Coding Etiquette for (non-coder) Social Scientists

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Topics in Applied Data Science
for Social Scientists

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RECAP: A Data Science Project

- Three **aims** of a data science project
  a) **reproducibility**
     - anyone should be able to arrive to your **same results**
  b) **portability**
     - anyone should be able to **pick up where you left off** on any machine
- crucial tenets for **collaborative work**
  c) **scalability**
     - your project should also work for **larger data sets** and/or be on the path of **automation**

RECAP: Structuring DS projects

some basic principles...

1. use **scripts for everything** you do
   - **NEVER** do things **manually**
2. organize your scripts in a sequence
   - **separate activities** in sections
   - keep an early section for **definitions**
   - call **other scripts** when necessary
3. write **efficient** (aka lazy) code
   - turn code used multiple times into **functions**
   - **re-use functions:** make them generic enough
4. rely on **version control** (git)

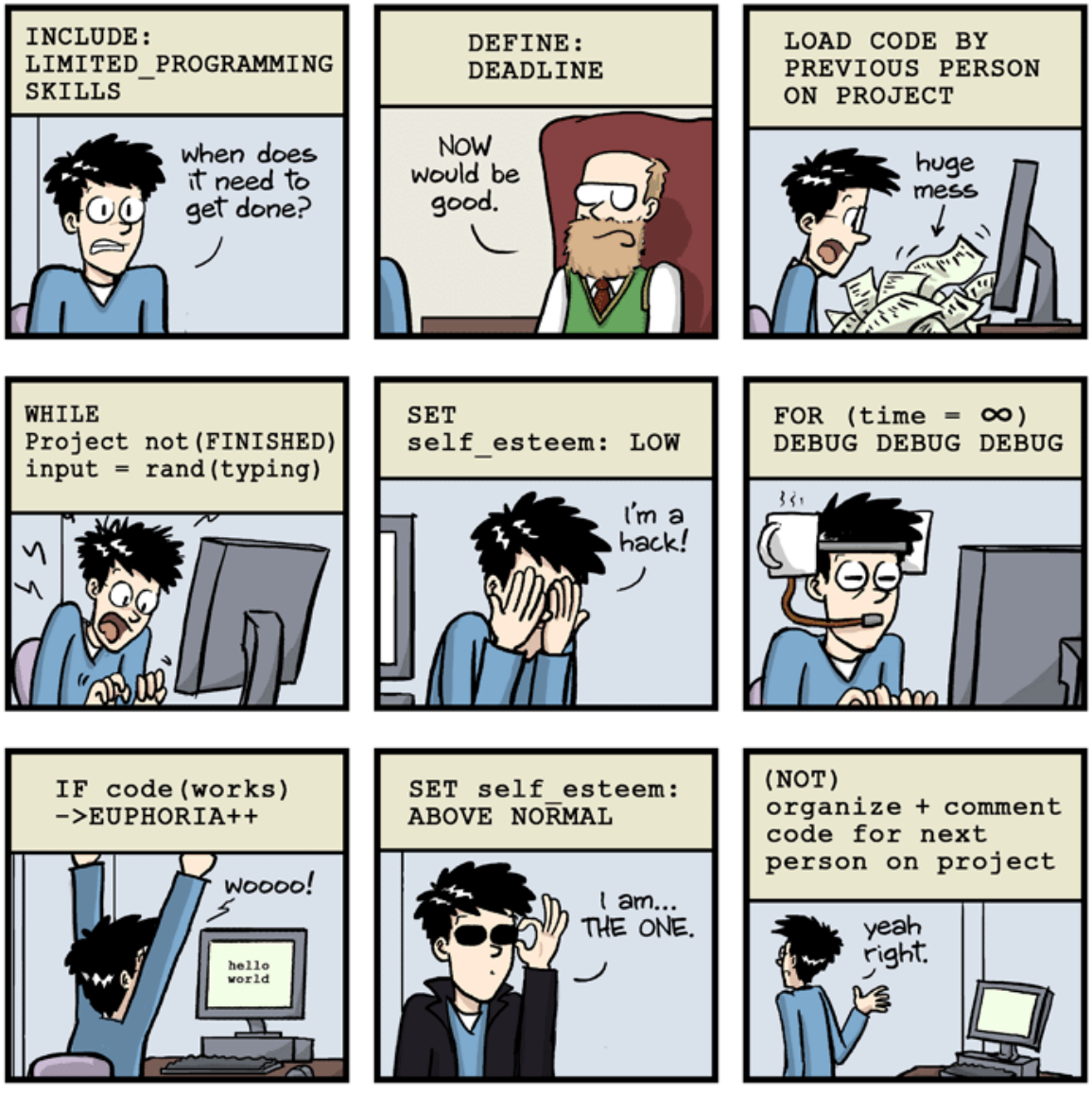
