

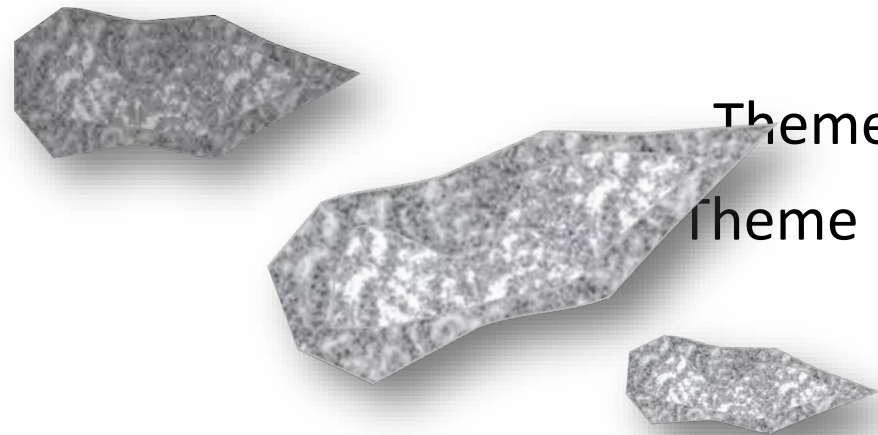
SWARMS

Speerpunten voor de krijgsmacht van 2035

Ir.dr. C.J.M.(Chris) Verhoeven

Theme leader Space Robotics, TUD Space Institute

Theme leader Swarm Robots, TUD Robotics Institute



**Because the future
does not exist yet
it cannot be in a model**

**ET L'HISTOIRE
SE RÉPÈTE**

VOORLOPIG PROGRAMMA KOOY SYMPOSIUM

RUIMTE VOOR VEILIGHEID
Marinekazerne Amsterdam, 14 april 2010

12:00 Ontvangst en broodjeslunch

12:45 Opening

- LtGen bd D. (Dirk) Starink, dagvoorzitter
Opening en inleiding Kooy Symposium 2010
- Ir. J.A. (Jan) Dekker, President KIVI NIRIA
Uitreiking Prof. Ir. Dr. J.M.J. Kooy Prijs 2010

13:00 Beleid en Visie:

- J.G. (Jack) de Vries, Staatssecretaris van Defensie (video)
- Drs. R.F. (Rob) de Jong, Directeur Beleid van de Defensie Materieel Organisatie DMO
Visie over het gebruik van ruimtevaarttechnologie van Defensie en betrokkenheid van het Nederlandse bedrijfsleven.
- S.J. (Jack) Bosma, Inspector General van het European Space Agency (ESA)
Huidige en toekomstige mogelijkheden van ruimtevaarttechnologie voor Defensie en Veiligheid
- Pauze
Bezichtigen expositie
- GenMaj Drs. J.H. (Hans) Wehren, Plv Cdt Luchtstrijdkrachten
Militaire aspecten van het gebruik van ruimtevaarttechnologie

16:00 Excellente Technologieën:

- Communicatie: Ir. R.O. (Frank) Zeppenfeldt, ESA
Gebruik van satellieten voor communicatie met UAV's
- Navigatie: Ir. F.J.P. (Frank) Wokke, NLR
Satellietnavigatie voor kritieke toepassingen
- Aardobservatie: Ir. A.J.M. (Astrid) Humme, Hansje Brinker BV
Deformatie-analyse van het aardoppervlak met satellieten
- Vluchtsystemen: Ir.Dr. C.J.M. (Chris) Verhoeven, TU Delft
Nanosatellieten

17:00 Afsluiting

- LtGen bd D. (Dirk) Starink, dagvoorzitter.
Conclusies symposium

17:15 Netwerkborel
Bezichtigen expositie

18:00 Rijsttafel buffet

19:00 Einde



2010



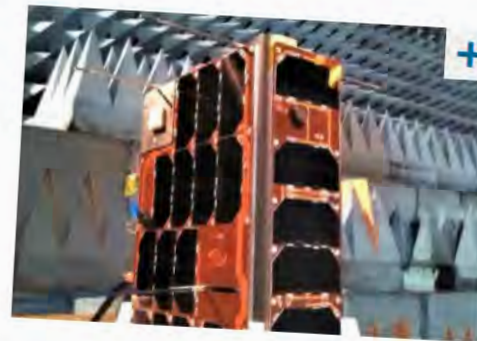
Ministerie van Defensie

Defensie.nl > Actueel > Nieuws >

Nederland lanceert 1e militaire nanosatelliet

Nieuwsbericht | 25-01-2021 | 17:32

Het bedrijf Virgin Orbit lanceert medio maart Nederlands 1e militaire satelliet in een baan om de aarde. Het gaat om een zogenoemde nanosatelliet die net iets groter is dan een pak melk. Vernoemd naar Nederlands 1e militaire vliegtuig betreft Defensie met de Brik II het ruimtedomein. De exacte datum van de lancering moet nog worden bepaald omdat die onder meer afhankelijk is van het weer en de beschikbaarheid van het luchtruim.



Het is nu nog een experimenteel project van de Koninklijke Luchtmacht, maar op termijn moet het tot eigen capaciteiten leiden. Dit moet de communicatie- en observatiemogelijkheden verbeteren. Tegelijkertijd maakt het Defensie minder afhankelijk, en dus minder kwetsbaar, van externe partijen. De NAVO benadrukte het belang van de ruimte eind 2019 al door het operationeel domein te verklaren. Ook in de Defensievisie 2035 staat dat het ruimtedomein een noodzakelijke schakel is in informatievoorziening.

Defensie onderkent het belang van de ruimte in de Defensievisie 2035 staat dat het ruimtedomein een noodzakelijke schakel is in informatievoorziening.

2021



James Maxwell

Modelling

$$\begin{aligned} \nabla \cdot D &= \rho_v \\ \nabla \cdot B &= 0 \\ \nabla \times E &= -\frac{\partial B}{\partial t} \\ \nabla \times H &= \frac{\partial D}{\partial t} + J \end{aligned}$$

Evaluation

Scientist

Prediction

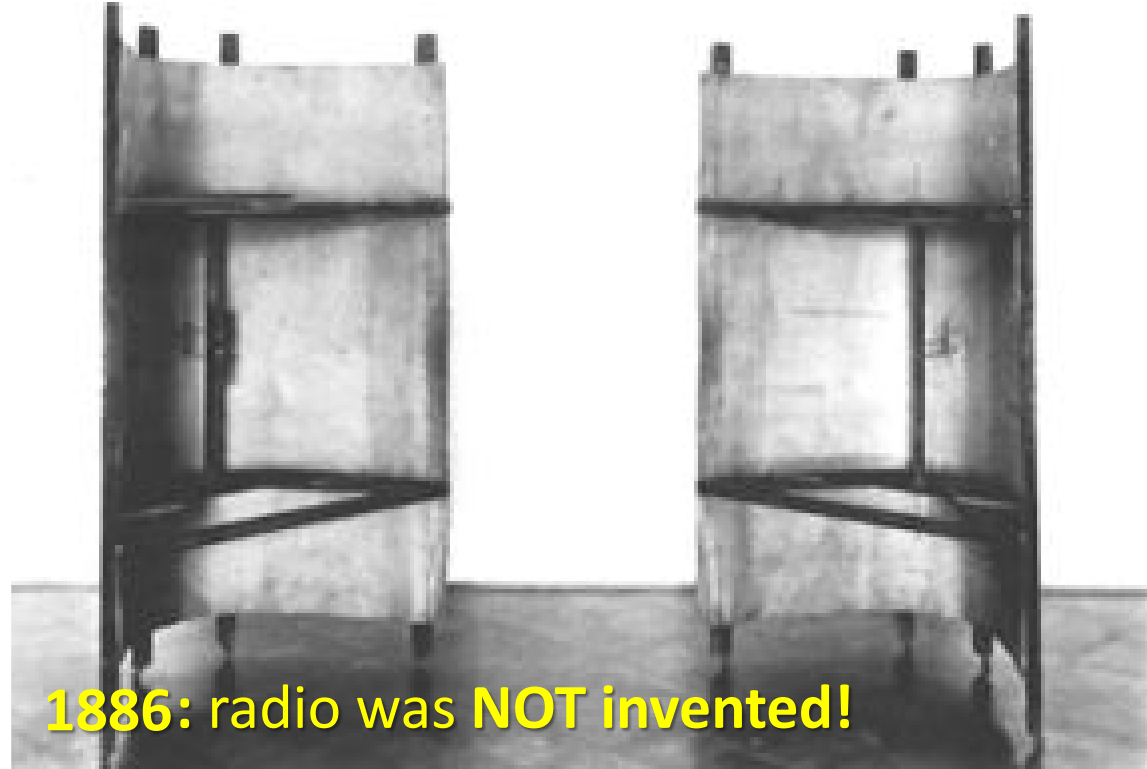


Michael Faraday

Observation



Heinrich Hertz

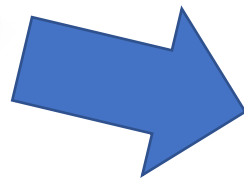


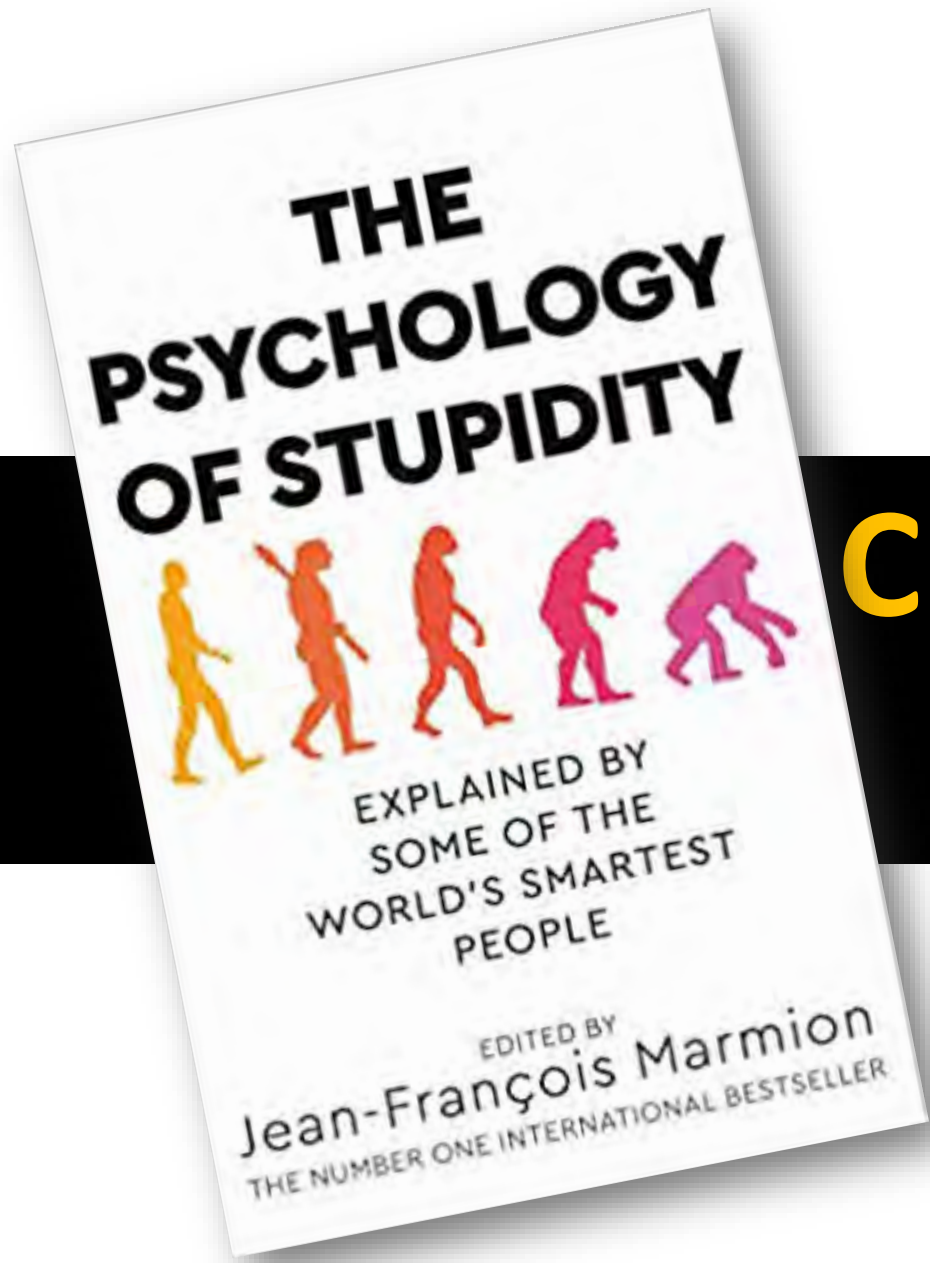
1886: radio was NOT invented!

