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Standards of Scientific Computing

Perspectives from Ethics and Philosophy of Science

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Module M4 „Ethics and Best Practices for Data Science"
CAS "Applied Data Science" (CAS ADS)

Introduction

"Computing and software is the core of many sciences. Consequently reproducible code is a basic criterion for high quality science. Scientific code should be Findable, Accessible, Interoperable and Reproducible (FAIR). Producing FAIR code is a societal obligation for researchers working with software. The version control software Git is a good tool for reaching this."

course description

Image: Bundesamt für Strassen

Terminology

- Obligations
- Do’s and don’t’s
- Best practices
- …

Value judgments

standards

Aim of this lecture

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Improve your thinking about standards

1. Introduction to value judgments
2. Basic distinctions
3. Justification of standards and application to codes

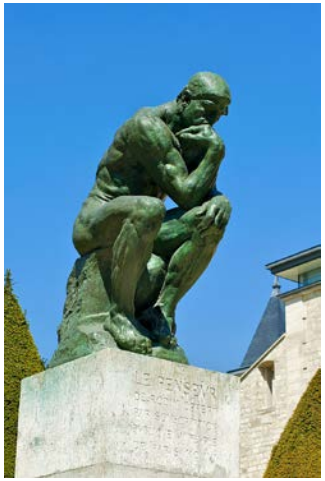

Image: A. Rodin (D. Stockman)

1. Value judgments

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course description in ILIAS

Value judgments can be recognized using typical words:

- "high quality", "should", "obligation", "forbidden", "ought", …

But apart from words, what are central features of value judgments?

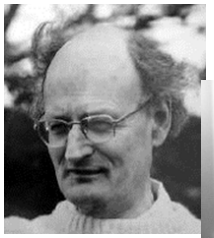
The key characteristics

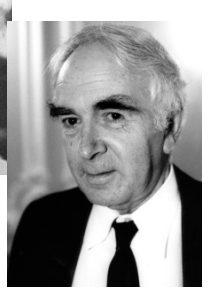
1. Value judgments are practical: they guide choice and action.
2. Value judgments can be justified.

Following R. M. Hare[1] and E. Tugendhat[2]

[1] Richard M. Hare (1919-2002), The Language of Morals (1952), Freedom and Reason (1963), Moral Thinking (1981)

