Schedule

12:00 h   Introduction

12:10 h   Presentation by Auris-E Lipinski:
            On artificial intelligence and the technologies that supposedly amount to it
13:10 h   Discussion
13:40 h   Pause

13:50   Presentation by Kristina Georgieva:
            Using evolutionary algorithms for neural network generation
14:20 h   Discussion
14:50 h   Pause

15:00 h   Presentation by Alexander Mankowsky:
            Mor(e) on: Why AI seems to be indicating a need for Magic in Society.
16:00 h   Discussion
16:30 h   Pause

16:40 h   Discussion of all presentations

PHEN
CO
CO

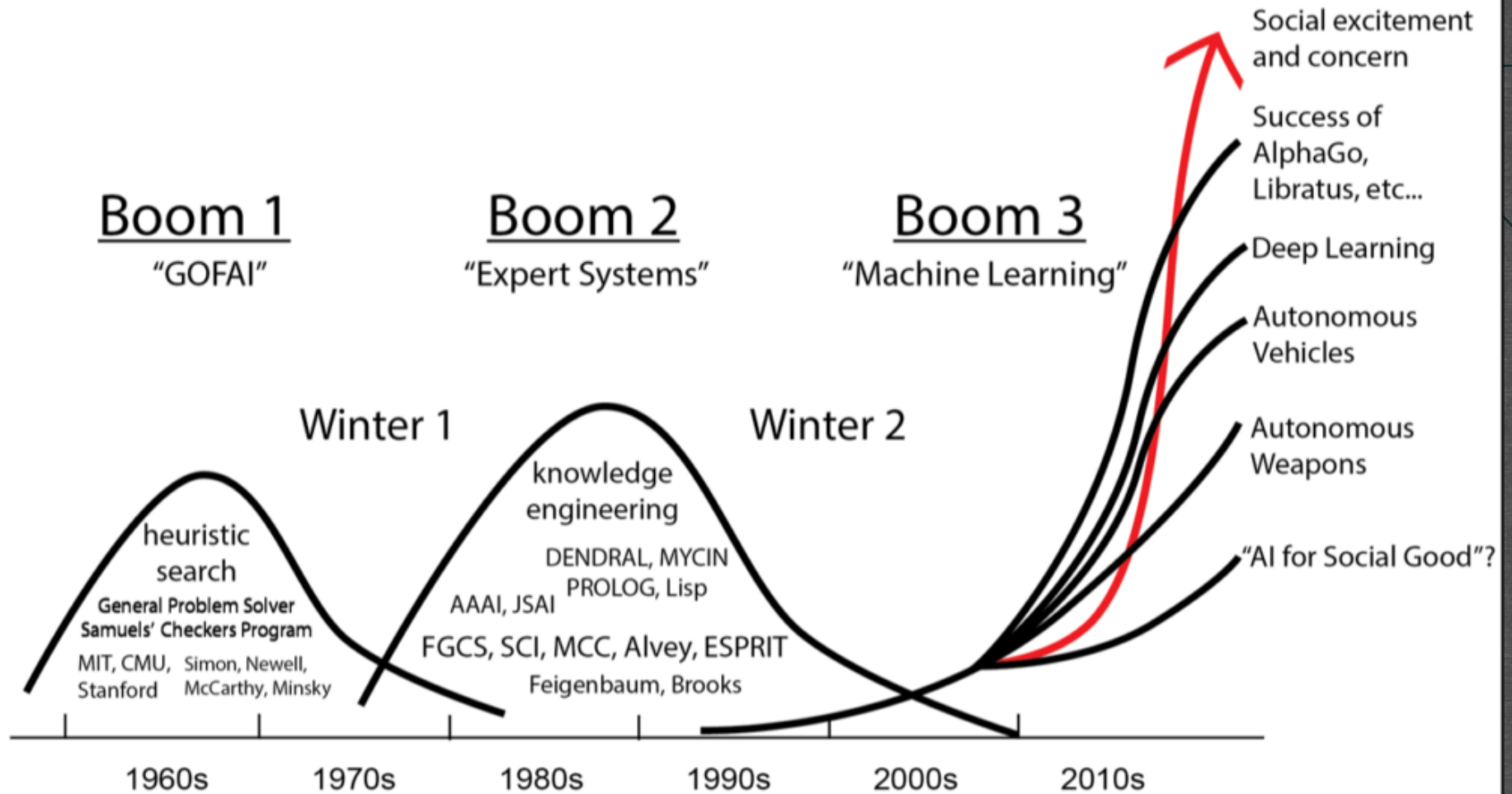On artificial intelligence and the technologies that supposedly amount to it

