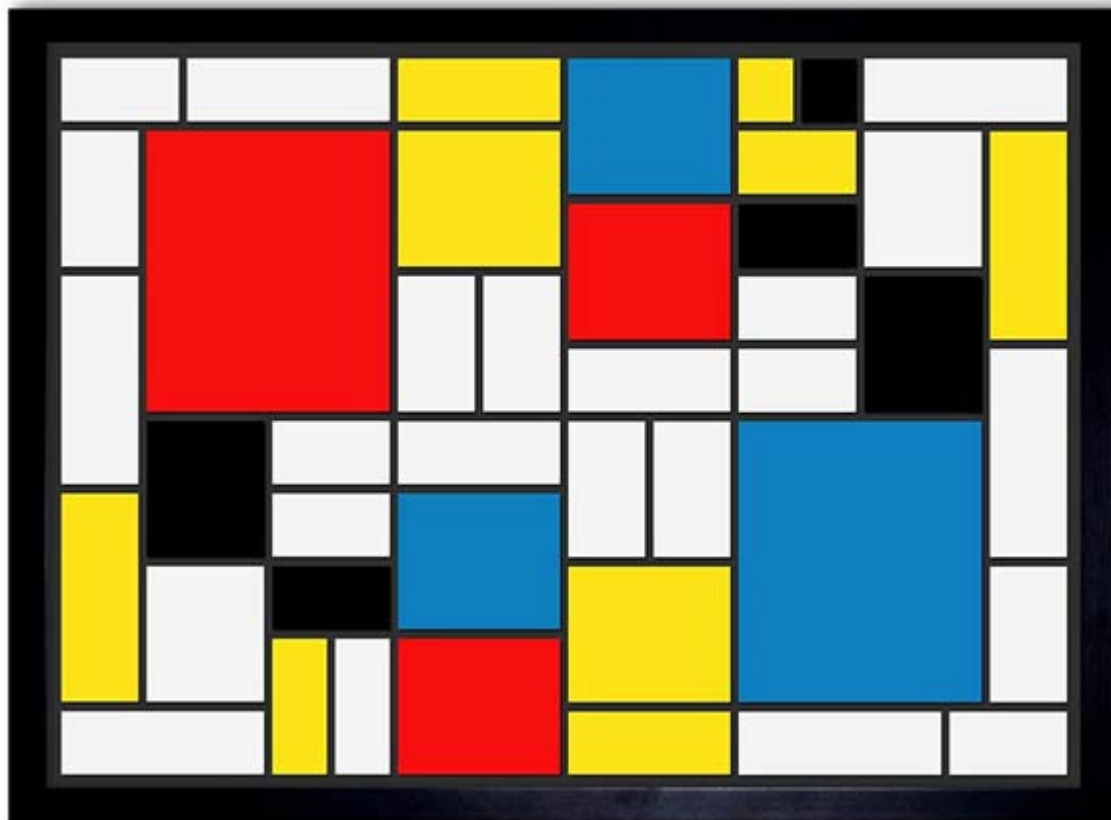# Life in the Cognitive Era
seminar slides
Don Peterson. IEA. USP.

The World Has Changed,
Machines Have changed,
Life Has changed.

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.

Cyberology

Cyberology = the study of the opportunities, risks, and practicalities of new technologies.

Futurism = the study of near-future conditions.

Cyber-stoicism = a reasonable life in cyberspace. For the Stoics on ethics [press §1 §5, press, press §Ethics] are relevant. For Aristotle on practical wisdom [press esp. §5, press].

conditions

Technologies	CAR	connectivity, AI, robotics
Conditions	MVIF	mass data, volatile, immediate, fragmented
Life	EWHW	Education, Work, Health, Wellbeing

LCE =
> multidisciplinary
> theoretical + practical
> critical + technical
> timely
> ditropic.

cognitive architecture

Our cognitive architecture is situationist.

We use schemas (general formulae) for action, together with application of context (circumstances, situations) to modulate action.

This is recognised in Aristotle (phronesis), brain science (executive function), and logic (epiduction).

Thus we face the new technologies and conditions of LCE with the architecture we already have. This situationist architecture affects the ditropic result.