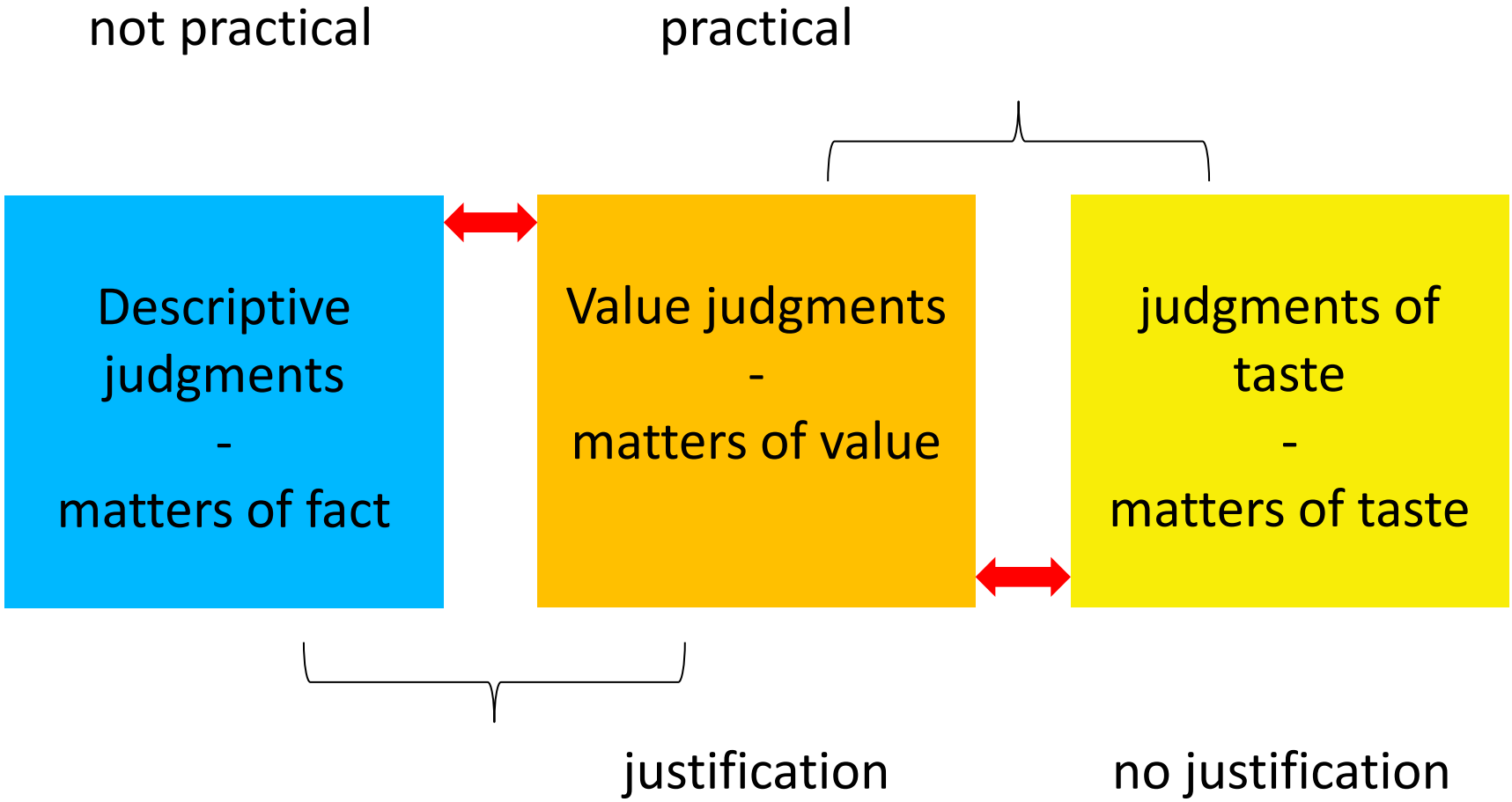
[2] Ernst Tugendhat (born 1930): Vorlesungen über Ethik (1993)





Images: www.utilitarian.net/hare; V. Berg, suhrkamp.de

Illustration



2. Basic distinctions

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course description in ILIAS

Method:

a. Explain a distinction
b. Apply it to the examples in the text

i. Type of object of assessment

For instance:

- actions: “This is the right thing to do!”
- people in roles: “She is a good computer scientist.”
- people: “He is a good guy.”
- things: “This is a good knife.”

ii. Scope

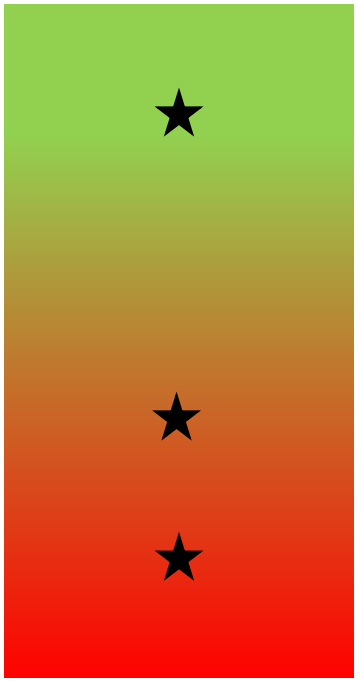
general: “Lying is wrong.”
singular: “She is a good computer scientist.”

Terminology:
General value judgments are often called principles.