RECAP: Structuring DS projects

a thin layer...

```
project\
|
| -- src
|      |-- data             <- code to read/munge raw data
|      |-- features         <- code to transform/append data
|      |-- models           <- code to analyze data
|      |-- visualizations   <- code to create visualizations
|
| -- data
|      |-- raw              <- original, immutable data dump
|      |-- external         <- data from third party sources
|      |-- interim          <- intermediate transformed data
|      |-- processed        <- final processed data set
|
| -- reports
|      |-- documents        <- documents synthesizing the analysis
|      |-- figures          <- images generated by the code
|
| -- references             <- data dictionaries, explanatory materials
|
| -- README.md              <- high-level project description
| -- TODO                   <- future improvements, bug fixes (opt)
| -- LabNotebook            <- chronological records of project (opt)
```

Sources: **Cookiecutter for Data Science**, **ProjectTemplate**

PROGRAMMING FOR NON-PROGRAMMERS



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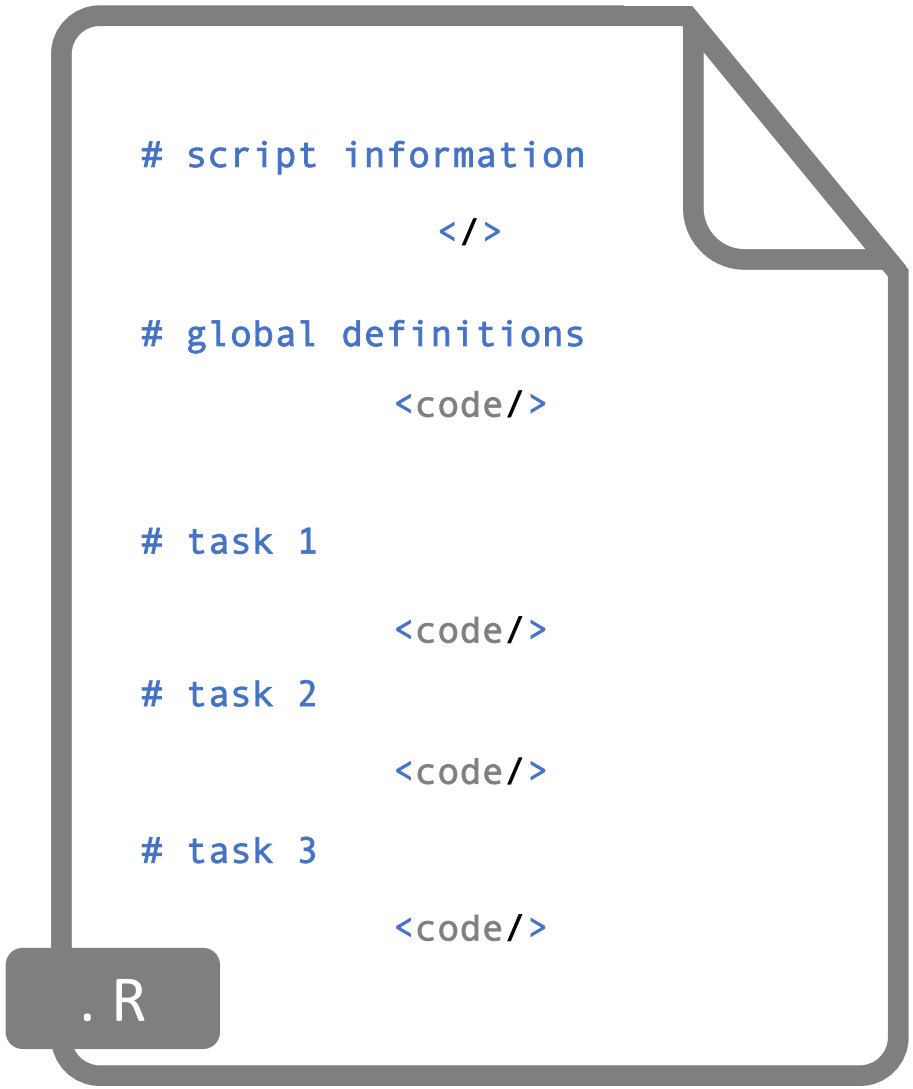
scripts