E.g. situational volatility is a significant pressure, while available data may be a benefit.

adaptivity 1: phronesis
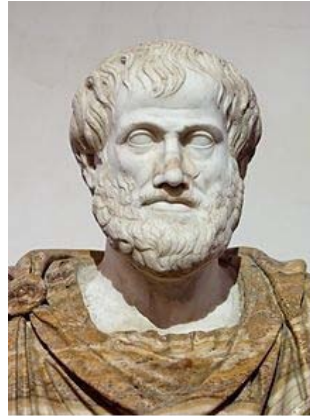
Aristotle (Nichomachean Ethics, Book 6). Phronesis is practical wisdom which adjusts action to situations / contexts / circumstances
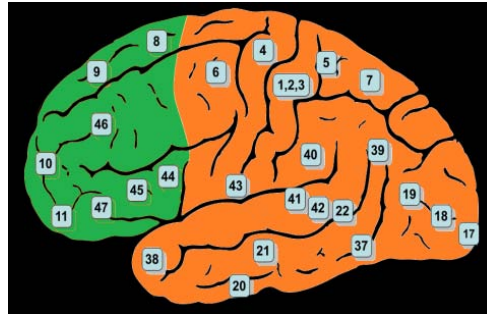
In modern times we have <u>situational volatility</u>

This requires agility (business studies)

It requires cyber-phronesis (for MVIF conditions).

adaptivity 2: executive function

Executive function (EF) is mediated mainly by the pre-frontal cortex of the human brain

EF is a manager function (like air traffic control)

EF adjusts action to situations/contexts, adjusting which+when+how.

adaptivity 3: epiduction

Epiduction (or transduction) is the logic of adaptivity. Its basic unit of analysis is the situation (Z). See Peterson 2015.

It has 12 laws:

1. $Z = \langle S, D, C, R \rangle$
2. $E = K \times A$
3. $A = I + M$
4. $P(D, C, G) = F$
5. $I(S, F) = R$
6. $M(S, F) = R$
7. $U_{M/I} \, \alpha \, V_C$
8. $B_{M/I}(Q_C) \leftarrow L_I = L_T$
9. $M = M_N + M_W$
10. $T(K) \, \& \, T(I) \, \& \, T(M_N) \rightarrow E \, \alpha \, M_W$
11. $Z_H = \langle S, D, C_H, R_H \rangle$
12. $Z_X = \langle S, D, C_{++}, R_{++} \rangle$.

And 25 factors:

Where: A = adaptivity, B = breakpoint, C = context, CL = closed, D = default action, E = effective performance, F = frame, G = goals, H = hypothetical, I incorporation, K = knowledge, L = load, M = modulation, N = natural, OP = open, P = pragmatise, Q = quantity, R = reset action, S = schema, T = maximum (top), U = utility, V = volatility, W = wired, X = multiplex, Z = situation.

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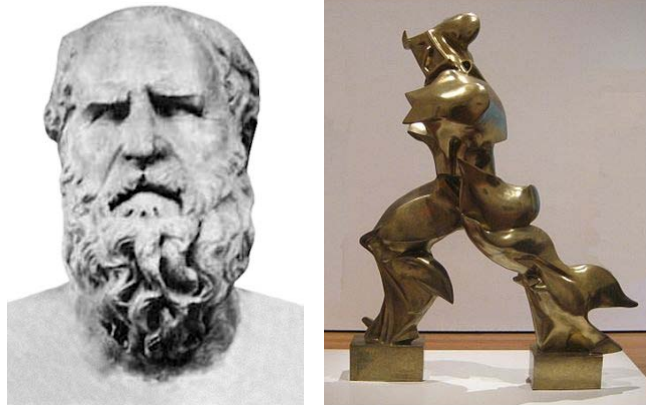
situation. Agility in business is the ability to respond to changing circumstances. As the volatility of situations and circumstances rises, as change accelerates, agility is prioritised. [Heraclitus left, Boccioni right.]

