UNIVERSITY OF
LUCERNE

The ABC of Computational Text Analysis

#9 Introduction to Python

Alex Flückiger
Faculty of Humanities and Social Sciences
University of Lucerne

Recap last Lecture

- from unique words to embeddings 🧮

  recontextualized word meaning

- today's data-driven NLP is both powerful and biased ⚠️

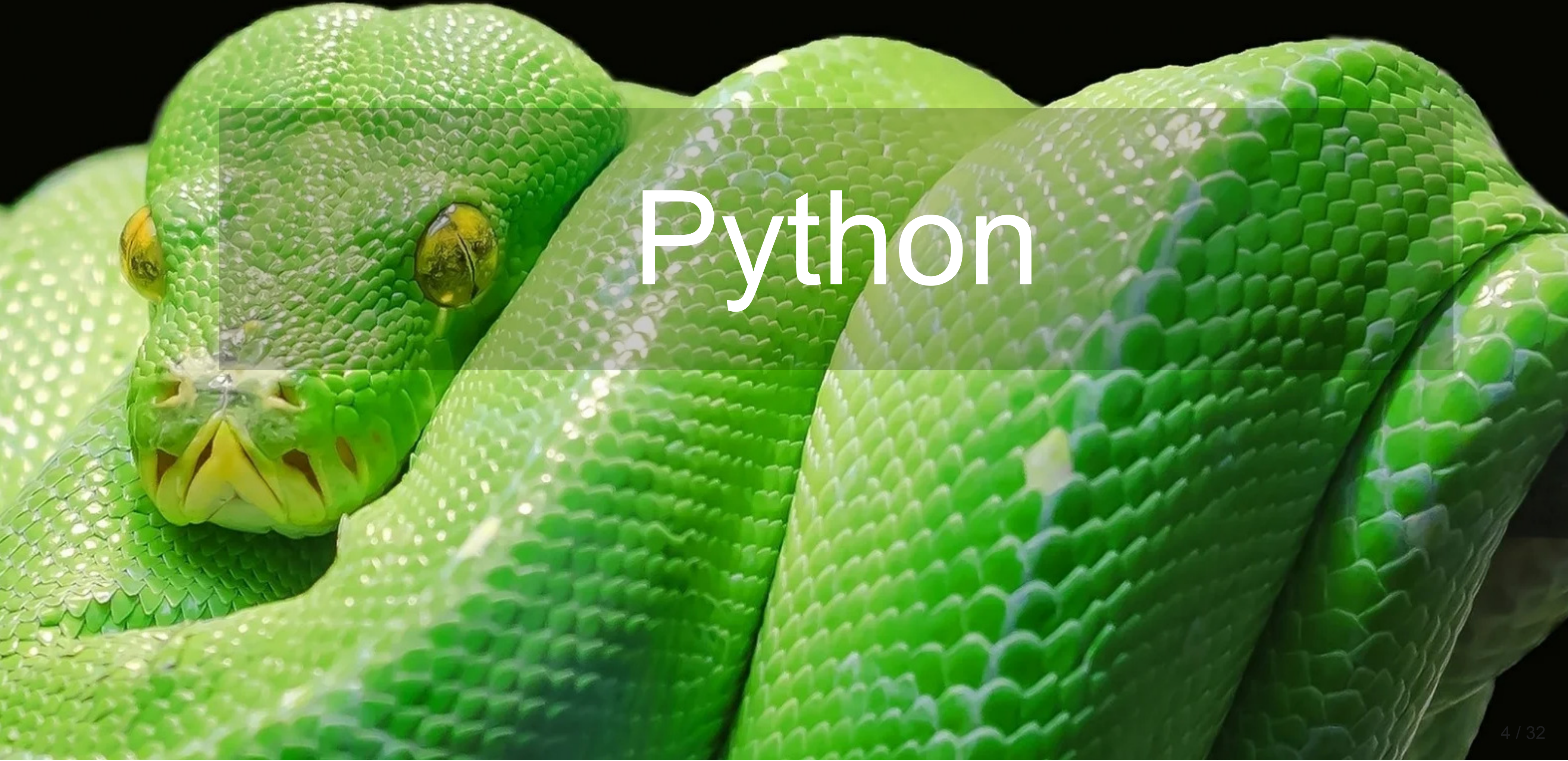
  data is never raw but depends on many decisions