Very often "artificial intelligence" is being used synonymous with "artificial learning methods".
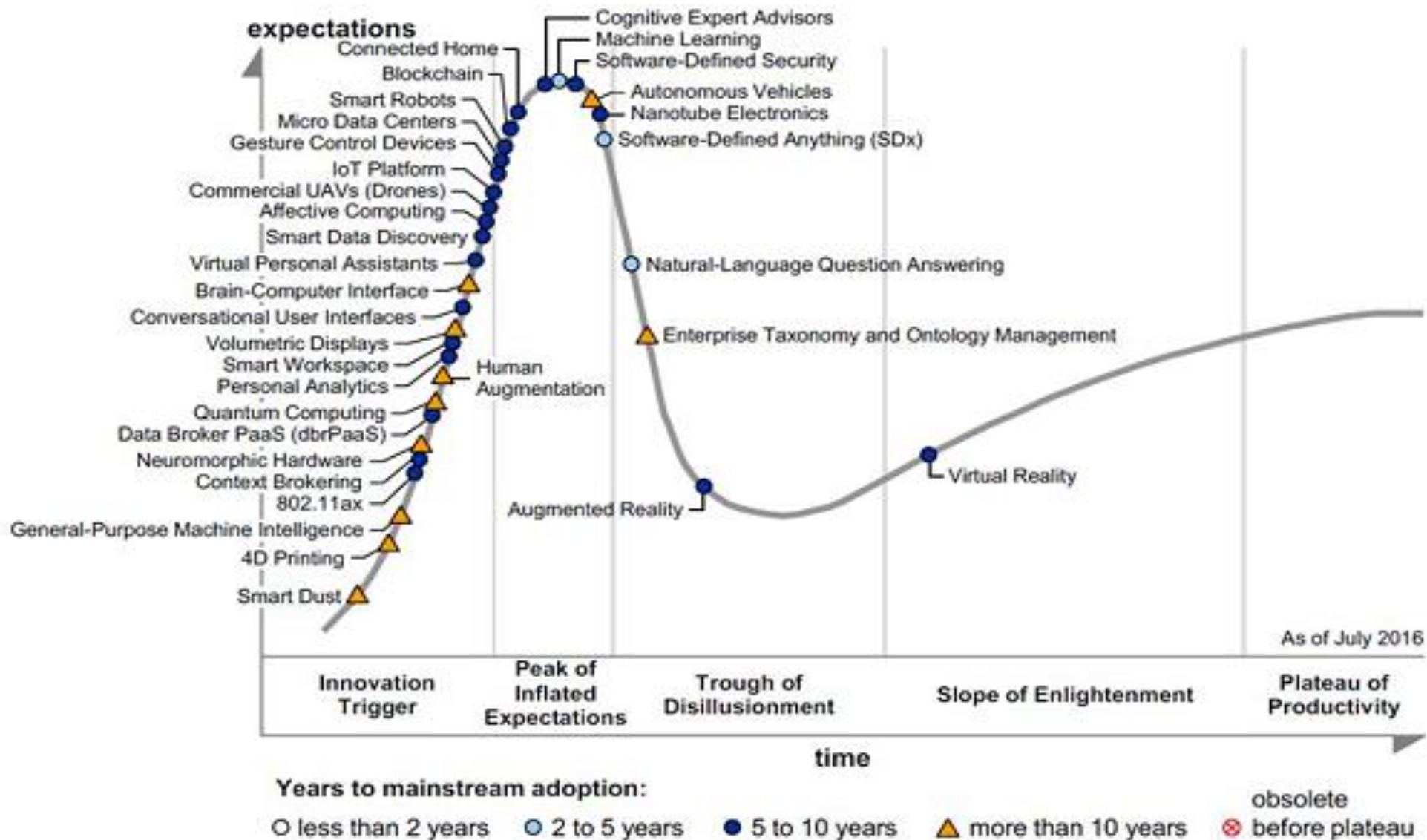
Artificial Intelligence Approaches:

- Symbolic (GOFAI)

- Bayesian networks

- Deep learning

PHEN
CO
CO

Artificial Intelligence Approaches

expectations

Cognitive Expert Advisors
Machine Learning
Software-Defined Security
Connected Home
Blockchain
Autonomous Vehicles
Smart Robots
Nanotube Electronics
Micro Data Centers
Software-Defined Anything (SDx)
Gesture Control Devices
IoT Platform
Commercial UAVs (Drones)
Affective Computing
Smart Data Discovery
Virtual Personal Assistants
Natural-Language Question Answering
Brain-Computer Interface
Conversational User Interfaces
Enterprise Taxonomy and Ontology Management
Volumetric Displays
Smart Workspace
Human Augmentation
Personal Analytics
Quantum Computing
Data Broker PaaS (dbrPaaS)
Neuromorphic Hardware
Context Brokering
Virtual Reality
802.11ax
General-Purpose Machine Intelligence
Augmented Reality
4D Printing
Smart Dust

As of July 2016

| Innovation Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Years to mainstream adoption:

○ less than 2 years ◔ 2 to 5 years ● 5 to 10 years △ more than 10 years ⊗ obsolete before plateau

Source: Gartner (July 2016)

https://hackernoon.com/state-of-dev-c609cc12084b

On artificial intelligence and the technologies that supposedly amount to it

Canada was the first country to release a national AI strategy.