“This experiment shows Maxwell was right”

“Radio Waves do exist,”

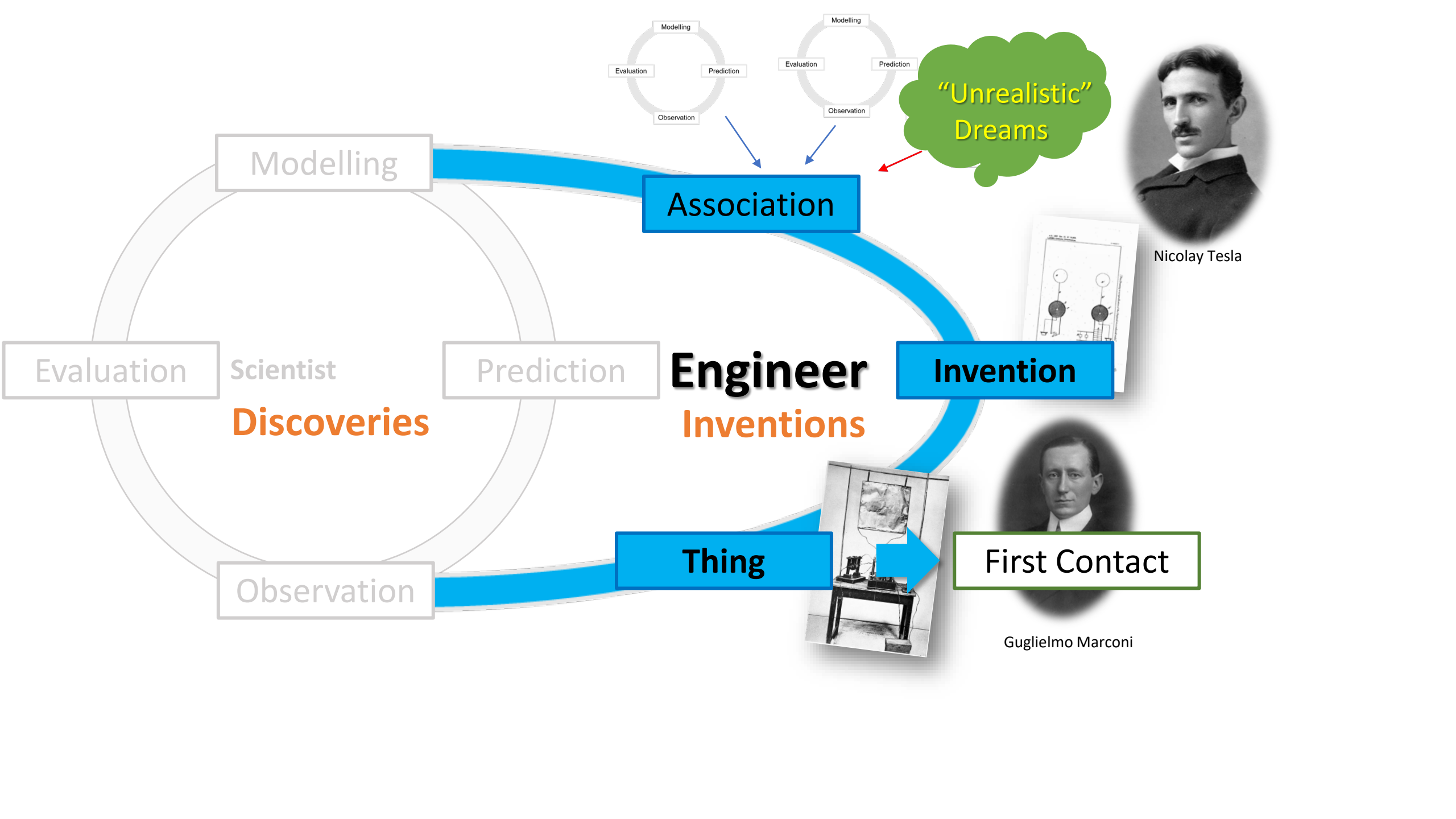
“but they are useless...”





