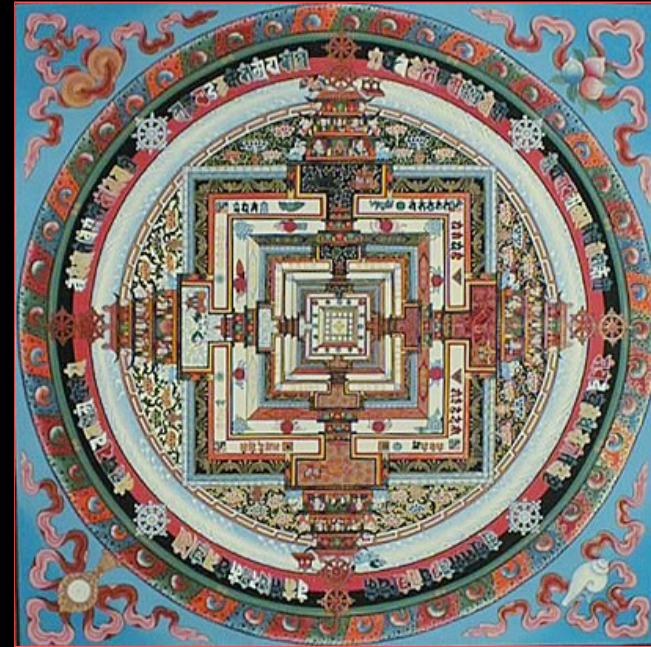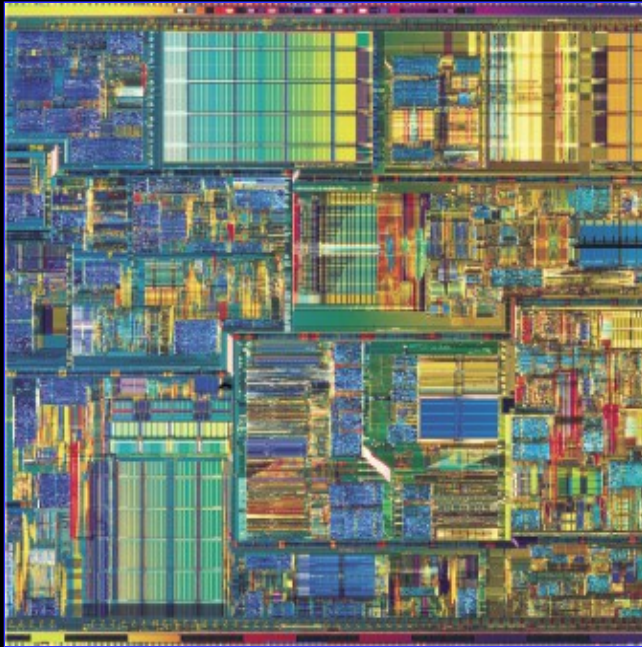# La tecnologia non e' un destino

Milano, 14 Novembre 02019

Norberto Patrignani

"La tecnologia non e´ un destino"
Norberto Patrignani, Docente di Computer Ethics,
Scuola di Dottorato, Politecnico di Torino

Da oltre sessanta anni la cosiddetta "intelligenza" artificiale preme sulla societa'
per trovare applicazioni che abbiano un senso.
Oggi la disponibilita' di immense basi di dati e potenze di calcolo
permette di calibrare con piu' precisione gli algoritmi e trovare interessanti "correlazioni".
Come evitare di confondere le "cause" con le "correlazioni" ?

Le imprese possono essere supportate dalla tecnologia nelle loro "scelte",
ma possono le "scelte" essere ridotte a "decisioni" algoritmiche e delegate alla macchina?

Come possono le imprese socialmente responsabili usare un approccio
"Slow Tech" (un'informatica buona, pulita, e giusta)
come "bussola euristica" per orientarsi verso strategie di innovazione
socialmente desiderabili, ambientalmente sostenibili e eticamente accettabili?

Se etica significa ricercare dei criteri per una "scelta" tra giusto o sbagliato,
e' forse tempo di assumersi la responsabilita' di dire
cosa puo' e cosa non puo' essere automatizzato?
La tecnologia non e' un destino.

Global CO$_2$ Emissions
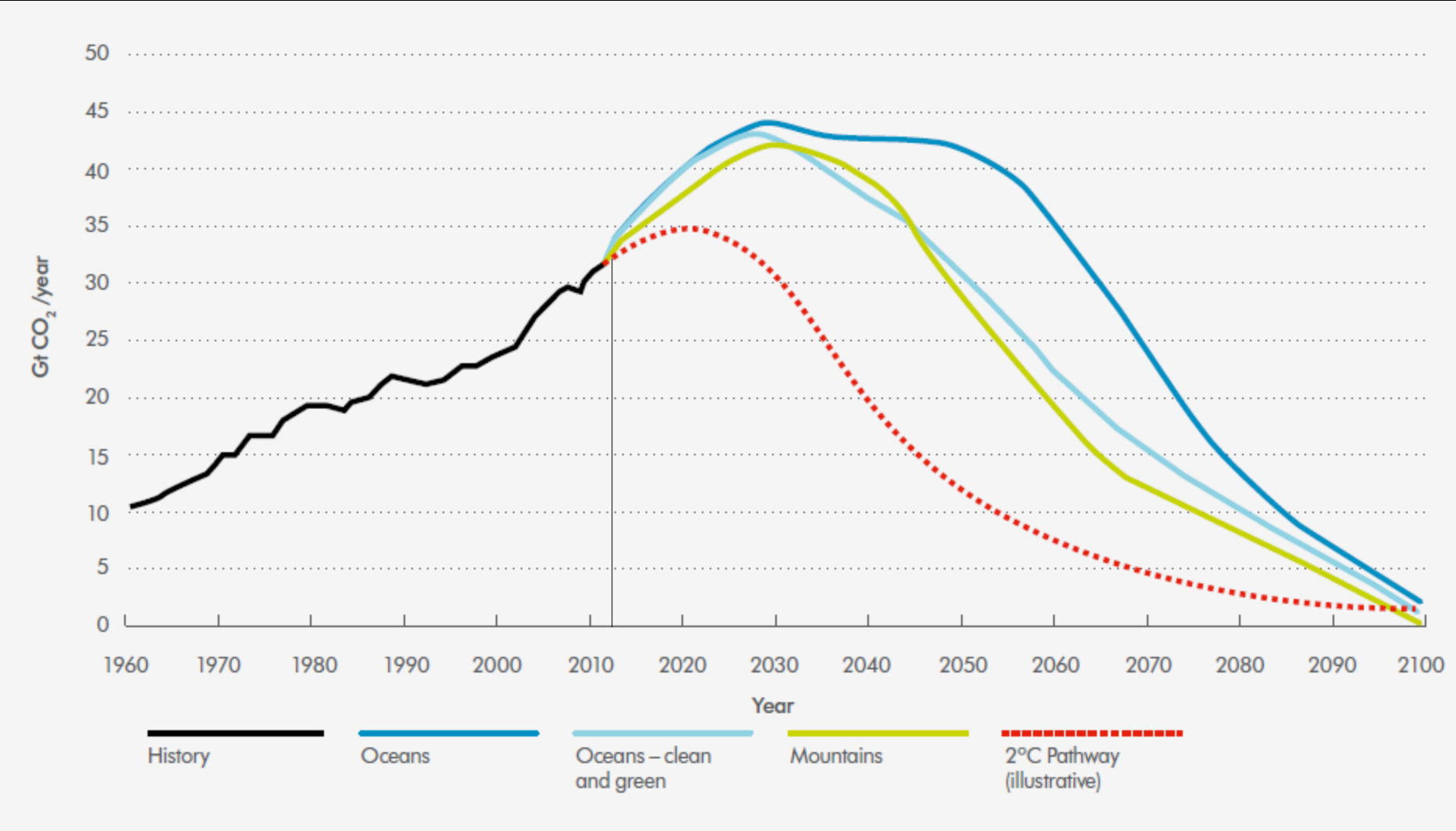
Computer Ethics
History

Norbert Wiener
(1894-1964)

Joseph Weizenbaum
(1923-2008)

