# Analysis Reproducibility

## Why it matters and how to do it?

8 July 2021

# Learning objectives

**About today:**

- Understand what you can gain from analysis reproducibility.
- Know what the main technical requirements are to set up for their analysis to be reproducible.
- Have a demonstration of a practical way to make a cake using household survey data: crunching, analysis & interpretation & data stories!

**Not today:**

- Induction Training on R language! For this head to UNHCR Learn & Connect- R training

# A Vision for data analysis

"Multi-functional teams, with strengthened data literacy, regularly conduct meaningful and documented joint data interpretation sessions to define their strategic directions based on statistical evidences"

# A Theory of Change for Data analysis

## Proper user of data for advocacy & programmatic decision making

↪ Corporate **Standards** exist to define how to encode & process household surveys dataset

↪ Field data experts are trained based on precise recipes and predefined tools at each step of the **data life cycle**

↪ Data are presented, discussed and linked to expert knowledge during data **interpretation** sessions with a multi-functional team

↪ All potential valid interpretations, including diverging views, are systematically **recorded**

↪ **Persuasive** "Data Stories“ and Policy papers are generated

# Data Science is like cooking

When a chef is starting out with a new dish...

- Hypothesis Tasting -- Setting the right questions
- Ingredients = source the Data
- Wash your food = clean your data
- Flavor engineering = create calculated & derived variables
- Taste and explore = reshape & visualize the data
- Tune your oven = statistical modeling
- Art of plating = use styled brand
- Document your recipe = add technical comments

# Information Anxiety & Analysis paralysis

*When people do not want to eat the cake...*

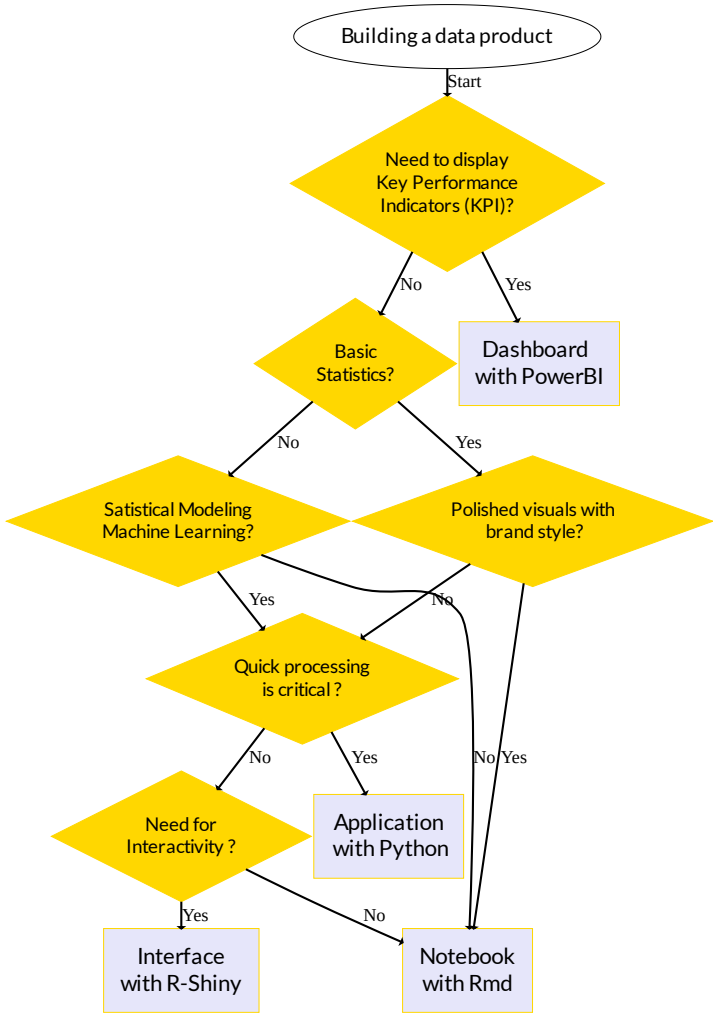
Potential source of reluctance...

