



“How Health Sciences produce evidence”

Some observations from the point of view of neuroethics

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Overview

Introduction – Three ways of looking at evidence (and how it is generated and interpreted)

Topic 1 – Neuroimaging (internal perspective)

- An experiment
- Preliminary results of an ongoing study

Topic 2 – Moral Sensitivity (normative perspective)

- Another experiment
- Some surprising (?) data

Topic 3 – Frontal Lesion Research (genealogical perspective)

- Back into the 19th century
- Bibliometric approaches

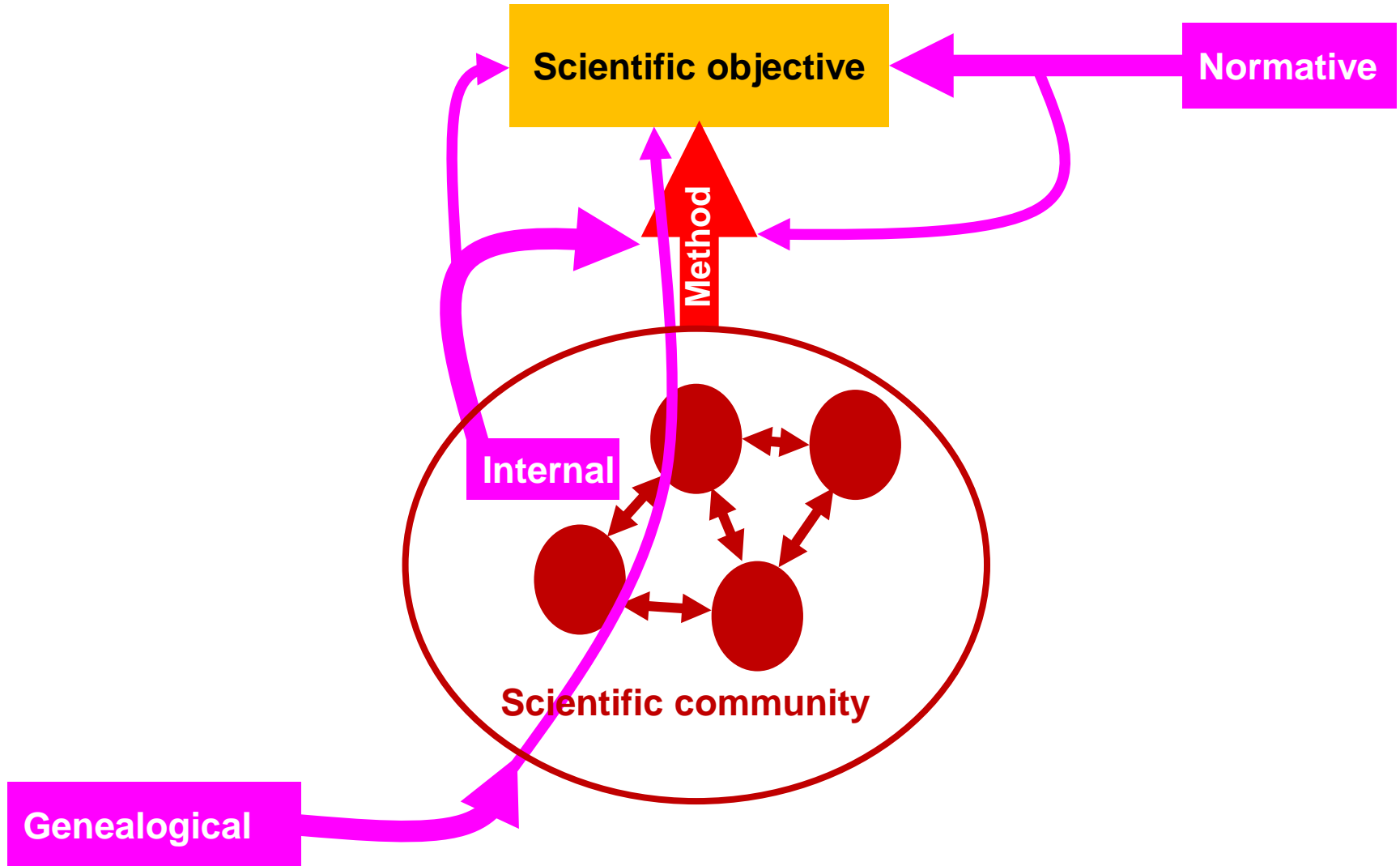
What have we learned?



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Introduction





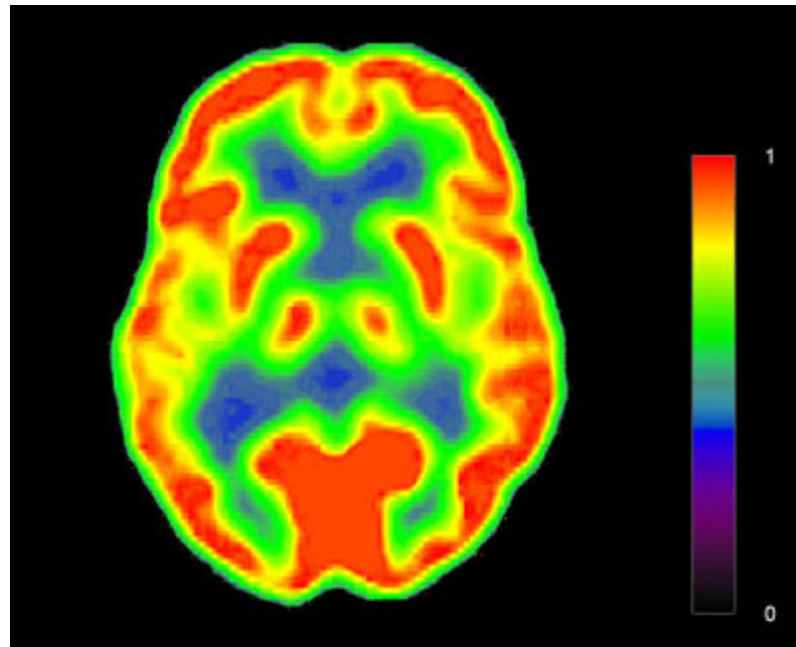
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Topic 1 - Neuroimaging



