Mathematics & Society: Ethical and Professional Aspects

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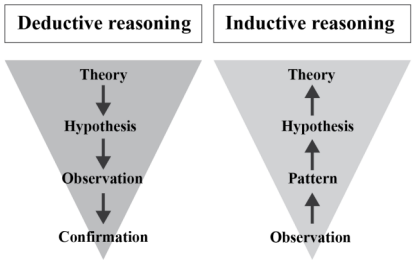
Contents

Chapter 1

Question 1: What is truth
Question 2: How can we ascertain that something is true? This is called:
Epsitemology: the study of the nature and origin of knowledge.
Science is ordered by: Question, hypothesis, experiment, analysing, conclusion.
2 Different ways of reasoning:



Rationalism: Knowledge based on ideas, props, pure reason
Mathematical modelling, application.

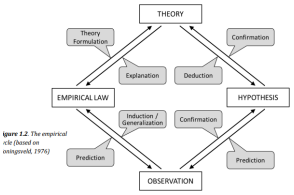
Empiricism Knowledge is ultimately acquired through sense experience.

- John Locke (1632-1704), tells us that everything starts from tabula rasa: blanke slate. Born with knowing nothing and all ideas have origin in experience.
- David Hume (1711-1776):
  - A priori reasoning: reasoning independ. of exp.
  - Posteriori resoning: producing reasoning from understanding of relations and ideas.

induction: argument using pattern of observations to draw a conclusion.
Problem of induction: Assuming that future will always be the same way as past.

Logical positivism/logical empiricism: all problems can be solved by science.
Vienna circle: Group of 20th century philosophers and scientists, inspired by greatest successes of their times.

Standard view by empirical cycle:

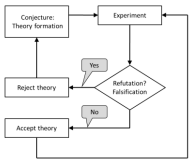


Eperical laws: based on facts indep. of theory and personal view researcher.
Theory: needed for explanations
Hypotheses, reallity derived from theory, predictions based on.

Refutation and confirmation: First formulate a theory with general statements, then derive singular statements from thesse in a logically valid way.
It must be possible to reproduct result.

falsification: Theories and hypotheses are falsifaiable when it is possible to refute or falisfy the theory with observations or derive testable statements from it.

Corroboration: The theory holds, for the time being at least.



Theory-laden observation: To describe an observation, you need some form of framework

Thomas Kuhn:
Normative Do not understand
Descriptive analysis: truth seeking. Paradigm: Framework. Normal science: Kuhn's frame work.
Crisis: can arise after a lot of anomies on the science. Anomies is misfit of data.
Non-rational:Do not understand.
Scientific revolution: Few scientists may hang on the old paradigm, but majority proceeds with the new.

Science & Technology studies (STS), Studies on the way in which scientific research is actually carried out within a societal context.
Undertermined theorem: it is formulated more broadly than the empirical evidence

allows.
Constructivism: The uncertainty of theorems, makes it possible for researchers to play an active, constructive role.
Interpretative flexibility: a brief or lengthy controversy about the accuracy of a researcher's claim.
Relativism: no universal objective truth and that scientific knowledge thus reflects the prevailing culture.

Mertonian Norms: norms stated by Robert Merton:

communism common ownership of scientific knwoledge.

universalism Truth of scientific statements, based on objective observation, logical consistency

disinterestedness scientists product their results without influence from emotional, ideological, commercial or other interests.

organised scepticism requirement of consumers to accept facts an theories not too rapidly.

Metascience: puru=puse is intervening and improving science
Open science: entire scientific community acklowadges and propagates openness, transparaency, rigour, reproducibility, replicability and accumulation of knowledge.
Replication research: Allows us to exactly repeat experiments.

Mode 1: linear model: First step is fundamental research, then application development and introduction to society, followed by ensuring adoption by society.
Mode 2: knowledge product/contextualised science: context is a factor.

Characteristics	Mode 1	Mode 2
Choice of social issues	From a science discipline	From parctical issues or applications in society
Nature of knowledge	Disciplinary; inter- or multi-disciplinary: based on premises of one or more scientific/academic disciplines	Transdisciplinary; encompaasing principles with a discipline and, more pragmatically, approaches outside it
Location research	within Universities, academic institutes	within & without universities/academic institutes
Nature of though & discussion process	Strongly objectifying, rationalising and reductive: societal considerations exc. as far as possible	strongly reflective: hypotheses own interests, societal views etc. also play a role and made explicit
Quality assessments	fellow res.	acamedic & societal actors

Chapter 2

Policy: preferred course of action, with the desired consequence of solving a problem.
Politics is about the distribution of power.
David Easton, defined politics as "authoritative allocation of values."
value: something that is important to sociey.
Authoritative: refers to fact that politics is related to power.

Trias politica: System to distribute power.

Legislative power Make laws

Executive power Execute laws

Judical power reviews the laws

Fourt power Bureaucracy item[Fifth power] Science and/or media.