- I do not know how to eat it: I see all those elements on it without being able to understand why they were added there and how this works...
- I do not trust this cake: How was it created? Did you follow correctly the recipe? Were the ingredient fresh? Can I trust how you sourced the ingredient?
- This is not the cake I need! It looks too heavy & too big: I will not be able to digest it...
- I am not hungry and do not even know what cake I want...

# Data Products: When What?

Dashboard are relevant for displaying KPIs! (*like when you drive your car...*)

> Key Performance Indicators (KPIs) are indicators specificlly designed to show progress toward an intended result, i.e a predefined **target**
>
> Create an analytical basis for **decision making**, aka Business Intelligence
>
> Help focus attention of Snr Management on what matters most - a good dashbaord needs to be **concise**

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# Why we need to work in a reproducible way?

**Ethics, Productivity, Learning**

# Ethics: Science is '*show me*' - not '*trust me*'

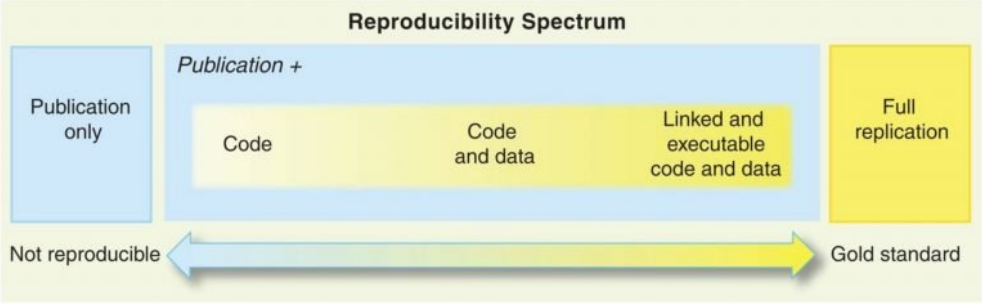
## Reproducibility allows for **peer review**

Peer Review allows for **transparency**

Transparency allows for **scrutinity**

Scrutinity allows for **accountability**

> *It's okay to make mistakes, as long as one can detect them and that we can learn from them...*

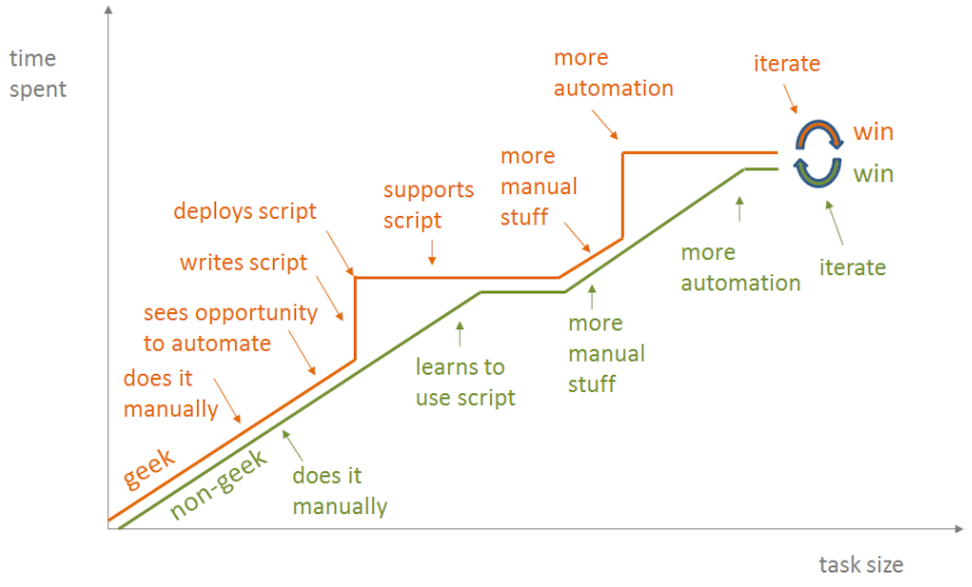


# Productivity: getting things done quickly and safely!

## Automation through functions & scripts can help skipping **repetitive tasks**

> Tasks that involve recurrent **data manipulation** are undertaken by teams... .. but not everyone in the team needs to be a **geek/coder**!

When enough investment can be made, **Graphical User Interface** (GUI) can be developed for specific functions to ease the learning curve of new users while they are still in the process of building up their personal R skills.



