Seminar series: As Várias Faces do Risco e os Desafios da Educação na Sociedade Contemporânea.
Session: The risks and benefits of AI to life in the cognitive era: a ditropic approach.
Don Peterson. IEA. USP. 12/11/2019.

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O mundo mudou.

As máquinas mudaram.

A vida mudou.

Então ...

Qual é o destino dessa nova ponte?

Quais são seus riscos e oportunidades?

Quais são seus desafios para a educação?

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ditropism

All technologies are **ditropic**.

They produce good effects, bad effects, or both according to use, context, and purpose … according to how they are used, in what situations they are used, and what goals we have.

Risk and benefit, therefore, are contextualist and not essentialist phenomena: they are issues of **utilisation in context**.

the logical form of ditropism

$$\forall t(\exists c_1,c_2(U(t,c_1) = \checkmark \ \& \ U(t,c_2) = \times))$$

Where: t = technology, c = context, U = utilise.
I.e: for all technologies, there exists context in which their utilisation is beneficial, and context in which it is not.

Our ethical task, then, is steerage: directing what we have to good effect.

Our futurist task is predictive steerage: preparing ahead of time for conditions which are predicted.

the dialectical form of ditropism

opportunity  risk

Opportunity and risk form a dynamic dialectic.

Where there is opportunity, there is also risk.

Where there is risk, there is also opportunity.

Lǎozǐ (6th C BC, chapter 2), 'High and low rest on each other'.

Heraclitus (6th-5th C BC, fragment 60), 'The way up and the way down are one and the same'.

cyberology

Cyberology is defined here as the study of the benefits and risks of cybertechnologies.

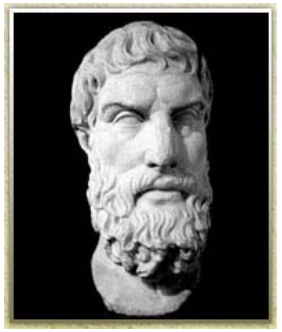
Our categories are:		
Conditions	MVIF	massive, volatile, immediate, fragmented
Technologies	ARUC	AI, robotics, ubiquitous computing, connectivity
Life	EWBH	education, work, business, health

Our matrix is: **MVIF x ARUC x EWBH**	**Our methodology is:** **multidisciplinary** **theoretical + practical** **ditropic.**
This gives a reference grid of 4^3 = 64 3-tuple cells, e.g. <M,A,E>, e.g. interpreted as "education in the use of AI for mass data"	**These are necessary but not sufficient for success.**

1. education & cybersense

ie]

EWBH



situation. We increasingly need cybersense --- practical understanding of how to live in a world of information overload, fragmented delivery, compromised privacy, multiple and changing interfaces, software upgrades, multiple passwords, etc. [Epictetus left.]

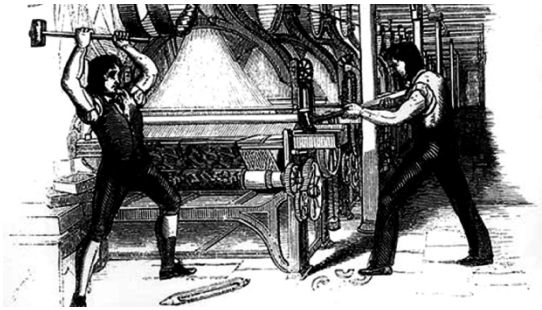
details. A key skill is how to navigate this maelstrom. When do we attend to something and when not? Do we use our cellphone at the meal table? We face a dilemma of attention --- if we attend to everything we die, if we ignore anything we may lose out. Aristotle advocated practical wisdom or phronesis (Nichomachean Ethics, book 6) The Stoics advocated a type of rational detachment. In any case we need to be methodical in navigating cyberspace. We need cyberphronesis and cyberstoicism. For this we need education which teaches habits and methods advocated by the ancients, applied now as cybersense.

education & cybersense

education & cybersense	
Education	School curriculum. The Stoics. Aristotle. Methodical navigation of cyberspace.
Work	Greater effectiveness. Re-skilling.
Business	Short courses.
Health	Human relations. Family life. Stress relief. Laws and regulations (e.g. France).

2. work & metarobotics

EWBH



situation. The robots are coming, and we need to prioritise metarobotics --- human work in design, manufacture, maintenance, use, management, installation, marketing, repair, regulation, legislation, etc. for robots. [Luddites left.]

details. This involves expertise in several fields, it requires education, including short courses, and should lead to employment, consultancy, training, teaching, etc. It involves both software and hardware robots, intelligent agents, medical robotics, geriatric carer robots, agricultural robots, personal robotics, robot tailoring, humanoid robotics, and robots in every industry. It requires expertise in HRI (human-robot interaction) and RRI (robot-robot interaction).