Source:
Wiener N., "Cybernetics: or Control and Communication in the Animal and the Machine", 2nd ed. Cambridge, MA: MIT Press, 1948
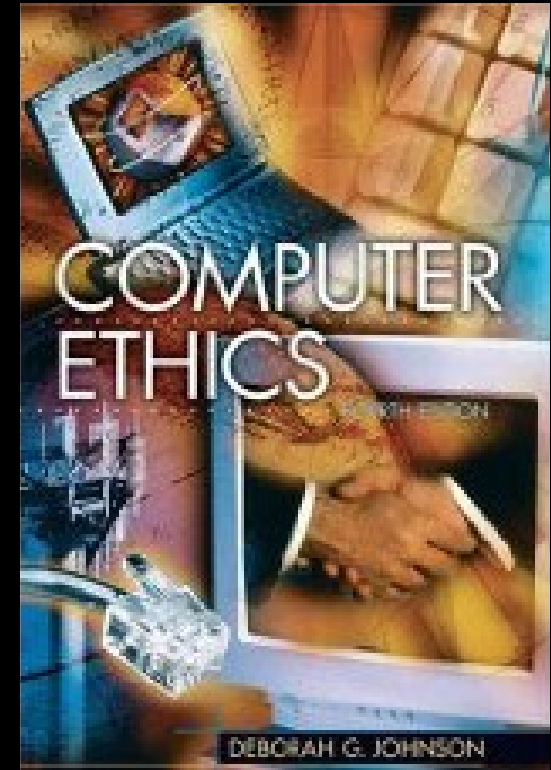Wiener N., "The Human Use of Human Beings. The Riverside Press (Houghton Mifflin Co.), 1950
Weizenbaum J., "Computer Power and Human Reason: From Judgment To Calculation", Freeman, 1976

1985: Deborah Johnson
Computers as *Socio-Technical Systems*

Deborah Johnson

"Technology is NOT neutral, technology and society co-shape each other"

Deborah Johnson, 1985

Data-Information-Knowledge

Causation vs Correlation
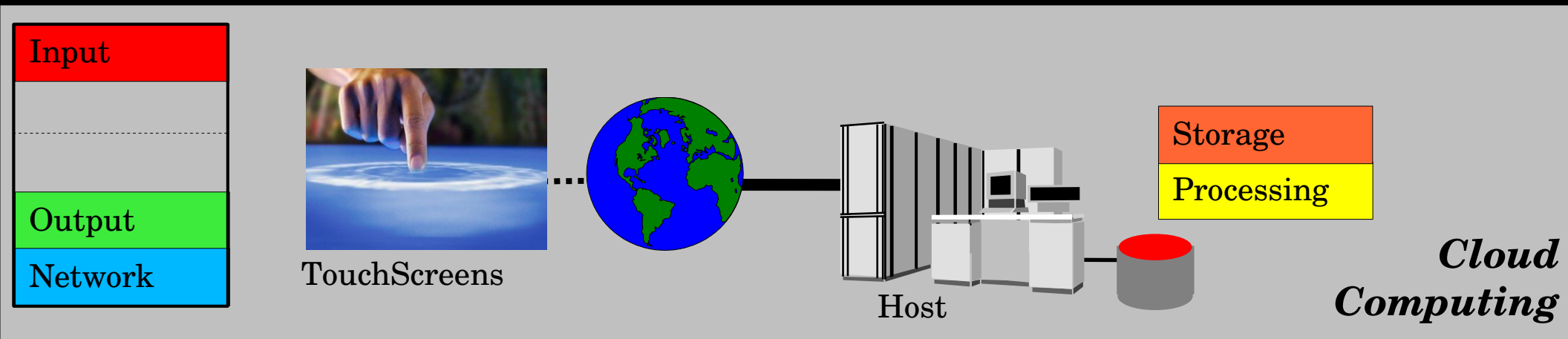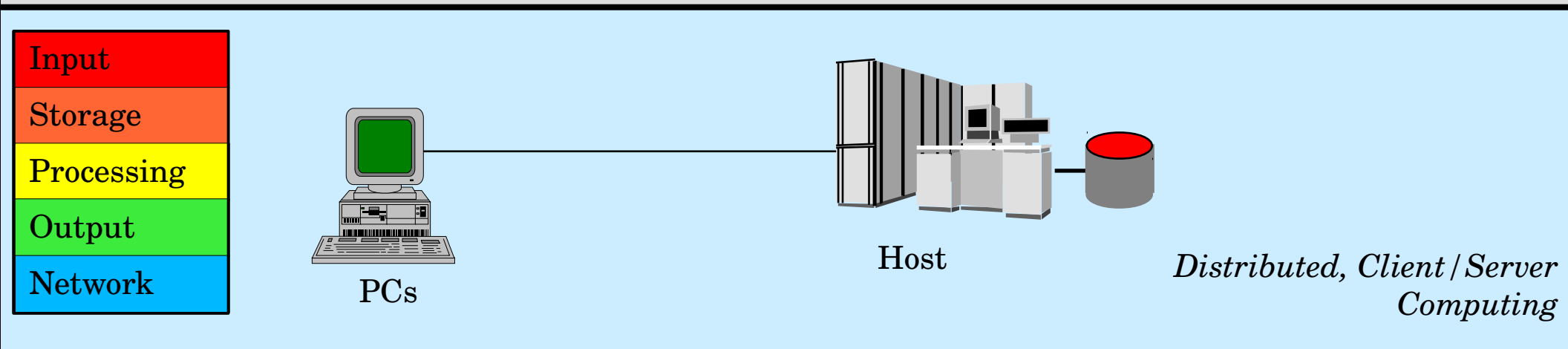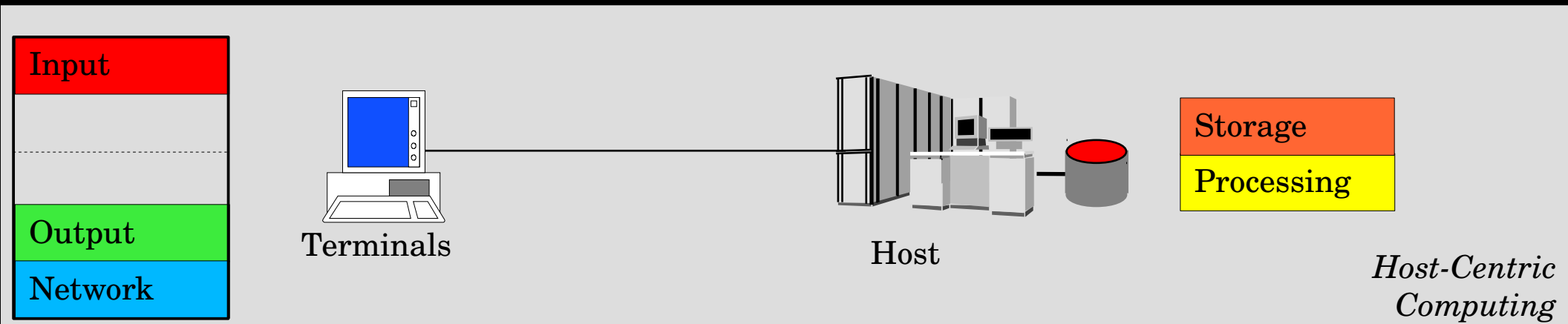
Choice vs Decision