purpose of your (pseudo) code

- (Markdown / Jupyter) **notebooks** are great for **sharing** work and (code) review
  - nice sandbox to **develop** / **test** code
  - nice way to **review code + outputs** without having to run it
  - (usually) terrible for scaling!
- **scripts** are preferred for **running processes**
  - scripts can be run directly from source
  - you may need to extract your code from a notebook if you developed there
- **define the purpose of your code** early on!
  - avoid doing the same task twice!

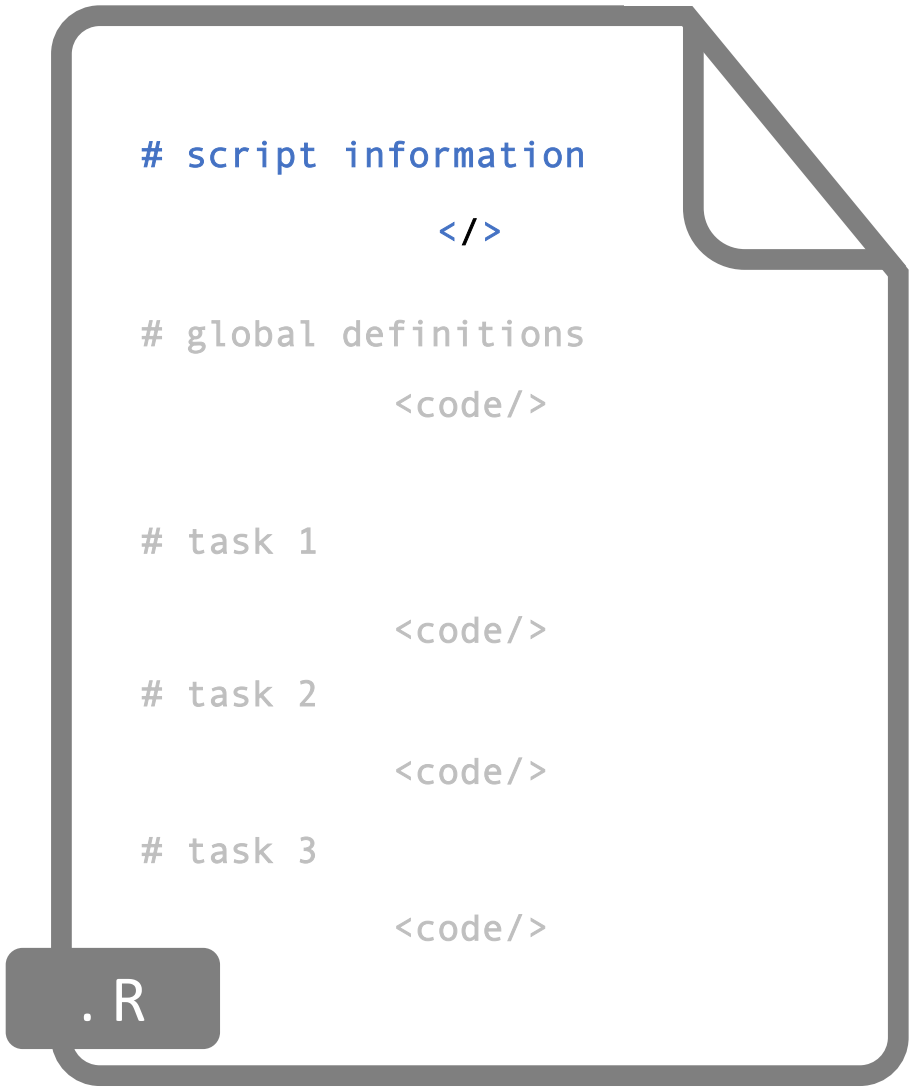
create structured scripts



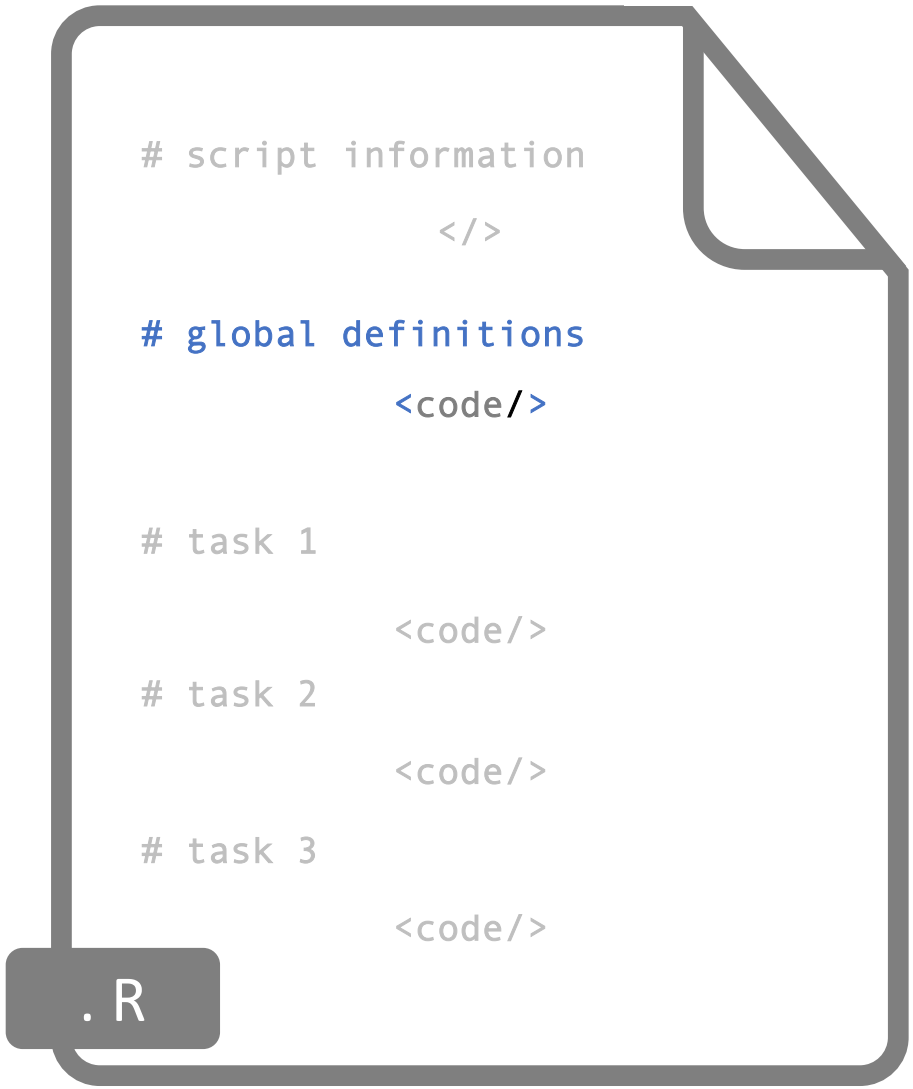
create structured scripts

- each script should perform **only one task**
  - useful to **call additonal scripts** from your script if/when needed