Detailed in the 2017 federal budget, the Pan-Canadian Artificial Intelligence Strategy *is a five-year, C$125 million plan to invest in AI research and talent. The strategy has four goals:*
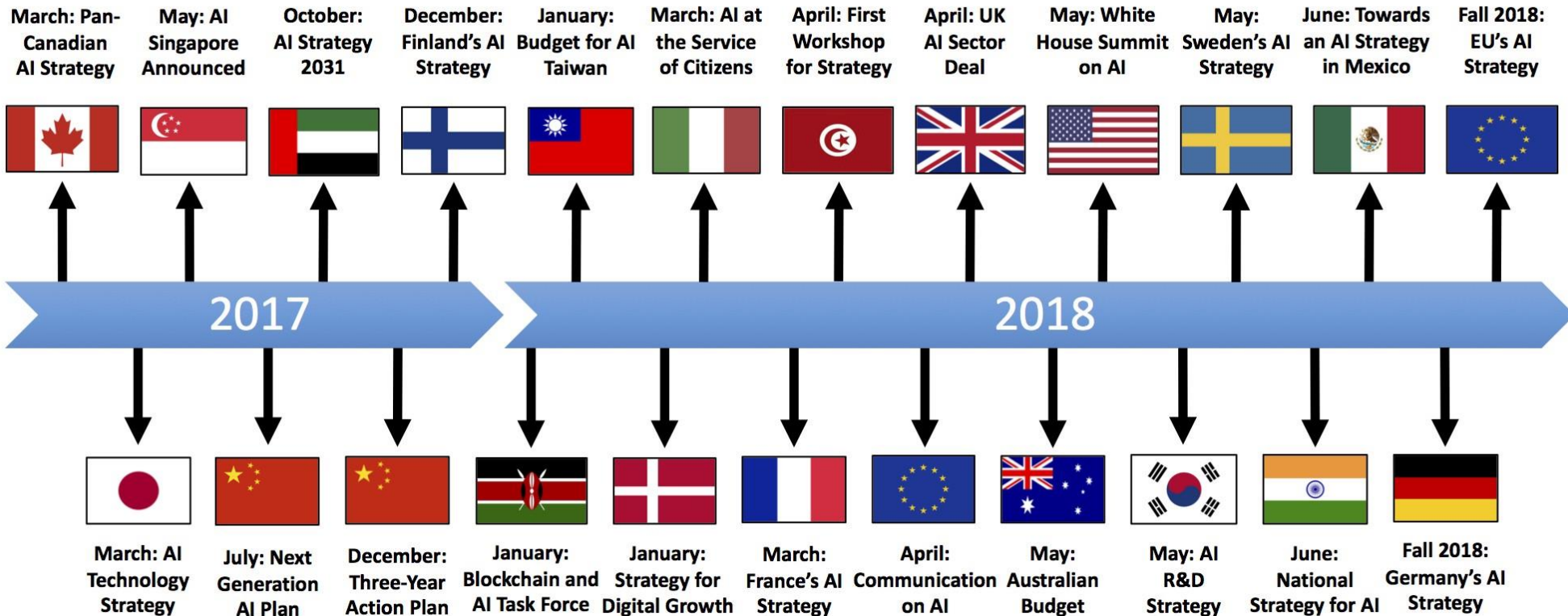
(1) increase the number of AI researchers and graduates,

(2) establish three clusters of scientific excellence,

(3) develop thought leadership on the economic, ethical, policy, and legal implications of AI, and (4) support the national research community on AI.

On artificial intelligence and publishing of official governmental strategies

Artificial Intelligence Strategies

March: Pan-Canadian AI Strategy — Canada
May: AI Singapore Announced — Singapore
October: AI Strategy 2031 — UAE
December: Finland's AI Strategy — Finland
January: Budget for AI Taiwan — Taiwan
March: AI at the Service of Citizens — Italy
April: First Workshop for Strategy — Tunisia
April: UK AI Sector Deal — UK
May: White House Summit on AI — USA
May: Sweden's AI Strategy — Sweden
June: Towards an AI Strategy in Mexico — Mexico
Fall 2018: EU's AI Strategy — EU

2017   **2018**

March: AI Technology Strategy — Japan
July: Next Generation AI Plan — China
December: Three-Year Action Plan — China
January: Blockchain and AI Task Force — Kenya
January: Strategy for Digital Growth — Denmark
March: France's AI Strategy — France
April: Communication on AI — EU
May: Australian Budget — Australia
May: AI R&D Strategy — South Korea
June: National Strategy for AI — India
Fall 2018: Germany's AI Strategy — Germany

2018-07-13 | Politics + AI | Tim Dutton

https://medium.com/politics-ai/an-overview-of-national-ai-strategies-2a70ec6edfd

T. Ziemke / BioSystems 148 (2016) 4–11
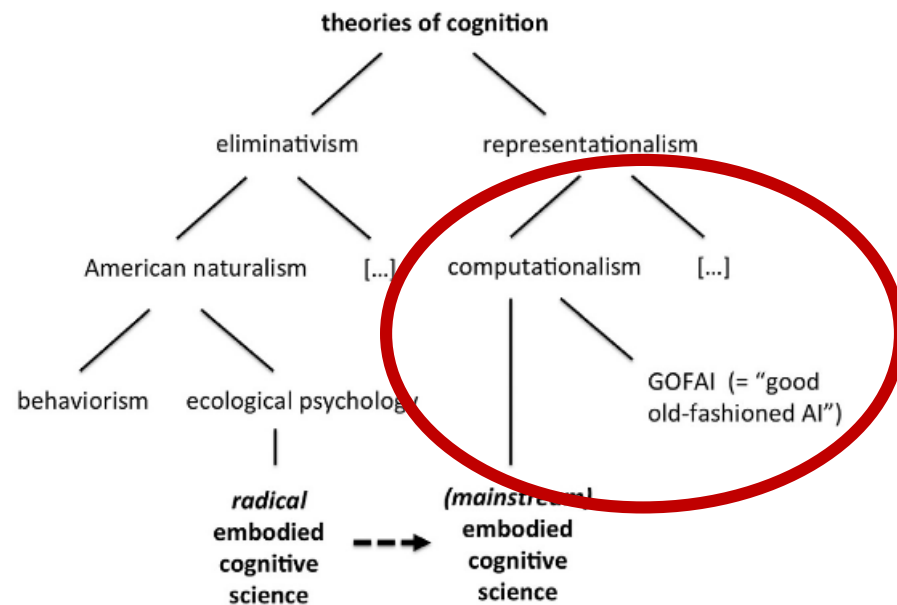
Fig. 1. Current notions of embodied cognitive science and their historical roots. Adapted from Chemero (2009: 30).

