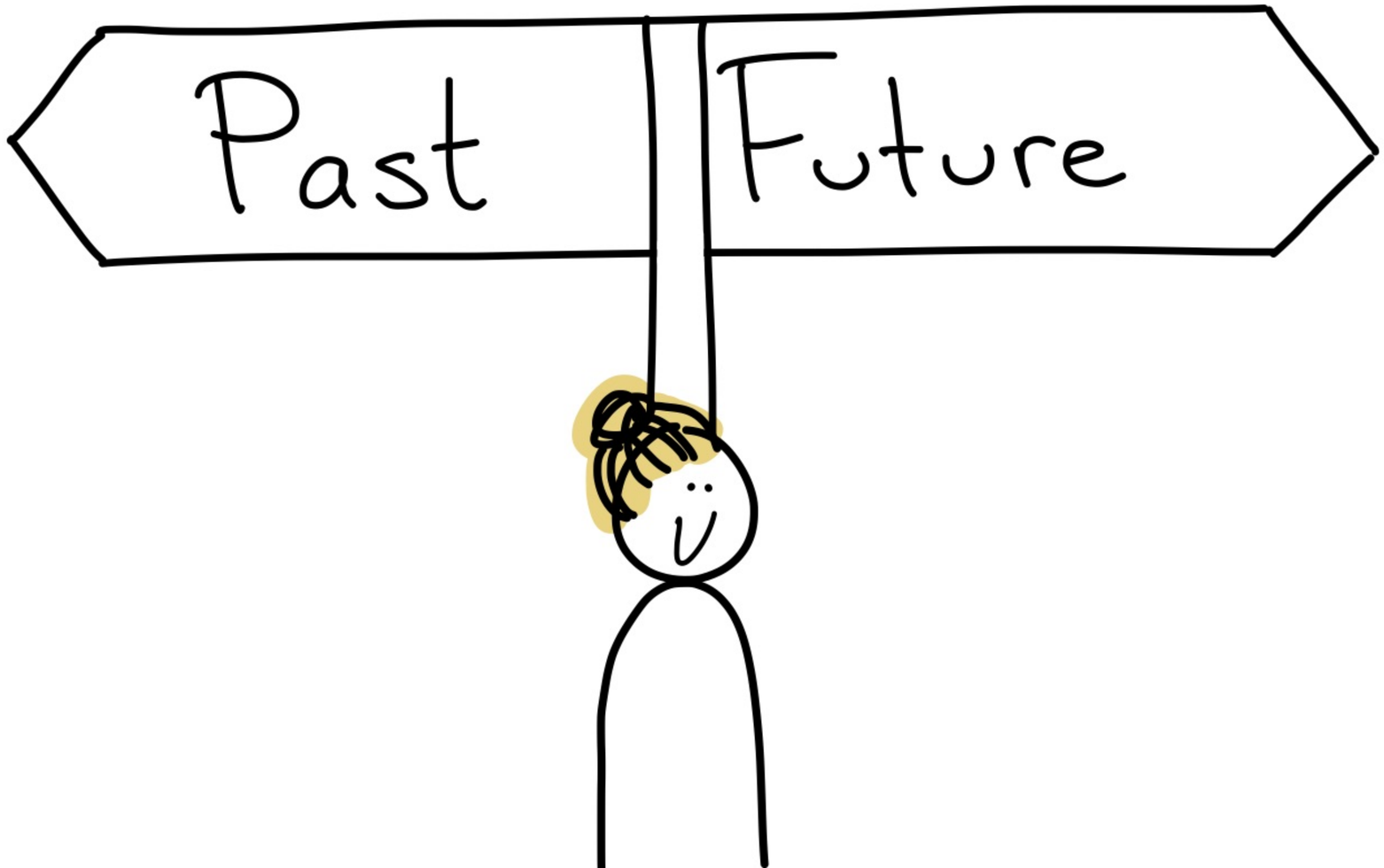
0 0

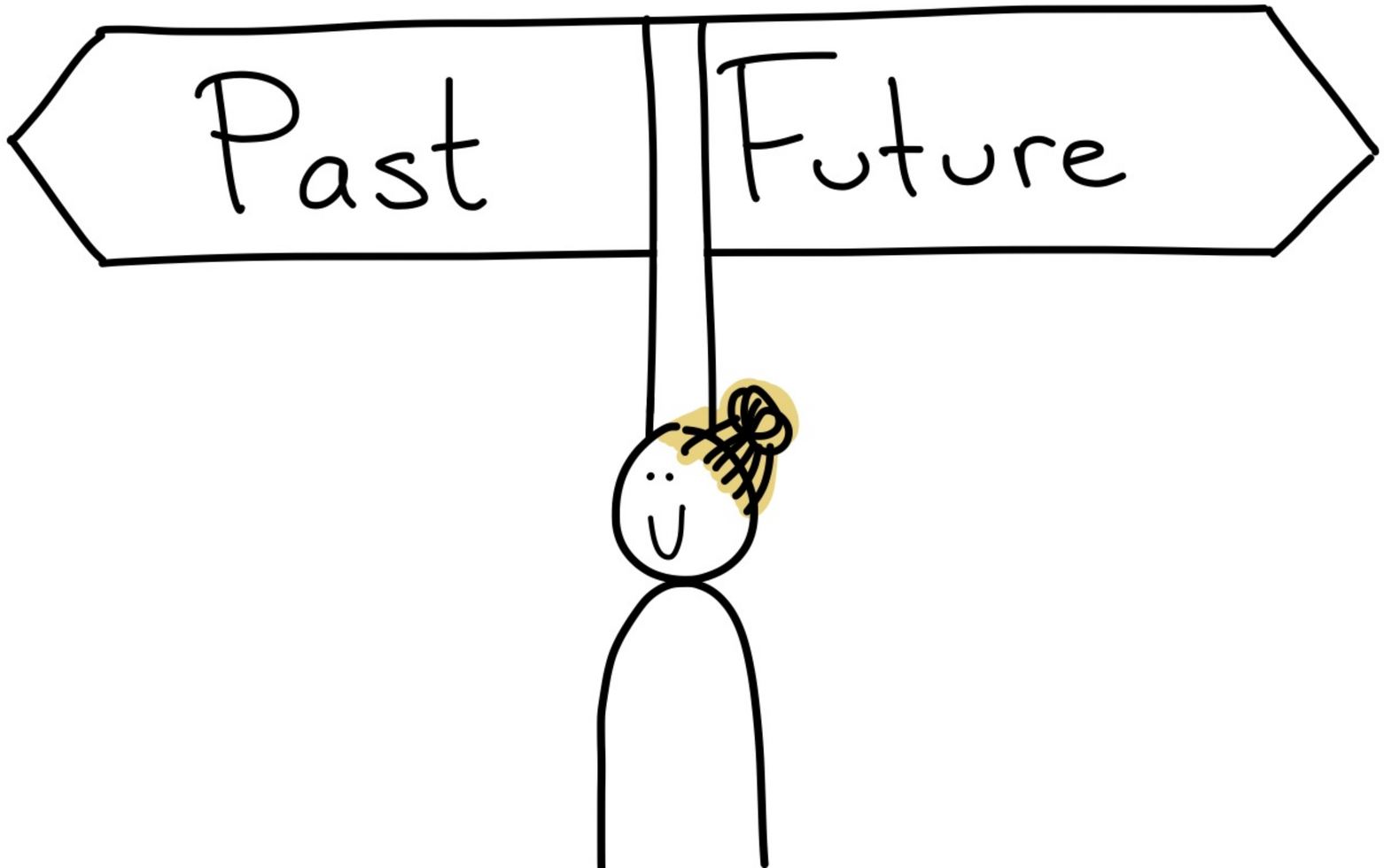
eReader PDF

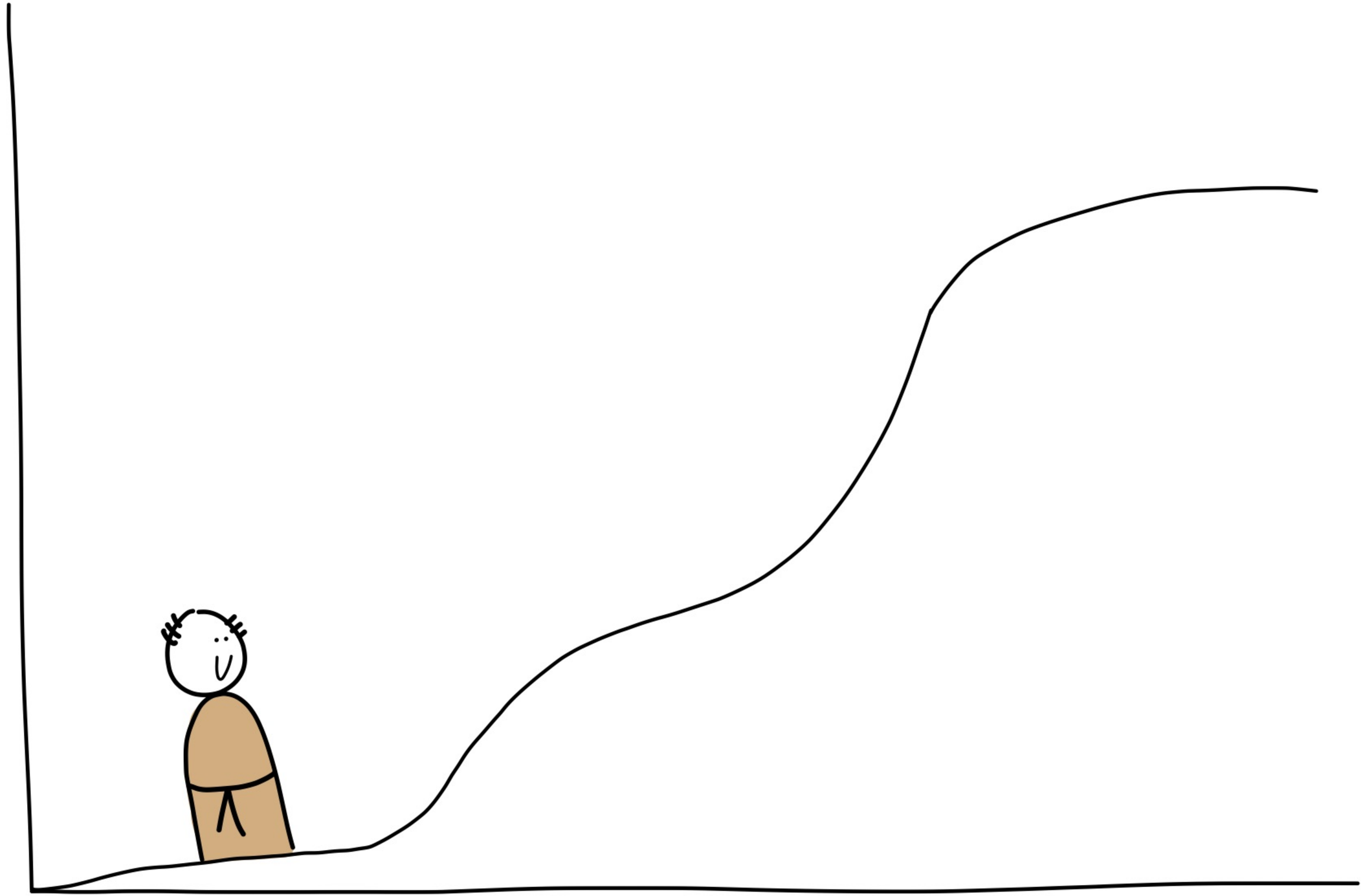
ABSTRACT

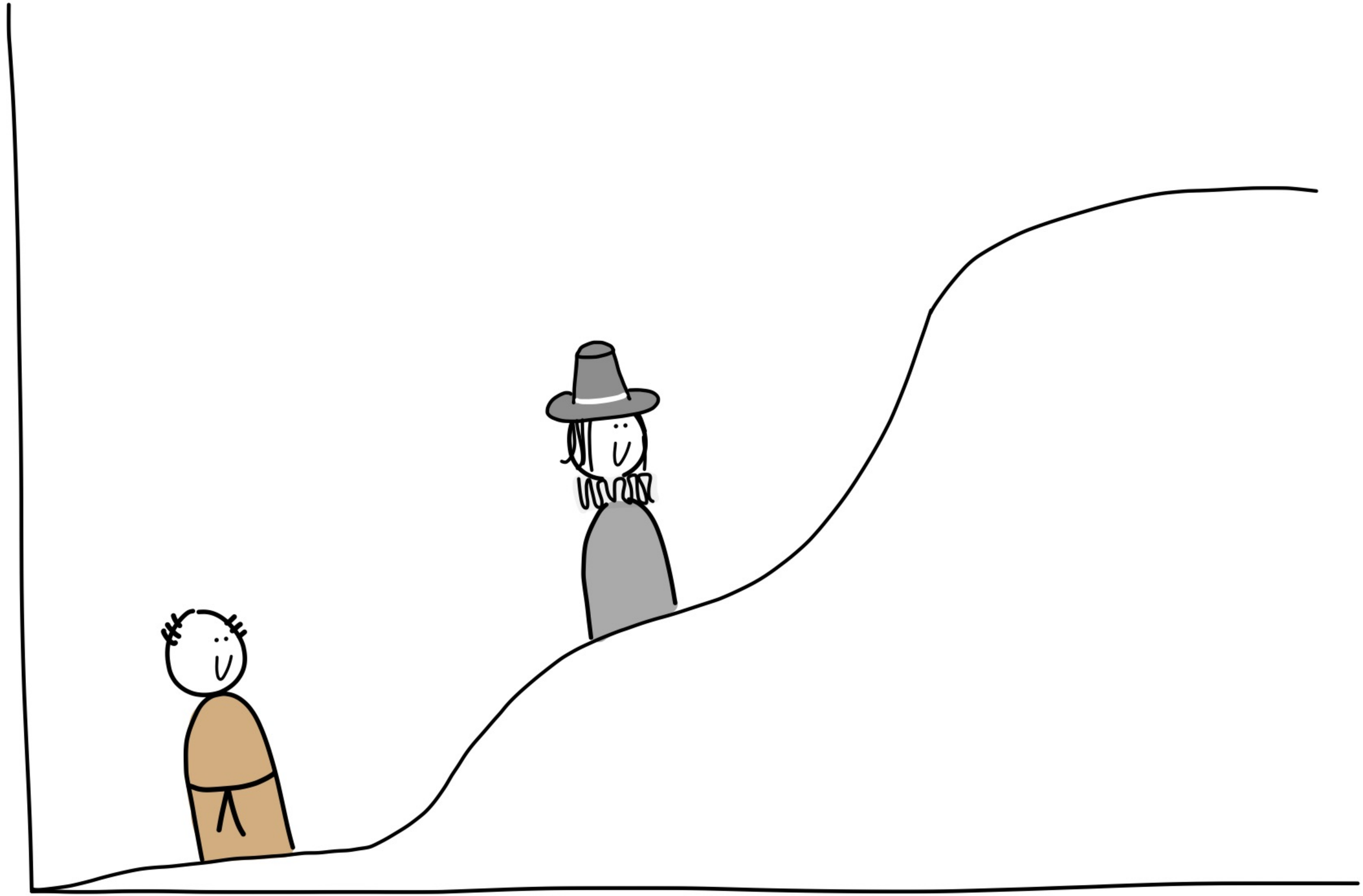
Most programming languages are only available in English, which means that speakers of other languages need to learn at least some English before they can learn to program. This creates well-documented barriers to entry into programming. While many educational programming languages are localized in some way (e.g. keywords), they often miss important other aspects (e.g. numerals or word order). This paper describes a framework of 12 aspects of programming languages that can be localized, helping tool designers localize their languages better and educators to make more informed decisions about introductory languages in non-English contexts.