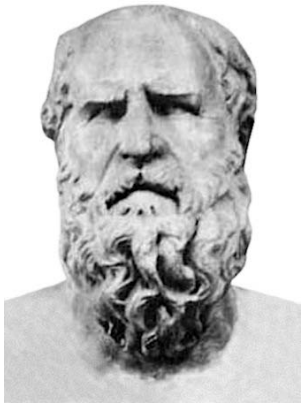
The Luddites were concerned that machines would take human jobs, and the same seems inevitable in the case of robots. It is imperative therefore that we anticipate this with re-education, re-skilling, and re-definition of human roles at work. A particular danger is that there will be a selective effect on the less skilled parts of the workforce, thus increasing inequality: people who are already on low income could then become unemployed.

work & metarobotics

work & metarobotics	
Education	All aspects of metarobotics. Training. New skills. Re-skilling.
Work	Short courses. Redefinition of roles. Human employment.
Business	Dangers of robots. Safety-critical situations.
Health	Regulations, laws, standards.

3. business & agility

EWBH



situation. Agility in business is the ability to respond to changing circumstances. As the volatility of situations and circumstances rises, as change accelerates, agility is prioritised. [Heraclitus left, Boccioni right.]

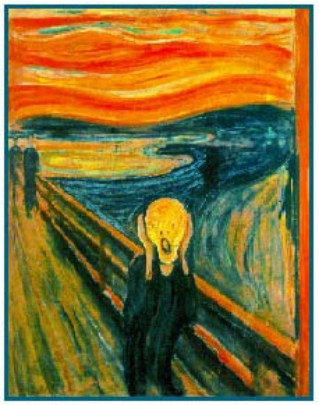
details. An example is Nokia who “saw the heat coming round the corner” and changed from photocopiers to cellphones. Agility in response to volatility is a generic issue: for businesses, individuals, leaders, institutions, etc. In terms of systems theory, we gain and we lose through the required openness. In terms of brain science, agility is associated with “set shifting” in working memory in executive function. In terms of training there exist games for “mental agility”, and rudimentary instruments for measuring AQ (agility quotient).

business & agility

business & agility	
Education	Agility training. AQ.
Work	Fast change. Volatility & agility. Situation-awareness.
Business	Globalisation. Fast-change.
Health	Lifestyle, nutrition, meditation, etc.

4. health & cyberstress

EWBH



situation. cyberstress is a growing problem for mental health --- it is a response to MVIF conditions, global connectivity, fast change, complexity, overload. [Munch right.]

details. Cogtech is a threat to mental health. Some factors are information bombardment, multiple passwords and interfaces, endless upgrades, always-on reception, mobile devices, fake news, the need for attention, obligation to be available, expectations of fast response.

We have cyberrecluse syndrome, digital detox, internet addiction, social media addiction, de-contextualised communication. France has recently legislated the right to disconnect outside working hours and also restrictions on use of social media at school. Some ameliorative forces are cybersense, health practices, art, and the development of intelligent agents to act as buffers (DPAs, digital PAs).

health & cyberstress

health & cyberstress	
Education	School curriculum. Cyberstoicism.
Work	Stressed people are ineffective.
Business	Cybersense. Job design.
Health	Cybersense. Lifestyle. Time out. Digital detox.

some opportunities

Some of the opportunities of new technology (ARUC) are obvious. Some examples:

opportunities	
Education	Access to information. Support for teaching. Distance learning. Mixed mode.
Work	Labour is reduced. Safety is improved.
Business	Safety, sustainability, predictive maintenance, agriculture.
Health	Entertainment. Communication. Communities. Discovery of new drugs. Tele-medicine. Diagnosis. Operations.

some risks

Some of the dangers of new technology (ARUC) are also obvious. Some examples:

dangers	
Education	Anachronism re. technogenic reality. Increased digital divide. Lack of curriculum on cognitive computing and data science.
Work	Employment is lost. Selective effect.
Business	Security, privacy, data harvesting, data-bias, malware, hacking.
Health	Disenchantment (Weber), superficiality, logocentricity, information overload, cyberstress, cyber-recluse syndrome, internet addiction.

cybereducation

- education is crucial to the equilibriation of the forces of technological progress and quality of life (thus elevating opportunities over risks)
- to this purpose it needs to avoid anachronism (getting out-of-date & semi-relevant)
- this is what has happened, and technogenic reality is now several years ahead of our dictionaries and schools
  - this leaves us ***inarticulate and disempowered, unable to see, think, speak, or act***: ***gagged and blindfolded in cyberspace***
  - which encourages a ***second digital divide***
- we therefore need to ***TEACH CYBEROLOGY***.
  - all modes are relevant: school, university, distance education, short courses, etc.

desiderata

We need new or additional vocabulary, curriculum, formats, and objectives.

desiderata for education in cyberology	
conceptualisation	cyberspeak (cf Kant)
curriculum	cognitive computing, AI, data science, cybersense, metarobotics, cyber-XYZ, etc.
format	active (Freire, Rousseau, Dewey) bivalent (double in/out etymology of “education”) transversal (Naomar de Almeida Filho) transferable (skills & meta-skills)
objectives	quality, equality, **relevance.**

cyberlexicon

Some concepts used here are:

- cybereducation
- cyberlexicon
- cyberology
- cyberphronesis
- cybersense
- cyberspeak
- cyberstoicism
- cyberstress
- ditropic
- metarobotics
- steerage (actual & predictive)

Friendly challenge: can you find anything in the dictionary which expresses **exactly** what these terms are used here to express?