Wise people do clever things

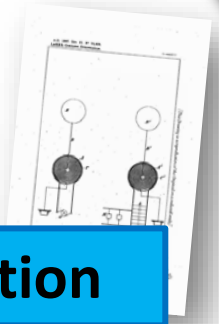
**Creative people
do stupid things**



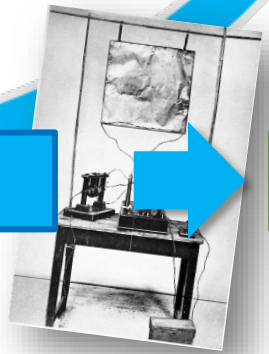
"Unrealistic" Dreams



Nicolay Tesla



Guglielmo Marconi



Modelling

Association

Invention

Thing

First Contact

Evaluation

Scientist

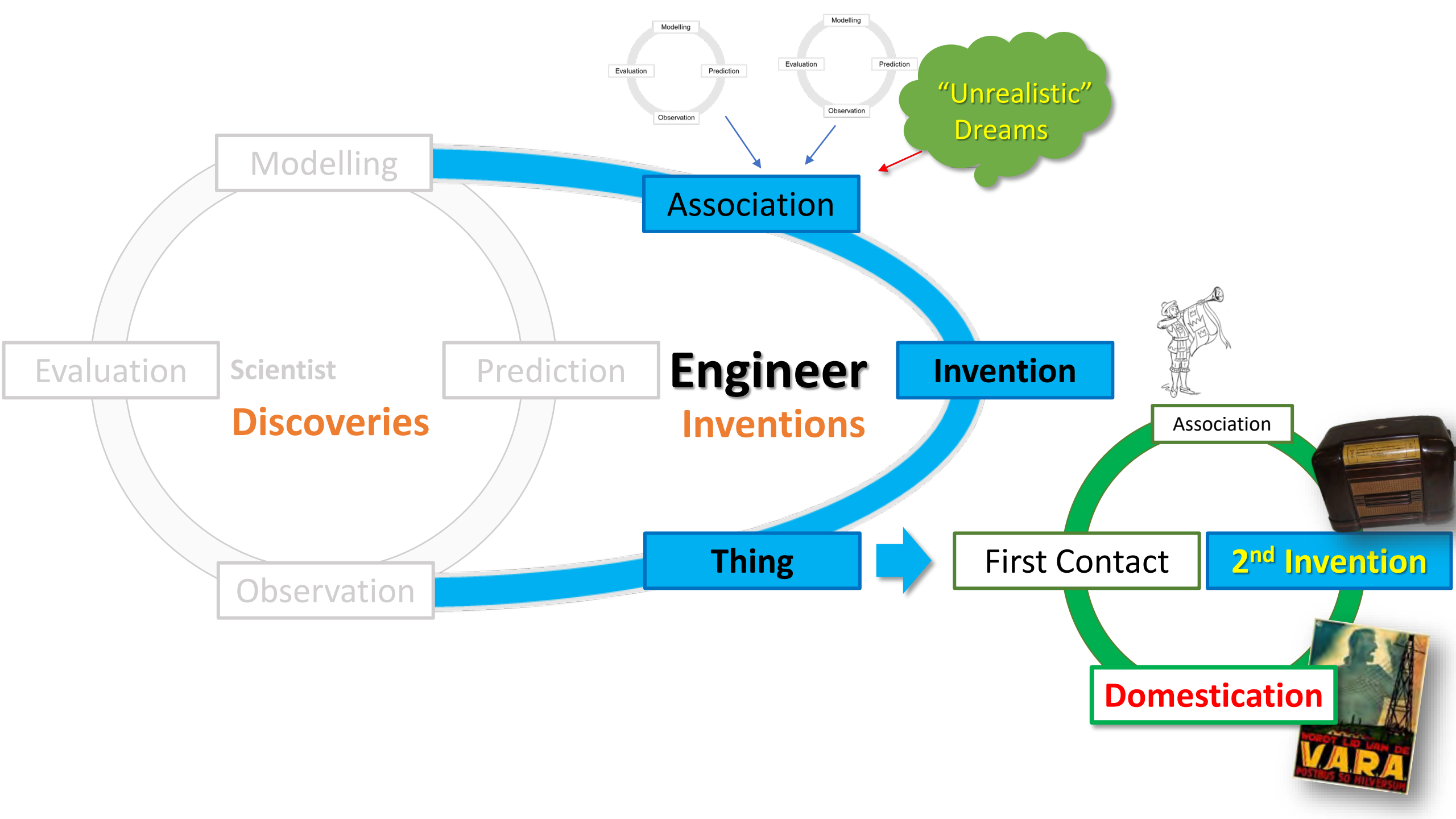
Discoveries

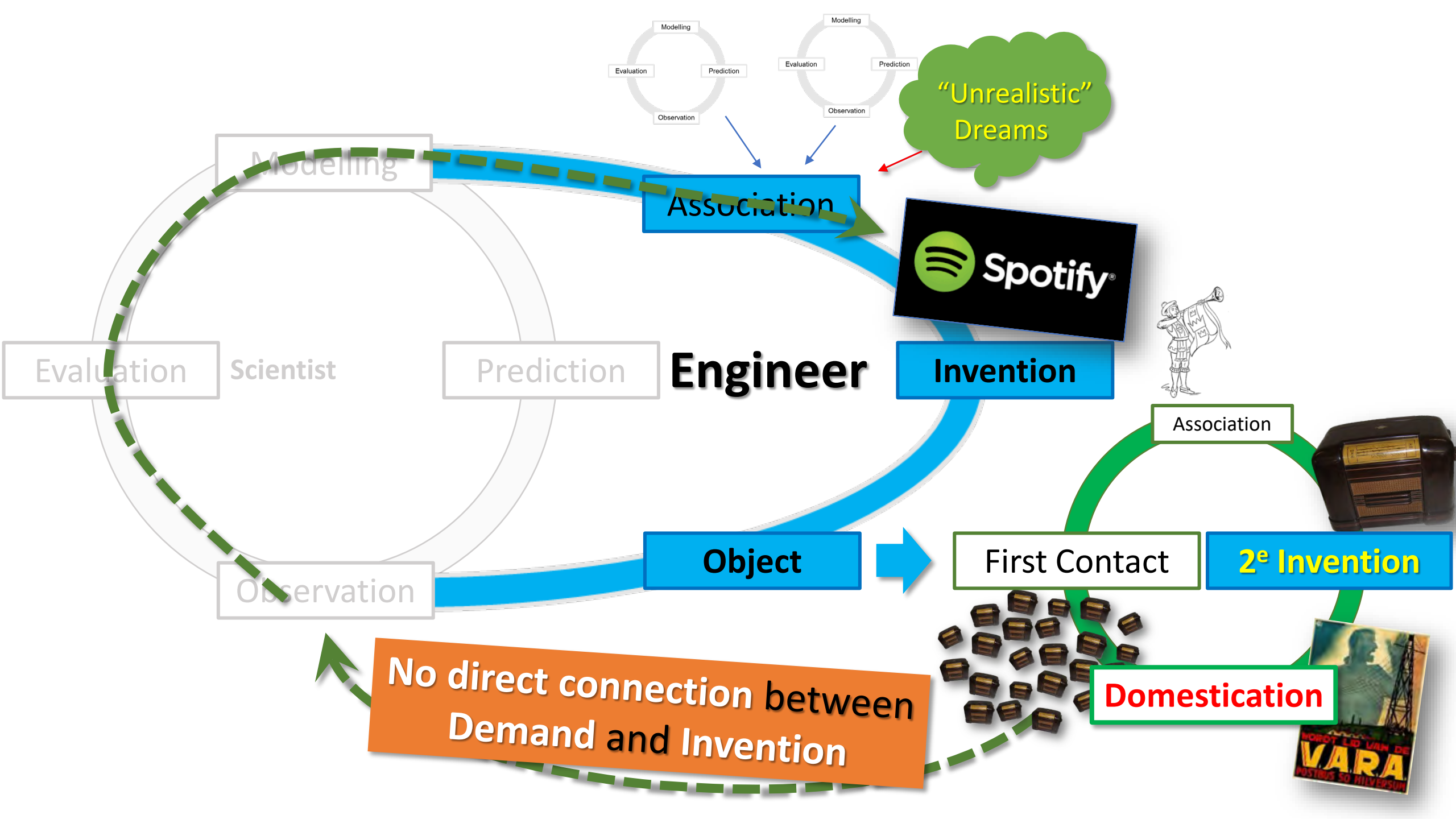
Prediction

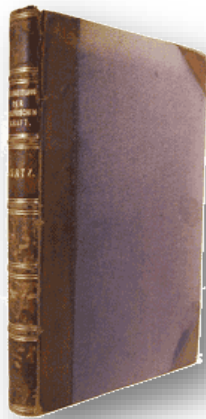
Engineer

Inventions

Observation



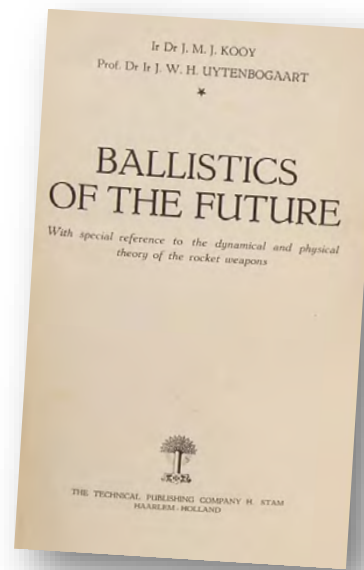




Untersuchungen über Die Ausbreitung Der Elektrischen Kraft
Heinrich Hertz, 1892

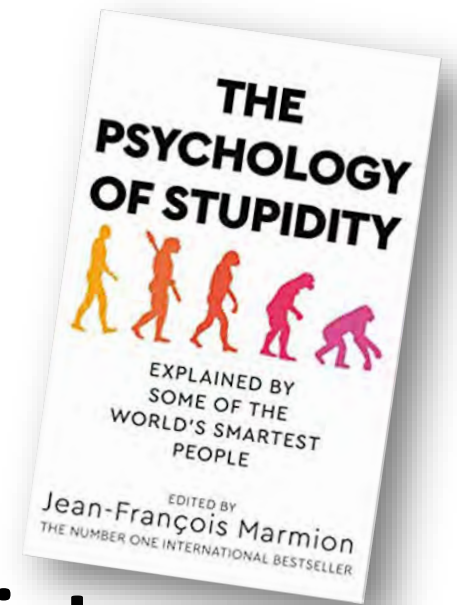
Scientist

Discoveries



Engineer

1st Invention



Society

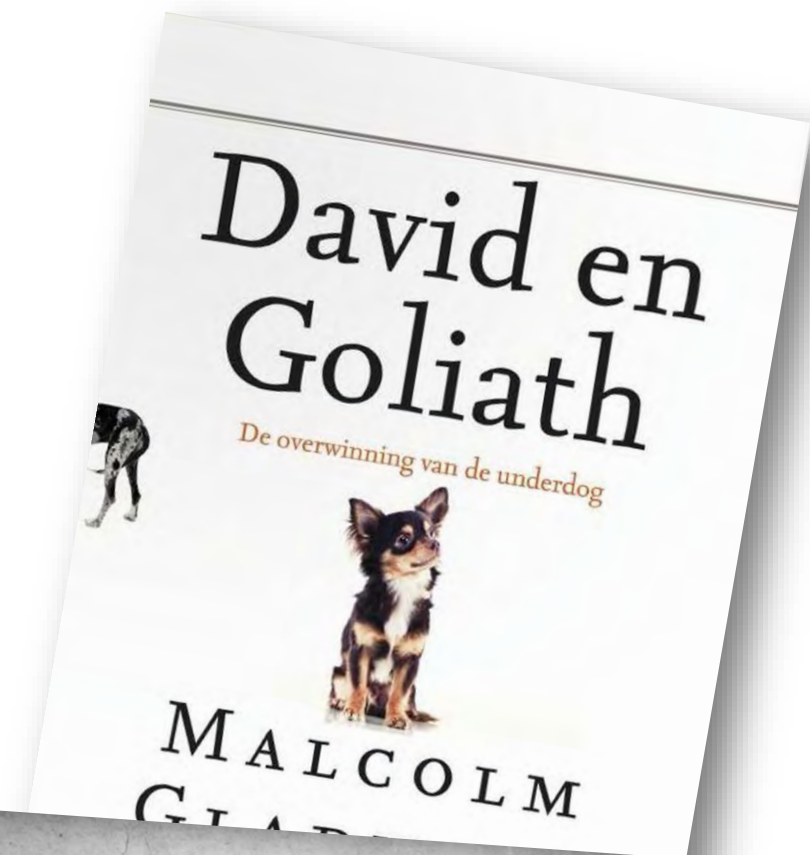
Association



$$\frac{d \text{ Earth}}{dt}$$

Do something stupid

Domestication



Keny Arkana - L'Histoire se Répète <https://www.youtube.com/watch?v=03YfZXQx60>

The Psychology of Stupidity: ISBN : 9781529053838, David en Goliath: ISBN: 9789047006275



Praetorian Guardsmen and Cavalryman. Artwork by Angus McBride



“Unrealistic”
Dreams

Association

Engineer

Invention



Association



Invention

ET L'HISTOIRE
SE RÉPÈTE



The Romans already had “radio”
One person could address the people.
The technology was different (horses, messengers etc.)
but the communication concept was the same.

Evaluation

Observation

Subject

1903



SE RÉPÈTE

The technology that would end the age of the battleships already existed at the start of it.
But it was considered not taken seriously at that time.

1941

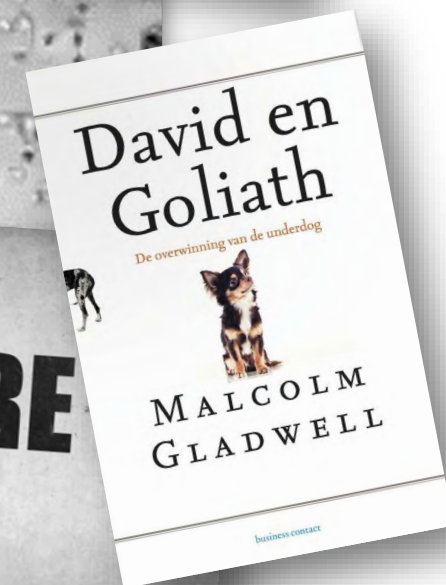
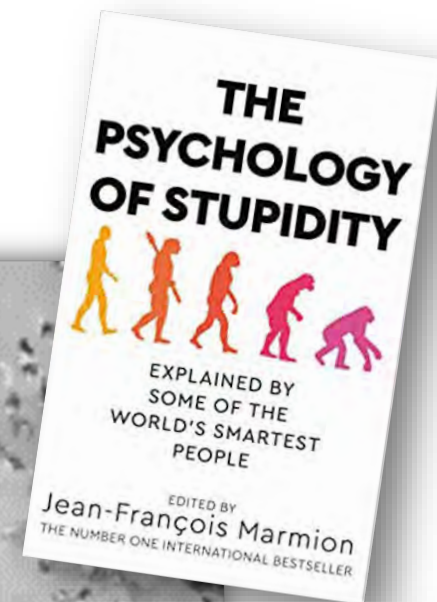


SE RÉPÈTE

The technology that would end the age of the battleships already existed at the start of it.
But it was considered not taken seriously at that time.
So, look for something stupid and take it seriously.