Images: www.utilitarian.net/hare; V. Berg, suhrkamp.de

iii. Type of assessment

<u>evaluative</u>

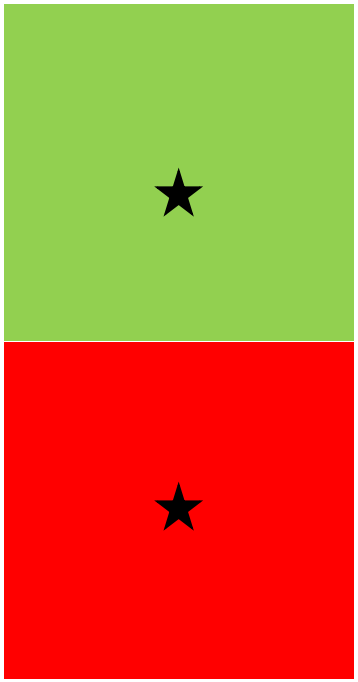


very good

better

quite bad

<u>deontic</u>



right

wrong

Terminology:

Principles about deontic matters are called norms.

iv. Content?

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Thick: specify in what respect something is valued:
- "She is friendly."
- "The lecture is interesting."
- "A distribution of goods should be fair."

Thin: do not specify aspect:
- "Lying is not permitted."

Note:

Deontic value judgments are thin.

v. Condition?

Hypothetical: conditional on a given aim, value or norm.

- "If you still want to go to Geneva this evening, you have to catch the train at 10:04."
- "Doings sports is good for health."

Categorical: not conditional on a given aim etc.:

- "You ought to help friends in need."

vi. Status

Moral:

- "It's (morally) wrong to tell lies."
- "The (morally) good thing to do is to help people in need."

Aesthetic:

- "The painting is beautiful."

Other:

- "This is a good code."

Summary of the distinctions

i. Type of object of assessment (people, …)
ii. Scope (general vs. singular)
iii. Type of assessment (evaluative vs. deontic)
iv. Content? (thick vs. thin)
v. Condition? (hypothetical vs. categorical)
vi. Status (moral, etc.)

Note

The distinctions are not completely independent.
For instance,

- Deontic judgments are thin.
- Moral judgments are categorical.
- Moral judgments are about people, their actions and motives.

3. Justification

Singular value judgments:

evaluative

"This is a good code."

deontic

"You should tell her that you are in Bern."

But why???

"It's simple and transparent."

Appeal to positive features (evaluative standards)

"You should not tell lies."

Appeal to norms (deontic standards)

Analysis of the evaluative case

The justification is: “It’s simple and transparent.”

Two possible objections:

It’s not simple!

Need expertise

It’s simple, but is simplicity really a positive feature?

??? NB. A similar analysis can be given for the deontic case.

Basic question

Where do standards come from? How are they justified?

Options:

i. From the sort of thing that is evaluated.

"Knives should be able to cut."

ii. From the type of practice one is involved in.

"In science, theories should be falsifiable."

iii. From morality.

"Justice is a basic moral demand."

Ad i. type of object

Knives have a certain function, viz. cutting.

They are the better, the more effective they are in fulfilling their function.

What this function is, is a matter of everyday knowledge.

Application to codes

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What evaluative standards/norms can we get from the very idea of a code?

- Fulfill their specific functions (codes can have many functions depending on the user's intention)

Ad ii. type of practice

Example of a practice: playing chess:

- norms: rules for moves.
- value: winning; moves are the better the more conducive they are to winning.

In our context, the practice is science or scientific computing.

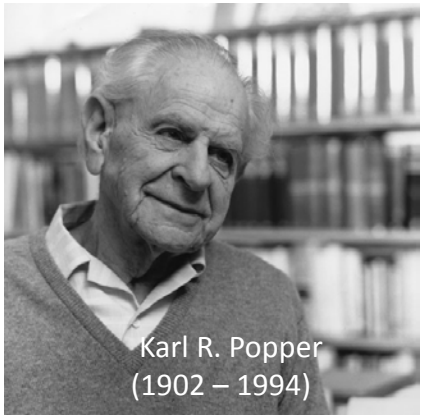
What exactly is science? What are the underlying norms and values?

