

# ethics of scientific conduct

M U N I  
S C I

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:: laboratory of functional genomics and proteomics



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The training is aimed at the researchers of the Institute of Mathematics of the Czech Academy of Sciences  
The cost of the training is covered from the OPVTV project CZ.02.2.69/0.0/0.0/18\_054/0014664  
Institute of Mathematics CAS goes for HR Award - implementation of the professional HR management

## ***ethics, science & scientific conduct***

: human mind & cognition, cognitive biases, ethics, science, ethics & scientific conduct, ethics in science, honest error vs misconduct, research integrity

## ***ethical aspects of science as a way of methodical knowledge acquisition***

: pseudoscience, correct data handling, p-hacking, HARKing

## ***ethical aspects of science as an organised system***

: peer review publishing and its traps, unethical scientific publishing, predatory practices, ethics in scientometry, unethical argumentation and reasoning, unethical aspects of system influence

## ***ethical aspects of science as a social institution***

: vivisection, unethical employment of scientists, unethical aspects of society influence, unethical use of scientific knowledge, ethics in mathematics movement

## ***dealing with scientific misconduct***

: sources of unethical behaviour, elementary ethical rules in science, difficulties of implementing the ethical conduct

## ***summary and conclusions***

## ***appendix – extending materials***

: cognitive biases in science, argumentation fallacies, unethical self-citations, misleading presentations, CUDOS

## **course overview**



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# ethics science scientific conduct



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# human mind and knowledge

- : acquiring knowledge and decision making requires mind
  - :: mind is a product of biological adaptation
    - ::: some functions are less useful out of the adaptive context
  - :: model of human mind – **dual process theory**

## system 1 – fast thinking (rabbit)

- : automatic and quick
- : comparing qualities and quantities
  - :: without voluntary control
    - ::: intuition, instinct, emotions
- : mind actions are mostly driven by system 1
  - :: rather efficient in adaptive environment
    - ::: prone to erroneous decisions outside of it



## system 2 – slow thinking (turtle)

- : effortful and slow
- : analytical and objective
  - :: feeling of voluntary control
    - ::: logic, rationality
- : may influence the decisions of system 1
  - :: allows deciding in a non-adaptive environment
    - ::: fallible, but **could be trained**

**scientific thinking is superposition of system 2**  
**: but succumbs to system 1**



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## mind must draw relevant conclusions from incomplete information

- : information is **always incomplete**, the **degree of incompleteness** and **context** are important
  - :: e.g. cognitive mind reading through facial expressions and body language
- : results in tendency to **intuitively behave with high confidence**
  - :: even if information only indicates
  - :: we pay a high price for the confidence – **(self-)deception**
    - ::: poker game or simply any negotiation 😊
  - :: the deception is effective and must be punished
    - ::: gossips serve spreading disrepute of liar and lies
      - ::: thus their elimination through transmission in society
    - ::: science must uncover deceptions, it relies on formerly achieved knowledge



: *emotion recognition*  
:: *machine vs man*



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# cognitive biases

when mind fails in a sake of its own stability

- : stability or consistence of a mind or a social group is vital to survival
  - :: when something threatens it, a mind or a group resists it – we may become cognitively biased
  - :: it is a matter of evolutionary adaptation, of system 1
  - :: system 2 may re-evaluate, if applied
- : more, mind is not only fallible, manipulation is a functional part of human social communication
  - :: to keep status quo and to survive is more important than any truth
- : creativity is often slowed down by scepticism



**mind could be rational & irrational at once**

: tallow lamp

: tooth for spirits



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## types of cognitive biases

# Ball paradox



The diagram illustrates the setup for the Ball Paradox. It features two identical red doors, labeled 1 and 2, each with a yellow handle. Above each door is a green rectangular box representing a camera. A red ball is positioned in the center of the space between the two doors. The entire scene is set against a green background.

Academy of Sciences  
0014664  
IP management

## HR Management

## behavioural norms

: guidelines to decision-making aka morale



## what is ethics good for?

: consistency & functionality of human community

## why does ethics exist at all?

: without it, no human community may be stable in a long term  
:: eccentric forces of personal interests do destabilise system

## forms of ethics

: unwritten norms  
: ethical code  
: law

## sanctions for non-compliance

: info dissemination about the offender in community  
: individual refusal to cooperate with the offender  
: exclusion of the offender from the community  
: court of justice



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## science is a method of acquiring knowledge

- : a way of acquiring reliable knowledge
  - :: testability is crucial
    - ::: science is constantly revised
  - :: complex and non-trivial

## science is an organised system

- : scientists and their institutions
  - :: science is based on co-operation and trust

## science is a social institution

- : summary of all generally accepted explanations (theories and hypotheses)
- : society is deeply influenced by (scientific) knowledge



**does the question “is mathematics a science” has any sense?**

- : it very much depends on the definition of science
  - :: the use of the scientific method of theorising based on empirical data gained from rigorous and repeatable experimentation to explain natural phenomena through theories
  - :: *science is doubting axioms* – Alan Turing
  - ::: if older theories are understood as axioms, this has to work

**is mathematics out there or inside our mind?**

- : math combines spatial and linguistic neural circuits to formulate advanced thought concepts
  - :: done by evolution of higher cognitive functions through synergy of formerly independent networks

## empirical science

- : grey zones are part of the game
  - :: we may never know for sure
- : system of functional models
  - :: it is true cos we cannot say otherwise

## theoretical/formal science

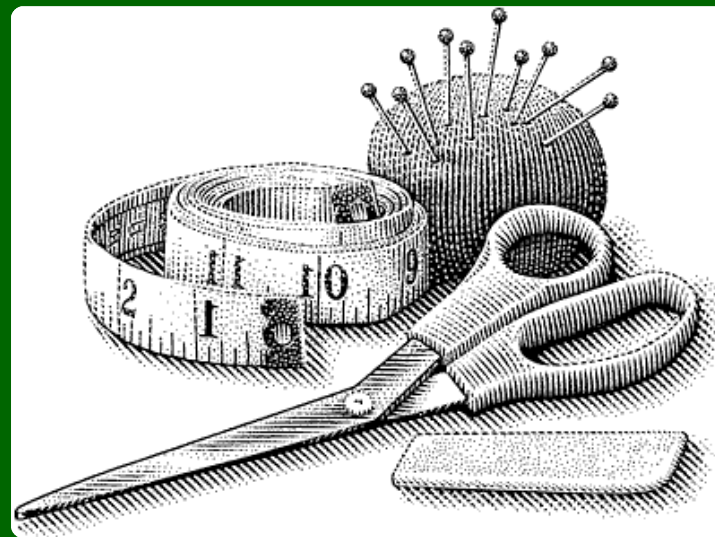
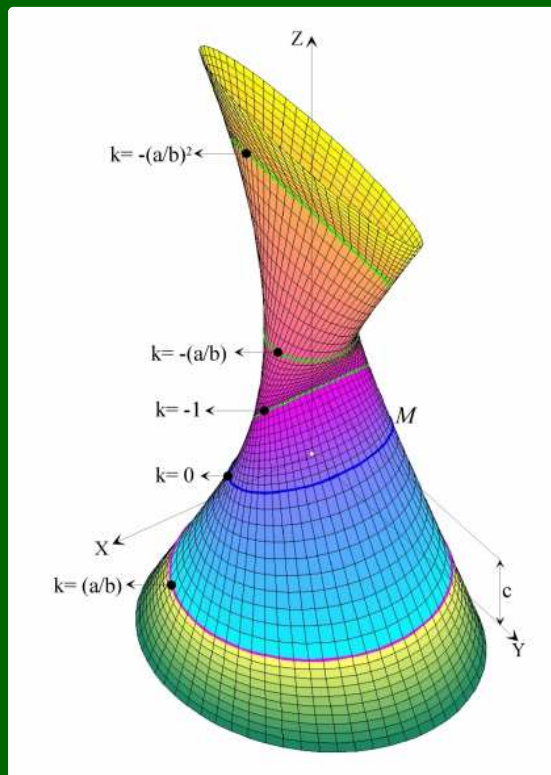
- : white zones are part of the game
  - :: we may be pretty sure (QED)
- : system of abstract models
  - :: it is true cos it is internally consistent

: *undecidable statements*



... creators of mathematical models are like mad tailors; they sew all kinds of clothes hoping, that some of them could be put on ...

*Stanisław Lem*



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# ethics & nature of scientific conduct

- : collecting unbiased data
- : methodically correct evaluation
- : formulation of valid conclusions
- : proper presentation of results

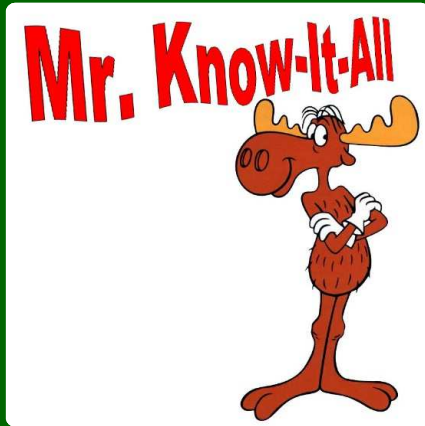


- : working (mostly) within a collective
- : community depends of work of others
- : positive results are expected from science/scientists

## scientific conduct

### scientist is

- : lab technician
- : engineer
- : teacher
- : student
- : publicist
- : manager
- : politician



### to cut a long story short

- : labourer of knowledge
  - :: often over-specialised, with a limited perspective
- : majority of activity are learned on-the-job
  - :: soft skills education is more common today



## science is first of all a human activity



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## scientific knowledge acquisition

- : often applies intuition and guesses instead of cold rational reasoning
  - :: **serendipity** – role of lucky co-incidence (*fortune favours the prepared*)
  - :: **heuristics** – pure empiricism
- : hypotheses are not always tested in a correct manner
  - :: incorrect interpretation or conduction
  - :: wishful thinking, egocentrism and intellectual inertia
- : logical abduction
- : *ad & post hoc* hypotheses

... without anger and zealotry ...

*Tacitus*

(*sine ira et studio*)

... scientist has a healthy scepticism,  
suspended judgement,  
and disciplined imagination ...

*Edwin Hubble*

during acquisition of **scientific** knowledge, the corrections appear

- : directly by original authors
- : or *ex post* in wider scientific community



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# ethics in science or pitfalls of scientific conduct

## : has to be a decision-making guide

- :: how to approach research and its results
  - ::: how to treat unexpected results (hypothesis testing)
  - ::: how to correctly acquire and evaluate data (vivisection)
  - ::: how to correctly present results (publication)
- :: how to approach colleagues (financing, evaluating, reviewing)
- :: how the colleagues are supposed to approach you



## : should show how to avoid a misconduct (i.e. ethical dilemmas)

- :: by knowing the rules
  - ::: their content and also the reason for it
- :: by knowing the rights and responsibilities
  - ::: co-authorship, conflict of interests, intellectual property, vivisection
- :: by ability to recognise the most common ethical misconduct examples
  - ::: from other or your own sources ;)



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## scientific misconduct vs honest error

**intentional misconduct** (*fraud, forgery*)

: discrepancy between reality and statement caused **by manipulation**

**unintentional misconduct** (*slip*)

: discrepancy between reality and statement caused **by negligence**

**honest error**

: discrepancy between reality and statement caused **by fallibility**

**honest errors are common in science, *de facto* science runs on them** : *Columbus & America*

**pragmatic point-of-view** (why misconduct happens not so often, even if we are not overseen)

: uninteresting research is not worth manipulation

: interesting research will be repeated one day

: *Woo-Suk Hwang & stem cells*

**scientific misconduct** – system characteristics of research community

: N. Lacetera, L. Zirulia, *J Law, Economics & Organization* **27** (2008) 568

: B. C. Martinson, M. S. Anderson, R. de Vries, *Nature* **435** (2005) 737



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## concept of integrity in ethics

- : commitment, loyalty to certain rules and principles
- : strength of character, honourability, honesty, impeccability