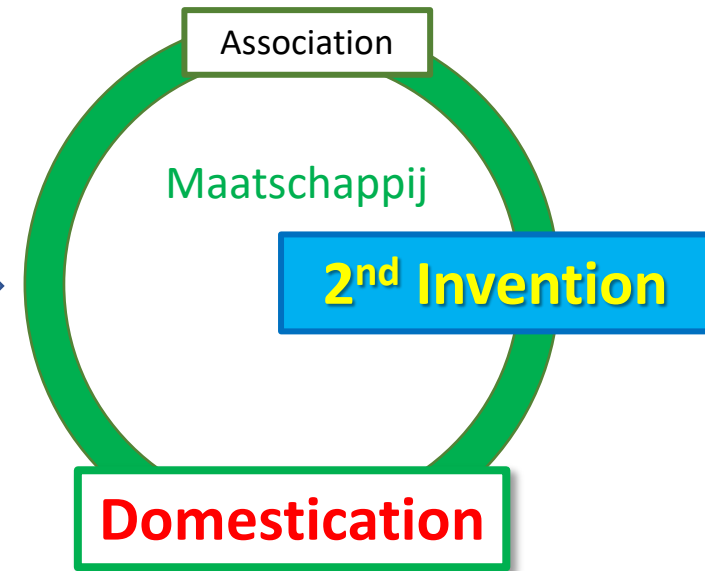
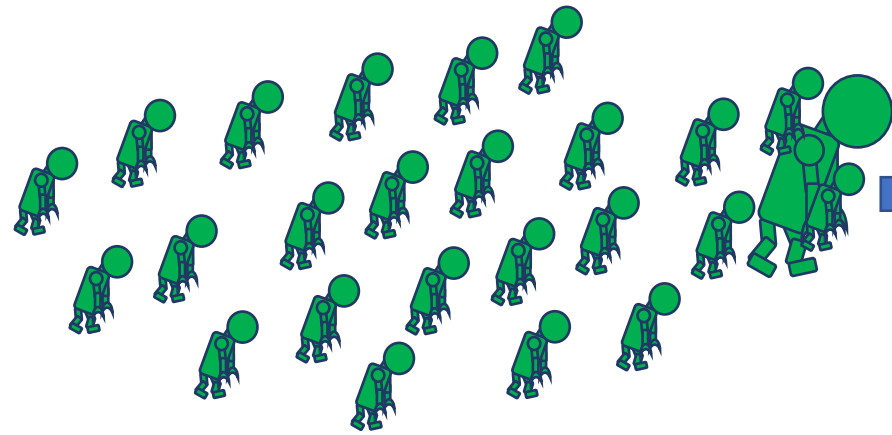


White blood cells attacking a parasite worm
<https://www.youtube.com/watch?v=dDn9hFdn7n8>



What *is* a robot?

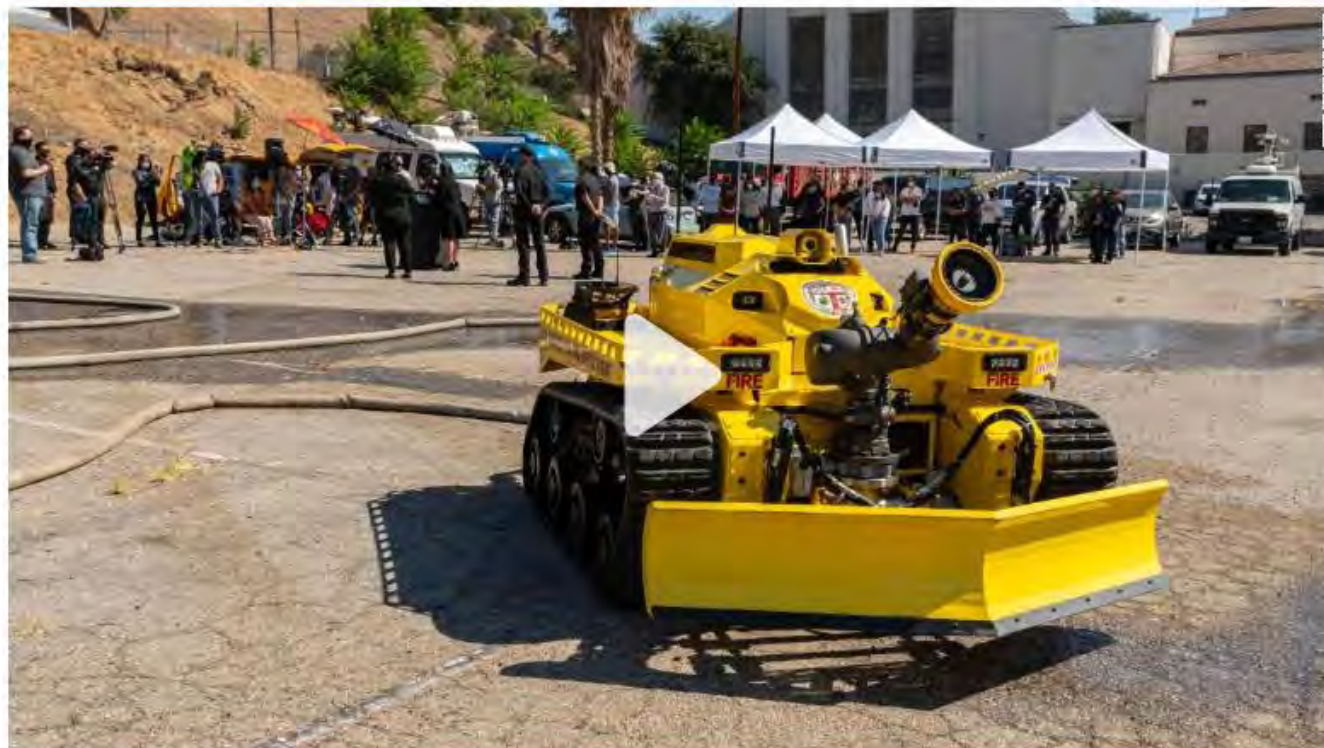
What *is* a swarm?



The first firefighting robot in America is here -- and it has already helped fight a major fire in Los Angeles

By Francesca Giuliani-Hoffman, CNN

Updated 2006 GMT (0406 HKT) October 21, 2020



TOP STORIES



Analysis: That Gallup poll doesn't say what Donald Trump thinks it does



Chris Christie still battles coronavirus as other senior...

Recommended by **outbrain**



UNIVERSAL ROBOTS

AUTOMATION EDUCATION STARTS TODAY.

Explore our e-books to get an easy start on





Remote control

Candy





Candy

~~Remote Control~~
Remote Command



Autonomy

Kaiser Wilhelm II
on a
Autonomous
Vehicle



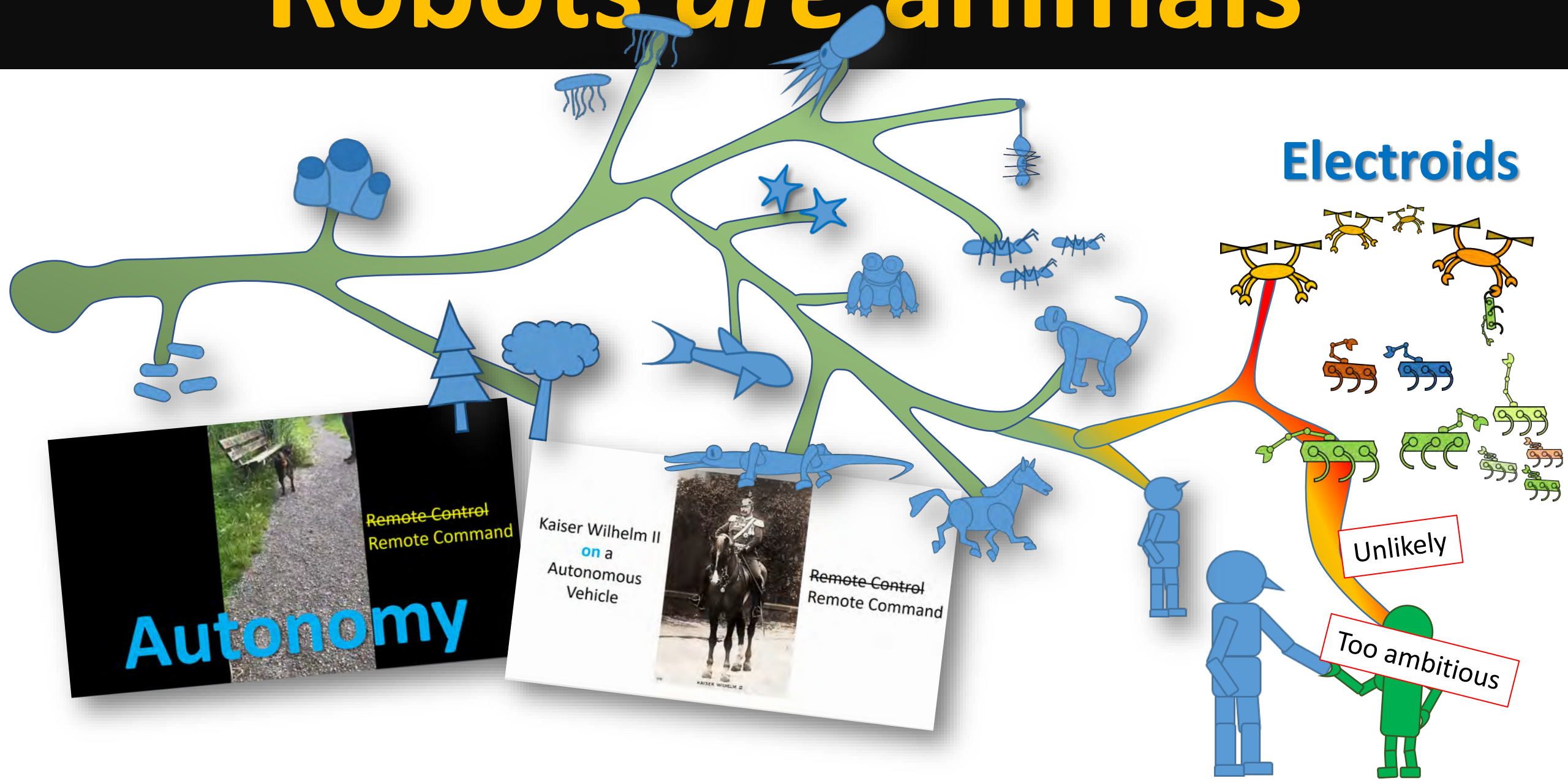
~~Remote Control~~
Remote Command

Kaiser Wilhelm II
in an
Autonomous
Vehicle

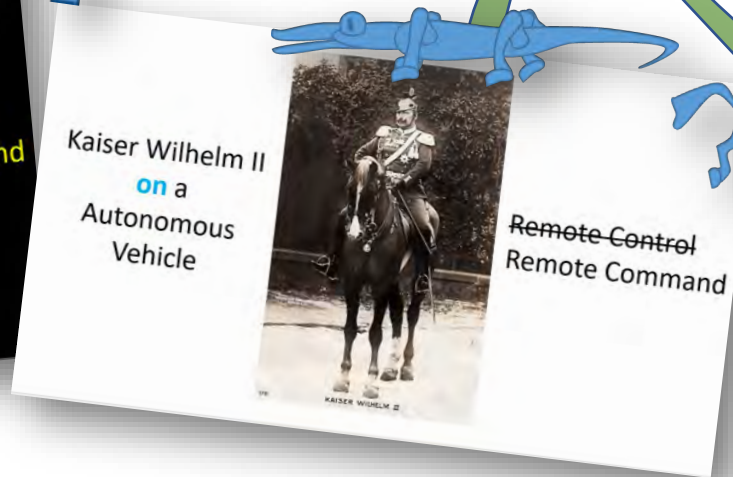
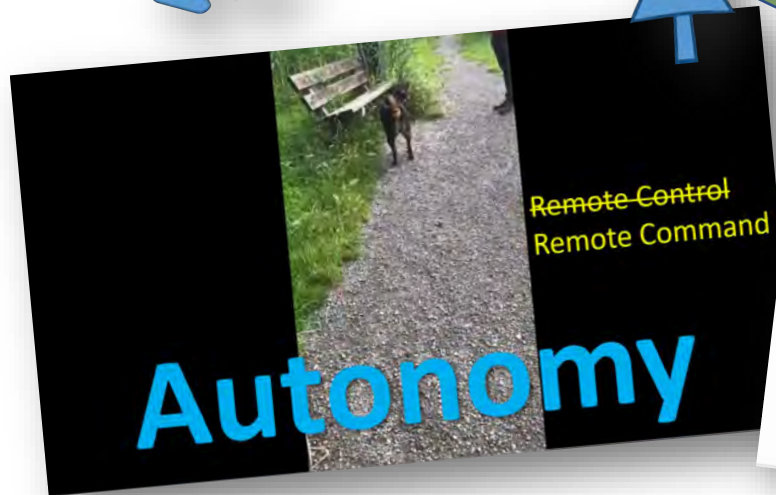


An autonomous car is just a better horse!