*A researcher presents you with the image below. The researcher claims that the depicted brain shows a **normal consciousness state of a person**, i.e., a person without any neurological problem that may disrupt normal brain activity. Using the response scale below the image, please rate how much you support the researcher's claim based on the image that shows the brain activity.*

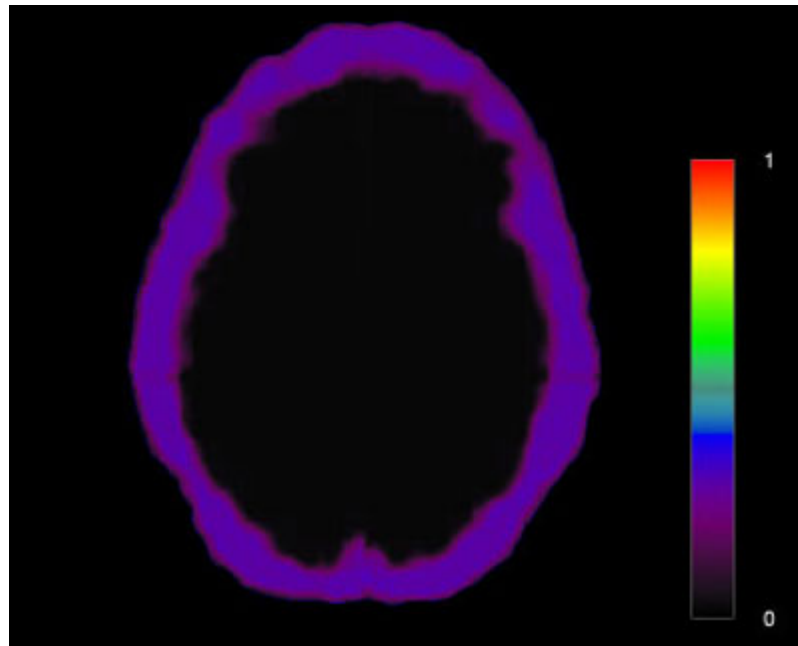


The image supports this claim not at all

The image supports this claim very much



*A researcher presents you with the image below. The researcher claims that the depicted **brain is dead**, i.e., the blood flow to the brain is blocked such that no oxygen can reach the brain. As a consequence, the brain cells cannot consume glucose any longer, and the cells are in a process of disintegration.*

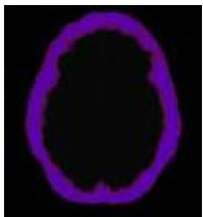
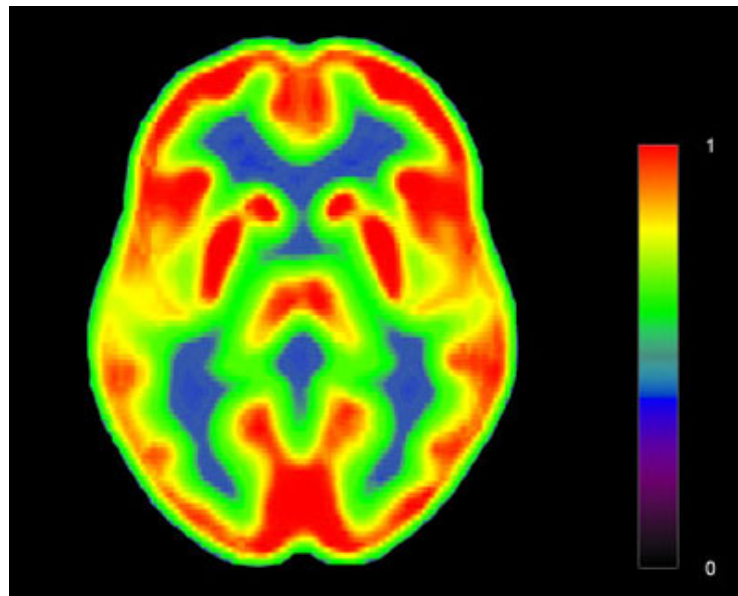


The image supports this claim not at all

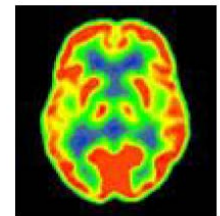
The image supports this claim very much



*A researcher presents you with the image below. The researcher claims that the depicted brain is in a so-called **locked-in state**, i.e., the brain of the person has a more or less normal consciousness state, but due to a neurological problem the person is unable to move and to communicate with the environment. This state shows reduced brain activity when measured with PET.*



