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Tutorial 2

Data Types and Structures in Python and R

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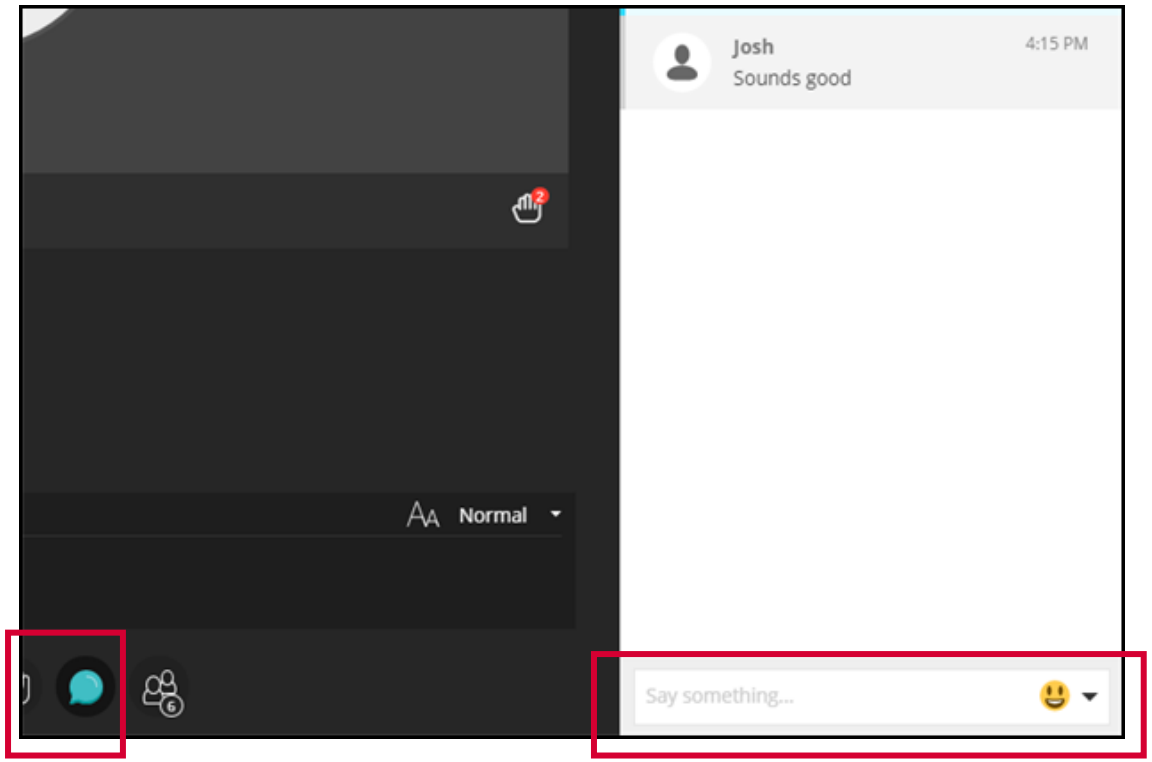

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How are you feeling today on this range of expressive animals?

Agenda

- ⁉ Error of the week
  - 🗀 Understanding and navigating folder structures in code
  - 🕮 Errors! Oh my … how to read them
- 🗈 Data types overview
- 🗪 Data types activity
- ? Any questions

⁉ Error of the week ⁉

🗀 Understanding and navigating folder structures in code

🕮 How to read error messages

How to find your current path

Python

- `OS` module to work with paths independent of operating systems
- `import os`

  `os.getcwd()`
  - to get the current working directory

R

- `getwd()`
  - base R function to get the current working directory
- When using R Projects, your current working directory automatically points to the root folder where that .Rproj file is saved
- When using an RMD, it is where the RMD file is located

Navigating folder structures in code

File path = location of a file on a computer's file system structure

Absolute path = specified from the root directory (which is the first or topmost directory)

- AKA "full file paths"
- ~ commonly used to represent user's home directory
- e.g., `C:\Users\bblankin\Teaching\AY2024-25\Data Types and Structures in Python and R\Tutorial Slides` or `~\Teaching\AY2024-25\Data Types and Structures in Python and R\Tutorial Slides`

