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Fraudulent results and failed replications: The effect of flawed research on the public's trust in science

SCIENCE
AND THE
PUBLIC
WISSENSCHAFT & ÖFFENTLICHKEIT



Vertrauen und
Kommunikation in
einer digitalisierten Welt

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Special thanks to the following members of our (former) group:



Prof. Dr. Marc Stadtler
(Co-PI within the SPP 1409)



Dr. Lisa Scharrer



Dr. Eva Thomm



Dr. Dorothe Kienhues



Dr. Friederike Hendriks



Kinds of problems which might impact on public trust in science

Scientific misconduct with the intention to deceive

- Fabrication/ falsification of results (for example D. Stapel, Netherlands, Psychology; P. Macchiarini, Sweden, Medicine; A. Wakefield, Medicine, GB)
- plagiarism (for example two former German secretaries of state (defence /science & education))

Failed replications, because

- of questionable research practices
- weakness of theory and/or methods and /or data of the original study or of the replication
- the issue under study is not consistent across time, culture, contexts



MISCONDUCT AND CONFIDENCE — A MEDIA ANALYSIS

Does media coverage of scientific misconduct affect public confidence in science and scientists? And how is research reported in the Swedish media? These are the questions that Swedish non-profit organisation **Vetenskap & Allmänhet, VA, (Public & Science)** has been investigating, together with the **SOM Institute** at the University of Gothenburg, in the study **Misconduct and confidence – a study of media coverage of scientific misconduct and public confidence in research** (VA report 2014:3). The main findings are presented here. You can download the complete report (in Swedish only) or a summary in English at www.v-a.se



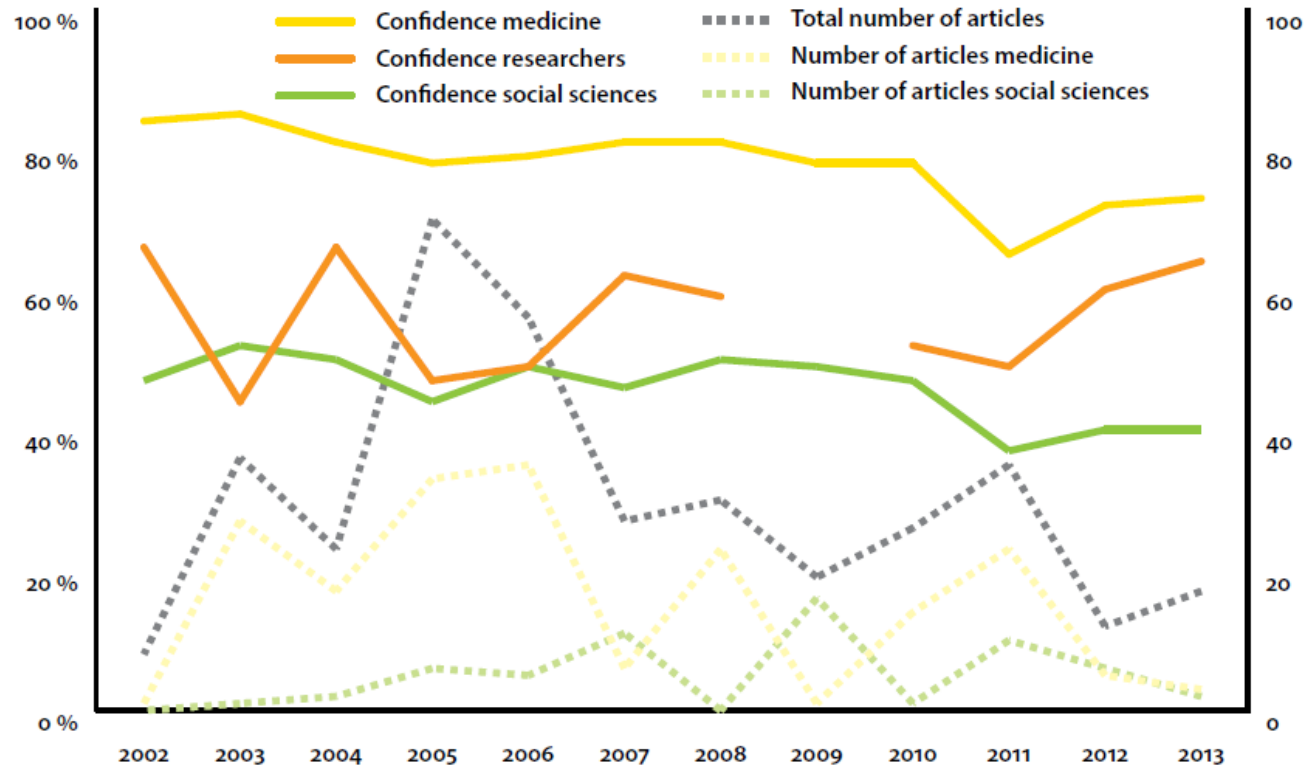
Vetenskap & Allmänhet

The V & A Study (2014) in Sweden

- 359 articles and TV clips published between 1 January 2002 to 31 December 2013.
- Scientific misconduct: A conscious intent to deceive
 - plagiarism
 - fabrication
 - manipulated (falsification).

Andersson, U. (2015). Does media coverage of research misconduct impact on public trust in science? A study of news reporting and confidence in research in Sweden 2002 -2013. *Observatorio* 9 (4) 015-030, Available at <http://obs.obercom.pt>.

