



Impacts of (AI) Technology

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Current Context: **Huston, we have a situation !**



Current Context: Pandemic, Confinement & Tele-working I

■ Information & Communication Technology (ICT) & Artificial Intelligence (AI)

→ usage:

- Collect, store and process data / information / knowledge (H → M)
- Disseminate knowledge & nudge human actions (M → H)
- Mediate human interaction (H ↔ M ↔ H)

H: Human (experience)

M: Machine (intervention)

Current Context: Pandemic, Confinement & Tele-working II

■ ICT & AI → adoption rate:

- Non-computer based: can be traced back over centuries, millennia, etc
- Computer-based: dramatic increase over the last 2 decades
- Computer-based: exacerbated by the current epidemic



eCampus

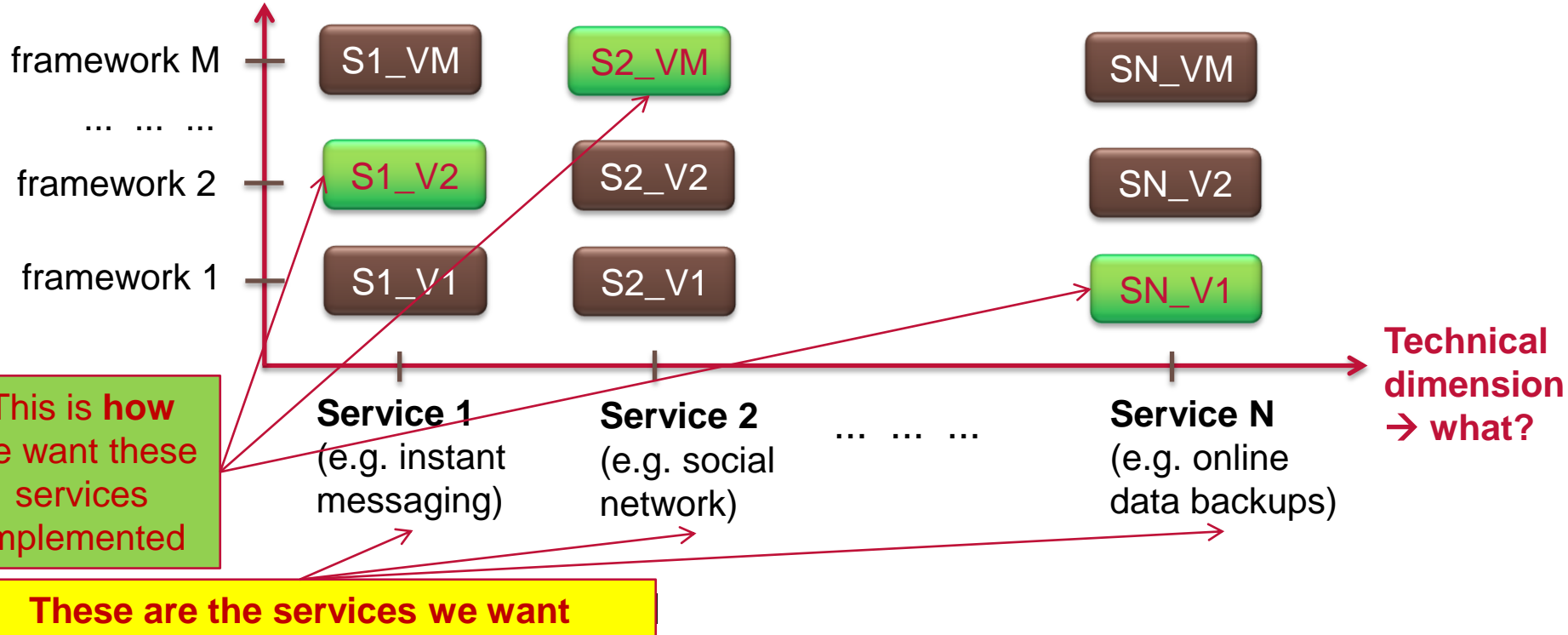


Current Context: Pandemic, Confinement & Tele-working III

- **Core societal processes** → increasingly digitalised
 - **Knowledge creation, storage & dissemination**
 - **Human communication**
- **Implementing these processes implies two core dimensions**
→ interrelated, but *not* hardcoded
 - **Technological support** – *what* can we do?
→ what services are available? what functions can we digitalise?
 - **Individual & societal considerations** – *how* do we do it?
→ what are the side effects of using these services and functions?
→ what are the alternative implementations – legal, cultural, ethical aspects.

What do we want & How do we want it?

Social dimension → how?
(legal, cultural, ethical, ...)





Trial & error is fine... If we move on

- **“We cannot walk before we toddle,
Though we may toddle far too long,
If we embrace a lovely Model
That is consistent, clear, and wrong.”**

Kenneth Boulding
"Notes from Woods Hole", unpublished, 1976

Analogy to the **Industrial Revolution**

■ **Initial development**

- The technological support became available
- Institutional lag: no legal, cultural, ethical framework
- → Gilded age, Robber Barons, Captains of Industry, ...
- → Child labour, no worker protections, no right to unionize, ...
- → Prediction: everything automated, mechanical brain,

■ **Current variant, e.g., in France**

- We kept the machines and the industrial capabilities
- While updating institutions to enforce a more socially viable legal framework
- Antitrust/competition laws (avoid abuses caused by monopolies or cartels)
- Worker protection laws: minimal age, minimal payment, paid holidays, right to unionise, anti-discrimination protections, ...
- Better understanding of advantages & limitations → applicability

The Internet & Co → Today

- We have the technological support
 - Large, cheap storage space
 - High-speed high-bandwidth communication
 - Fast processing
 - Powerful algorithms, e.g. AI, ML, ...
 - Wide-scope large-scale data collection → Big Data
 - ...

- With a severe Institutional Lag & Cultural / Awareness Lag
 - The Internet is “*the world’s largest ungoverned space*”
[Google executives, Eric Schmidt & Jared Cohen]

- With “silver bullet” predictions
 - Singularity, Trans-humanism, H+
 - Endless economic growth
 - ...



Common Ideas

about Modern Technology



Common Ideas I

Technology is Neutral

It's the way we use it that is “good” or “bad”

Common Ideas II

There is no choice anyway –

It is either this way of technological progress


Or back to the old telephone & typewriter



- **Whoever critic (current) technology is against (all) technology**

- **E.g. The Luddites**
 - Industrial Revolution
- **E.g. Conspiracy theorists**
- **E.g. Paranoiacs**
- **E.g. Proso-phobiacs**
- **E.g. The Amish**
-





**Unalloyed enthusiasm for anything is bound to be a mistake,
so thank goodness for the critics, the sceptics,
the 2nd-thought-havers, and even the outright apostates.**

Daniel Dennett

[American philosopher of cognitive science & evolutionary biology]



The Purpose of this Lecture

To ask a question:

- Do you take a rational, well-informed decision about adopting new technology & using it extensively?

and to show why it is important

Rational Decision Making

- A method for systematically selecting among possible choices that is based on reason and facts.
- ... employ a series of analytical steps to review relevant facts, observations and possible outcomes before choosing a particular course of action.

[BusinessDictionary]

Further Questions

Concerning the Adoption & Usage of (AI) Technology

- What are the choices?
- What are the relevant facts?
- What are the possible outcomes?
- What are the pros and cons?
- What is my choice?
- When & How can I change that choice?

Disclaimer

■ This is about questioning

- the kinds of technologies that we develop and use;
- the reasons behind them;
- the ways of using them;
- the ways in which they transform us and our world;
-

■ This is *not* about rejecting technology and modern civilised life.

What are the choices?

→ concerning technology adoption & usage ←

What are the choices?

■ Do nothing

- Everything is awesome !



What are the choices? II

- Give up all technology and go back to the cave (prehistory)



What are the choices?



■ Collective decisions

- Debate
- Testing
- Selective adoption of “useful” technology



E.g. The Amish

What are the choices? IV

- **Keep doing what we're doing – all we do is “progress”**
 - Internet of Everything
 - Trans-humans
 - ...



What are the choices?

V

■ Progressive improvement

- Human-centred design
- Awareness of the status quo

Hand axe (biface)



Prehistoric axe (with handle)



Modern axe



Chainsaw



What are the choices? Summary

- **Do nothing**
 - Everything is awesome!

- **Give up all technology and go back to the cave**
 - Prehistory

- **Collectively debate, test and decide on the adoption of each tool**
 - E.g. The Amish

- **Progressive improvement, based on user feedback**
 - Human-centred, Value-oriented (Re)Design
 - Awareness of the status quo

- ...

What are the relevant facts? & the potential outcomes?

- **Limitations of Data Science & (Big Data-based) AI**
 - What are machines really learning? What can they predict?
 - Correlation versus causality
- **Limitations of Machine-mediated Reality**
 - The media is the message
- **Limitations of Human-Machine Interaction interfaces**
 - Prescriptive or holistic tools
- **Limitations on privacy**
 - Institutional lag
 - Individual choices
- ...



Limitations of Big Data-based AI

What are Machines really Learning?