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 epiduction, some laws are relevant to fast change in circumstances. In terms of training there exist games for "mental agility", and rudimentary instruments for measuring AQ (agility quotient).
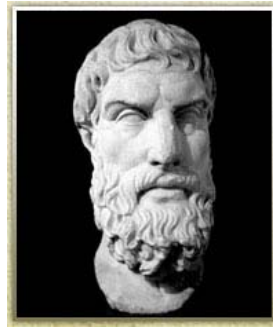
business & agility

LCE Chart
business & agility

Education	Agility training. AQ.
Work	Fast change. Situation-awareness.
Health	Lifestyle, nutrition, meditation, etc.
Wellness	Success.

education & cyber-sense

situation. We increasingly need <u>cyber-sense</u> --- 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 (phronesis), the Stoics advocated a type of rational detachment, and in any case we need nowadays to be methodical in navigating cyberspace. We need <u>cyber-stoicism</u>. We need both agility and focus. For this we need curriculum which teaches habits and methods of cyber-sense, as virtues of the New Stoic.
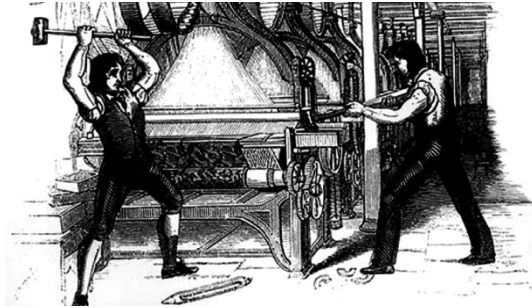
education & cybersense

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

work & meta-robotics

situation. The robots are coming, and we need to prioritise meta-robotics **---** 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: people who are already on low income could then become unemployed.

work & meta-robotics

LCE Chart	
work & meta-robotics	
Education	All aspects of meta-robotics. Training. New skills. Re-skilling.
Work	Short courses. Redefinition of roles. Unemployment.
Health	Dangers of robots. Compatibility of robots.
Wellness	Regulations, laws, standards.

health & cyber-stress

situation. <u>Cyber-stress</u> 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 cyber-recluse 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 cyber-sense, health practices, art, and the development of intelligent agents to act as buffers (DPAs, digital PAs).

health & cyber-stress

LCE Chart	
health & cyber-stress	
Education	School curriculum.
Work	Stressed people are ineffective.
Health	Meaningless stress.
Wellness	Cyber-sense. Lifestyle. Time out. Digital detox.

privacy and surveillance

situation. New technology is infringing old standards of privacy.

details. The ethics of privacy, the security/access dilemma, snooping and hacking, data harvesting, data hawking, Facebook *et al,* the data market, state surveillance, cybercrime, fraud, Tim Berners Lee and SOLID.

This is an attack on the good life (bem estar, wellbeing, flourishing, prosperity, blessedness) as in Aristotle (eudaimonia). However, if we were denied the connectivity which makes intrusion possible, this would also be an attack on the good life.
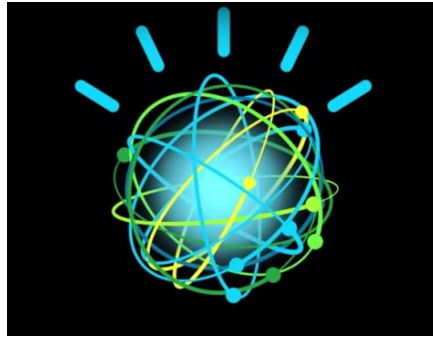
privacy and surveillance

LCE Chart	
privacy and surveillance	
Education	Public awareness of surveillance, snooping, hacking, data harvesting, cybercrime, fake news, fraud, etc.
Work	Monitoring. Laws on monitoring.
Health	Personal health records.
Wellness	Attack on wellbeing.

big data & cognitive computing

situation. Basic digital literacy should now include understanding of big data and cognitive computing. Current curriculum, however, usually does not.

details. IBM Watson. Jeopardy! Architecture: natural language processing + intelligent data-mining + probabilistic reasoning + parallel hardware. DeepQA. UIMA. The candidate-generation-selection-pipeline (CGSP). Scoring and ranking. Correspondence with human brain architecture (schemas + executive function). Unstructured and heterogeneous data. Data from the internet of things (IoT). Industrial applications for cognitive computing: agriculture, energy (grid operation, oil and gas, renewable energy), banking, fashion, hospitality, insurance, marketing, medicine, security, traffic flow.

perspective: opportunities and dangers

In a world of increasingly volatile and massive data, a system´s capability may be pressurised. However if we can cope with these conditions, e.g. with the help of machines and improved self-understanding, then they may also provide opportunities.

cybernetics

We now turn to cybernetics. This invokes a control loop used to adjust action to circumstances and consequences, and is essential to a system´s **adaptivity** and therefore **performance**.