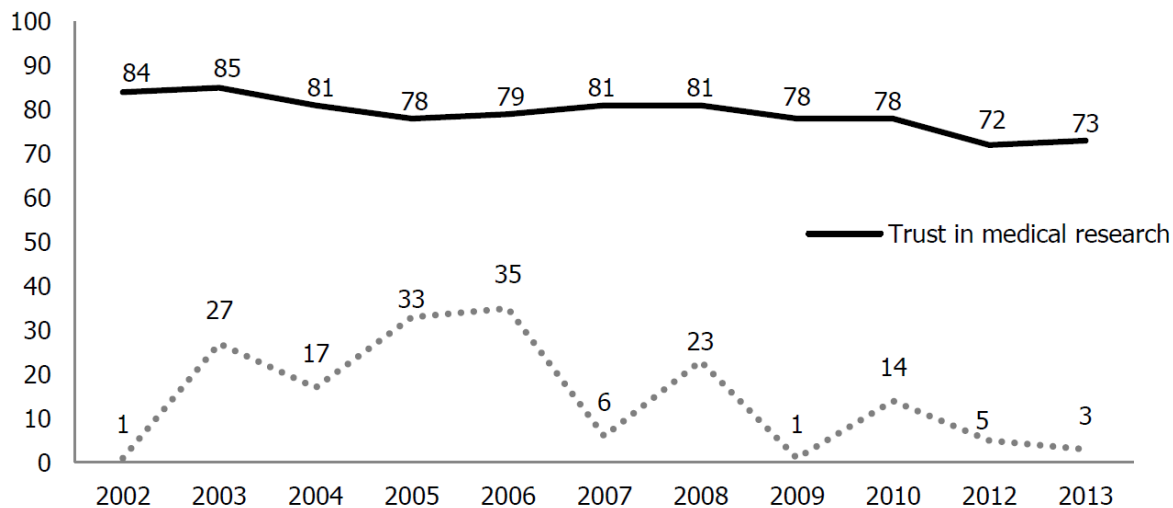
FIGURE 1: CONFIDENCE IN RESEARCH AND SCIENTISTS (PERCENT) AND THE NUMBER OF ARTICLES/ITEMS ABOUT SCIENTIFIC MISCONDUCT, 2002–2013



The V & A Study
(2014) in Sweden

Comment: The solid lines show the percent that have confidence in scientists as a profession, as well as confidence in research in medicine and the social sciences, respectively. The respondents stated that they have very or fairly high confidence in the national SOM survey 2002–2013. Confidence in scientists was not measured in 2009. The dotted lines show the number of articles about scientific misconduct per year and the number of articles about scientific misconduct relating to medicine and the social sciences, respectively.

Figure 2. Public trust in medical research and number of news reports on research misconduct in medicine in years 2002–2010 and 2012–2013 (Per cent; Number)

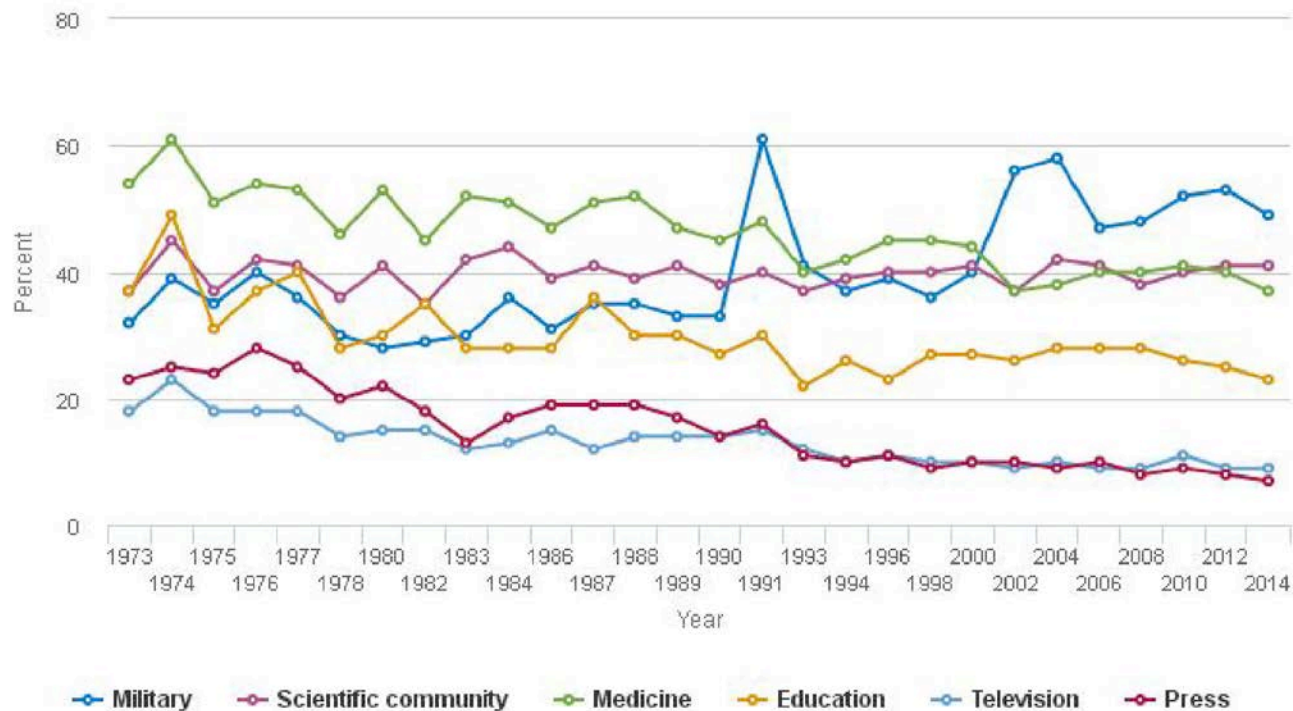


The V & A Study (2014) in Sweden

(from Andersson, 2015, 025)