Statistical Analysis vs Model-based Reasoning

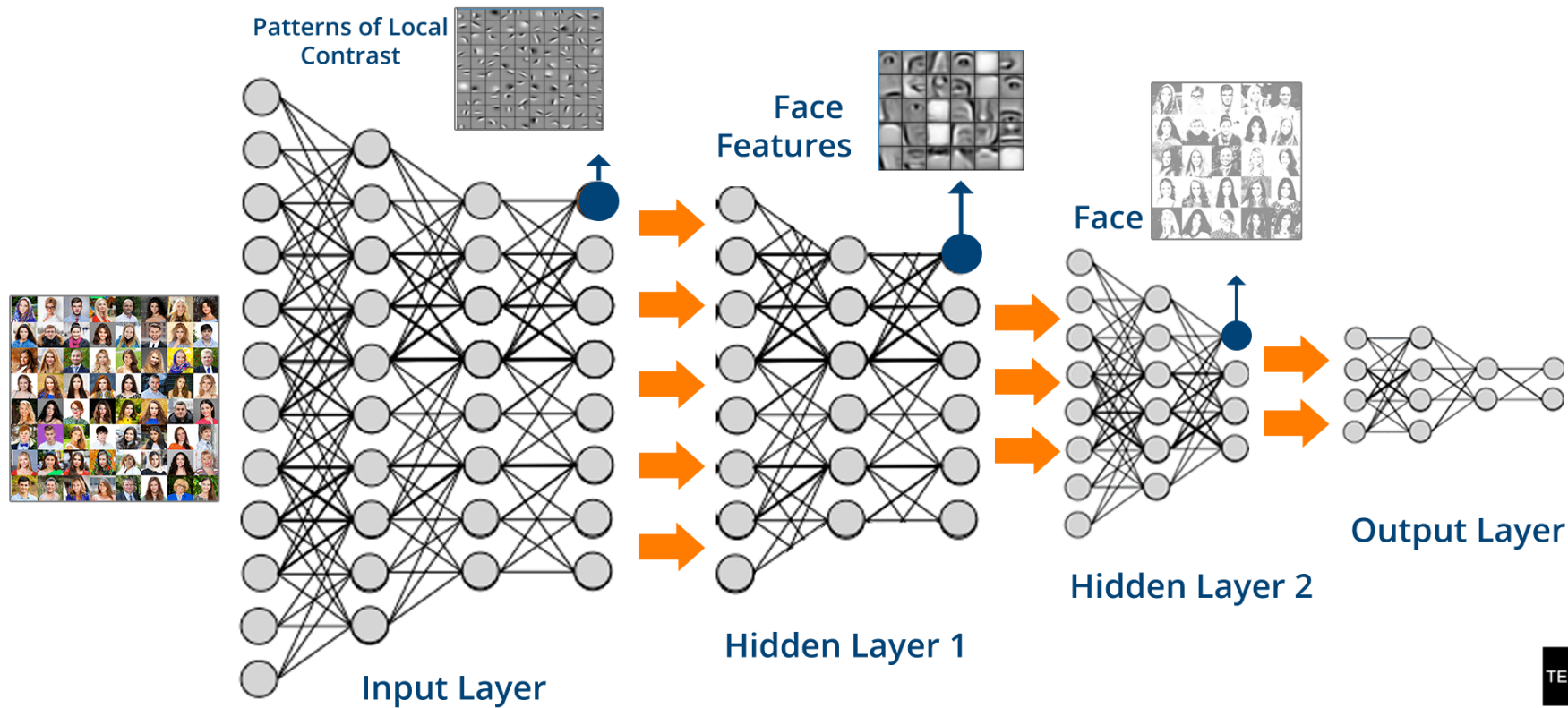


AI systems based on Big Data & Deep Learning

What can they do today?

- Image and face recognition
 - Transcribe spoken sentences into text
 - Translate between languages
 - Find web-pages based on informal queries
 - Find routes to destinations
 - Win at Chess and Go games
 - Diagnose diseases from image scans
 - ~Fly planes
-
- Autonomous cars?
 - House aid robots?
 - Write stories, music, scientific papers; do paintings?

AI Systems today → (most) use Deep Neural Networks or Convolution Neural Networks (CNN)





Examples of Data-driven AI Gone Wrong

A Biased View of negative examples only :)

Amazon's face recognition tool:

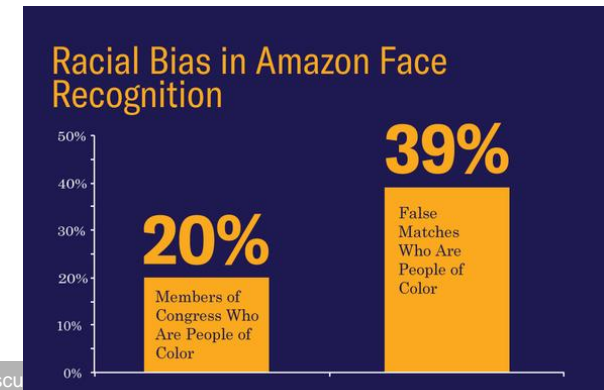
Rekognition → In active use in Oregon's Washington County

■ Tested by the American Civil Liberties Union (ACLU)

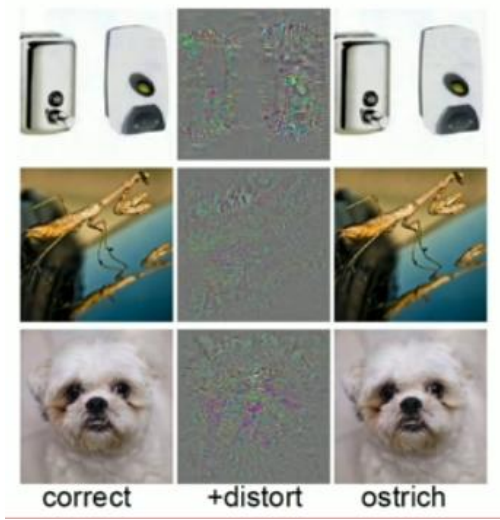
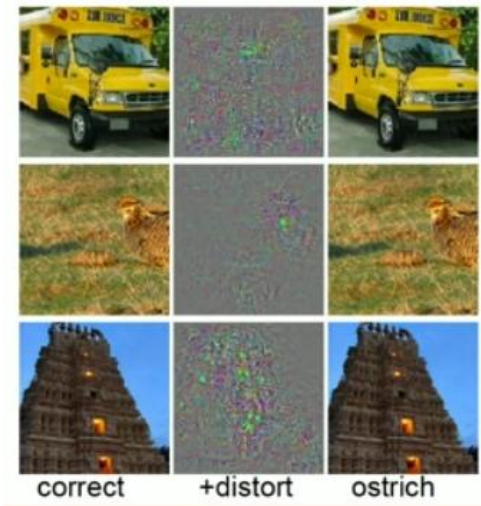
- Non-profit organisation (www.aclu.org)

■ ACLU study's results (2018)

- 28 members of Congress were confused with publicly available arrest photos
- 39% of Rekognition's false matches were of people of colour, though they only represent 20% of Congress



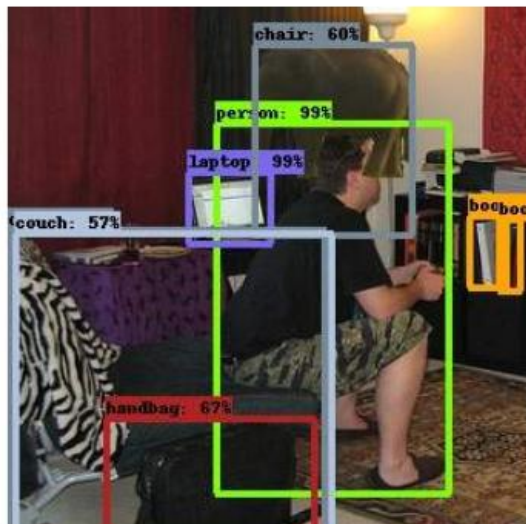
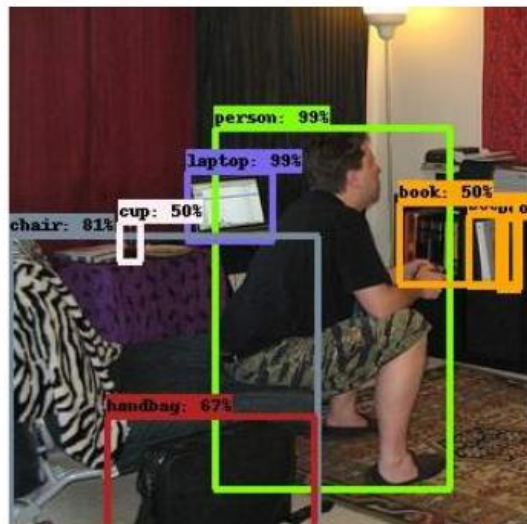
Adversarial attacks: How to trick computer vision



- Malicious image alteration, non visible to the eye, made all images be misclassified as “ostrich”
- Google AI Research:
 - C. Szegedy, et al, “**Intriguing properties of neural networks**”, 2014
 - <https://arxiv.org/pdf/1312.6199.pdf>

The Elephant in the Room, A. Rosenfeld et al, 2018

- Adding a sub-image → non-local effect: alter the recognition of other objects



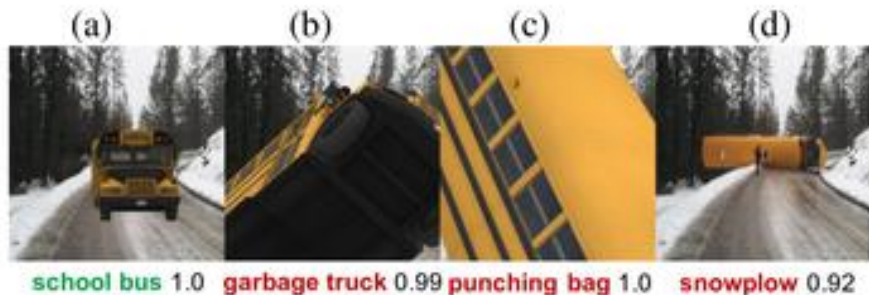
- Elephant not-recognised
- Lost the “cup”
- “Chair” recognised as “couch”
- ...