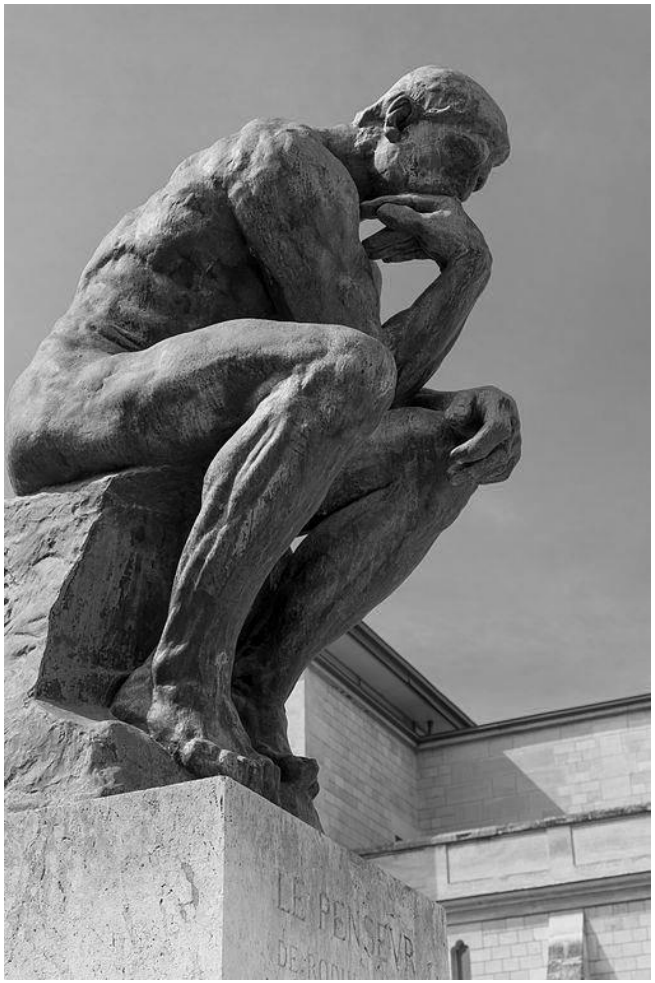
Philosophy of science

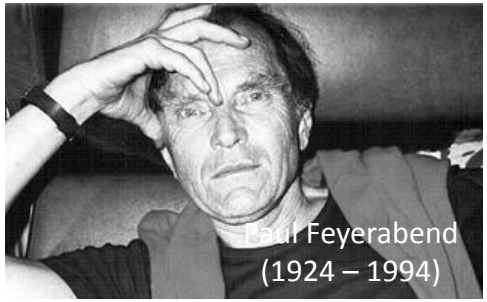
Answers these questions.

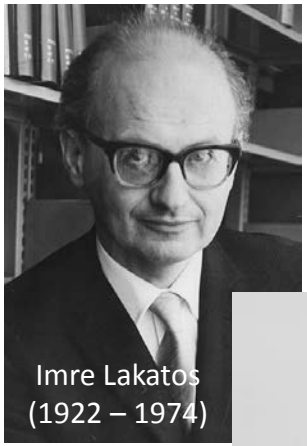
Goals: knowledge, understanding, …
Norms: scientific method.

