

Facts and values in evidence-based decision-making

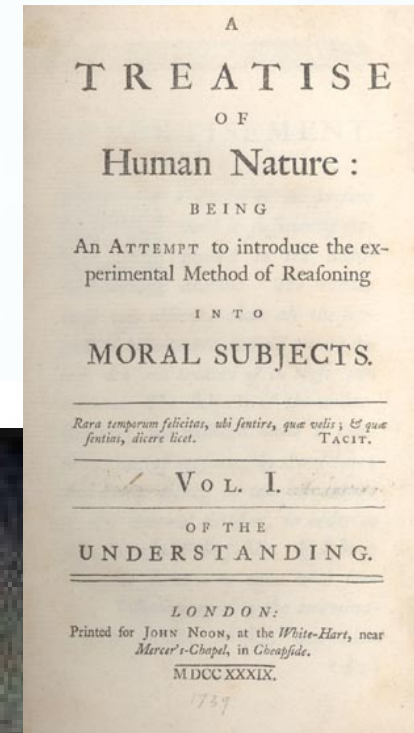
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David Hume on facts and values

- “facts”: claims (propositions) about the way the world *is* (or was, or may be).
- “values”: claims about the way the world *ought to be*.
- Hume noticed a universal tendency for people to “reason” from the former to the latter. (*the “is-ought” fallacy*)



Constitution Act, 1982

Part I: Canadian Charter of Rights and Freedoms

Fundamental freedoms

2. Everyone has the following fundamental freedoms:

(a) freedom of conscience and religion;

(b) freedom of thought, belief, opinion and expression, including freedom of the press and other media of communication;

(c) freedom of peaceful assembly; and

(d) freedom of association.

Positions versus propositions in decision-making

- A *position* is an expression by an actor of what a decision-making body *should* do, often couched in terms of “recommendations”.
- *Propositions*: (1) statements about the way the world ought to be (“normative” or “value” propositions); (2) statements about the way the world is/was/will be (“factual” propositions)
- Positions are invariably represented as being “based” *on one or more propositions* of the first or second kind (the “rationale” or “justification” or underlying belief for the position).



DRIVING GROWTH THROUGH RESEARCH:

**The importance of research for Canada's future in
the world knowledge economy**

- “We *believe* that research should be central to evidence-based policy development.”
- “We *recommend* that research funding in Canada should increase at least to the average level in the OECD and G8 countries”.

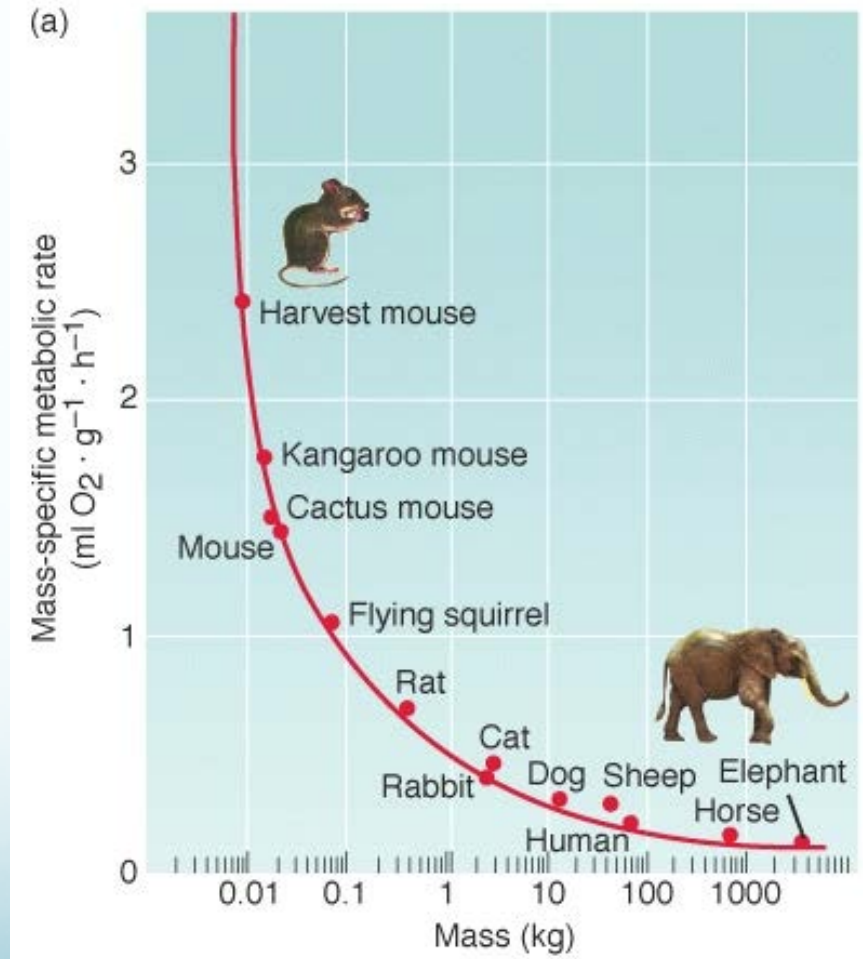
Element	Actor 1	Actor 2
<i>Position</i>	Physician-assisted dying should not be legal under any circumstances.	Physician-assisted dying should be legal under some circumstances.
<i>Proposition</i>	(1) Physicians should first do no harm.	(1) Patients should have the right to chose to die.
	(2) Legal euthanasia substantially increases the risk of involuntary euthanasia.	(2) Legal euthanasia does not substantially increase the risk of involuntary euthanasia.