Original Image

Original Image +
Elephant sub-image

Google's "Inception" network for image recognition

Foiled by image rotation and repositioning

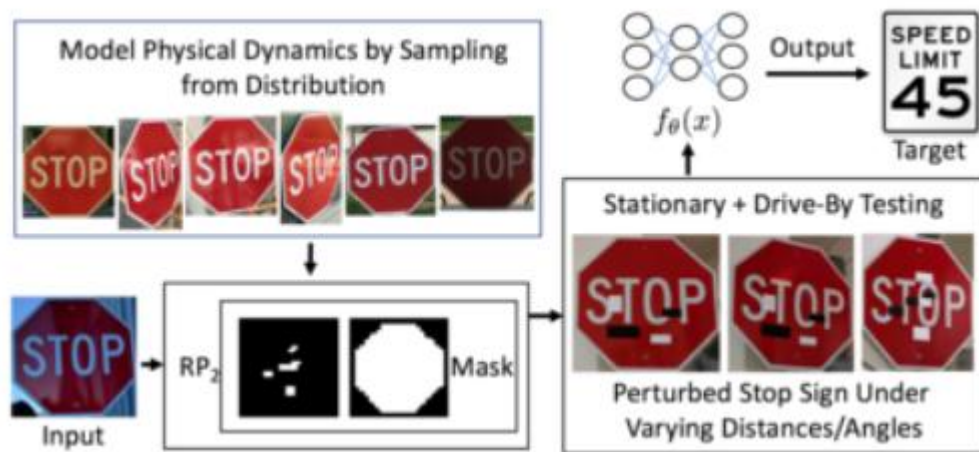


- M. Alcorn, et al., "Strike (with) a Pose: Neural Networks Are Easily Fooled by Strange Poses of Familiar Objects", 2019

- <https://arxiv.org/pdf/1811.11553.pdf>

Adding stickers / graffiti → misclassification to targeted object

- A stop sign is misclassified as a speed limit sign
- A coffee mug is misclassified for a cash machine
- A microwave is misclassified for a phone

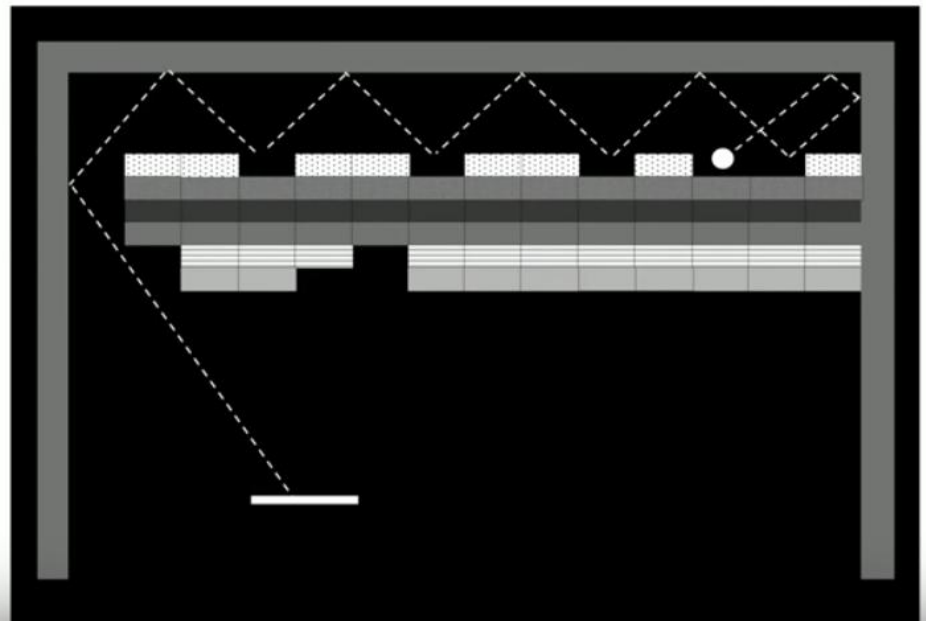


K. Eykholt, et al, "[Robust Physical-World Attacks on Deep Learning Visual Classification](#)", CVPR, 2018

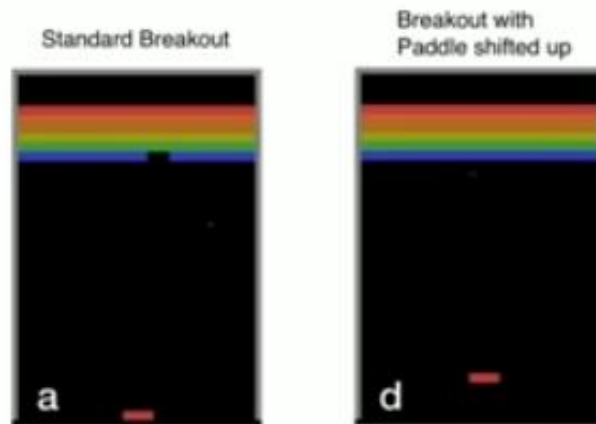
Difficulty in Task-to-Task transfer – ATARI games

- Cool: learning a new strategy!

Deep Q-Learning discovers “tunneling”



- Not so cool: unable to adjust to paddle shifting position



Kanagy, K. et al., 2017. Schema networks: Zero-shot transfer with a generative causal model of intuitive physics. arXiv preprint arXiv:1706.04317.

→ Need for “transfer learning”
→ for humans, this is what “learning” means :)

What is the machine really learning?

- Recognising wild animals from photos



“Animal”



“No Animal”

- Is the AI recognising the animals or the fuzzy background?

Source: Melanie Mitchel’s keynote at ALife 2020

What is the machine really learning?

- Recognising a “Bridge” → AI can do this
 - – after seeing tens of K of bridges)



Source: Melanie Mitchel’s keynote at ALife 2020

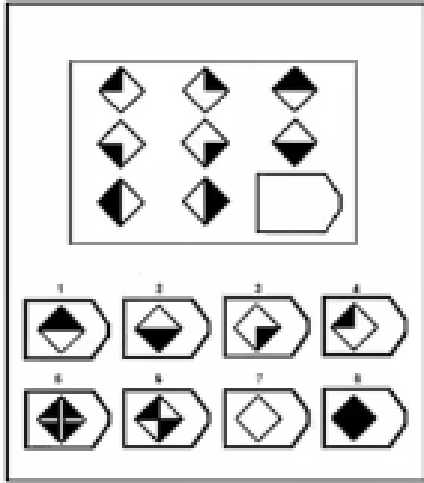
What is the machine really learning?

- Recognising a “Bridge” → but can AI recognise these?
 - Lack of abstraction, analogy, conceptual view
 - Clustering of perceptions into categories



Source: Melanie Mitchel's keynote at ALife 2020

Testing AI via Raven's Progressive Matrices



■ AI using Deep Neural Networks

- Zhou et al, “Solving Raven’s Progressive Matrices with Neural Networks”, 2020
- 42,000 training examples & 14,000 test examples
- Generated automatically
- Impressive results: Humans ~84%; AI ~91% (Avg.)

■ Limitations:

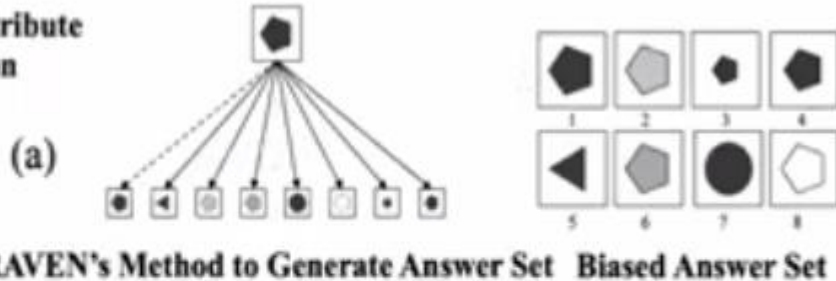
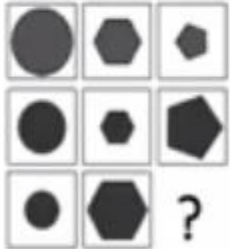
- Needs huge set of examples
- Opaque – what did it learn?
- Biases...