Outline

- enter the shiny world of Python 😎

  programming basics

- get familiar with Visual Basic Code



Python

Python is …

a programming language that is…

- general-purpose

  not specific to any domain

- interpreted

  no compiling

- very popular in data science

Common (programming) languages

How to learn programming?

Three inconvenient truths 😰

- programming cannot be learnt in a course alone

  I try to make the start as easy as possible!

- frustration is part of learning

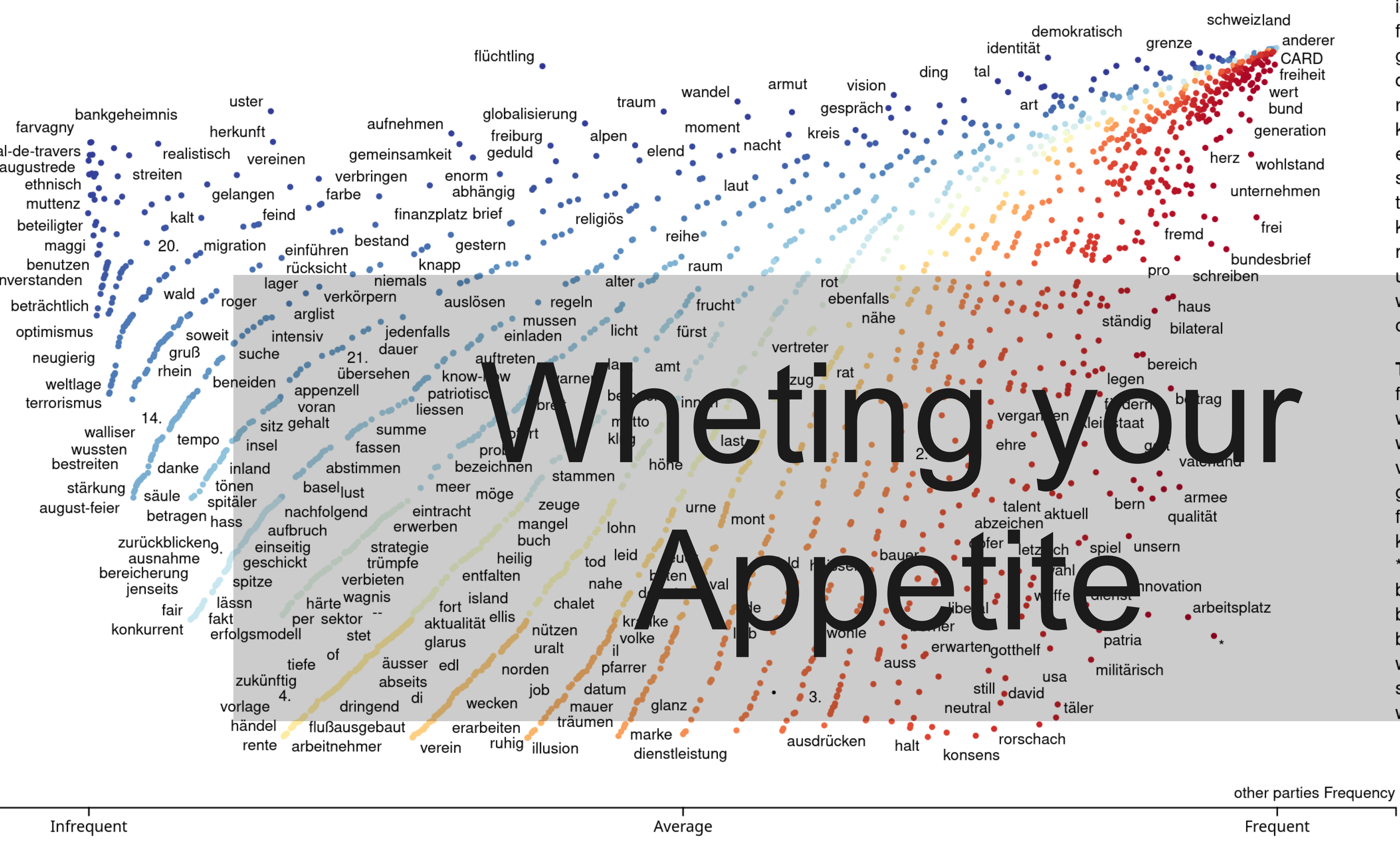
  fight your way!