## official frame for research integrity in Europe & Czechia

- : *European Charter for Researchers 2005/251/ES*
  - :: EU Official Journal, march 3, 2005
- : *Ethical research frame*
  - :: resolution of Czech government, august 17, 2005 No. 1005

## research integrity practice in institutions and scientific community

- : *Rules of Good Scientific Practice*, Max Planck Society, 2000
- : *Good Manners in Science; A Set of Principles and Guidelines*, Polish Academy of Science, 2001
- : *All European Memorandum on Scientific Integrity*, Amsterdam 2003
- : *Ethical code of researchers in AS CR*, 2006
- : *Singapore Statement on Research Integrity*, 2010
- : *Montreal Statement on Research Integrity in Cross-Boundary Research Collaborations*, 2013





## institutions guaranteeing the research integrity

### internal

: *ethical committees (& ethical codes)*

:: Committee for the Scientific Integrity (art. VII ethical code of CAS, 2016)

::: Code of Ethics for Researchers of the Czech Academy of Sciences

### external (third-party)

: *ethic offices*

:: *Office of Research Integrity (ORI)*

::: created merging several governmental and institutional offices

: *independent non-profit organizations*

:: *UK Research Integrity Office (UKRIO)*

: *scientific journals*

:: ethical statements, plagiarism check, sharing information on frauds

:: *The Committee on Publication Ethics (COPE)*



# ethical aspects of science as a way of methodical knowledge acquisition



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it would like to be a science, but it does not follow rules

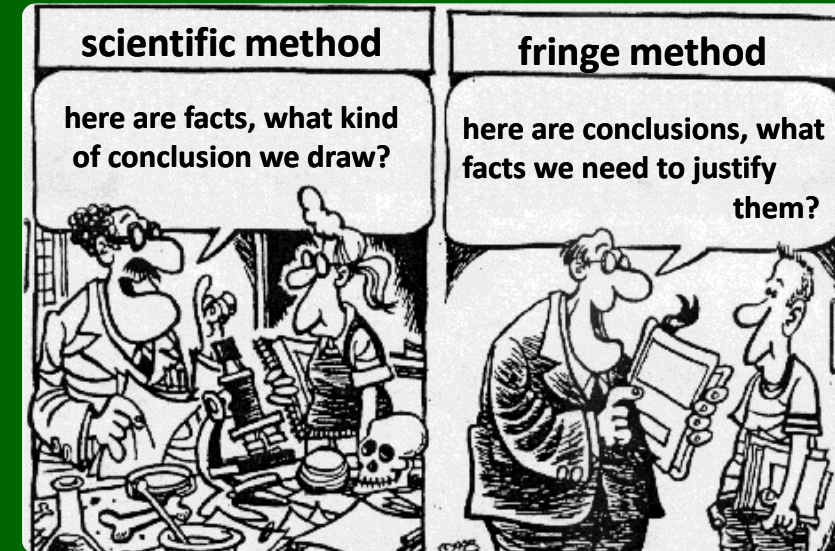
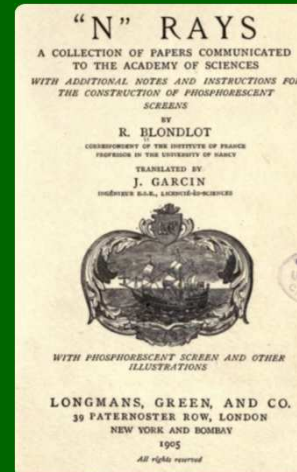
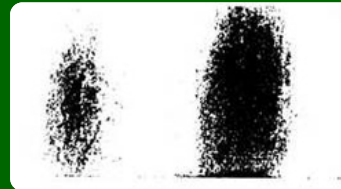
**pseudo-science**  
**fringe science**

## N rays (1903)

- : Prosper-René Blondlot announced them
- : 30 papers in one year
- : no-one was able to reproduce the results

Robert W. Wood – *Nature* test, 1904

- : seen, he removed important component
  - :: the rays were not observed
- : unseen, he put hand in a ray trajectory
  - :: the rays were observed
- : assigned the observation to cognitive errors



**no prestigious journal will publish any important discovery pre-published without review**



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## rules to distinguish fringe from science? it *could not* be done **positively**

### science:

**primary goal knowledge**

often side effects: ideology, culture, business

*ID : bible, UFO : anti-establish*

**knowledge evolves**

it is not evolving experiments justify only

*iconoclast in science is hero, not heretic*

**knowledge is tested**

testing knowledge is taken as heresy

*science generates  
more new questions than answers*

**conflicting data are interesting**

conflicting data are ignored & suppressed

*everyone likes soothsay  
no one really tests it*

**no knowledge stays once for ever**

knowledge is often dogmatised

*impossibility to disprove is not a proof*

**knowledge must stand alone**

knowledge supported by authority

*supporting the said by scientific degrees*

**unambiguous language**

vague & ambiguous language

*energy, vibration, field*

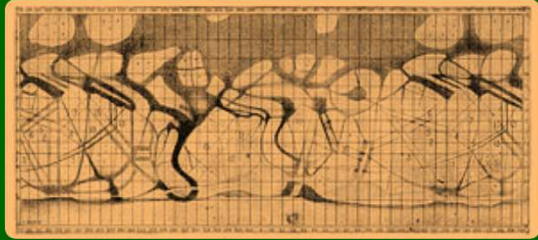


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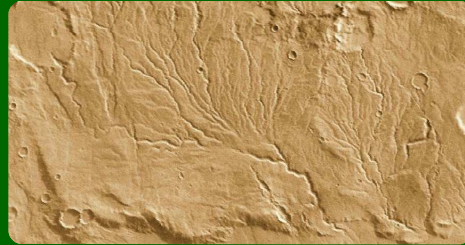


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# why should we deal with pseudo-science?



: *Martian channels, Schiaparelli (1877), Antoniadi (1909)*



: *Freud and a case of childless woman*



## applicable cognitive biases

- : desire to see something causes we see it
- : desire for pure force affecting our lives

## dangerous ethical aspects of pseudo-science

- : destructive charlatanry, commercial frauds; sectarian cults, political pressure
- : closely linked to distrust towards unknown and over-confidence in “magic”

## and wasn't science once called pseudo-science?

### may happen on the break of a new paradigm

: A. Michelson, J. J. Thomson, A. Wegener

## and could not science become sometimes pseudo-science?

### may happen when unable to test new hypothesis

: superstring theory; an attempt on changing methodical rules of “game” only to “win”



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: what is the reading precision of measured values?

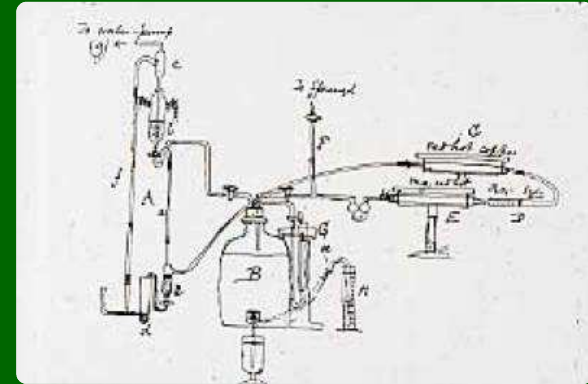
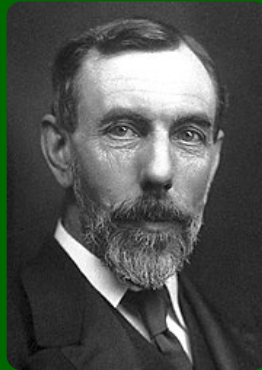
*:: there are three kinds of lies: lies, damned lies, and statistics*

*:: the only statistics you can trust are those you falsified yourself*

**6.63 ± 0.05 ml**

*:: if the measurement error is 0.03 %, the difference of 0.48 % must be significant*

*::: difference between unit mass of two nitrogen preparations from air and by chemical reactions*

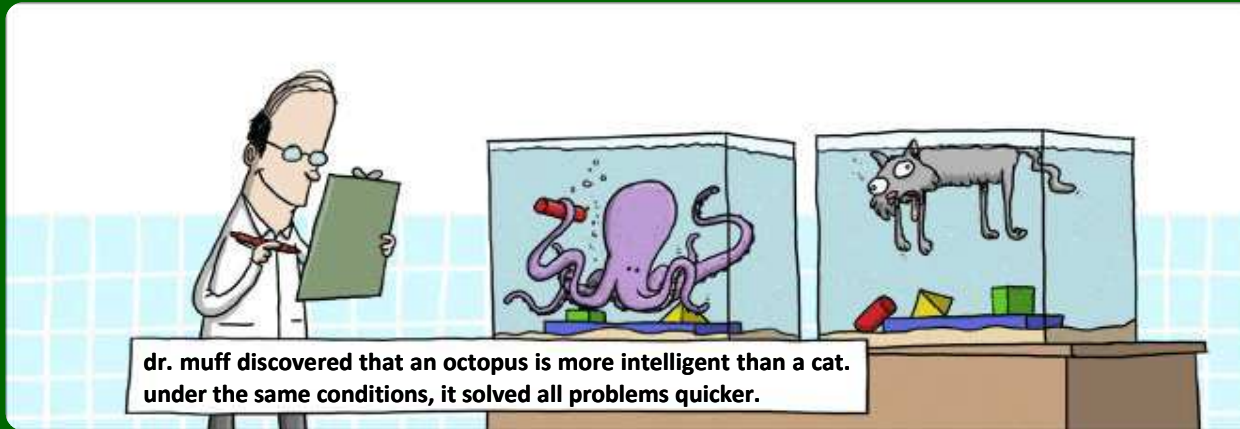


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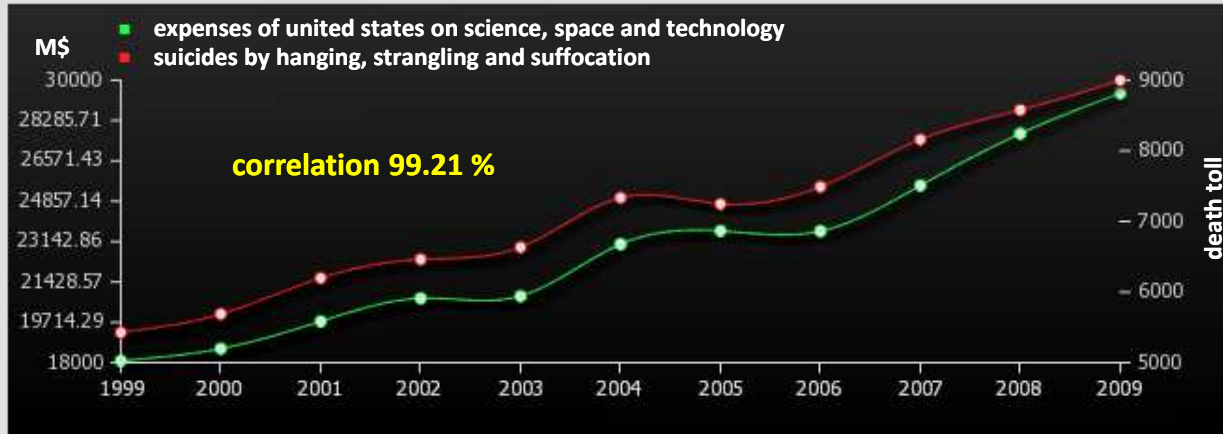


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## garbage in, garbage out (G.I.G.O.)