  - create a **global parameters** script if/when needed
  - if too many functions, create a **separate script defining all functions**
  - separate data manipulation from data analysis in different scripts
- your code should be **as simple as possible**
  - being clever can - and will! - come back to haunt you when sharing or revisiting code

start with a meaningful script information section



add a global definitions section at the beginning



add a global definitions section at the beginning

- place all **important definitions** that will be used throughout the project in a **single section**

```
# ::::::: SOME GLOBAL DEFINITIONS ::::::::::::::::::::::::::


# packages to load
library(tidiverse)
library(here)


# additional scripts to call
source(modeling_functions.R)


# objects to use in the script
raw_data_confrontations  <- here("data", "raw", "A-E.xlsx")
equivalence_table        <- here("data", "external", "ARCH535.csv")
```

add a global definitions section at the beginning

- load **all packages** from a single location

```
# packages to load
library(tidiverse)
library(here)
```

- call **additional scripts** from a single location

```
# additional scripts to call
source(modeling_functions.R)
```

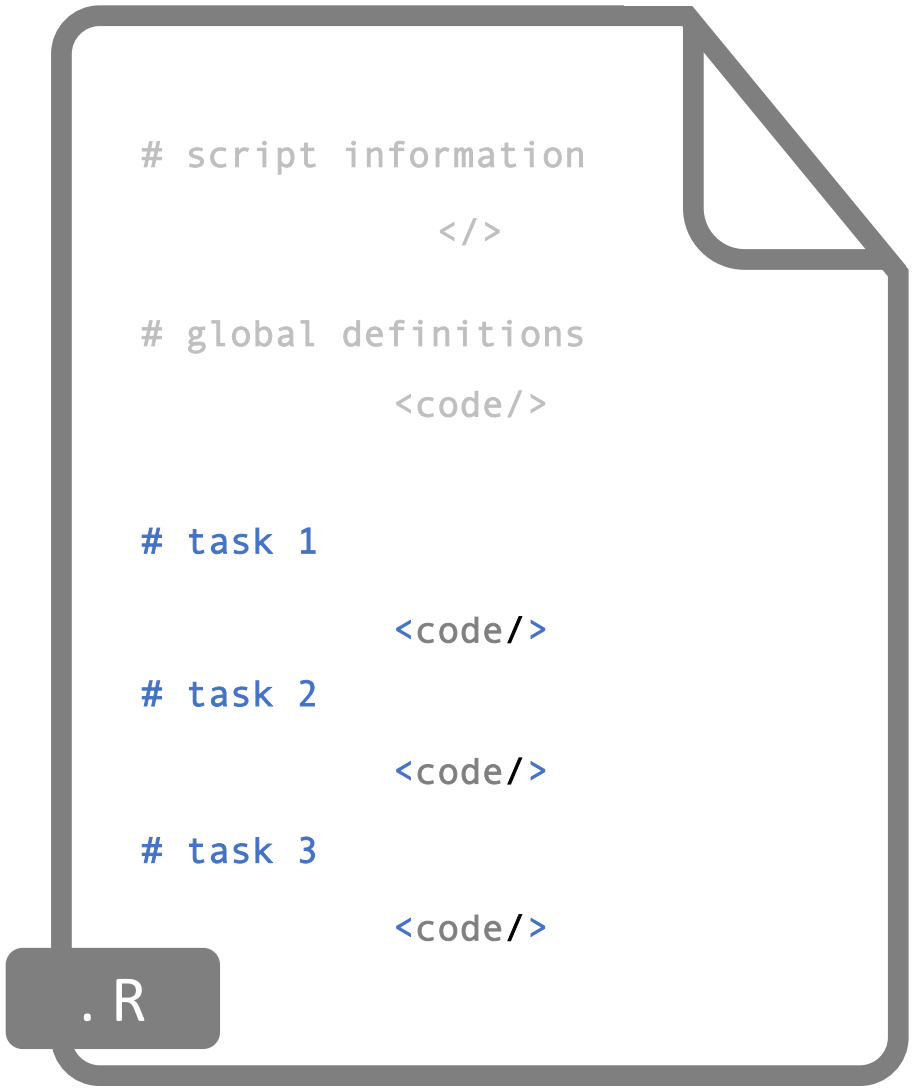
- always use **relative paths** when defining locations and files

```
# objects to use in the script
raw_data_confrontations  <- here("data", "raw", "A-E.xlsx")
equivalence_table        <- here("data", "external", "ARCH535.csv")
```