1. Representational and computational views of embodied cognition are wrong.
2. Embodied cognition should be explained using a particular set of tools **T**, including dynamical systems theory.
3. The explanatory tools in set **T** do not posit mental representations.

To summarize the discussion so far, it should now be clearer why exactly it is still surprisingly difficult to pinpoint what embodied cognition is, or what kind of embodiment an artificial cognitive system might require. There are different positions along at least a couple of dimensions of embodiment: physicality, the view of representation, and the role of the underlying biology. Embodied AI researchers emphasize the importance of physical grounding, but in their research practice they commonly make use of software simulations (cf. Ziemke, 2003), and the computer programs controlling their robots – physical or simulated – are for the most part still just as computational as the computer programs of traditional AI. Radical embodied cognitive science, at least according to Chemero, is strictly anti-representationalist, whereas mainstream embodied cognitive science more or less still embraces the traditional computationalist/representationalist framework, but emphasizes the need for representations to be grounded, i.e. a robotic functionalism instead of the traditional computational functionalism. Naturally,

embodied AI researchers who – like Searle – take the *Chinese Room Argument* to be a valid argument against traditional AI, but at the same time – unlike Searle – consider the physical and sensorimotor

Haugeland´s "claims essential to all GOFAI theories"

1. *our ability to deal with things intelligently is due to ourcapacity to think about them reasonably (including sub-conscious thinking); and*

2. *our capacity to think about things reasonably amounts toa faculty for internal "automatic" symbol manipulation.*

Paraphrased:

[O]ur ability to deal with things intelligently is due to our faculty for internal "automatic" symbol manipulation.

Articicificial Intelligence approaches

Symbolic (GOFAI)

Good Old Fashioned Human Artificial Intelligence?

December 26, 2014   electrobleme

Science will eventually create AI (Artificial Intelligence) but will they ever be able to replicate the human mind, thinking or soul?

Do people already use AI. Do you sometimes know something that you just can not or should not know? Where does that 'esoteric' knowledge come from?
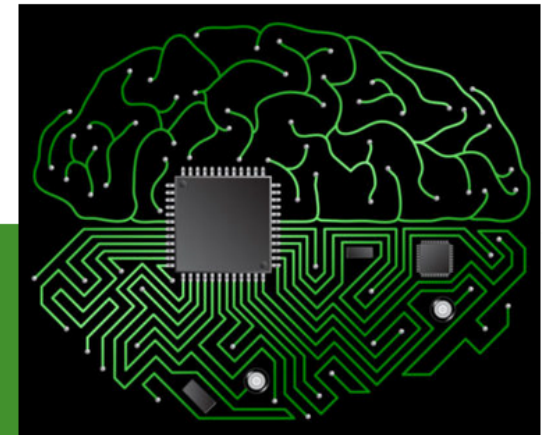
> The field was founded on the claim that a central property of humans, intelligence—the sapience of Homo sapiens—"can be so precisely described that a machine can be made to simulate it."

> This raises philosophical issues about the nature of the mind and the ethics of creating artificial beings endowed with human-like intelligence, issues which have been addressed by myth, fiction and philosophy since antiquity.
> Artificial intelligence (wiki)

Articificial Intelligence approaches

Bayesian networks
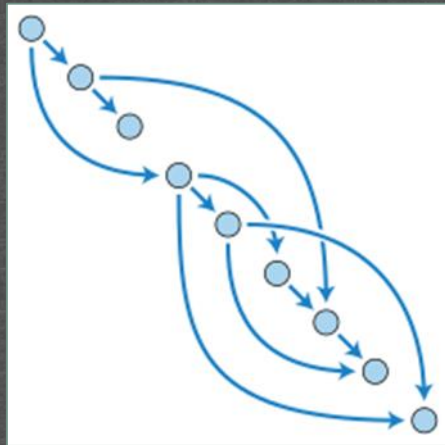
A probabilistic graphical model

(a type of statistical model)

that represents a set of variables and their

conditional dependencies

via a directed acyclic graph (DAG).
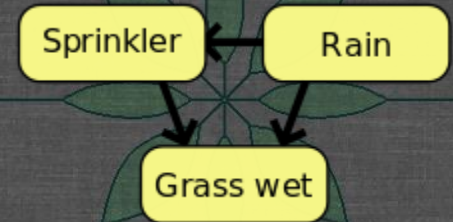
directed acyclic graph (DAG):

A topological ordering of a directed acyclic graph: every edge

goes from earlier in the ordering (upper left)

to later in the ordering (lower right). A directed graph is

acyclic if and only if it has a topological ordering.