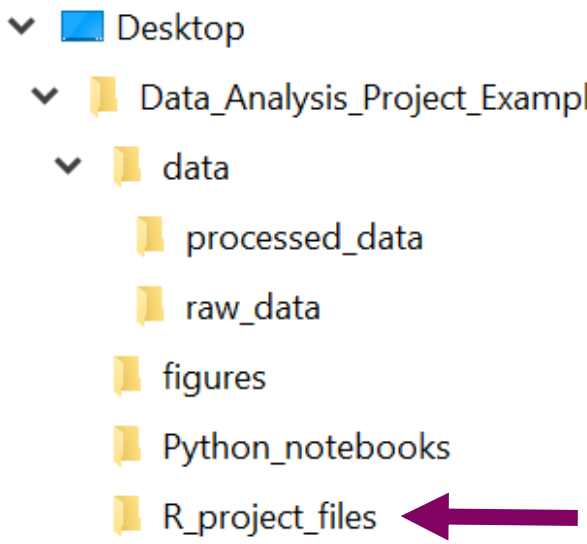
Relative path = path relative to the current directory

- Reproducible if you share your code with someone who has the same file and folder set up!
- Single dot (.) indicates current directory & double dot (..) represents parent directory
- e.g., `.\Data Types and Structures in Python and R\Tutorial Slides`

Path separators formatting note: Mac & Linux use / whereas Windows uses \

- URLs follow a standard format always using forward slash / regardless of operating system

Navigating folder structures in code



In Noteable, your home directory (`\home\jovyan\` or `~\`) = Jupyter Notebook File Browser (what you see when you open a Standard Python 3 server)

The absolute path to a RMD file in "R_project_files" is location:

```
~\Desktop\Data_Analysis_Project_Example\
R_project_files\R_file.RMD
```

To navigate **up** the folder tree, use the "`..`" prefix.
To navigate 2 levels up, repeat the up prefix twice "`..\..\`"
For example to go up to figures from R_project_files it would be:

```
..\figures\figure_1.png
```

To get to raw_data from within R_project_files:

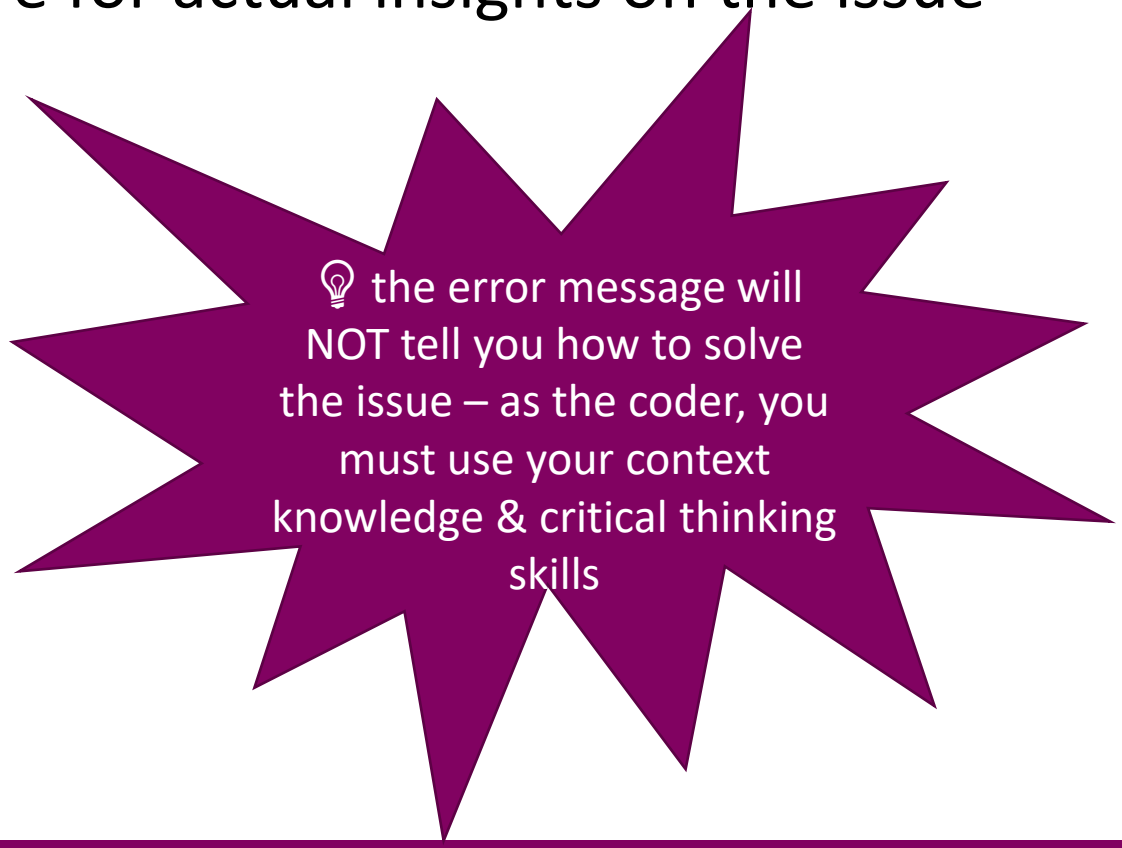
```
..\data\raw_data\raw_data.csv
```

How to read errors

- Step 1: Take a deep breath
- Step 2: Go to the bottom and read there for actual insights on the issue

⬆ Read from bottom to top!