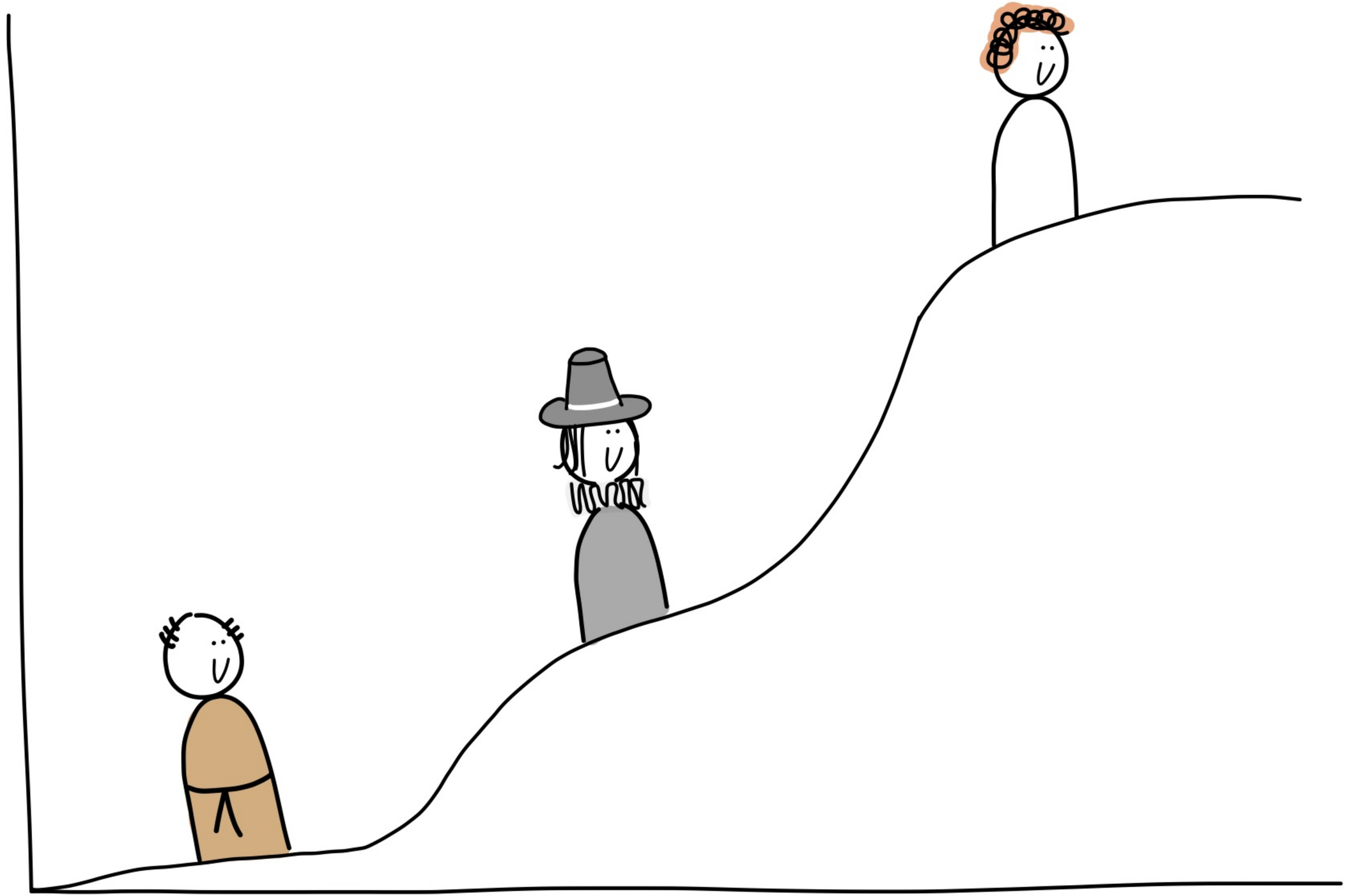


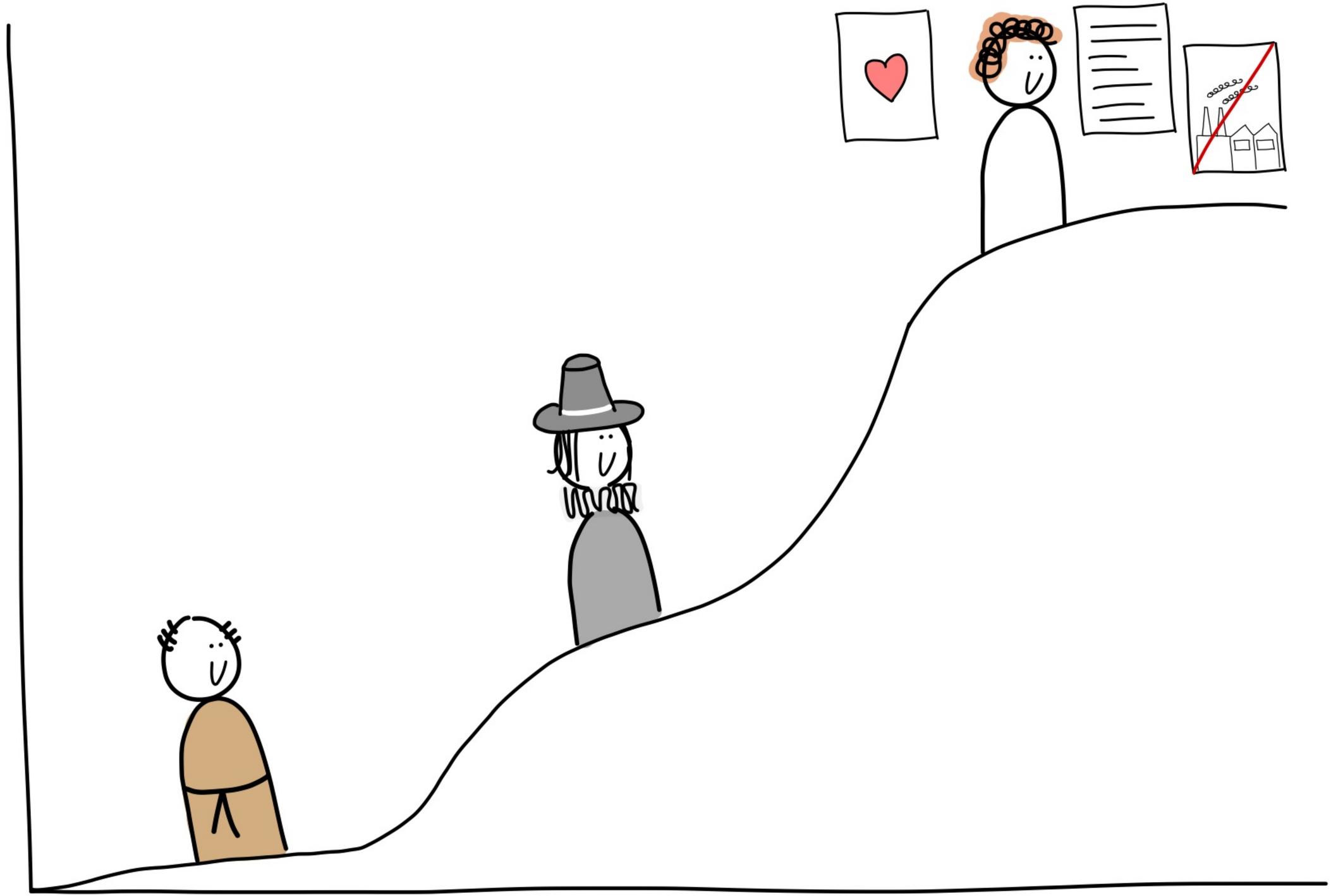

Past
Future

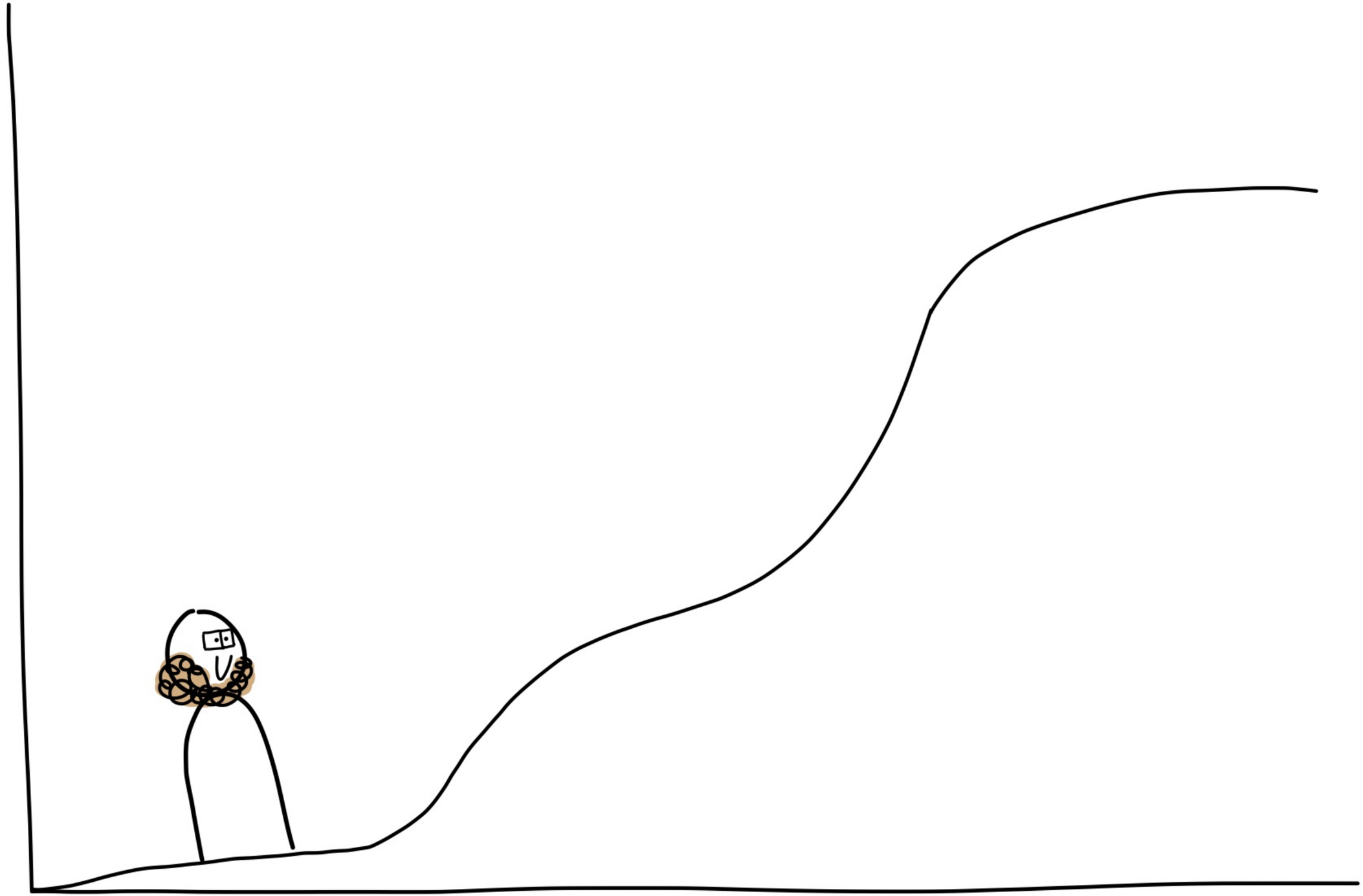

Past
Future

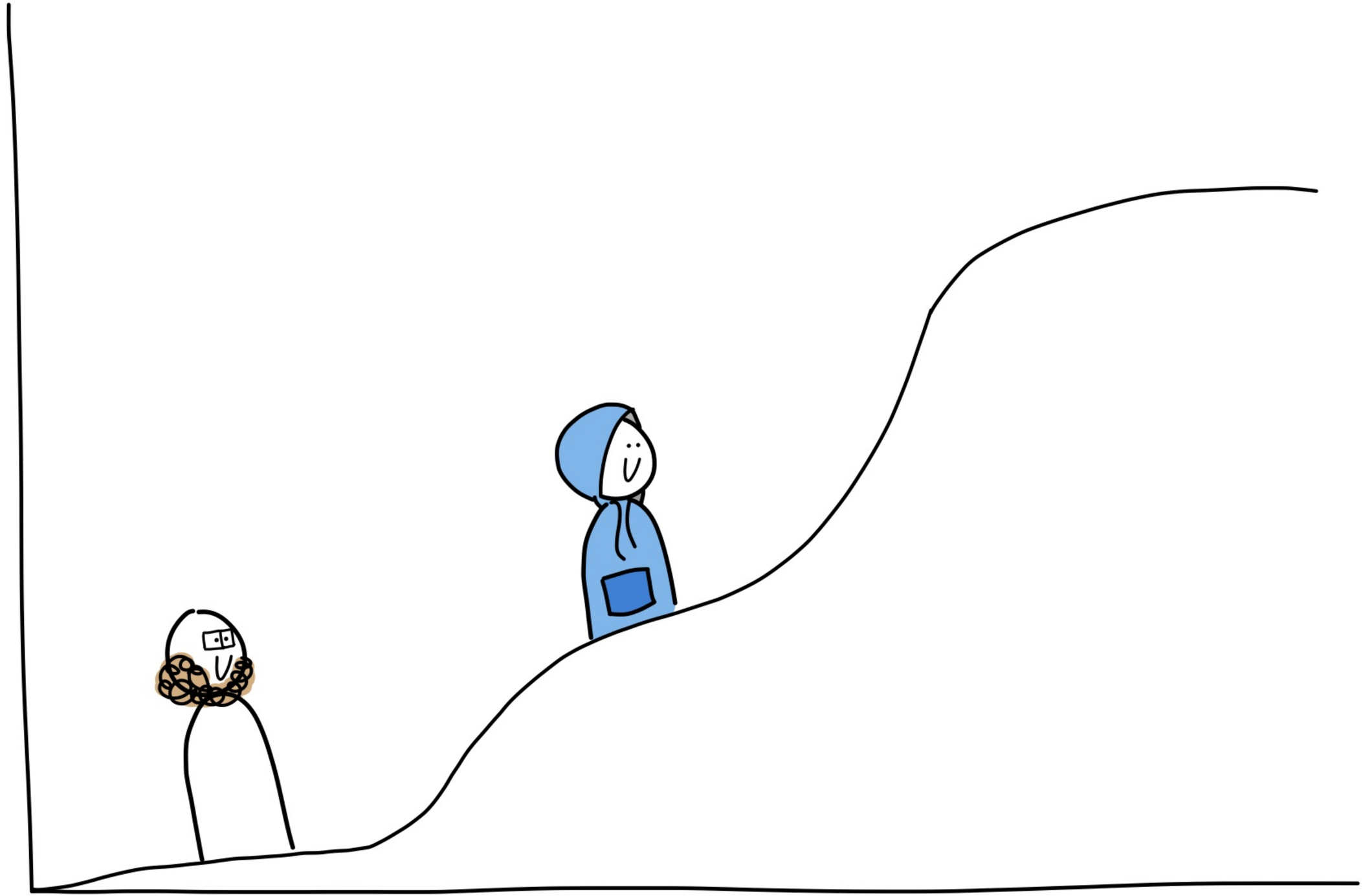