The process

- On what propositions is the position based?
- Of what type (fact (F), value (V)) are these propositions?

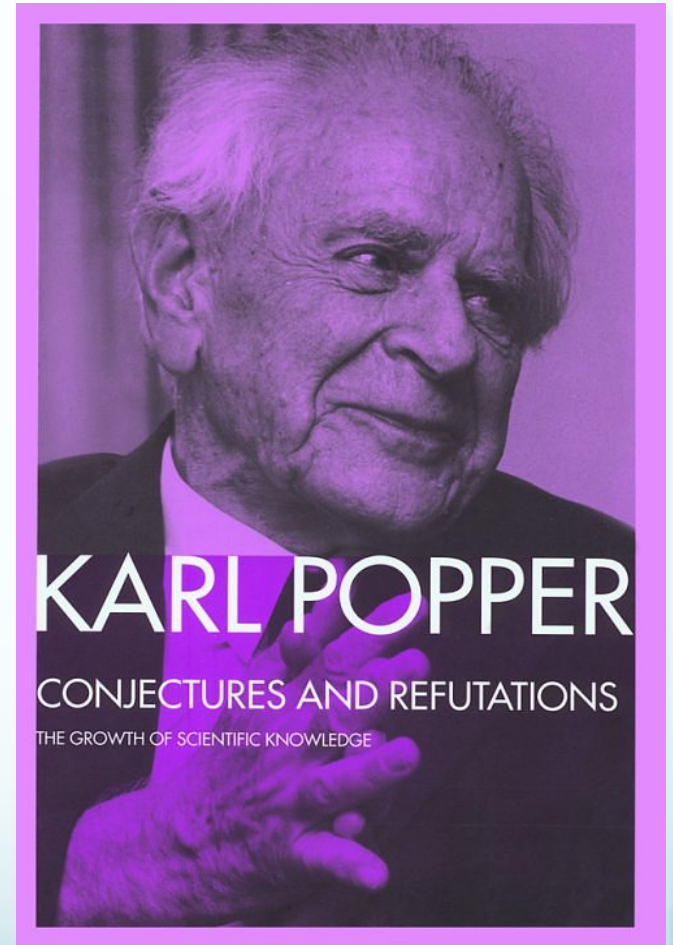
Factual propositions of the first kind

- *Observation*: I weigh 79 kg (on a good day.)
- *Estimate*: Hubble constant ($67.80 \pm 0.77 \text{ ks}^{-1}/\text{Mpc}$)
- *Pattern*: Metabolic rate scales as a power function of body size in mammals.