- Key components:
  - Error location (if applicable)
  - Error type (more likely in Python)
  - Error message



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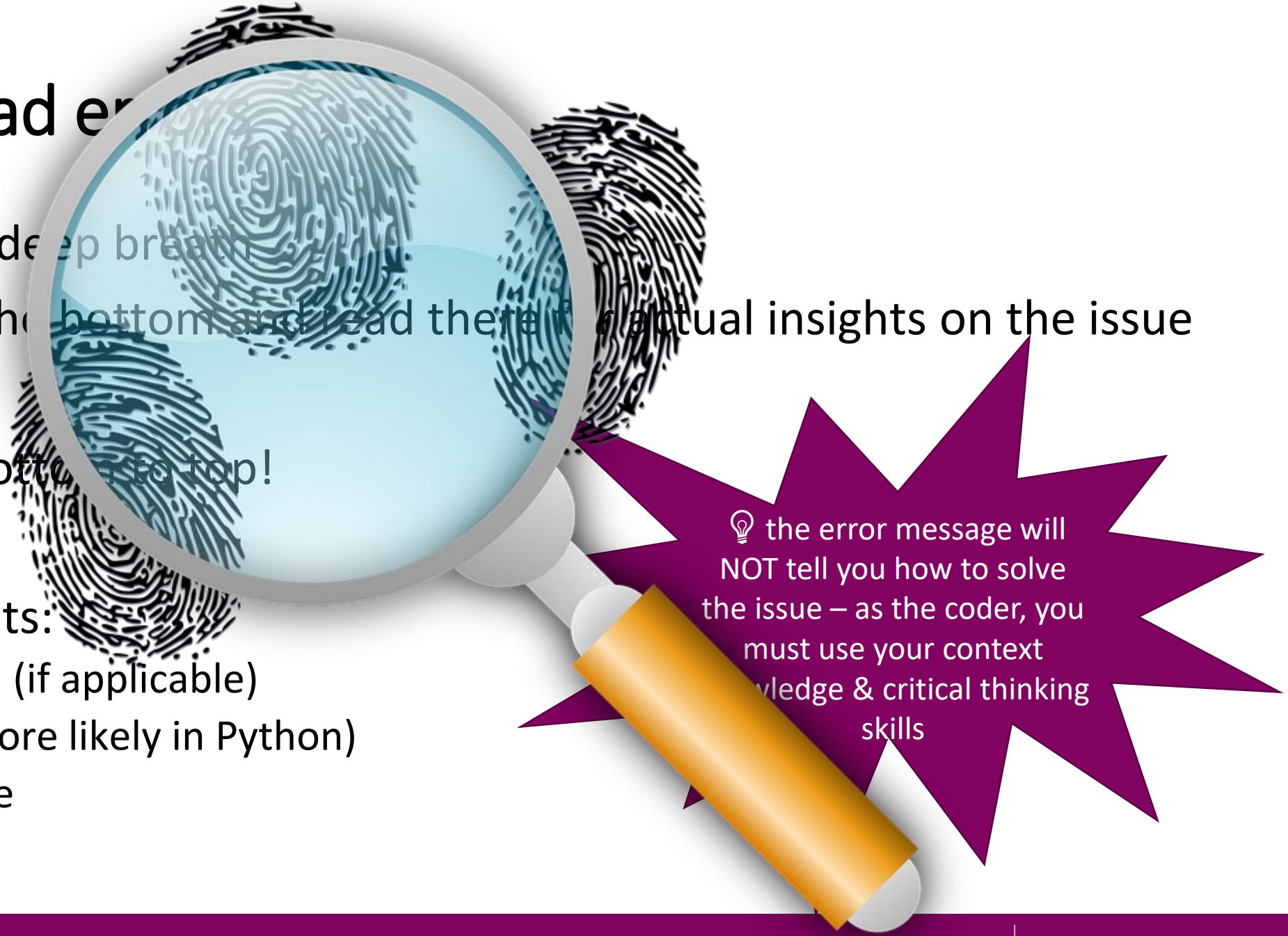
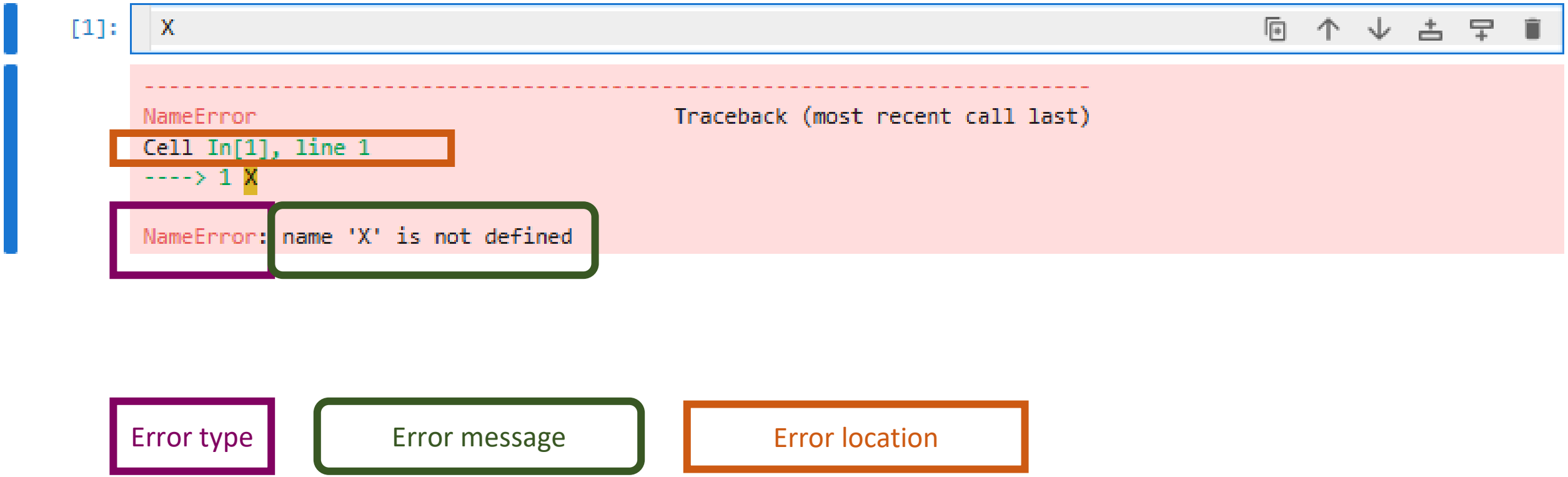