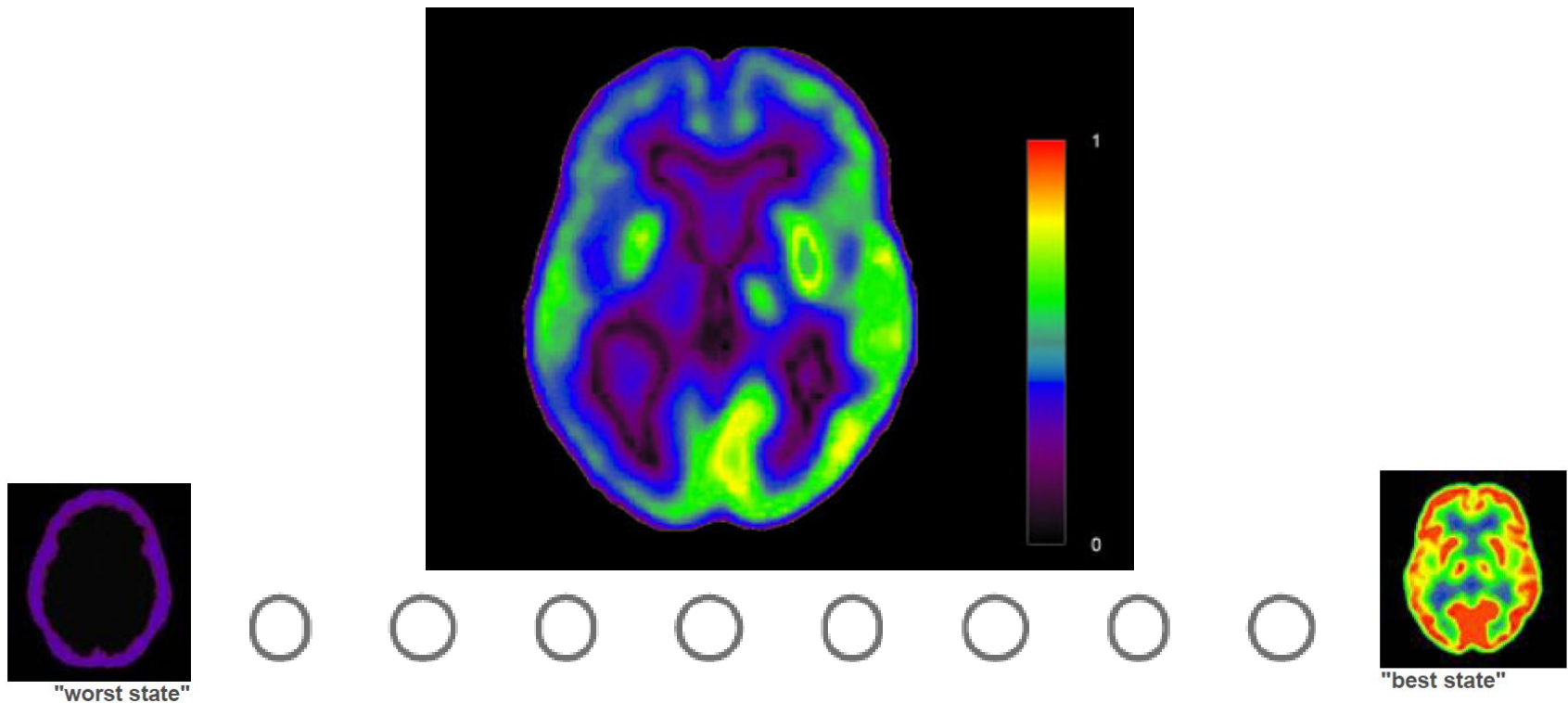
"worst state"



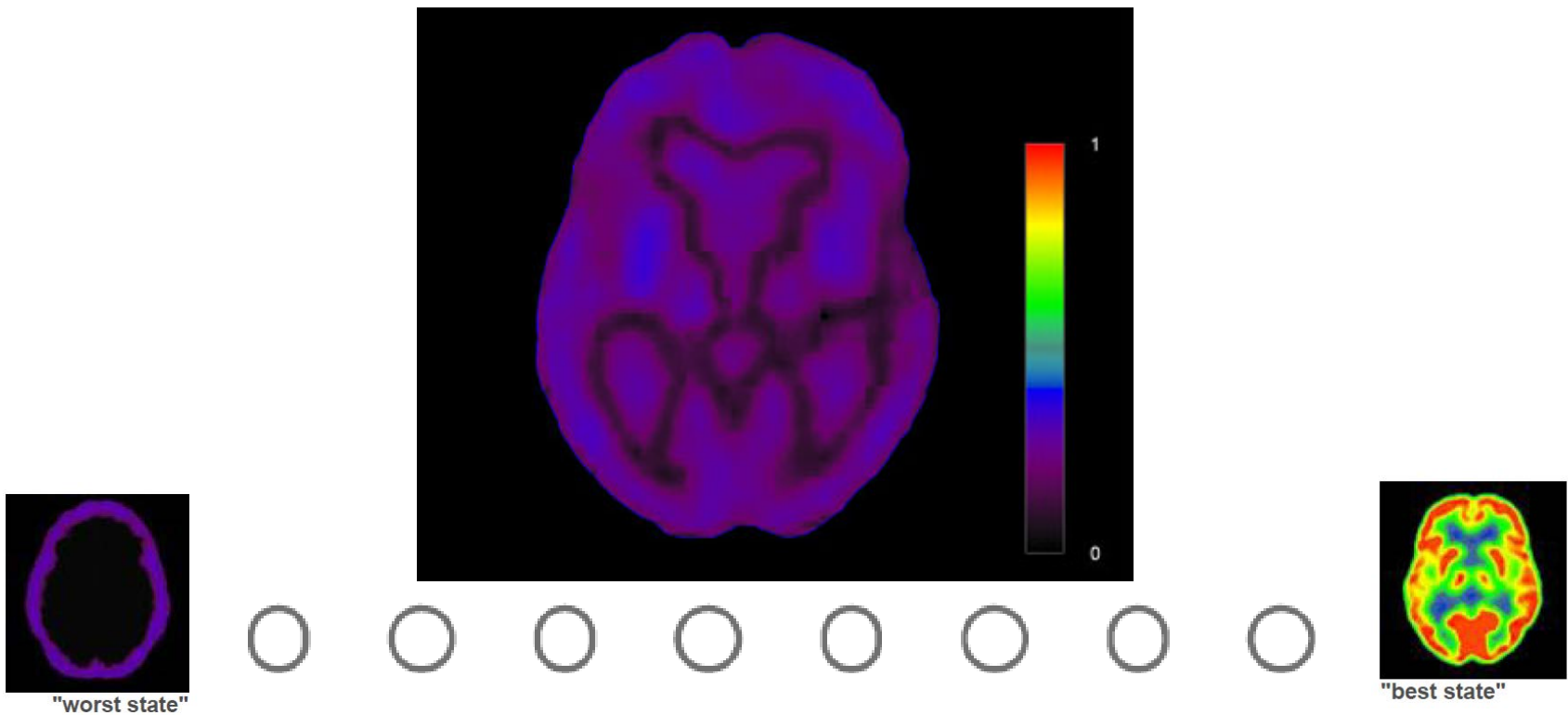
"best state"



*A researcher presents you with the image below. The researcher claims that the depicted brain is in a so-called **minimally conscious state**, i.e. the person has a severely damaged brain, but still has partial preservation of consciousness. The person also displays minimal but clear behavioral evidence of self/environmental awareness. This state shows reduced brain activity when measured with PET.*