**correlation** needs not to be a **dependence** (it is often only **coincidence**)



**voodoo correlation**



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## p-hacking

### data fishing (data dredging, data snooping)

doi 10.1038/506150a

- : *if you torture your data enough, they'll eventually confess*
- : or search for statistically significant patterns in data, but without hypothesis
  - :: this is not true testing, does not produce relevant conclusions
  - :: allows to formulate hypothesis, but it should be tested with new data
  - :: ends mostly with publishing false positive results



*the scientist decided to experimentally study one phenomenon (dependence). the first study design did not work as expected, but the scientist modified the experimental procedures and conducted the second study. it looked more promising, but still did not give  $p < 0.05$  after data analysis.*

*the scientist, convinced that he is on track, is collecting additional data. he decided to exclude few results that looked clearly off. then he noticed that one of his adjustments to the procedure gave a clearer picture and therefore focused on it. a few improvements to the procedure and the scientist finally identifies a slightly surprising but really interesting dependence that reaches  $p < 0.05$ . the scientist stubbornly tried to find such a dependence, knowing it was hiding somewhere. he also felt the pressure to reach the desired p-value.*



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*but there is a catch.*

*in fact, there was no such dependence. despite a statistically significant result, the scientist published a false positive result.*

*the scientist felt that he was using his scientific insight to reveal the hidden phenomenon when he took various steps after he started his studies: he collected more data. he excluded some data that looked off. he abandoned his failed attempts and focused on the most promising. he analysed the data a little differently and made some more tuning.*

*in fact, he worked methodically incorrectly, unscientifically because he did not fully understand the scientific method.*

: methodologically wrong and ethically dubious research

: considered to be the cause of the replication crisis

:: published dependence does not exist *de facto*, the study cannot be repeated

## how to deal with it?

: instead of calculating  $p$ , the **estimation statistics** is better

:: uses confidence interval, data meta-analysis and effect size analysis

: pre-registration of the study (e.g. at OSF) and subsequent publication of the procedure

:: monitoring of the correctness of the study progress



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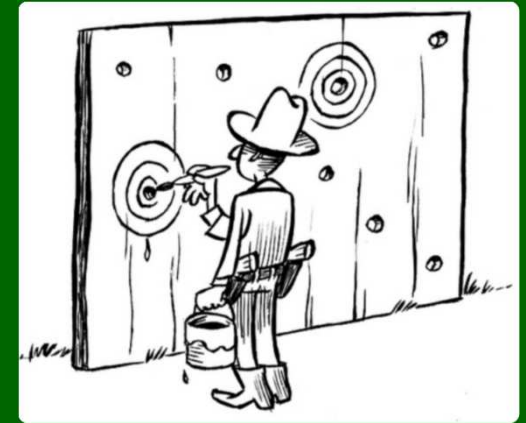
## HARKing (hypothesising after the results are known)

doi 10.1207/s15327957pspr0203\_4

- : formulating *a priori* hypothesis after *de facto* testing this hypothesis
  - :: *post hoc* hypotheses formulated based on data tests, pretending to be *a priori* hypotheses
  - :: denying community of a disproved *a priori* hypothesis
- : from the outside it seems that all *a priori* hypotheses are accepted and none is refuted
  - :: the effect of the hunt on positive results
  - :: considered to be the cause of the replication crisis
- : the solution is to change the culture of the publication and the severity test
  - :: strict type I error checks, statistical power analysis, correct random experiment

*a texan sharpshooter aims and fires his gun at target on a barn wall but misses. he then walks up to the wall, rubs out the initial target, and draws a second target around his bullet hole in order to make it appear as if he is a good shot.*

A reader quick, keen, and leery  
Did wonder, ponder, and query  
When results clean and tight  
Fit predictions just right  
If the data preceded the theory

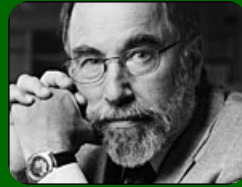


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**David Baltimore (1938)**  
: biologist, Caltech



## affair of David Baltimore

Weaver D., Reis M. H., Albanese C., Costantini F., Baltimore D., Imanishi-Kari T., *Cell* 45 (1986) 247

**1991** – results of fraud investigation are published

: M. O'Toole, subordinate of T. Imanishi-Kari – data were supposedly fully forged

: D. Baltimore defended Imanishi-Kari

: entrance of senator John Dingell, “hunter” of scientific frauds

:: politicisation & media-promotion (Baltimore resigned from all functions)

:: civil court denied the cause and returned it to the *Office of Research Integrity*

:: animosities between former colleagues

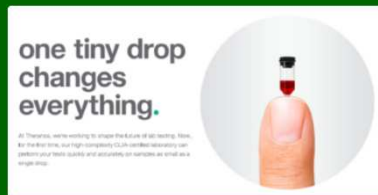
::: T. N. Wiesel taking over his positions, lobbied to expel him from scientific organisations, even to retract his Nobel prize

**1996** – *Office of Research Integrity* decided, that **no fraud happened**

: results successfully reproduced by independent laboratory already in 1993

## affair of Elisabeth Holmes and Theranos

- clinical bioanalytics start-up with massive support from celebrities (Kissinger, Clinton, Shulz)
- : 19 years old E. Holmes, drop-out from *Stanford's School of Engineering* (after a year)
- :: 2003 – patent for new type of microanalyser of capillary blood (fear of needles)
- : start-up *Theranos* with *Edison* analyser, > 200 analytes from 5 µl of blood
- :: never peer-reviewed technology, no proper technical documentation
- :: internal doubts since the start (Tyler Shulz – employee and grandson of director)
- :: revealed by scientific journalist John Carreyrou of *The Wall Street Journal* in 2015
- :: analyser never worked, results were taken from classical, “checkout” measurements
- : rocket founding raising, in 2014 value of 9 G\$, in 2018 it was 0 \$
- :: stealth-mode running – no official info going outside
- :: EH is facing 20 years sentence for a fraud
- : 2019 HBO documentary *The Inventor: Out for Blood in Silicon Valley*



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# ethical aspects of science as an organised system (intrinsic ethical issues)

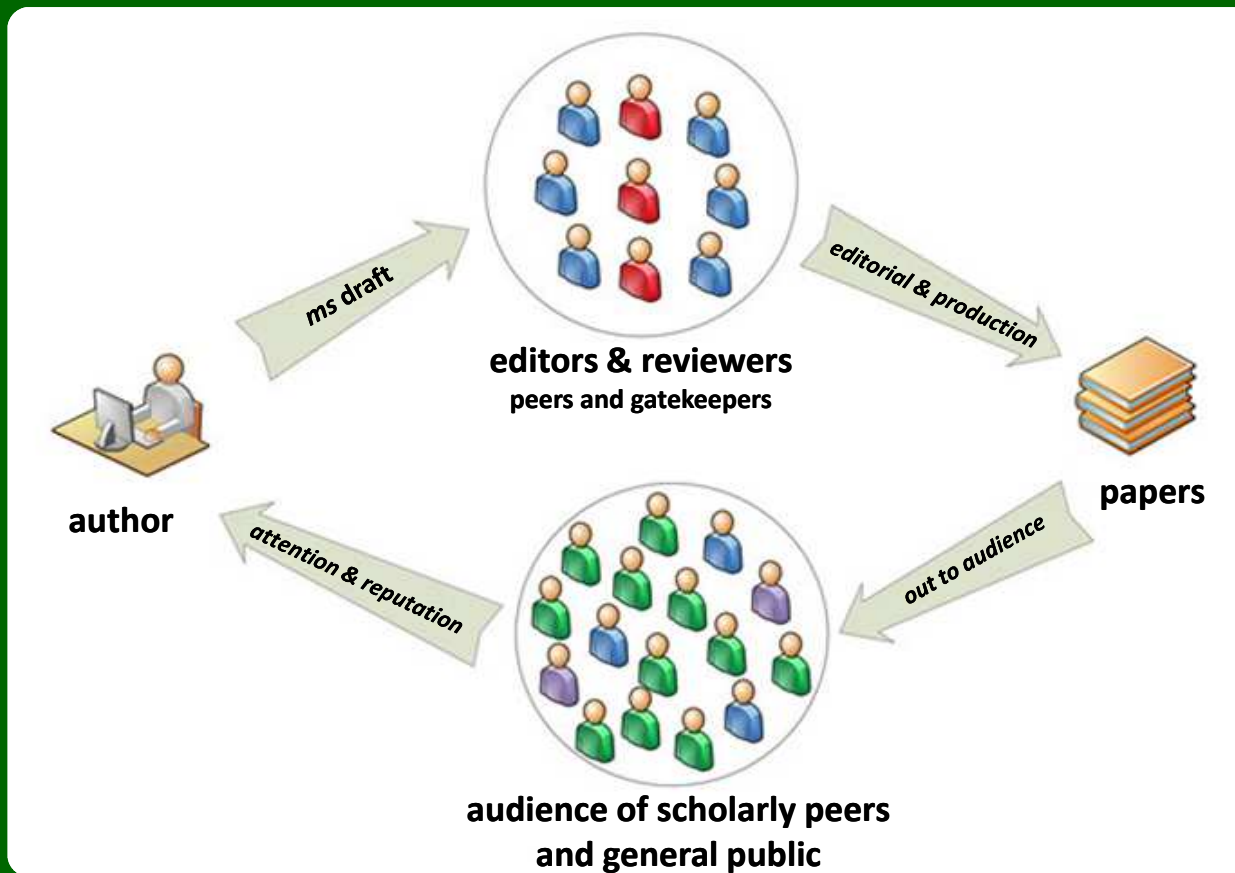


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# peer-to-peer review based publishing system



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# trap of positive results publishing



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# unethical scientific publishing

## : publishing unethical research

- :: publishing forged results or (self)plagiarism

## : manipulating research authorship

- :: co-author has to be able to defend all conclusions

## : manipulating citations

- :: citation gangs, effect of St. Matthew, effect of the Omniscient, citation deflection, ...

## : manipulating peer reviews

- :: “forthcoming” editors

- ::: choice of reviewers, ignoring legitimate objections from scientific community

- :: private companies co-ordinating fraudulent publication processes

- ::: ghost writing of *ms* from preforms & manipulated contact lists of reviewers

- :::: true names of offered reviewers, but fake contacts





## Sokal affair



### Alan Sokal

\*1955, professor of physics at New York University (NYU)

Sokal, A., Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity, *Social Text*, 46/47 (1996) 217

: accepted 1994-11-28, revised 1995-05-13, published 1996-05-XX

## confession

: A Physicist Experiments With Cultural Studies,  
*Lingua Franca*, 4 (1996) 62

: **prior** to confession, **no negative** response

: journal **failed** peer-review

:: *ms* were read only by editors

:: published based on **person of author & sounding**

## interesting publication affairs

### Transgressing the Boundaries

TOWARD A TRANSFORMATIVE HERMENEUTICS  
OF QUANTUM GRAVITY

Alan D. Sokal

Transgressing disciplinary boundaries . . . [is] a subversive undertaking since it is likely to violate the sanctuaries of accepted ways of perceiving. Among the most fortified boundaries have been those between the natural sciences and the humanities.

—Valerie Greenberg, *Transgressive Readings*

The struggle for the transformation of ideology into critical science . . . proceeds on the foundation that the critique of all presuppositions of science and ideology must be the only absolute principle of science.

—Stanley Aronowitz, *Science as Power*

There are many natural scientists, and especially physicists, who continue to reject the notion that the disciplines concerned with social and cultural



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**James Lindsay, Helen Pluckrose & Peter Boghossian tried what Sokal did again**

: 2018 – 20 fake papers of fashionable jargon & ridiculous conclusions tried to high-profile journals

:: fancy fields including gender or obesity studies

:: 4 get published (and retracted), 3 accepted, 1 under review and 9 rejected

:: debunked by science journalists (*The Atlantic*, *NYT* and *the Economist*)



: it received mixed reactions

:: praise for exposing the weakness of scientific media for sensational anti-system articles

::: *Stars, Planets, and Gender: A Framework for a Feminist Astronomy*

::: *Super-Frankenstein and the Masculine Imaginary: Feminist Epistemology and Superintelligent Artificial Intelligence Safety Research*

:: criticism for non-scientific approach & pointlessness

::: as an experiment it was poorly designed, at least there were no controls

::: peer review can hardly discover fraud, unless there are flagrant discrepancies in the paper





**Igor**  
semiologist  
theoretical physicist

## affair of Bogdanov brothers

**Yourievitch Osten-Sacken-Bogdanoff**  
\*1949, Ph.D. University of Burgundy, France



**Grichka**  
mathematician

6 articles in mathematics & physics journals, including well-known *Annals of Physics & Classical and Quantum Gravity* : all peer-reviewed

: *de facto* only two were “original” – the rest were variation of the two

other scientists find their work fallacious

: **Max Niedermaier** (2002), **Urs Schreiber** (2004), ...