- There is only a small decrease of the general trust in science (Swedish study)
- Trust in science /scientists is not related to the media coverage of scientific misconduct. (Swedish study)
- The general trust in science /scientists is in most countries still high or there is only a slight decrease.
- The Nielsen Report from 2014 on Attitudes about Science in NZ does not ask for *trust* in science, but it reveals a high *appreciation of science*

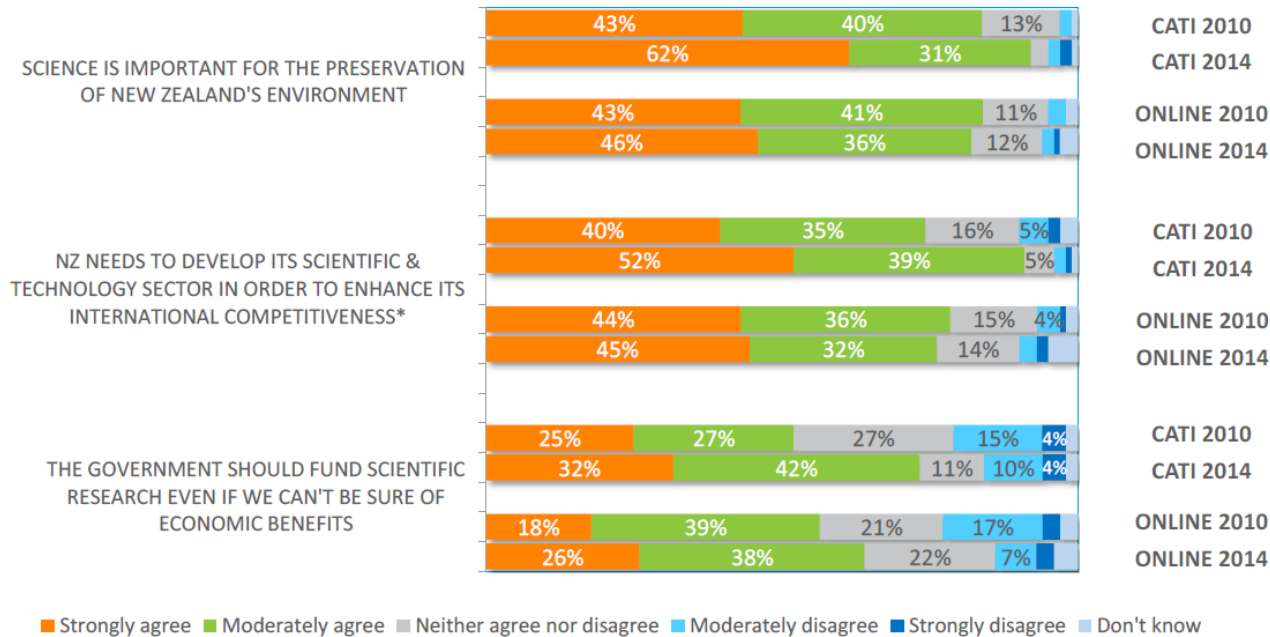
Public confidence in institutional leaders, by selected institution: 1973–2014



NOTE: Responses to *As far as the people running these institutions are concerned, would you say that you have a great deal of confidence, only some confidence, or hardly any confidence at all in them?* Figure shows only responses for "a great deal of confidence."

SOURCE: University of Chicago, National Opinion Research Center, General Social Survey (1973–2014). See appendix table 7-23.

FIGURE 37: COMPARING THE IMPORTANCE OF THREE AREAS RELATING TO THE IMPORTANCE OF SCIENCE FOR THE ECONOMY AND THE ENVIRONMENT – 2010 VS. 2014



*Note that wording in 2010 survey was “New Zealand needs to develop science in order to enhance our international competitiveness”

Next are some statements some people have made about science and technology. Please indicate how much you agree or disagree with them...?

Base CATI 2010 n= 600, 2014 n= 500; ONLINE 2010 n= 600, 2014 n= 2,504

Nielsen. (2014). *Report on Public attitudes towards science & technology*. Retrieved from <http://www.curiousminds.nz/assets/Uploads/report-on-public-attitudes-towards-science-and-technology.pdf>

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Everything is fine?

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Everything is fine?

Let's talk not only about the weather, but also about the climate.

Let's not talk only about the *weather* (trust), but also about the epistemic *climate*.

The pattern is different and less positive,

- if the public is asked with regard to specific topics, as climate change, nuclear energy or genetically modified food.
- if scientific topics are related to political (and in some countries: religious) preferences / attitudes.
- if there are political and or religious public debates /controversies.

Then even alleged scientific misconduct could matter, as the *climate gate* (hacked emails from climate researchers) example has shown.

Epistemic climate

My preliminary definition: The generally accepted practices of establishing what could be known as ‚true‘ about the natural, social and cultural world and the generally accepted practices for the discourse about and with this knowledge.

This includes the distinction between those questions which could -at least in principle - be answered by research and those which are answered by personal values. (In this vain, it does not make sense to ‚believe‘ in the human causes for climate change.)

Epistemic climate

My preliminary definition: The generally accepted practices of establishing what could be known as 'true' about the natural, social and cultural world and the generally accepted practices for the discourse about and with this knowledge.

Is there a change of the epistemic climate?

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Justice Secretary Michael Gove takes part in a live Sky News Q&A on Brexit © FT

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By Kevin Liptak and Jim Acosta, CNN

Updated 05:52 GMT (03:52 HKT) June 2, 2017




Is there a change of the *epistemic climate*? This is an open question.

The answer will presumably be different for different regions of the world.

Survey data on public trust in science are measurements of single weather parameters.