PHEN
CO
CO

Stochastics – foundations and methods

- *response spaces*

- *events*

- *tree diagrams & fourfold table*

- *faculty*

- *binomial coefficient*

PHEN
CO
CO

Bayesian networks: conditional probability

tree diagrams & fourfold table

$$\chi^2 = \sum \frac{(Observed - Expected)^2}{Expected}$$

Die **Vierfeldertafel** ist ein Hilfsmittel in der Stochastik, um Zusammenhänge zwischen zwei Ereignissen darzustellen.

An ihr kann man neue Informationen (zum Beispiel Wahrscheinlichkeiten, oder absolute Häufigkeiten) ablesen.

Die Vierfeldertafel hilft auch, die Unabhängigkeit von Ereignissen zu untersuchen.

	A	$\bar{A}$	
B	42%	25%	67%
$\bar{B}$	8%	25%	33%
	50%		100%

Wenn in einer Vierfeldertafel genügend Einträge da sind, ist es sehr leicht, die fehlenden Werte zu ergänzen.

Tree diagram:

$P(B)$
- $P(A|B) = P_B(A)$ → A : $P(B \cap A)$
- $P(\bar{A}|B) = P_B(\bar{A})$ → $\bar{A}$: $P(B \cap \bar{A})$

$P(\bar{B})$
- $P(A|\bar{B}) = P_{\bar{B}}(A)$ → A : $P(\bar{B} \cap A)$
- $P(\bar{A}|\bar{B}) = P_{\bar{B}}(\bar{A})$ → $\bar{A}$: $P(\bar{B} \cap \bar{A})$

PHEN CO CO
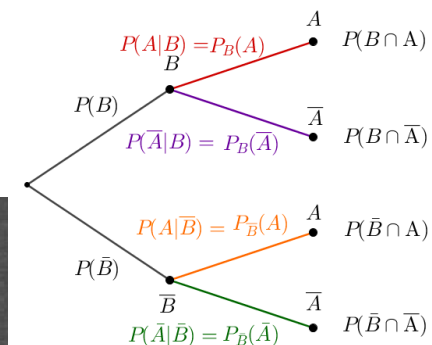
Bayesian networks based on mathematics

influence diagram

can serve at the three levels of specification :

relation   *function*   *number*

income depends on age and education and that education depends on age

assign the conditional distribution of income give assign the conditional distribution of income given age and education and the distribution of education given agen age and education and the distribution of education given age

assign the unconditional distribution on age

PHEN
CO
CO

Bayesian networks: conditional probability

tree diagrams & fourfold table

Heidegger's Fourfold (das Geviert)

We are too late for the gods and too early for Being. Being's poem, just begun, is man.

— From **Thinker as Poet** by Martin Heidegger

"Every man makes a god of his own desire."

— **Virgil**

	Tool (Concealed)	Broken Tool (Revealed)
Specific Something	Gods	Sky
Something at All	Earth	Mortals
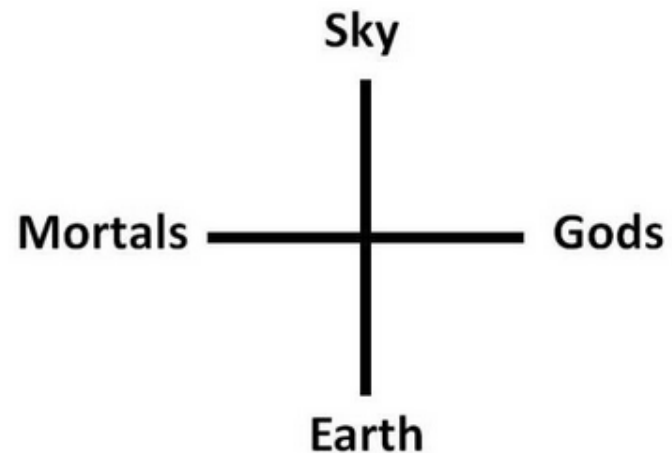
It is defined as

the Probability of an event A given B equals the probability of B and A happening together divided by the probability of B."
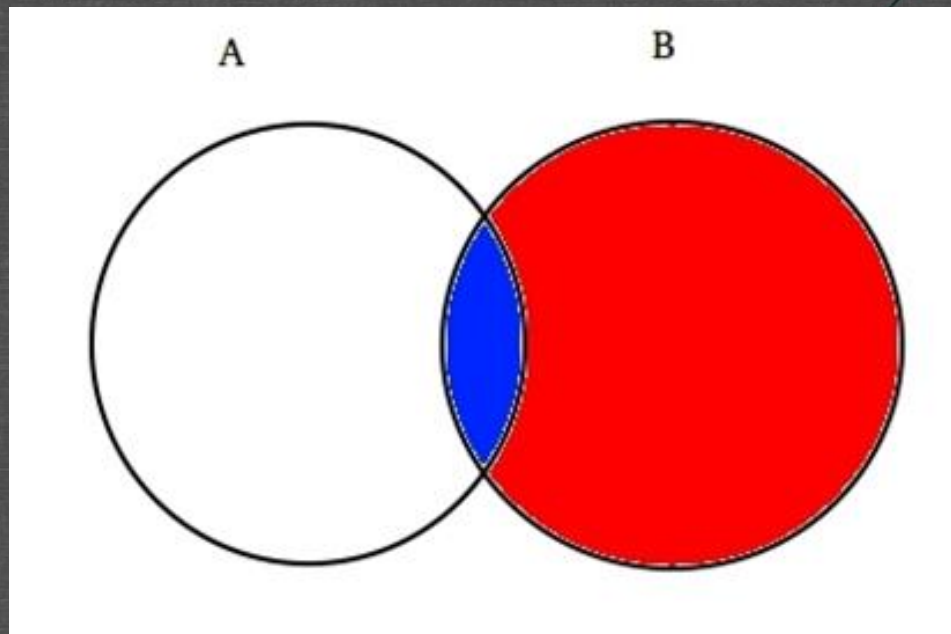
$$\frac{Blue Area}{Red Area + Blue Area}$$