Robots *are* animals



Electroids



Unlikely

Too ambitious

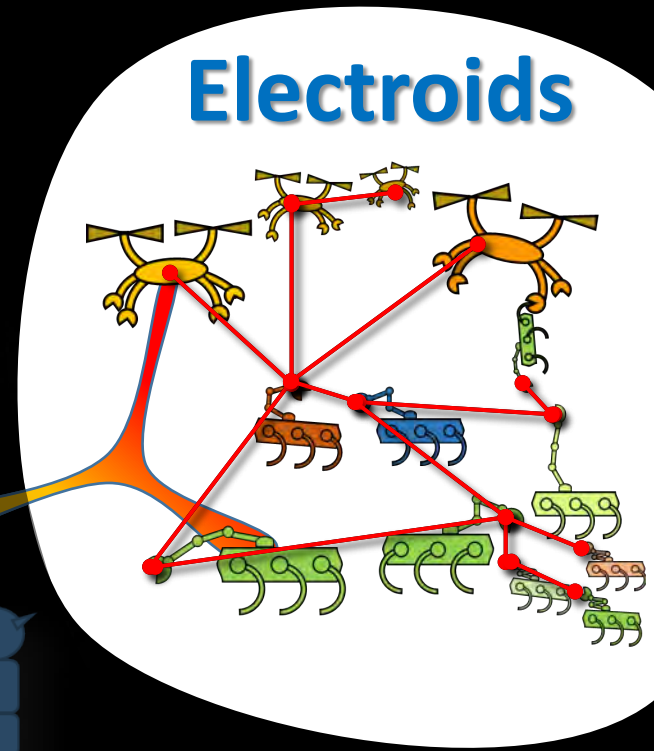
Robots *are* animals

Faster : **Electronic brain**

Stronger : **Electric Muscles**

Morphic field : **Radio Contact**

Morphic field : **Morphic Resonance**



The screenshot shows a website for Rupert Sheldrake. The top navigation bar includes links for "about", "books", "research", "participate", "reactions", "videos", and "audio". The main content area is titled "Morphic Resonance" and contains a paragraph of text. To the left of the main text, there is a list of links to various articles or papers, including "Rat Learning and Morphic Resonance", "Cattle Pooled by Phoney Grids", "An Experimental Test of the Hypothesis of Formative Causation", "Abstract - An Experimental Test of the Hypothesis of Formative Causation", and "Rose Responds to 'An Experimental Test of the Hypothesis of Formative Causation'".

Internet of **Robots**

~~Intelligence?~~

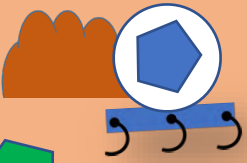
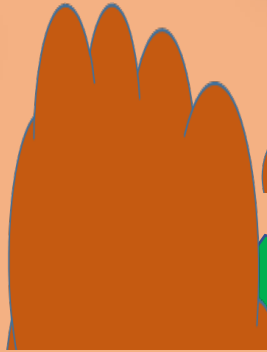
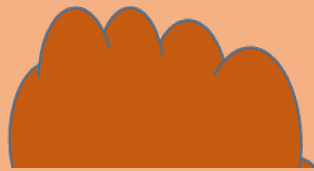
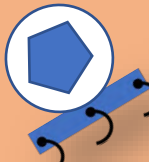
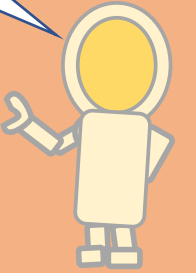
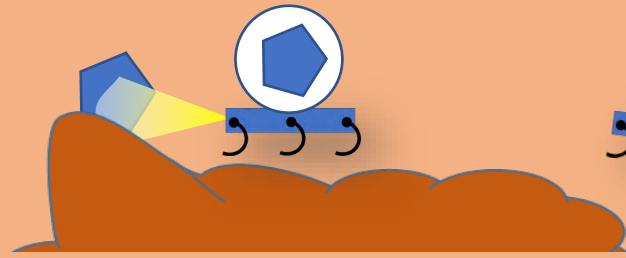
Autonomy!

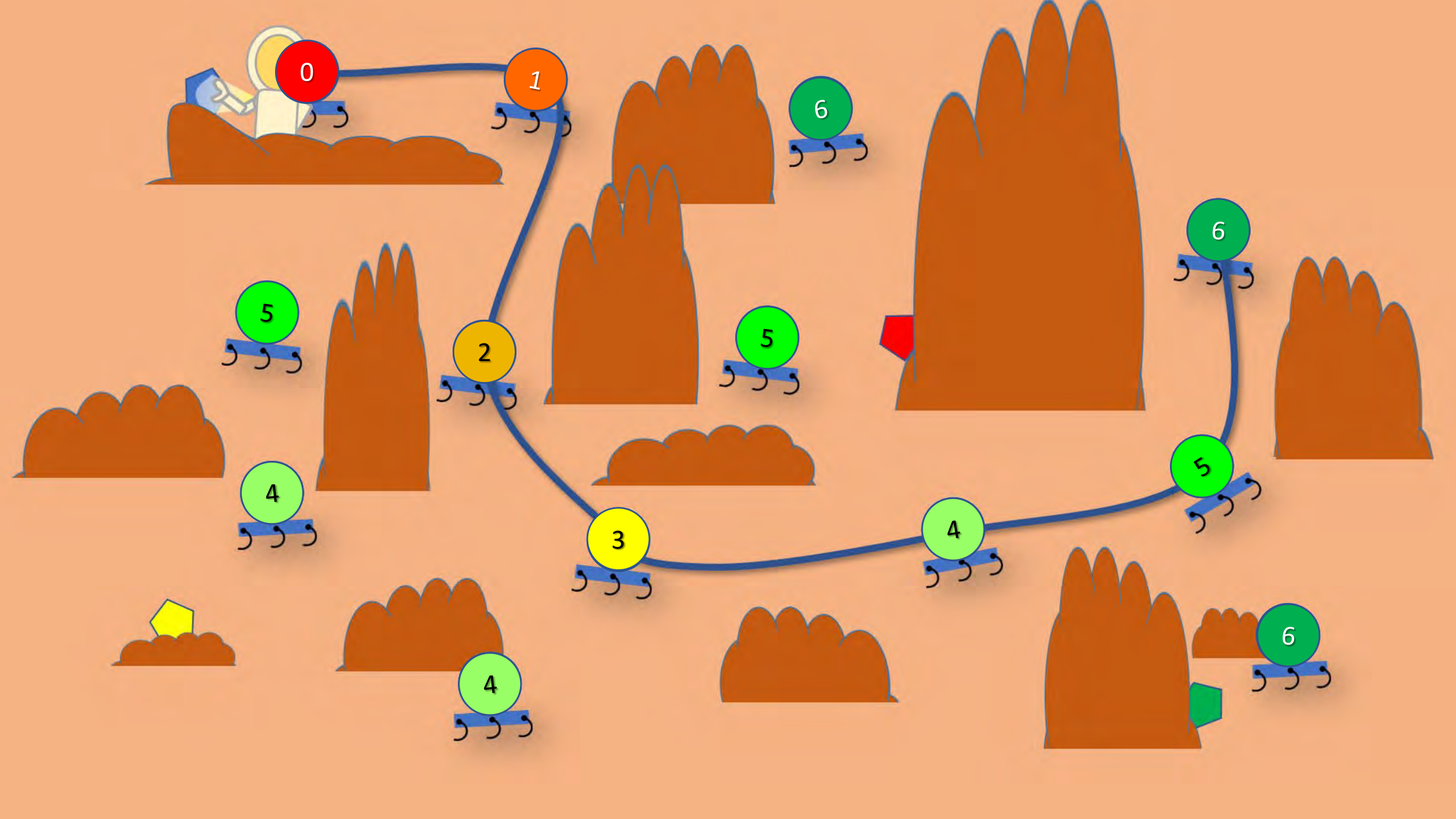
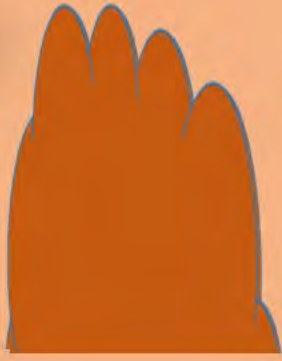
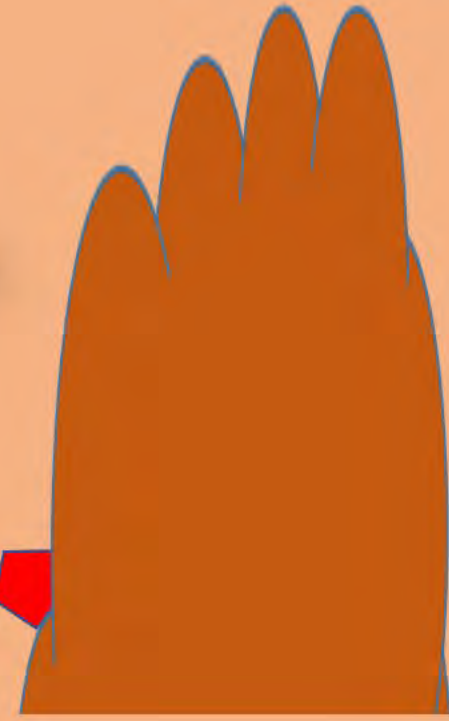
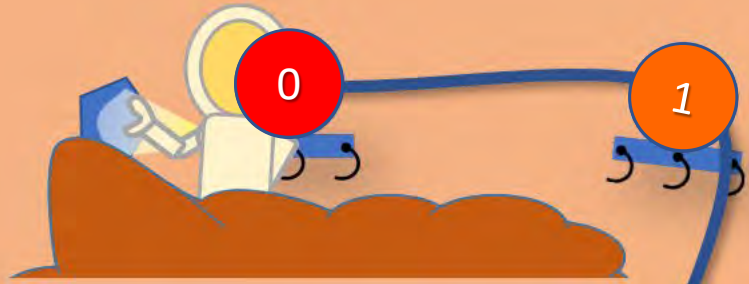
Swarm

A stylized landscape with brown hills and a white astronaut. The hills are represented by various brown shapes, some with small colored objects (blue, red, green) on top. A white astronaut is standing on the right side of the image.