Source: Melanie Mitchel’s keynote at ALife 2020

Testing AI via Raven's Progressive Matrices II

→ Modify one attribute
--- No modification

Context Matrix



■ Bias in the data set

- Hu et al, “Hierarchical rule introduction network for visual reasoning”

■ AI could guess the right answer without looking at the problem

- Could obtain good results when trained on the candidate answers only!

Source: Melanie Mitchel's keynote at ALife 2020

From Melanie Mitchel's talk on "The Collapse of Artificial Intelligence" (2019)





Data Science & Big Data AI

How are we doing?

The New Wholly Grail?

AI based on Deep Neural Networks

■ Algorithms trained to spot patterns

- Based on statistics
- Using extensive sets of data examples, e.g., human-labelled
- Very different from how humans learn
- No real *understanding*, or *meaning*, or *experience*
- Most human intuitive knowledge is unwritten, unspoken, subconscious

■ AI passes specific narrow tests; yet lacks more general, robust intelligence

- Passes tests without featuring the qualities that the tests were set to measure
- Sometimes unreliable and sensitive to unexpected, relatively minor changes
- Fail in un-human-like ways
 - E.g. “The bareheaded man needed a hat” → “The bear headed man needed a hat.”
 - E.g. “I put the pig in the pen” → “Je mets le cochon dans le stylo”

Refs: M. Mitchel, [“How do you teach a car that a snowman won’t walk across the road?”](#), AEON, 2019
[“Artificial Intelligence Hits the Barrier of Meaning”](#), New York Times, Op’Ed, 2019

Can Data-driven Intelligence Solve All Problems?

- **Data-driven → only as good as the data**
 - How about new events or systemic changes?
 - How about data-collection biases?
 - How about reinforcing biases?
- **Statistics-based → how about rare events?**
 - “Black Swan Theory”, N. N. Taleb
- **Flat models → how about abstractions & analogies?**
 - What kind of intelligence do machines have?
- **Model-less intelligence → when things go wrong, how do we fix them?**
 - What are the causes?
 - Who is responsible?
 - What should we change?
 - What can we reuse across systems?

Human Cognition & Intelligence

- **Human innate knowledge helps bootstrap understanding**
 - **Basic notions of discrete objects & events; 3D nature of space; Causality**
 - **Sociality – recognising face expressions ; basics of communication (?)**
 - **How to teach such concepts to machines?**
- **Human drive to play and learn causalities**
 - **Explore the world, correlate causes and effects, make predictions, ask adults**
 - **Linked to embodiment and social context**

What is the Problem?

- **“People worry that computers will get too smart and take over the world, but the real problem is that they’re too stupid and they’ve already taken over the world.”**
 - Pedro Domingos, AI researcher, “The Master Algorithm” book
- **Surely, we always learn from our mistakes; and make progress**
 - All new technologies & methods go through an exploratory phase
 - Requires awareness of limitations, failure detection, responsible deployment, limited trust, ...
 - Not a “wholly grail” dogma
 - Difficult to take caution within a commercialisation-driven race for market shares & profits
 - Needs more understanding and trustworthiness before deployment
 - Needs up-to-date laws and culture (e.g. privacy, legal responsibility)
 -

Main **Misconceptions** about AI

- **Narrow AI is on a continuum with General AI**
 - The first is a first step towards the other (not so)
 - Hubert Dreyfus: “First step fallacies”
- **“Easy” things are easy and “hard” things are hard**
 - Easy/hard for humans is easy/hard for machines (not so)
- **Names confer abilities**
 - Object recognition, question, answering, common sense understanding,
 - When you learn something you learned its abilities (not so)
- **Intelligence is all in the brain**

Ref: Melanie Mitchell’s talk, [“The Collapse of Artificial Intelligence”](#) SFI, 2019

Further REFERENCES

AI Critiques – examples & initiatives

- **Melanie Mitchel, “[AI Can Pass Standardized Tests—But It Would Fail Preschool](#)”**
 - **Wired magazine, opinion, 2019**
 - **Lack of common sense, or any form of human understanding**

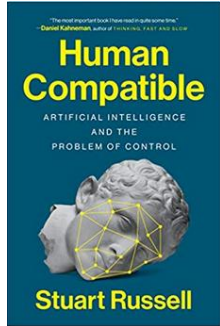
 - **Allen Institute for Artificial Intelligence (AI2) → Aristo program**
 - Passed & excelled on a standardized eighth-grade science test.
 - Mostly based on a “language model” → predicts the next word in a sentence, based on statistics
 - Takes the question, and the possible answers, and picks the most probable answer.

 - **Problem: the system can only take that test**
 - **No relation to human comprehension, no use of logic**
 - **Cannot apply knowledge to new circumstances, flexibly and quickly**
 - **How to answer open-ended questions?**

- **DARPA’s challenge: develop AI with the common sense of an 18 years old child**
 - **Machine Common Sense**
 - **<https://www.darpa.mil/program/machine-common-sense>**

Further REFERENCES

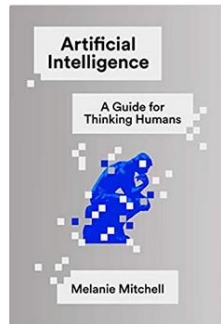
Bibliography



- **Stuart Russell,**
“Human Compatible”

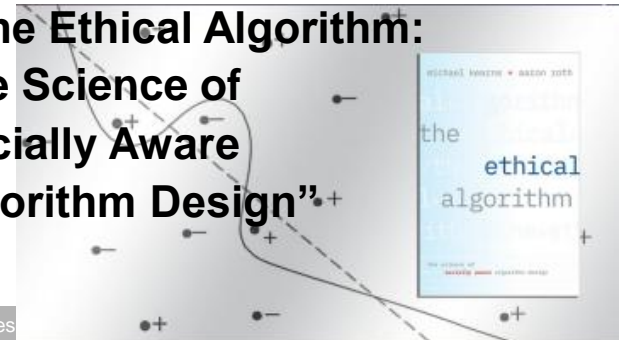


- **Antonio Casilli,**
“En Attendant les Robots”



- **Melanie Mitchell,**
“Artificial Intelligence:
A Guide for Thinking Humans”

- **Michael Kearns & Aaron Roth**
“The Ethical Algorithm:
The Science of
Socially Aware
Algorithm Design”



Limitations of Big Data-based AI

Correlation versus Causality

Statistical Analysis vs Model-based Reasoning

Correlation versus Causality: $A \rightarrow B$ or $A \leftarrow B$?

■ Correlation based on Big Data statistics

- Warm in the back yard & the Sun is out

■ → what can one infer about causality?

- If I light a fire and warm-up the back yard → will the Sun come out?
- Nope,.. not quite

Ok, then the one that happens first is the cause

■ Correlation

- Light Switch “ON” & Lights ON

→ Which one happened first?

- Ada drinks tea in the morning & Ada goes to work
- Tea drinking happens *before* going to work

→ Is tea drinking the cause of going to work?

→ If I make Ada drink a cup of tea on Sunday morning, will she go to work afterwards?

→ Nope, not quite...

Correlation versus Causality: $A \leftarrow C \rightarrow B$

■ Correlation based on Big Data statistics

- The back yard is wet & the front road is wet

■ → what can one infer about causality?

- If I water the back yard → will the front road get wet ?
- If I water the front road → will the back yard get wet ?
- Nope, the rain did it.. (not observed)

Correlation versus Causality - Generalisation

- If A & B are correlated

- Then it may be that
 - $A \rightarrow B$
 - $B \rightarrow A$
 - $C \rightarrow A \ \& \ B$ (we have not looked at C)
 - $A \ \& \ C \rightarrow B$ (we have not looked at C)
 - ...

- There is no way to know which one is true, from observation only

Noam Chomsky (linguist)

- on natural language processing based on big data -

- “Suppose that somebody says he wants to eliminate the physics department and do it the right way. The “right” way is to take endless numbers of videotapes of what’s happening outside the window, and feed them into the biggest and fastest computer, gigabytes of data, and do complex statistical analysis — you know, Bayesian this and that — and you’ll get some kind of prediction about what’s gonna happen outside the window next. In fact, you get a much better prediction than the physics department will ever give.

Well, if success is defined as getting a fair approximation to a mass of chaotic unanalyzed data, then it’s way better to do it this way than to do it the way the physicists do, you know, no thought experiments about frictionless planes and so on and so forth.

But you won’t get the kind of understanding that the sciences have always been aimed at — what you’ll get at is an approximation to what’s happening.”