Philosophers of science

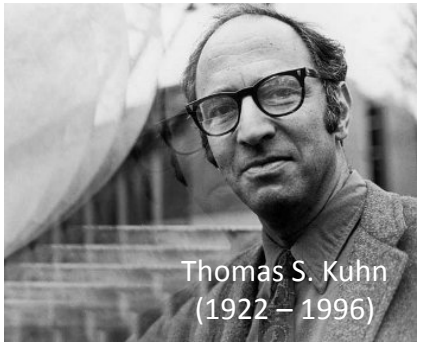

Karl R. Popper
(1902 – 1994)



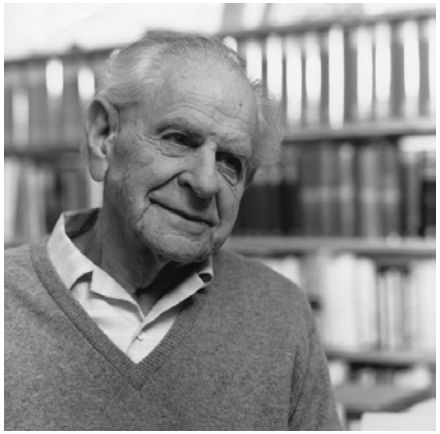

Paul Feyerabend
(1924 – 1994)


Imre Lakatos
(1922 – 1974)


Larry Laudan
(* 1941)


Thomas S. Kuhn
(1922 – 1996)

One example, details



Karl R. Popper
(1902 – 1994)

Claim:
The basic aim of natural science is not to gain knowledge, but to correct human error.

Image: LSE library

Background

Enumerative induction:

1. Raven Rob is black.

2. Raven Rita is black.

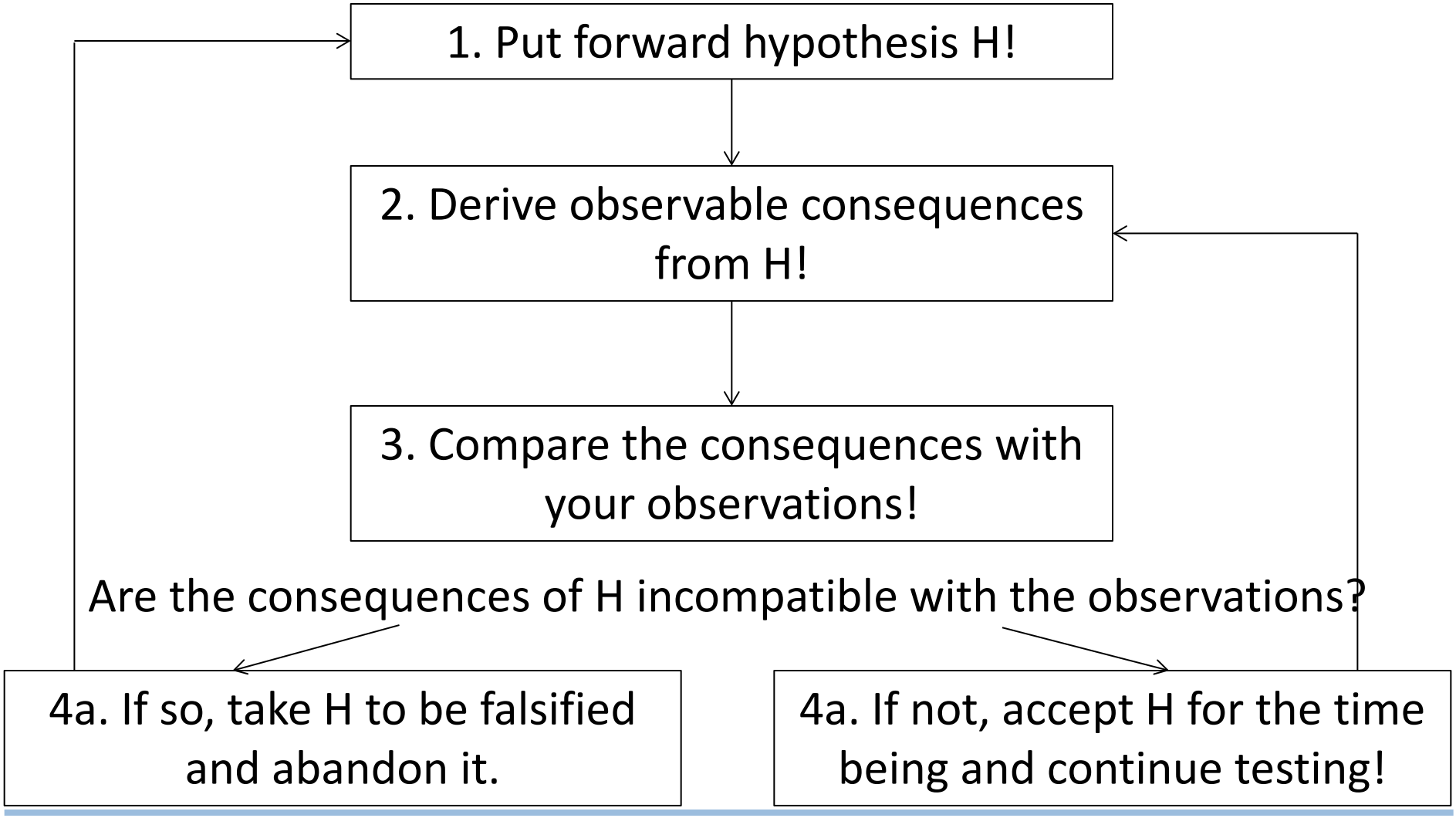
---

3. All ravens are black.

Popper thinks that enumerative induction is irrational. So he cannot allow that data supports a general hypothesis. Thus, he thinks that general hypotheses can only be falsified using data.

Photos: R. Altenkamp, http://www.20min.ch/schweiz/bern/story/12175915

Scientific method after Popper



Application to codes

Which standards on codes can be derived from this picture?

- Codes can help in the analysis of data and in the derivation of observable consequences.
- Derivation of observable consequences: Codes should be faithful to hypotheses (e.g. a model) and really provide approximate solutions to the equations of the hypothesis (verification)
- Validation of a computer model and the related code is not an issue for Popper because he doesn't allow for positive support for a hypothesis.

Discussion

Is it really true that science can only falsify general hypothesis? I was expecting more.

Popper's account of science is in fact controversial. Bayesians, for instance, think that data can positively support a general hypothesis.

Application to codes

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What evaluative standards/norms can we get from the idea that we are doing science?

- Code should be reproducible.

Ad iii. morality

One moral value:

Distributive justice:
Any distribution of benefits/ burdens should be fair.

Each person should obtain what she deserves.

What are moral standards more systematically?

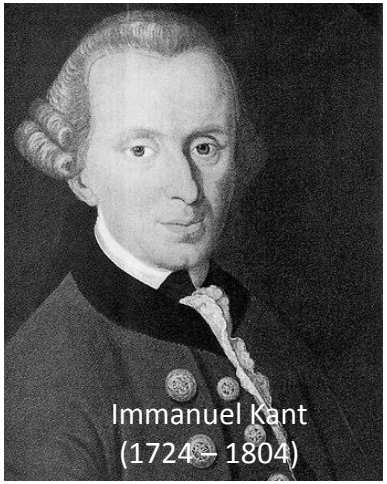
Image: Frankfurt/M.; user „Mylius“, wikipedia;