**fictive collaborator**

: professor L. Yang, Hongkong

**fictive institute and internet address** in Riga ([www.phys-maths.edu.lv](http://www.phys-maths.edu.lv))

: Mathematical Center of Riemannian Cosmology (MCRC)

**Bogdanovs** vs journal *Ciel et Espace* (Dec 2004)

: Bogdanovs found guilty in 2006 to pay court costs (2500 EUR)



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Jan Hendrik Schön \*1970, Ph.D., Bell Labs

young prodigy scientist – Otto-Klung-Weberbank in physics 2001, Braunschweig prize 2001

discovery and construction of **transistor on molecular level**

**briefly after publication the negative response**

: anomalies in data, too precise data, different data had the same noise...

: same graph, different publications @ different conditions

**25 suspicious articles with 20 co-authors**

: **prestigious journals *Nature, Science***

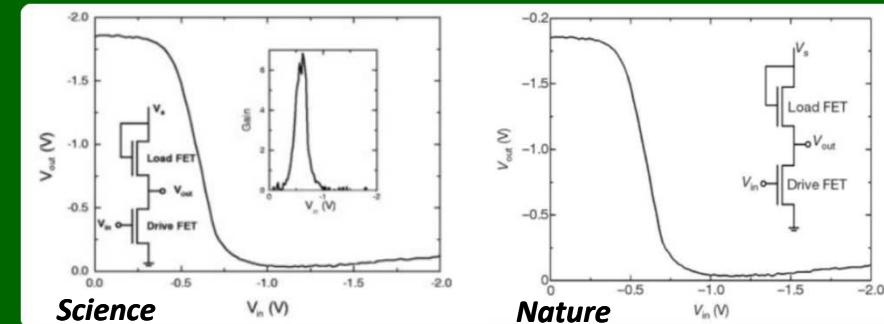
: **in 21 cases, the frauds were confirmed**

: **none of co-authors was accused** (even his boss Batlogg)

: **papers are still cited** as evidence (work retracted in 2001 from *Nature* 37x !)

since 2004 revision on his Ph.D. & DFG relation (banned to apply for grants)

: **2014 federal constitutional court** finally recognized decision of the university



## who's afraid of peer review?

: John Bohannon, Science 2013

**Bohannon affair**

## generation of untraceable fictive authors

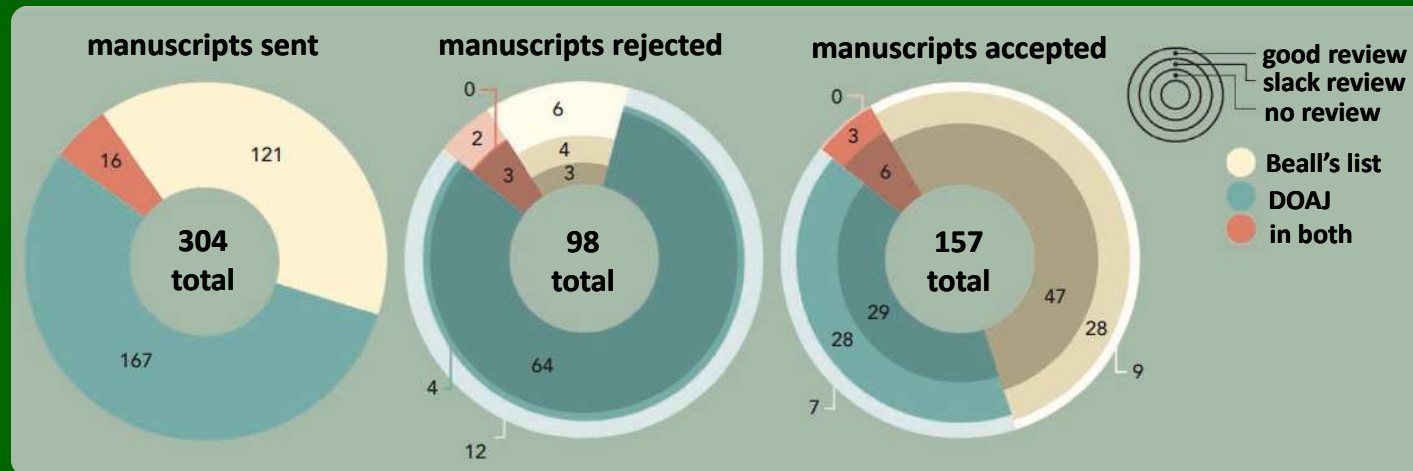
: e.g. Ocorrafoo Cobange, Wasse Institute of Medicine, Asmara, Eritrea

## generation of manuscripts

: molecule X of lichen of Y specie inhibits growth of cancer cells type Z

:: database of X, Y & Z + programme à la MadLibs in Python

::: D. Aguayo, M. Krohn, J. Stribling – **SCIgen + SCIpheR** (2005); 85 articles managed through



DOAJ  
: directory of open access journals



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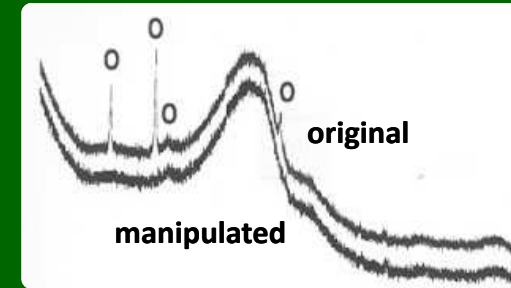


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## high profile nanomaterial scientist at Palacký University of Olomouc

- : The Regional Centre of Advanced Technologies and Materials (RCPTM)
- : H-index > 60, one of the most cited researchers in Czechia
- : spectra manipulation in his 2007 *JACS* article revealed by student in 2012
  - :: it was ignored and the student has failed defence (7 negative)
  - :: new defence in 2013 again failed (2 positive, 2 negative, 2 invalid)
- : new dean in 2018 started the process of re-evaluation of the 2012 revelation
  - :: fraudulent behaviour was found with the highest possible probability
  - :: dean submitted it to rector and he to ethical committee, which agreed with the previous findings
  - :: JACS refused errata offered by authors and retracted the paper
- : new manipulation with data was found in 2016 *Nature Communication* paper in 2019
  - :: errata submitted contained another picture manipulation
    - ::: questionable defence of the authors vs rigorous arguments of the opponents
    - ::: mathematical analysis of the noise in new spectra showed that they were manipulated
    - ::: internal fight lead by powerful clique of bosses of research centre against faculty
    - ::: ethical committee chair resigned in a protest (being falsely accused of fraud)
- : still going on

## case of Radek Zbořil





## difference between different publication affairs?

**Schön & Bogdanovs & Sokal's epigones** (and probably **Bohannon** would too) were **exposed**

: not due to reviews, but application of scientific method (reproducing & critical analysis)

:: self-correcting tendencies in science

**Sokal wouldn't be exposed**, if he did not confess

: pseudo-science only piles texts & concepts without possibility to test them

**negligible sanctions for a bad review lead to slack reviews**



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## predatory journals

- : flattering proposal to publish in a special journal issue or even editing it
  - :: *pseudo-open access*, misusing the idea of open publishing
- : after acceptance (often without review) follows an info on high price to be paid
  - :: regarding some unannounced service
- : more publication ethics violations
  - :: editorial board members without their consent, false journal identity (ISSN)
- : **Beall's List & Stop Predatory Journals**

## predatory conferences

- : email asking you to give a lecture on “an important” conference
  - :: importance is fictive, often obscure locations
- : generous offer of significant discount (*ca* 300 USD)
- : thereafter hefty bill comes (*ca* 1600 USD)
- : misleading homepage
- : *OMICS Group, Global Technology Community, Coltharp Institute...*

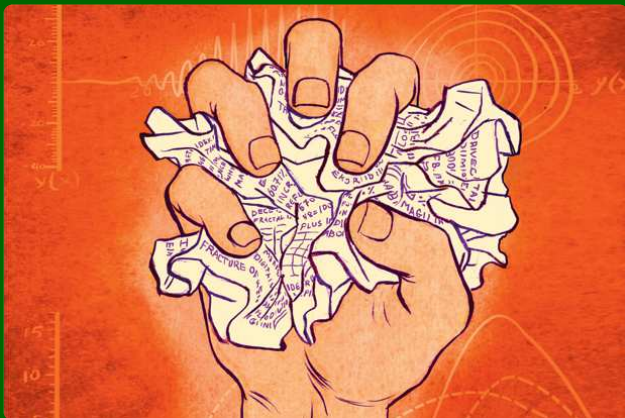
## predatory practices



- : publisher's honesty
- : honest business practices
- : transparency of processes







- : **publication ethics blog**
  - :: retractionwatch.com
  - :: since August 2010, I. Oransky, A. Marcus
- : **informs about malpractice**
  - :: retracted articles
    - ::: mistake vs fraud
  - :: fraudulent publishers
  - :: fraudulent authors

## retraction watch



### : **Scott S. Reuben**

- :: 21 articles retracted
- :: sentenced
  - ::: 3 years of supervised release
  - ::: 400 000 USD to pay

### : **the drawbacks of fighting non-ethical publishing**

- :: blackmailing authors under false pretence of allegedly unethical *ms* revision
- :: predatory companies often pose as defenders of research integrity

### : **self-correcting processes in science**

- :: to cheat is worth only for a short term
- :: up to 100% chance to be discovered



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# renaissance of scientific publishing

- attempts to **maximally open** the process and result of publication
- : free access, publishing data and eventually errata
- :: not publishing data & errata may have be un-ethical
- ::: in a survey, 200 authors were asked to publish data, 56 % refused

journal *Matters* (2015, Rajendran)

- : publishing results of empiric tests regardless of positivity/negativity
- : 150 USD academic institutes, 300 USD profit institutes; paid reviewers
- : score 1 – 10 : score > 4 published within 2 weeks, score > 8 into special issue *Mattersselect*

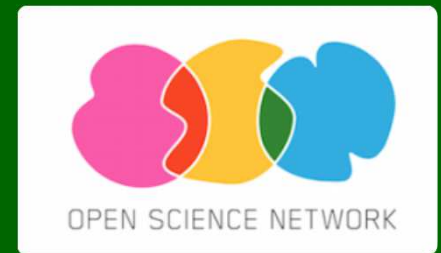


journal *Collabra* (2015, University of California Press)

- : low initial costs open publishing 875 USD
- :: 625 USD direct publication costs, 250 USD to editors & reviewers
- ::: editors & reviewers may give their money to publication fund

*The Winnower* journal  
(2014, J. Nicholson)

- : post-publication reviewing



system *Open Science Network SHARE* (2015, Center for Open Science)

- : shared data and documents
- : free



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- : authors want a lot of articles and citations
  - :: the more the better for career and financing
- : journals want a lot of citations
  - :: the more the better, it's business
- : scientific institutions want a lot of articles and citations

|            |        |        |
|------------|--------|--------|
| astronomer | 3000   | 350x   |
| physicist  | 7000   | 526x   |
| chemist    | 30000  | 2895x  |
| biologist  | 100000 | 20304x |

## scientometrics central

### Science Citation Index

- : Institute for Scientific Information (Clarivate Analytics 2016)
- : published in **Journal Citation Reports**
- : on-line form (Web of Knowledge)
- : covers over 10 % of all articles, but 90 % of citations

exists since 1973, retrospective 1940  
8400 articles from 60 countries  
16000 new records weekly  
number of published papers rises 2x each 9 yrs

# unethical behaviour in scientometry

## : citation manipulation

:: unethical citation – different kinds of self-citations, citation amnesia, citation fabulation, ...