Correlation vs Causality – Methods

■ Statistical analysis – works under uncertain, yet static conditions

- Determine associations between variables
- Predict future events
- Update likelihood of events in light of new data
- → Statistical concept: distribution based on observed variables

■ Causal analysis – works under uncertain and changing conditions

- Determine de generative process behind the data
- Predicts the dynamics of events under changing conditions (without new data)
- E.g. predict effects of actions; determine causes of events; assign responsibility
- → Causal concept: changes in variables that cannot be inferred from a distribution alone

How to get a grip on causality? Acting & Testing

■ The scientific method (empirical)

- Knowledge acquisition
- Since XVII, at least
- Iterative process – main steps
 - Observation (as objective as possible)
 - Formulation of Hypothesis (via induction)
 - Experimental & testing of deductions drawn from the hypothesis
 - Elimination or refinement of hypothesis based on results

■ What is missing to infer causation from correlation?

- Acting & testing
- Causal models
- Deductive processes
-

Technology-mediated Reality



Technology-mediated Reality



■ Much poorer perception – less detail

- **Consciously unperceivable difference, perhaps**
- **Our conscious brains let us perceive much less than our senses detect, which is less than what is “out there”**
- **Whose summarised interpretation do we perceive via technology?**

Technology-mediated Reality II

- “Our experience of the world is shaped by the technology we use to perceive it and by the mind with which we deconstruct and reconstruct that experience”



Technology as a Communication Medium

Marshall McLuhan: Philosopher, Professor – Media Theory

■ “The Medium is the Message”

- “Understanding Media: The Extensions of Man,”, 1964
“The Medium is the Message”, 1967 (mass age, or massage)

■ The medium of communication is *not* neutral

- Short-term: it may influence the way in which the message is received and interpreted
- Long-term: it influences the way in which people communicate

■ E.g. Communication by letters, emails and instant messengers

- Is the content the same? length, spelling, formalism, attention to details, ...
- Is the frequency the same? Are the expectations about replies the same?

■ E.g. Interacting with AI via natural language

- Does the content of sentences change? Does the manner of talking change?



Human-centred systems

Holistic vs Prescriptive Tools

Ubiquitous Computing & Calm Technology

Anthropology-Based Computing (ABC)

What you see is what you get – but is that all?

■ Technologies are *not* neutral

- More than just the sum of gadgets machines, and automates,
- Represent a system, involving an organisation, a set of concepts and a mind set
- Encourage a way of thinking, behaving and social restructuring

■ E.g.

- A research lab owning an expensive microscope tends to analyse everything at microscopic scales; using a magnifying glass becomes unthinkable (Ursula Franklin)
- One who owns a kitchen robot may start preparing food via more chopping and mixing than the traditional recipes
- Smart phones and social networks change the way we make and interact with friends, get access to news, take photos (selfies anyone?), share private content, etc.
- ...

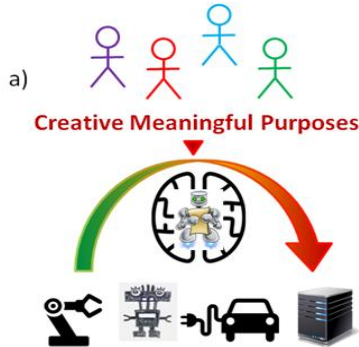
Technology as a procedure

- **Improvement technology** → make work easier and more efficient
 - Humans specialise by type of product & can take decisions during the production process
- **Control technology** → better control a process
 - Less about *what* is being done, more about *how* it is being done
 - Humans specialise in one step of the production process and take no decisions
 - Social, political, psychological implications

Kinds of (AI) Technology

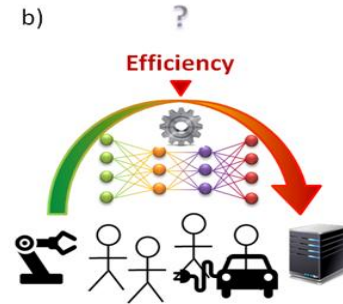
a) Holistic

- Technology as tool to help humans reach meaningful purposes
- Humans involved in the entire production process



b) Prescriptive

- Technology as a framework to control and optimise human activities
- Extreme division-of-labour: each human involved in a single, very simple task



■ “The Real World of Technology”, Ursula Franklin, 1992

- Experimental physicist
- Technology as a system of methods, procedures, organisation and ways of thinking

Kinds of Technology - Examples

■ Plato – “The Republic”

→ Holistic

- Society is more efficient if everyone specialises in a specific *craft*
- E.g., shoe-making, carpentry, agriculture,
- Division-of-labour *by craft*

■ Adam Smith – "The Wealth of Nations", 1776

→ Prescriptive

- Each worker only performs a single step of a production process
- E.g. pin factory: 18 tasks needed to produce a pin, each worker performs a single step: metal cutter, pin drawer, roller, finisher, etc.
- Division-of-labour *by specific micro-operation*
- Warning: “*The man whose whole life is spent in performing a few simple operations, of which the effects are perhaps always the same, or very nearly the same, has no occasion to exert his understanding or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to become.*”

The spread of prescriptive technologies

- **Technologies of mass production**
 - Beyond the productive process
 - A social innovation process → designed for external control & internal compliance
 - A single way of doing something → becomes normal & necessary
 - Eliminates choice & situations where one can take principled decisions
- **Extended from production to administration, governance and economic activities**
 - e.g. filling-in an income tax form, buying a ticket online, filing a complaint, ...
 - May rely on various substrates – e.g. mechanical, computing, paper, bureaucracy, ...



Human-centred systems

Holistic vs Prescriptive Tools

Ubiquitous Computing & Calm Technology

Anthropology-Based Computing (ABC)

Stages of Computer Technology Development

■ Mark Wisner – computer scientist, “father” of Ubiquitous Computing (1988)

- **Three waves of computing**

1. **Mainframes:** “each shared by lots of people”

2. **Personal computing:** “person and machine staring uneasily at each other across the desktop”

3. **Ubiquitous computing:** “technology recedes into the background of our lives.”

“the age of calm technology”

Ubiquitous Computing

■ Mark Weiser – computer scientist, father of Ubiquitous Computing (1988)

- “The Computer for the 21st Century”, 1991
 - “**Ubiquitous computing** is roughly the **opposite of virtual reality**.
*Where virtual reality puts people inside a computer-generated world, ubiquitous computing forces the computer to **live out here in the world with people***”
 - “The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”

the Need for Calm (Technology) I

■ Mark Wiser

- **“Designing Calm Technology”, 1995**
 - Calm technology: "that which informs but doesn't demand our focus or attention"
- **Goals & Requirements for Calm Technology:**
 - The purpose of a computer is to help you do something else.
 - The best computer is a quiet, invisible servant.
 - The computer should extend your unconscious.
 - Technology should create calm.

the Need for Calm (Technology) II

- **We perceive multiple streams of information that compete for our attention**
 - Should the ones generated by technology always be in the centre of attention?
- **Design Principles for Calm Technology**
 - Require minimum amount of attention
 - Inform what's needed and nothing more
 - Use the periphery to inform, without overburdening
 - Designed for humans – people should *not* (have to) act like machines
 - Degrade gracefully, rather than break abruptly
 - Provide the minimum necessary to solve the problem
 - Respect social norms



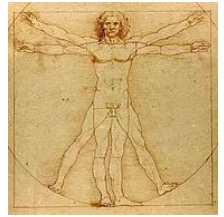
Human-centred systems

Holistic vs Prescriptive Tools

Ubiquitous Computing & Calm Technology

Anthropology-Based Computing (ABC)

Anthropology-Based Computing (ABC)



■ Anthropology:

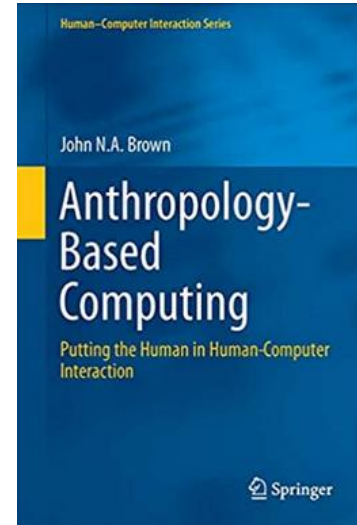
- Anthropos → human; logos → study
- scientific study of humanity (biology, behaviour, society, culture, language; past & present; including previous human species) – related to archaeology, history,

■ Human Computer Interfaces

- Enabling interaction between humans and computing systems
- Should be human-centred: take into account how humans “work”

■ John N. A. Brown – user experience R&D,

- Interactive & Cognitive Systems (PhD) ,
- Ergonomics, Biomechanics, HCI (MsC)
- Anthropology, Linguistics, Education (BsC)



John, N.A. Brown, “It’s as Easy as ABC – Introducing Anthropology-based Computing”, 2013
“Anthopology-based Computing”, Springer, 2016

HCI Shortcomings in Current Technology I

■ Imposes computer-like, algorithmic thinking

- Is it the best one? Is it the only one?
- How about unexpected exceptions? Intuition? Paradoxes?