- the Python ecosystem is huge

  grow skills by step-by-step

Programming can be absolutely captivating! ✌️

Wheting your Appetite



Top SP
identität
flüchtling
grenze
demokratisch
rütli
kulturell
eu
symbol
tal
kultur
nachbar
uster
wandel
ort

Top other parties
frei
wohlstand
wert
volk
generation
freiheit
kraft
*
bürger
bund
bundesbrief
wirtschaft
sicherheit
wille

Characteristi
CARD
politisch
vieler
anderer
gemeinsam
freiheit
wirtschaftlich
demokratie
wohlstand
eidgenossens
brauchen
bleiben
schweizerisch
stehen
zukunft
heutig
eidgenosse
bundesrat
kanton
verantwortung
grenze
schaffen
bedeuten
nationalfeierta
vertrauen
wichtig
bundesbrief
feiern
einzeln
staat

Programming Concepts & Python Syntax

Variables

Variables are kind of storage boxes 🎁

```python
# define variables
x = "at your service"
y = 2
z = ", most of the time."

# combine variables
int_combo = y * y          # for numbers any mathematical operation
str_combo = x + z          # for text only concatenation with +

# show content of variable
print(str_combo)
```

Data Types

The type defines the object’s properties

Name	What for?	Type	Examples
String	Text	str	`"Hi!"`
Integer, Float	Numbers	int, float	`20`, `4.5`
Boolean	Truth values	bool	`True`, `False`
⋮	⋮	⋮	⋮
List	List of items (ordered, mutable)	list	`["Good", "Afternoon", "Everybody"]`
Tuple	List of items (ordered, immutable)	tuple	`(1, 2)`
Dictionary	Relations of items (unordered, mutable)	dict	`{"a":1, "b": 2, "c": 3}`

Data Type Conversion

Combine variables of the same type only

```python
# check the type
type(YOUR_VARIABLE)

# convert types (similar for other types)
int('100')  # convert to integer
str(100)    # convert to string

# easiest way to use a number in a text
x = 3
mixed = f"x has the value: {x}"
print(mixed)
```

Confusing Equal-Sign

= vs. == contradicts the intuition

```
# assign a value to a variable
x = 1
word = "Test"

# compare two values if they are identical
1 == 2                  # False
word == "Test"          # True
```

Comments

- lines ignored by Python
- write comments, it helps you… 📝
  - to learn initially
  - to understand later