summary

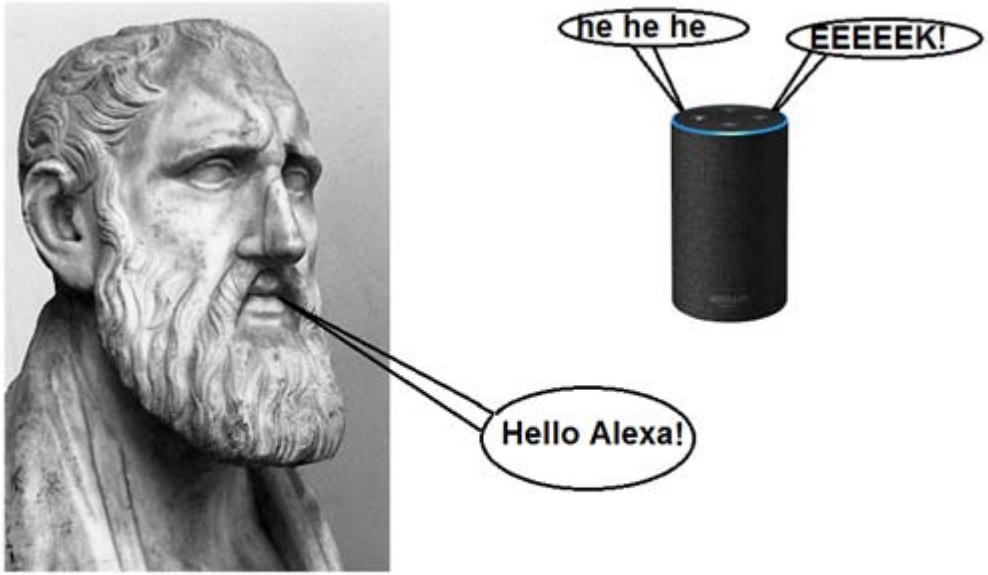
In this presentation, we have taken a ditropic approach to the opportunities and risks of new technologies with attention to education.

We have presented:

- a definition of ditropism
- a framework for cyberology with application to 4 cases
- some desiderata for education in cyberology
- a lexicon of terms for cyberology.

Muito obrigado!

coda



Zeno and the Matrix

O mundo mudou.
As máquinas mudaram.
A vida mudou.

Cognitive technologies (cogtech) are informing life and work, and we need critical understanding of their opportunities and dangers. These include artificial intelligence, adaptive systems, augmented reality, automated translation, big data analytics, cognitive computing, collaborative robotics, context-sensitive systems, digital supply chain management, driverless cars, enhanced interfaces (haptic, gestural, multi-sensory, personalised, and predictive), humanoid robotics, intelligent agents, museum and event systems, person recognition (face, eyes, finger, movement), personalising learning systems in education, the semantic web, smart phones, social media, speech recognition and synthesis, surveillance technologies, targeted marketing, ubiquitous computing, virtual personal assistants, virtual reality, wearable systems, etc. These are complemented by innovations in biometrics, nanotechnology, 3D printing, and quantum computing, and by systems such as cryptocurrency and blockchain, producing a different planet.

Appendix 1: Cybernetics and Steerage

Steerage and predictive steerage are essential to the positive utilisation of technologies in a ditropic universe.

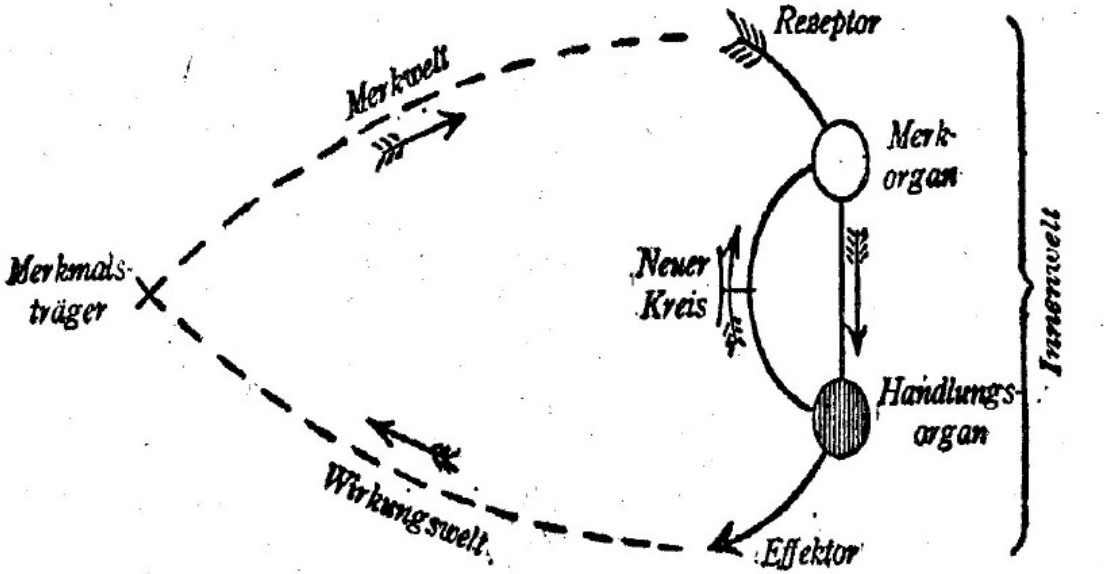
A useful model of steerage is to be found in cybernetics. This invokes a **feedback loop** used to adjust action to circumstances and effects.