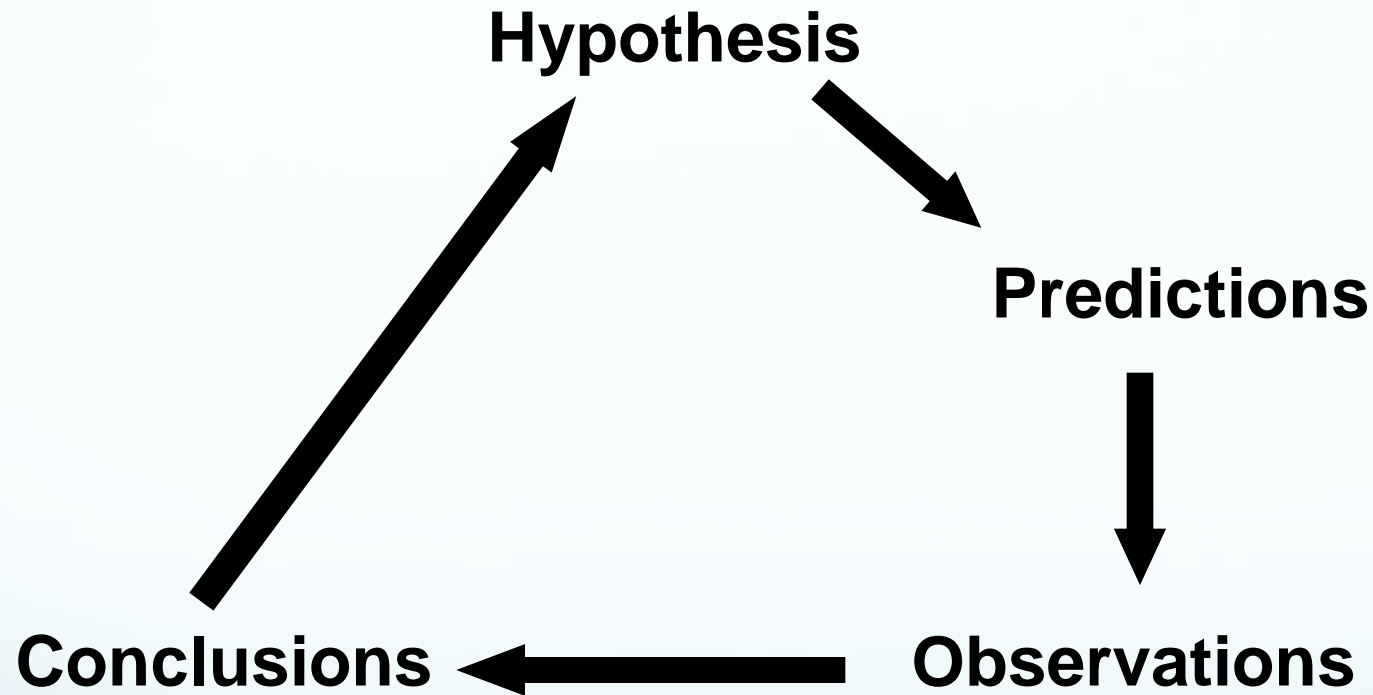


Factual propositions of the second kind: scientific hypotheses

- According to Sir Karl Popper, all scientific propositions (hypotheses) must be *refutable*, at least in principle.
- A refutable hypothesis is one for which, at least in principle, there are *empirical observations which could be inconsistent with the hypothesis*.