💡 the error message will NOT tell you how to solve the issue – as the coder, you must use your context wledge & critical thinking skills

Some examples – Python



Some examples – Python

Error type

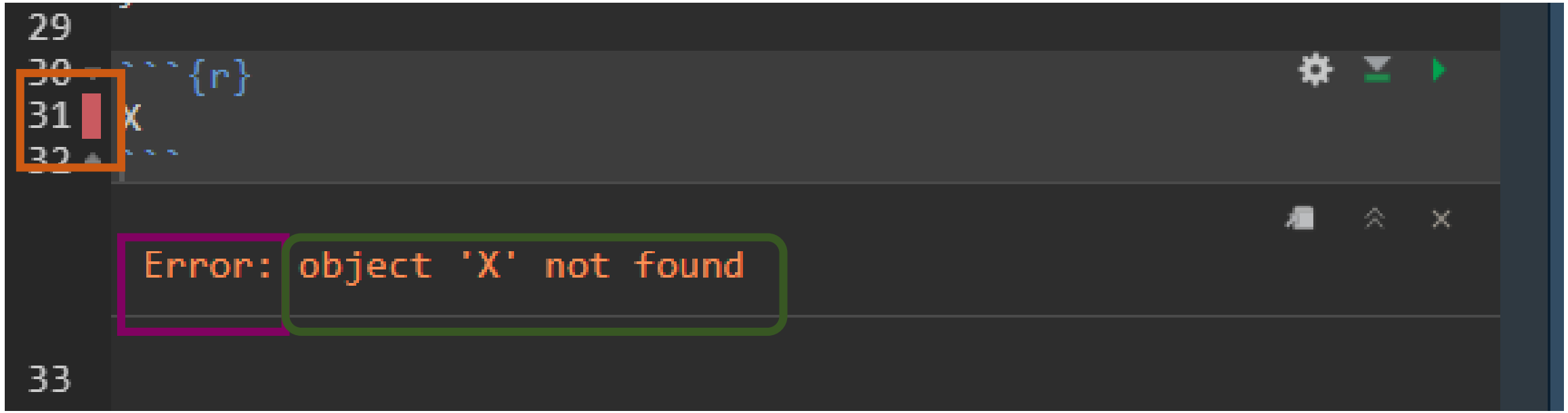
Error message

Error location

```
[5]: from IPython.display import Image
     Image(filename = "figures/PythoLogo.png")
```

```
---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
Cell In[5], line 2
      1 from IPython.display import Image
----> 2 Image(filename = "figures/PythoLogo.png")

File /opt/conda/lib/python3.11/site-packages/IPython/core/display.py:970, in Image.__init__(self, data, url, fil
ename, format, embed, width, height, retina, unconfined, metadata, alt)
    968 self.unconfined = unconfined
    969 self.alt = alt
--> 970 super(Image, self).__init__(data=data, url=url, filename=filename,
    971         metadata=metadata)
    973 if self.width is None and self.metadata.get('width', {}):
    974     self.width = metadata['width']

File /opt/conda/lib/python3.11/site-packages/IPython/core/display.py:327, in DisplayObject.__init__(self, data,
url, filename, metadata)
    324 elif self.metadata is None:
    325     self.metadata = {}
--> 327 self.reload()
    328 self._check_data()

File /opt/conda/lib/python3.11/site-packages/IPython/core/display.py:1005, in Image.reload(self)
   1003 """Reload the raw data from file or URL."""
   1004 if self.embed:
-> 1005     super(Image,self).reload()
   1006     if self.retina:
   1007         self._retina_shape()

File /opt/conda/lib/python3.11/site-packages/IPython/core/display.py:353, in DisplayObject.reload(self)
    351 if self.filename is not None:
    352     encoding = None if "b" in self._read_flags else "utf-8"
--> 353     with open(self.filename, self._read_flags, encoding=encoding) as f:
    354         self.data = f.read()
    355 elif self.url is not None:
    356     # Deferred import

FileNotFoundError: [Errno 2] No such file or directory: 'figures/PythoLogo.png'
```

Some examples – R (in RMD/console)