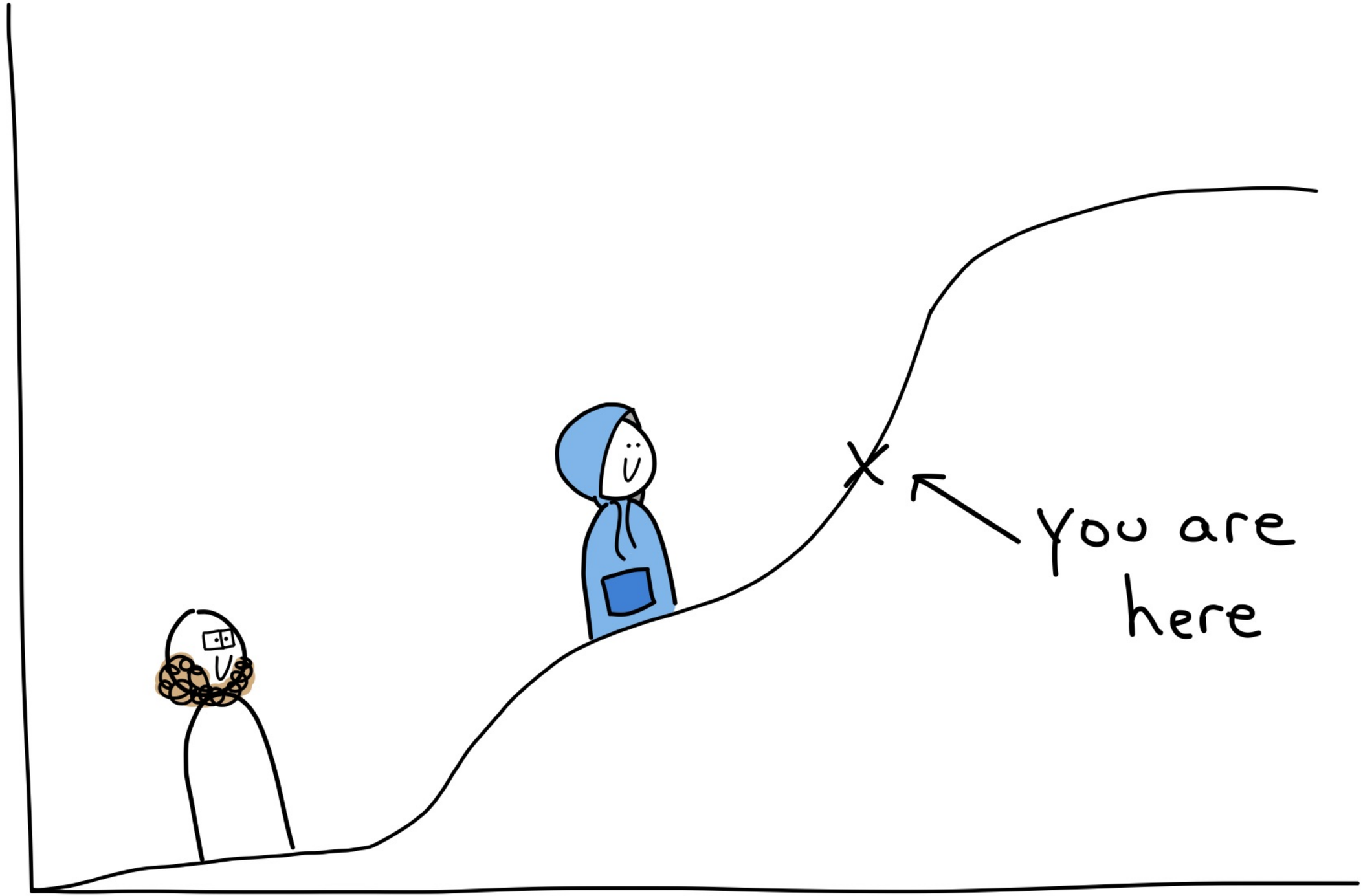


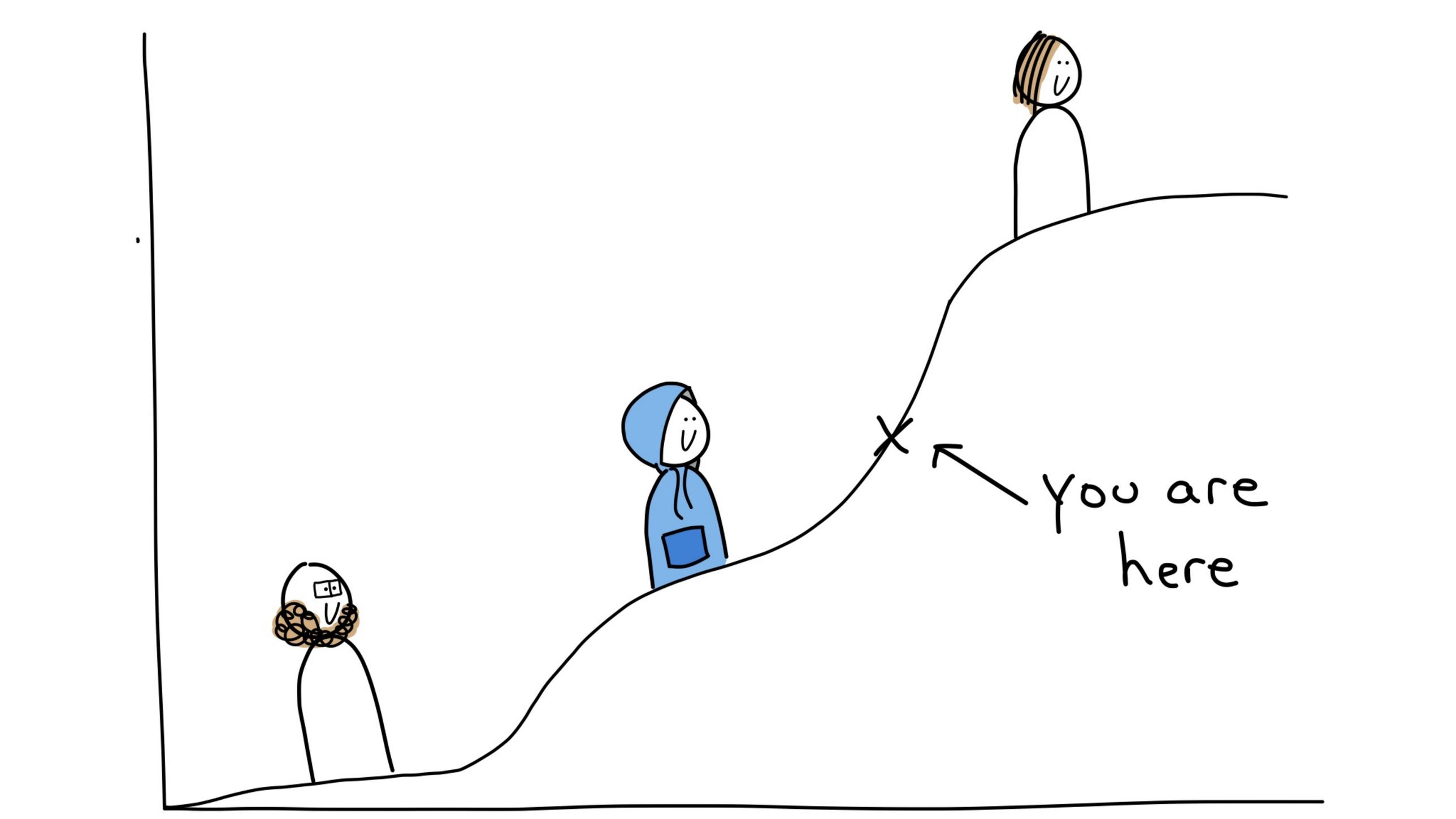


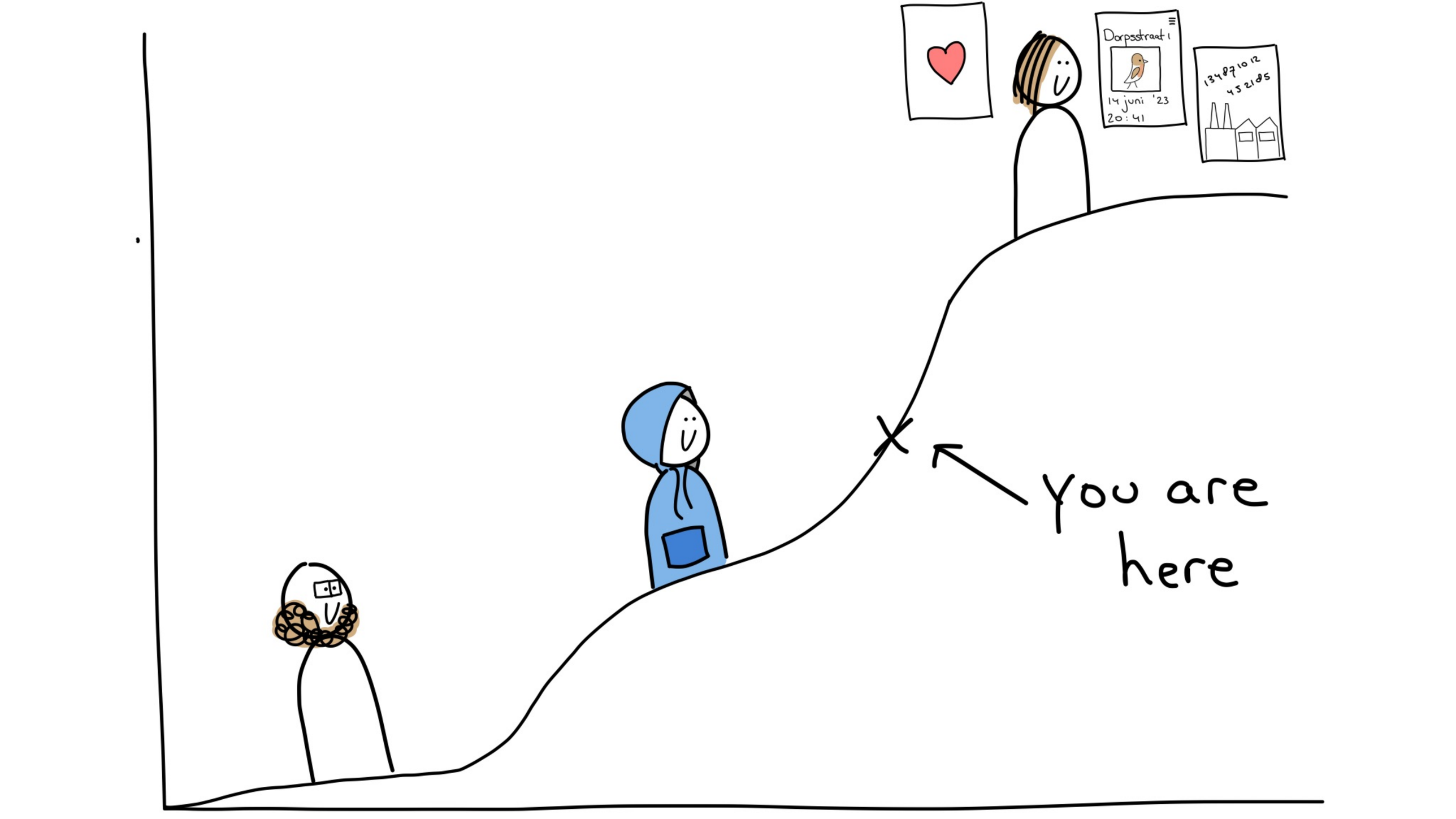


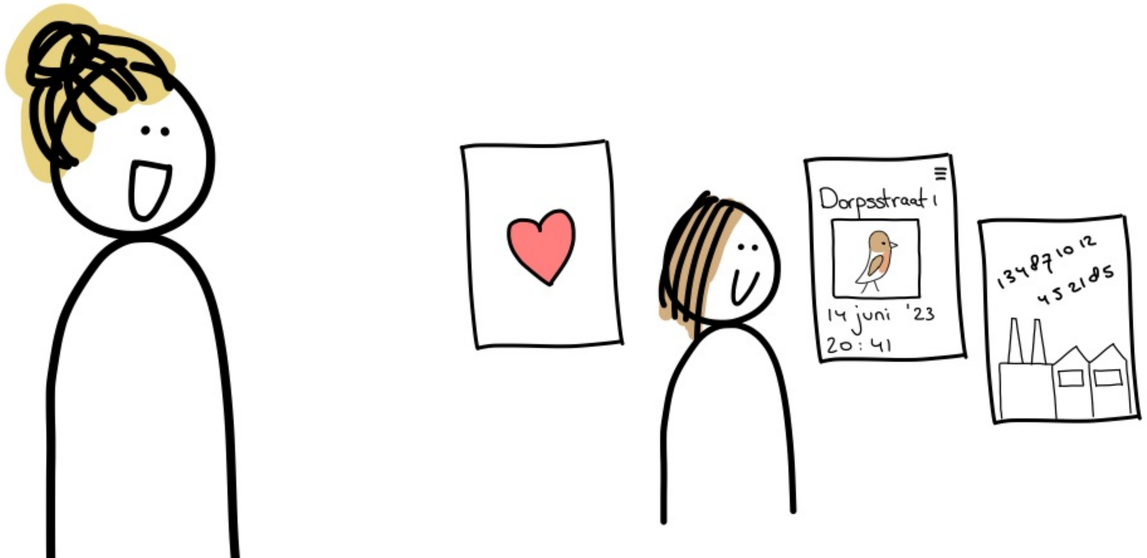


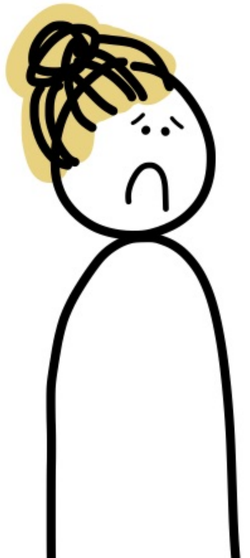


