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The ABC of Computational Text Analysis

#9 Introduction to Python

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05 May 2023

Recap last Lecture

- from words to embeddings
  - recontextualized word meaning
- 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
  - development editor
- **think about mini-project**

Python

Python is ...

a programming language that is ...

- general-purpose

  not specific to any domain

- interpreted

  no compiling

- standard language in data science

Popular programming languages src

How to learn programming?

Three inconvenient truths 😰

- programming cannot be learnt in a course

  I try to make the start as easy as possible!

- frustration is part of learning

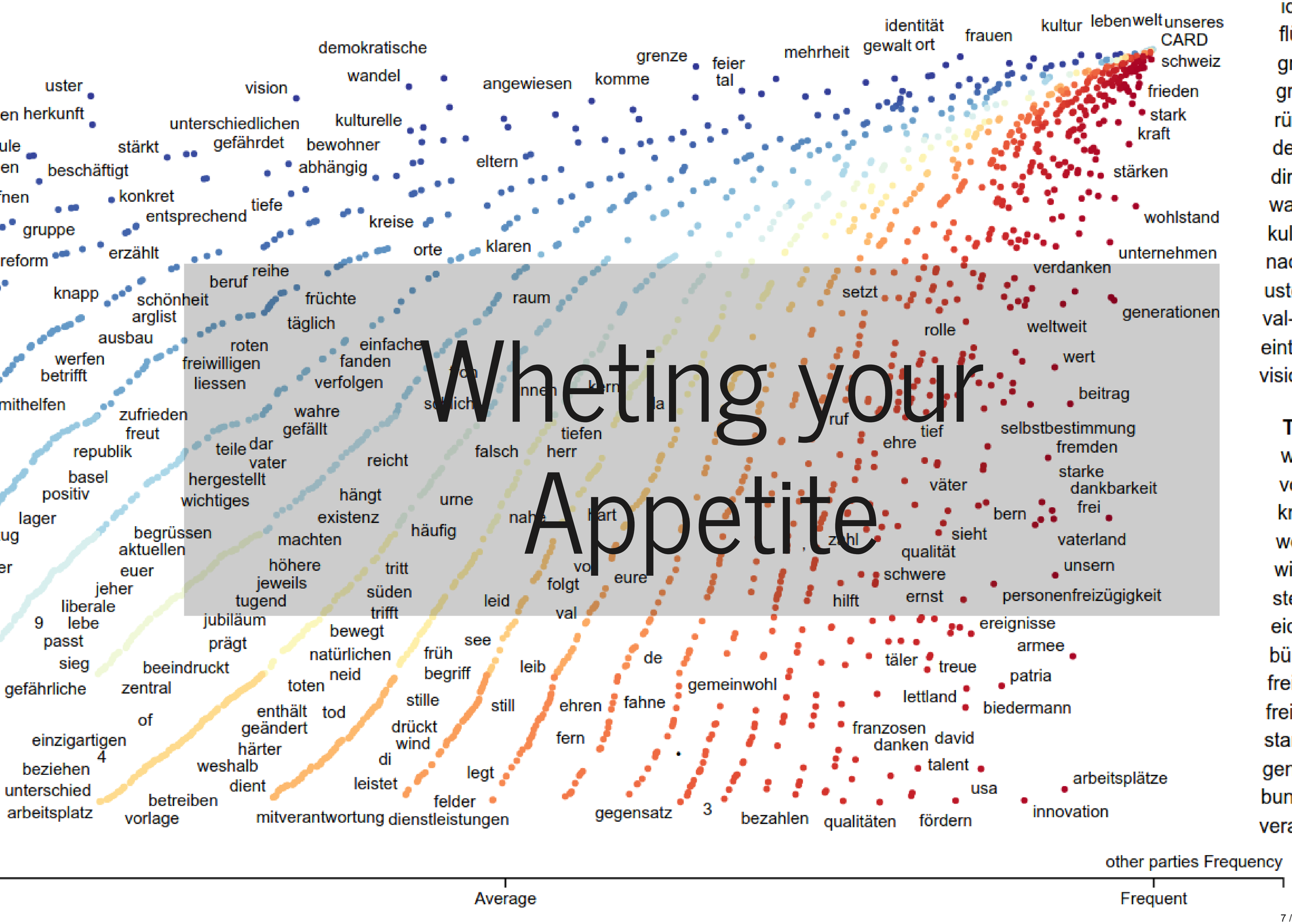
  fight your way!