Error type

Error message

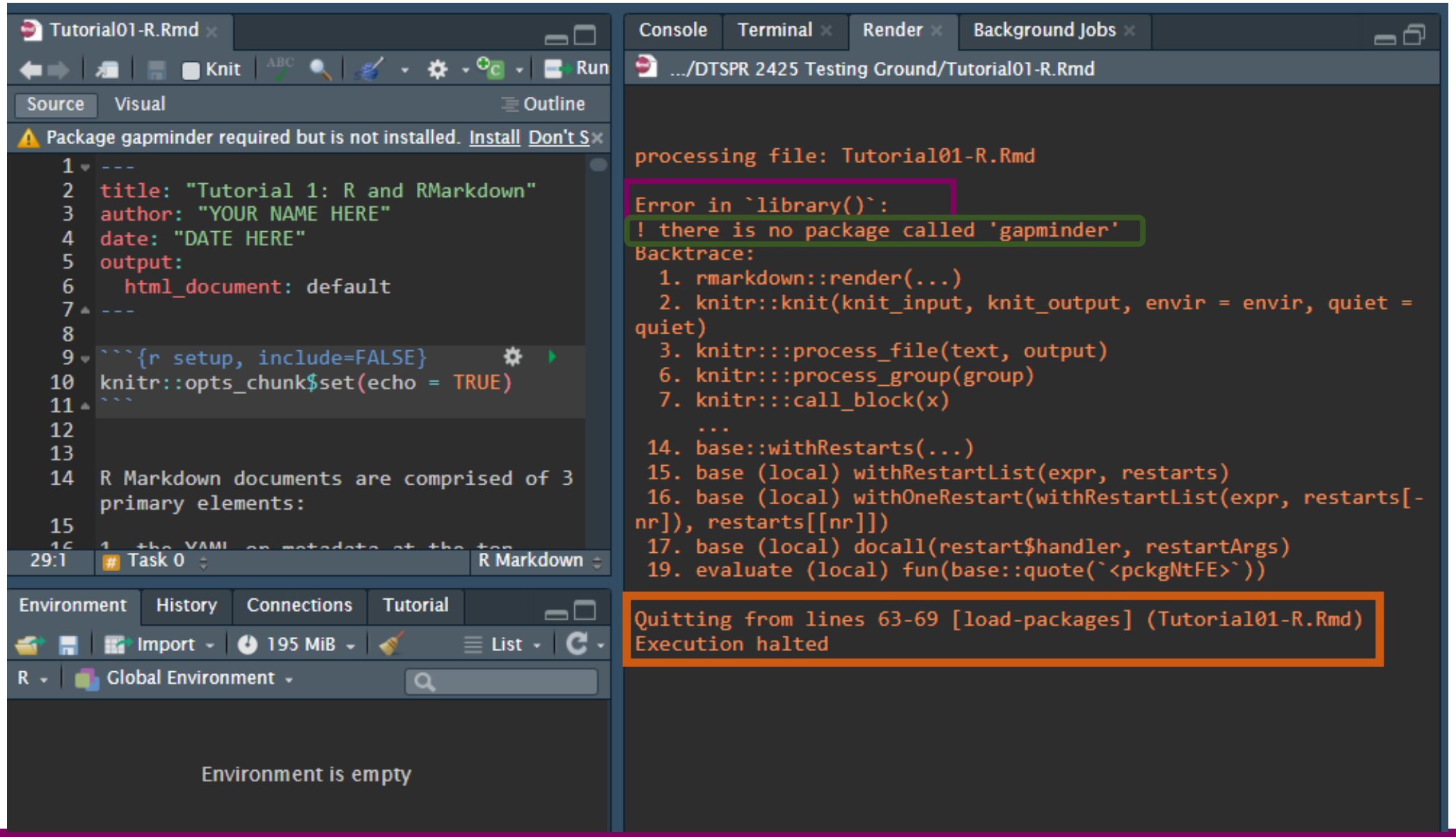
Error location

Some examples – R (knitting)

Error type

Error message