A system, e.g. a person or organisation is in a more-or-less effective feedback loop with the outside world.

Our question is what role new technologies can play in enhancing this feedback loop.

cybernetics and cyberspace

- One challenge 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.
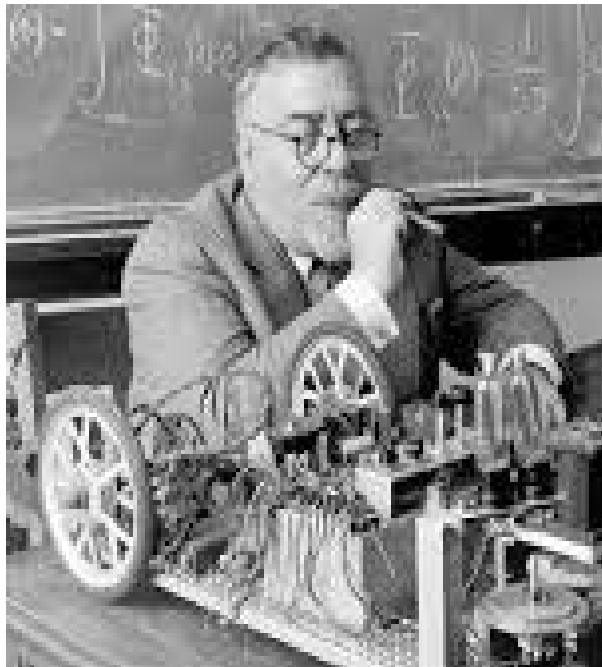
Jakob Johann von Uexküll