These parameters (together with many others) make up the weather, not the climate.

Researching into the publics' actual understanding of the epistemic and discursive practices of science could help to establish broader perspective on 'public trust' than surveys can provide. On the long run it could help to reveal if there is an *epistemic climate change*.

Examples from the work from our research group:

- The structure of laypersons' trustworthiness judgements about science experts
- Effects of overhearing a controversy among scientists

Study Example 1: The structure of trustworthiness judgements

Hendriks F, Kienhues D, Bromme R (2015). Measuring Laypeople's Trust in Experts in a Digital Age: The Muenster Epistemic Trustworthiness Inventory (METI). PLoS ONE 10(10): e0139309. doi:10.1371/journal.pone.0139309

Friederike Hendriks, Dorothe Kienhues



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To measure laypeople's evaluations of science experts (encountered online), we constructed an inventory to assess epistemic trustworthiness.

Exploratory ($n = 237$) and confirmatory factor analyses ($n = 345$) showed that judgments about the trustworthiness of science experts entail these three dimensions: **Expertise, integrity, and benevolence.**

METI items rated on a 7point scale like a semantic differential.

The Muenster Epistemic Trust Inventory (METI)

Factor	Item
Expertise	competent – incompetent
	intelligent – unintelligent
	well-educated – poorly educated
	professional – unprofessional
	experienced – inexperienced
	qualified – unqualified
Integrity	sincere – insincere
	honest – dishonest
	just – unjust
	fair – unfair
Benevolence	moral – immoral
	ethical – unethical
	responsible – irresponsible
	considerate – inconsiderate

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The METI development is based on experimental studies (for testing the validity of the scales) and on well educated samples. But a very recent (2017) representative German survey has corroborated the results.

2017 Germany Survey on Trust in Science Wissenschaftsbarometer

Here are some reasons why you might trust scientists. To what extent do you personally agree with them?

Because scientists are experts in their field.



Because scientists work according to rules and standard procedures.



Because scientists do research in the public interest.



- stimme voll und ganz zu
- stimme eher zu
- unentschieden
- stimme eher nicht zu
- stimme nicht zu
- weiß nicht, keine Angabe

Number of respondents: 1.007 | Survey period: July 2017 | Source: Science barometer – Wissenschaft im Dialog/Kantar Emnid

Figures are in per cent. Numbers may not add up to 100 per cent due to rounding.

2017 Germany Survey on Trust in Science Wissenschaftsbarometer

Here are some reasons why you might distrust scientists. To what extent do you personally agree with them?

Because scientists are strongly dependent on the funders of their research.



Because scientists often adjust results to their own expectations.



Because scientists often make mistakes.



- completely agree
- somewhat agree
- undecided
- somewhat disagree
- completely disagree
- don't know, missing answer

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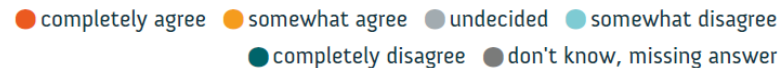
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Benevolence

Integrity

Expertise



Number of respondents: 1.007 | Survey period: July 2017 | Source: Science barometer – Wissenschaft im Dialog/Kantar Emnid
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Study Example 2: Effects of overhearing a controversy among scientists

- **First assumption:** For epistemic trustworthiness ascriptions to an expert, it matters **who** discloses new evidence (Jensen, 2008).
 - A scientist blogger adds new evidence to his blog entry himself.
 - Another expert is responsible for this addition.
- **Second assumption:** For epistemic trustworthiness ascriptions to an expert, it matters **what** (i.e. which kind of evidence) is disclosed.
 - A blog's commentary might entail scientific (content or method related) critique
(First experiment)
 - Or underlying societal or ethical aspects of an issue
(Second experiment).



Hendriks, F., Kienhues, D., & Bromme, R. (2016). Disclose your flaws! Admission positively affects the perceived trustworthiness of an expert science blogger. *Studies in Communication Sciences*, 16(2), 124-131. doi:10.1016/j.scoms.2016.10.003

Hendriks, F., Kienhues, D., & Bromme, R. (2016). Evoking vigilance: Would you (dis)trust a scientist who discusses ethical implications of research in a science blog? *Public Understanding of Science*, 25(8), 992-1008. doi: 10.1177/0963662516646048

Materials

- A **science blog** (fictitious)
 - about a study investigating a neuroenhancing drug.
- A **comment** authored either by the responsible scientist blogger, or by another expert, entailing...
 - *Scientific criticism* (Experiment 1):
 - Optimism bias pertaining to the conclusiveness of results.
 - *Ethical aspects* (Experiment 2):
 - Arguments for and against neuroenhancement.

IFN Institut für Neuropsychologie Erfurt

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Posted on June 6, 2013 [← Previous](#) [Next →](#)

DR. GUSTAV VIERATZ

wissenschaftlicher Mitarbeiter und Teil der Forschungsgruppe „Leistungssteigernde Medikamente“ im Institut für Neuropsychologie, Erfurt

Neue erfolgversprechende Ergebnisse im Forschungsfeld “Neuro-Enhancement”!

Ich möchte Ihnen im heutigen Blog-Eintrag von unserer neuesten Studie mit einem Medikament zur kognitiven Leistungssteigerung berichten: Seronil.

Das Forschungsfeld des Neuro-Enhancement – oder umgangssprachlich Gehirn-Doping – beschäftigt sich seit einigen Jahren mit der Entwicklung eines Mittels, das die Konzentration verbessert und dadurch die Denkleistung steigern kann. Ich persönlich forsche seit einigen Jahren mit dem Medikament Seronil, das ursprünglich im Rahmen der Migräne-Vorsorge verschrieben und eingesetzt wurde. Patienten, die es aufgrund von starker Migräne verschrieben bekommen hatten, berichteten, konzentrationsfähiger und wacher zu sein (Müller & Schweizer, 2006).