# An R-Community geared towards learning

Which approach is the most appealing exercise among the 2 proposed aside?!!

## Start from an end-product and **reverse engineer it**!

Eat the cake first! (then play with and change ingredients...)

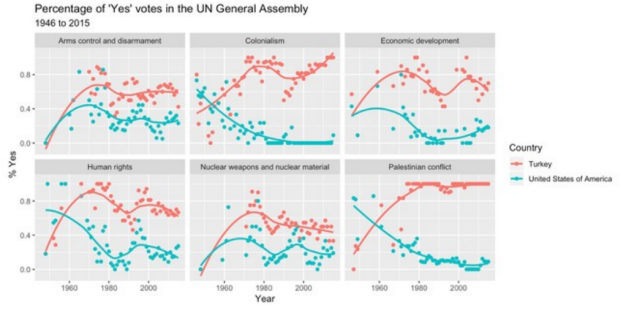
**(a)**

- Declare the following variables
- Then, determine the class of each variable

```
# Declare variables
x ← 8
y ← "monkey"
z ← FALSE

# Check class of x
class(x)
#> [1] "numeric"

# Check class of y
class(y)
#> [1] "character"

# Check class of z
class(z)
#> [1] "logical"
```

**(b)**

- Open today's demo project
- Knit the document and discuss the results with your neighbor
- Then, change `Turkey` to a different country, and plot again

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# Conditions for reproducibility.

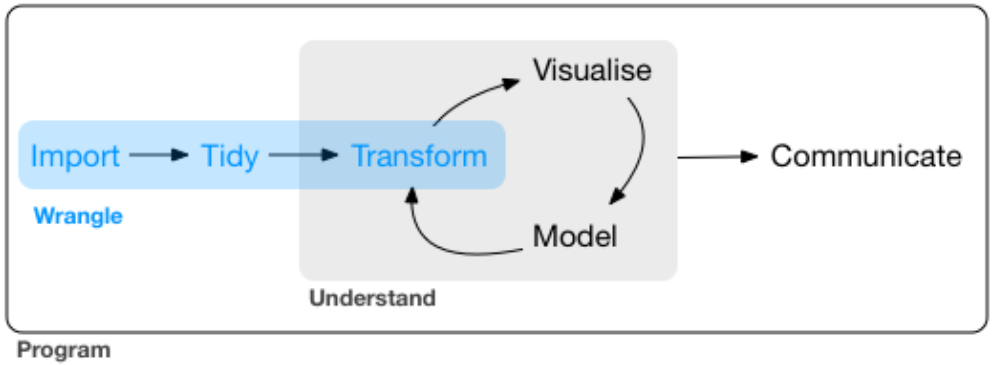
## Sourcing data, documenting analysis, & packaging output

# Preparing data

Data Wrangling takes usually more than 80% of any data project time...

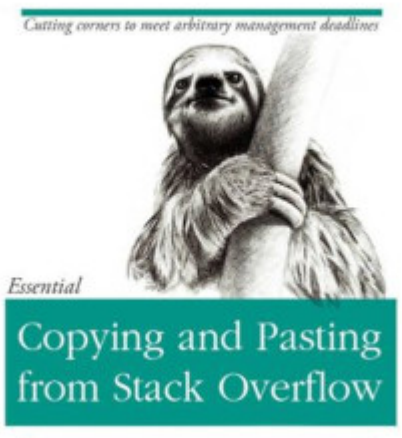
Imagine if you need to rewind your analysis...

Correct at any steps in the process and re-run all..