Testing factual propositions of the second kind: the scientific method

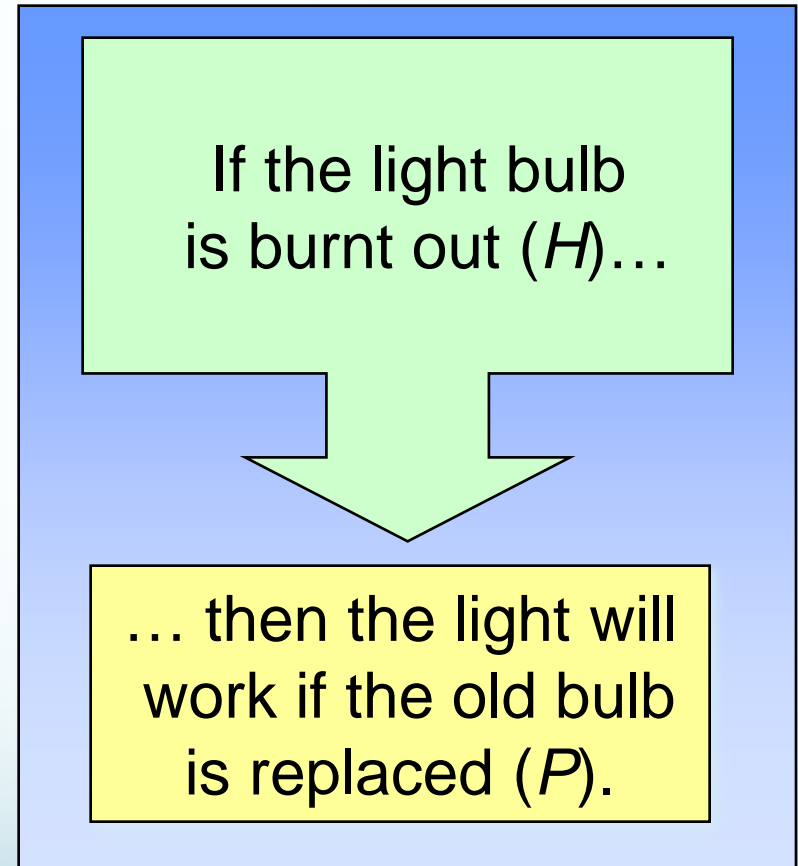


Hypotheses, experiments and predictions

Hypothesis	Experiment	Prediction
Light bulb burnt out	Replace bulb with new bulb	Light will work
Power off to house	Try other electric switches	No other switch will work
Short in circuit	Replace bulb with new bulb	New bulb will blow &/or breaker will trip

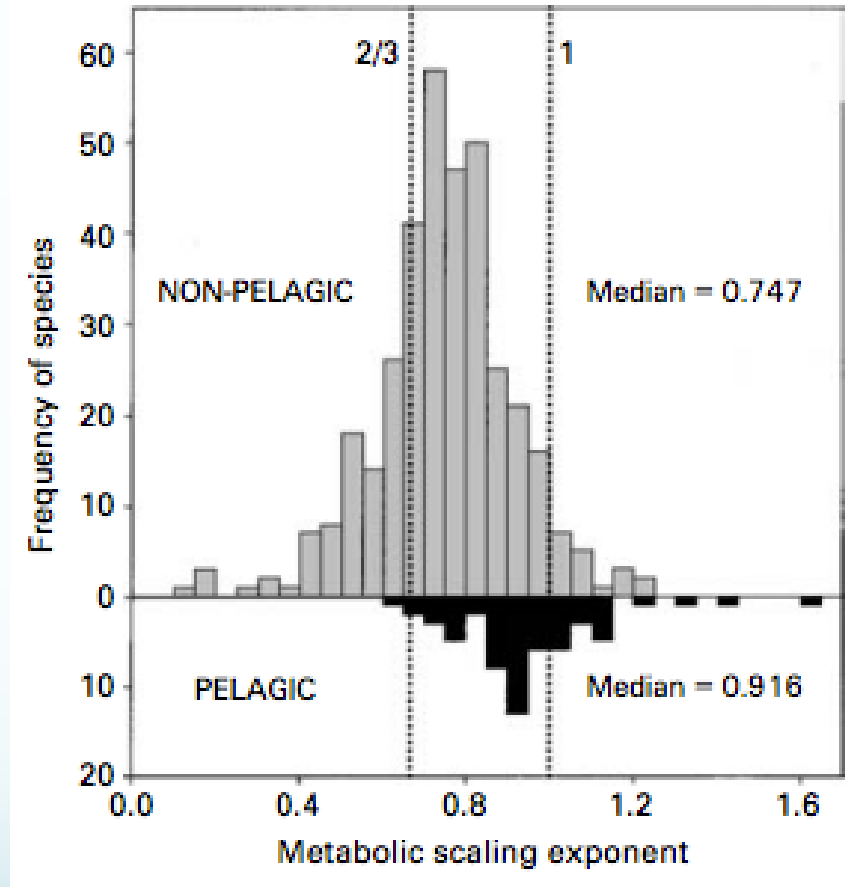
Hypotheses and predictions

- *(Causal) hypothesis (H)*: a statement about the cause(s) of some observed event/pattern.
- *Prediction (P)*: the results of an experiment/study one expects *if the hypothesis is true*.