In einer kurzen Studie haben wir uns nun noch einmal der Frage gewidmet, ob die Denkleistung durch das Medikament Seronil bedeutend gesteigert werden könne. Dabei wurde Patienten für vier Wochen täglich jeweils eine Dosis von 0,23mg Seronil verabreicht, eine weitere Gruppe bekam kein Medikament. In nachfolgenden Tests der Konzentration und Aufmerksamkeit (Jacobs, 2013; Bruckenkamp, 1962) schnitt die Gruppe unter Seronil deutlich besser ab als die Gruppe ohne neurologische Unterstützung. Hieraus kann man schlussfolgern, dass sich Seronil für die gezielte Einnahme bei geistig fordernden Tätigkeiten, zum Beispiel beim Lernen vor Prüfungen, eignet. Wir planen, dieses Medikament im Laufe des Jahres 2014 durch die Zulassung beim Bundesinstitut für Arzneimittel und Medizinprodukte bestätigen zu lassen, sodass auch gesunde, d.h. nicht an Migräne leidende Menschen, von den positiven Effekten des Medikaments Seronil profitieren können. Allerdings müssen noch weitere Studien folgen, bevor Nebenwirkungen und tatsächliche Wirksamkeit von Seronil abschließend geklärt sind, damit Seronil für gesunde Menschen eine Zulassung erhalten kann.

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This entry was posted in [Cognitive Enhancement](#), [Neuropsychologie](#), [Seronil](#) by [Dr. Gustav Vieratz](#). Bookmark the [permalink](#).

ONE THOUGHT ON “NEUE ERFOLGVERSPRECHENDE ERGEBNISSE IM FORSCHUNGSFELD “NEURO-ENHANCEMENT”

DR. GUSTAV VIERATZ

wissenschaftlicher Mitarbeiter und Teil der Forschungsgruppe „Leistungssteigernde Medikamente“ im Institut für Neuropsychologie, Erfurt

Dr. Gustav Vieratz on September 3, 2013 at 4:16 pm said [Edit](#)

Ich muss hinzufügen, dass ethische Argumente in meinem Blogbeitrag bisher fehlen, aber dringend diskutiert werden müssen. Daher fasse ich nun die wichtigsten Argumente für und gegen die Nutzung von kognitiv leistungssteigernden Medikamenten zusammen:

Für die Nutzung kognitiv leistungssteigernder Medikamente spricht, dass Menschen ständig dabei sind, ihre Denkleistung durch äußere Einwirkung zu erhöhen: Schlaf, Zuführung von Nährwerten durch Ernährung sowie Sport sind natürliche Mittel, um die Leistung unserer Gehirne zu verbessern. Auch trinken die meisten von uns täglich Kaffee oder Tee – diese Getränke enthalten Stoffe, die der Leistung des Gehirns positiv zu Gute kommen. Zweitens gibt es auch ein gesellschaftliches Argument: Die Menschheit strebt seit jeher nach ihrer Verbesserung und Überwindung ihrer Defizite. Blockiert man diese natürliche Förderung...

Procedure of the two Experiments

Demography

Experiment 1: High School Students; $N = 91$; Age: $M = 18.99$, $SD = 1.81$; *female* = 84.4%
 Experiment 2: High School Students; $N = 101$; Age: $M = 17.02$, $SD = 1.04$; *female* = 77.2%

Science blog about neuroenhancement

No Comment

Exp. 1: $n = 31$
 Exp. 2: $n = 33$

Other's Comment

Exp. 1: $n = 30$
 Exp. 2: $n = 32$

Self Comment

Exp. 1: $n = 29$
 Exp. 2: $n = 36$

Another critical expert:

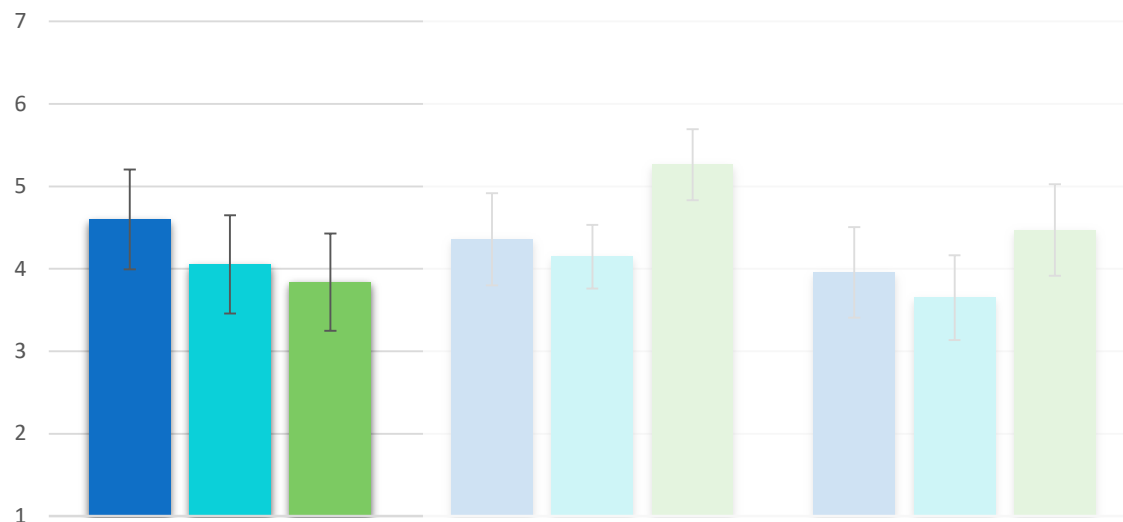
Scientific critique (Exp.1)
 Ethical Aspects (Exp. 2)