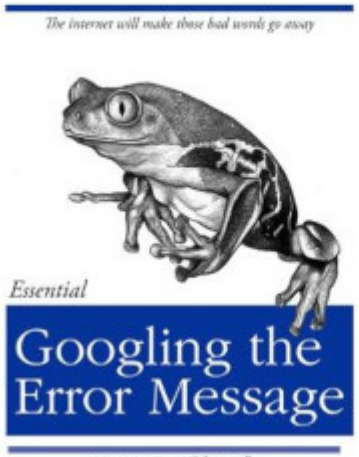


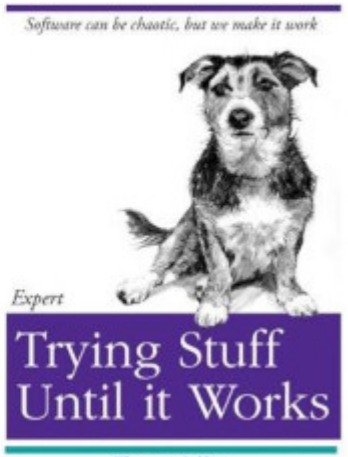
# Documenting analysis

**DO**

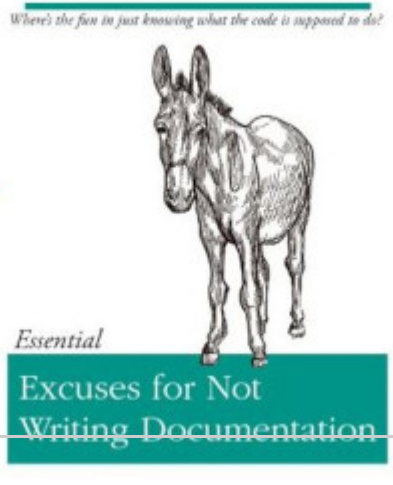


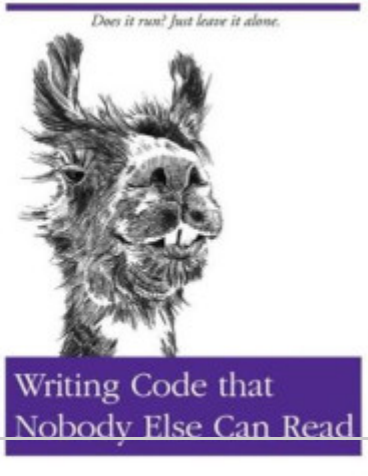




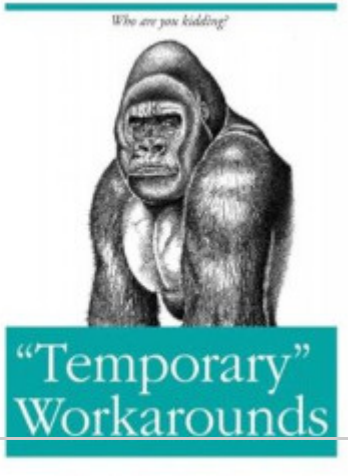




**DON'T**





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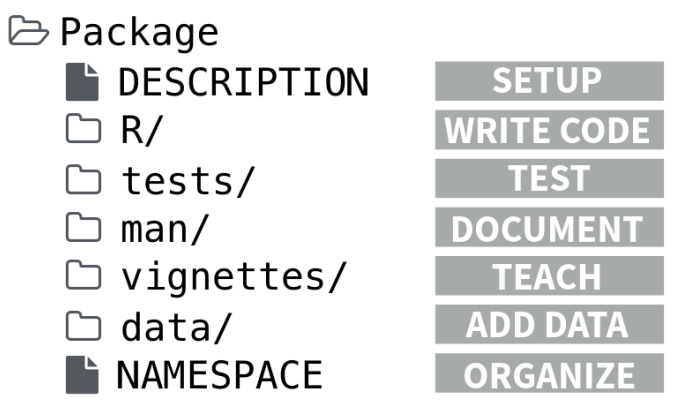
# Packaging functions

Gradual automation

- level 1: write a command
- level 2: organize multiple command together in re-usable function
- Level 3: organize multiple functions together in a package
- Level 4: includes test data & Documentation
- Level 5: Unit testing, aka code review
- Level 6: Graphical User Interface (GUI)