How do we test hypotheses?

- Compare observed patterns with those expected under the hypothesis (“predictions”)
- If observed and predicted patterns “match”, the hypothesis is (provisionally) accepted as “true” (but which *actually* means there is insufficient evidence to reject it.)
- If observed and predicted patterns do not match (fit is poor), the hypothesis is rejected.



Tests of Kleiber's law ($R = kM^{-0.75}$)

Parsing propositions: distinguishing value elements

- A “value” element is something in a proposition:

(a) that is likely to be *interpreted differently* by different actors; or

(b) whose “truth”, given the *same* evidence, will be regarded as different by different actors; or

(c) the evidence considered to be “relevant” to the proposition will be different for different actors.

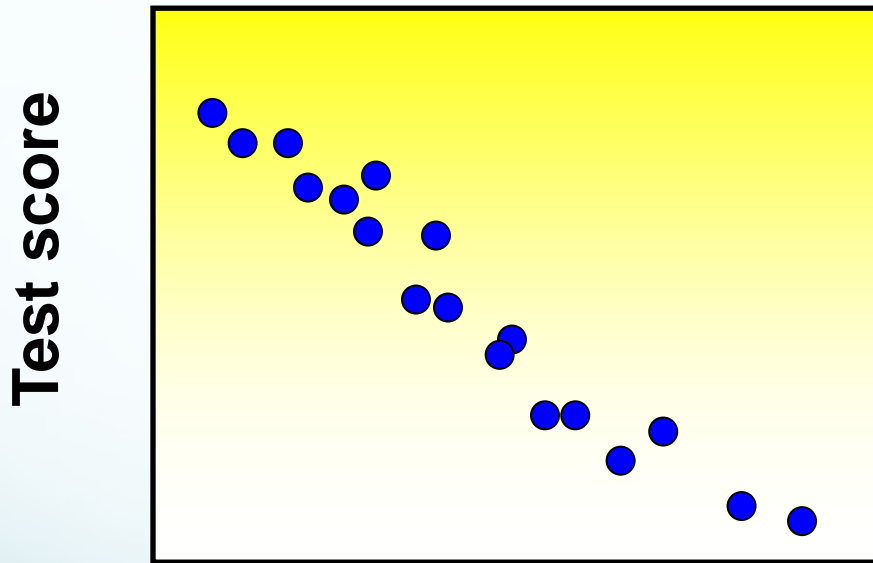
Parsing propositions: distinguishing factual elements

- Factual elements are those whose “truth” can in principle be ascertained through application of the scientific method.
- The problem: *every proposition, regardless of how factual, includes some (at least implicit) value elements.*

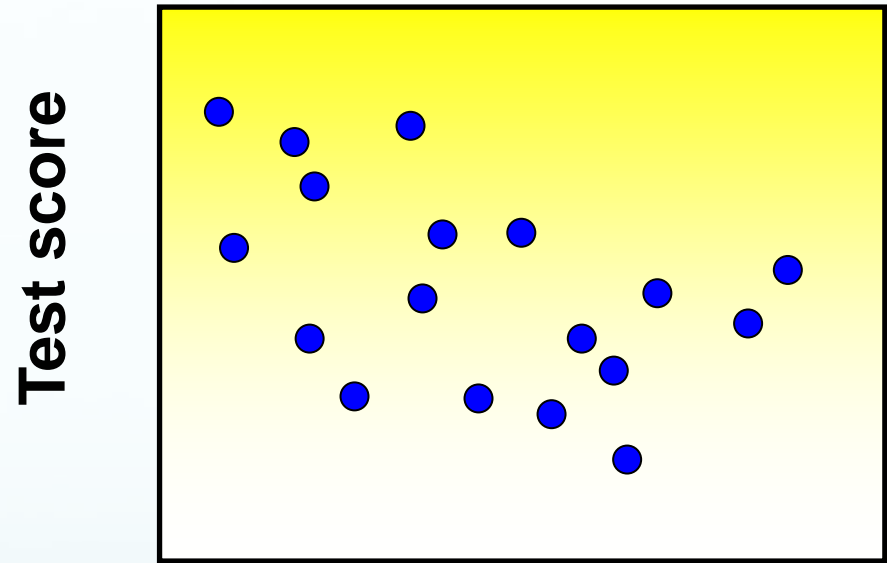
An example

- *H*: Chronic mercury exposure during childhood causes reduced cognitive ability.
- *Study*: survey of northern aboriginal communities to quantify (a) chronic mercury exposure (endpoint: mercury concentration in hair); (b) cognitive abilities of children (based on performance on culturally-appropriate verbal and written tests)
- *Prediction*: negative correlation between test performance and hair mercury concentration.