Slow Tech

Data-Information-Knowledge

Causation vs Correlation

Choice vs Decision

Slow Tech

Cloud Computing: Back to the Future

T2x

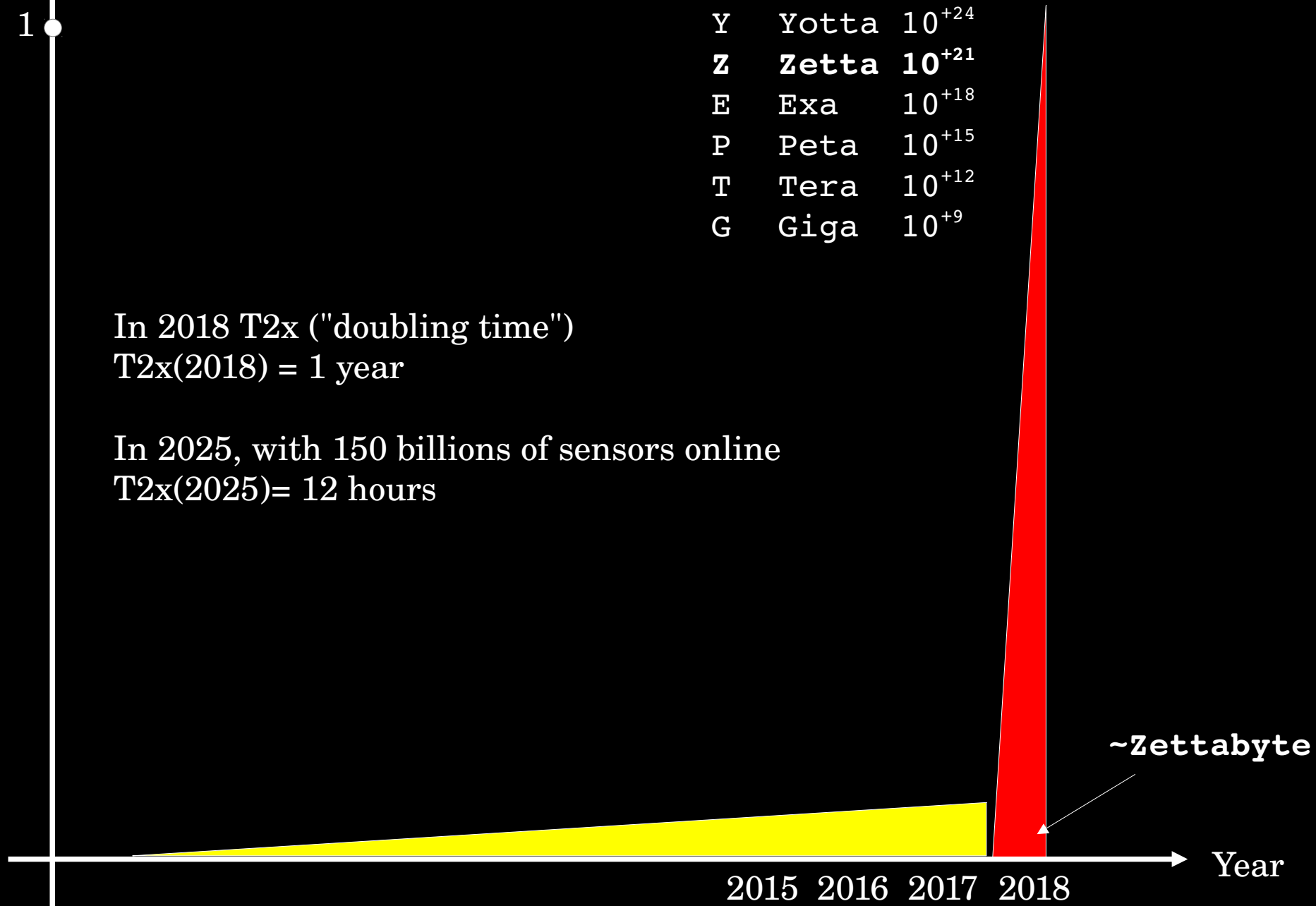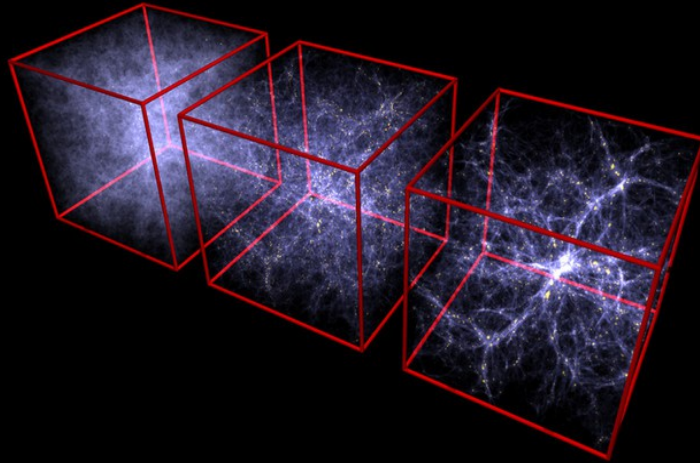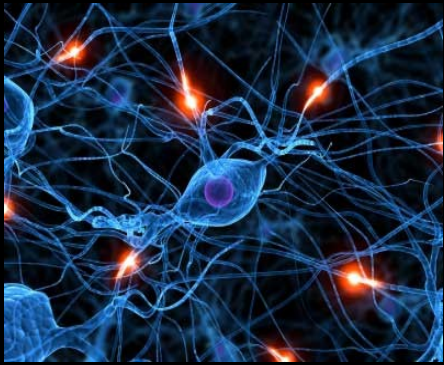| Y	Yotta	10^{+24}
Z	**Zetta**	**10^{+21}**
E	Exa	10^{+18}
P	Peta	10^{+15}
T	Tera	10^{+12}
G	Giga	10^{+9}

In 2018 T2x ("doubling time")
T2x(2018) = 1 year

In 2025, with 150 billions of sensors online
T2x(2025)= 12 hours

~Zettabyte

2015 2016 2017 2018

Year

Knowledge
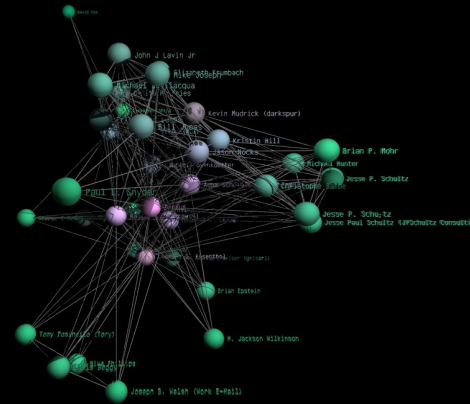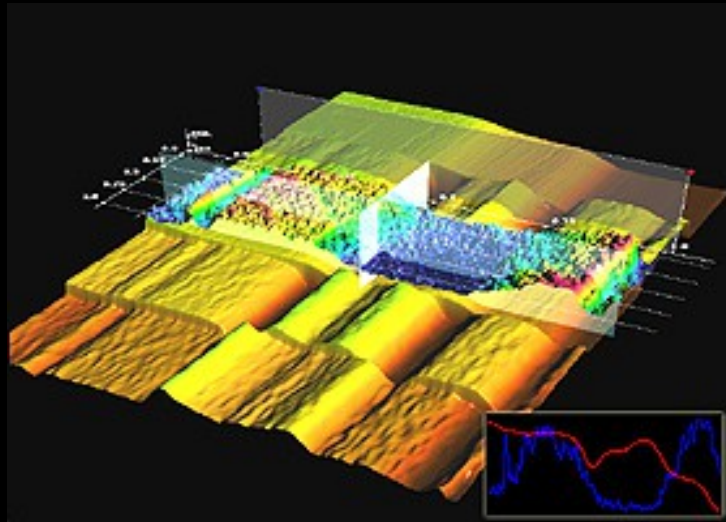
Information

Data

Data vs Information vs Knowledge

Data =

- Data in itself **does not have a meaning**
- a collection of bits in memory in a agreed code
- "*records* (or descriptions or memories or trace) *of events* (or objects)" (Bateson, 1972)
- "*the recording* in an agreed code of the *measurement* of certain attributes *of an object* (or an event)" (Melese, 1979)
- data is an (imperfect) *representation of reality* (it is not reality), it is a *human construct*, subject to *biases*, limitations,...
  - what is "*irreducible to encoding*" is lost (*the map is not the territory*)

Data

data is an imperfect representation of reality

- random errors
    broken equipment
    human mistakes

- systematic errors
    selection bias (*analysing twitter when most of us do not twit*)
    social desirability bias (*participants do not report a choice due to
                            perceptions that this is the unpopular choice*)

- errors of choosing what to measure
    think you are measuring one thing, but
    in fact you are measuring something else (*looking for top job candidates,
                            preferring those who went to top universities*)
    looking for data where it is more easy to find them (*drunkard joke*)

- errors of exclusion
    populations are systematically ignored in datasets (*making inferences about apples
   from data about oranges*)

usefulness of data and science comes
not from the fact that it's perfect and complete,
but from the fact that we recognize the limitations of our efforts

Information =

- data that has been **contextualized**, interpreted and that **has meaning**
- "*any difference which makes a difference in some later event*" (Bateson, 1972) (*)
- data that makes a difference, a message that changes the way the recipient perceives something
- any signal message or perception that **has an impact on the behavior of recipient**