## : publication manipulation

:: not acknowledging publishing unethical article

## : false comparison between unrelated fields

## citation manipulations

### self-citations

: up to 20 % of all citations, hidden self-citations up to 40 %

### mutual citations among teams (citation gangs)

: tit-for-tat

**effect of St. Matthew** – success brings more success (Mt 25,29)

*: or unto every one that hath shall be given, and he shall have abundance, but from him that hath not shall be taken away even that which he hath*

### effect of the Omniscient

: key papers in the field must be cited



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## artificial increase of IF through dubious citations

- : frequent publishing of reviews
- : publishing of editorial



## reality of IF and citations relation

*Nature* journal, year 2004, IF – 32.182

- : 89 % of all citations from 25 % of articles
- : the most cited article had 522 citations in 2004
- : the second most cited article had 351 citations in 2004
- : only 50 of 1800 articles had more than 100 citations in 2004
- : *ca* 97 % of articles has less than 20 citations
- : never cited articles – 3.8 %



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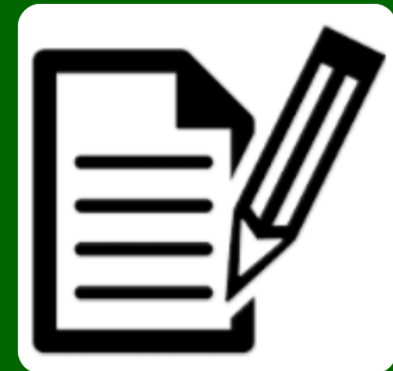
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attempts for **robust** and **non-formal** system of **evaluation**

D. Hicks, P. Wouters, L. Waltman, S. de Rijcke, I. Rafols  
: *Nature*, April 23, 2015

### 10 points of new publication policy

- : 01 – quantitative evaluation with qualitative, expert assessment
- : 02 – performance measure against the research missions
- : 03 – protect excellence in locally relevant research
- : 04 – open data collection and analytical processes, transparent & simple
- : 05 – open evaluation, evaluator-evaluated feed-back
- : 06 – account for variation by field in publication and citation practices
- : 07 – multi-criterial evaluation of scientific work
- : 08 – avoid misplaced concreteness and false precision
- : 09 – recognize the systemic effects of assessment and indicators
- : 10 – scrutinize indicators regularly and update them





# unethical argumentation and reasoning

**valid** argument – *measure of form*

- : corresponds to rules for deductive constructions
- :: conclusion results from premises
- : invalid argument does not necessarily result from premises
- : need not to be necessarily true

P1: it snows

P2: if it snows, cats speak

C: cats speak

**true** argument – *measure of content*

- : premises are true statements

P1: all cats are animals

P2: some cats are black

C: thus some things black are animals

**acceptable** argument is **formally & contentually** correct

P1: Arrhenius supported eugenics

P2: Arrhenius warned against global warming

? C: all who support idea of global warming are also supporters of eugenics



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**the burden of proof** (*onus probandi*)

: the one who tells, not an opponent

**Ockham razor**

: less complex solution is more probable

**Hume razor**

: lie is more probable than a miracle

**correct argumentation**

- i have a can of beer.
- really? prove it.
- yes, here it is.
- ah, you're right.

**incorrect argumentation**

- i have a can of beer.
- really? prove it.
- ha, prove that i don't!
- wtf?

**statement evidence**

searching for **obviously true** statements (empiric support)

+ already **supported statements** (literary research)

: we cannot repeat the whole history of science

**evidence process – logical judgement chain**



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# statements (appeals)

## logical appeals

- : on sense of reason; targets system 2
  - :: not only evidence, but interpretation makes the cause stronger
- : sets the credibility of topic, and thus of disputants

## emotional appeals

- : on feelings and instincts; targets system 1
  - :: unconscious reactions – dangerous
- : sets the credibility of disputants

## social/ethical appeals

- : on a sense for right and wrong; targets both systems, but mainly system 1
  - :: again, unconscious reactions of system 1 make it dangerous
- : sets the credibility of disputants

### scientist

A correlates with B ( $p = 0.56$ ), under C, D & E

### university PR

under certain conditions,  
there is a relation between A & B

### journalists

A causes B, say scientists

### conspiracy theorists

A is dangerous and can kill us



# unethical aspects of system influence

- : financing through research grants and grant committees
  - :: malversations and clientelism
- : competitiveness in research
  - :: supposedly positive as in economy
  - :: may limit the research by suppressing negative results, requiring only those positive
- : collaboration in research
  - :: should be a norm methodologically and because of efficiency
    - ::: competitiveness may impede it
    - ::: anything could be achieved, if not presented under particular team member name



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# ethical aspects of science as a social institution (extrinsic ethical issues)



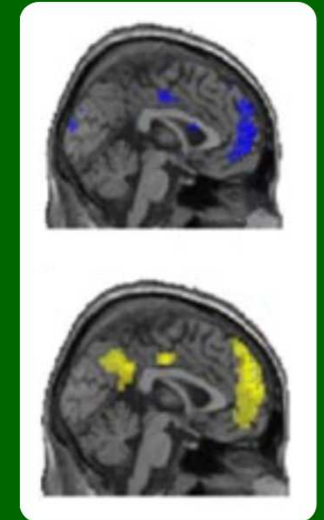
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# vivisection

- : controlled by strong rules
  - :: they alone are not the solution
    - ::: feeling guilty of suffering
- : without vivisection, research is not always possible
  - :: far too complex systems to study
    - ::: HIV monoclonal antibodies, active substances
- : we have to consider the responsibility
  - :: benefit does not ease off responsibility



## anonymity

- : randomised identifiers of samples and experimental subjects
- : never publish non-anonymous data

## confidentiality

- : if not possible to keep anonymity, than at least confidentiality

## consensuality

- : honest approach to all eventual experimental subjects





# unethical employment of scientists

: unethical expertise

- :: falsifying expert opinion in unethical business or political practice
- :: spreading conspiracy theories and post-truths (e.g. Judy Mitkovits)

: unethical research

- :: research done under pressure from employer
- ::: in math e.g. in financial business, data processing, etc.



# unethical aspects of society influence

: political & social choices of research topics

- :: limiting thus the public research financing to chosen topics only

: economic support of pop-science (cancer, nanomaterials, biotechnology, ...)

- :: commercialisation of science and research
- :: substituting science for technology causing false dilemma between basic and applied research



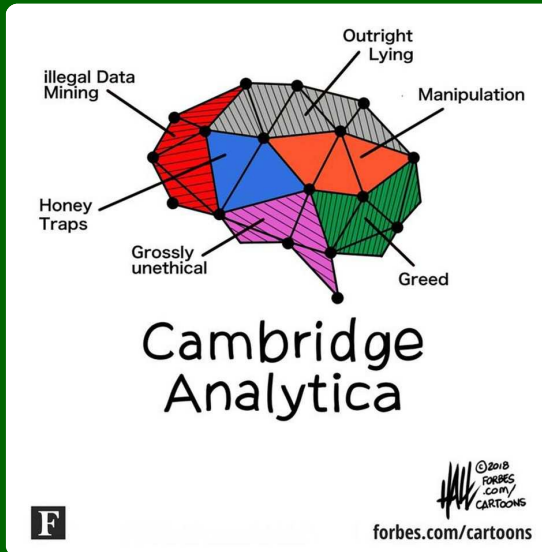
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# unethical use of knowledge

- : knowledge is not *per se* good
  - :: but neither is evil
  - :: it is not an excuse anyway, because power should be followed by responsibility
- : employees as citizens respect the law
  - :: scientists move on the edge of law
  - ::: scientific auto-censorship – do not allow your research to be misused



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# movement for ethics in mathematics



1<sup>st</sup> conference *Ethics in mathematics (EiM1)*

Cambridge University on April 20-21, 2018

2<sup>nd</sup> conference *Ethics in mathematics (EiM2)*

Cambridge University on April 3-5, 2019

*Cambridge University Ethics in Mathematics Project (CUEiMP)* – 2016

: teaching responsible behaviour and ethical awareness to mathematicians (Mathematics Faculty)

: *Cambridge University Ethics in Mathematics Society (CUEiMS)* – 2016

:: students' activity to organise EiM

: *Ethics in Mathematics Discussion Papers* (ISSN 2632-4245) – Maurice Chiodo, Dennis Müller

: lecture course *Ethics for the working mathematician*

: diversity plays against groupthink

: does neutrality save the math from morale?



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## *European Mathematical Society Ethics Committee – 2010*

*: code of practice + procedures + internal policy on conflicts of interest – 2012*

*:: ethical aspects of publication, dissemination and assessment of math*

*:: raising awareness of ethical problems in math*

*:: encouraging publishers to deal with unethical publishing*

*:: helping researchers to pursue unethical behaviour*

*: comments issued in 2017 dealing with the definition and procedure problems*

*:: e.g. how to practically define *plagiarism*, *co-authorship**

*:: caution in unethical behaviour pursuit*

*: study materials in a form of practical mathematical tasks – 2019*

*:: self-awareness of potential problems*



**do you agree with the following statement?** *if you don't do it, then someone else will.*

express the above statement in symbolic notation (using  $\Rightarrow$ ,  $\Leftarrow$ ,  $\neg$ , etc.); find its contrapositive and its negation, giving each in symbols and in words. Do you think the result makes sense?

the point of this question is to get the students to show, mathematically, that the paradigm “if you don't do it, someone else will” is quite flawed as a argument or incentive to do something. hopefully this can equip the students with enough realisation to push back on such an argument, should they ever encounter it in their professional life.

# dealing with scientific misconduct



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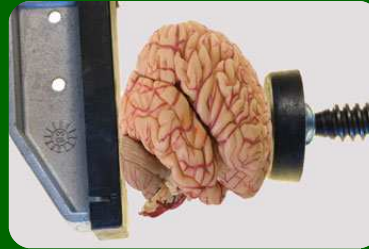
# sources of unethical behaviour in science

## : career pressure

- :: desire to reach the top positions in community hierarchy
- ::: semi-isolated (scientific) society
- :: high level of inner & outer competition

## : circumstance pressure

- :: tendency to ignore unexpected results
- :: negligence, haste
- :: lack of consideration of the circumstances



## : social pressure

- :: desire to excel & to be useful

## : personality pressure

- :: lowered self-reflection of one's own abilities
- :: absence of critical approach to one's own work
- :: hypercriticism to the work of others
- :: difficult control over conflicting personal traits

**disappointment and fear of failure → sense of threat → unethical behaviour**

... to recognise failure is an important part of scientific strategy, part of scientific ethics ...

*Daniel Friedan*



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**if you ask scientists directly**

: 2 % forged results

: 34 % did not work rigorously

**if you ask about scientists (indirectly)**

: 14 % forged results

: 72 % did not work rigorously

: in fact 10 – 15 % of scientists manipulate measured data in their own image

### **peer-to-peer review**

: includes version of so-called altruistic punishment

:: keeps co-operating group functional

### **project review**

: 20 % of project proposals through-put in connection to committee members

:: in less developed countries it is 40 – 60 %

### **influence of political and economic power on scientific work**

: 96 % of pharmacologic paper authors with positive results are connected to manufactures

: 60 % of authors with neutral results

: 37 % with negative results



# elementary ethical rules in science

## research

- : do not do questionable research (negligence or fraudulence)
- : do not tolerate such research in your vicinity
- : do not hinder other's research because of your interests

## publishing

- : do not publish results of questionable research
- : do not allow publication of such results while reviewing (negligent or uncritical reviews)
- : do not hinder publishing of other's results because of your interests (falsely critical reviews)

## financing

- : do not spend grant money on questionable research
  - : do not allow fundraising for questionable research
  - : do not hinder fundraising for other's because of your interests
- : Robert Merton (1942), system of ethic maxima in scientific work (CUDOS)
- : Lee Smolin (2006), rules of scientific work ethics



# difficulties of implementing the ethical conduct

ideal norms vs psychological & social reality

- : **struggle for survival** (and resources) – whatever fictive they may seem
    - :: biological adaptation devised with many tools
      - ::: personal necessity to preserve (or elevate) status
      - ::: interest groups (e.g. citation gangs, management of scientific institutions)
      - ::: deception, selective blindness, doublethink, groupthink
  - : **it's very difficult to point out unethical behaviour** (not only in science)
    - :: often uneasy to evidence when analysing questionable results
      - ::: only reasonable doubt, without possible empirical verification
      - ::: anonymity in peer review may help detect, but also cover unethical behaviour
    - :: covering unethical behaviour in a name of apparent stability of society by powers that are
      - ::: false loyalty
    - :: easy misuse of unethical behaviour detection in a struggle of powers
    - :: intuitive aversion to publish doubts on ethicality of behaviour
      - ::: denunciation, slander vs discontent, information on suspicion
- : you have to be either very brazen  
or very stupid to get caught at  
cheating in science*
- Peter Gray



# ethics in regulation of scientific conduct

## more & more non-scientists influence science

- : with what intentions they interfere?
- : but they rely more & more on science

## regulation type in science

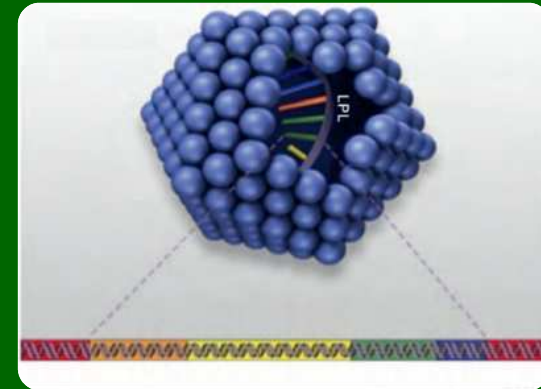
- : economical regulation
  - :: what research to fund and how?
- : political regulation
  - :: what are the consequences of the discovery?
  - :: how would be the discovery achieved?