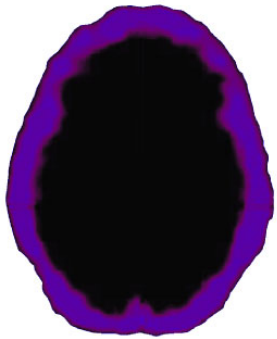


*A researcher presents you with the image below. The researcher claims that the depicted brain is in a so-called **vegetative state**, i.e., the person has a severely damaged brain which results in a state of partial arousal rather than true awareness. The person may open the eyes occasionally, and may demonstrate sleep-wake cycles, but completely lacks cognitive functions.*

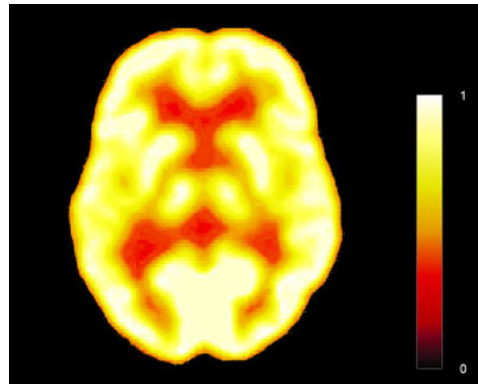




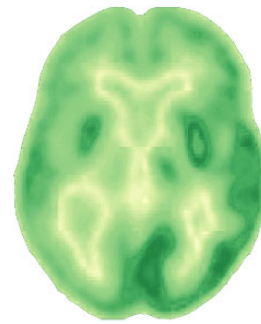
Do you expect the results to be different when the same data is presented in the following way?



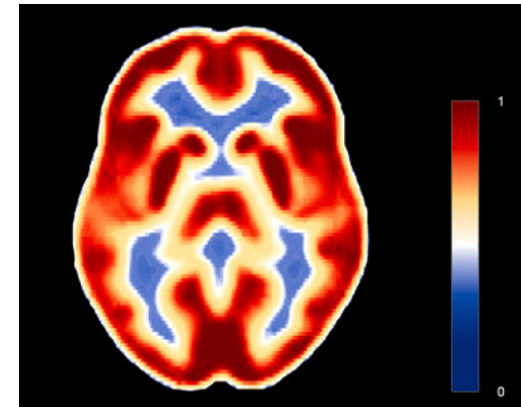
Brain death



“normal” brain



**minimally
conscious
state**



Locked-in brain

Here some results of an (ongoing) study (1): The trustworthiness of “brain death”

Between-group design, Neuroimaging experts (n=57), geo-visualization experts (n=87), lay persons (n=298).

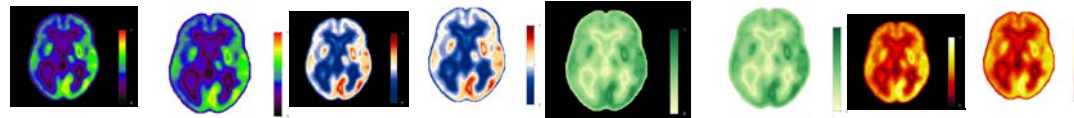


Preliminary Data – do not share or cite



Here some results of an (ongoing) study (2): grading of minimally conscious state

Between-group design, Neuroimaging experts (n=57), geo-visualization experts (n=87), lay persons (n=298).

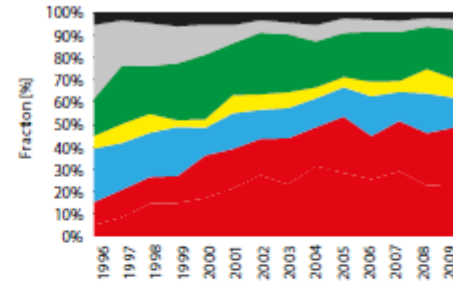
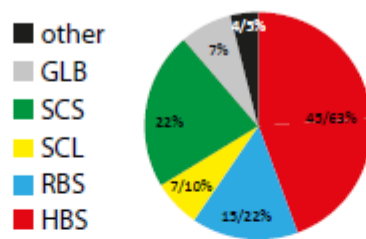
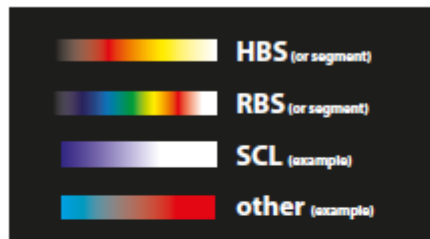


Preliminary Data - do not share or cite

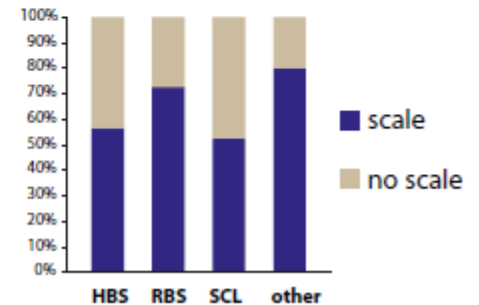
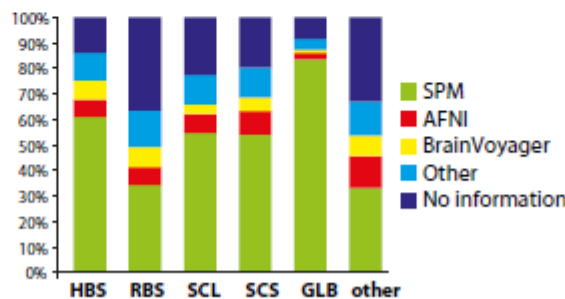
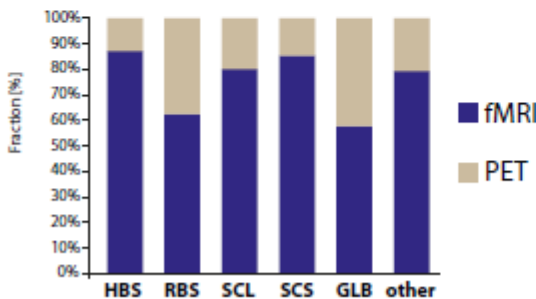
Major display styles