In the case of new technologies (ARUC):

- how can we enhance our feedback loop with the results of their utilisation?
- how can we use these new technologies themselves to enhance this feedback loop?

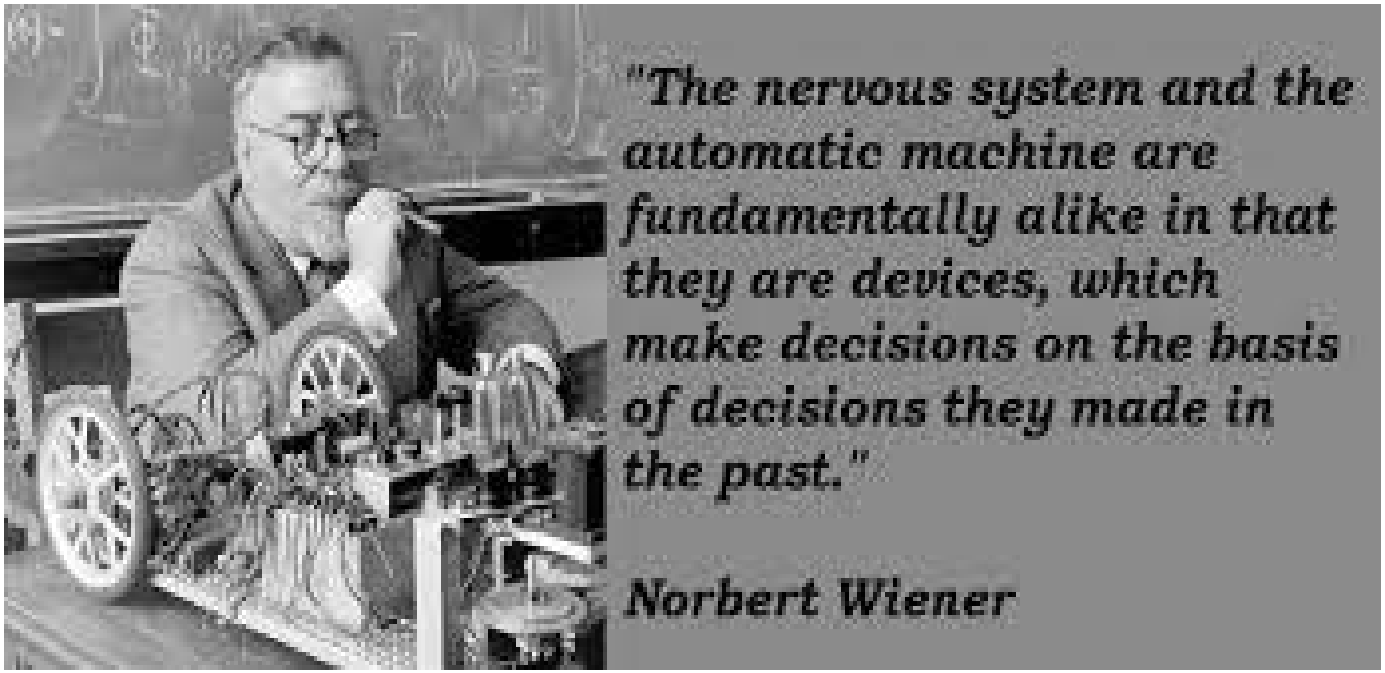
Jakob Johann von Uexküll

Uexküll introduced the concept of a feedback loop:

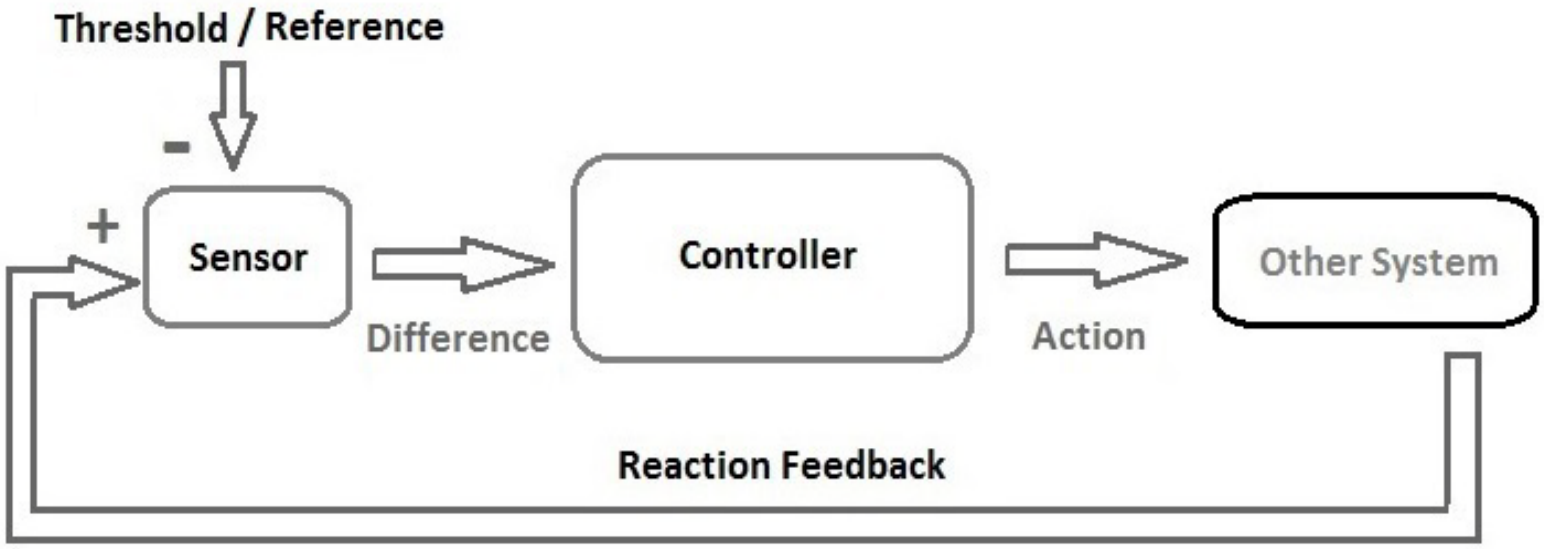


Figur 4.

Norbert Wiener



Wiener applied this in the science of cybernetics:



A Cybernetic Loop

cybernetics and cyberspace

- A challenge in modern times is that contexts (relevant circumstances) have become volatile. Therefore the consequences of a system´s actions are more volatile, and comparison-with-goals is more complex.
  - A corresponding opportunity is that, if our system is sufficiently agile, we can exploit this volatility to satisfy our goals more quickly.

- Another challenge is that the data-space for sensing the consequences of a system´s actions has become massive, in the sense that we may detect patterns with the aid of big data analytics.
  - A corresponding opportunity is that, if our big data analytics is sufficiently effective, we can exploit this data-space to support feedback and system-adjustment.

Appendix 2: Cognitive Computing and Steerage

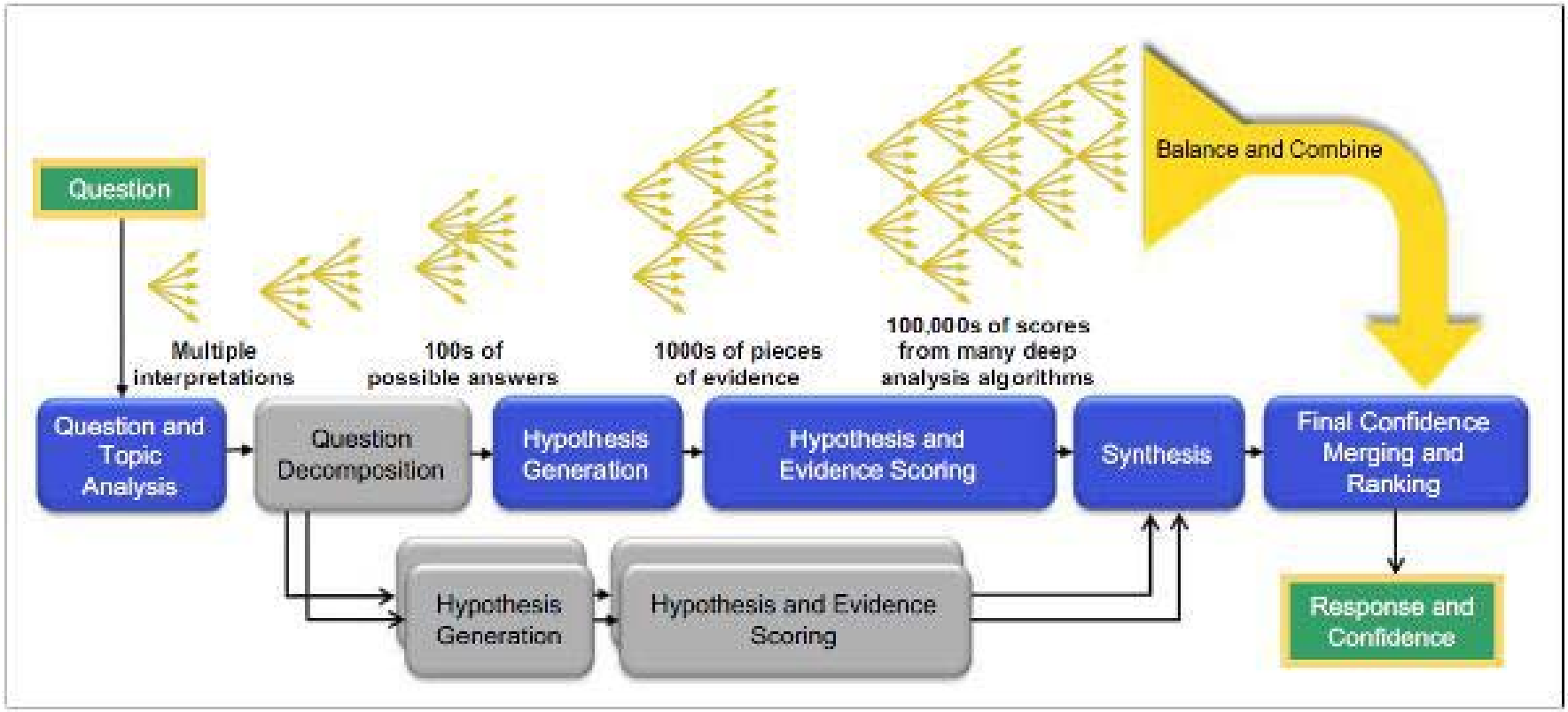
We illustrate here the potential of cognitive computing systems such as IBM Watson to support the cybernetic loop involved in steering the utilisation of new technologies to good effect.