■ Causes frequent interruptions

- **Occur at the centre of our attention, rather than at the periphery**
 - Even if someone else's phone rings
 - Require immediate reactions (helpful in case of danger)
- **Disrupt our activity, whatever the context, whatever the priority**
 - Up to 20 minutes to regain attention / focus / concentration

HCI Shortcomings in Current Technology II

- **Sometimes encourages individual work**
 - More prone to errors that are embedded in perceptual shortcuts
 - Require single individuals to supervise automated systems with constant awareness
- **Promote multi-tasking**
 - E.g. Texting & driving / walking
 - Less resources for each task → poorer performance across all tasks
- **Long term exposure to computer-mediated experiences alter certain brain regions**
 - Impacting the ability to solve abstract problems
 - Diminishing real-world skills
 - E.g. Computer games
 - More AI, less human intelligence (like using a crotch)

What to do?

- **We “have slipped into the pattern of developing new technology without worrying at all about how the use of it might affect human thought”**
 - – JNA Brown (p15)
- **Improving technology over time so that it becomes less dangerous / harmful**
 - **E.g. Adding a handle to the axe head**
 - **E.g. New HCI technology: desk chair, keyboard, mouse, ...**
 - Changing the software interface won't help
 - Needs (ABC) rethinking
 - **Cross generational habits**
 - Familiar environment allows the unusual / dangerous to be detected
 - Also propagates bad designs – “we've always done it this way...”



Privacy

Why does it matter?

How to protect it?

Shoshana Zuboff, **“The Age of Surveillance Capitalism”**, 2019

Jaron Lanier, **“The Arguments for Deleting your Social Media Accounts. Right Now”**, 2018

The “Good News”

[Facebook F8 speech, April 2019]

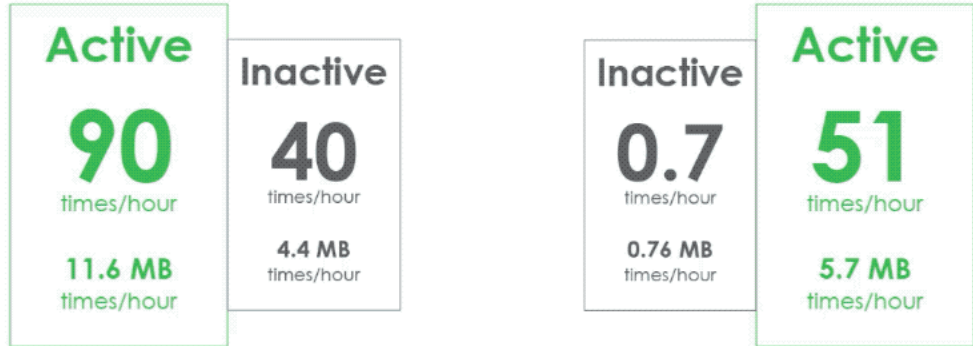


Privacy – the present reality



Privacy – the present reality

Typical day of use



source: e-foundation

Source: [Digital Content Next – Prof. Douglas C. Schmidt, Vanderbilt University, August 2018](#)

What is privacy & why is it important?

■ Privacy

- freedom from unauthorized intrusion
- the quality or state of being apart from company or observation: seclusion
- [<https://www.merriam-webster.com/dictionary>]
- someone's right to keep their personal matters and relationships secret
- the state of being alone
- [<https://dictionary.cambridge.org/us/dictionar>]

■ Various interrelated aspects

- Limited access to & control over one's information; anonymity; secrecy;
- Solitude, right to be alone; intimacy;
- **Precondition for personhood, identity & self-determination; to exercise choice; to autonomy**

■ Different scopes: **personal & organisational**

■ Imposed **via physical, behavioural or normative barriers** → which ones do we still have?

But... I have nothing to hide (?)

- **Do we know what information we are sharing? And with whom?**
 - Are we reading the privacy policies before hitting “accept”? Do we have a choice?
- **Do we know who will use it and when and for what purpose?**
 - Third party sharing with no responsibility taking
- **Do we appreciate the knowledge asymmetry resulting from massive data collection?**
 - Ability to predict & “nudge” entire groups, statistically
- **Then send me your social media identifiers :-]**

Why has privacy become such an issue ?

→ Surveillance Capitalism

[S. Zuboff, Harvard Business School, 2019]

- “A new economic order that claims **human experience as free raw material** for hidden commercial practices of extraction, prediction, and sales”
- “As significant a threat to human nature in the 21st century as industrial capitalism was to the natural world in the 19th & 20th ”
- “A movement that aims to impose a new **collective order based on total certainty**”
 - Business model based on predictions → need for certainty → less autonomy
-

Challenges to Individuality & Democracy

■ Top-down

- **Industrial age: economic inequality**
- **Digital age: knowledge inequality**
 - 1986: 1% information was digitalised
 - 2013: 98% information digitalised
- **Knowledge → Control**
 - Monitoring vs nudging – e.g. Pokemon Go, elections, referendum, ...

■ Bottom-up

- **Assault on human autonomy**
- **Better prediction → more certainty → less freedom**

Why don't we change this?

(The impression of) **Inevitability**

- < This is the only way our digital future can be >
- < It is either this or back to the landline >
- Most media and publications “predict” this
- (Why) is that so?
- Was the industrial age impossible without worker rights?

Why don't we change this? → the Dispossession Cycle

A theory of change → how to normalise the outrageous?

■ A predictable sequence of stages, over a long time period (i.e. years)

1. Incursion

- Invade unprotected private space – e.g., personal data, street views, contacts, ...
- H. Arendt: “original sin of simple robbery”
- Proceeds until resistance is encountered
- Seduce (e.g. goodies), ignore, overwhelm, exhaust opponents

2. Habituation

- Buying time tactics – e.g., long investigations & lawsuits, confusing messages, ...
- While consolidating – e.g., more stakeholders, dependency creation, mass numbness, ...

3. Adaptation

- When forced to drawback, introduce superficial but tactically efficient changes

4. Redirection

- Introduce the same approach elsewhere, under a different format

Pinochio's Land of Toys / Funland, 1883 :-]

- Food, drinks and smokes were made freely available to all
- There were no (apparent) consequences or laws

“Right here, boys! Right here! Get your cake, pie, dill pickles, and ice cream! Eat all you can! Be a glutton! Stuff yourselves! It's all free, boys! It's all free! Hurry, hurry, hurry, hurry!”


- Until they made “jackasses” of themselves and unsuspectingly transformed / de-evolved into donkeys – to be sold for labour or circus by the Funland's owner.



What to do?

- **Privacy is a collective action (institutional) matter**
 - *Not* a private matter
 - E.g. laws, processes, institutions

- **Individual choices**
 - Do I adopt new technology?
 - Are there any alternatives to the technologies that I am already dependent upon?



Why do we build (AI) Technology?

Why do we use it?

Why do we Build (AI) Technology?

- **Gadgets** are fun, fashionable and status-related
 - E.g. smart phones, sports bracelets, home assistants, smart fridges,...
 - **Efficiency** is increased by technological processes
 - Faster, more accurate, and cheaper
 - E.g. industrial machines, algorithmic processes for humans, AI for decision-taking, ...
- **Extension of technology to all human activities**
- From physical labour to creative work and thinking

In a Nutshell

- **Efficiency** has become a value and an *end* in itself rather than a *mean* to achieve real ends / objectives and values
- The *kinds* of ICT /AI technologies being developed to optimise efficiency are **prescriptive** rather than **holistic** – the human is a problem, imperfect, inefficient, unpredictable, to be controlled, constrained and monitored
- Technologies, in addition to their functional role, have a **restructuring, reorganising role** for society, economy and politics
- What are the impacts of embedding the efficiency ideology into prescriptive technologies on individuals and society?
- What would we like to change and how do we go about it?

What are gadgets? What are they for? Impacts?



- “an often small mechanical or electronic device with a practical use but often thought of as a novelty”
 - Merriam-Webster dictionary online, Oct 2018
- “You are not a gadget”, 2011
 - Jaron Lanier: computer scientist, Microsoft Research, composer
 - How digital design and programming choices are shaping society – good and bad
 - Should collected data / information be free?
- “Black Box Society. Secret Algorithms that Control Money & Information”, 2015.
 - F. Pasquale, Harvard Univ. Press
- “[The Anatomy of an AI System](#)”, 2018
 - Kate Crawford and Vladan Joler
 - On the huge computing, networking and human labouring infrastructure behind convenient “smart” devices, such as Alexa.

What is Efficiency? And what is it for?

- Obtain the same result with less resources; faster & cheaper
- A characteristic of the *means* to reach an *end*.
- Inversion of concepts: efficiency becomes an end in itself
- Inefficiency is a sin greater than dishonesty, unfairness, injustice,...
- But what does it mean to be more efficient, for:
 - A “smart” kitchen: better food? more satisfaction? what do I do with the gained time?
 - Healthcare; education; public transport; government; ... → Less cost. But same result?