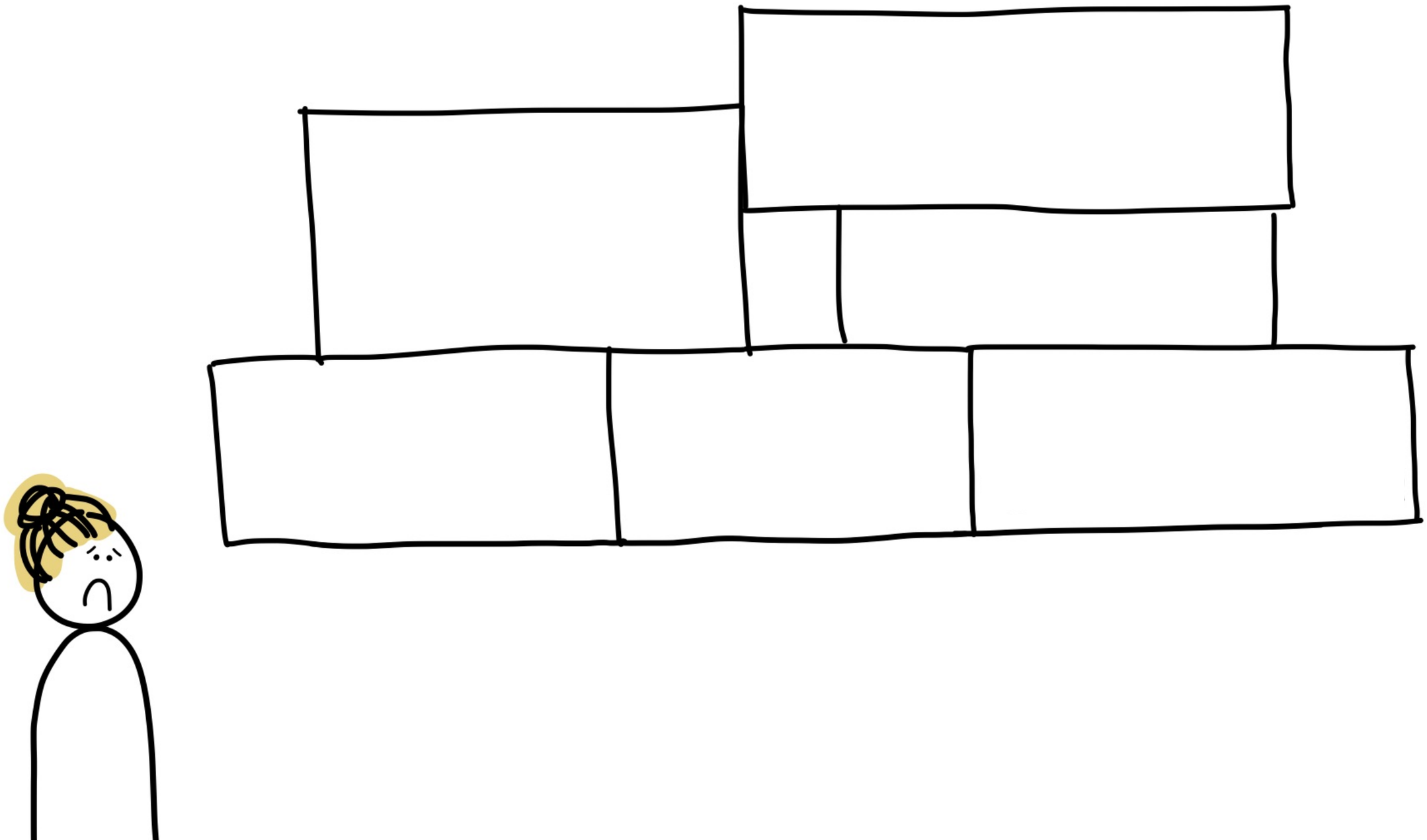

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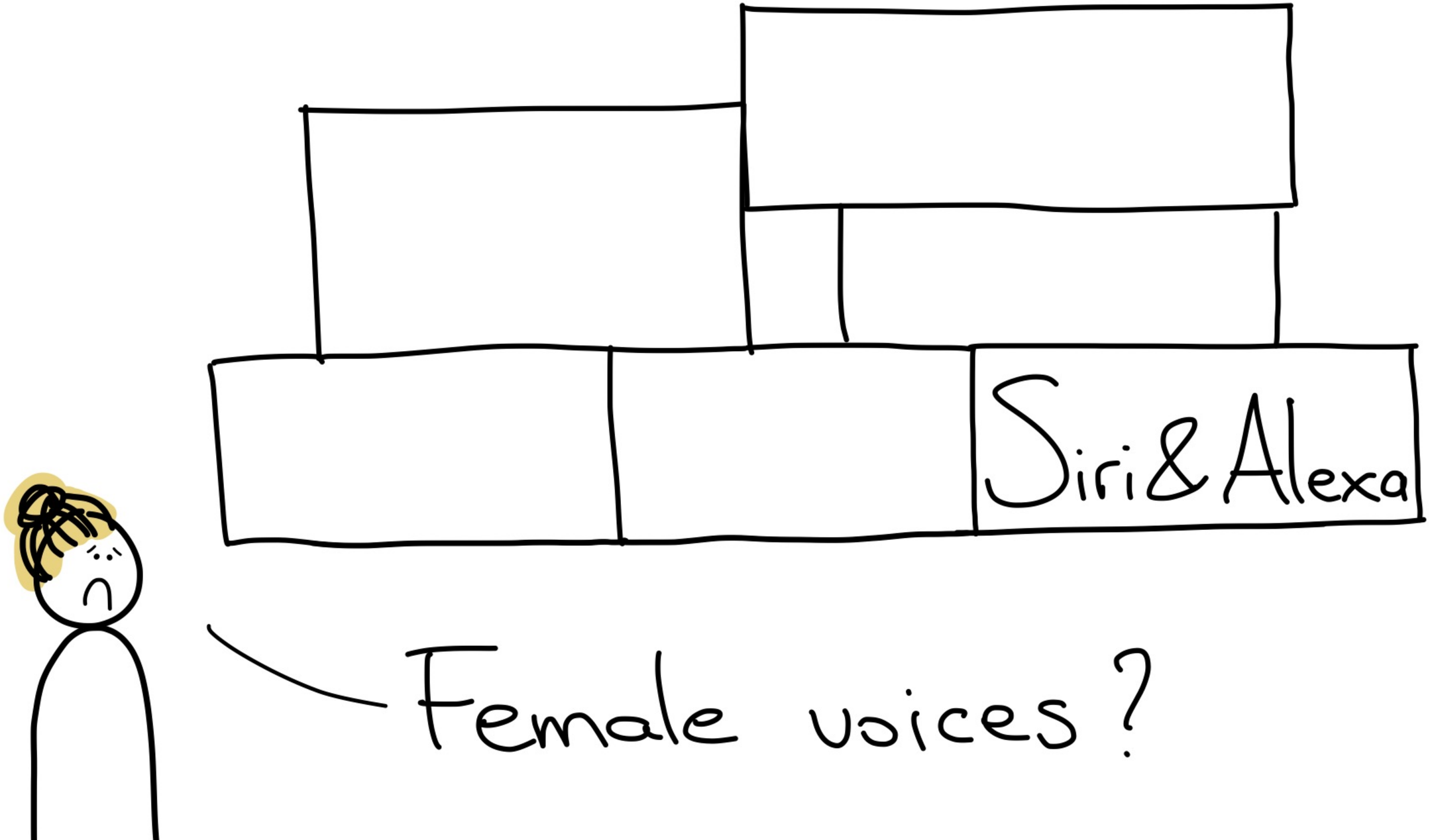

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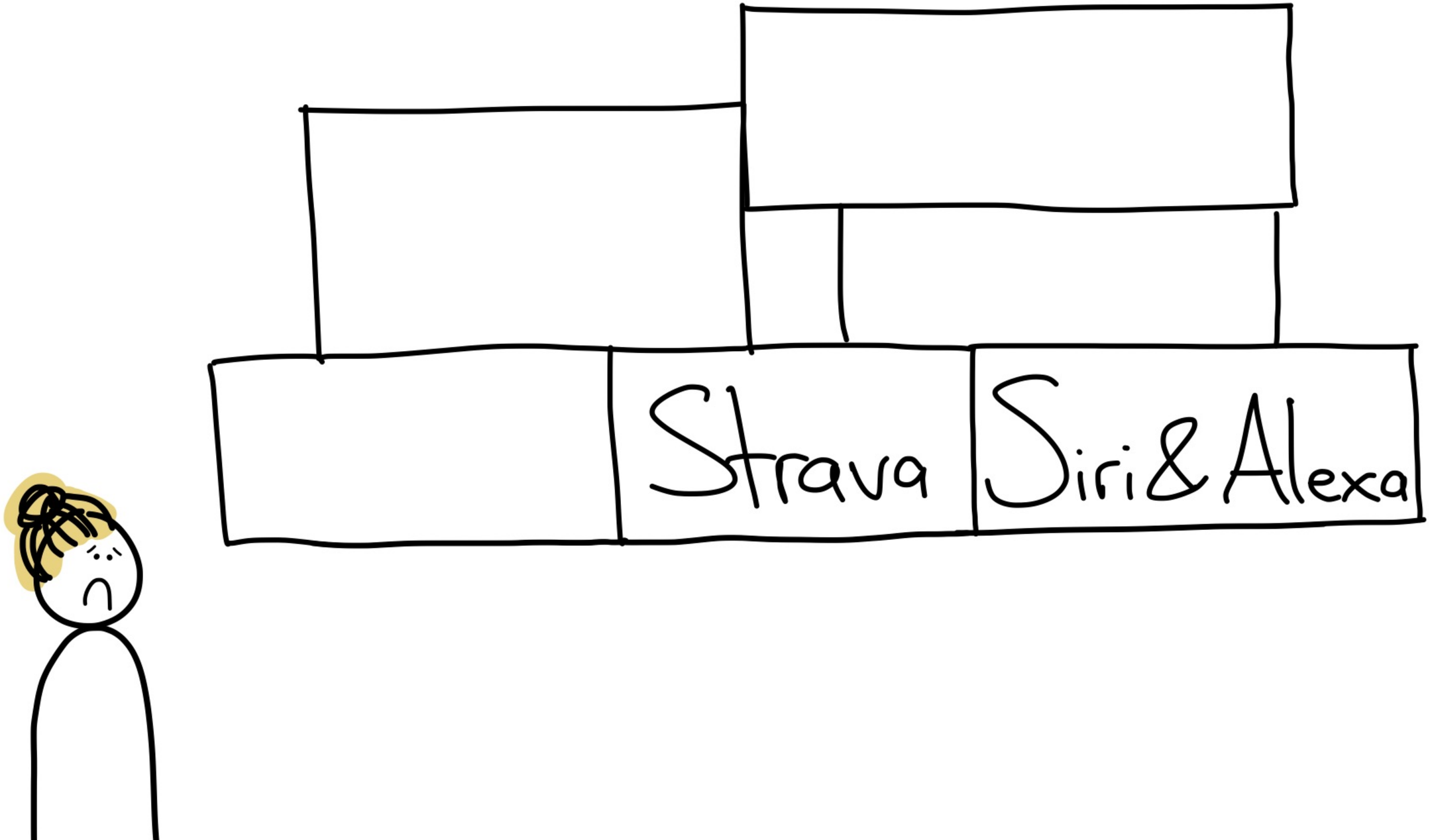

