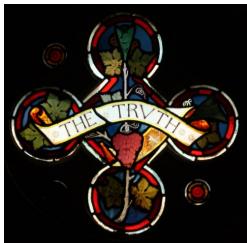


Science, truth, and honesty

Andy J. Wills

Topics

- ▶ What is truth?
- ▶ What is science?



Truth as a property of claims

- ▶ Statements about truth
 - ▶ “Andy is in Plymouth” \rightarrow TRUE
 - ▶ “Andy is on the Moon” \rightarrow FALSE
- ▶ Statements about the limits of our knowledge
 - ▶ “Andy was born in the month of June” $\rightarrow P(\text{true}) = 1/12$
 - ▶ “Andy has £3.57 in his pocket” \rightarrow UNKNOWN

Subjective and objective claims

- ▶ **Subjective claims** are those whose truth differs for different people.
- ▶ “My favourite colour is blue”
- ▶ **Objective claims** are those whose truth value is not affected by who says it.
- ▶ “Charlotte Smith’s favourite colour is blue”
- ▶ The term *subjective* is widely misused.
- ▶ “I think chocolate tastes better than cabbage” is subjective.
- ▶ “Chocolate tastes better than cabbage” is objective, and is amenable to scientific test.

Testing a claim

Online poll 1 ...

Vague claims are subjective

- ▶ “Smoking is wrong” - Subjective.
- ▶ “Smoking increases life expectancy” - Objective.
- ▶ Note: Claims do not need to be correct to be objective.

What is truth?

- ▶ “What does it mean to say that an objective claim is true?”
- ▶ **Relativism**
 - ▶ There are no objective claims.
 - ▶ All claims are subjective.
 - ▶ The truth value of all claims depends on who is speaking them.
 - ▶ **The truth is relative to different cultures or societies.**
- ▶ Problems with relativism
 - ▶ Any definition of relativism is self-defeating
 - ▶ “All truth is relative”
 - ▶ This claim is, in itself, universal and so proves that not all truth is relative.
 - ▶ Similarly, “no one can say what is right or wrong”
 - ▶ Relativism seems to preclude the possibility of being wrong.
- ▶ Weak relativism
 - ▶ “some truth is relative”
 - ▶ Uncontentious - see subjective claims
- ▶ What does it mean to say that an objective claim is true?

Truth, correspondence, and coherence

► Correspondence Theory

- Truth is determined by the correspondence between what is claimed and what is observed.
- A murder suspect claims to have been at home between 10pm and midnight...
- ...but he was seen by a reliable witness some miles from his house at that time.
- The suspect's objective claim is judged to be false because it does not correspond to observations.



Truth, correspondence, and coherence

► Coherence Theory

- Truth is determined by the coherence between new claims and other justified claims
- The Defence claims the victim committed suicide.
- No history of depression or other mental illness.
- Appeared happy
- The claim is unlikely to be true, not on the basis of anyone having observed how the injuries were inflicted, but on the lack of coherence between this claim and other justified claims.



Scientific claims

- ▶ Science is the process of making scientific claims...
- ▶ ...and determining whether those claims are true or false.
- ▶ Scientific claims are **objective** rather than **subjective**.
- ▶ Scientific claims are those whose truth can, at least in principle, be clearly determined.
- ▶ Scientific claims are largely **descriptive** rather than **prescriptive**.

Descriptive versus prescriptive claims

- ▶ **Descriptive claims** say something about how the world is, was, or will be:
 - ▶ “Plymouth University was once a polytechnic”
 - ▶ “Reaction times slow as people age”
 - ▶ “The UK’s Gross Domestic Product will grow by 3% next year”

Descriptive versus prescriptive claims

- ▶ **Prescriptive claims** say something about how things *should* be:
 - ▶ “Abortion should be made illegal”
 - ▶ “People should not drink and drive”
- ▶ How to examine prescriptive claims scientifically:
 - ▶ Look for a descriptive claim that might support the prescriptive claim:
 - ▶ *Anti-abortion*: “foetal pain receptors have developed by eight weeks gestation”
 - ▶ *Pro-abortion*: “foetal pain receptors are not connected to the brain until 20 weeks”
 - ▶ *Anti-drink-driving*: “Risk of car accidents doubles at 80mg/100ml blood alcohol (UK drink-driving limit)”

Descriptive versus prescriptive claims

- ▶ Science is not about avoiding societally difficult questions; nor is it exclusively about societal impact.
- ▶ It's about making claims that can be reliably examined.
 - ▶ Some of those claims have direct societal impact (drink driving claims)
 - ▶ Other claims change the way we view ourselves and the world in the longer term.
- ▶ Quality of science is orthogonal to its “impact”.