This has application e.g. in the formulation and updating of policy. For this we need pattern-detection, and this is where big data analytics is relevant.

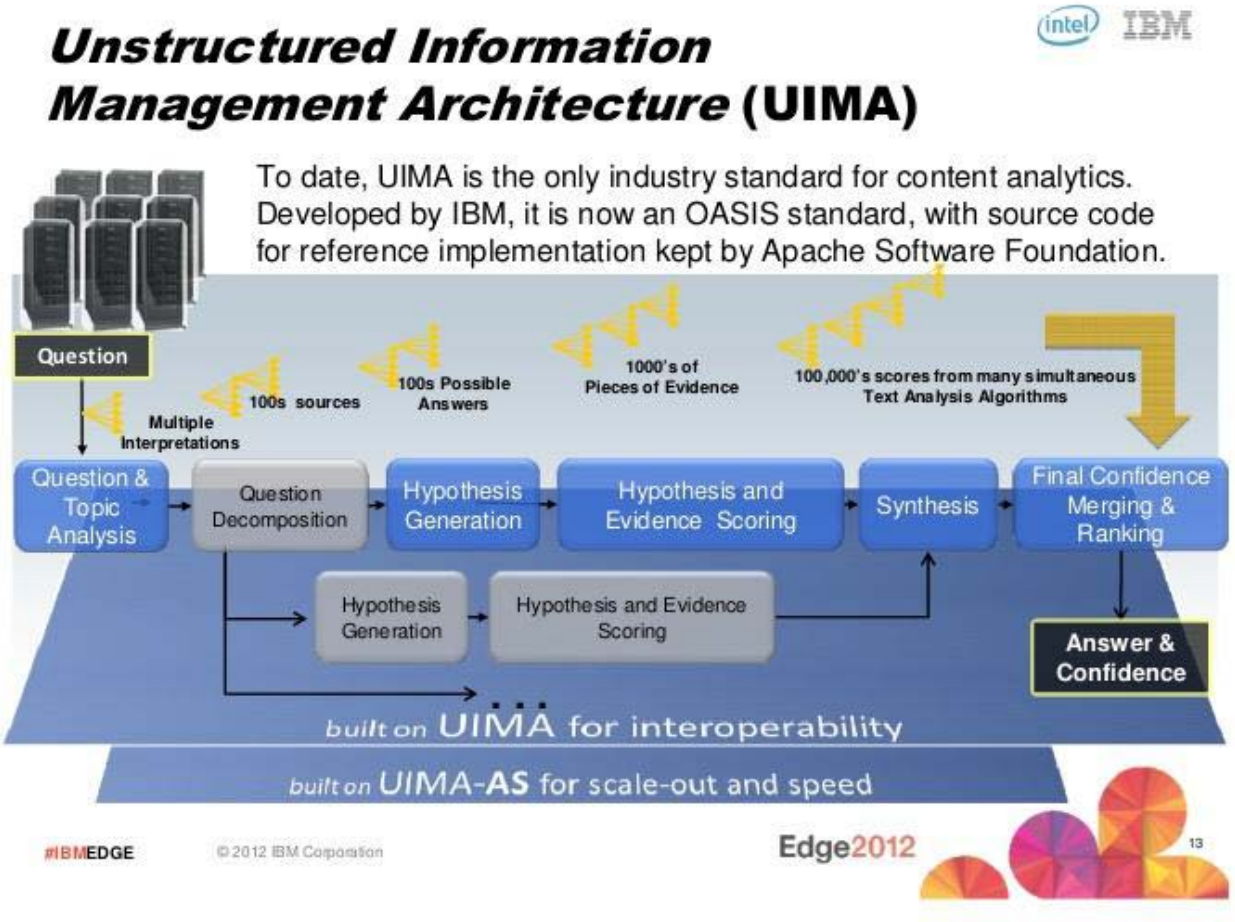
An essential feature of Watson´s architecture is the candidate-generation-selection-pileline (CGSP), as follows.

This supports the massive task of navigating massive cyberspace.