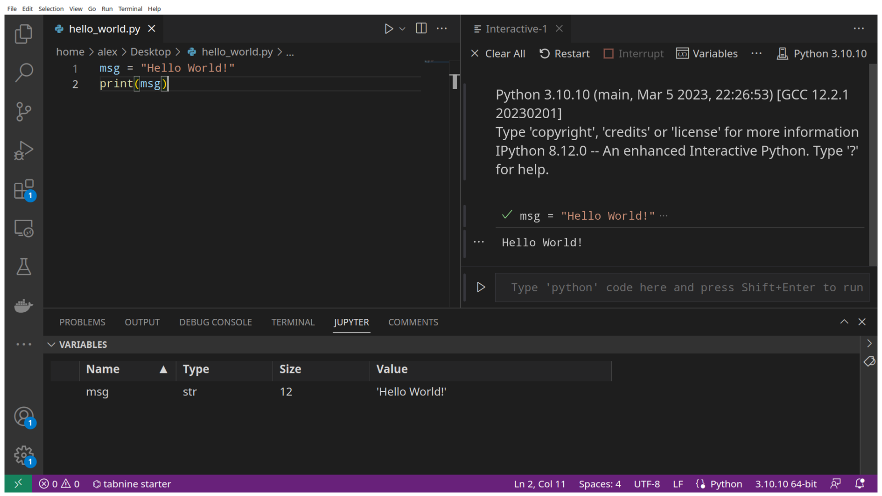
```
# single line comment

"""
comment across
multiple
lines
"""
```

Visual Studio Code

The (best) editor to program in Python

- VS Code features
  - interactive programming
  - integrated development environment (IDE)
  - similar to RStudio
- 3 views in editor
  - programming (left)
  - output (right)
  - additional information (bottom)
- use `tab` for autocompletion


File Edit Selection View Go Run Terminal Help
hello_world.py
home > alex > Desktop > hello_world.py > ...
Interactive-1
Clear All
Restart
Interrupt
Variables
Python 3.10.10
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL JUPYTER COMMENTS
VARIABLES
Ln 2, Col 11 Spaces: 4 UTF-8 LF Python 3.10.10 64-bit
tabnine starter

```python
msg = "Hello World!"
print(msg)
```

```
Python 3.10.10 (main, Mar 5 2023, 22:26:53) [GCC 12.2.1
20230201]
Type 'copyright', 'credits' or 'license' for more information
IPython 8.12.0 -- An enhanced Interactive Python. Type '?'
for help.

msg = "Hello World!" ...

Hello World!

Type 'python' code here and press Shift+Enter to run
```

Name	Type	Size	Value
msg	str	12	'Hello World!'

Interface of Visual Studio Code

In-class: Get started for Python

1. Make sure that your local copy of the Github repository KED2023 is up-to-date with `git pull` in your command-line.
2. Open the Visual Studio Editor.
3. Windows User only: Make sure that you are connected to `WSL: Ubuntu` (green badge lower-left corner, see image on the slide after the next). If not, click on the badge and select `New WSL Window`.