## gene therapy

- : in China since 2003
- : in Europe since 2012
  - :: uniQure Glybera (2012)
  - ::: lipoprotein lipase (LPL)

## embryonal development imaging

- : in China legal
- : in Europe and elsewhere not
  - :: loss in important field



## interspecies chimaerism

- : discovered 30 years ago
- : patent attempt for control
  - :: not approved
- : no-one does it
  - :: reputation apprehension
- : today potentially useful
  - :: human transplants in pigs

# summary and conclusions



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# how may the scientific conduct go wrong?

## what should not we do in science?

- : questionable research
  - :: negligence, fraudulence
- : questionable publishing
  - :: also reviewing
- : questionable financing
  - :: spending, fundraising
- : problem of tolerance to questionable practices
- : a will not putting one's interests into other's way

## what to do when discovering scientific misconduct?

- : are there any tolerable limits?
  - :: is there a harmless misconduct?
  - :: is it acceptable to marginalise misconduct?
- : is reporting a misconduct a snitch?
- : who is responsible for dealing with scientific misconduct?
- : internal & third-party research integrity institutions





# why do people misconduct in science?

: psychological pressure

:: internal

::: personal traits and upbringing

:: external

::: society and its morale

: human mind & society

:: evolutionary behaviour mechanisms

::: survival, ambitions ...

::: conformity, social success ...

## how to distinguish honest error from misconduct?

: is it formally wrong?

:: inadequate evaluation and presentation process

::: picture & data manipulation (*Corel*-ation)

::: statistical manipulation (*p*-hacking, HARKing)

: is it contentually wrong?

:: apparently wrong inputs

: is it methodically wrong?

:: inadequate methodical approach

: critical thinking & argumentation

:: detecting, uncovering, exposing  
of fraudulent scientific conduct



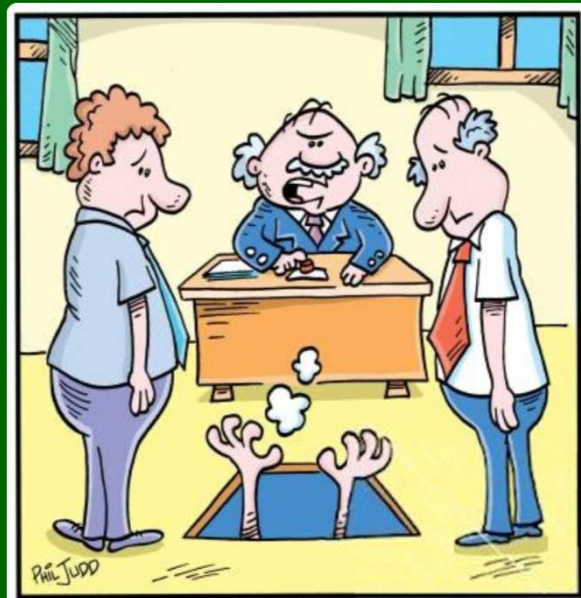
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**science works only because ethic rules are (mostly) followed**  
: there is a fidelity to ethics, not to any particular knowledge or solutions

**thanks for your attention**



**some one else has objections  
against ethical aspects of our work?**



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# appendix

## extending materials



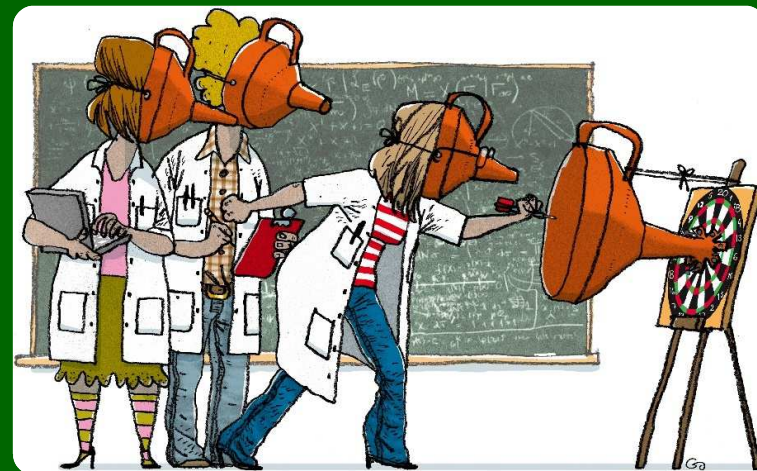
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# the most important cognition biases applicable in science

- : we tend to **ignore counter-evidence**
  - :: we rather believe to what approves our opinions
- : we tend to **create an explanation at any cost**, even it is wrong
  - :: we rather accept quick and dirty explanation that spend efforts thinking
- : we tend **not to see the bigger picture**
  - :: we mistake what we remember for what is
- : we tend to **eliminate loss at any cost**
  - :: we rather cheat (risk) than admit an error (loss)
- : we tend to **be easily mislead by manipulative presentation**
  - :: the first impression makes 70 % of the opinion
- : we tend to **defend members of our group** even we are wrong
  - :: distortion or withholding of information in a name of social consistency, collective reasoning, self-assigned higher moral stance, opposition demonisation, insufficient & exaggerated or misleading responses to critics; high level of group anxiety (groupthink/ group stupidity)



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# untrue and irrational statements

ethically dubious argumentation

## hasty generalization

: claim made on an inadequate evidence

:: *youngsters reading violent books are violent, so ban the books*

## sweeping generalization

: claim made on an absolute statement

:: *all males are obscene*

## *post hoc ergo propter hoc* (after this, therefore because of this)

: claim made on just one thing preceeding the other

:: *immigrants settle city, it suffers from decline, thus immigrants cause it*

## *non sequitur* (it does not follow)

: claim made on linking facts with no connection

:: *he is blind, so he is unhappy*

## *ad hominen* (to the man)

: claim made on personally attacking other disputant

:: *he cannot be a good scientist, if he is a micronationalist*



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***ad verecundiam*** (appeal to questionable or faulty authority)

: claim made on a source with arguable credibility

:: *dr. smith says that stars are small dots in the sky*

**begging the question** (circular argument, tautology)

: claim made on a missing evidence

:: *we should cut the science budget due to useless research done*

**false (or weak) analogy**

: claim made on implying two things are similar

:: *if we can go to moon, why we cannot cure the influenza*

**red herring**

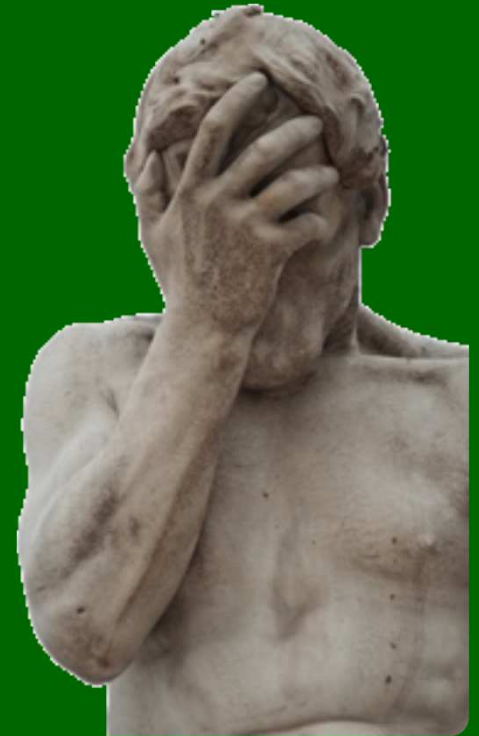
: claim made on a distractive statement

:: *why to worry about whales, if there is an unemployment here*

***ad baculum, ad misericordiam*** (appeal to fear or pity)

: claim made on substituting emotions for reason

:: *if you do pass this letter to 10 friends, you will face bad luck*



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## straw man

: claim made on an oversimplified evidence

:: *those who favour gun control cause criminality in the streets*

## slipper slop (snowball argument, domino theory)

: claim made on a suggestion that one thing leads to other negative things

:: *vivisection reduces respect for life, and if we do not respect life, we will tolerate violence and thus we cause end of civilisation. we have to ban vivisection.*

## burden of proof (appeal to ignorance)

: claim made on not proving something makes it true

:: *since you cannot prove that gods do not exist, they exist*

## ad populum (bandwagon appeal)

: claim made on an assumed popular support

:: *everyone likes watching TV thus it is good*

## undistributed middle

: claim made on premises, which may or may not overlap

:: *all wolves have hair, all men have hair, thus all wolves are men*





# potentially unethical self-citations difficult to find

## auctorial self-citation

: author cites in his own paper other his papers published elsewhere, including papers, in which citing author is a co-author

## periodical self-citation

: papers cites articles from the same journal regardless, who is an author of those papers; probably an intention of editors to cite older papers

## institutional self-citation

: citation of papers of authors from one institution, eventually from one larger or multidisciplinary project or larger collective of authors

**group self-citation** (citation gangs) – groups of authors or journals

**cyclic self-citation** (2nd generation citation) papers citing cited papers

## self-citation impact factor problem

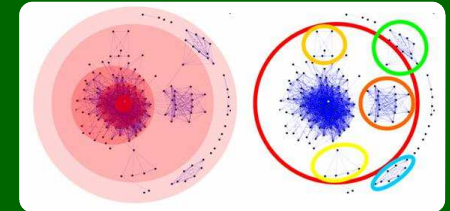
: retracted, they may cause significant decrease of IF

:: *International Journal of Electrochemical Science*

:: *Analytical Chemistry*

1.956 → 1.096 (2013)

5.825 → 5.006 (2013)



**citation gangs analysis**



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## **citations sensitive to author's name**

: the first letter of the name explains 33 % of variability in citation, 10 % of citations contain mistakes

## **excessive citation of controversial publications**

: because of easy starting the controversy

## **crediting authors with high titles (professors)**

: syndrome of boss citations

## **citing the work of manuscript editors and potential reviewers**

: adulation to promote the manuscript

## **quoting colleagues from own workplace or university**

## **nodal citations**

: bibliographically coupled networks

:: cited reference co-occurrence

:: co-citation network of documents, authors, journals

## **citation bias**

: excessive citations of works agreeing with the author's hypothesis



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## **amplification citation**

: citations referring to documents that do not contain primary data, in order to elevate the number of citations to support claims

## **citation diversion**

: author cites the content, but declares that it has a different meaning, and it thus redirects its

## **citation transmutation**

: conversion of hypothesis into empiric reality just through a citation

## **dead-end citation**

: support of the claim by citation of documents that do not contain a relevant content