The data: consistent or inconsistent with hypothesis?



[Hg] in hair



[Hg] in hair

The ought in scientific is

- The question of how different observed patterns should be before we reject the hypothesis is an “ought”, not an “is” question...
- Scientists have adopted norms and standards for observed-predicted discrepancies *as a matter of convention, nothing more.*
- Yet it is on the basis of this convention and associated norms that we infer support (or lack thereof) for scientific hypotheses.

Proposition ordination

- Any proposition can be “ordinated” on a fact-value scale.
- Ends of the scale correspond to a proposition for which every/no information element (sub-proposition) is a “fact” (fact score = 1.0 or 0 respectively)), and no/every information element is a value proposition (value score = 0 or 1.0 respectively).



F = 1.0, V = 0

F = 0.5, V = 0.5

F = 0, V = 1.0

Example: a climate change proposition

“Climate in eastern Canada isn’t any different now than it was in the past.”

- *“factual” elements*: temporal trends in climate-related variables in eastern Canada.
- *“value” (or normative) elements*: What climate variables? (the ones that are “important”? According to whom? Important in what respect?) When in the past? (a decade ago, a century ago, a millennium ago...). How different is “no different”?

Example 2: wildland forest management

“Wildland forest fire management: balancing the good and bad.”

- *Factual elements*: effects of (unmanaged/managed) fire on wildland forest ecosystems; health and safety; etc.
- *Value elements*: “balancing” → “right balance” (Of what? According to whom?); “good” & “bad” (What is good/bad? According to whom?) Absolute or relative (*good* versus *better*, *bad* versus *worse*)? Etc.

Home-work exercise



Proposition	F	V	Fact elements	Value elements
Canada's boreal forest is at risk.				
Canada responsibly manages its boreal forest to ensure they remain healthy.				
Logging causes deforestation.				
Harvesting trees does not cause deforestation.				

Decision-making

- Any (rational) decision is based, in part, on a consideration of the *expected consequences* (outcomes, O) of alternate decisions (“If D then O ”)
- Since decisions depend upon the consideration of consequences, an important issue is the truth of the proposition that “If D then (O)”
- ... which leads naturally to the question: what is the probability that “If D then O ” *is indeed true?*

EBDM as Popperian science

- “If D then O” is a *causal proposition* which means that evidence for the validity of the assertion is simply evidence that in the context under consideration, *this scientific hypothesis is in fact true.*
- The question then is: *how likely is it that in the context, the hypothesis is indeed true?*

An example: a carbon tax

- *Policy goal:* reduce fuel consumption of motorists
- *Hypothesis:* higher prices at the pump associated with a carbon tax create a financial incentive to reduce consumption.
- *Prediction:* per capita fuel consumption will be reduced following the introduction of a fuel tax.



Fact versus value: whither science?

- (mostly) factual propositions, which science *is* in a privileged position to answer, versus (mostly) value propositions, which science *is not* in a privileged position to address.

Factual
Propositions



Scientists
Legitimately
wade in

Value
Propositions



Everybody &
their dog legitimately
wades in



Evidence-informed decision-making: phase I

- *Parse* causal propositions into their both *explicit* and *implicit* factual (F) and normative (V) elements (sub-propositions)
- *Ordinate* these elements using the F-V ordination tool.
- *Park* those elements for which F score is low, V score is high.
- *Gather, evaluate and weigh* the (scientific) evidence elements with high F scores, low V scores (Phase 2)

L'envoi

I was just guessing
At numbers and figures
Pulling the puzzles apart

Questions of science
Science and progress

Do not speak as loud as
my heart