Information
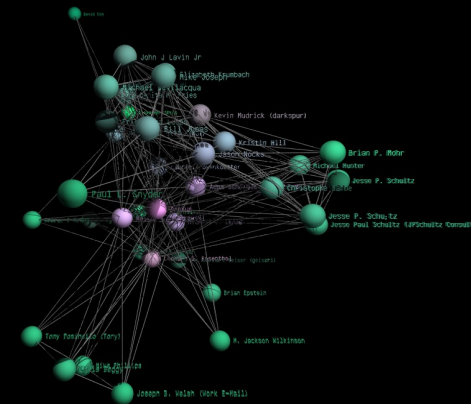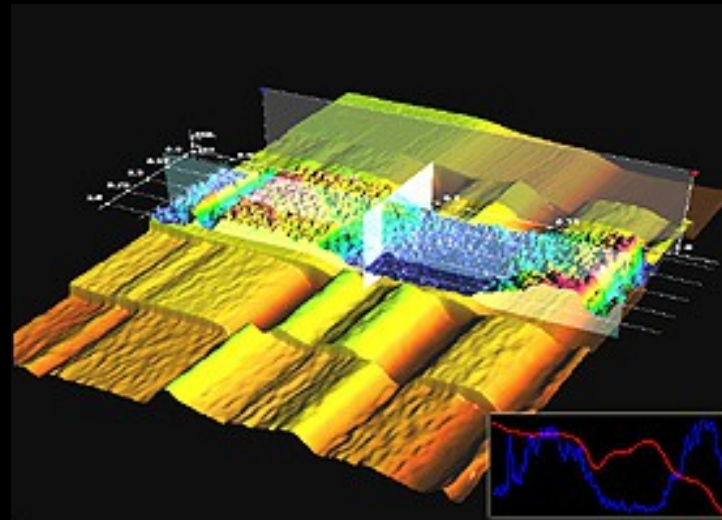
"*Information is neither Matter nor Energy, but it needs Matter for its Embodiment and Energy for its Communication*"
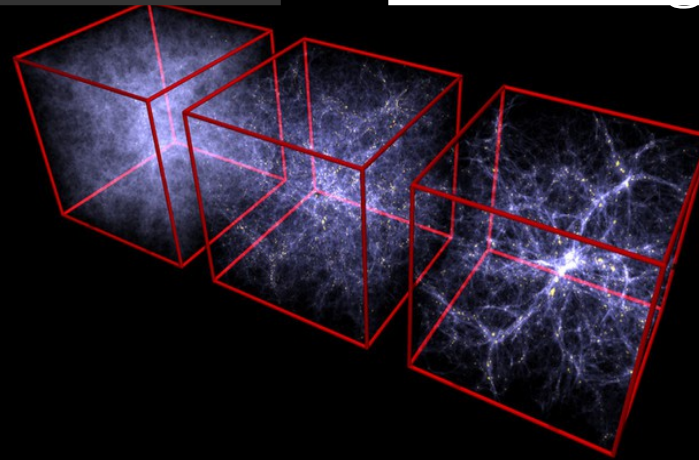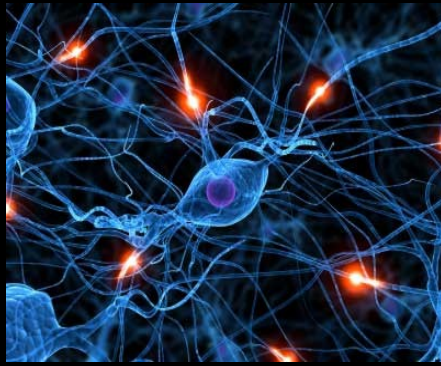Norbert Wiener, 1948
"Cybernetics: or Control and Communication in the Animal and the Machine", MIT Press, 1948

* (Gregory Bateson, *Steps to an Ecology of Mind*, Chicago University Press, 1972)
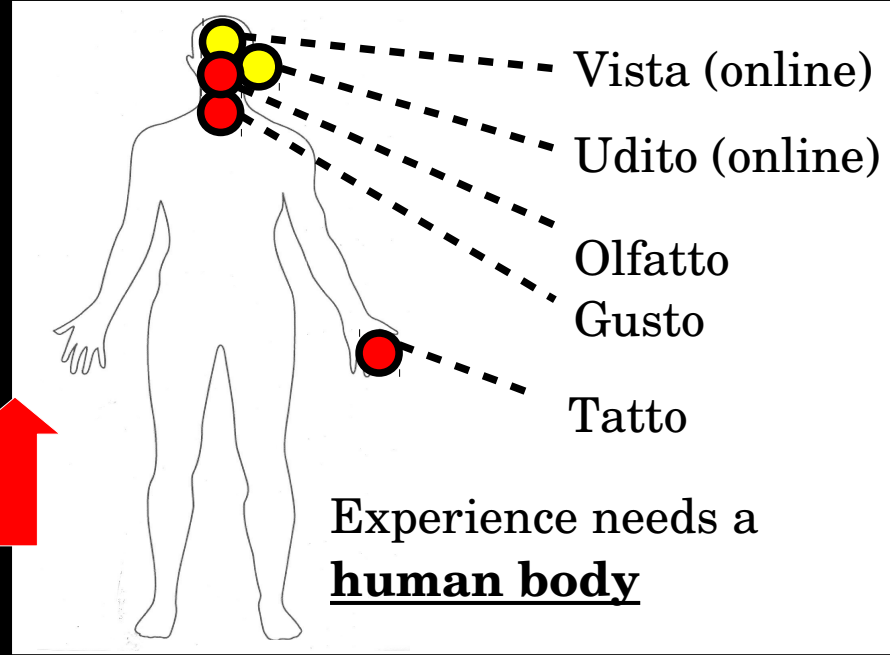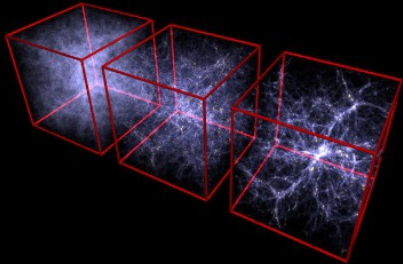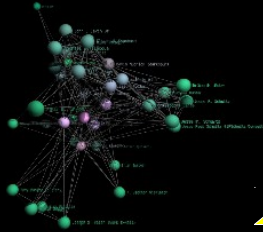
Knowledge

Knowledge =
- is based on information and cannot be dissociated from <u>**experience**</u>
- *"The only source of knowledge is experience, everything else is just information"* (Albert Einstein)
- A fluid mix of <u>**framed experience**</u>, values, contextual infomation, and <u>**expert insight**</u> that provides a framework for evaluating and incorporating new experience and information
- It is applied in the minds of knowers. <u>**Knowledge requires a subject: a human!**</u>

Information -> *Experience* -> Knowledge

Knowledge

Information

Data

Vista (online)

Udito (online)

Olfatto

Gusto

Tatto

Experience needs a
human body
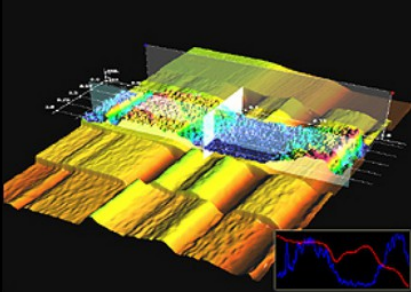
Experience