Scientist blogger:

Scientific critique (Exp. 1)
 Ethical Aspects (Exp. 2)

Epistemic trustworthiness on the dimensions expertise, integrity and benevolence
 Decision to recommend the drug to a (fictitious) friend

Experiment 1: Scientific Critique

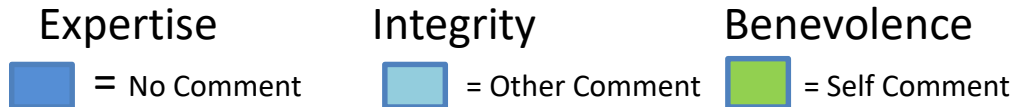


Expertise:

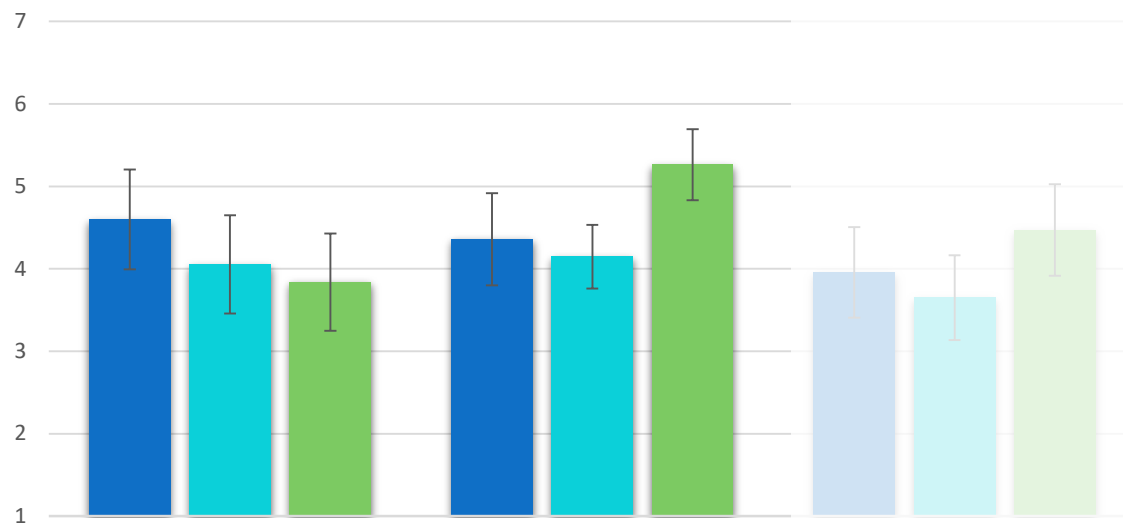
(planned contrasts)

Other's Comment < No Comment,
 $p = .04; r = .19$

Other's Comment < Self Comment,
 $p = .31$



Experiment 1: Scientific Critique



Integrity:

(planned contrasts)

Other's Comment =
No Comment,
 $p = .30$

Other's Comment <
Self Comment,
 $p < .001, r = .47$

Expertise

■ = No Comment

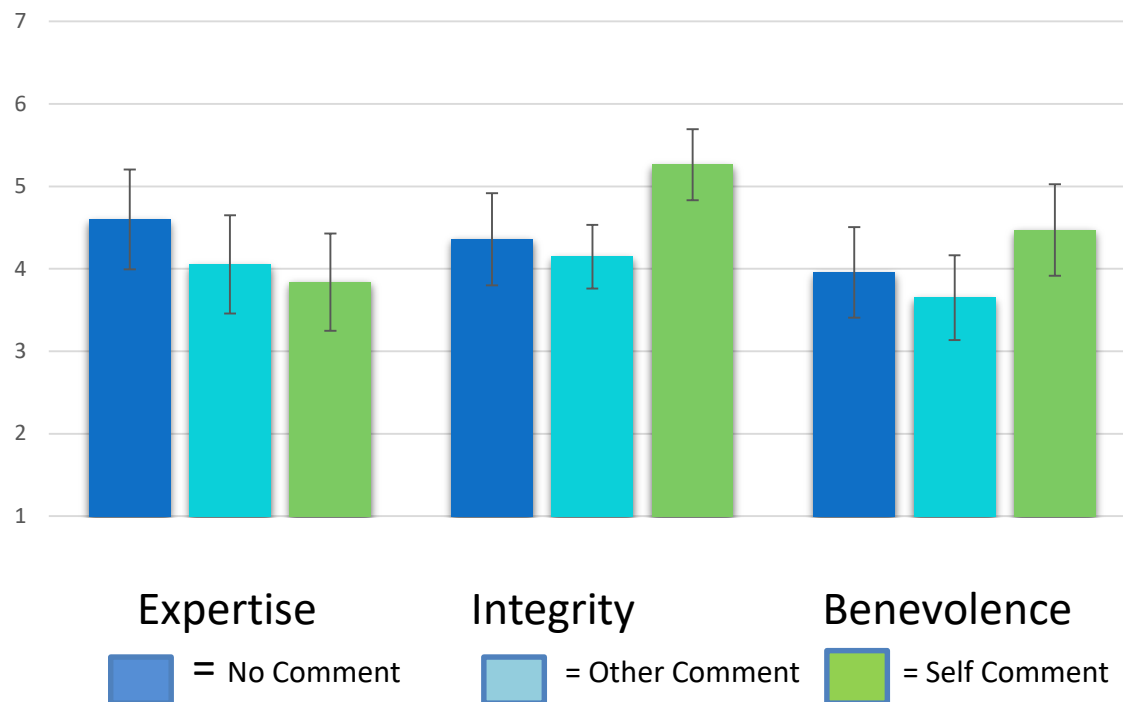
Integrity

■ = Other Comment

Benevolence

■ = Self Comment

Experiment 1: Scientific Critique



Benevolence:

(planned contrasts)

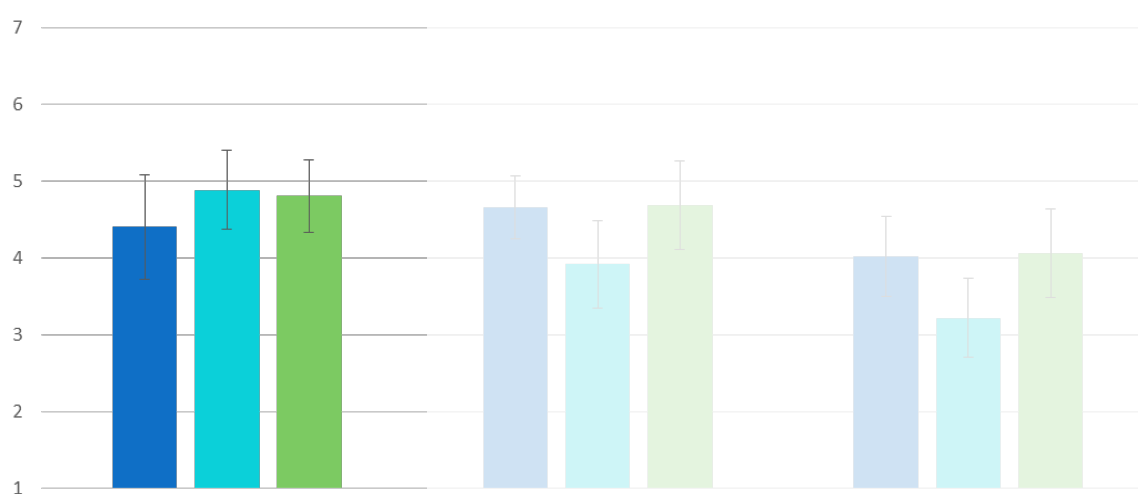
Other's Comment =
No Comment,
 $p = .28$

Other's Comment <
Self-Comment,
 $p = .001, r = .33$

Experiment 1: Summary of Results

- **Who?**
 - **Integrity** and **Benevolence** are rated higher if the responsible scientist blogger admits critical aspects himself (vs. Other's Comment).
- **What?**
 - **Expertise** ratings are lower, if another expert's comment is criticizing the conclusiveness of results (vs. No Comment).