Emergent

behavior







No central control

No leader

No intelligence

Autonomy

Lunar Zebro

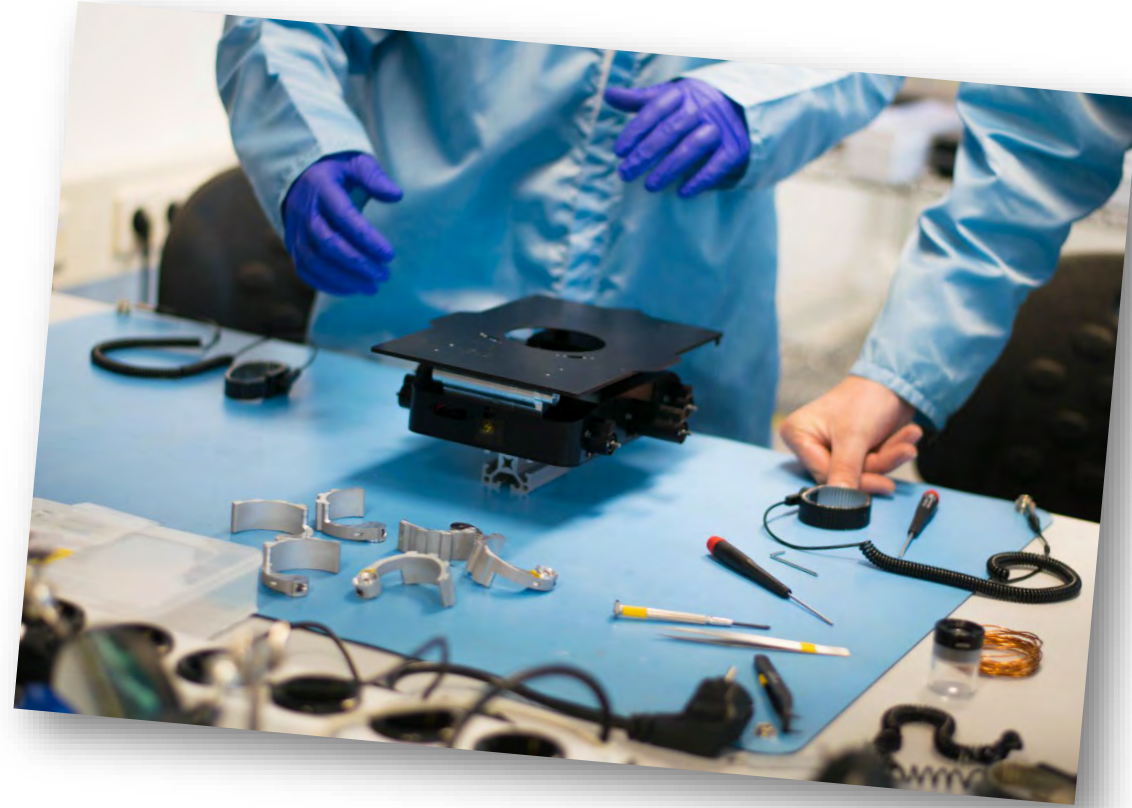
<https://zebro.space/>



Autonomy

Lunar Zebro

<https://zebro.space/>





kleine drones kan gaslekken lokaliseren

Zwerm **autonome** kleine drones kan gaslekken lokaliseren

NEWS - 14 JULI 2021 - WEBREDACTIE COMMUNICATION

een gaslek in een groot gebouw of op een industrieterrein moeten brandweerlieden nu nog naar binnen met gasdetectie-instrumenten. Het kan geruime tijd duren voordat ze het gaslek vinden en ze riskeren hierbij soms hun leven. Onderzoekers van de TU Delft, de Universiteit van Barcelona en Harvard University hebben nu voor het eerst een zwerm kleine – en dus zeer veilige – drones ontwikkeld die autonoom gasbronnen kunnen detecteren en lokaliseren in onoverzichtelijke binnenruimten.



Photo by Egor Kamelev

<https://www.pexels.com/photo/macro-photography-of-a-fruit-fly-8201454/>

Departure gates



bmi

bmi

bmi

bmi

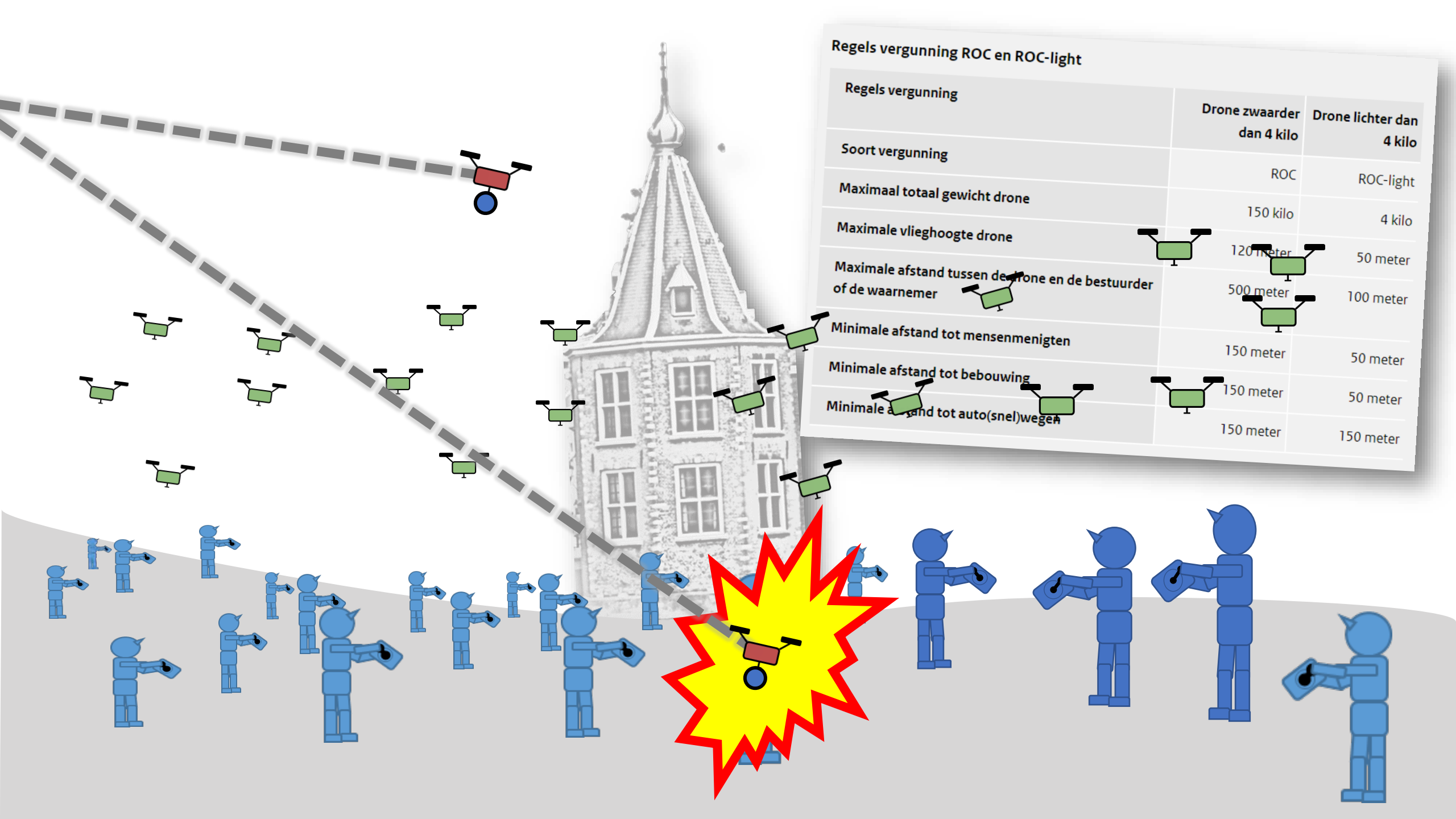
bmi

bmi

bmi

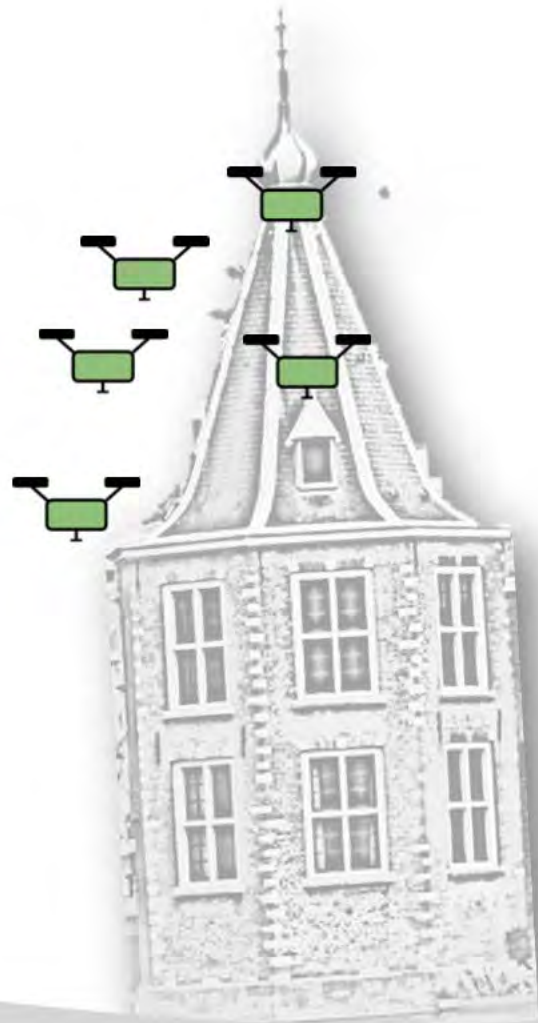
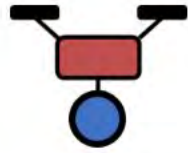


Figure 1: Commercial Drone Modified for Projectile Drop Capability by Islamic State Operatives (Photo credits: Plastic Tube (Mitch Utterback); Servo Motor, Release Rod (Conflict Armament Research); Warhead (Conflict Armament Research))