Dorpsstraat 1
14 juni '23
20:41
1 3 4 8 7 10 12
4 5 2 11 9 5
You are here

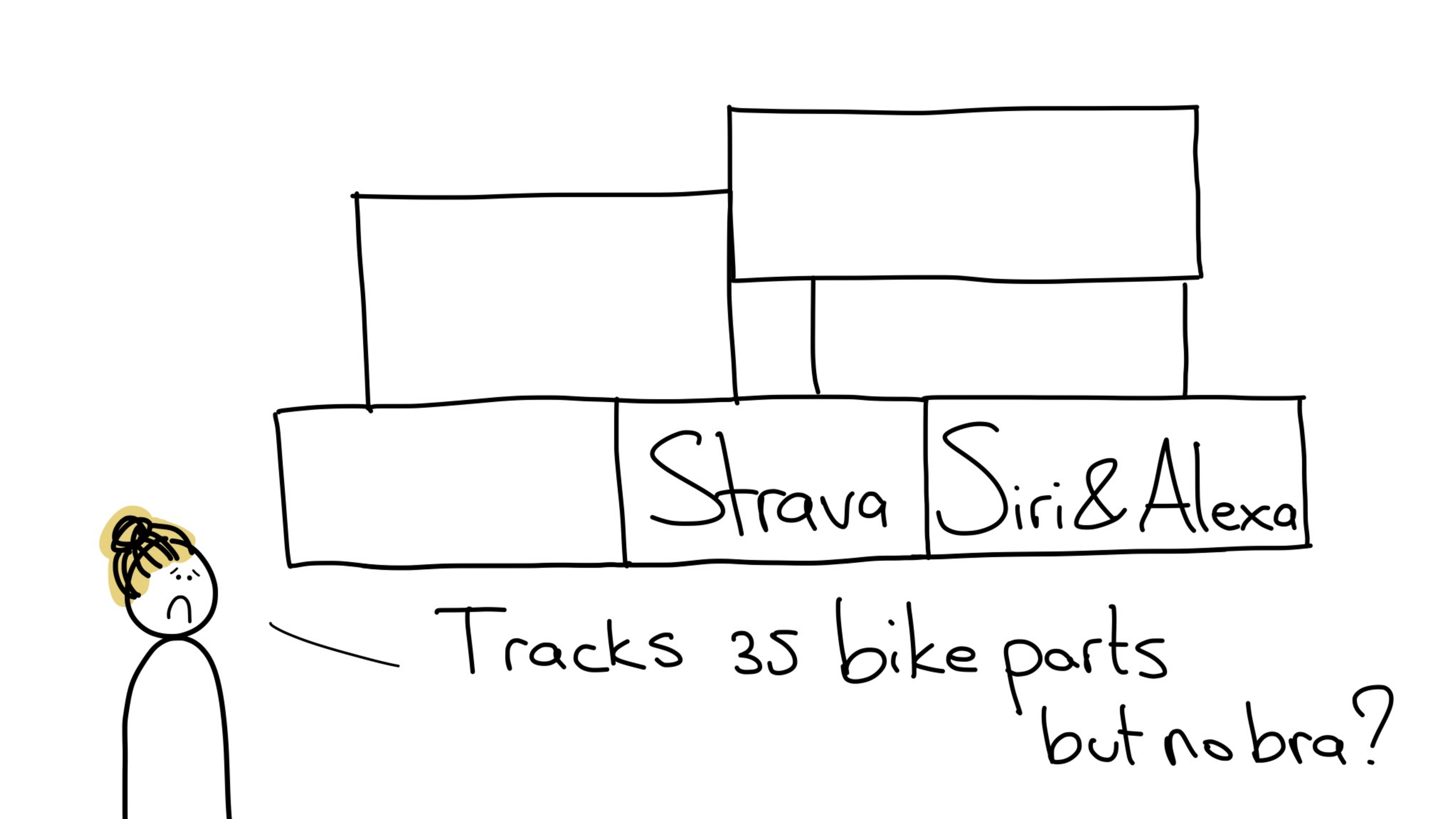

Dorpsstraat 1
14 juni '23
20:41
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4 5 2 1 9 5