Error location

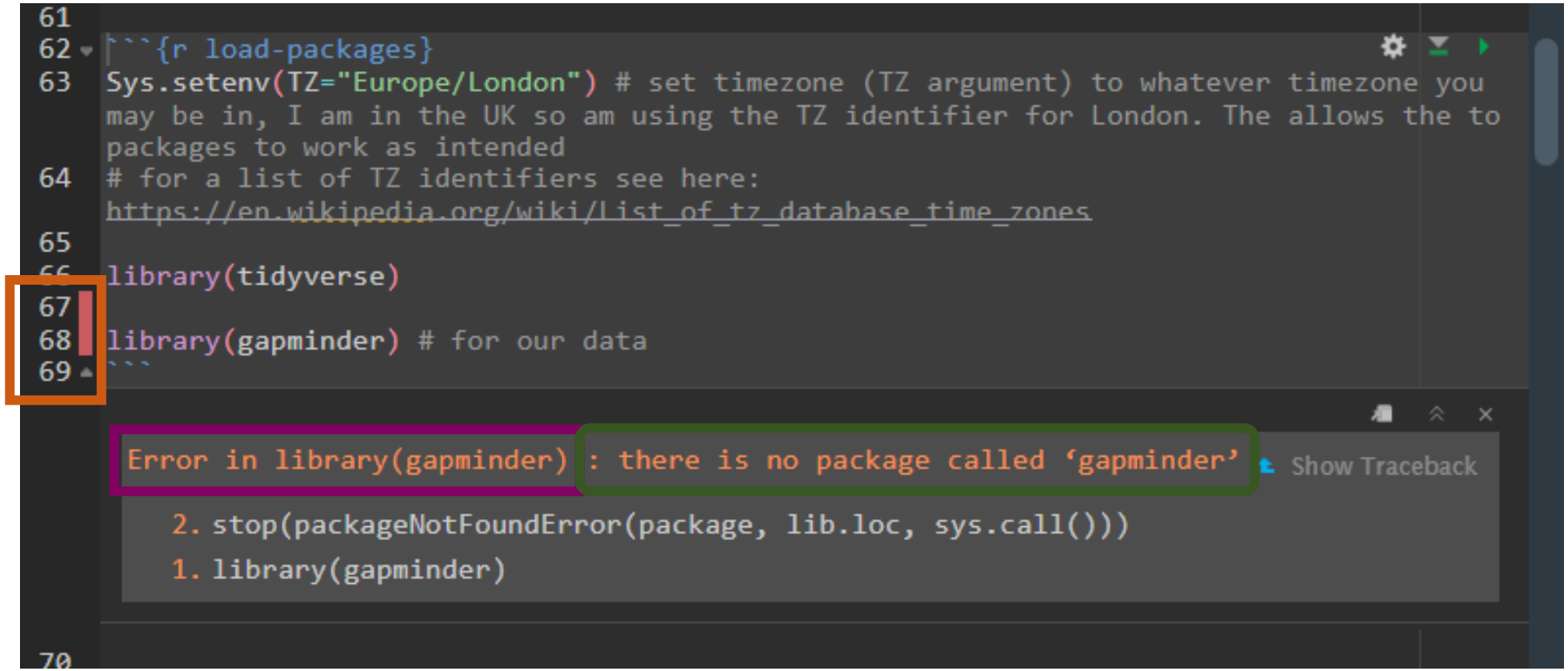


Some examples – R (knitting) … what lines 63-69 look like when code is run in the RMD document