# Hands-on practice: a practical run-through based on Household survey dataset

## Crunching, Interpretation & Dissemination

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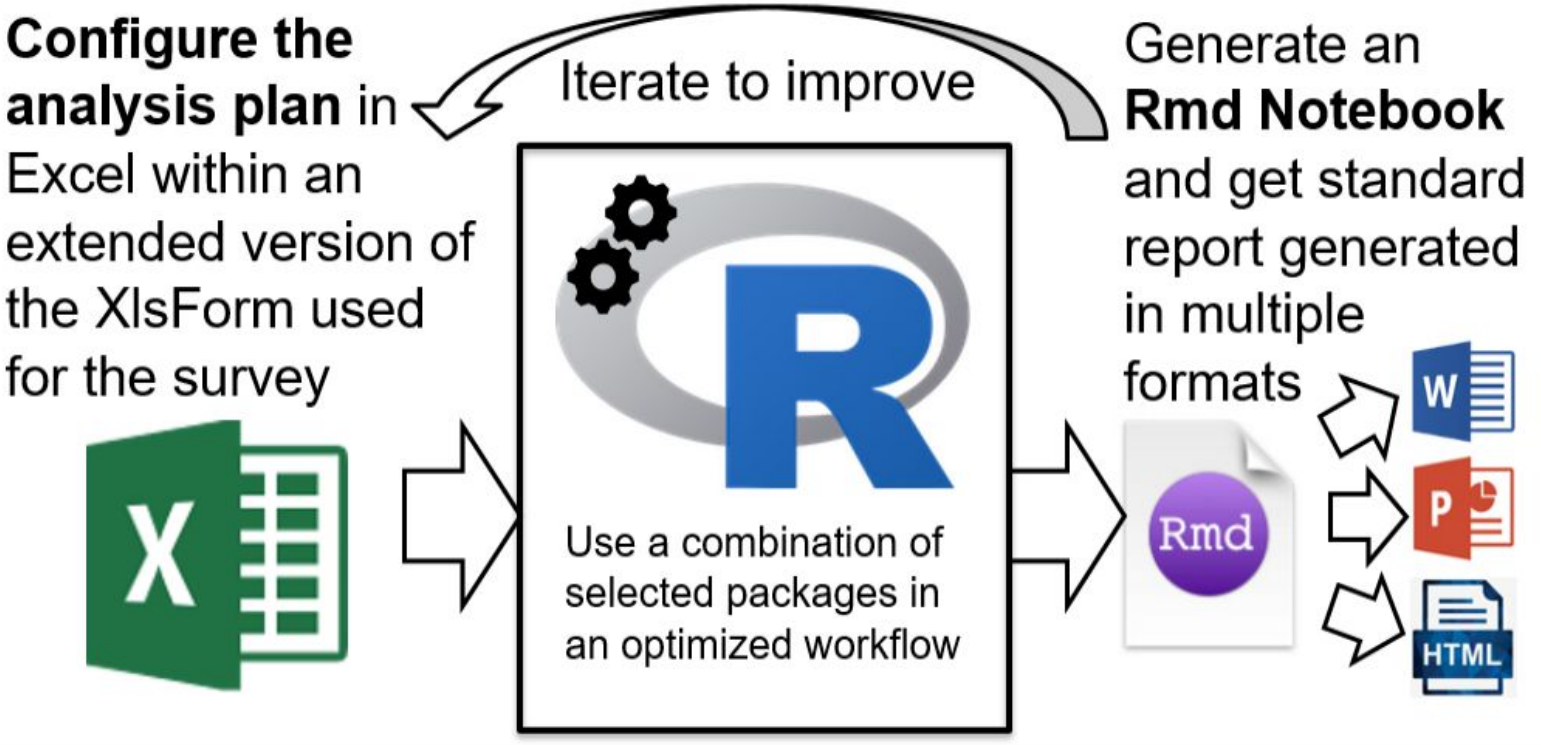
# Step 1- Notebook for Automatic Data exploration, aka "crunching"