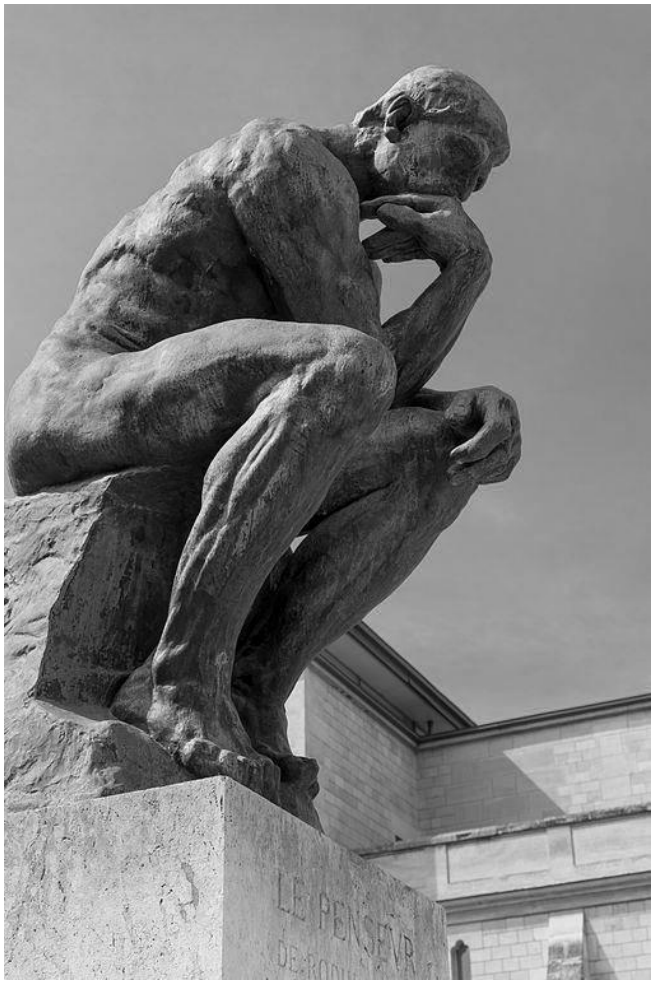
Ethics

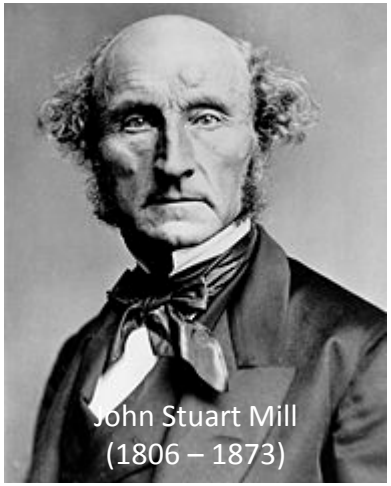
Answers this question.

More specifically, ethicists try to systematize and justify moral values and norms.

Famous ethicists


Immanuel Kant
(1724 – 1804)