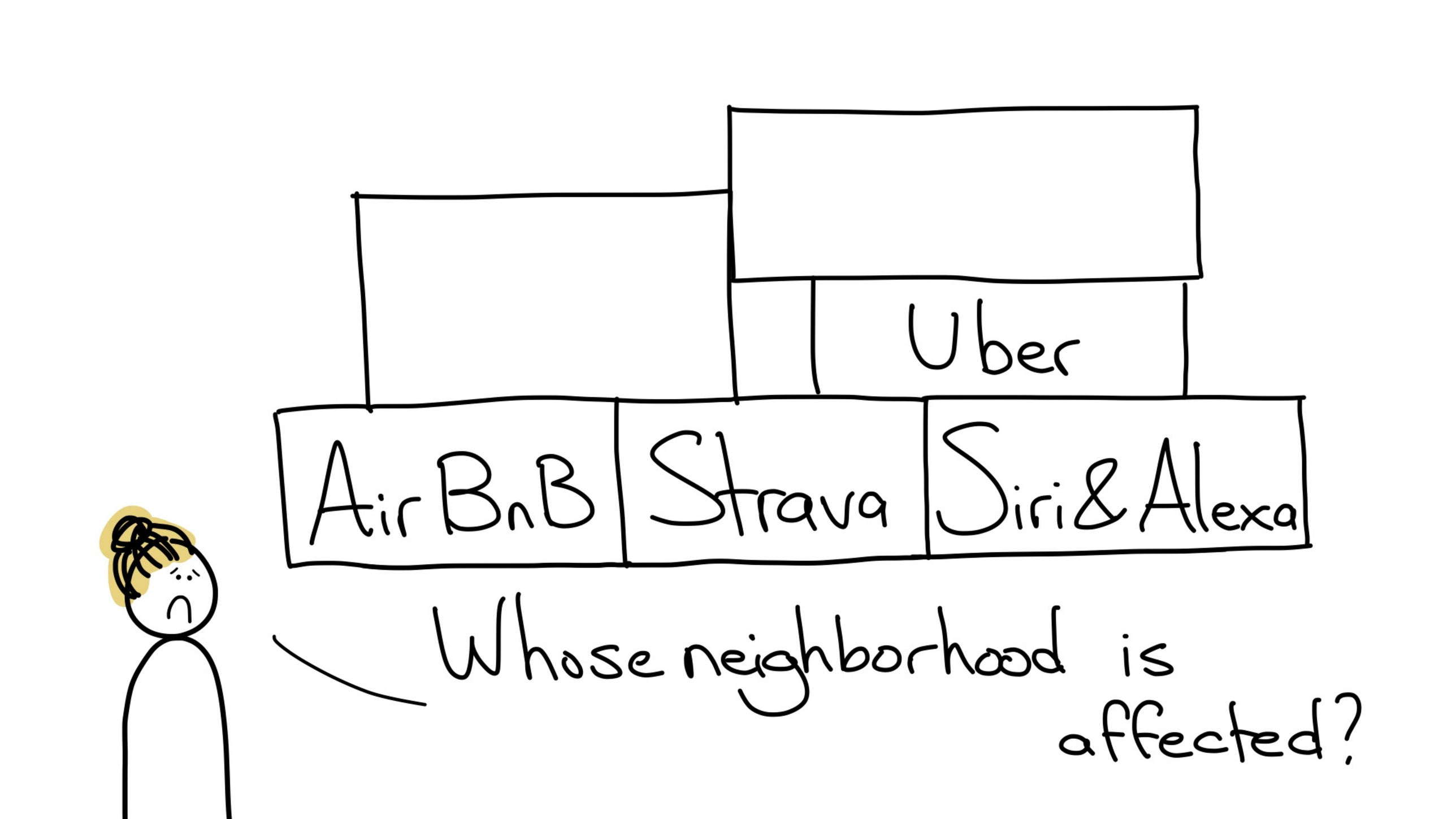


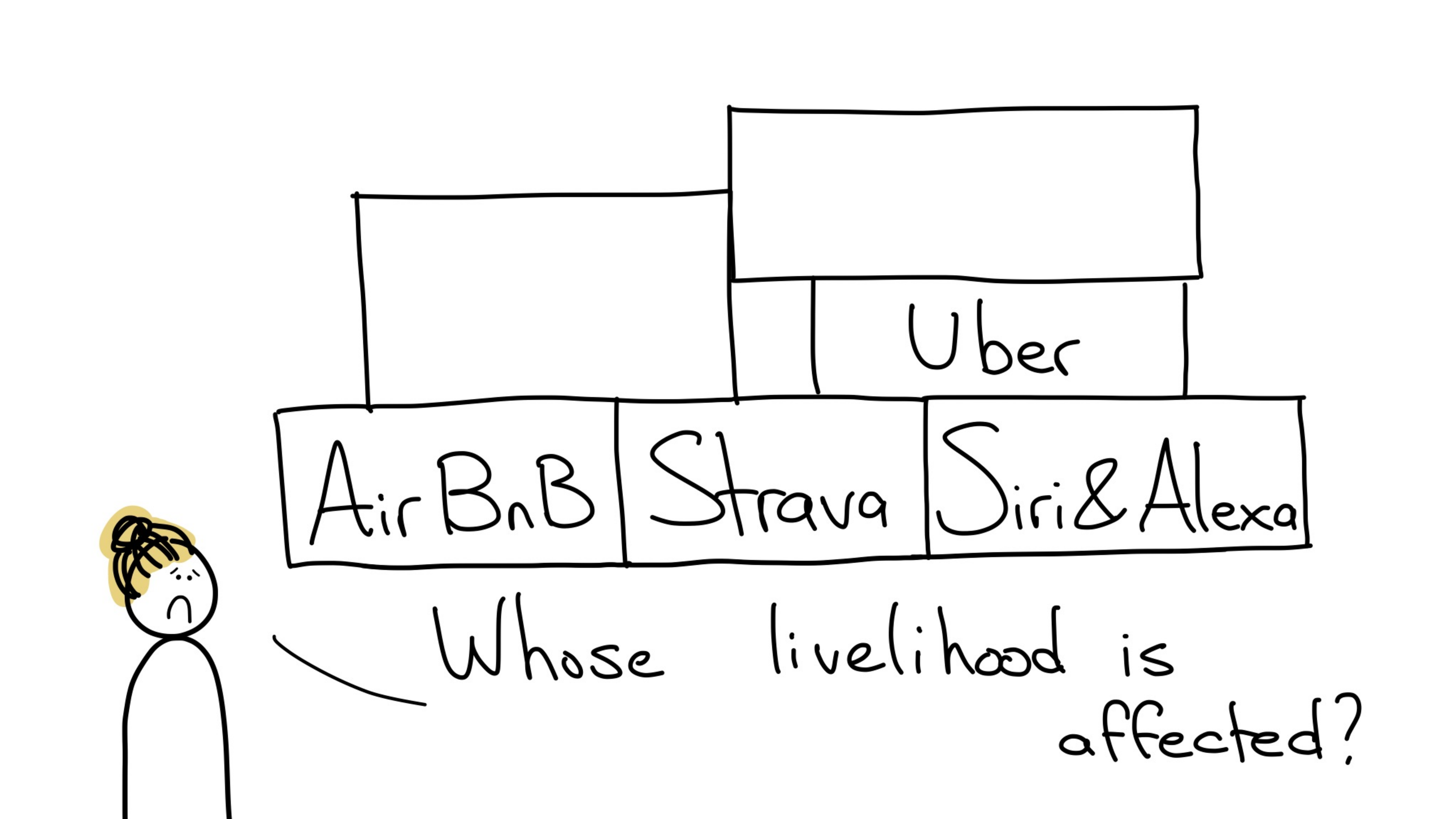


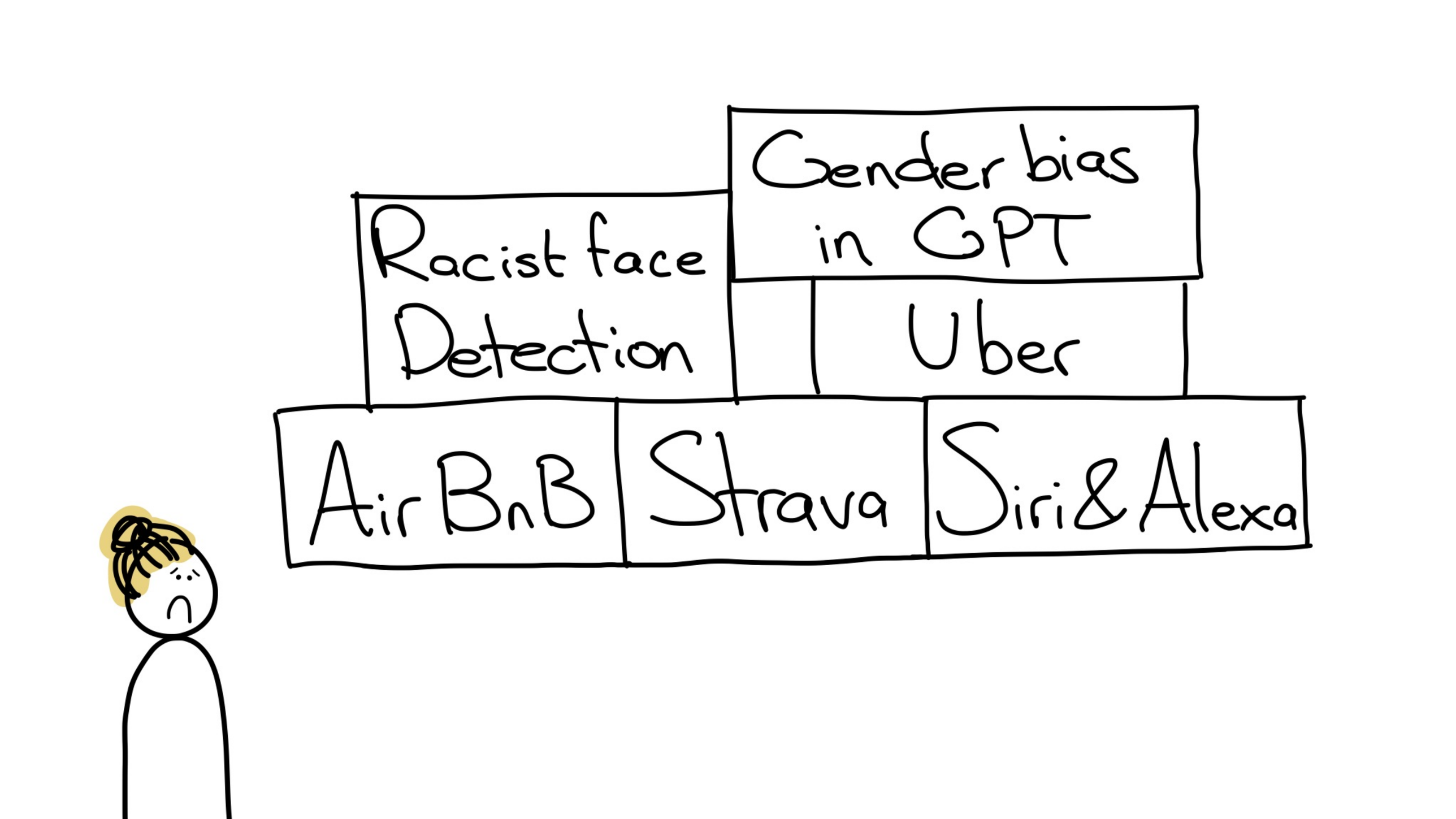

Siri & Alexa
Female voices?