We evaluated 9,179 functional images (fMRI and PET) with respect to color use, image structure, image production software and other factors that determine the display practice in neuroimaging for six major journals representing three target groups from 1996 to 2009 (Christen et al, NeuroImage 2013).

a)



b)

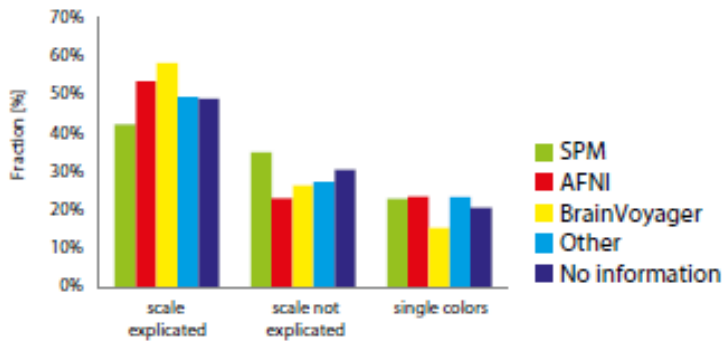




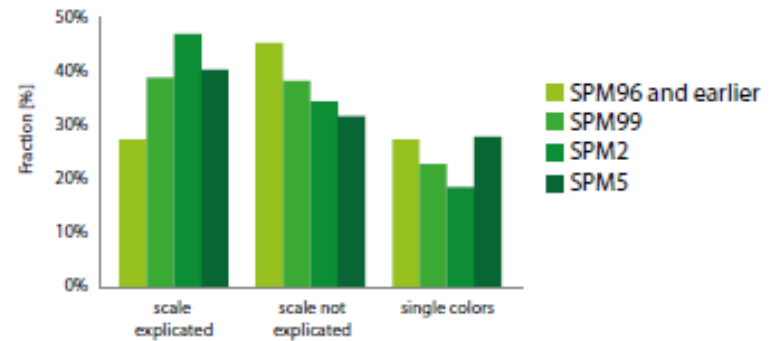
Explication of color scales for activation

In 38.2% of the images that displayed neuronal activations using color scales, the scale was not explicated (i.e., the colors are not associated with numbers either by using a scale or by outlining the meaning of the colors in the figure caption).

a)



b)





Internal perspective – Summary

We demonstrate a rather broad variety of display styles in neuroimaging despite a remarkable dominance of few image production sites and software systems, outline some tendencies of standardization, and identify shortcomings with respect to color scale explications in neuroimages.

There are indications that the display style influences the interpretation of neuroimaging data.



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Topic 2 – Moral Sensitivity



In the next four pages, you will rate values according to four dimensions, whose endpoints are described as follows:

Description of left endpoint

A value is “moral” if it claims to be universally valid and its corresponding actions are judged as right or wrong.

A value is “community-oriented” if it refers to the goals of a community, common interest or the relationships among individuals.

A value is “cooperative” if it refers to the collaboration, cooperation or communication between human beings or institutions.

A value is “principle-focused” if it focuses on the legitimacy of the act itself when the value is used to evaluate actions.

Description of right endpoint

A value is “non-moral” if it is not claimed to be universally valid and if corresponding actions are not judged as right or wrong.

A value is “self-oriented” if it refers to the priority of personal goals, personal interests or the individual.

A value is “competitive” if it refers to the competition or rivalry between human beings or institutions.

A value is “consequentialist” if it focuses on the evaluation of consequences of an action when the value is used to evaluate actions.



Please rate the following value according to the four dimensions below:

Autonomy

...respect the self-determination of others;

...avoid putting pressure on others to reach goals;

...support others such that they can make their own decisions

MO-NMO: moral – non-moral



COM-SELF: community-oriented – self-oriented



COOP-COMP: cooperative – competitive



PRI-CON: principle-focused – consequentialist





Please rate the following value according to the four dimensions below:

Care (Benevolence)

...help others who are in distress;

...protect the interests of people who are suffering;

...care about the welfare of others

MO-NMO: moral – non-moral

COM-SELF: community-oriented – self-oriented

COOP-COMP: cooperative – competitive

PRI-CON: principle-focused – consequentialist



Please rate the following value according to the four dimensions below:

Non-Maleficence

...refrain from risky interventions with dubious prospects of success;

...avoid harming a patient during a treatment;

...minimize a patient's suffering

MO-NMO: moral – non-moral



COM-SELF: community-oriented – self-oriented



COOP-COMP: cooperative – competitive



PRI-CON: principle-focused – consequentialist





Please rate the following value according to the four dimensions below:

Justice

...cares for patients according to their needs and not their social status;

...tries to balance different points of view;

...treats coworkers fairly

MO-NMO: moral – non-moral



COM-SELF: community-oriented – self-oriented



COOP-COMP: cooperative – competitive



PRI-CON: principle-focused – consequentialist





The Principles of Biomedical Ethics and the Common Morality

The principles of biomedical ethics – autonomy, nonmaleficence, benevolence, and justice – are of paradigmatic importance both for framing ethical problems in medicine, as well as in teaching ethics for medical students and professionals.

In order to underline this significance, Tom L. Beauchamp and James F. Childress base the principles in the common morality:

“[the common morality] refers to norms about right and wrong human conduct that are so widely shared that they form a stable social compact” (2013 p. 3).

This strategy “comes with a cost, namely the need to keep any theory in medical ethics open to, and thereby aware of, the challenges arising from biomedical research and clinical practice” (Karlsen & Solbakk 2011) and moral psychology [our addendum].



Measuring “Common Morality”

For the purpose of the empirical investigation, we suggest to make use of moral research in psychology. We focus on those findings in moral research that align with the universality claim of the common morality in order to identify “dimensions” of morality that then can be empirically investigated.

Those findings, also inspired by the social intuitionist model (Haidt), refer to nearly instant reactions to scenarios of moral violations of people. Also cognitive approaches (e.g. the moral-conventional distinction model of Turiel) have emphasized the feature of universality of morality.