- the Python ecosystem is huge

  grow skills by step-by-step

Programming can be absolutely captivating! ✌️

Wheting your Appetite



Programming Concepts and Python Syntax

Variables

Variables are kind of storage boxes 🎁

```
# 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

```
# 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

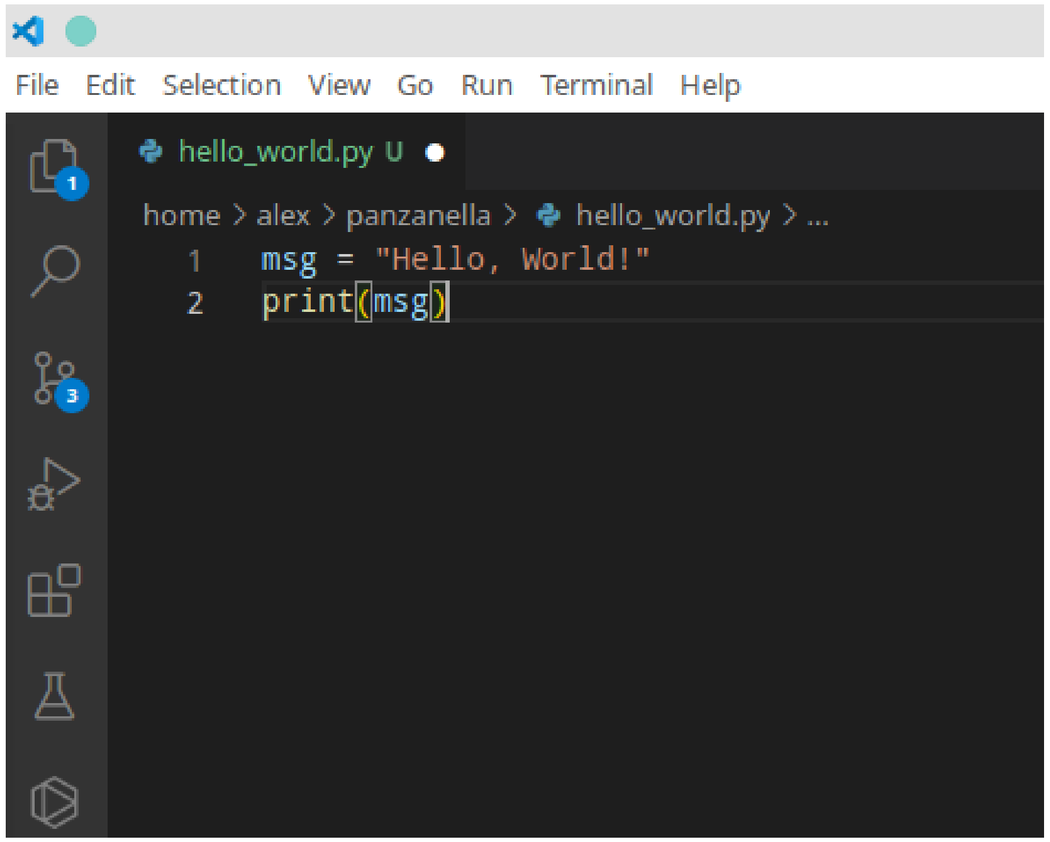
```
# single line comment

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

Visual Studio Code

The (best) editor to program in Python

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



Visual Studio Code

In-class: Run your first Python Program I

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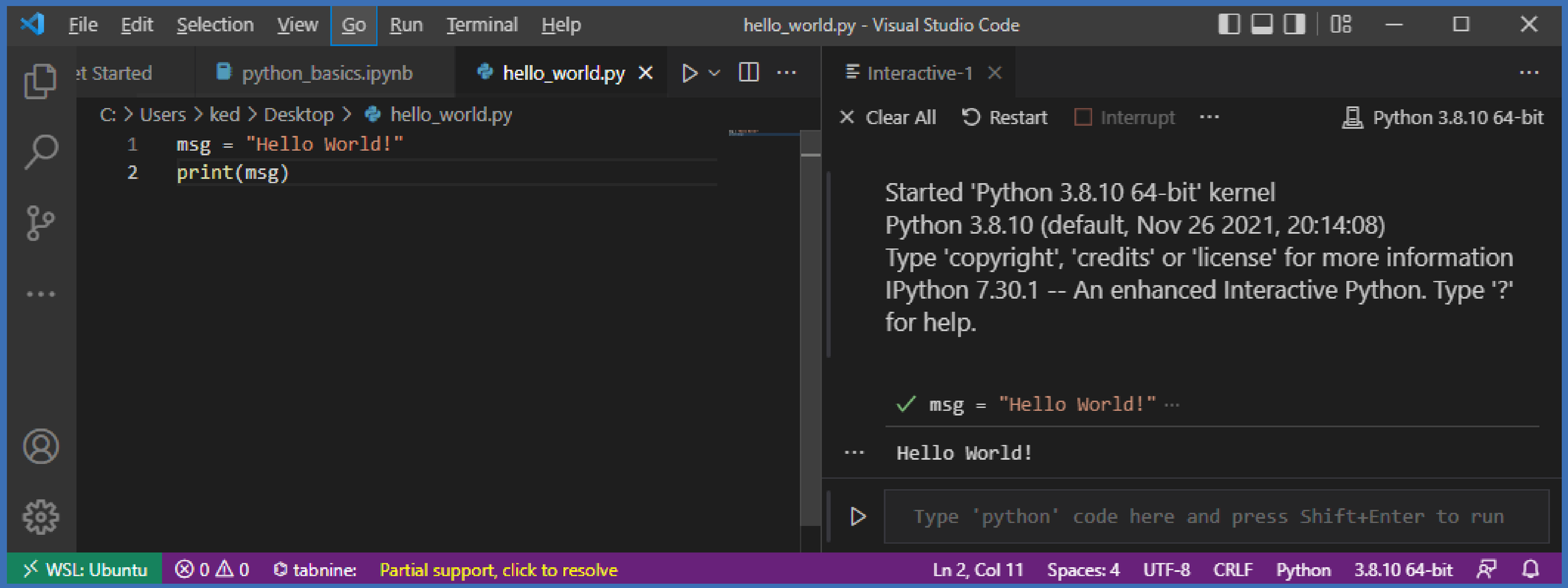


Iterations

for-loop

do something with each element of a collection