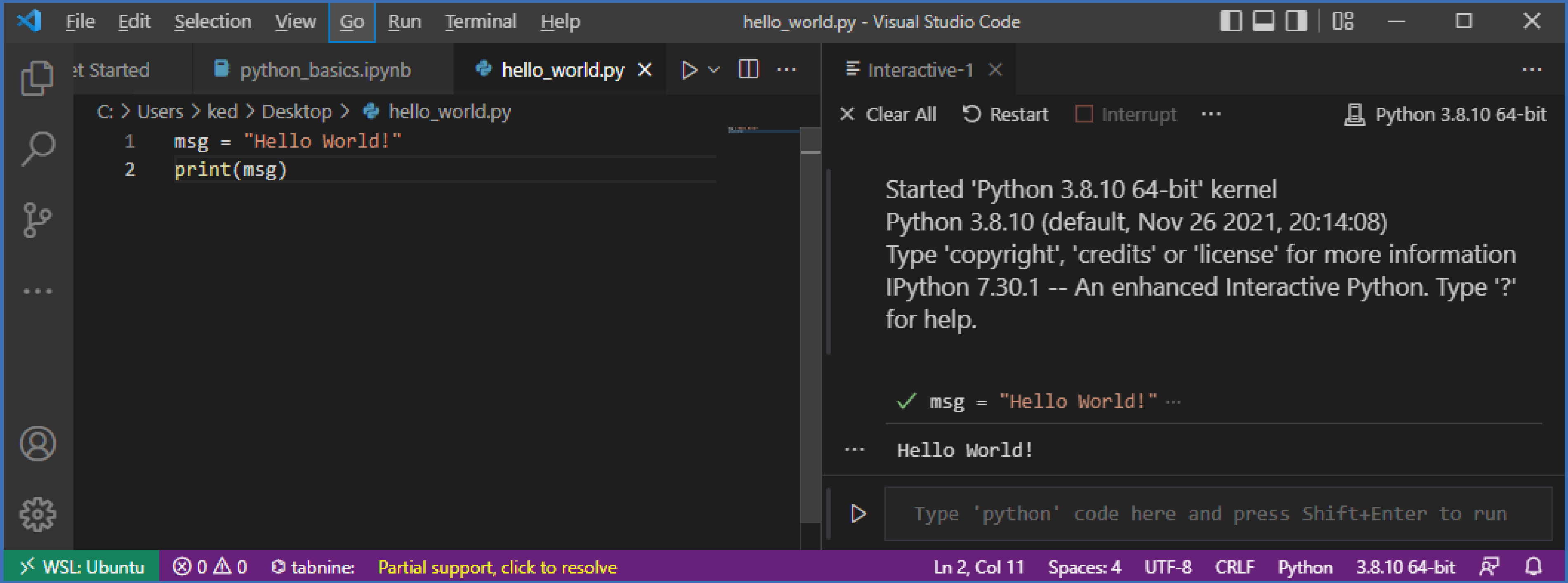
In-class: Run your first Python Program

1. Create a new file with the following content, save it as `hello_world.py`. Then, execute it by a right click on the code and select `Run current file in interactive window`.

   ```python
   # print out a message
   msg = "Hello World!"
   print(msg)
   ```

2. Does the output looks like the screenshot on the next slide? If the execution doesn’t work as expected, ask me or your neighbour. There might be a technical issue.

In-class: Expected Output



File Edit Selection View Go Run Terminal Help
hello_world.py - Visual Studio Code
et Started
python_basics.ipynb
hello_world.py
Interactive-1
C: > Users > ked > Desktop > hello_world.py
Clear All
Restart
Interrupt
Python 3.8.10 64-bit
WSL: Ubuntu
0 0
tabnine: Partial support, click to resolve
Ln 2, Col 11 Spaces: 4 UTF-8 CRLF Python 3.8.10 64-bit

```
msg = "Hello World!"
print(msg)
```

```
Started 'Python 3.8.10 64-bit' kernel
Python 3.8.10 (default, Nov 26 2021, 20:14:08)
Type 'copyright', 'credits' or 'license' for more information
IPython 7.30.1 -- An enhanced Interactive Python. Type '?'
for help.

✓ msg = "Hello World!" ...

... Hello World!

Type 'python' code here and press Shift+Enter to run
```

The Output "Hello World!" on the right side should look like in the screenshot

Iterations

for-loop

do something with each element of a collection

```python
sentence = ['This', 'is', 'a', 'sentence']

# iterate over each element
for token in sentence:

    # do something with the element
    print(token)
```

Conditionals

if-else statement

condition action on variable content

```
sentence = ['This', 'is', 'a', 'sentence']

if len(sentence) < 3:
    print('This sentence is shorter than 3 tokens')

elif len(sentence) == 3:
    print('This sentence has exactly 3 tokens')

else:
    print('This sentence is longer than 3 tokens')
```

Indentation matters!

- intend code within code blocks

  loops, if-statements etc.

- press `tab` to intend

✅

```python
if 5 > 2:
    print('5 is greater than 2
```

❌

```python
if 5 > 2:
print('5 is greater than 2')
```

Methods: Create new Objects

Build your world! 🌍

```
sentence = 'This is a sentence'

# split at whitespace and save result in new variable
tokens = sentence.split(' ')

# check the content and type variables
print(sentence, type(sentence), tokens, type(tokens))
```

Methods: Change Objects

Depending on the object, you can do different things 🛠️

```
# add something to a list
tokens.append('.')

# concatenate elements to string
tokens = ' '.join(tokens)
print(tokens, type(tokens))
```