ProTips:

- do not add them manually at different places in the code!
- place at beginning of the script if using a single short script
- place on separate script if working on a larger project

separate tasks in sections



separate tasks in sections

- each section of your script should perform a **single task**

```
# ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
# ::::::::::::::::::::::: LOADS DATA ::::::::::::::::::::::::::::::::::::::::::


confrontations <- read_excel(
                              raw_data_confrontations,
                              sheet = 1,
                              na = "9999"   # converting sentinel value to null
)


# :::::::::::::::::::: SOME DATA PROCESSING ::::::::::::::::::::::::::::::::::


forces_confrontations <- WrangleTable(forces_table_confrontations,
                                      forces_name_lookup)

forces_aggressions <- WrangleTable(forces_table_aggressions,
                                   forces_name_lookup)
```

syntax

generate readable code

- improve the readability of your code with **spaces**, though never before a comma

```
#Good
inner_join(forces_table, by = c("event_id" = "ID")

#Bad
inner_join(forces_table,by=c("event_id"="ID")
```

- **indent and align** your code to enhance readability

```
confrontations <- read_excel(
                              raw_data_confrontations,
                              sheet = 1,
                              na = "9999"
                              )
```

- ***ProTip:*** **never mix spaces and tabs** to indent your code

name your objects meaningfully and consistently

- name objects **consistently** - and **meaningfully** - throughout your scripts
  - objects should always be **lowercase**
  - be consistent if you use **CamelCase**
  - use _ to **separate words**

name your objects meaningfully and consistently

- use object names that have **substantive meaning**

```
rename(
       detained = DE,
       total_people_dead = PF
      )
```

- transform each object to correspond as closely as possible to a **verbal description of its contents**

```
rename(
       female = ifelse(gender == "female", 1, 0)
      )
```

- use object names that indicate **direction** where possible

```
rename(
       wounded_increase = ifelse(
                                 total_wounded_change >0, 1, 0)
      )
```

name your objects meaningfully and consistently

- **do not use names of existing functions or variables** for your new objects

```
# Bad
mean <- function(x) median(x)
TRUE <- 0
FALSE <- T
```

- use only `"` or `'` to wrap **strings** for the language you are working on

```
# R
"Text"

# Python
'Text'
```

commenting code

comment your code!!

- always start your comments with **# followed by a space**
- separate your code into distinguishable chunks using visually distinct characters like `:`, `-`, or `=`

```
# ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
# ::::::::::::::::::::::: LOAD DATA ::::::::::::::::::::::::::::::::::::::::::::


raw_deaths_data <- read_csv(raw_confrontations)


# ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
```

comment your code!!