## **back door invention**

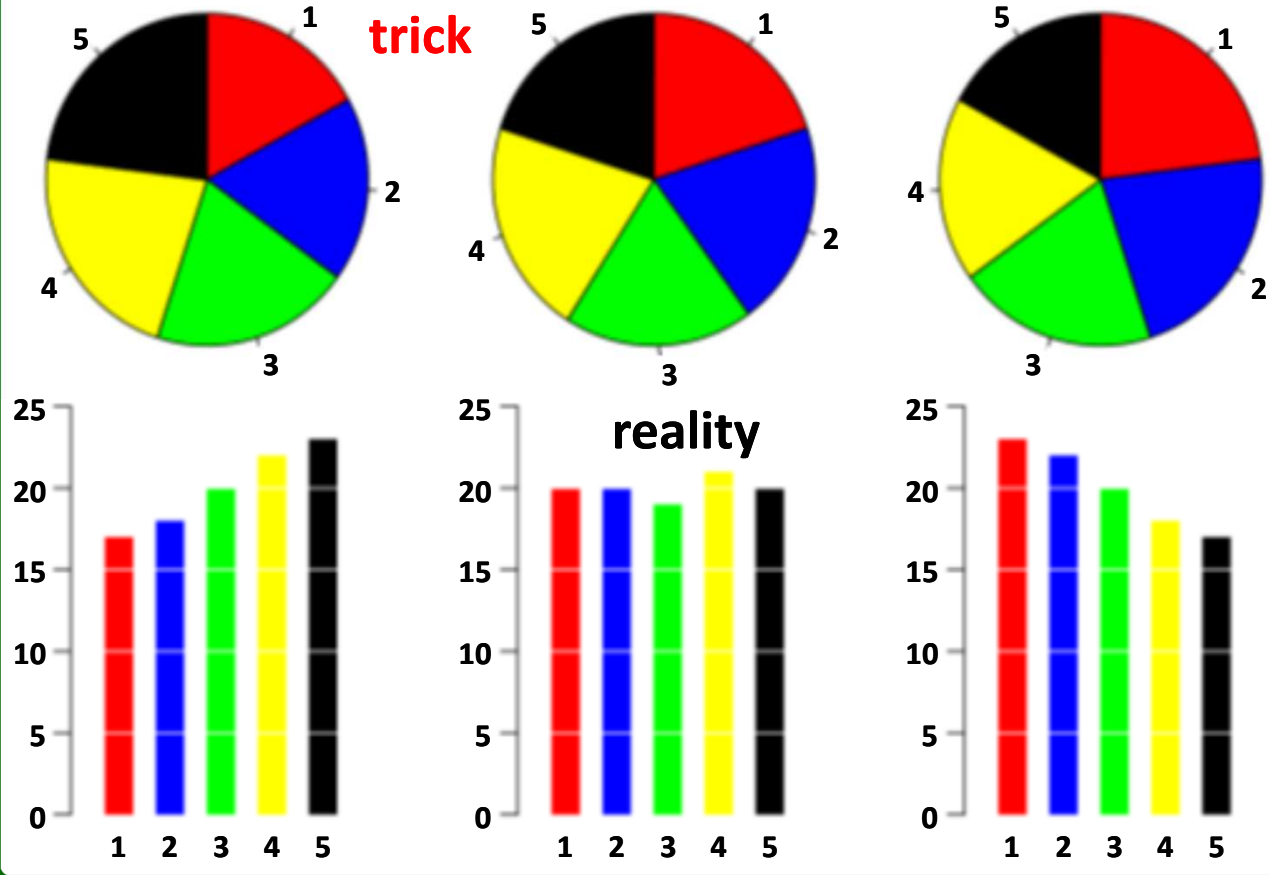
: repeated fooling by abstracts pretending to be peer-reviewed works to deceive the reader, who may think that published claims are based on methods and data reviewed by experts

## **citation cascade**

: citing a secondary source from other author – reviews



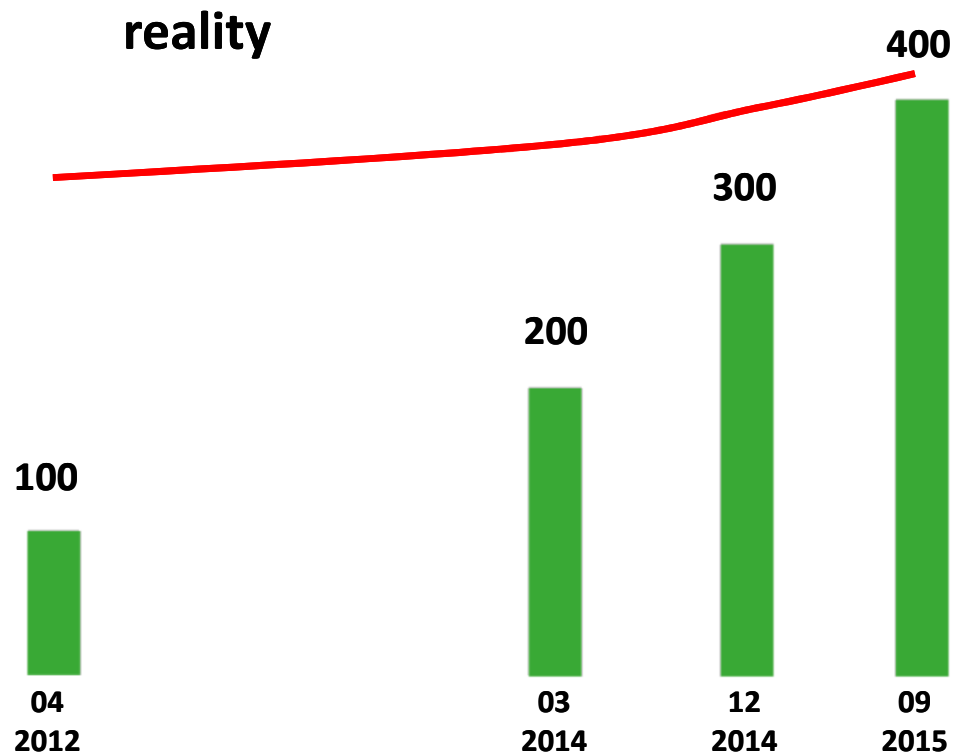
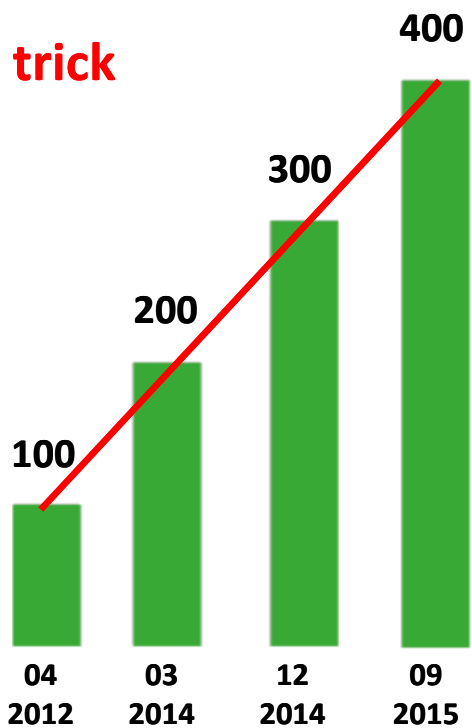
misleading presentations