Government: main body or institute that runs country/state/province.
governance: process that "do not rely simply on power politics or markets, although it may well include either or both. In democartic, pluralistic societies it will involve action by multiple intermediate voluntary associations, from churches to labour unions and culture organisations.

dualist position: Strictly seperation between science and politics/policy.
Politicised position: Politics/policy served by science.
Technocratic position: Politics/policy driven by science.
Interactive position: ensure science remains indep., can develop, testable, transparancy. Furthermore it ccontributes to politics.

Policy cycle:

1. Agenda Setting: determination whether public policy problems should enter policcy cycle.

2. Policy formulation: process of generating a set of plausible policy choices capable of addressing problems identified during agenda-setting.

3. Decission-making: Policy makers have to select course of action.

4. Policy implementation. Policy implemeneted in society, we need enforcement: measure to ensure that policy is actually implemented and monitored. 4 different public policy instruments can be used to achieve goal:

(a) Commutative: Inform actors about possible consequences of certain actions.

(b) Legal: set up juridical norm (law) to enforce an actor into certain behaviour

(c) economical: Financially stimulate them to comply with desired change in behaviour (taxes).

(d) Physical: for example garabage bins.

5. Policy evaluation: Determine whether policy produces desired results.

Societal consensus		***Scientific consensus***	
		Low	High
	Low	*unstructured problems / wicked problems* *Policy as a learning process* *Science as a problem source* *Example: climate change*	*moderately structured societal problems* *Policy as pacification* *Science as a mediator* *Example: euthanasia*
	High	*moderately structured scientific problems* *Policy as negotiation* *Science as an advocate* *Example: traffic safety*	*structured problems / tamed problems* *Policy as regulation* *Science as a problem-solver* *Example: road maintenance*

- Structured/tamed problem: high degree of scientific and societal consensus. Littel debate, clear how tt be tackled. Science is primarily problem solver that serves policy.
  Pure scientists.

- moderatly structured scientific problems: lack of certainty/consensus regarding knowledge or means required. Little disagreement in society. Controversies may arise, because applications and consequences of the research are considered problematic.
  issue advocate

- Moderately structured societal problems. great deal of societal discussion, unproblematic in terms of knowledge or science as the know-how in there. Science often mediator in such problems.
  For example military applications.
  Scince arbiters: mediator between different societal groups.

- Unstructured problems/wicked problems: lack of consensus regarding goals, norms, values. Science can not give a clear solution. Sometimes if they provide

an answer, it contradicts other scientifists.
Honest brokers of policy alternatives with "desire to clarify, sometimes expand the scope of options available for action as to empower the decision maker".

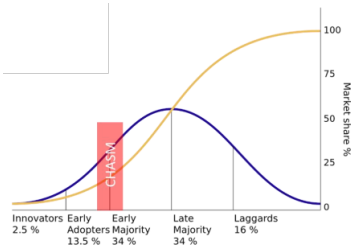
Chapter 3

Knowledge and understanding: consequence of science, products: consequence of technology.
Technology: refers to methods, systsems, devices, which are results of scientific knwoledge being used for practical purposes.
Evolutionary model: cycle of variation and selection. 5 different selections for technology:

1. Relative advantage: advantage to what it replaces
2. Compatibility: how much compatible with adopters past experience, values, other technologies.
3. Complexity: how easy to use?
4. Trialability: "Try before you buy?"
5. Observability: Can you first observe the benefits by other users?

2 types of reasons to produce:

1. Technology push model: Technology is produced/manufactured, after which it is pushed by marketing and sales out into the market. For example transistor
2. Market demand: market is source of ideas for direct research and development.



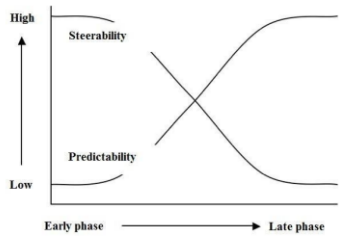
. Chasm: transition from heavy (personal) investment without ceertainty of commercial success.

Technological regime: The influence of earlier technologies on the development of new technology.
Technology trajectory: The certain direction a technological regime leads to.
Path dependency: the trajectory the development of technology is forced to, because of the dependence on previous technology.

Socio-technical regime: regime where scientific development and new policies are

subject to locks in. The small steps in innovation are called incremental innovation.
Radical innovations: innovations that overthrow a technical regime.
Niche: available resources, room for experimentation (Most of the time really specific)

Collingridge Dilemma



Technology assemsment: allows us to analyze new or existing technogolies based on possible conseq. We automatically talk aobut risk. We identify 5 dilemmas regarding risk assesment:

1. Fact-value delemma: risk assesment can not be wholly factual and wholly sanctioned via democratic process because moral considerations also need to be considered.