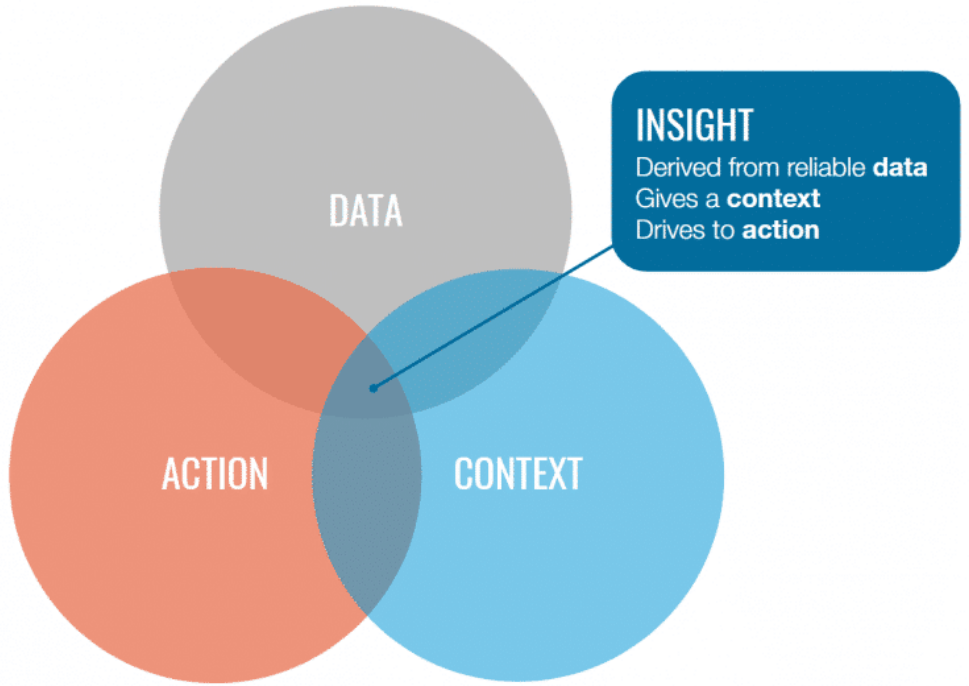
# Step 2- Notebook for Data Insights documentation: Analysis Repo

> Insight: The capacity to gain an accurate and deep understanding of someone or something

Not all charts will emulate need for interpretation - the data analyst need to gemerate the one that can create **debates**.

Charts need to be **crafted** - for instance use chart title framed as "opening question"...

Insights arive when a multifunctional team is able to explain **unexpected patterns**, to challenge or revise **existing assumptions**, or to identify evidence to support **Call to action**.



# Step 3- Notebook to communicate with data: Microsite

From **assumptions to evidence** based statement

Data is to support Narrative - not the other way around!

Leverage Art Data Storytelling to:

- **Explain**,
- **Enlighten**,
- **Engage**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# Conclusion

# R in Humanitarian Context

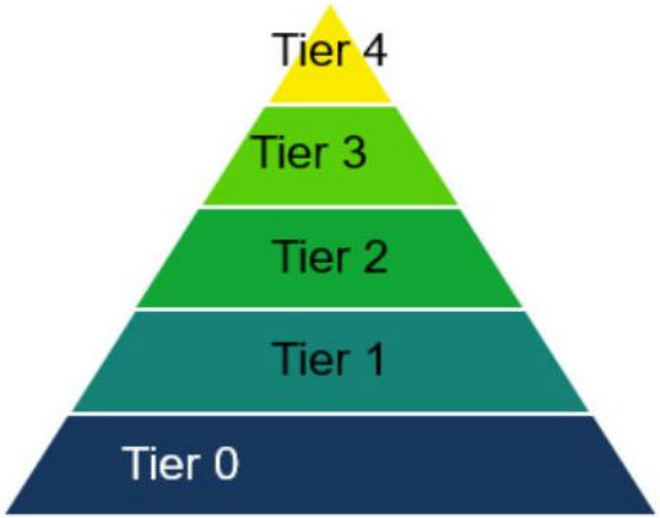
## You are not alone

> More than 450 users from multiple organisation in the humanitarian-useR-group
>
> Around already ≈20 R champions within UNHCR vs more than 420 PowerBI Pro users
>
> Try to start by using existing UNHCR packages and start from a project you can reproduce

# A call for Institutionalisation

Using Standard Multi Tier IT Standard Support model to enhance reproducible analysis...

- Tier 4: Code Review & Quality Insurance / Contracted Company with global frame agreement
- Tier 3: Internal package development / Internal R champions team (cost: one yearly Rdev meeting to incentivize contributing staff)
- Tier 2: User induction & Advanced User Support / Global Data Service/DIMA (Data Science Team)
- Tier 1: Basic User Troubleshooting / Global Service Desk (WIPRO according to Documented Scenario)
- Tier 0: Self-support / Package documentation (maintained and improved on continuous basis)



## Your Opinion Count

Please fill this survey to share your opinion and thoughts on the topic presented here