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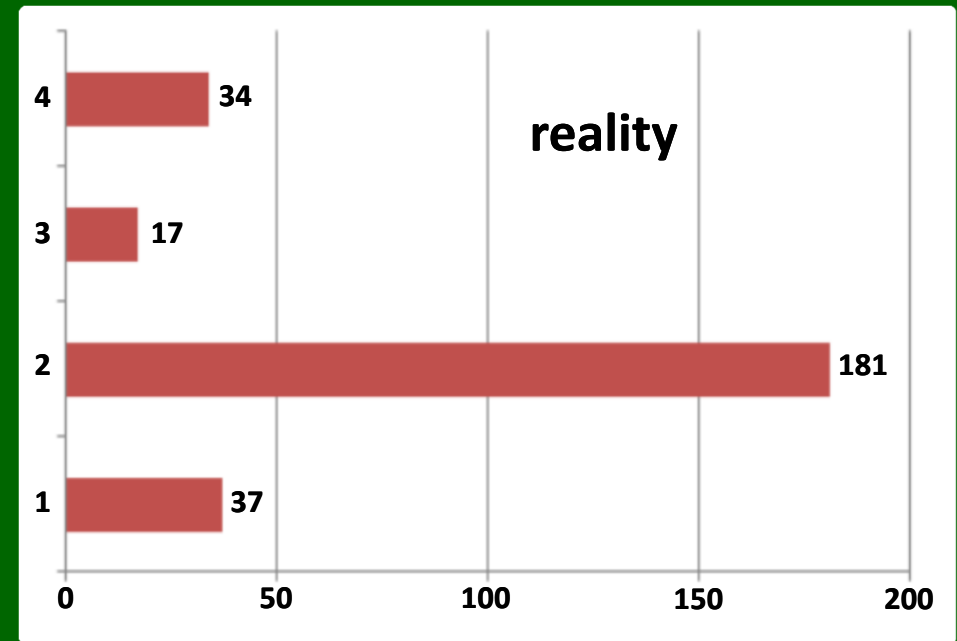
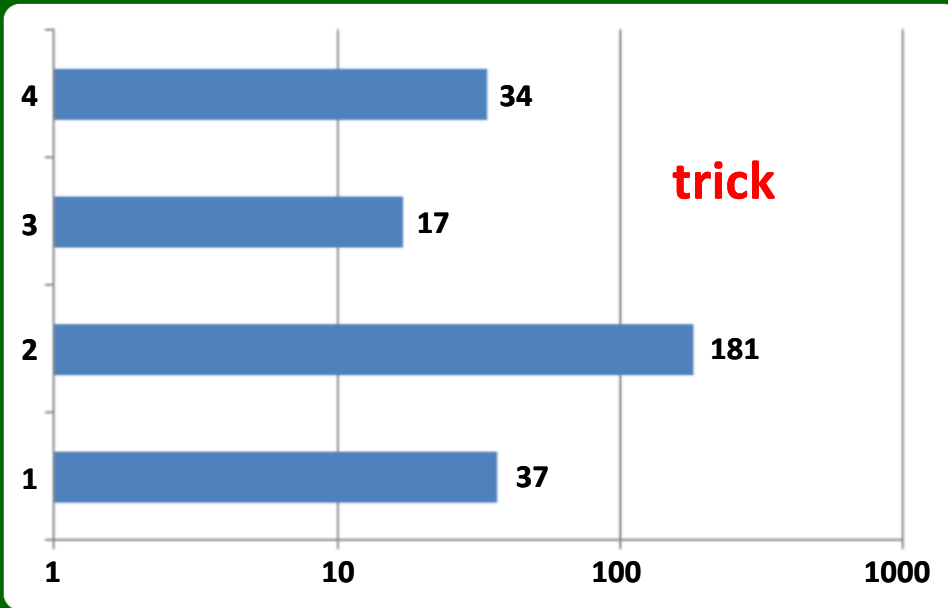
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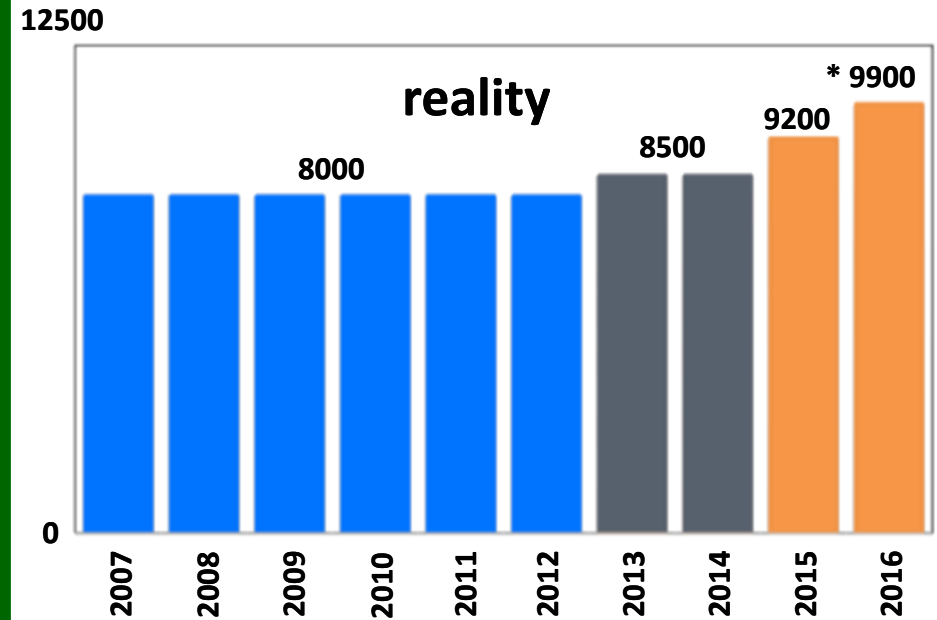
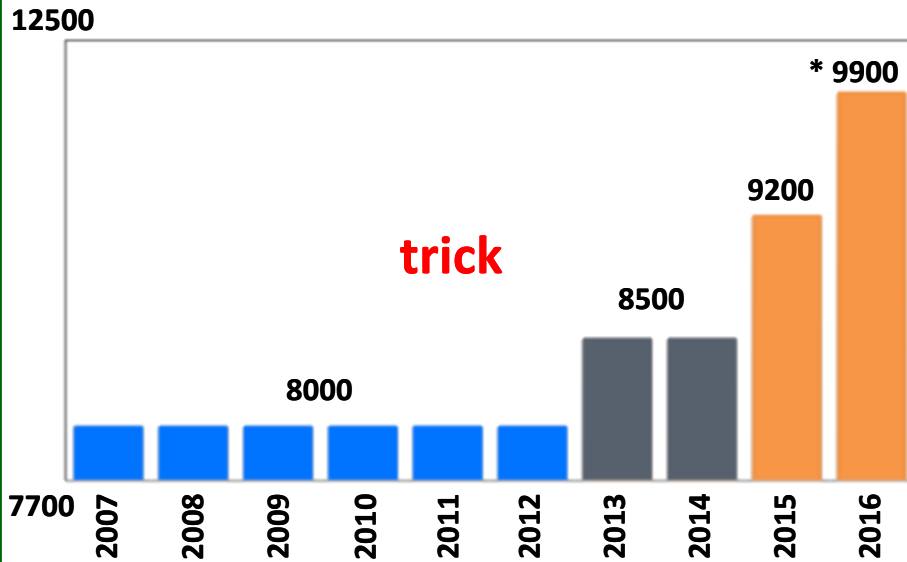
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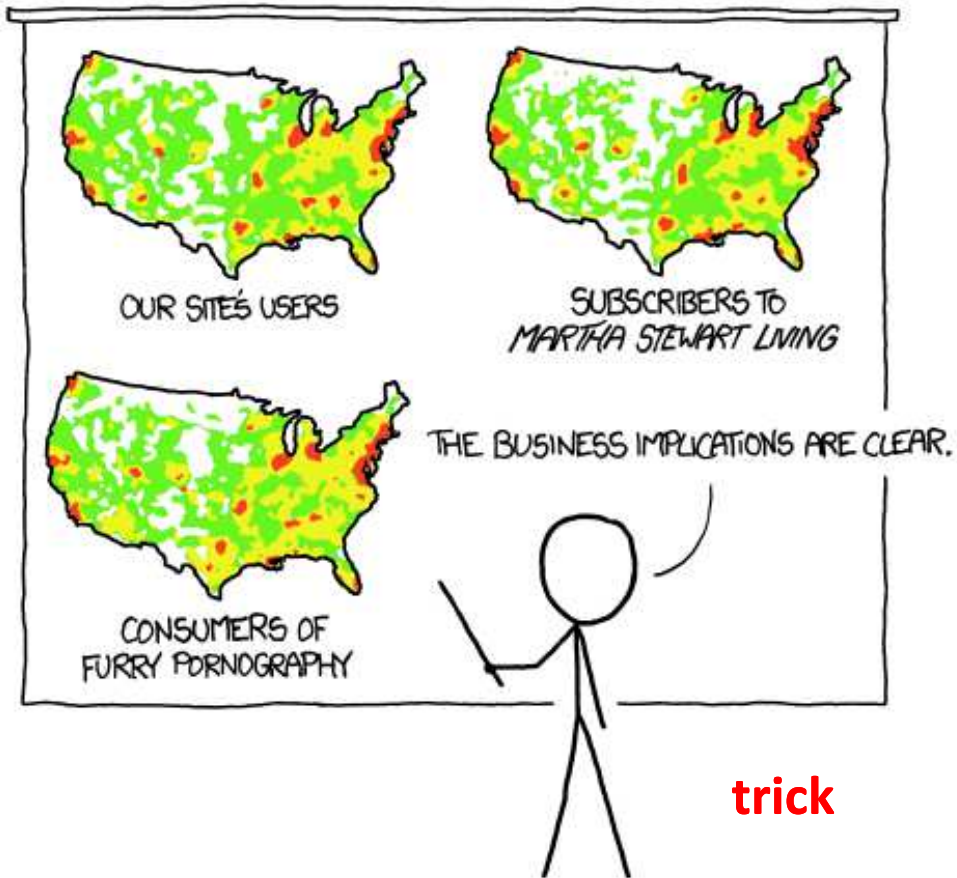


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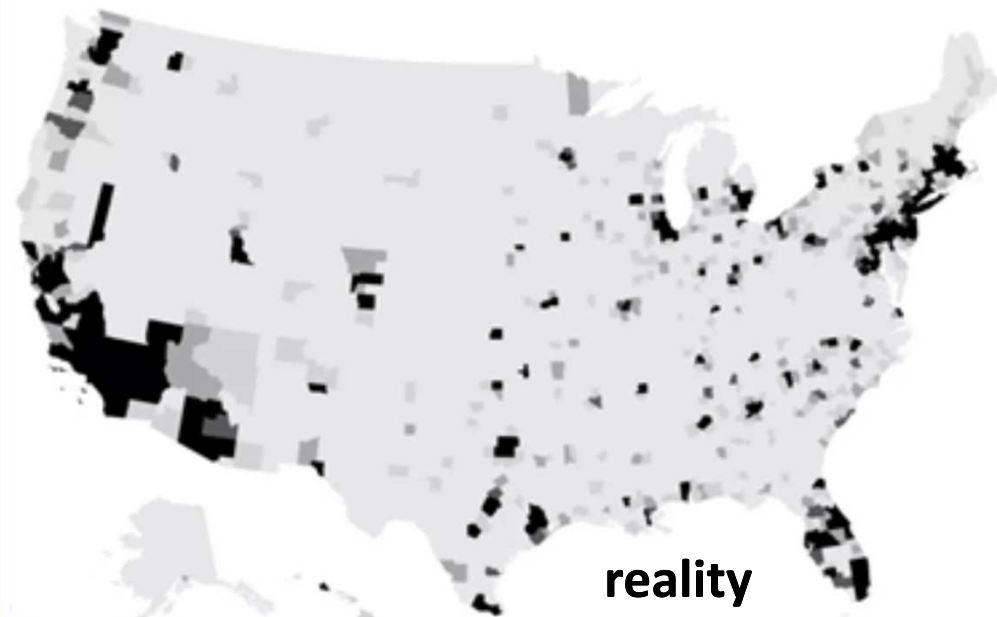
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**trick**

*population density in USA*



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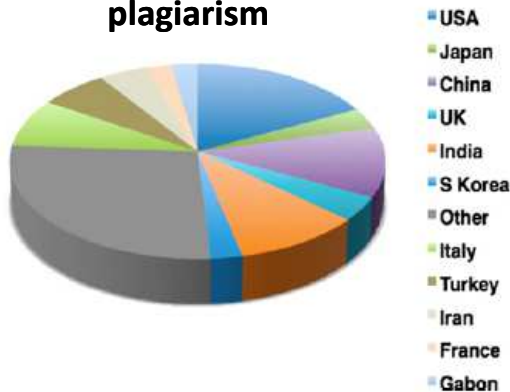
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## some interesting numbers on ethics in science

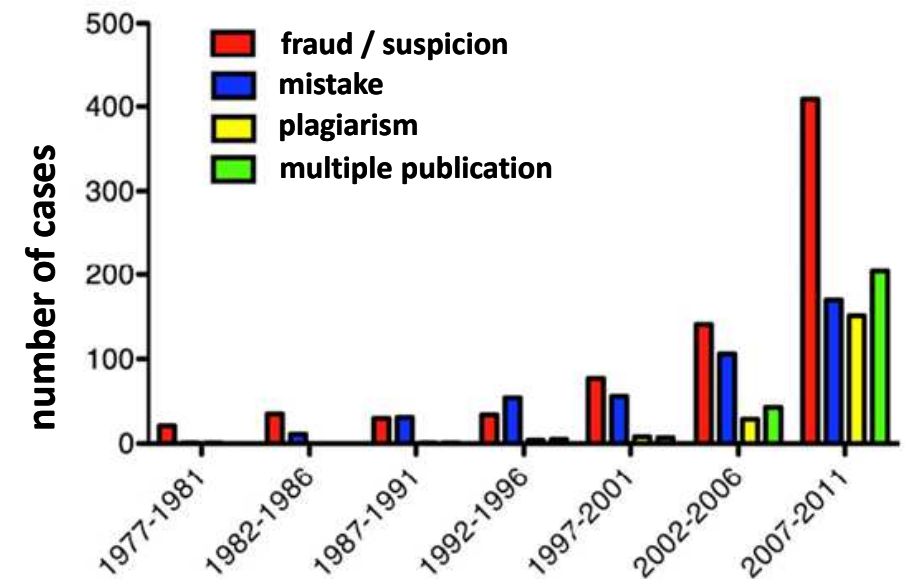
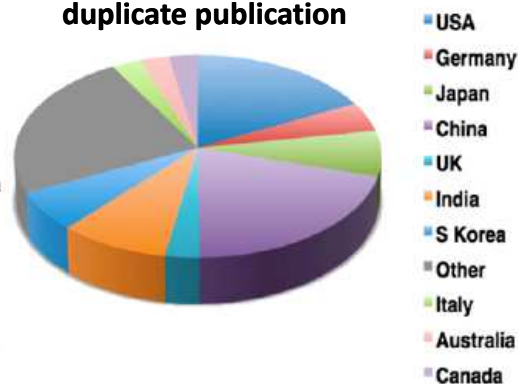
fraud / suspicion



plagiarism



duplicate publication



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# system of ethic maxima in scientific work (CUDOS)

## communalism

- : scientific discoveries are fruits of co-operation and collaboration, natural laws has no proprietors
- : scientific research stands out of trade market

## universalism

- : science is universal, it is not dependent on state borders, race, nationality, philosophy or worldview, it is property of all mankind
- : science should be evaluate only by scientific means

## disinterest

- : personal interests should not interfere to the process of scientific research
- : *sine ira et studio*; humility and neutrality

: Robert Merton (1942)

sociologist of science

## originality

- : novelty of research contribution, scientist has the right to choose tools and ways leading to it
- : openness to new questions, academic freedom

## scepticism

- : critical thinking prompts to respect authority of previous knowledge, but not to let the research results submit to it
- : every scientist has to be sceptical, because authors are (erroneous) people



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# rules of scientific work ethics

- : if the scientific problem could be solved in a good faith and based on proper argumentation applied on generally accessible data, it should be solved this way
- : if the previous step does not lead to solution, then community of scientists should support alternative opinions and results

: *Lee Smolin* (2006)  
physicist

## circumstances for scientific work in a frame of these rules

- : good faith and correct argumentation on generally accessible data
- : freedom in conclusions
  - :: mandatory argumentation and empirical tests
- : craft
  - :: working knowledge of scientific craft and its pitfalls
- : agreement is a goal, but not at all cost
  - :: future scientific community is an arbitrator
- : scientific community is open
  - :: craft know-how and ethics are the conditions