2. Standarization Dilemma: We want standardization, but special conditions are put forward by spec. stakeholders/actors

3. COntributors dilemma: many pot. hazards may not be investigated: A,B both not safe, but maybe safe together

4. De minimis Dilemma: What is safe enough

5. Consent Dilemma: People most affected, are least to give consent.

Chapter 4

Values: standards of intrinsic qualitative worth
Norms; rules and expectations that quantitively/normatively specify how people should and shoul dnot behave in various social situations.
Public norms: apply to everone (ofter forced legal/social conventions)

Deontological ethics: study of morality as duty.
Moral rules are supposed to be universal laws. Duty-baesd ethics, principle based ethics
Not based on consequneces, purely on the basis whether the act itself complies with a certain principle.

Categorical imperative: treath others as how you also wish to be treated.

Consequentialism rightness depends solely on its (intended/foreseeable) consequences.
Utilitarianism, invented by Jeremy Bentham, we look at the utility principle: Action is moral if it leads to greatest benefit, happiness, welfare of greatest number of people.

Virtue ethics emphasizes virtues or moral character. Mostly concerned with question, what sort of person should i try to be. Virtue: possitive, vice: negative

Too little (vice)	Mean (virtue)	Too much (vice)
Cowardice	Bravery	Foolhardiness
Stinginess	Generosity	Profligacy
Self-ridicule	Confidence	Boastfulness
Apathy	Calmness	Short-Temperedness

Ethics of care: stressed compassion and empathetic understanding.
Moral community: based on which ethical theory you use. We have 2 groups:

Moral agents morally accountable for their action, atuonomous actors

moral patients non-accountable parties, but interests and positions are at stake.

medical ethics: oldest sub-discipline of bioethicts, the "do not harm", and "action that is done for benefit of others", and the balance tween them are most important principles.
Animal ethics: Evolved by claiming that the ability to suffer is keypoint.
Environmental ethics: the moral dimensions of relationships between humans on one hand, and non-human nature on the other hand.

Cyberethics: study of moral, legal, social issues involving cybertechnology.

Science ethics: ethical responsibility of scientists as addressed on glabal level
Research ethics: ethics of planning, conduct, reporting of reserach.
Reserach subject projection: Universal agreement that science should be performed for legitimate purposes only.

Scientific misconduct: willful lack of intention to strive for honesty and integrity.
So banding game-rules to cheat the system. Manly 3 major types: fabrication of data, falsification of data, plagiarism (FFP)

Questionable practice: Area where it does not clearly fall into misconduct, but obviously not things that an integrous person would do.
Integrity of scientific knowledge: Scientists must truts the reporting of published authors.

Responsible conduct of research.
Scrupulous person: working precies, neat and careful manner.
Transparency: related to scrupulousness and honesty. Research is transpareant, if all research parameters are suff. clear to other scientists.
Scientists should act responsible.
Moral responsibility: willingness to account for actions or decisions and draw conclusion from this.

Chapter 5

Responsible research and innovation (RRI): guiding concept at EU level, to orient research and innovation ntowards societal needs and being reflective towards its societal role and mission. Involves:

1. Public engagement (PE) cocreating fucture, with widest possible diversity of actors that would not noramlly interact with eachother, on matter of science and technology.

   Deficit model:Do not understand
   Dialogue model: one-way mode of communication between science and society.

   Use of Civil society organizations: Organizations that are non-governmental, non-for-profit, not representing commercial intersets, and that pursuea common purpose for the public intersets.
   User involvement:
   engagement of users in product development. There are diff. methods (ethnographic observations. user behaviour)
   participatory design processes: sharing knowledge, experience and insight.

   Science shop: to democratize science, you can "buy" the knowledge of scientists, which can freely use the material of the shop.

   Must pay attention to sutsainability in currect research.
   Sustainability development goals, stated by UN in 2015. Set of long-term sustainability goals.

   Planetary boundaries: concept with ambition to quantify and map out impact of humankind on planet earth.
   Doughnut economy: exp. notion of planetary boundaries with similair approach to fund needs of society (equal., health, educ.) Upstream public engagement: involving public stakeholders right from start of innov. in order to integrate knowledge and expect.

2. Open access, open data, open research
   Open science: process of making content and process of producing evidence and cliams transparent and accessible to others.
   Open character of science: open access: practice of making reserach findings available free of charge for readers.
   Example: Open educational resources.

Open data: Open access beyound application that outline reserach findings to data fundamental to reasearchl. Should sere as an enabler of barrier-free knowledge discovery.

Fair:

- Findable: both humans, automated processess should be able to locate data. Now and in future.
- Accessible: no barriers of any nature should hinder finding and using.
- Interoperable. Data should be ready for combination with other data.
- Reusable: data stored and offered s.t. it serves use in range as wide as possible.

Open science largely considered functional and linked to demands for improved efficiency.

3. Gender equality.
4. Ethics
5. Science education.