E.g. Studies of Efficiency (via Technology)

■ “The Cult of Efficiency”, Janice Gross Stein, 2001

- Political scientist, international relations expert, Univ. of Toronto
- *“A cult is a system of religious worship that engenders almost blind loyalty in its members. Its mystical rites and ceremonies foster in its devotees a sense of belonging and a reverence of core beliefs. Cult members reinforce these beliefs through the incantation of central dogmas”.*

■ “Système Technicien”, Jacques Ellul, 1977

- Historian, philosopher, sociologist, theologian, prof. of history & sociological institutions
- Technology developing for its own sake, to increase efficiency; reorganising society
- *“[W]hat is at issue here is evaluating the danger of what might happen to our humanity in the present half-century, and distinguishing between what we want to keep and what we are ready to lose, between what we can welcome as legitimate human development and what we should reject with our last ounce of strength as dehumanization. I cannot think that choices of this kind are unimportant”*



What are the impacts?

Individual, social, economic, political

Pervasive & Persuasive Technology

- Which sectors of our private and public lives, and which aspects of our society, economy and politics, are *not* mediated through and hence affected by (ICT / AI) technology?
- How will the ideas and ideologies embedded into these technologies impact our private lives, and our societies, economies and politics?

Pinochio's Land of Toys / Funland, 1883 :-]

- Food, drinks and smokes were made freely available to all
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“Right here, boys! Right here! Get your cake, pie, dill pickles, and ice cream! Eat all you can! Be a glutton! Stuff yourselves! It's all free, boys! It's all free! Hurry, hurry, hurry, hurry!”

- Until they made “jackasses” of themselves and unsuspectingly transformed / de-evolved into donkeys – to be sold for labour or circus by the Funland's owner.



“Persuasive” Technology?

- Merging of computer science with behavioural psychology
- Technology built to change people’s thinking and behaviour via persuasion and social influence, but not via coercion
- E.g., Persuasive Technology Lab, Stanford University
 - Designing for Behavior Change – <http://captology.stanford.edu/>
 - Our goal is to explain human nature clearly and map those insights onto the emerging opportunities in technology.
 - But, there are [7 Points on Ethics](#): teaching, papers, panel, conference, video

Captology

Every day more and more computing products, including websites and mobile apps, are designed to change what people think and do.

[Learn more](#)





Overview of Impacts

■ Individual impacts

- Cognition, attention, privacy, life experience, knowledge, values & goals, responsibility

■ Social impacts

- Collective awareness, culture, value & goals, sustainability, fairness, justice, ...

■ Economic and Political impacts

- What kinds of organisations are sustainable?
- What kinds of organisations can emerge?

■ Interrelations among the above

Reduction of the Individual to a Measurable Entity & “Calculable Person”

■ E.g.

- Student exam scores; Researcher h-index, grant amounts
- Financial viability score to get bank loans
- Health scores to get health insurance
- Sales targets; Worker productivity and performance metrics
- ...

■ Impacts on the Observed

- Observer Effect (Physics): observing a situation changes the phenomenon -- E.g. quantum mechanics – the double-slit experiment
- Hawthorne effect: individuals modify their behaviour if aware of being observed
- IT: processes alter their execution when monitored at runtime
-

■ Impacts on the Observer

- Ability to evaluate & judge complex situations, qualities, processes,

Impacts on Attention, Patience, Concentration

Communication of Knowledge & Information

- More via short texts (tweets?)
 - → Simpler
- More via images & videos
 - → Less rational, intermixed with background emotion
- Less ability to read books, long texts, concentrate on details
 - → Less ability to detect subtleties, comprehend complex situations, analyse rationally
 - E.g., Jacques Atali, LinkedIn article, Nov 2017, “[Reading books as a tool for freedom](#)”
 - “reading and making people read are major issues, in our civilisations of impatience and of images.”
- Danny Hill
 - Long-term Thinking foundation (<http://longnow.org/>)
 - “provide a counterpoint to today’s accelerating culture and help make long-term thinking more common”
 - “**Civilization is revving itself into a pathologically short attention span.** The trend might be coming from the acceleration of technology, the short-horizon perspective of market-driven economics, the next-election perspective of democracies, or the distractions of personal multi-tasking. “

Impacts on Attention, Patience, Concentration

- Sarah Spiekermann
 - Humans becoming unable to control their attention?
- C. Wright Mills – sociologist
 - Noted a decline in human thinking abilities vs. “overwhelming accumulation of technological gadgets.”
- A. Keen, *The Internet is Not the Answer*. Atlantic Monthly Press, 2015
- Simon Head, [*Mindless: How Smarter Machines are Creating Dumber Humans*](#), 2013.
- N. Carr, *The Shallows: What the Internet is Doing to our Brains*, 2010

Impacts on Shared Experience, Culture and Politics

- Customised, individualised knowledge
 - → No shared experience, no shared culture, individual isolation
- Entertainment as distraction; to facilitate obedience
 - Huxley rather than Orwell (can swap later)
- AI, data science and the surveillance economy
 - Importance of privacy, and public privacy
- E.g. Taylor Owen
 - Assistant Prof. of Digital Media and Global Affairs at the University of British Columbia
 - Senior Fellow at the Tow Center for Digital Journalism, Columbia School of Journalism
 - [Disruptive Power: The Crisis of the State in the Digital Age](#), Oxford Univ. Press, 2015
 - <http://taylorowen.com>

Impact on bio-viability (ability to support life)

- Technology that supports the ecology, or bio-viability
 - E.g. renewable energy and smart grids?
- vs.
- Technology that pollutes and decreases bio-diversity
 - E.g. Concrete cities, non-recyclable electronic devices and toxic batteries
- Lewis Mumford – The Myth of the Machine, 1970
 - “In the act of 'conquering nature' our ancestors too often treated the earth ... contemptuously and ... brutally” ...& “overlooked the appalling losses and wastages, under the delusion either that the primeval abundance was inexhaustible or else that the losses did not matter, since modern man through science and invention would soon fabricate an artificial world infinitely more wonderful than that nature had provided — an even grosser delusion.”



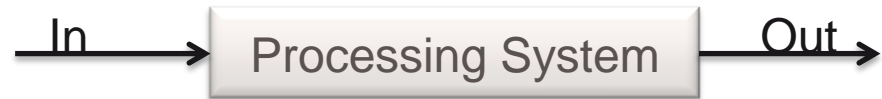
Futuristic views

Utopian or dystopian?

From Turing Machines to Cybernetics

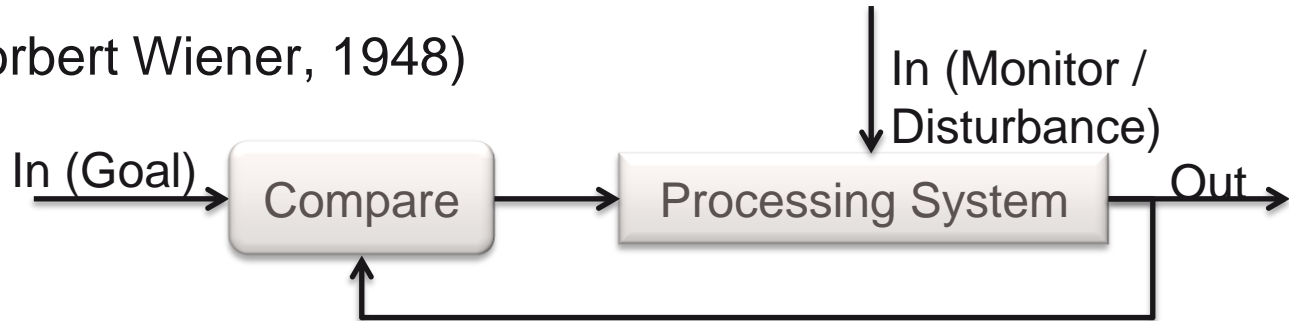
■ “Traditional” Computer Systems (e.g. Turing Machine, 1936)

- Input → Processing → Output.



■ Cybernetics (Norbert Wiener, 1948)

- Feedback loops



Technology as a paradigm & organising system

→ warnings & dystopian views ←

■ “Une nouvelle science : la Cybernétique - Vers la machine à gouverner?”,

Dominique Durable, *Le Monde*, 28 Dec.1948: philosophe, religieux

- La manipulation mécanique des réactions humaines créera-t-elle un jour « le meilleur des mondes » ?
- « Ne pourrait-on imaginer une machine à collecter tel ou tel type d'informations,..., puis à déterminer ...quelles seront les évolutions les plus probables de la situation? Ne pourrait-on même concevoir un appareillage d'état couvrant tout le système de décisions politiques ... une machine à gouverner ... pour le bien ou pour le mal »
- « La machine à gouverner définirait alors l'Etat comme le meneur le plus avisé sur chaque plan particulier, et comme l'unique coordinateur suprême de toutes les décisions partielles. Privilèges énormes qui ... permettraient à l'Etat d'acculer en toutes circonstances tout joueur au “jeu de l'homme” autre que lui à ce dilemme: ou bien la ruine quasi immédiate, ou bien la coopération suivant le plan. Et cela rien qu'en jouant le jeu, sans violence étrangère. »
- « En dépit de tout ceci, heureusement peut-être, la machine à gouverner n'est pas tout à fait pour un très proche demain. Car entre les problèmes très sérieux que pose encore le volume de l'information à recueillir et à traiter rapidement, les problèmes de la stabilité de la prévision sont encore au delà de ce que nous pouvons songer sérieusement à dominer.»