IBM Watson architecture



UIMA


Unstructured Information Management Architecture (UIMA)
intel
IBM
To date, UIMA is the only industry standard for content analytics. Developed by IBM, it is now an OASIS standard, with source code for reference implementation kept by Apache Software Foundation.
Question
Multiple Interpretations
100s sources
100s Possible Answers
1000's of Pieces of Evidence
100,000's scores from many simultaneous Text Analysis Algorithms
Question & Topic Analysis
Question Decomposition
Hypothesis Generation
Hypothesis and Evidence Scoring
Synthesis
Final Confidence Merging & Ranking
Hypothesis Generation
Hypothesis and Evidence Scoring
...
Answer & Confidence
built on UIMA for interoperability
built on UIMA-AS for scale-out and speed
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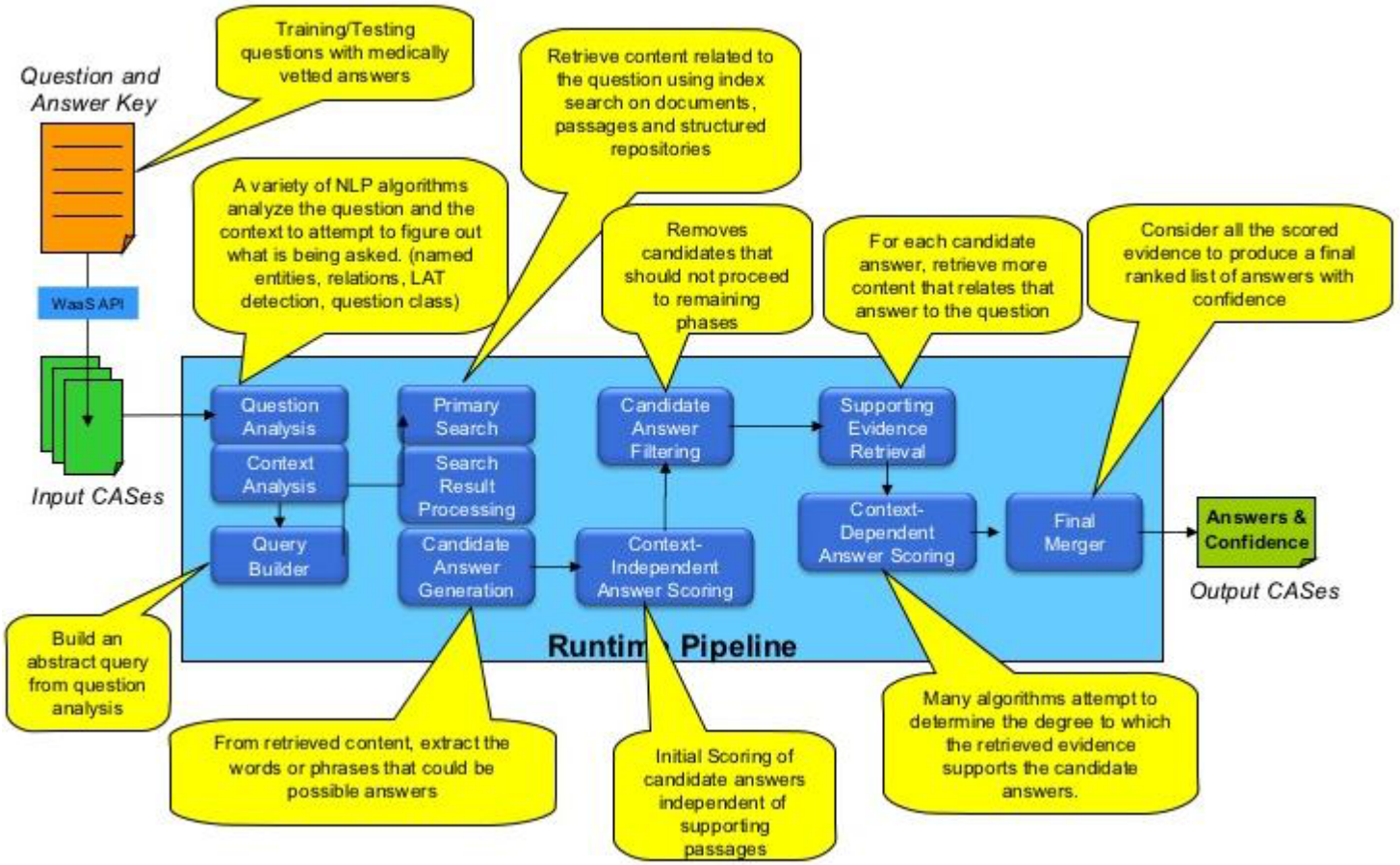
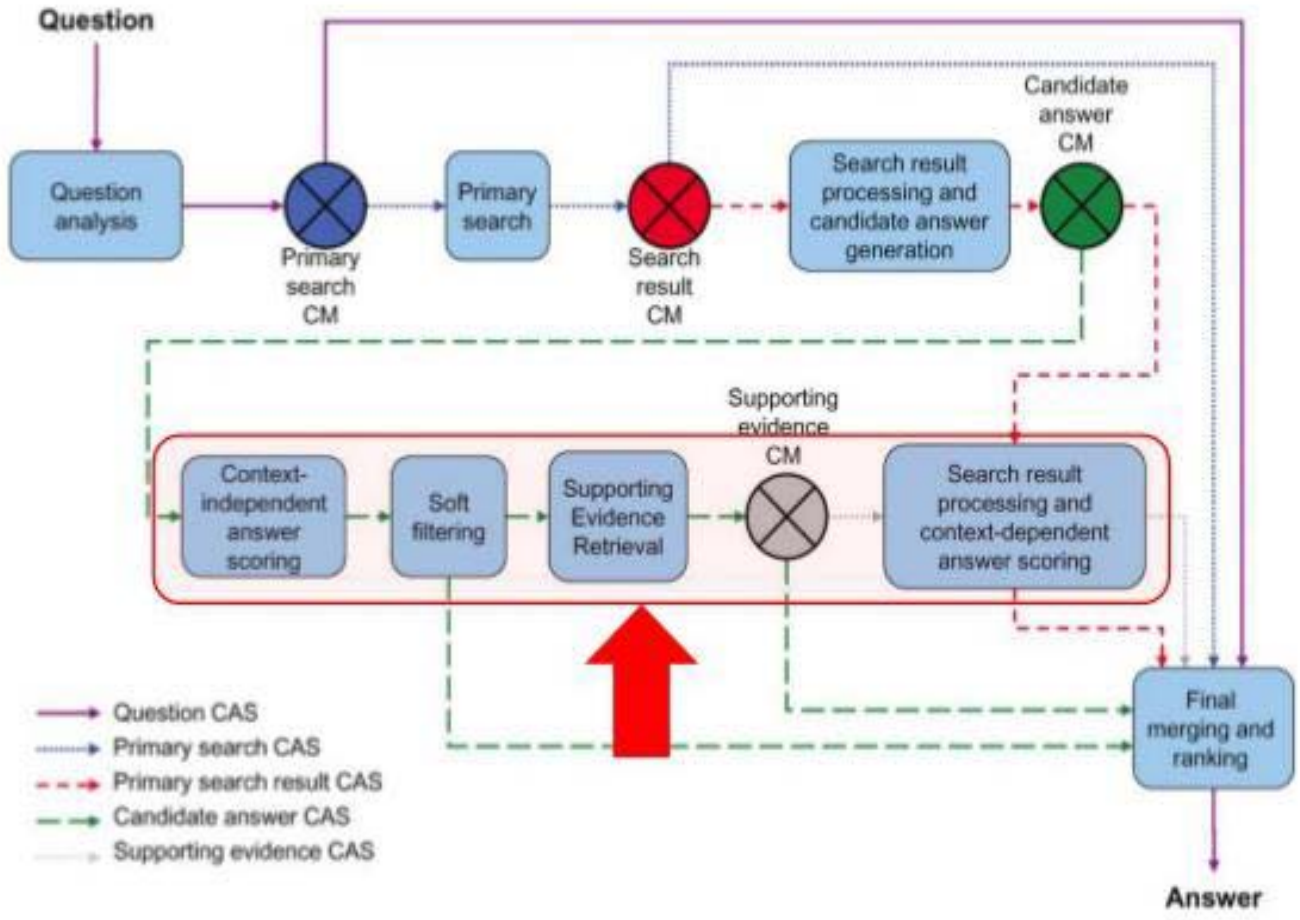
CGSP