- include **comments before each block of code** describing its **purpose**

```
# :::::: LOADING NAME CONVERSION TABLE
# the original file treats numeric codes as strings, must convert to integers
# upon loading. Also, names of municipalities are in Spanish, so must specify
# the encoding as the file is read

name_table <- read_csv(conversion_table,
                       col_types = cols(
                           CVE_ENT = col_integer(),
                           NOM_ENT = col_character(),
                           NOM_ABR = col_character(),
                           CVE_MUN = col_integer(),
                           NOM_MUN = col_character()
                           ),
                       locale = locale(encoding = "ISO-8859-1")
                       )
```

comment your code!!

- **comment your functions** thoroughly, including **inputs** and **outputs**

```
MungeData <- function(baseEventData, StateNames, ForcesTable, SourceString){

    # ::::::::: DESCRIPTION
    #
    # The function performs the following transformations in the data to
    # produce the desired output data:
    #
    # 1. add actual names of states and municipalities from a Census table;
    #    currently the database only has their numeric codes
    # 2. rename columns from Spanish to English (not everyone speaks both languages)
    # 3. adding a new variable that indicates the armed force involved in the
    #    confrontation event
    # 4. replace all missing values with 0; this will come in handy as we start to
    #    explore the data futher
    #
    # ::::: INPUTS
    #
    # i)   BaseEventData - the raw database to be munged
    # ii)  StatesName - a table with State/Municipality names
    # iii) ForcesTable - a table that identifies armed forces involved in the event
    # iv)  SourceString  - a string that will identify origin of the table
    #
    #:::::: OUTPUT
    #
    # the function returns a dataframe
```

comment your code!!

- include comments for any line of code **if meaning would be ambiguous** to someone other than yourself

```
# filling in NAs with zeros, to facilitate graphing and basic computations
# replace_na() requires a list of columns and rules to apply. Code below
# provides that
replace_na(
    # creates an object with numeric column names
    setNames(
        lapply(          # applies a function that links numeric column names
                         # with the asignment of 0
           vector("list", length(select_if(., is.numeric))), # creates list len= 25
           function(x) x <- 0),  # defines assignment of 0 to numeric col names
        names(select_if(., is.numeric))  # provides numeric column names
)
```

- ***ProTip:*** if your code needs too many comments, you probably will have to simplify it when cleaning it up

code validation

validate that your code does what you think it does

- verify that **transformed variables** resemble what you intended

```
# create a new global unique ID
processed_data %<>%
+     mutate(
+          global_id = 1:nrow(.)
+     )

# verify there are no duplicates
length(processed_data$global_id) == length(unique(processed_data$g
[1] TRUE

# a quick look to see the distribution of the variable
summary(processed_data$global_id)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
      1    1350    2698    2698    4047    5396
```

validate that your code does what you think it does

- verify that **missing data is handled correctly** on any recode or creation of a new variable