Error type

Error message

Error location

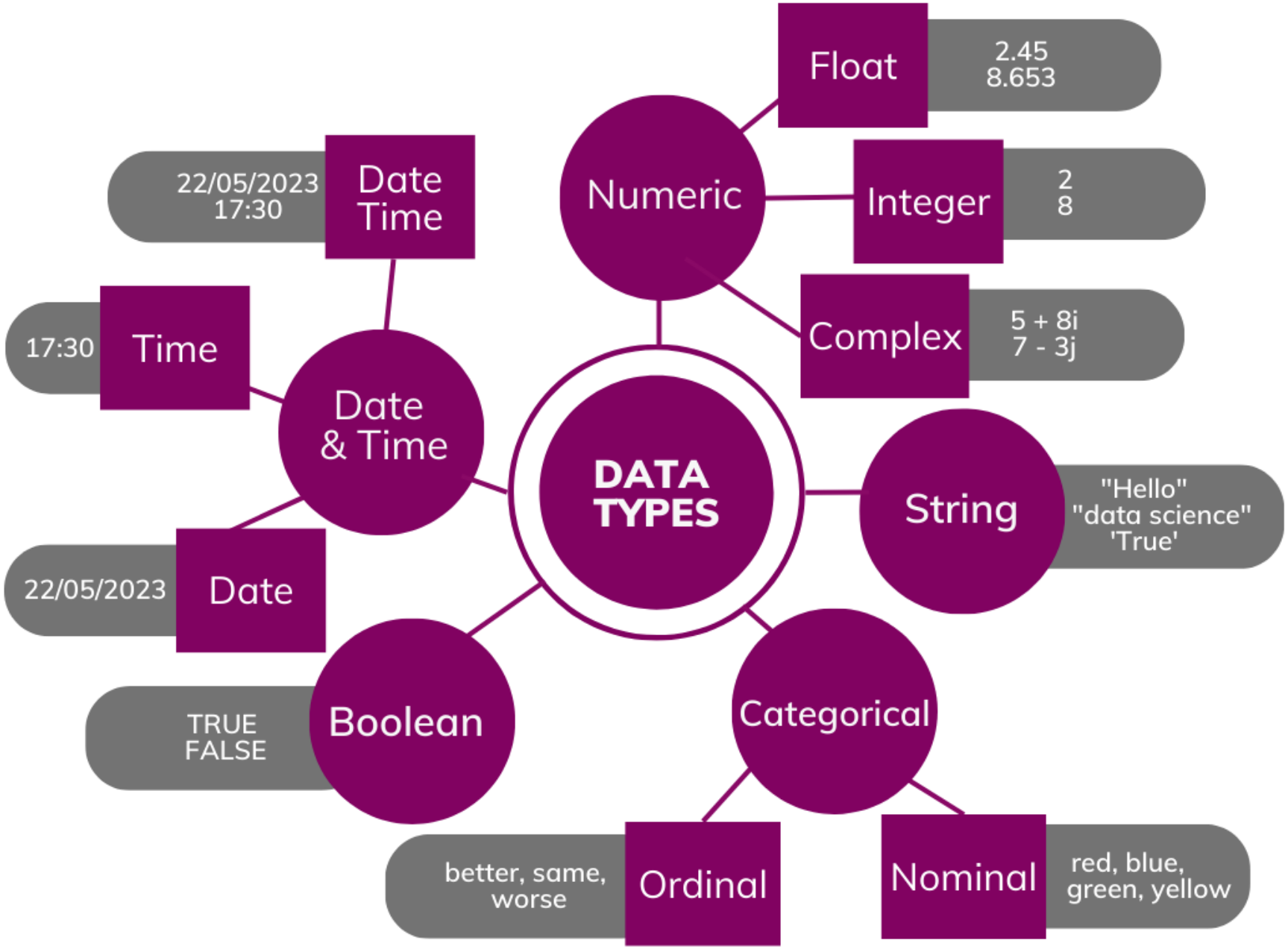


What are data types

- Type of data or values an object contains
  - Internal construct that a programming language uses to understand how to store and manipulate data

- Determines:
  - What kind of mathematical, relational, or logical operation can be applied
  - Which operations can be performed to create, transform, and use the variable in further computation