```
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

✅

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

❌

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

Methods

Do somethin with an object

```
sentence = 'This is a sentence'

# split at whitespace
tokens = sentence.split(' ')

# check the variables
print(sentence, type(sentence), tokens, type(tokens))

# 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)`

```
# define a new function
def get_word_properties(word):
    """
    My first function to print word properties.
    It takes any string as argument (variable: word).
    """

    # print(), len() and sorted() work also as functions
    length = len(word)
    sorted_letters = sorted(word, reverse=True)
    print(word, 'length:', length, 'letters:', sorted_letters)

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

Indexing

Computers start counting from zero! 😵

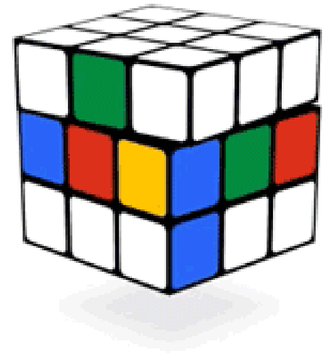
```
sentence = ['This', 'is', 'a', 'sentence']

# 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']
```

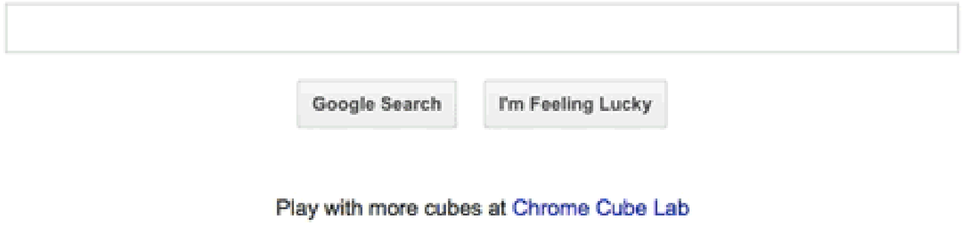
Errors

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 specific functionalities
- packages need to be installed first

NLP Packages

- spaCy

  industrial-strength Natural Language Processing (NLP)

- textaCy

  NLP, before and after spaCy

- scattertext

  beautiful visualizations of how language differs across corpora

Mini-Project

present project on 2 June 2023

- analyze any collection of documents
- apply quantitative measures + interpretation
  - compare historically
  - compare between actors
- form groups of 2-4 people

In-class: Exercises I

1. Open the script with the basics of Python in your Visual Studio Editor: `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 list 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 explainations

- Introduction of Python for Social Scientists (Walsh 2021)

Learn basics interactively

- Python Principles
- LearnPython

Official Python introduction

- Python introduction

Questions?

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