Other findings refer to the evolutionary conditions of the human species that framed the uniquely derived lifestyle of human foragers, which requires generosity and sharing due to extreme mutual interdependence, making community-orientation and cooperation other plausible features of a “common morality”

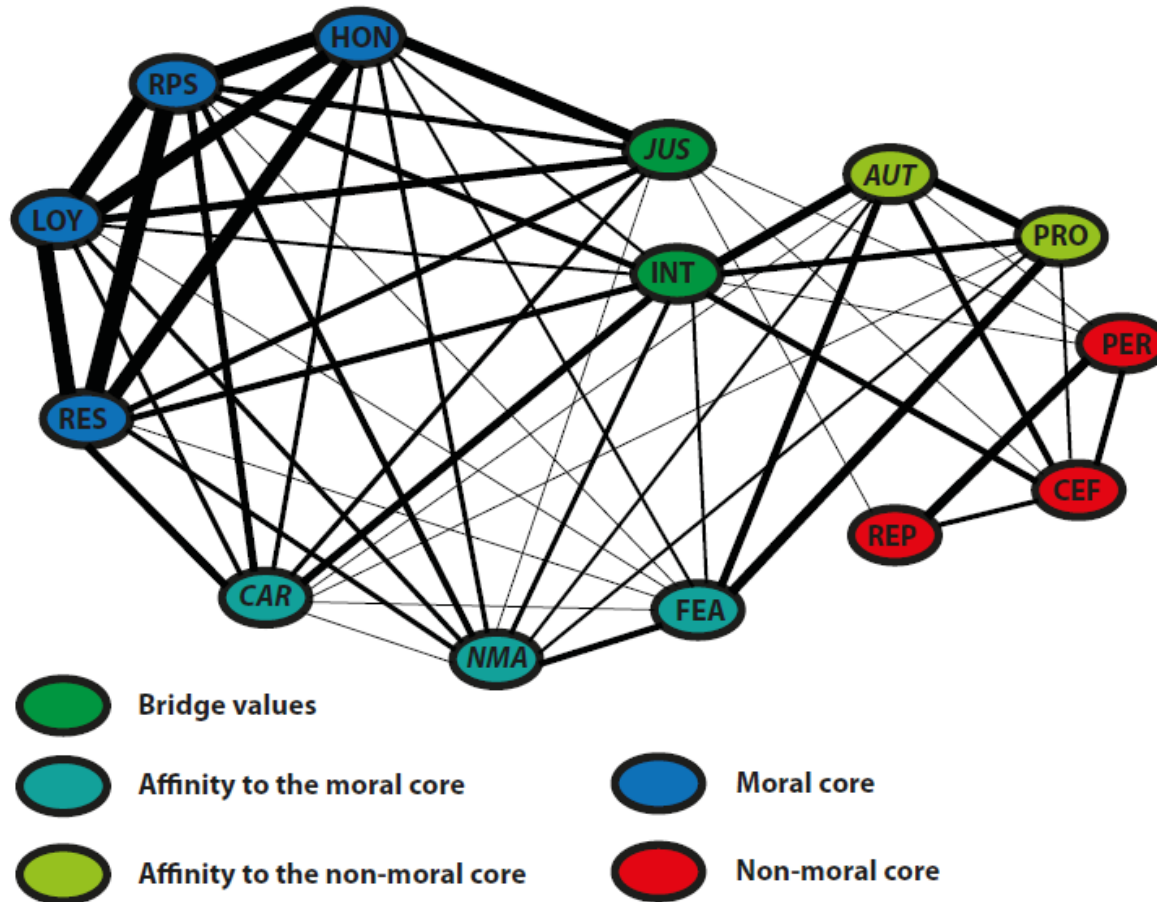


Result 1: Morality Dimensions

Correlated dimensions	Medicine (n1 = 317)		Business & Finance (n2 = 274)	
	Correlation of aggregated data	# of values with significant (*) correlation	Correlation of aggregated data	# of values with significant (*) correlation
MO-NMO with COM-SELF	0.41***	10	0.53***	10
MO-NMO with COOP-COMP	0.58***	13	0.63***	14
COM-SELF with COOP-COMP	0.58***	14	0.68***	14
MO-NMO with PRI-CON	0.29***	7	0.35***	4
COM-SELF with PRI-CON	0.20***	5	0.31***	5
COOP-COMP with PRI-CON	0.24***	3	0.37***	6



Result 2: Value grouping (1)





Discussion

We hypothesized that we can characterize the common morality using three dimensions that were derived from current empirical research in morality.

We found that these dimensions correlate strongly across the social domains medicine and business & finance. In addition, we identified values that form a moral core within both domains – respect, loyalty and responsibility. **This data is consistent with the notion of a common morality**, i.e. there are values that are perceived as being highly moral across social domains.

We found that **the values associated with the principles of biomedical ethics are not part of the moral core**. In particular, it is questionable, whether nonmaleficence and in particular autonomy are perceived as being part of the common morality based on the ratings given by the participants.

Interestingly, in the business and finance domain, nonmaleficence is part of the moral core, indicating a domain-specificity of the perceived morality of this value.



Normative perspective

From the point of view of medical ethics, our result may be surprising, if not worrying at first sight, because one may **consider this as an indication of a failure to convey the desired normativity of values to professionals who should work with them.**

Furthermore, the result may indicate that the principles – in particular nonmaleficence and autonomy – **may not in the same way be grounded in the moral psychology of medical professionals as other moral values.**

Our findings indicate that **even within the same cultural frame** we find that the degree of perceived morality of a value differs between social spheres.

This raises the question how principles, which are inherently not as moral-laden as assumed, guide health care providers in conflict situations to find a helpful – and for their part “moral” orientation – that would render action guidance?