Therefore, we can write the formula for event B given A has already occurred by:

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

or

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Now, the second equation can be rewritten as :

$$P(A|B) = \frac{P(B|A) X P(A)}{P(B)}$$

This is known as **Conditional Probability**.
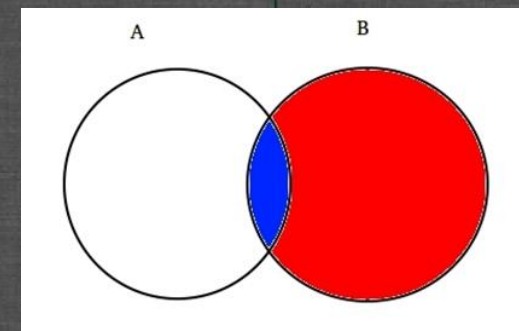
Bayesian networks:

conditional probability as betting problem

P(A) =1/2, since it rained twice out of four days.

P(B) is 1/4, since James won only one race out of four.

P(A|B) =1, since it rained every time when James won.

„Goat-Problem"
https://de.serlo.org/91407-ziegenproblem

Bayes Theorem

3.2 Bayes Theorem

Bayes Theorem comes into effect when multiple events A_i form an exhaustive set with another event B. This could be understood with the help of the below diagram.

A1	B	
A2		
A3		

Now, B can be written as

$$B = \sum_{i=1}^{n} B \cap A_i$$

So, probability of B can be written as,

$$P(B) = \sum_{i=1}^{n} P(B \cap A_i)$$

But

$$P(B \cap A_i) = P(B|A_i) \times P(A_i)$$

So, replacing P(B) in the equation of conditional probability we get

$$P(A_i|B) = (P(B|A_i) \times P(A_i))/(\sum_{i=1}^{n}(P(B|A_i) \times P(A_i)))$$

This is the equation of **Bayes Theorem**.

PHEN
CO
CO

Bayesian networks: Bayes Theorem

Now, B can be written as

$$B = \sum_{i=1}^{n} B \cap A_i$$

So, probability of B can be written as,

$$P(B) = \sum_{i=1}^{n} P(B \cap A_i)$$

But

$$P(B \cap A_i) = P(B|A_i) \times P(A_i)$$

So, replacing P(B) in the equation of conditional probability we get

$$P(A_i|B) = (P(B|A_i) \times P(A_i))/(\sum_{i=1}^{n}(P(B|A_i) \times P(A_i)))$$

This is the equation of **Bayes Theorem**.

Bayesian networks:

Bayesian Inference

- *Models are the mathematical formulation of the observed events.*
- *Parameters are the factors in the models affecting the observed data.*

PHEN
CO
CO

Bayesian networks

Spacial bayesian processing

Voronoi Diagrams: Concepts

Basic Properties

4) Sites in the unbounded voronoi cells correspond to the vertices on the **convex hull**.

Voronoi Diagrams: Algorithms

Algorithm
The concept is applied using half plane intersection.