Question and Answer Key
Training/Testing questions with medically vetted answers
Retrieve content related to the question using index search on documents, passages and structured repositories
A variety of NLP algorithms analyze the question and the context to attempt to figure out what is being asked. (named entities, relations, LAT detection, question class)
Removes candidates that should not proceed to remaining phases
For each candidate answer, retrieve more content that relates that answer to the question
Consider all the scored evidence to produce a final ranked list of answers with confidence
WaaS API
Input CASes
Question Analysis
Context Analysis
Query Builder
Primary Search
Search Result Processing
Candidate Answer Generation
Candidate Answer Filtering
Context-Independent Answer Scoring
Supporting Evidence Retrieval
Context-Dependent Answer Scoring
Final Merger
Answers & Confidence
Output CASes
Runtim Pipeline
Build an abstract query from question analysis
From retrieved content, extract the words or phrases that could be possible answers
Initial Scoring of candidate answers independent of supporting passages
Many algorithms attempt to determine the degree to which the retrieved evidence supports the candidate answers.

ranking


Question
Question analysis
Primary search CM
Primary search
Search result CM
Search result processing and candidate answer generation
Candidate answer CM
Supporting evidence CM
Context-independent answer scoring
Soft filtering
Supporting Evidence Retrieval
Search result processing and context-dependent answer scoring
Final merging and ranking
Answer
Question CAS
Primary search CAS
Primary search result CAS
Candidate answer CAS
Supporting evidence CAS

logic

Does this candidate-generation-selection-pipeline (CGSP) implement a type of deduction, induction, or abduction, or all of them at once?

Oswaldo Pessoa (USP) has pointed out that the logic generated by Watson´s CGSP is hypothetico-deductive, since a (large) set of hypotheses (candidates) is generated, and then (through scoring and ranking) a favourite is selected.

cognitive computing as loop support

Strategic querying of a system such as Watson suggests use of a front-end-query-engine.

An initial query from the Controller triggers trawling of cyberspace, which then returns a *response* through *feedback* to the *Sensor*, which *evaluates* this as a candidate response.

This is the *candidate-generation-selection-pileline* seen from a cybernetic perspective.

This puts cognitive computing in perspective as one form of loop support for decision making in the cognitive era.

big data & cognitive computing

big data & cognitive computing	
Education	Digital literacy should now include cognitive computing and data science. It should be a school subject, a subject for distance education, etc.
Work	Cognitive computing is already part of life and work, whether we know it or not. Thus early education is essential to reduce the digital divide.
Business	Several industries are already engaged, and this will grow.
Health	Natural language processing. Sustainable energy. Sustainable agriculture.