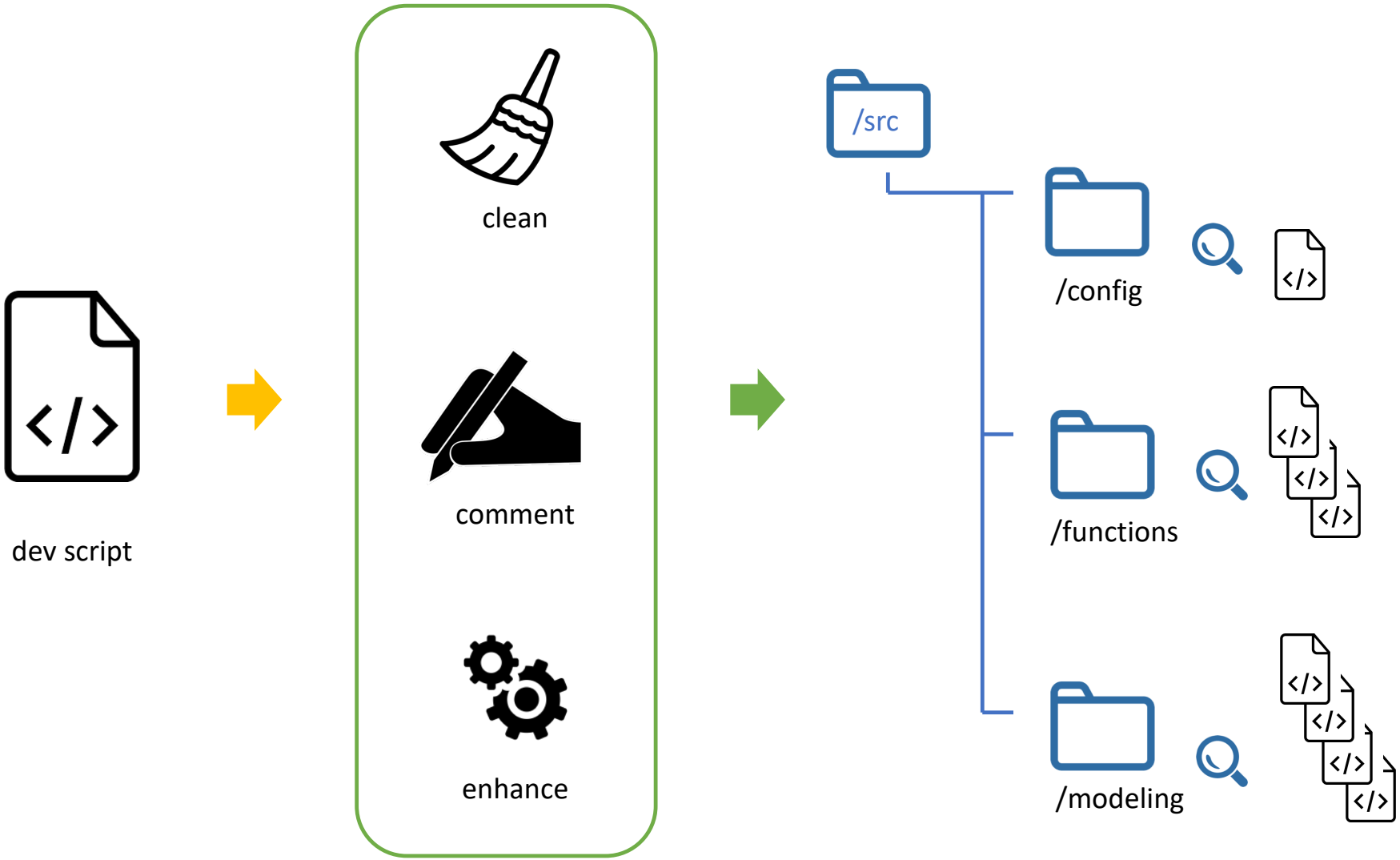
```
# computes lethality indices
processed_data %<>%
+   mutate(organized_crime_lethality =
+              organized_crime_dead /
+              organized_crime_wounded
+   )

# exploration to identify undefined values
summary(processed_data$organized_crime_lethality)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
      0       1     Inf     Inf     Inf     Inf    3090
```

workflow principles

general workflow principles

- **80 characters** should be the maximum length of any line in your code
- if you find an **error** in your code, **correct it exactly where it happened**
  - do not try to fix it from a later chunk of code
- when you are done with your project, go back and:
  - **clean up** your code
  - **add comments** where appropriate (for the *you* of the future)
  - perform **stress tests** with as many **edge cases** as you can imagine
  - make sure to **document future enhancements** (especially to scale up)

general workflow principles



`commit` messages in `git`

`commit` with informative messages

- **remember:** `commit` **small chunks of logically grouped changes**
  - you may want to undo a change, but only that change
- message summarizes **what changed**
  - use imperative mood
    - [*this commit will*] `Rename income variable`
  - start with a **capital letter** and **do not end with a period**
  - maximum length: **50 characters**
- if you need to provide more detail on the **what** and **why**:
  - add a **body** by adding a **blank line**
  - add a **paragraph** that wraps text at **72 characters**

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