Voronoi diagrams
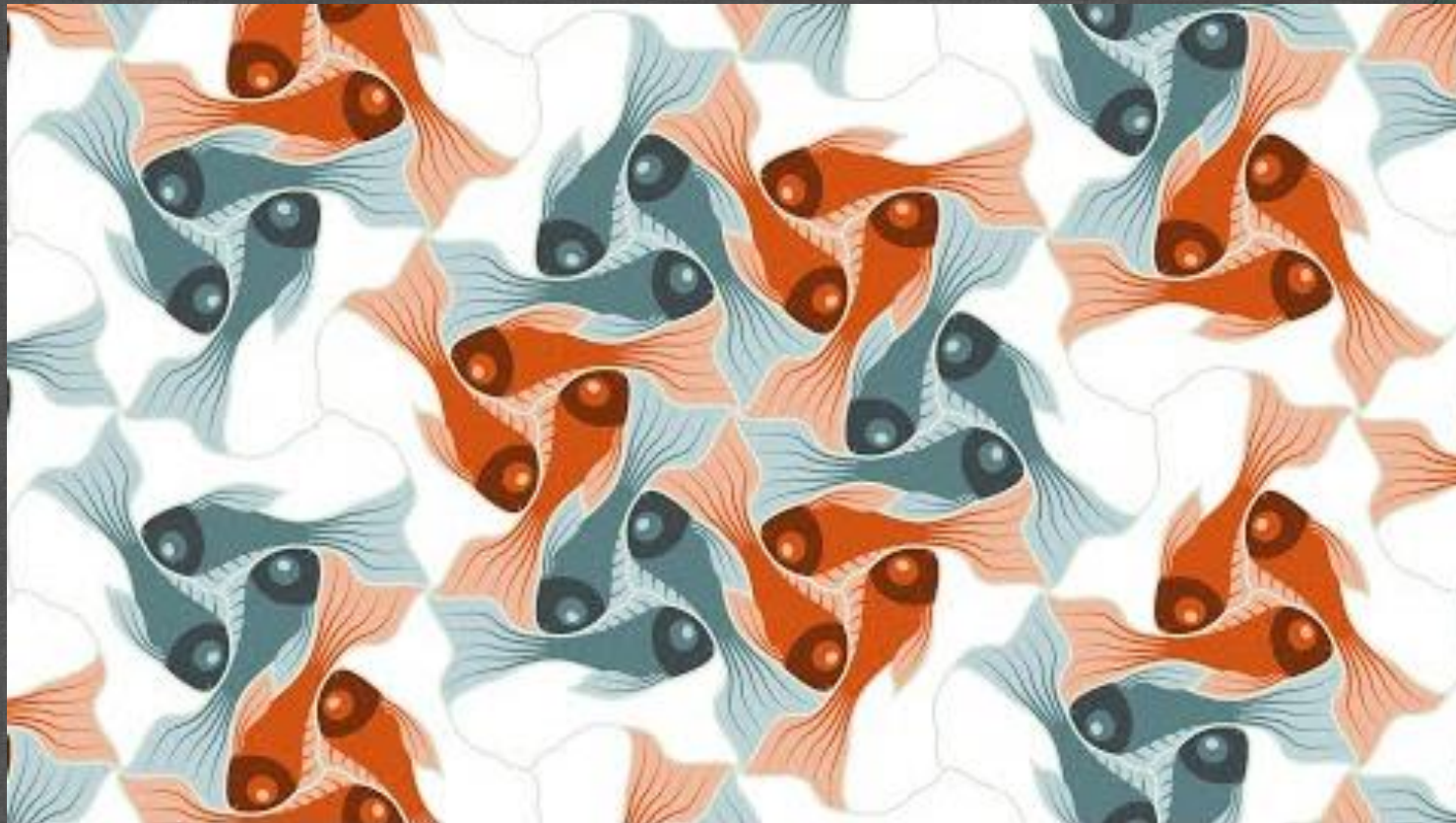
Tesselation

Articificial Intelligence approaches
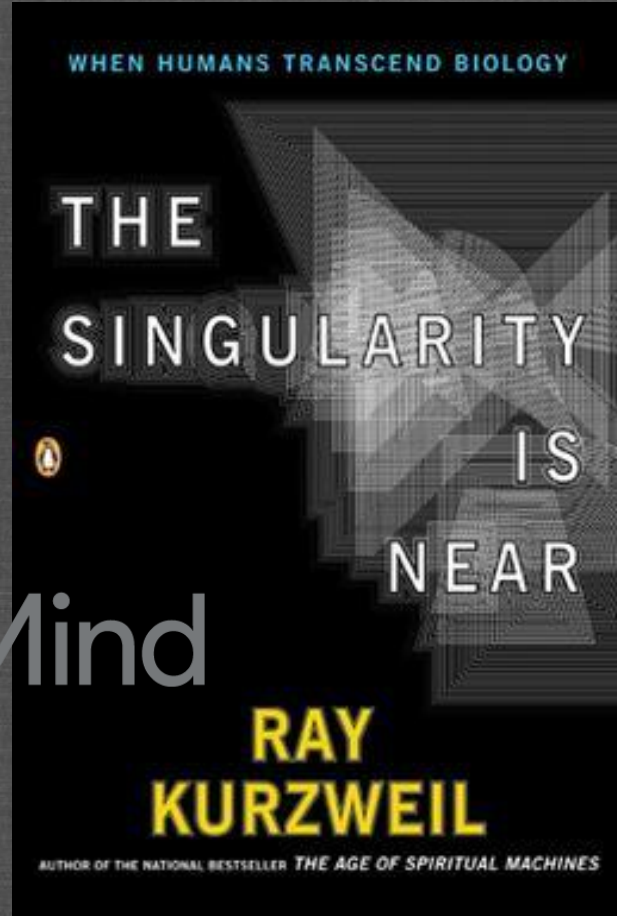
Deep learning

DroidFish is a free Android chess program that bundles the Stockfish engine.