Big Data Analytics

measurement /
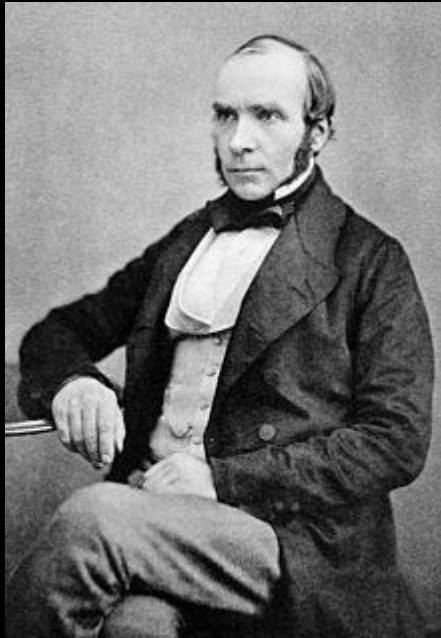data collection
IoT

Reality

Data-Information-Knowledge
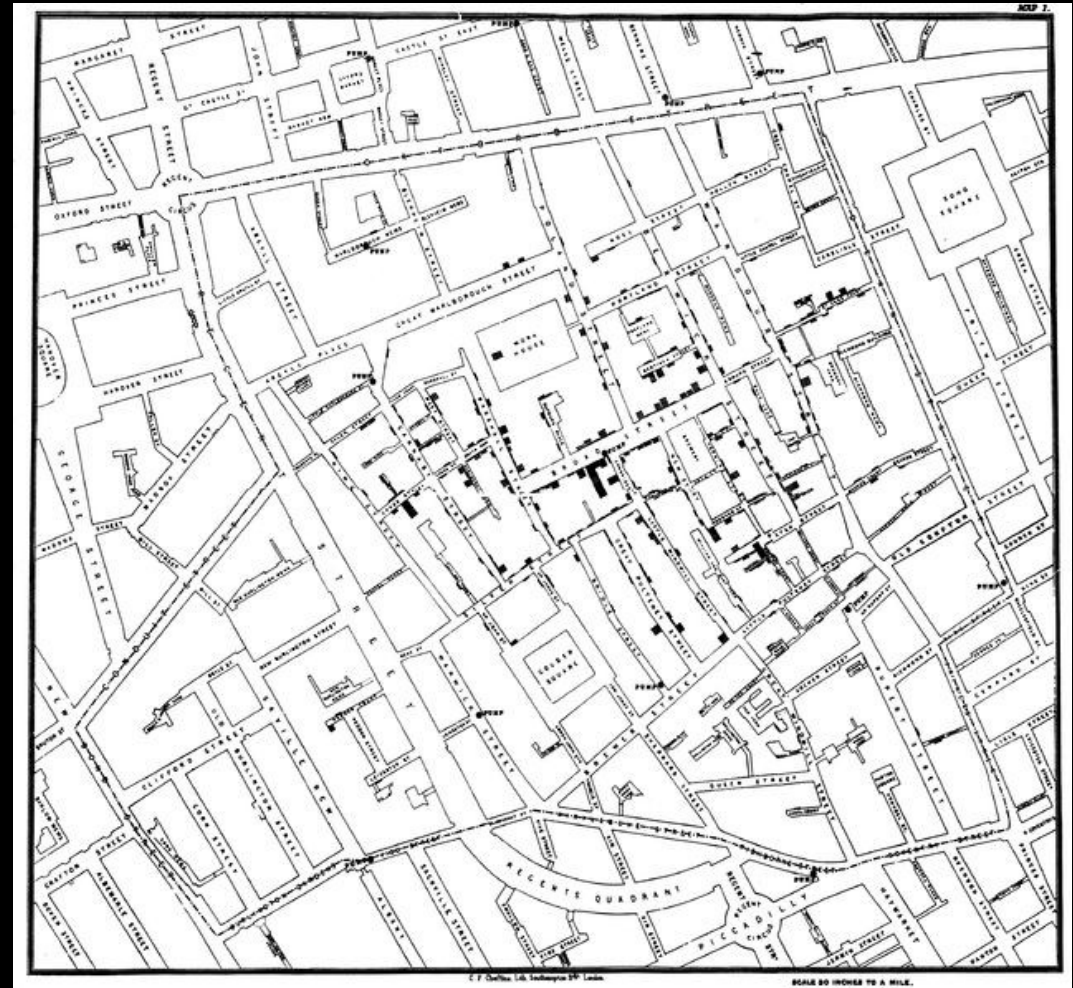
Causation vs Correlation

Choice vs Decision

Slow Tech

causation *vs* correlation

John Snow
(1813-1858)

1854, London
discover the cholera water transmission in Soho
super-imposing the maps of fountains with cholera diffusion points

causation *vs* correlation

Type 2 diabetes (T2D, 29 million in US)
- High-dimensional electronic medical records
   +genotype data from 11,210 individuals
- T2D have a variety of phenotypes
and susceptibilities to diabetes-related
complications
- 3 subgroups of T2D
1. Subtype 1: diabetic nephropathy and
   diabetic retinopathy;
2. Subtype 2 cancer malignancy and
   cardiovascular diseases;
3. Subtype 3 associated most strongly with
cardiovascular diseases, neurological diseases,
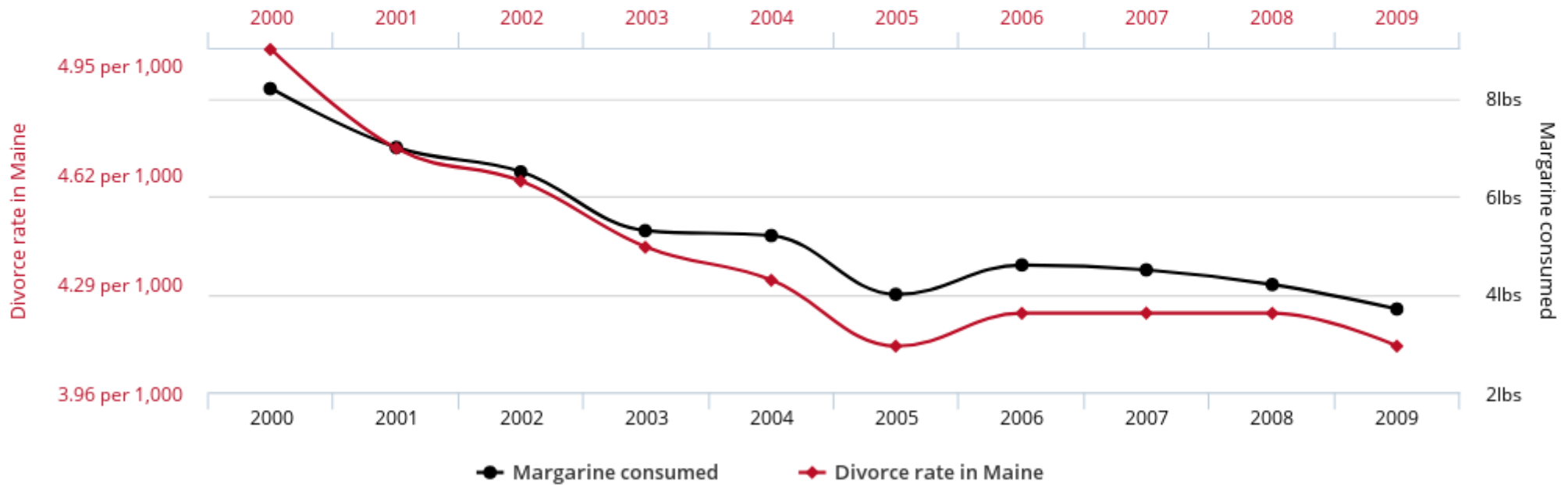allergies, and HIV infections
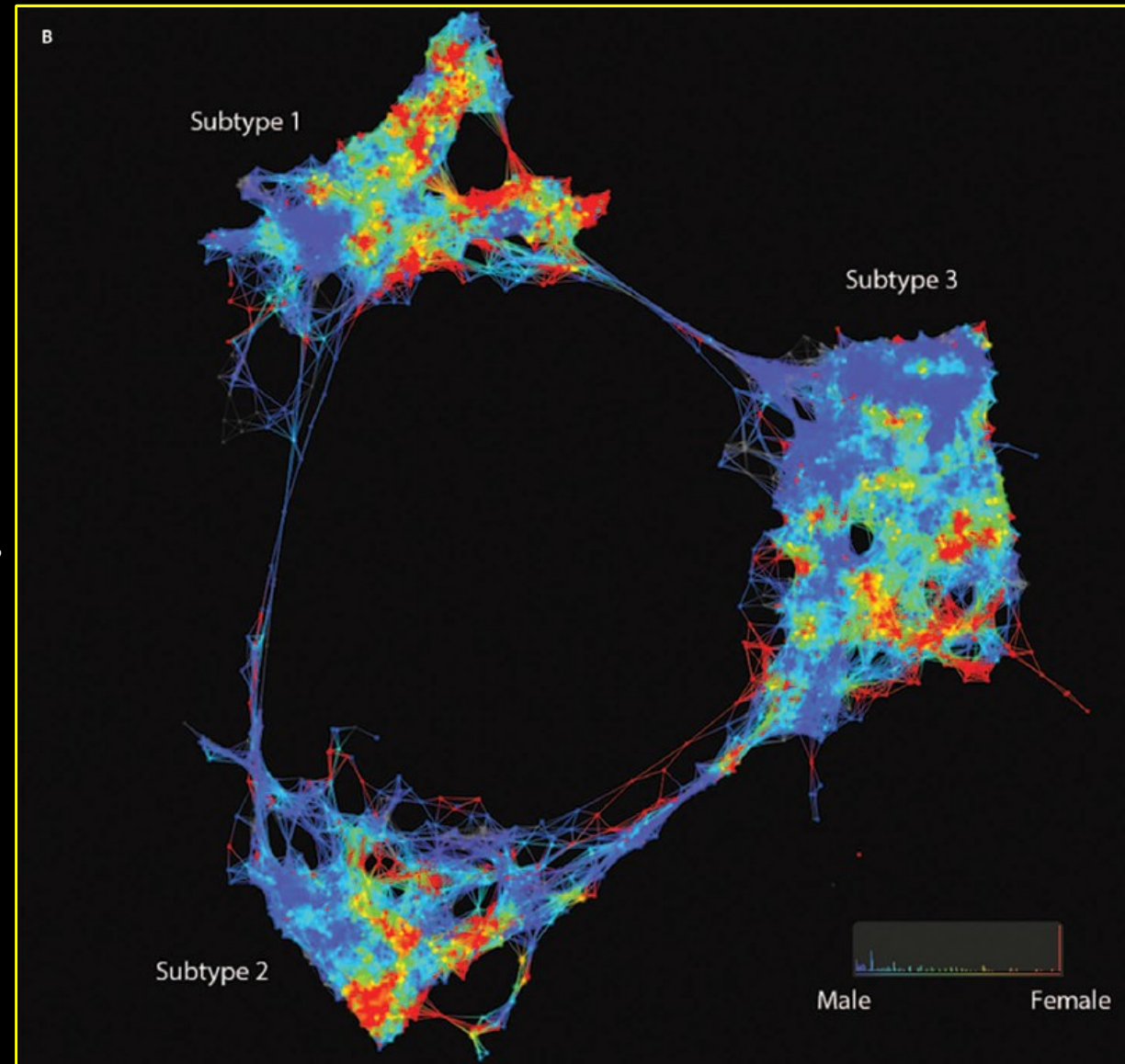
2015: AI and Precision Medicine
Topology-based Patient-Patient Networks