Absolute versus contextual claims

- ▶ **Absolute claims** are invariant. They hold always. Their truth value is not conditional on circumstances. They are not conditional on time or place.
- ▶ **“Relative” (contextual) claims** hold under a defined set of conditions.
 - ▶ “The leadership positions that women occupy are less promising than those of their male counterparts”
 - ▶ Not intended to be an absolute claim.
 - ▶ If the claim is true now, but no longer true in 20 years, this does not undermine the truth value of the original claim.
- ▶ Scientists generally wish to make claims that are as context-independent as possible; otherwise it is hard to make further predictions.
 - ▶ “The leadership positions that women in 2003 in UK FTSE100 companies occupy are less promising than those of their male counterparts”

Scientific claims and truth

- ▶ Some scientific claims are true, others are false.
- ▶ A claim that is false can still be scientific

Observable, measurable states

- ▶ Scientific claims are based on observable, measurable states
- ▶ Objective, descriptive claims are not always measurable.
- ▶ “Impulsive people are more likely to be criminals”
 - ▶ Being a criminal is a state that is observable and measurable.
 - ▶ Impulsivity is a vague concept that must be translated into something measurable.
 - ▶ e.g. Barratt Impulsivity Scale.
- ▶ “People with one or more criminal convictions score higher on the BIS than people without a conviction”

Independent replication

- ▶ Scientific claims must be expressed in such a way that they permit independent replication.
 - ▶ “Willsian Therapy reduces depression”
 - ▶ Wills is the only person who can perform Willsian therapy
 - ▶ The claim is not scientific because any attempt to assess its truth value would have to involve Wills and hence could not be independently replicated.

Scientific claims

1. **O**bjective
2. **D**escriptive
3. **A**ppropriately context-independent
4. **T** rue or false
5. **B**ased on observable measurable states
6. **I**ndependent replication
7. **F**alsifiable

Science and dishonesty

- ▶ Dishonesty
 - ▶ Partially reporting your results (if your intention is obfuscation).
 - ▶ Choosing a form of data analysis because it gives you the best p-value.
 - ▶ Keeping on testing until $p < .05$
 - ▶ Publishing the same data more than once.
 - ▶ Making up data!
- ▶ Dishonesty gets in the way of reliably evaluating claims.

Diderik Stapel



Dutch social psychologist - admitted to inventing data

See also - Dirk Smeesters - Dutch social psychologist - "cherry picked" data.

Listening to music about old age reduces your age

“We asked 20 University of Pennsylvania undergraduates to listen to either ‘When I’m Sixty-Four’ by The Beatles or ‘Kalimba’.

Then, in an ostensibly unrelated task, they indicated their birth date (mm/dd/yyyy) and their father’s age. We used father’s age to control for variation in baseline age across participants. An ANCOVA revealed the predicted effect: According to their birth dates, people were nearly a year-and-a-half younger after listening to ‘When I’m Sixty-Four’ (adjusted $M = 20.1$ years) rather than to ‘Kalimba’ (adjusted $M = 21.5$ years), $F(1, 17) = 4.92$, $p = .040$ ”

Simmons et al. (2011, Psychological Science)

Science and skepticism

- ▶ Scientists should welcome skepticism.
- ▶ Scientists should solicit and welcome criticism.
- ▶ Emotionally quite difficult.
- ▶ Independent replication
 - ▶ Scientific claims permit independent replication.
 - ▶ Independent replication should be sought.
 - ▶ High profile failures to replicate...

Ap Dijksterhuis



Dutch social psychologist - his “intelligence priming” effects fail to replicate.

<http://www.nature.com/news/disputed-results-a-fresh-blow-for-social-psychology-1.12902>

See also - John Bargh - US social psychologist - his “age and walking pace” results fail to replicate

Reproducibility project

	Replications $P < 0.05$ in original direction	Percent
Overall	35/97	36
<i>JPSP</i> , social	7/31	23
<i>JEP:LMC</i> , cognitive	13/27	48
<i>PSCI</i> , social	7/24	29
<i>PSCI</i> , cognitive	8/15	53

<http://www.sciencemag.org/content/349/6251/aac4716>

Science and publication

- ▶ Science is highly social and cooperative.
- ▶ Collecting data, and evaluating claims, and then keeping the results of that evaluation to yourself is generally frowned upon.
- ▶ Some scientists would even go so far as to say it is unethical to not publish your work.

Science and Open Access publication

- ▶ Scientific journals cost £1000s each per year.
- ▶ Only held by university libraries, which are not fully open to the public.
- ▶ Solution: **Open Access** publishing - making publications freely available at no charge



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New publications (accepted or in press)

[Wills, A.J., Lavric, A., Hemmings, Y. and Surrey, E. \(accepted\)](#). Attention, predictive learning, and the inverse base-rate effect: Evidence from event-related potentials. To appear in *NeuroImage*.
doi: 10.1016/j.neuroimage.2013.10.060

2013

[Wills, A.J., Milton, F., Longmore, C.A., Hester, S., and Robinson, J. \(2013\)](#). Is overall similarity classification less effortful than single-dimension classification? *Quarterly Journal of Experimental Psychology*. 66. 299-318.

Science and Open Access raw data

- ▶ Making your raw data freely, publicly, permanently, available.
- ▶ Incredibly important. Slowly becoming accepted.



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Culture of modern science (and future directions)

- ▶ Evaluation of scientific claims
- ▶ Honesty
- ▶ Skepticism (Independent replication)
- ▶ Publication (Open Access, Raw data)

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- ▶ Check you have received email with login details
- ▶ Check your login works: `rstudio.plymouth.ac.uk`
- ▶ Any issues, contact Tech office urgently to resolve:
`tech.psy@plymouth.ac.uk`

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