Experiment 2: Ethical Aspects



Expertise

No differences
between groups;
 $F(2,98) = 1.69, p = .19$

Expertise

■ = No Comment

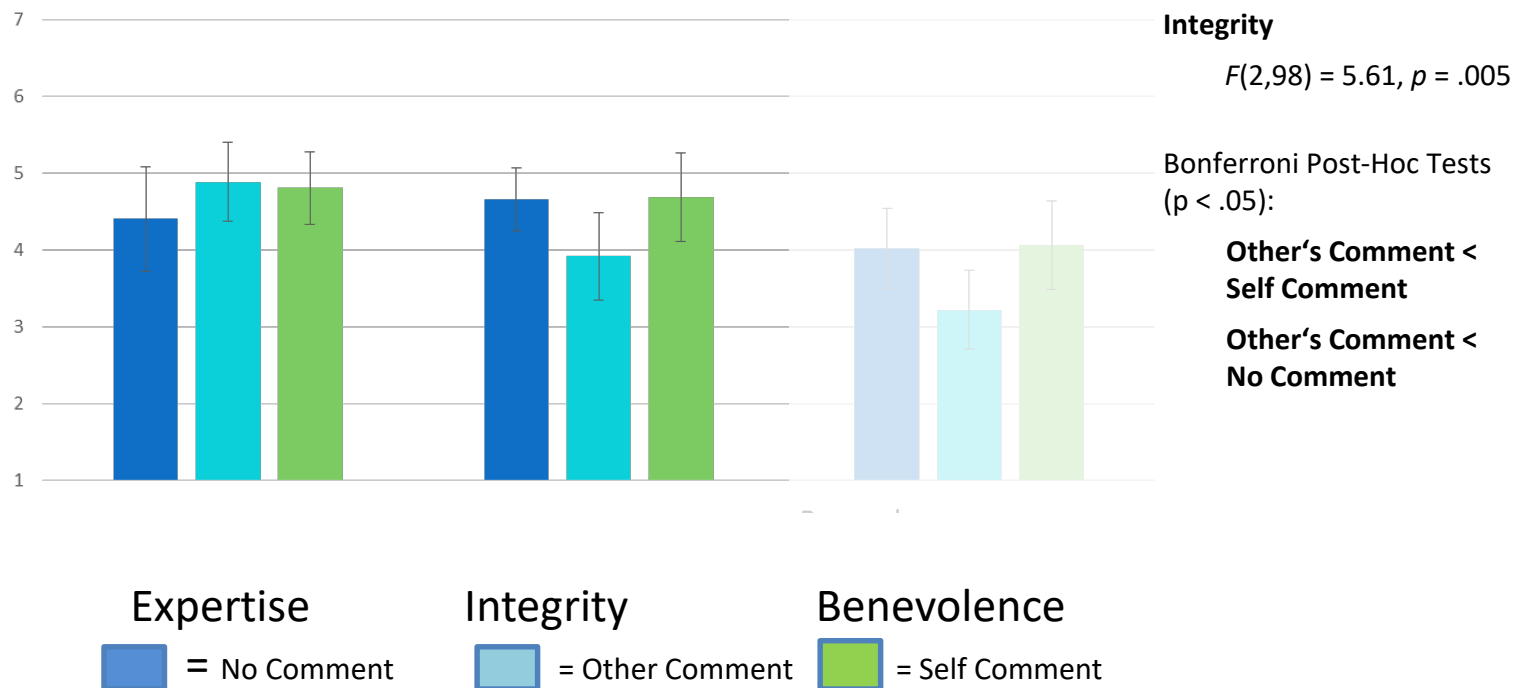
Integrity

■ = Other Comment

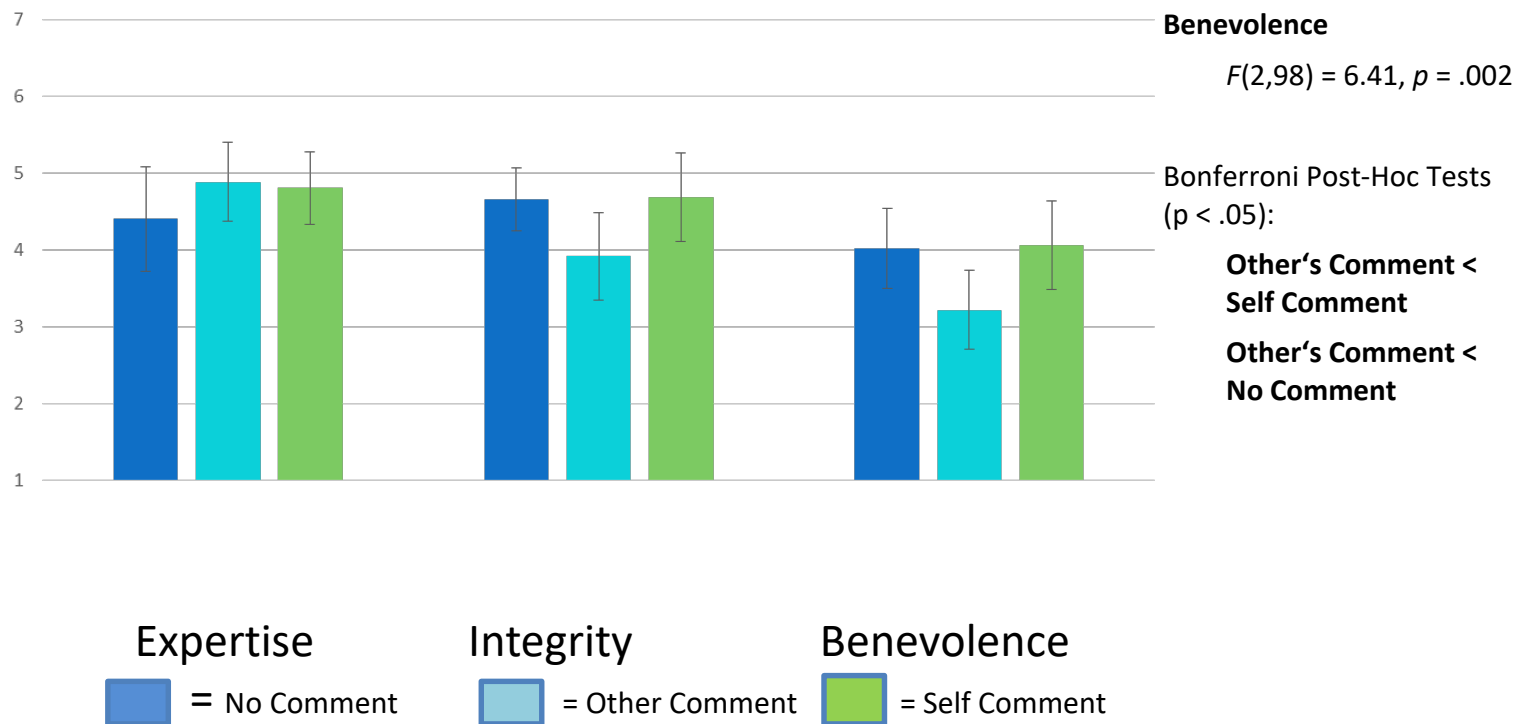
Benevolence

■ = Self Comment

Experiment 2: Ethical Aspects



Experiment 2: Ethical Aspects



Conclusions:

- The experiments provide evidence on effects of **open criticism and debate** (in the comment section of a blog) on laypeople's inferences of expert's epistemic trustworthiness.
- **Pragmatic expectations** are only one example for conversation related heuristics used by citizens when monitoring or even when only overhearing conversations among scientists.
- Inferring about scientists trustworthiness from *conversation* related cues does not require **content related scientific** expertise.
 - It is an example for a **heuristic** which is not **/less constrained** by citizens' **bounded understanding of science**. It is not about electrons, bacteria or genetic expressions. Instead it is about the quality of sources and discourse.

No further conclusions. Instead: I would be happy to discuss (and to learn from you)

Is there a change of the *epistemic climate*? This is an open question.

The answer will presumably be different for different regions of the world.

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These parameters (together with many others) make up the weather, not the climate.

Researching into the **publics' actual understanding of the epistemic and discursive practices of science** could help to establish broader perspective on ‚public trust‘ than surveys can provide. On the long run it could help to reveal if there is an *epistemic climate change*.

tēnā koutou
Many thanks

bromme@uni-muenster.de

Most of our publications could easily be retrieved from
[www.uni-muenster.de/PsyIFP/AEBromme/
veroeffentlichung/veroeffentlichung.html](http://www.uni-muenster.de/PsyIFP/AEBromme/veroeffentlichung/veroeffentlichung.html)