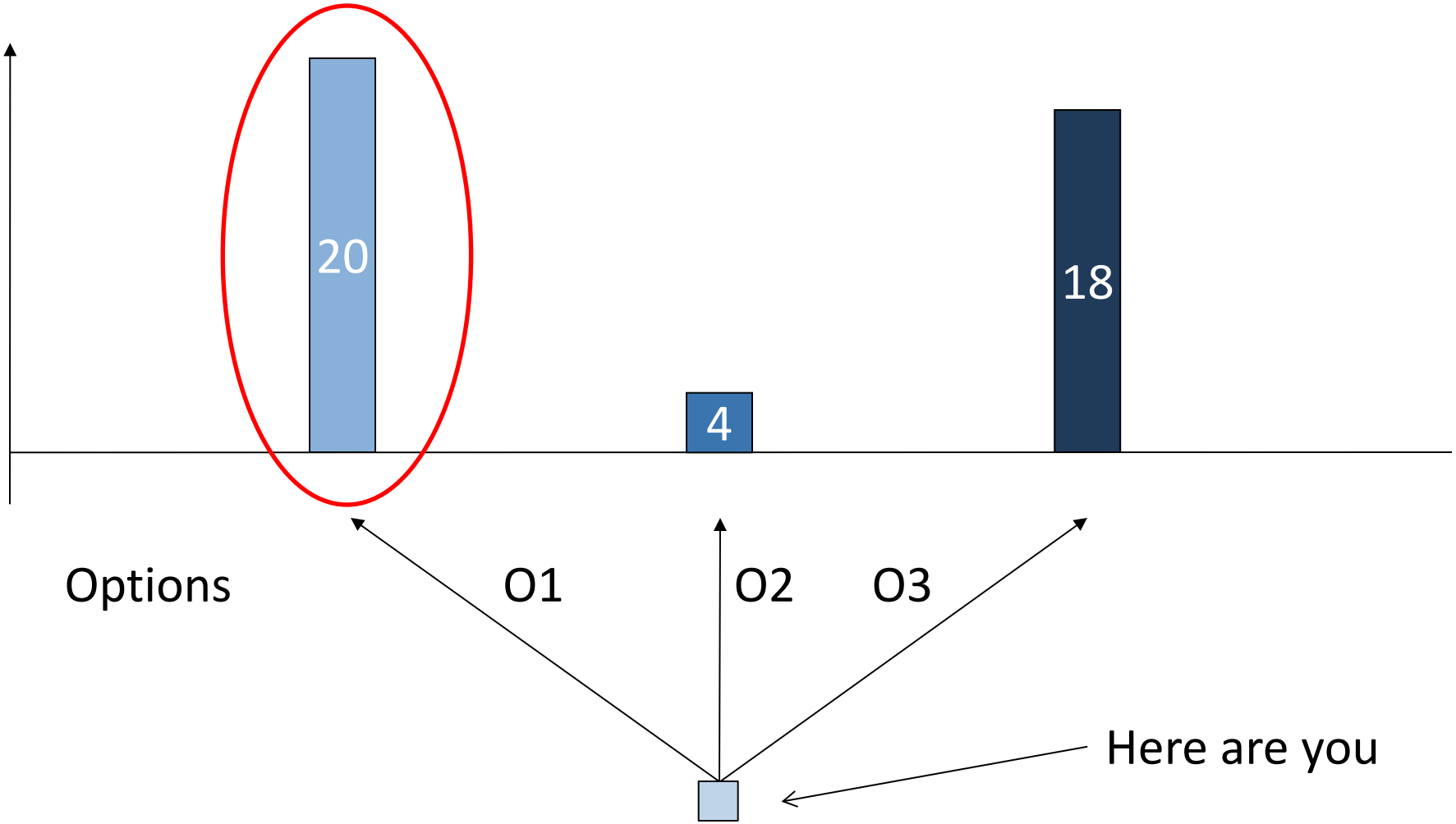

John Stuart Mill
(1806 – 1873)

One example: Mill‘s utilitarianism

Mill: utilitarianism:

One value: human welfare
One norm: An action is morally right if, and only if, it maximizes human welfare.

Illustration



Application to codes

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How do codes impact on welfare?

- Running codes produces costs. The costs should be minimized in order to save the costs.
  - Codes should be fast (short CPU time).
  - Codes should not need much storage space.
  - Codes should be reusable.
  - Codes should have broad scope of applications.

Discussion

Is it really true that morality is only about welfare?

Mill's account of science is in fact controversial. Kantians, for instance, think that there are basic human rights that should not be violated.

Application to codes

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What moral significance do codes have otherwise?

- If codes take decisions, the decisions should comply with moral standards, e.g. be just (perspective of machine ethics).
- Codes can violate human rights on privacy.

Note

The consequences of morality of codes, programming etc. are now investigated in some special branches of ethics:

- Information ethics focuses on the production and use of information.

  See e.g. Bynum (2018)

- Data ethics is focused on handling data.

  See e.g. Floridi & Taddeo (2016)

- Computer ethics concentrates on work done with computers.

  See e.g. Bynum (2018)

- Ethics of algorithms deals with algorithms.

  See e.g. Kraemer et al. (2011), Mittelstadt et al. (2016)

These branches of ethics overlap and are to some part not yet settled disciplines.

Summary

1. Talk about good codes, best practice etc. involves value judgments.
2. Value judgments guide choice and action and can be given justification.
3. The justification appeals to norms or evaluative standards.
4. Norms or evaluative standards derive from the function of a thing, a practice or moral values.
5. In the case of codes, the function of codes, the idea of science and moral values and norms are decisive.
6. What the very idea of science implies is investigated in philosophy of science; moral values and norms are systematized in ethics.

References (incl. overview articles)

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