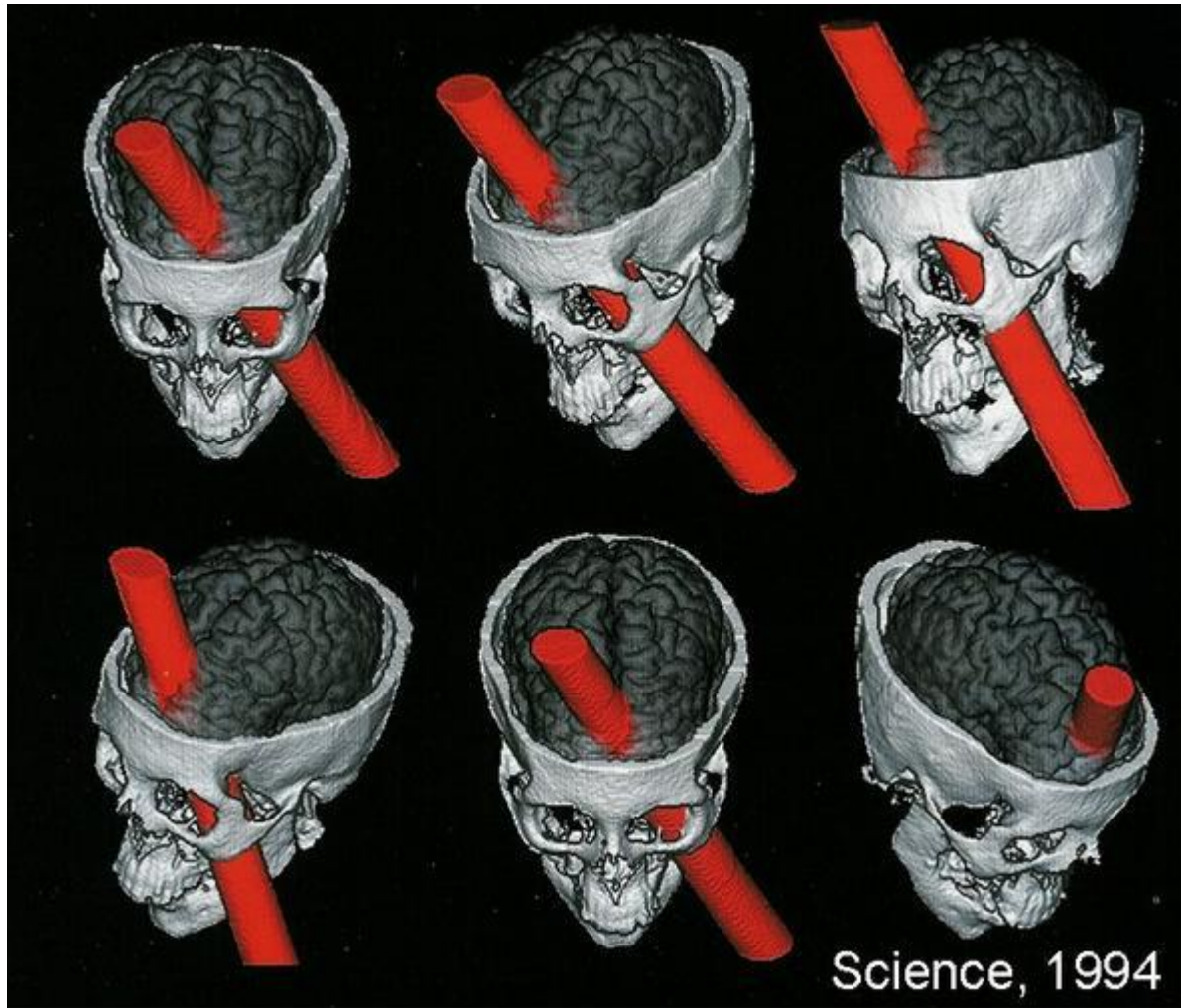
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Topic 3 – Frontal Lesion Research



When this happens to you: how would your character change?



An exemplary case: Leonore Welt (1859-1944)

Ueber Charakterveränderungen des Menschen infolge von
Läsionen des Stirnhirns.

Aus der medicinischen Klinik in Zürich.

Von

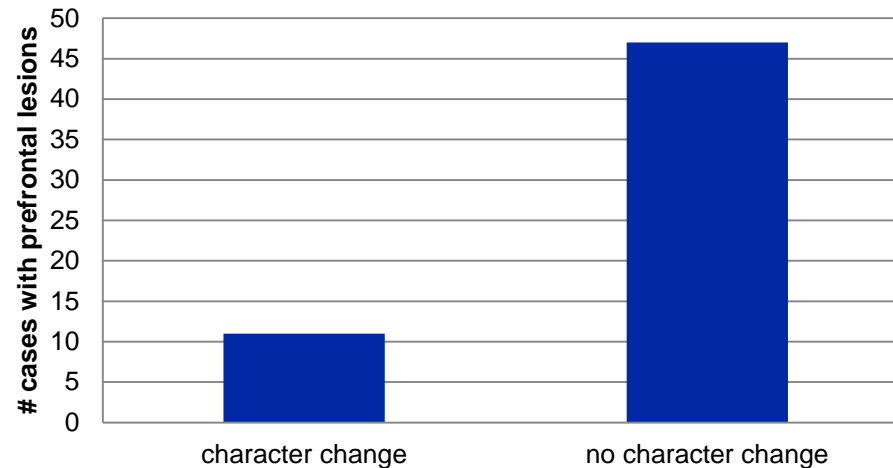
Leonore Welt,
prakt. Arzt in Genf.



Image: Deutscher Lyzeum-Club,
1929 (Brinkschulte 1993)



Cases described by Welt (1888)



Es ist schon im Vorhergehenden oft gezeigt worden, dass Läsionen dieser Theile keineswegs immer, ja wie man aus der geringen Zahl der hier gesammelten Beobachtungen sehen kann, sogar sehr selten zu Charakterveränderungen führen. Schon die auf S. 358 an-

As it has been shown before, lesions of this part of the brain [prefrontal cortex] do not always lead to character changes; actually, as the small number of observations demonstrate, they lead very rarely to such changes.



Jedenfalls wird man rücksichtlich der diagnostischen Verwerthung der in Rede stehenden Veränderungen bis jetzt kaum weiter zu gehen wagen dürfen, als dass, wenn derartige Störungen vorhanden sind, eine Läsion des der Medianlinie naheliegenden Theiles der orbitalen Fläche des Stirnhirns besteht, vorausgesetzt, dass man sich dessen bewusst ist, dass man den diagnostischen Schluss nicht umkehren dürfe und sagt, dass jene Stelle intact sein müsse, wenn solche Veränderungen nicht vorhanden sind.