causation *vs* correlation

Source: http://www.tylervigen.com/spurious-correlations

causation *vs* correlation

- data doesn't *say* anything, *humans say* things, humans say what they *notice* or *look for* in data
- difference between *micro* and *macro* is not only *quantitative* (*complex systems*)
- correlation: **<u>identifies *hypotheses*</u>**
    explores, reveals unknown connections
- causation: **<u>tests *hypothesis*</u>**
    basis of the scientific method, experimental method
- **<u>*data*</u>** *is a necessary ingredient in discovery*,
you need a machine to extract **<u>*information*</u>** from **<u>*data*</u>**
but *you need a human* to select it, shape it, and then
turn it into **<u>*knowledge*</u>**, *insight, intuition, understanding, judgement, ...*

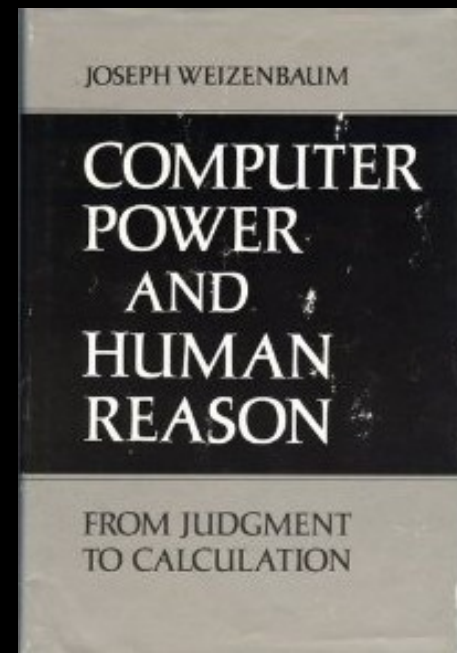> **<u>*epistemological "shift"*</u>**, *subsidence*
> - forecast -> prediction -> prescription (*automation of choices*)
> - AI systems are proposed as an *alternative to human choices*
> - AI systems must *support humans in their choices* (cobot)

Data-Information-Knowledge
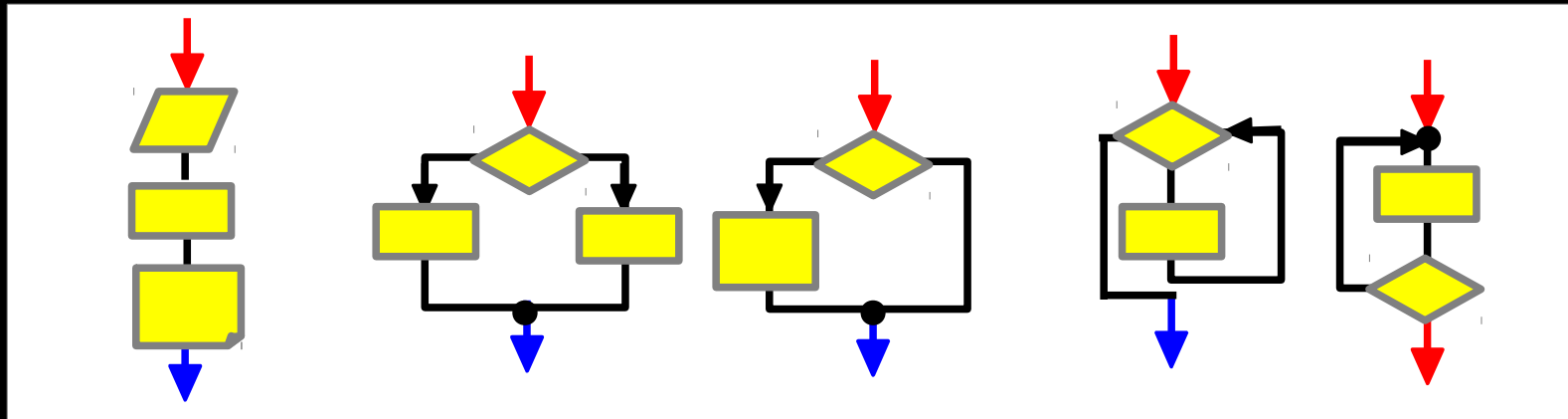
Causation vs Correlation
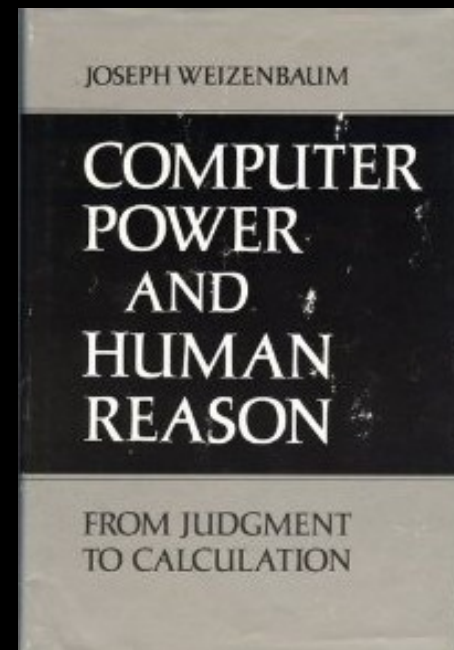
Choice vs Decision

Slow Tech

Deciding
is a Computational activity,
something that can ultimately be programmed.

Choosing

is the product of Judgment, not Calculation.

It is the capacity to Choose that ultimately makes us Human.
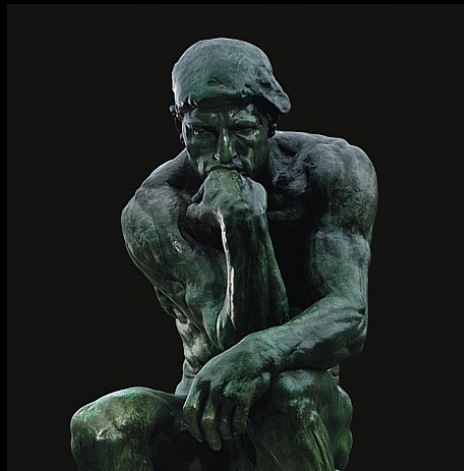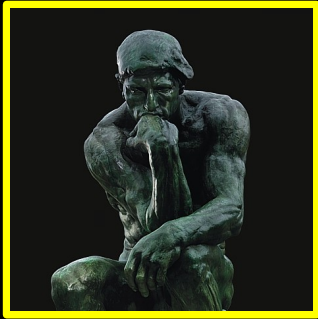
The *Choice* between *Choosing* and *Deciding* is not a *Decision*...
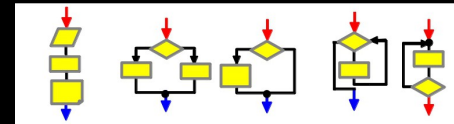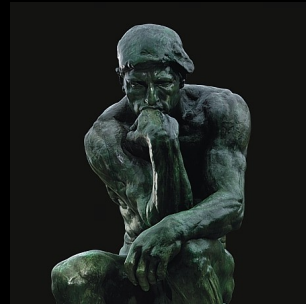
La *Scelta* tra *Scegliere* e *Decidere* non e' una *Decisione*