Regels vergunning ROC en ROC-light

Regels vergunning	Drone zwaarder dan 4 kilo	Drone lichter dan 4 kilo
Soort vergunning	ROC	ROC-light
Maximaal totaal gewicht drone	150 kilo	4 kilo
Maximale vlieghoogte drone	120 meter	50 meter
Maximale afstand tussen de drone en de bestuurder of de waarnemer	500 meter	100 meter
Minimale afstand tot mensenmenigten	150 meter	50 meter
Minimale afstand tot bebouwing	150 meter	50 meter
Minimale afstand tot auto(snel)wegen	150 meter	150 meter



Autonomous birds catch birds



Een drone als 'eye in the sky' moet de politie helpen bij incidenten

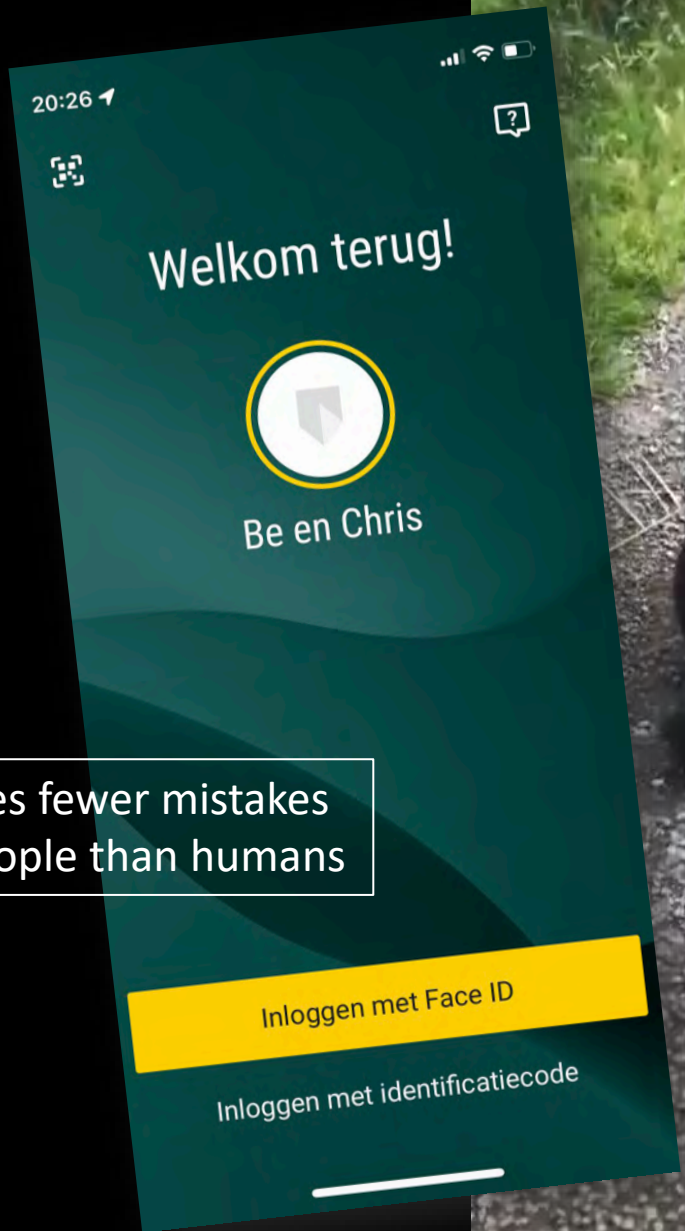
8 april, 17:46 • 3 minuten leestijd



Niels Nijman en Remco Aagtjes laten trots de drone zien
© RTV Oost

Een automatische drone die uit zichzelf naar een incident vliegt, zónder dat er een piloot aan te pas komt. Het klinkt als een scène uit een sciencefictionfilm, maar dit kan over twee jaar werkelijkheid zijn. Vandaag trapte de politie bij Space53 in Enschede de piloot met de onbemande drone af.

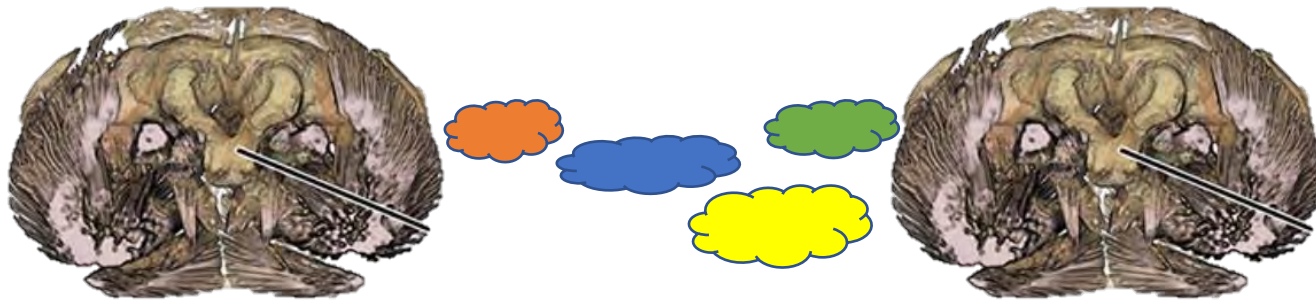




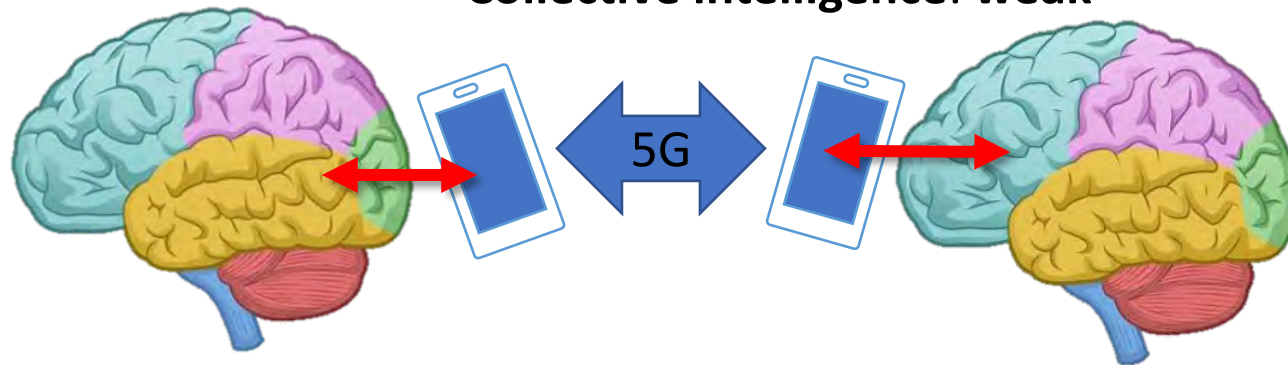
A computer makes fewer mistakes
in recognizing people than humans

~~Remote Control~~
Remote Command

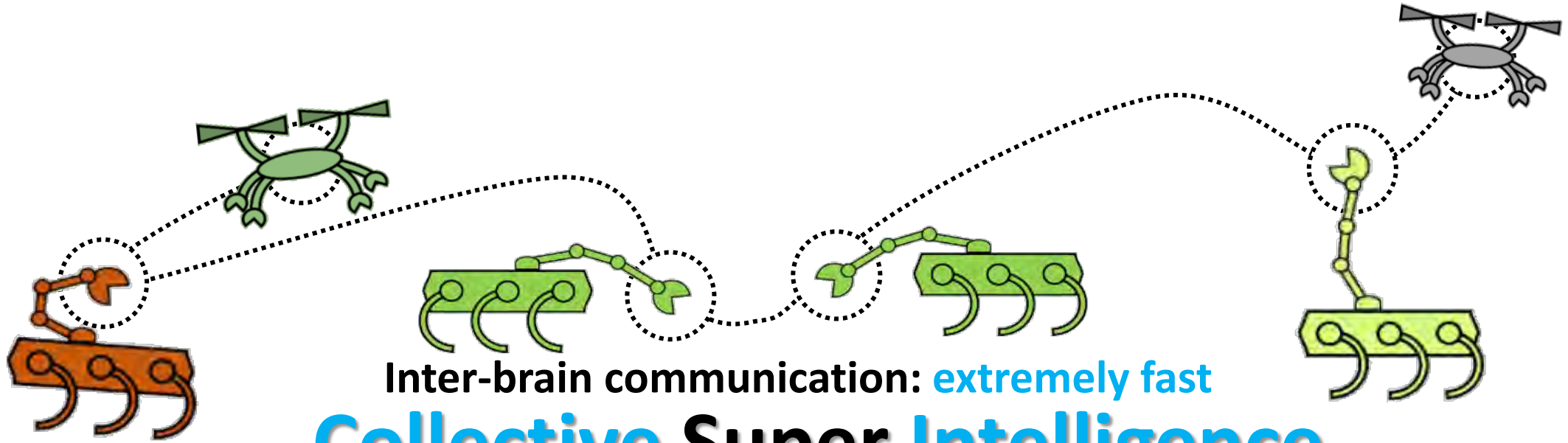
Collective Intelligence



Ants brain with 250.000 cooperating neurons
Inter-brain communication: extremely slow
Collective intelligence: weak

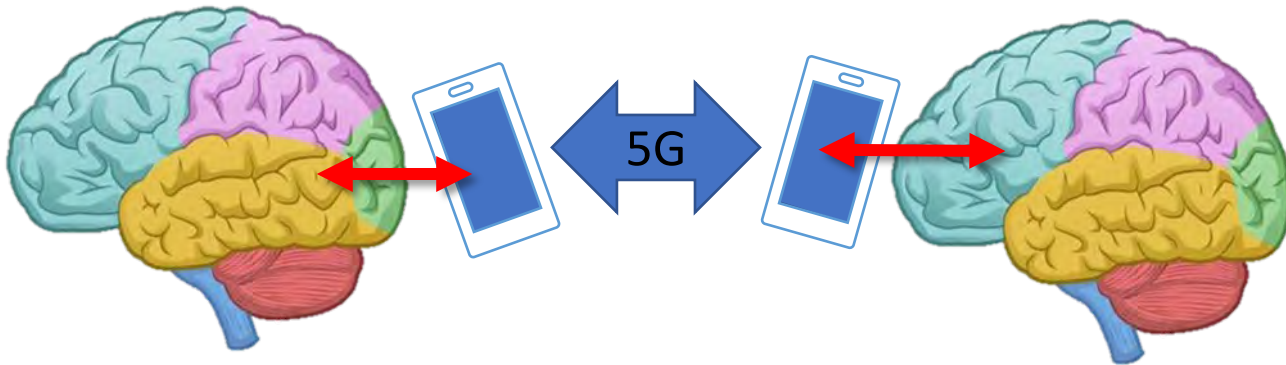


Human brain with 100 billion cooperating neurons
Inter-brain communication: **slow**
Collective intelligence: DISAPPOINTING