Articificial Intelligence approaches
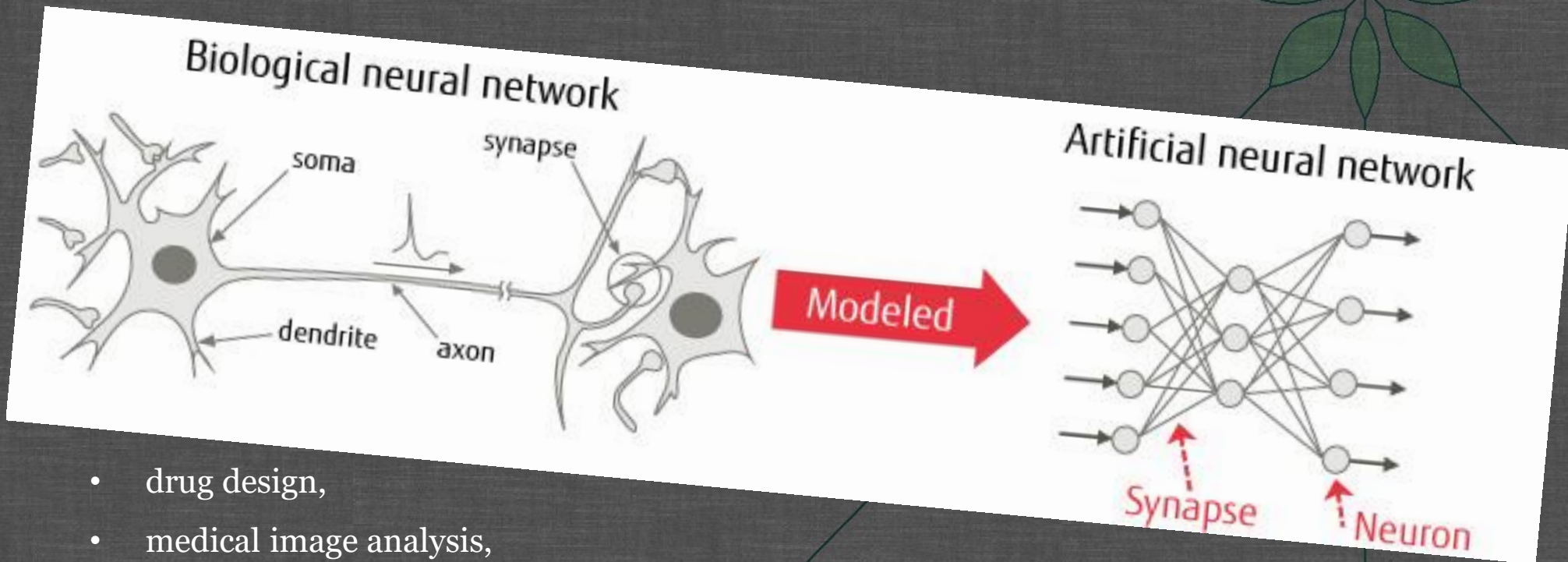
Deep learning

- drug design,
- medical image analysis,
- material inspection and
- board game programs

Articificial Intelligence approaches

Deep learning

Deep learning models are vaguely inspired by information processing and communication patterns in biological nervous systems

But they have various differences from the structural and functional properties of biological brains (especially human brains), which make them incompatible with neuroscience evidences.

Articificial Intelligence

How does an Evolutionary Algorithm (EA) work ?

Initiation of a
random population

Desired:

2) Using evolutionary algorithms for neural network generation

- What are evolutionary algorithms and adaptive models?

- How can we use these to change from our training of neural networks into an evolutionary process instead?

Speaker: Kristina Georgieva

https://www.kip.uni-heidelberg.de/vision/
previous-projects/evolvable-hardware/
evolutionary-algorithms/

Ressourcen:

- http://www.everythingselectric.com/gofai-good-old-fashioned-human-artificial-intelligence/
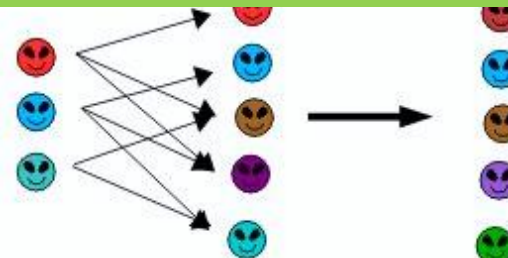
- https://en.wikipedia.org/wiki/Bayesian_network

- http://www.cs.ru.nl/~marinav/Teaching/BDMinAI/influencediagrams05.pdf

- https://www.analyticsvidhya.com/blog/2016/06/bayesian-statistics-beginners-simple-english/

- http://www.systransoft.com/systran/translation-technology/what-is-machine-translation

- https://www.cambridge.org/core/books/cambridge-handbook-of-artificial-intelligence/gofai/FCF7D6DD921658FE8AE9F2A2B0FECBDD

- http://www.cs.yale.edu/homes/dvm/papers/http://www.cs.yale.edu/homes/dvm/papers/nogofai.pdfnogofai.pdf

- http://www.anthrobase.com/Txt/R/Risan_L_05.htm

- https://en.wikipedia.org/wiki/Binary_classification

PHEN
CO
CO

Ressourcen:

- Voronoi diagrams 1 https://www.youtube.com/watch?v=7eCrHAv6sYY

- Voronoi diagrams 2 https://www.youtube.com/watch?v=Y5X1TvN9TpM

- https://hackernoon.com/state-of-dev-c609cc12084b

- https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=imgres&cd=&ved=2ahUK EwiOk8WuqIXhAhWMbVAKHRM7AzkQjxx6BAgBEAI&url=https%3A%2F%2Fmedium. com%2Fpolitics-ai%2Fan-overview-of-national-ai-strategies- 2a70ec6edfd&psig=AOvVaw3wcM-l01DE28fNGzju_-Mw&ust=1552779450766934

- https://www.youtube.com/watch?v=7GiKeeWSf4s

PHEN
CO
CO