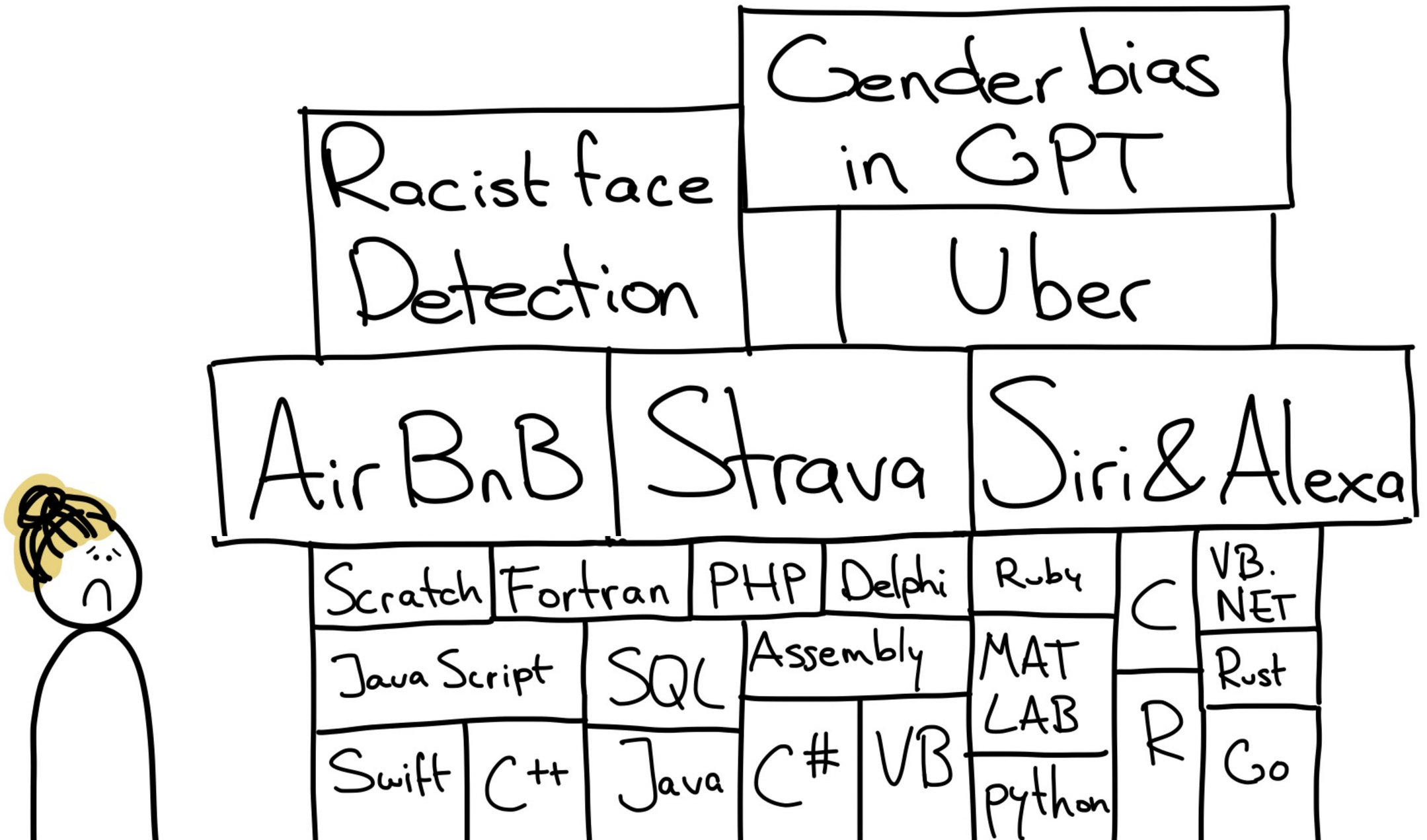

Strava
Siri & Alexa

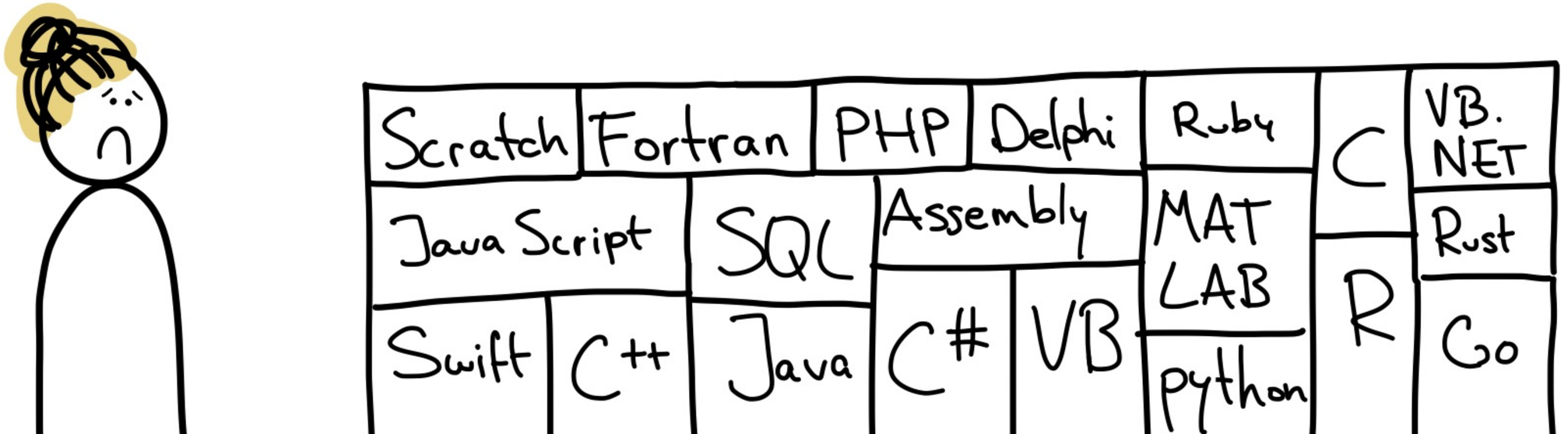

Strava
Siri & Alexa
Tracks 35 bike parts but no bra?

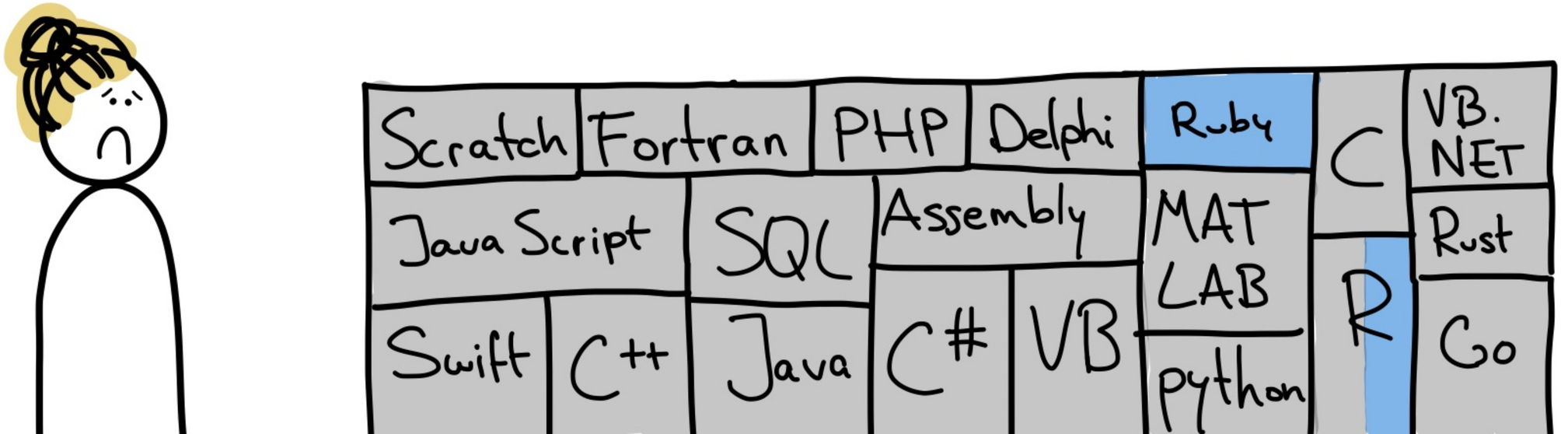

Uber
AirBnB
Strava
Siri & Alexa
Whose neighborhood is affected?


Uber
AirBnB
Strava
Siri & Alexa
Whose livelihood is affected?


Racist face Detection
Gender bias in GPT
Uber
AirBnB
Strava
Siri & Alexa

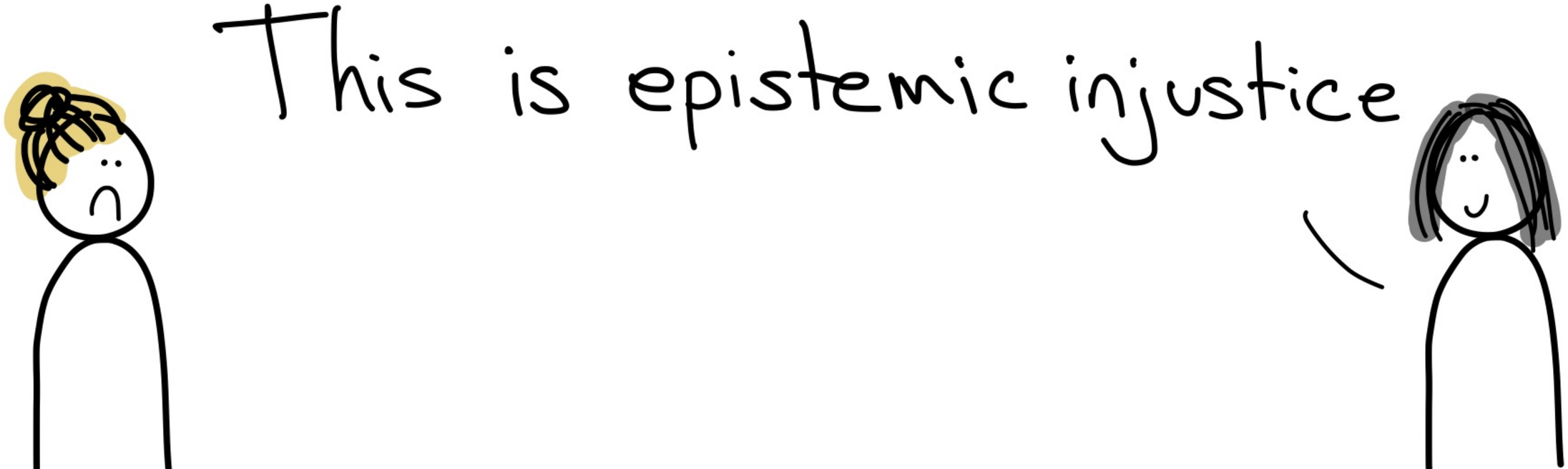

Racist face Detection
Gender bias in GPT
Uber
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Strava
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Scratch
Fortran
PHP
Delphi
Ruby
C
VB. NET
Java Script
SQL
Assembly
MAT LAB
Rust
Swift
C++
Java
C#
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R
Go
python


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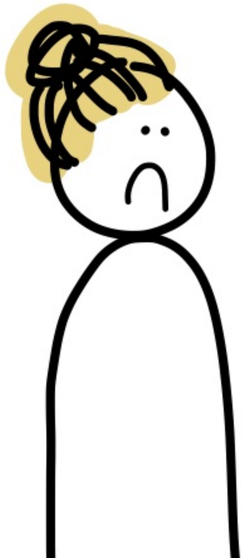
```cpp
#include <iostream>

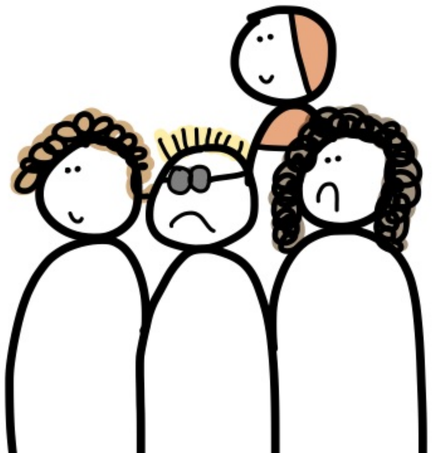
int main() {
    std::cout << "Hello World!";
    return 0;
}
```