choice *vs* decision

Market
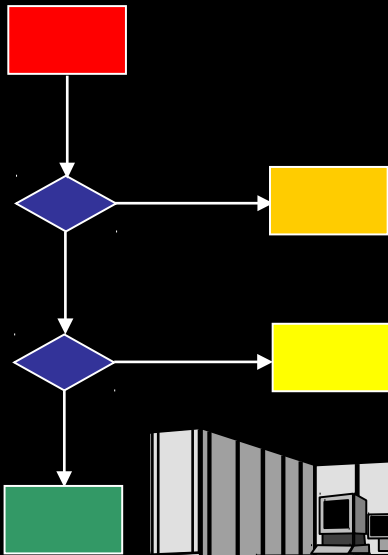
Architecture

Education

Law

Source: Lessig, L. (1999), *Code and other laws of cyberspace*, Basic Books.
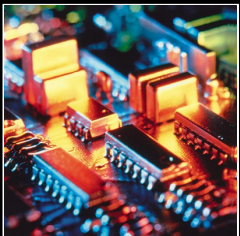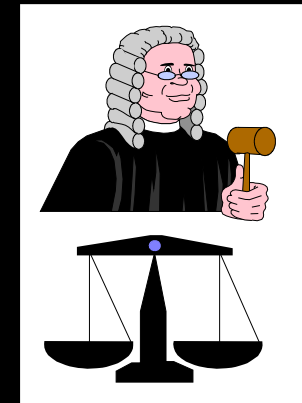
1999: Lawrence Lessig
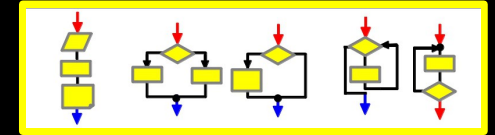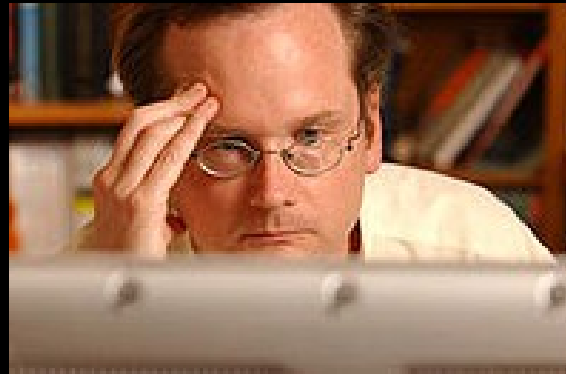

Lawrence Lessig
Harvard Law School

"Code is Law"

Lawrence Lessig, 1999

Code and other laws of cyberspace, Basic Books

2006: Torino Underground

(foto Michele D'Ottavio)

How the new Max flight-control system (MCAS) operates to prevent a stall

Angle-of-attack sensor aligns itself with oncoming airflow

Airflow

Level flight

Nose-up flight

The angle of attack—the angle between the wing and the airflow—is fed into the flight computer. If this angle rises too high, suggesting an imminent stall, the MCAS activates.

Horizontal tail

Source: Travis Gregory, How the Boeing 737 Max Disaster Looks to a Software Developer, IEEE Spectrum, 18 April 2019
Source: Norebbo.com
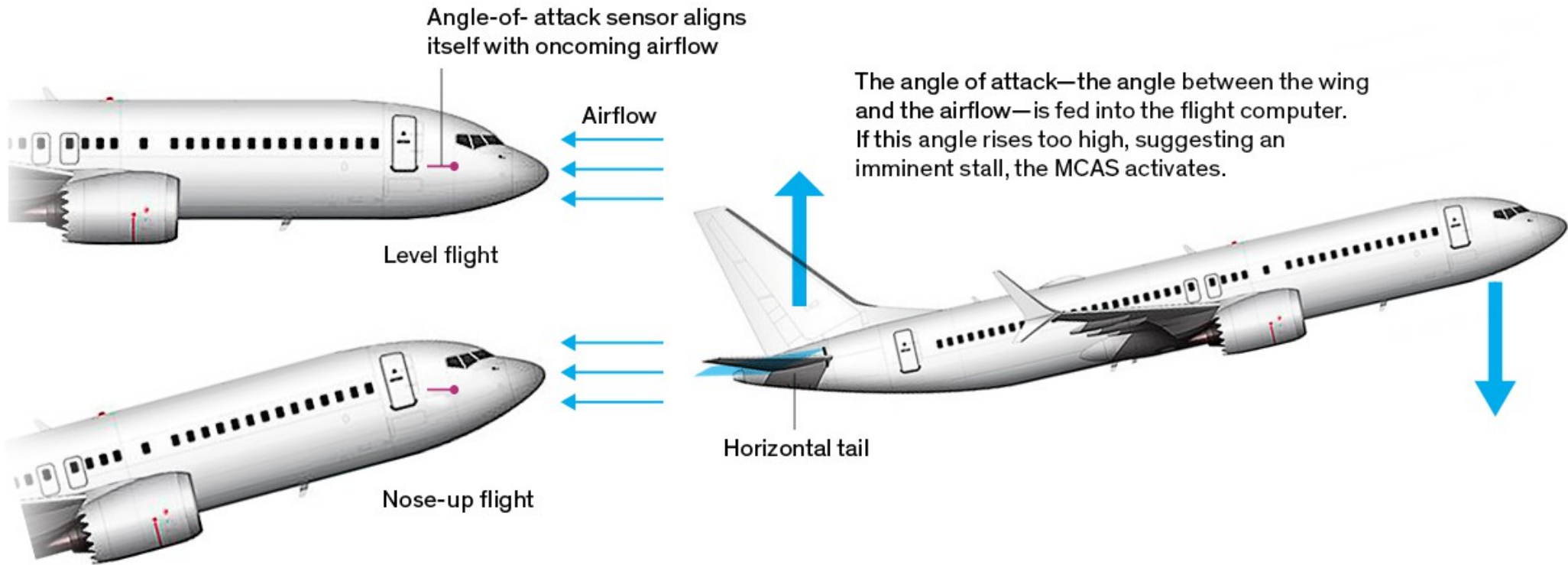
Data-Information-Knowledge

Causation vs Correlation

Choice vs Decision

Slow Tech

2018: Slow Tech
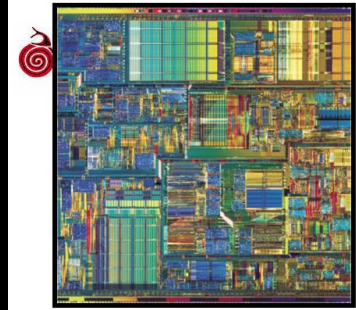
- A '*heuristic compass*'

for the Design of Systems with the three elements of
Slow Tech: *Good*, *Clean*, and *Fair* ICT

"*... a new starting point
for <u>systems design</u>
...based on a <u>long-term view</u>
of the <u>desirability</u> and
social importance of technologies,
their <u>environmental impact
and sustainability</u>,
and the <u>fairness</u> and equity
of the conditions of workers*"

Norberto Patrignani, Diane Whitehouse, 2018

2018: ACM Code of Ethics

Association for Computing Machinery
Advancing Computing as a Science & Profession