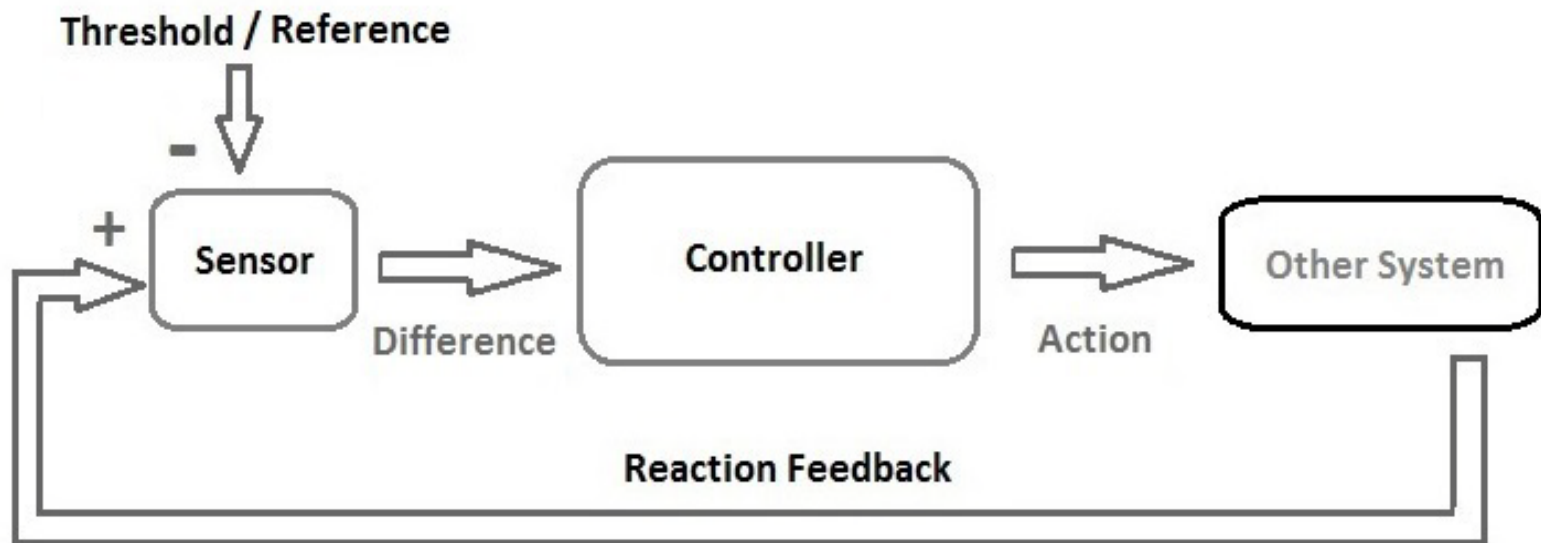# Uexküll introduced the concept of a feedback loop:
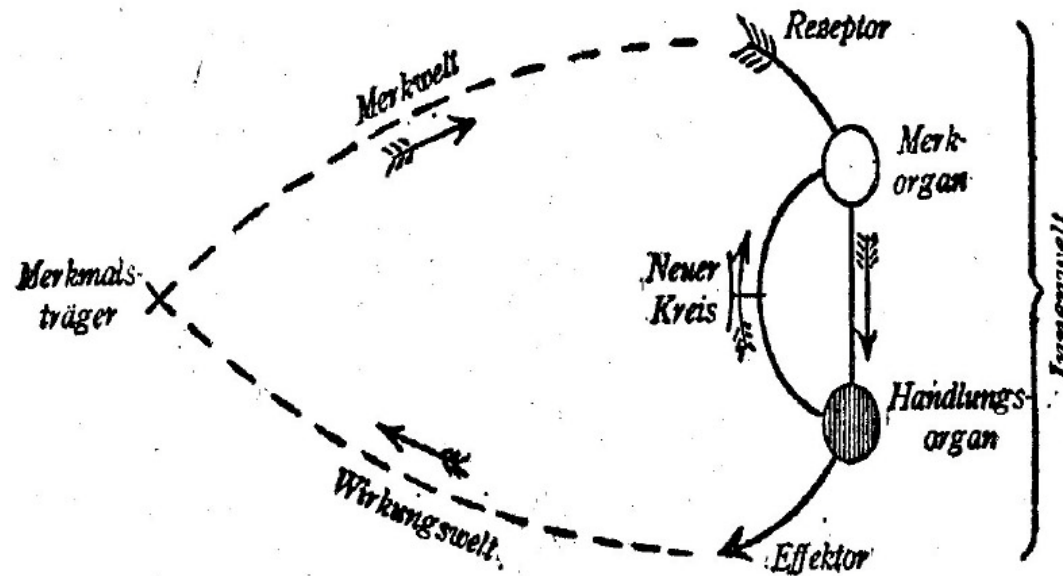
Figur 4.

Norbert Wiener

"The nervous system and the automatic machine are fundamentally alike in that they are devices, which make decisions on the basis of decisions they made in the past."

Norbert Wiener

Wiener applied this in the science of cybernetics:

A Cybernetic Loop

cognitive computing as loop support

Strategic querying of a system such as Watson is a form of *action*. (This suggests use of a front-end-query-engine.)

An initial query from then 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

LCE Chart
big data & cognitive computing

Education	Digital literacy should now include cognitive computing. It should be a school subject, a subject for distance education, etc.
Work	Several industries are already engaged, and this will grow.
Health	Epidemiology etc.
Wellness	Natural language processing. Sustainable energy. Sustainable agriculture.

summary
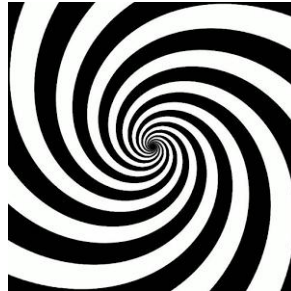
We have considered some of the benefits and harms which technologies can bring under the following broad categories:

- Technologies --- ARUC (AI, robotics, ubiquitous computing, connectivity)
- Conditions --- MVIF (mass data, volatile, immediate, fragmented)
- Life Issues --- EWHW (Education, Work, Health, Wellbeing).

Some guiding concepts used are:

- adaptivity (agility)
- cyber-phronesis
- cyber-sense
- cyber-stoicism
- cyber-stress
- ditropic
- epiduction
- meta-robotics
- situation, situation-processing, situationism
- volatility (fast change).

We have emphasised the issues of adaptivity, cognitive computing, and the cybernetic loop as they apply to issues of Education, Work, Health, and Wellbeing (EWHW) in our life in the cognitive era .

===