# What can Universities do to Foster Responsible Research Practices?

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Understanding Society

***Concentrate*** on

***Questionable Research Practices***

(**QRP**s) and

***Responsible Research Practices***

(**RRP**s)

***Not*** on

**F**abrication, **F**alsification, **P**lagiarism (**FFP**)

**F**abrication: Making up data, producing artificial data, no empirical data

**F**alsification: Manipulating real data, changing scores to obtain the desired effect

**P**lagiarism: Steal text and ideas from fellow researchers without reference

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Steneck (2006):

## RRPs – QRPs – FFP

| | |
|---|---|
| RRPs = Responsible Research Practices | Textbook Behavior, ***Perfect*** |
| QRPs = Questionable Research Practices | Real-World Behavior, ***Fallible*** |
| ~~FFP = Fabrication, Falsification, Plagiarism~~ | ~~Real-World Behavior,~~ ~~***Misconduct***~~ |

We know textbooks, what are QRPs?

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Examples of QRPs (John, Loewenstein, & Prelec, 2012; $N \approx 2{,}000$):

1 Not reporting all measurements (63%)

2 If test is non-significant, collect more data, and repeat (56%)

3 Not reporting all experimental conditions (28%)

4 Report intermediate result as if it were the final result (16%)

*5* Favorable rounding of *p*-values (*p* = .058 reported as .05) (22%)

6 Report only results favoring ones hypothesis (46%)

7 Delete cases if that produces better results (38%)

8 Present unexpected result as if it were expected (27%)

9 Deny relation with demographic variables when uncertain (3%)

10 Falsify data, etc—**FFP** (0.6%); do not discuss here

**Three topics**:

- Most likely ***causes of errors*** researchers make when designing research, analyzing data, and interpreting results from data analysis
- Why research ***policy*** helps more effectively to encourage **RRP**s than improved methodological and statistical methods
- How Tilburg University ***implements policy*** to *encourage* **RRP**s and *prevent* **QRP**s

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# Causes of Errors

***Where do errors in use of statistics come from?***

- Researchers ***need to use*** methodology and statistics, but M&S are ***not*** their ***profession***; they practice M&S ***on the side***

- Statistics is difficult and results are counter-intuitive; one is constantly ***misled***

- Add this to ***climate*** of performance pressure, and a ***toxic mixture*** called Questionable Research Practices (QRPs) is unavoidable

## ***Why is statistics difficult?***

Tversky & Kahneman (1970s) explained this:

Statistical reasoning requires ***rational and conscious reasoning***, costs a lot of effort, ***people do not do this***; first inclination is to follow their ***intuition*** and jump to conclusions

***Intuition*** works two ways:

- Based on ***experience***; makes one do approximately the right things, *before* one has started thinking about a well-founded answer

- Based on ***heuristics***; makes one respond using cognitive *automatisms* that replace the difficult but correct question (impossible to answer) with an easier but incorrect one (answerable); puts researcher on wrong track

***Third* reaction** is cognitively demanding: Try to solve problem ***rationally***;

this is ***not*** what we do first, we rather react intuitively

**Example** difficult question

Fold Saturday's edition of the newspaper (1 cm thick), then once more, again, and again; when is the pack of paper thick enough to reach from here to the moon?

**Intuitive**, ***experienced*** response: Something's going on, be careful! Puts one on guard: *Don't answer right away, take your time!*

**Intuitive**, ***heuristic*** response: Replace Q with easier Q that looks like it: "What's the distance to the moon?" A: Huge, folding takes forever

**Rational**, demanding response: Solve the problem; no one does this

Here is the solution:

Folding **35** times is too little, but **36** times is too much

Notice:

You ***experience*** an impossible task, and intuitively move to a wrong answer

You do not have a clue what is going on, even if you know the answer

# Policy instead of Statistics

**Lessons learned**:

Because they use ***intuition by heuristics***, people do not understand

- *Exponential growth*; Increase of # Covid-19 contaminations, governed by the *R*-number, can speed up and slow down, et cetera
- Further:

  *Probabilities* (e.g., group vs subgroup; event over time)

  *Chance* (e.g., lotteries, casino's)

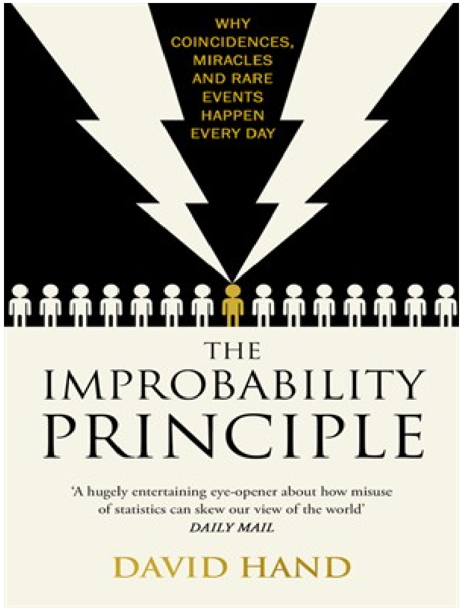
  (*Large*) *numbers* (how much is a million?)