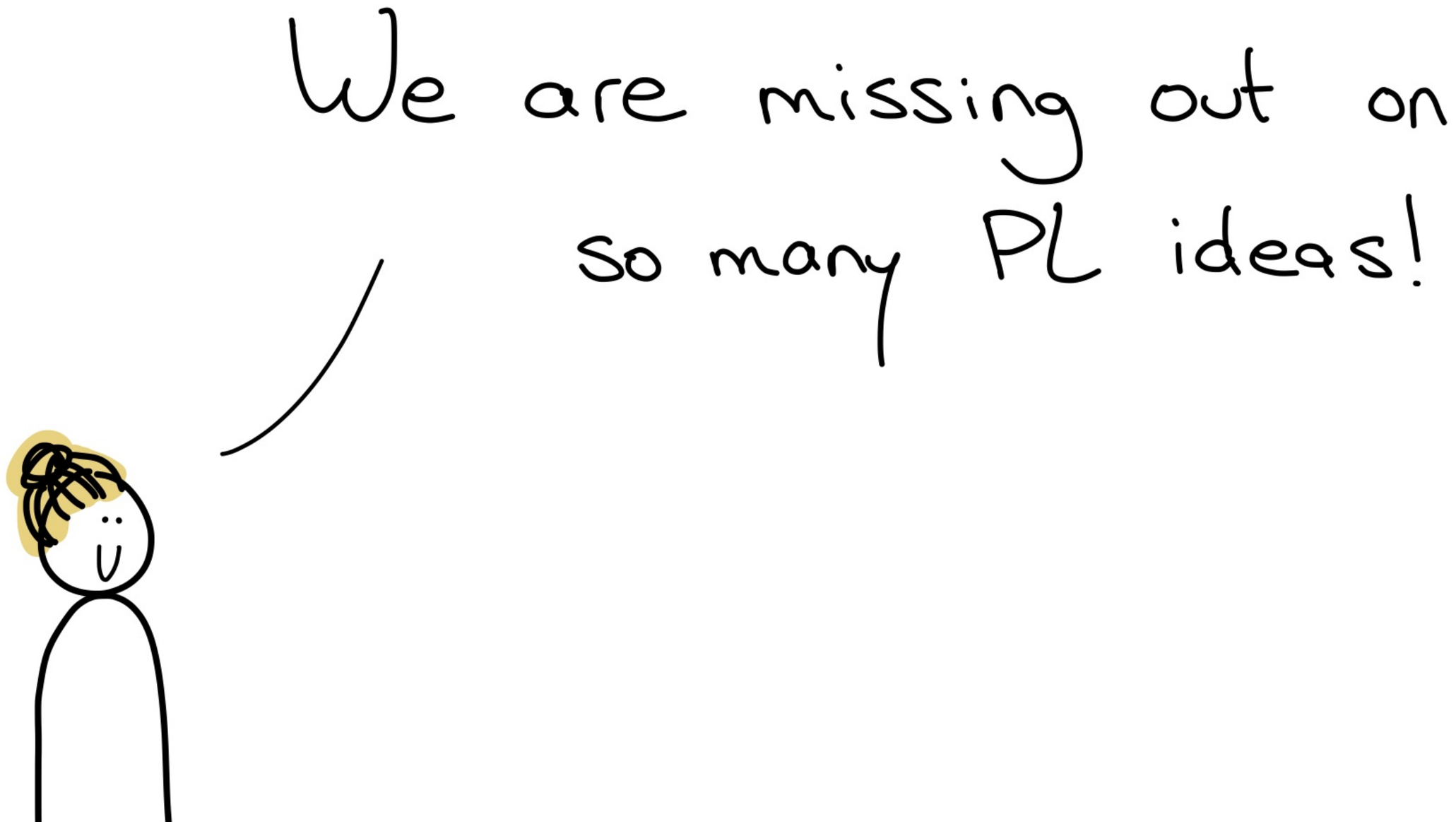


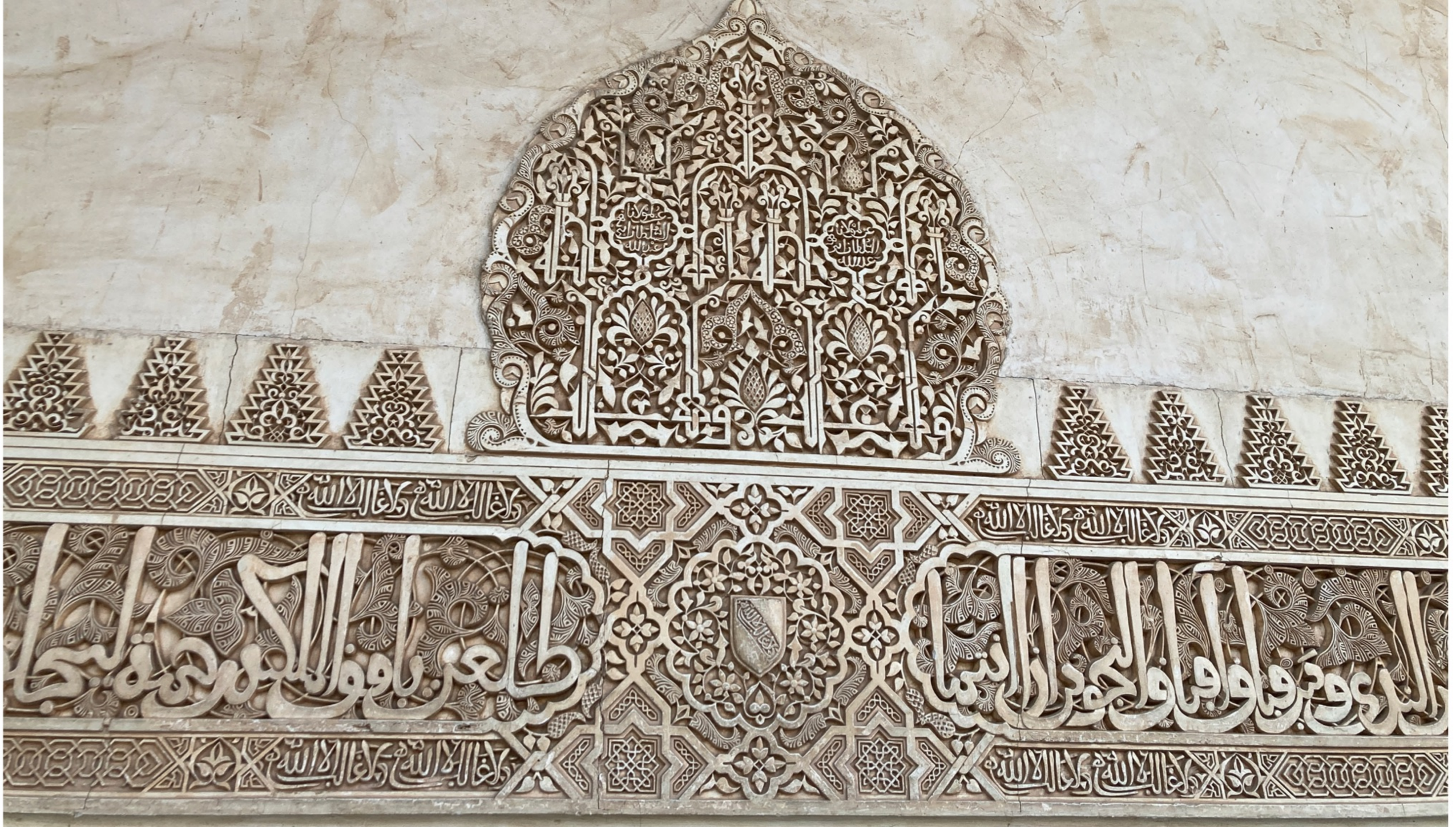
```cpp
#include <iostream>

int main() {
    std::cout << "Hello World!";
    return 0;
}
```






We are missing out on so many PL ideas!




ولا غالب الا الله ولا غالب الا الله
ولا غالب الا الله ولا غالب الا الله
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فائدته ويستحيل نقل الكنز من مكان الى مكان الثالث

ما نحن بصدده وهو البنكامات الدوريه المعمولة من الدواليب

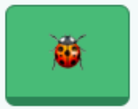
من الحديد او الفولاذ او النحاس او الخشب بدير بعضها بعضا

على نسب عددية في اسنانها او مقادير اقطارها واقربها من المحرك

فسبب

```
اسمك هو اسأل 'من يمشي في الغابة؟'
قول اسمك 'يمشي عبر الغابة'
قول اسمك '..واجه الوحش'
النهاية هو اسأل ' هل تريد نهاية جيدة او سيئة؟'
اذا النهاية هي جيدة قول اسمك ' يأخذ السيف ويهرب الوحش بسرعة'
وإلا قول 'الوحش يأكل' اسمك
```

تنفيذ البرنامج



الرجوع الى المستوى 4

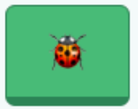
القراءة بصوت عال:

keywords-ar.lark

```
_PRINT: ( "_" "ل" *"_" "و" *"_" "ق" *"_"*  | "print") _SPACE?
_ASK: ( "_" "ل" *"_" "أ" *"_" "س" *"_" "ا" *"_"*  | "ask") _SPACE?
_ECHO: ( "_" "د" *"_" "د" *"_" "ر" *"_"*  | "echo") _SPACE?
_FORWARD: ( "_" "م" *"_" "د" *"_" "ق" *"_" "ت" *"_"*  | "forward") _SPACE?
_TURN: ( "_" "ر" *"_" "د" *"_" "ت" *"_" "س" *"_" "ا" *"_"*  | "turn") _SPACE?
left: ( "_" "ر" *"_" "ا" *"_" "س" *"_" "ي" *"_"*  | "left") _SPACE?
right: ( "_" "ن" *"_" "ي" *"_" "م" *"_" "ي" *"_"*  | "right") _SPACE?
black: ( "_" "د" *"_" "و" *"_" "س" *"_" "ا" *"_"*  | "black") _SPACE?
blue: ( "_" "ق" *"_" "ر" *"_" "ز" *"_" "ا" *"_"*  | "blue") _SPACE?
brown: ( "_" "ي" *"_" "ن" *"_" "ب" *"_"*  | "brown") _SPACE?
gray: ( "_" "ي" *"_" "د" *"_" "ا" *"_" "م" *"_" "ر" *"_"*  | "gray") _SPACE?
green: ( "_" "ر" *"_" "ض" *"_" "خ" *"_" "ا" *"_"*  | "green") _SPACE?
orange: ( "_" "ي" *"_" "ل" *"_" "ا" *"_" "ق" *"_" "ت" *"_" "ر" *"_" "ب" *"_"*  | "orange") _SPACE?
pink: ( "_" "ي" *"_" "ر" *"_" "ه" *"_" "ز" *"_"*  | "pink") _SPACE?
purple: ( "_" "ي" *"_" "ج" *"_" "س" *"_" "ف" *"_" "ن" *"_" "ب" *"_"*  | "purple") _SPACE?
red: ( "_" "ر" *"_" "م" *"_" "ح" *"_" "ا" *"_"*  | "red") _SPACE?
white: ( "_" "ض" *"_" "ي" *"_" "ب" *"_" "ا" *"_"*  | "white") _SPACE?
yellow: ( "_" "ر" *"_" "ف" *"_" "ص" *"_" "ا" *"_"*  | "yellow") _SPACE?
_IS: _SPACE ("هي" | "هو" | "is") _SPACE
_SLEEP: ( "_" "ر" *"_" "ظ" *"_" "ت" *"_" "ن" *"_" "ا" *"_"*  | "sleep") _SPACE?
_ADD_LIST: ( "_" "ف" *"_" "ض" *"_" "ا" *"_"*  | "add") _SPACE
```

```
اسمك هو اسأل 'من يمشي في الغابة؟'
قول اسمك 'يمشي عبر الغابة'
قول اسمك '..واجه الوحش'
النهاية هو اسأل ' هل تريد نهاية جيدة او سيئة؟'
اذا النهاية هي جيدة قول اسمك ' يأخذ السيف ويهرب الوحش بسرعة'
وإلا قول 'الوحش يأكل' اسمك
```

تنفيذ البرنامج



الرجوع الى المستوى 4

القراءة بصوت عال:

```
اسمك هو اســـأل 'من يمشي في الغابة؟'
قـــــــــــول اسمك 'يمشي عبر الغابة'
قـــــــــــول اسمك '..واجه الوحش'
النهاية هو اســـــــــــأل ' هل تريد نهاية جيدة او سيئة؟'
اذا النهاية هي جيدة قول اسمك ' يأخذ السيف ويهرب الوحش بسرعة'
وإلا قـــــــــول 'الوحش يأكل' اسمك
```

تنفيذ البرنامج

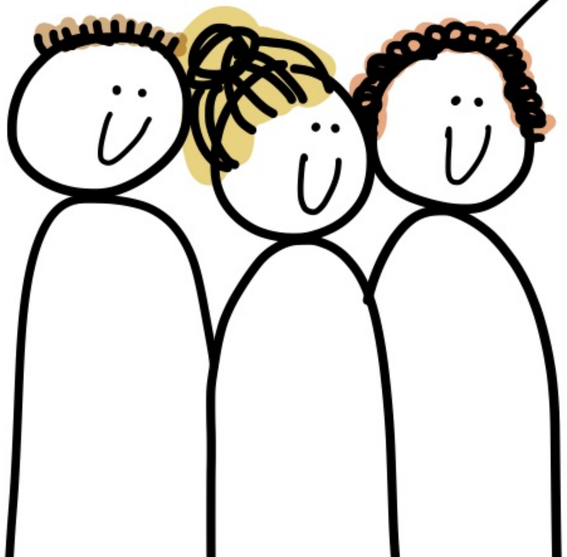
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الرجوع الى المستوى 4

القراءة بصوت عال: 🤫

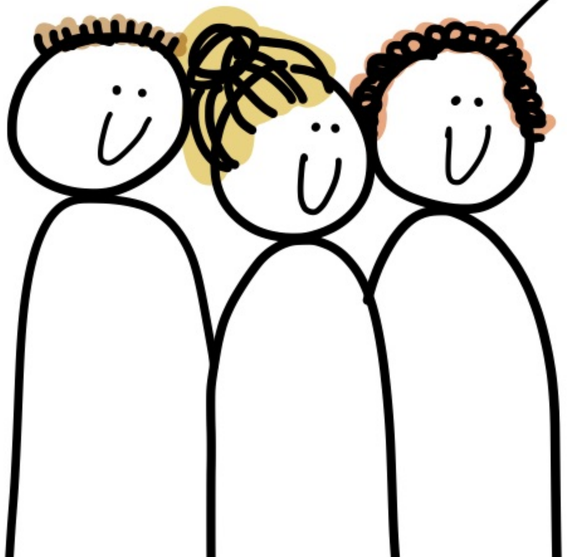
Hedy Community

Join us!



Hedy Community

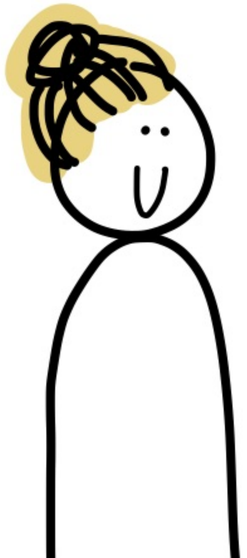
Join us!

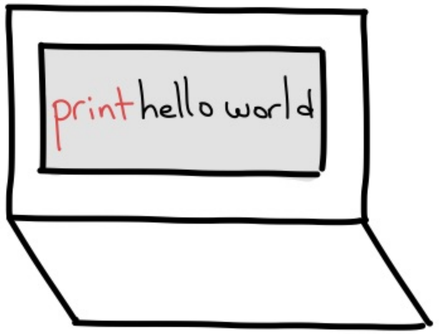


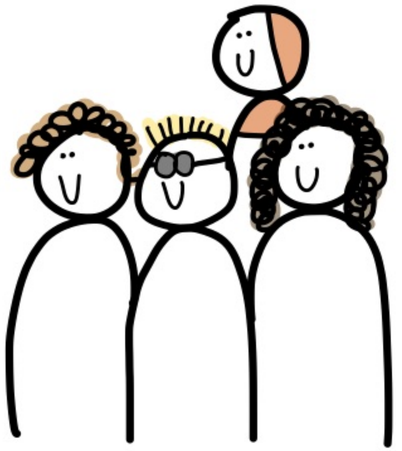
www.hedy.org/join

A human programming language

How to make programming languages more inclusive
and why that matters







prof. dr. ir. Felienne Hermans