Functions and Arguments

DRY: Don’t Repeat Yourself

- functions have a name and optional arguments

  `function_name(arg1, ..., argn)`

- some functions are predefined

  `print(), len() and sorted()`

```python
def get_word_properties(word): # define function
    """
    Print properties for a word given as an argument.
    """
    length = len(word)
    sorted_letters = sorted(word, reverse=True)
    print(f"{word} has {length} letters ({sorted_letters})".)

get_word_properties('computer') # call function with any word
```

Indexing

Computers start counting from zero! 😵

```
sentence = ['This', 'is', 'a', 'sentence']

# element at position X
first_tok = sentence[0]     # 'This'

# elements of subsequence [start:end]
sub_seq = sentence[0:3]     # ['This', 'is', 'a']

# elements of subsequence backwards
sub_seq_back = sentence[-2:]        # ['a', 'sentence']
```

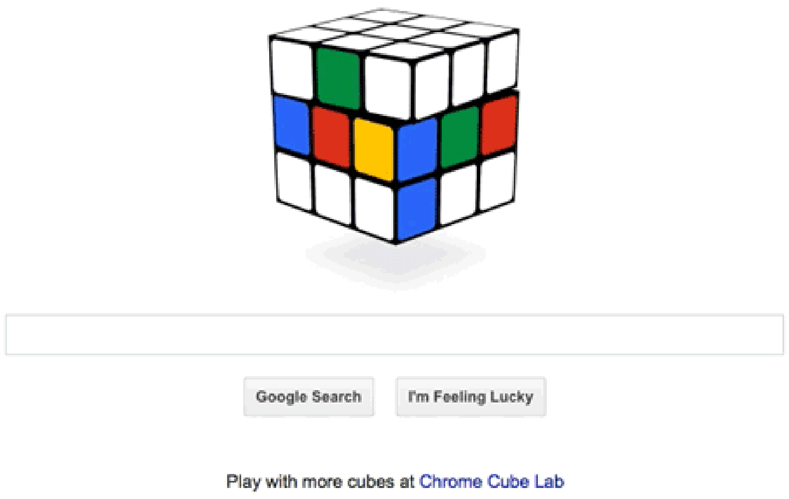
Errors

A myriad of things can go wrong 🤦

1. read the message
2. find the source of the error

    script name + line number

3. paste message into Google



Learning by doing, doing by googling

Modules/Packages

No programming from scratch 🎉

- packages provide more objects and functions
- packages need to be installed additionally

```python
# import third-party package
import pandas
import spacy
import plotnine
```

Jupyter Notebooks

- combine text and code in a single document

  similar to R Markdown
- open in VS Code
- run code with the play button left to the cell or with `CTRL+Enter`

In-class: Exercises I

1. Open the script with the basics of Python in your Visual Studio Editor: `KED2023/materials/code/python_basics.ipynb`
2. Try to understand the code in each cell and run them by clicking the play symbol left to them. Check the output. Modify some code as well as data and see how the output changes. Initially, this try-and-error is good strategy to learn. Some ideas:
   - Combine a string and an integer variable without converting it. What error do you get? How can you avoid it?
   - Select `is a` from the variable `sentence` using the right index.

In-class: Exercises II

1. Write a Python script that
    - takes text (a string)
    - splits it into words (a list)
    - iterates over all the tokens and print all tokens that are longer than 5 characters
    - Bonus: wrap your code in a function.
2. Go to the next slide. Start with some of the great interactive exercises out there in the web.

Resources

Get more explanations

- Google’s Python Class
- Introduction of Python for Social Scientists (Walsh 2021)
- Official Python introduction

Learn basics interactively

- Introduction to Python by IBM Cognitive Class
- LearnPython

Questions?

References

Walsh, Melanie. 2021. *Introduction to Cultural Analytics & Python* (version 1.1.0). Zenodo. https://doi.org/10.5281/ZENODO.4411250.