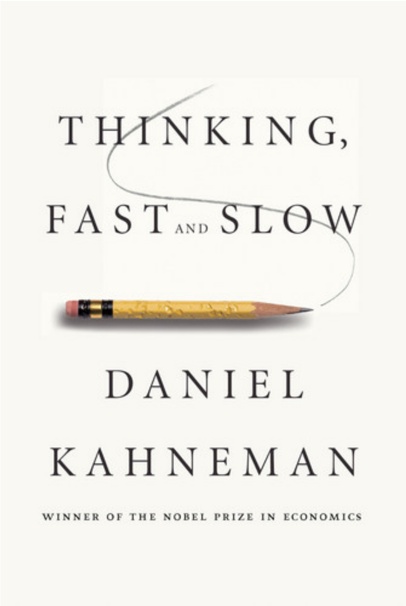
These and other concepts are ***central to statistical reasoning***

## Further reading (let others convince you):

Hand, D. (2014). *The improbability principle. Why coincidences, miracles and rare events happen every day*. London, UK: Penguin Random House.

Kahneman, D. (2011). *Thinking, fast and slow*. London: Penguin Books Ltd.



If statistics is ***difficult*** for ***everybody***,

Does additional statistics ***education*** help (to prevent QRPs)?

- Statistics education shows researchers what's in the toolbox, and what you can use the tools for; necessary knowledge
- More education provides ***more methods***, no ***experience***

So, ***what can statisticians do***?

In addition to helping people to *recognize* the method that suits their problem

- Teach people to recognize situations ***in which they need help***
- *Stop* suggesting everybody can do statistics
- Be *careful* teaching "crash courses" in multilevel analysis, etc.

# **Policy Advice** (to help encourage RCR)

**I. Make Data Publicly Available**

*Let other people look across your shoulder and* ***check*** *what you do*

Many researchers keep their data to themselves, also when asked to share them (Ioannides, 2016; Wicherts et al., 2006)

Make it easier for researchers to share data:

- Allow researchers first use of data until they have published
- "Owner" of data can be coauthor with others using their data
- Data sharing produces new results and develops networks

# **Policy Advice** (to help encourage RCR)

**II. Involve a Methodologist or Statistician in Data Analysis**

***Hire** intuition based on **experience** that you do not have yourself*

- Simmons, Nelson, & Simonsohn, 2011, *PsychScience*: Understanding and use of statistics are difficult and are the main causes of errors made in data analysis

- Tversky & Kahneman (1970s): Explanation of errors is absence of *experience*, and use of “wrong” intuition based on *heuristics*, causing researchers to fall into all the traps set by counter-intuitive statistics

***By the way***, statisticians do not always provide good solutions, may be too optimistic about statistics' possibilities:

- Bayesian statistics instead of frequentist statistics, Bayes factor instead of *p*-value; however, both approaches provide rules of thumb to researchers looking for "results"
- Alternative $\alpha$-values: $\alpha = .005$ instead of $\alpha = .05$ (recent discussion in *Nature*); however, it's just another rule of thumb
- Et cetera

# Implementation of Policy at TiU

Responding to the Stapel data-fraud affair in 2011, Tilburg School of *Social and Behavioral Sciences* installed the ***Science Committee***

***Science Committee***—What is it, what does it do, and why?

- ***Audit*** committee samples 20/500 articles from School's data base; assesses ***quality of data storage*** and ***reporting of research methods***
- *Advises* researchers about data storage, completeness data sets, honoring subjects' privacy, access to data, and data availability
- Aims:
  - ✓ Encourage concerted effort to improve researchers' ***accountability*** for data handling and methods reporting
  - ✓ Create opportunity for all to ***learn***; not a witch hunt
  - ✓ Contribute to development *university's* research policy and to a *Dutch* national protocol concerning research policy

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*Science Committee* was installed in 2012, started working as follows

- Set up rules and regulations for researchers' data handling
- Announced annual random audits (20/500 articles)
- Research groups devised their own data (storage) policy that suited their needs best; initially no general policy

Works quite well, but not perfectly:

- Some groups had their data policy better in place than others
- People tended to arrange their data storage only when they were audited
- When people left the School, they tended to loose commitment
- Remains much work to do, but creates greater awareness, stronger sense of responsibility and accountability

***Tilburg University policy*** with respect to *research policy and data management*; state of the art

- Other TiU Schools did not (yet) install a *Science Committee*
- They did install ***Ethics Committees***: Check in advance compliance with research ethics and privacy regulations, and data management.
- Presents one counter, almost all researchers comply
- But no auditing in retrospect
- Most Schools require researchers to assemble *data package*, saved on TiU servers (partly consistent with VSNU Integrity Code)
- TiU provides Data Verse (consistent!) for safe storage meta-data, data, code, etc., easy access; researchers have ***cold feet*** so far

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**Questions**:

- Why do researchers have cold feet?
  - “Local” storage feels better, Data Verse is not local
  - Afraid they will be “scooped”
  - Researcher may not be owner of data, not free to act
- Why differences between disciplines?
  - Exact sciences have long tradition of *team science*; data are available to all team members
  - Human sciences are *individualistic*; VSNU’s “***Room for Everyone’s Talent***” with emphasis on team science may help acceptance of open data culture

# Summary

- Our brains were designed for ***intuitive reasoning*** based on ***heuristics***; rational reasoning came later in evolution, and is ***difficult***

  Statisticians have ***experience***: postpone acting, are cautious

- Teach people which methods are available and to recognize their weakness; that is, ***no experience***, only heuristics, thus ***ask for help***

- QRPs are best fought ***not*** through more training and novel statistical methods (although neither will hurt) but though *policy*: ***Publish data, involve a statistician, and perhaps be audited to improve***


# Thank You

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