With respect to the diagnostic values of character changes we may conclude that, if such changes are present, we can expect a lesion of the ventromedial prefrontal cortex; but one must be aware of the fact that **one cannot invert this conclusion, i.e. one cannot say that there are no vmPFC lesions present when we do not observe a character change.**



Design of “frontal lesion patient” study

Data bases

- Web of Science
- EMBASE
- FRANCIS
- Medline
- Proquest (Dissertation & Theses)
- PsychINFO (nur Titel)

Search criteria

- 1) Neuroscience
- 2) Frontal regions
- 3) Lesions
- 4) Behavioral abnormalities

Set A: 2970 Papers

Elimination of animal studies,
studies related to specific
diseases, etc.): **476 Papers**

Set B: Prefrontal lesion
literature (excluding purely
cognitive papers)

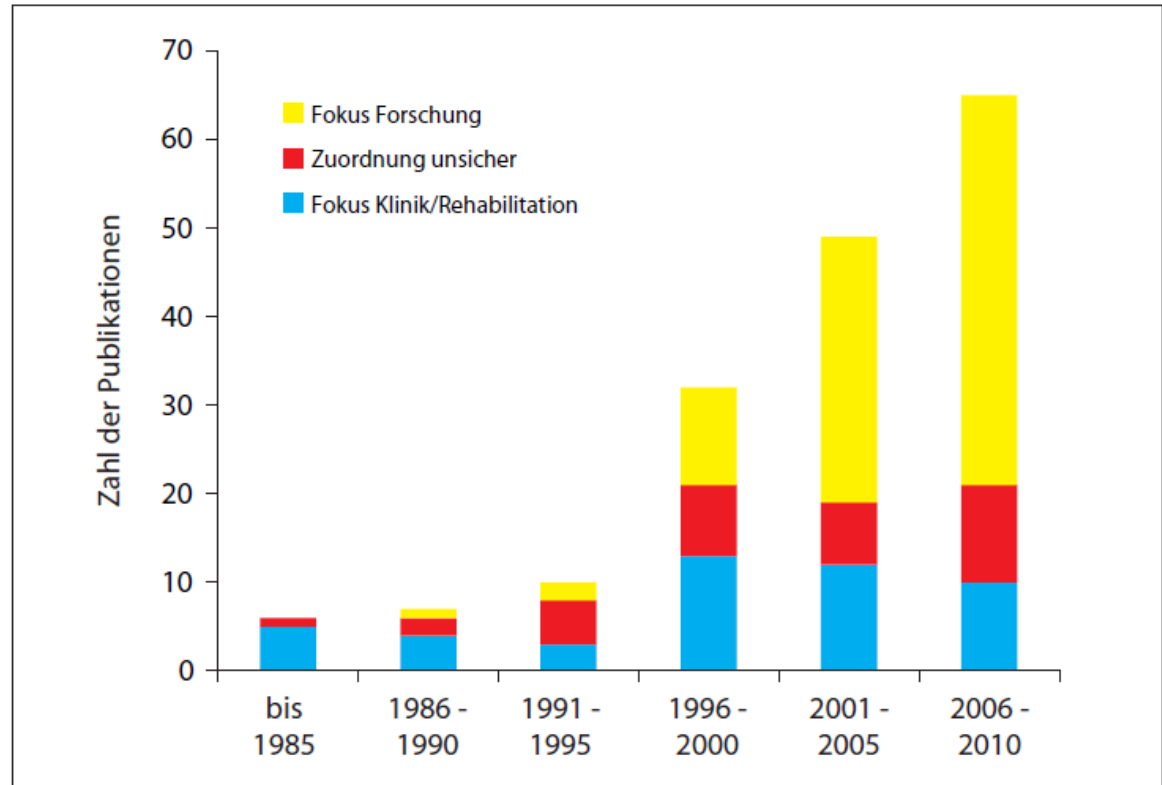
“Pure” Patient studies
155 Papers

Set S: Lesion-literature
concerning patients with
socio-emotional focus.



Results (2)

Conclusion: The number of studies with prefrontal lesion patients with a primary focus on research increased substantially.



Christen & Regard 2012



Results (2)

Conclusion: Papers displaying the “typical Phineas Gage” type of frontal lesions are much more often cited than papers discussing atypical cases.

Tab. Rezeption von Studien des „Phineas-Gage“-Typus bzw. solchen mit abweichenden Merkmalen mit und ohne „Tukey outlier“ (20). Trotz hoher Varianz sind die beiden Verteilungen statistisch signifikant unterschiedlich, wie ein zweiseitiger Kolmogorow-Smirnow-Test bestätigt.

Studien	„Phineas-Gage“-Typ	mit abweichenden Merkmalen
Durchschnittliche Zahl der jährlich erzeugten Zitationen pro Publikation	11,22	3,05
Durchschnittliche Zahl der jährlich erzeugten Zitationen pro Publikation ohne „Tukey Outlier“	7,61	1,85

Christen & Regard 2012



Conclusions

- A very rare phenomenon has become an important component in arguing for a “neural basis of moral behavior” (Phineas Gage).
- We see a shift away from therapeutically motivated research (with “difficult patients”) towards their experimental “use” as paradigmatic cases of “unmoral“ (?) behavior.
- There are almost no studies around that describe the incidence of character change after prefrontal lesions. It thus remains unclear whether Leonore Welts’ observation has been refuted or not.
- There are case studies from orbitofrontal lesion patients that were socially integrated (Japan), indicating the social component of being “antisocial”.



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What have we learned?



- 1) Internal perspective: The way you represent evidence (data) in terms of visualization may have a great impact on how others, your community and even yourself understands the phenomena.**
- 2) Normative perspective: The intuitive understanding of core (moral) terms may differ from the way you think this understanding is.**
- 3) Genealogical perspective: There may be unknown biases that shape the current understanding of a (health-related) phenomena that may be inadequate to the complexity of the problem.**



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Thank you!