The Code

ACM Code of Ethics and Professional Conduct

Affirming our obligation to use our skills to benefit society

- General Ethical Principles
- Professional Responsibilities
- Professional Leadership Principles
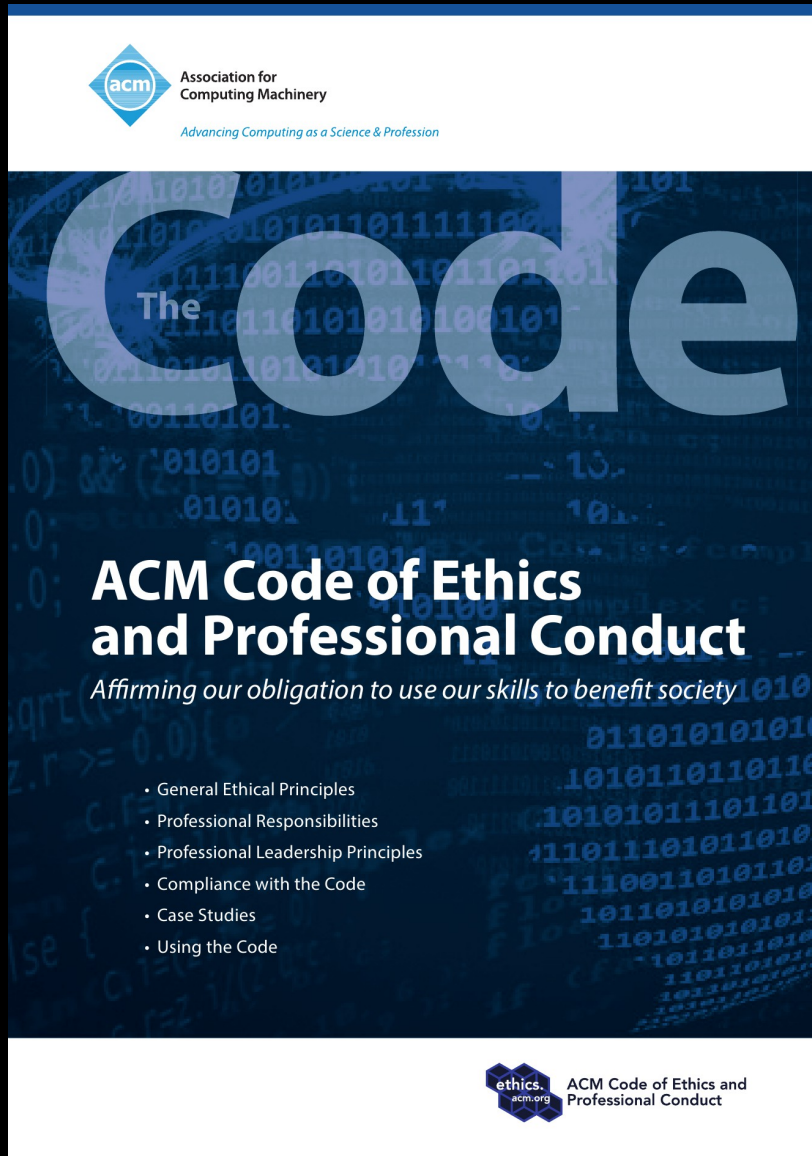- Compliance with the Code
- Case Studies
- Using the Code

ethics.acm.org
ACM Code of Ethics and Professional Conduct

ACM COMMITTEE ON PROFESSIONAL ETHICS

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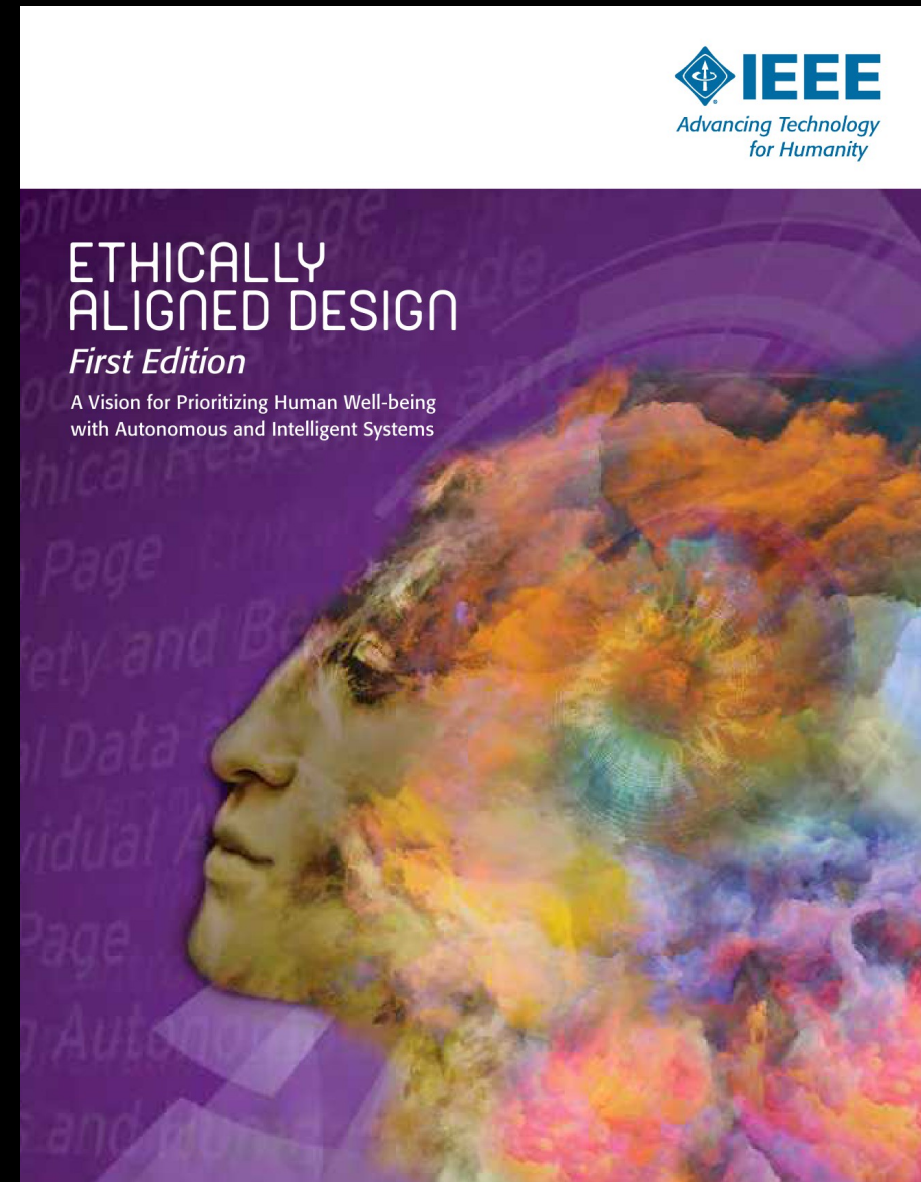Norberto Patrignani
Simon Rogerson
Kate Vazansky

Source: www.acm.org

2019: IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems

... systems must be developed and should operate in a way that is <u>beneficial to people and the environment,</u> beyond simply reaching functional goals and addressing <u>technical problems</u>...

GENERAL PRINCIPLES
- Human Rights
- Well-being
- <u>Data Agency</u> ("*<u>habeas data</u>*")
- Effectiveness (and fitness for purpose)
- Transparency (basis of decision should
    always be discoverable)
- Accountability (provide an unambiguous rationale
    for all decisions made)
- <u>Awareness of Misuse</u> (creators shall guard against
    all potential misuses and risks)
- Competence (creators shall specify and
    operators shall adhere to the
    knowledge and skill required
   for safe and effective operation)

⬦IEEE
Advancing Technology
for Humanity

ETHICALLY ALIGNED DESIGN
First Edition
A Vision for Prioritizing Human Well-being
with Autonomous and Intelligent Systems

Nel nostro tempo,
*come **informatici**,*
*dobbiamo **assumerci la responsabilità** di dire*
*cosa **può** essere e*
*cosa **non può** essere automatizzato*
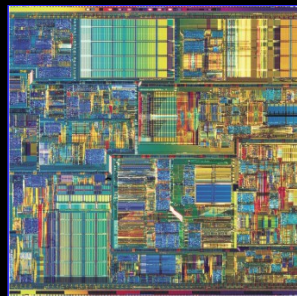
Adriano Olivetti
(1901-1960)
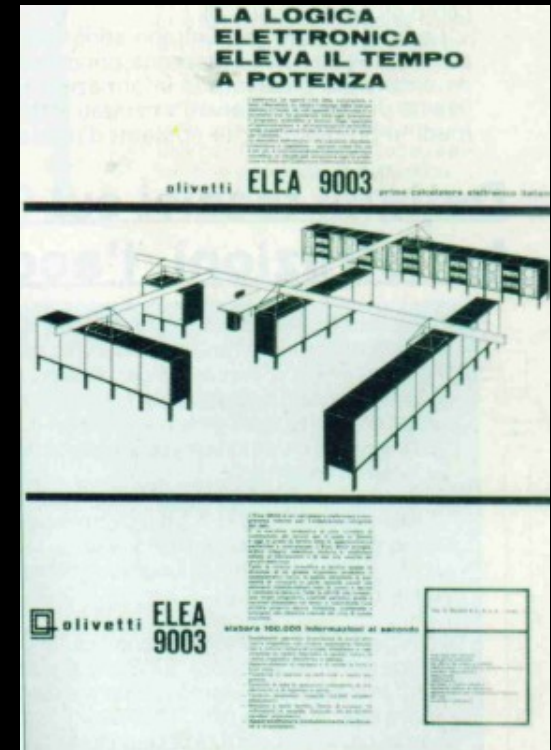
"*Con la realizzazione dell'Elea,*
la nostra Società ... tocca una meta in cui direttamente si invera
quello che penso sia l'inalienabile, più alto fine che un'industria deve porsi di operare, ...
per il progresso comune - economico, sociale, etico - della intera collettività"

Adriano Olivetti, 8 Novembre 1959

La tecnologia non e' un destino

Grazie!

Norberto Patrignani