DATA
TYPES

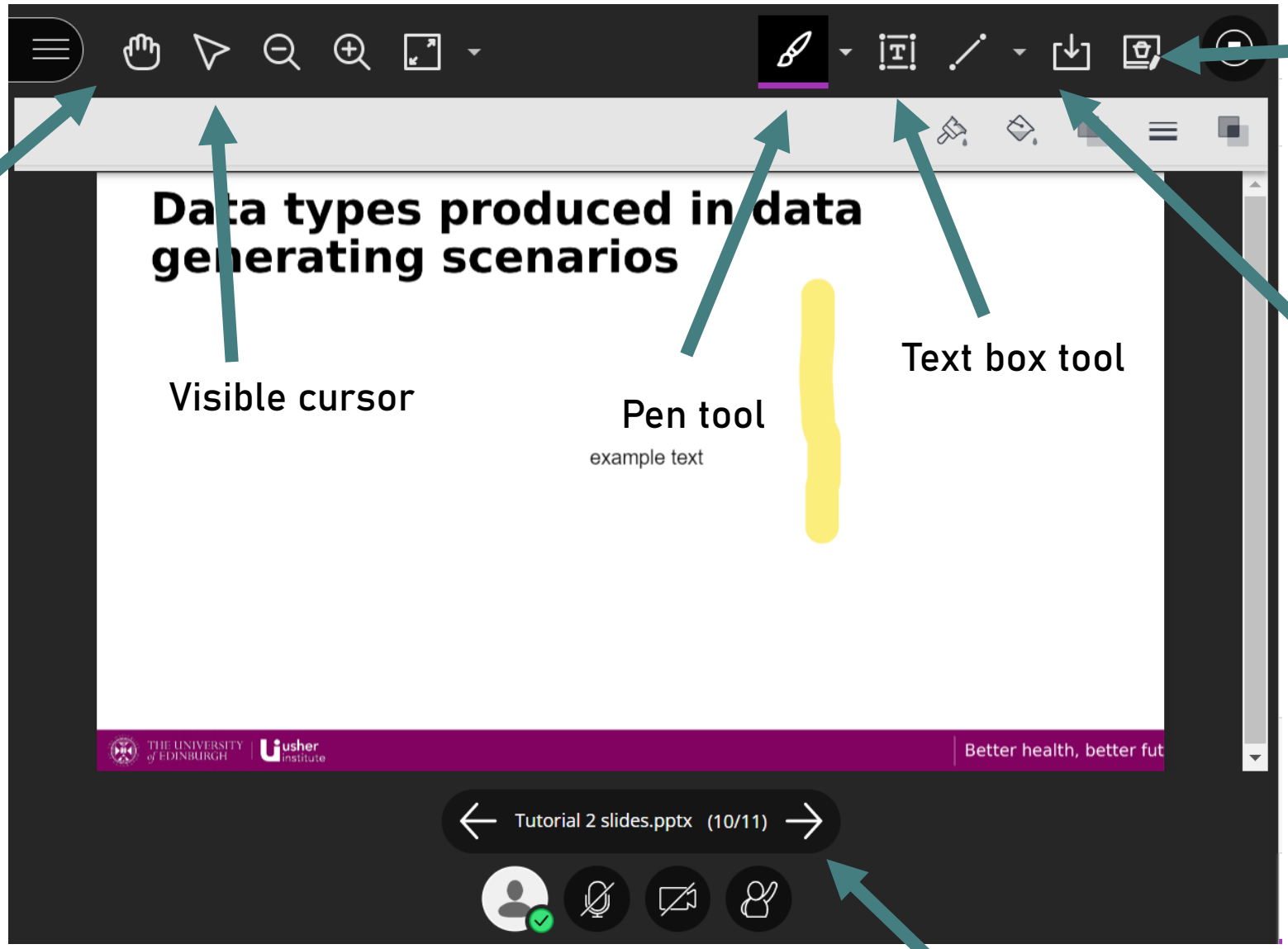

DATA TYPES
Numeric
Float
2.45
8.653
Integer
2
8
Complex
5 + 8i
7 - 3j
String
"Hello"
"data science"
'True'
Categorical
Nominal
red, blue, green, yellow
Ordinal
better, same, worse
Boolean
TRUE
FALSE
Date & Time
Date Time
22/05/2023 17:30
Time
17:30
Date
22/05/2023

Data types produced in data generating scenarios

- Emergency service call outs and transfers (e.g., ambulance)
- Hospital waiting times for non-elective surgeries
- Smoking behaviours in the community
- At-home carers in a local council area (local region)
- Any other health and social care situation you can think of!

Data types produced in data generating scenarios

- 💬 35 min: Discuss the data generated in your selected scenario
  - What types of data they are
  - What are the possible range of values
  - Could the data type vary depending on your analytic use case? If so, how?
- Share with everyone what you spoke about in your groups
- Be sure to save your document so you can post it on the discussion boards after!



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Delete annotations (be careful!)

Download slides with Annotations

Move between slides