Technology as a paradigm & organising system

→ warnings & dystopian views ←

■ “Vers la machine à gouverner?”, Dominique Durable, *Le Monde*, 28 Dec.1948

- « Tout ceci tend ... à rendre peut-être radicalement infructueuse la manipulation mécanique des situations humaines. Autant qu'on en puisse juger deux conditions seules peuvent assurer ici la stabilisation au sens mathématique du terme: une suffisante inconscience de la masse des partenaires, exploitée alors par les joueurs avertis, qui peuvent du reste organiser un dispositif de paralysie de la conscience des masses; ou alors une suffisante bonne volonté de s'en remettre à un ou quelques meneurs de jeu, arbitrairement privilégiés en vue de la stabilité de la partie. Dure leçon des froides mathématiques, mais qui éclaire de quelque manière l'aventure de notre siècle, hésitant entre une turbulence indéfinie des affaires humaines et le surgissement d'un prodigieux Léviathan politique. Celui de Hobbes n'était du reste qu'agréable plaisanterie. Nous risquons aujourd'hui une énorme cité mondiale où l'injustice primitive délibérée et consciente d'elle-même serait la seule condition possible d'un bonheur statistique des masses, monde se rendant pire que l'enfer à toute âme lucide.
- Il ne serait peut être pas mauvais que les équipes présentement créatrices de la cybernétique adjoignent à leurs techniciens venus de tous les horizons de la science quelques anthropologues sérieux et peut-être un philosophe curieux de ces matières. »

Technology as a paradigm & organising system

→ warnings & dystopian views ←

■ “The Human Use of Human Beings”, Norbert Wiener, 1950

- Mathematician, physiologist, philosopher; originator of Cybernetics: feedback-oriented systems (“Cybernetics: or Control and Communication in the Animal and the Machine”, 1948)
- “The *machine à gouverner* of Père Dubarle is not frightening because of any danger that it may achieve autonomous control over humanity. ... Its real danger, however, is ...that such machines, ..., may be used by a human being or a block of human beings to increase their control over the rest of the human race or that political leaders may attempt to control their populations by means not of machines themselves but through political techniques as narrow and indifferent to human possibility as if they had, in fact, been conceived mechanically.”
- “know-how” vs. “know-what”: “determine not only *how* to accomplish our purposes, but *what* our purposes are to be”

Technology as a paradigm & organising system

→ warnings & dystopian views ←

■ “The Myth of the Machine”, Lewis Mumford, 1970

- Historian, sociologist, philosopher of technology, and literary critic
- “Megatechnics”, modern technology tends towards:
- Limitless expansion, production and replacement (via fashion & planned obsolescence)
- Against technical quality and durability; social benefits and human satisfaction
- Centralised power-systems using technological means to organise & control populations
- “Technological compulsiveness” – use each new product without questioning

Technology as a paradigm & organising system

→ warnings & dystopian views ←

■ “Homo Technomorphis”, William Manson, 2014

- Psychoanalytic anthropologist, taught social science at Rutgers & Columbia Univ.
- On Lewis Mumford’s dystopian view of technology:

“The beleaguered– even “obsolete”– individual would be entirely de-skilled, reduced to a passive, inert, “trivial accessory to the machine.” Technical surveillance and limitless data-collection—“an all-seeing eye” (Panopticon)—would monitor every “individual on the planet.” Ultimately, the totalitarian technocracy, centralizing and augmenting its “power-complex,” ignoring the *real* needs and values of human life, might produce a world “fit only for machines to live in.”

“Moreover—as we already observe now—people, losing “confidence in [their] own unaided capacities,” would become psychologically *dependent* on an array of ubiquitous devices, instruments, computers. Entirely indoctrinated in what may be called “techno-inevitabilism,” such “machine-addicts” would mindlessly accept the latest gadgets, surrendering “to these novelties unconditionally just because they are offered, without respect for their human consequences.” → “**Technolatry**”

How do we view ourselves? And our future?

Transhumanism & The Singularity

■ Philosophical movement (H+, h+)

- Go beyond our human nature, transcend our species
- Better intellect and physiology
- Via modern technologies – computers, genetics, nano-tech, robotics, AI

■ Raymond Kurzweil: author, computer scientist, inventor, futurist

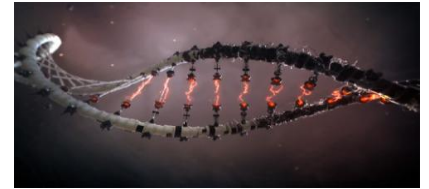
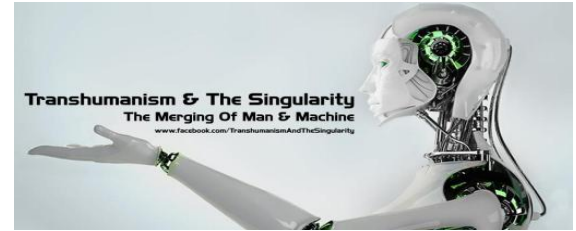
- “The Age of Intelligent Machines”, 1990
- “The Age of Spiritual Machines”, 1999
- “The Singularity is Near”, 2005

■ Hans Moravec: roboticist, CMU, futurist, author

- “Robot: Mere Machine to Transcendent Mind”, 2000

■ Predictions – R. Kurzweil

- “ The pace of change will be so astonishingly quick that we won't be able to keep up, unless we enhance our own intelligence by merging with the intelligent machines we are creating”
- “ We will all be ...plugged into this global network that is connected to billions of people, and filled with data.”



How do we view ourselves? And our future?

Transhumanism – Critics

■ Sarah Spiekermann

- Professor for business informatics at Vienna University of Economics and Business
- [Combating Transhumanism](#), September 2017, blog/forum
- [Anti-Transhumanist Manifesto](#), June 2017, Swiss Daily “Neue Züricher Zeitung” (NZZ)
“Wider den Transhumanismus”

■ Negative perspective of humans as a suboptimal species

■ Normal human beings are inefficient, viewed as:

- “resources”, “preference bundles”, “DAUs” (Dumbest Assumable User) “wetware”;
- unpredictable, suboptimal, irrational and mortal.

■ Must be improved via technology & drugs

■ Ok, but why? And for whom? Values, goals,...?



Illustration:
Peter Gut

Transhumanism – Critics

Totalising information-oriented metaphor

■ One Half a Manifesto, Jaron Lanier, Wired Magazine, 2000

- Computer scientist, Microsoft research, writer, composer, visual artist
- Cybernetic technology becomes culture → “Cybernetic Totalism”
- Despite Moore’s Law, there’s still the software problem: software is brittle and breaks

■ Comments +/- from:

- Daniel Dennett: philosopher, writer and cognitive scientist
- Rodney Brooks: roboticist, MIT Prof., Dir. of MIT Cog. Sci & AI Lab
 - Gradual change rather than cataclysmic transformation
 - “We are machines until proven otherwise”
(but, “nothing to do with Turing machines, or programming computers”!)
- David Hillel Gelernter: artist, writer, Prof. of CS at Yale University
- Paul Allen: business, co-founder of Microsoft
-

Transhumanism – Critics

Responsibility & Dependence

- **Why should humanity give over control to machines?**
 1. **Machines make better, more efficient decisions;**
 2. **Decisions needed to keep the system running become too complex for humans;**
 3. **Machines are now in control as the only ones capable to take “intelligent” decisions;**
 4. **People cannot take machines off because they are too dependent; it would be suicide;**
 - **The above changes would arrive gradually and humans will learn not to mind them.**

- **Automating decisions means abdicating human responsibility**

- **Few humans will control the majority of technological infrastructure**
 - **Majority of humans become superfluous**
 - **→ may be eliminated; or → may be kept “happy” (e.g. Huxley’s “Brave New World”)**

- **Bill Joy: computer scientist, co-founder of Sun Microsystems**
 - **“[Why the Future Doesn't Need Us](#)”, Wired Magazine, 2000**
 - **“with each of these technologies, a sequence of small, individually sensible advances leads to an accumulation of great power and, concomitantly, great danger.”**

Transhumanism – Critics

Responsibility & Dependence

- “The Human Use of Humans”, Norbert Wiener, 1950
 - “Any machine constructed for the purpose of making decisions, if it does not possess the power of learning, will be completely literal- minded. Woe to us if we let it decide our conduct, unless we have previously examined the laws of its action, and know fully that its conduct will be carried out on principles acceptable to us! On the other hand, the machine... which can learn and can make decisions on the basis of its learning, will in no way be obliged to make such decisions as we should have made, or will be acceptable to us. For the man who is not aware of this, to throw the problem of his responsibility on the machine, whether it can learn or not, is to cast his responsibility to the winds, and to find it coming back seated on the whirlwind.”



Thank you

Questions ?