Inter-brain communication: extremely fast

Collective Super Intelligence



Human brain with 100 billion cooperating neurons

Inter-brain communication: still slow

Collective intelligence: **DISAPPOINTING**

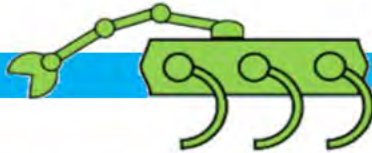
Robots



Internet of Robots

Collective Super Intelligence

AI



Internet Of Things

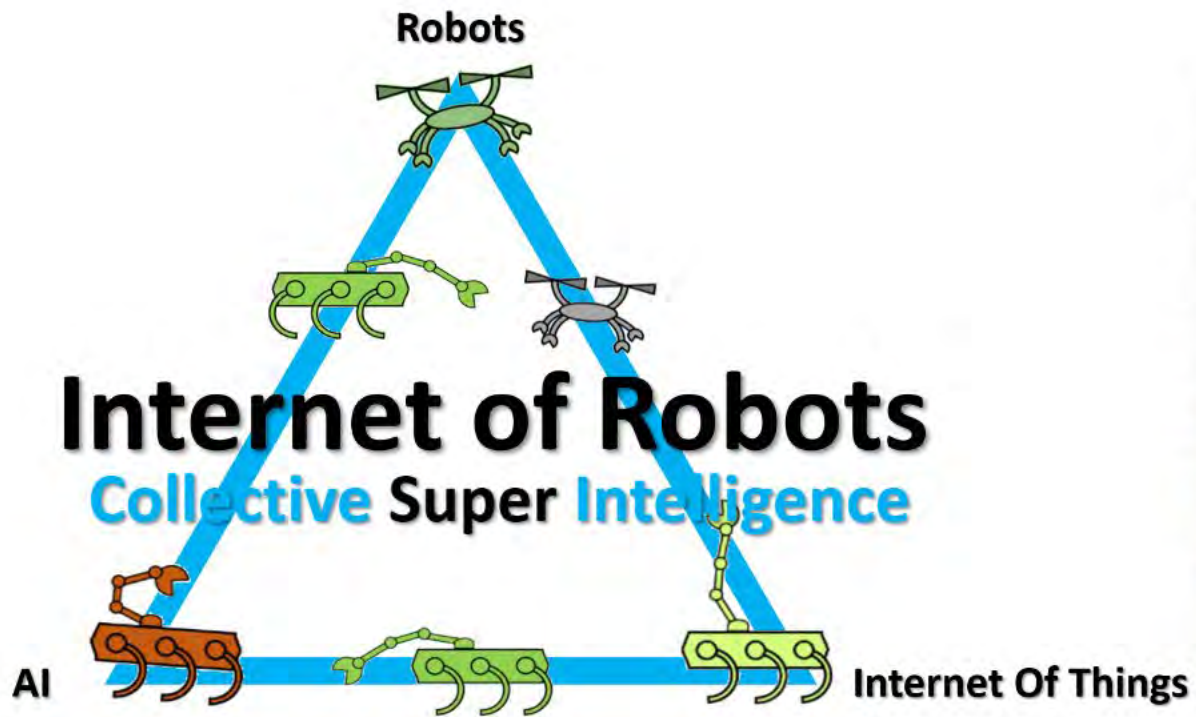


Photo by DAVID ILIFF. License: CC BY-SA 3.0

Many small brains

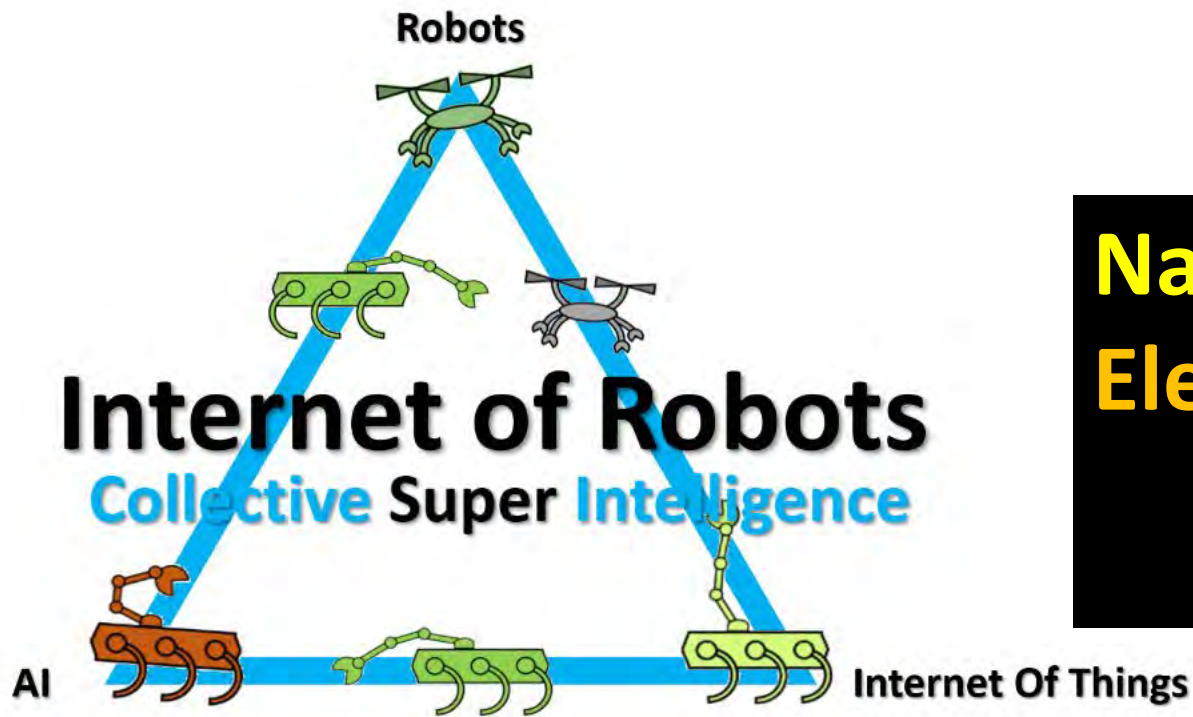
Dependable and communication

Enormous Collective Intelligence

Few large brains

Error-prone and slow communication

Disappointing Collective intelligence



Natural selection:

Electroid humans have no future

Large brains: single points of failure

No Morphic Resonance (collective intelligence low)

Many small brains

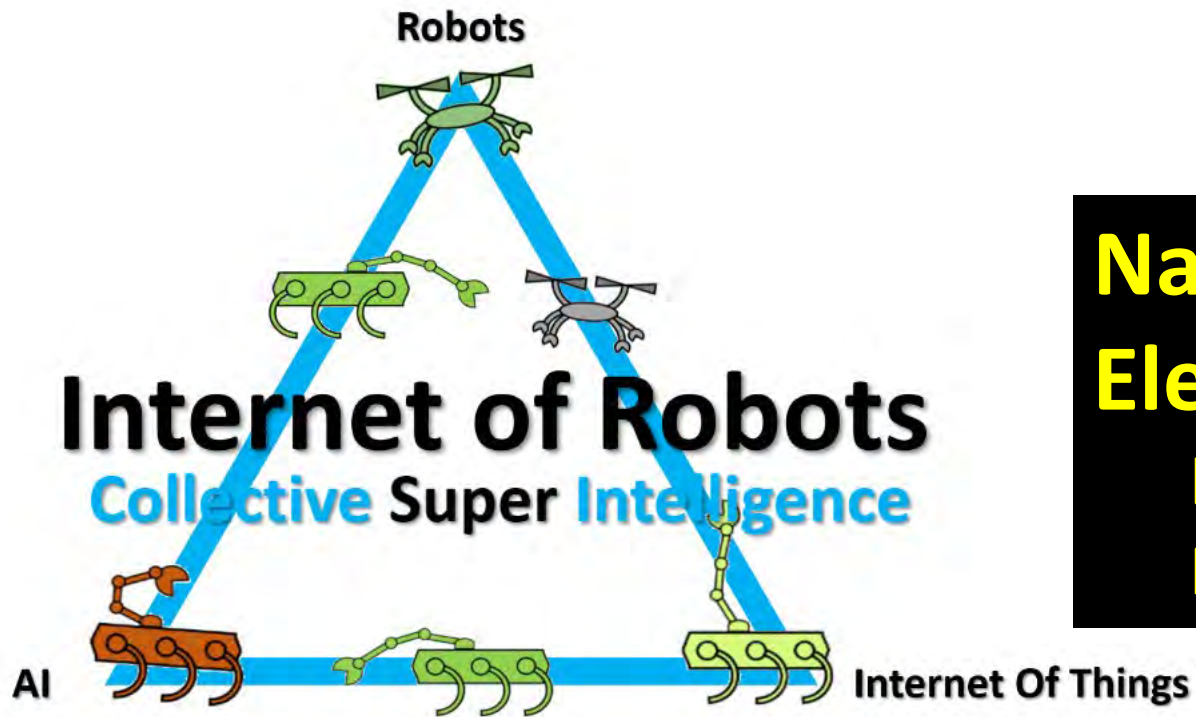
Dependable and communication

Enormous Collective Intelligence

Few large brains

Error-prone and slow communication

Disappointing Collective intelligence

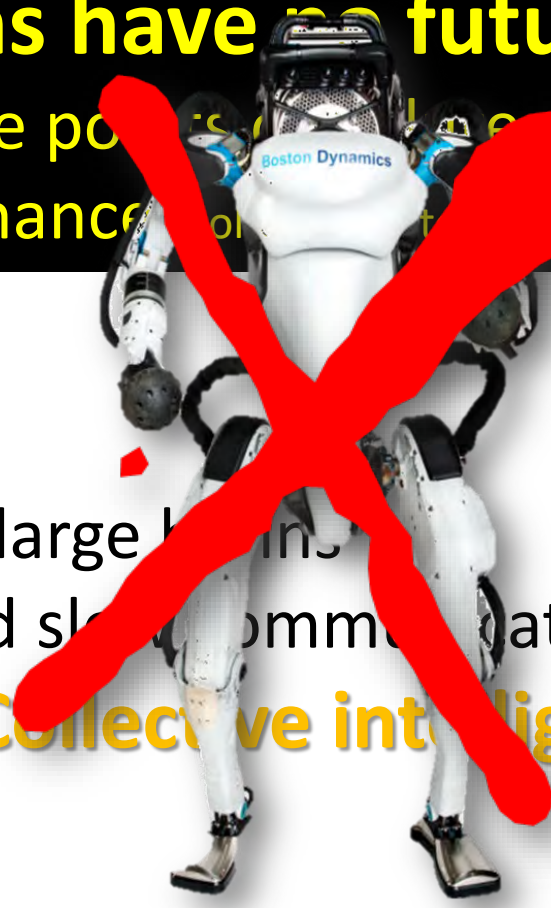


Many small brains
 Dependable and communication
Enormous Collective Intelligence

Natural selection:
Electroid humans have no future
 Large brains: single point of failure
 No Modulation Resonance (of the low)



Human



Electroid
 with human architecture

Few large brains
 Error prone and slow communication
Disappointing Collective intelligence

Robots



Conclusions

Autonomy

~~Remote Control~~

Remote Command

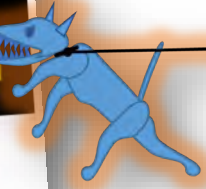


2nd Invention voor de krijgsmacht van 2035



Association

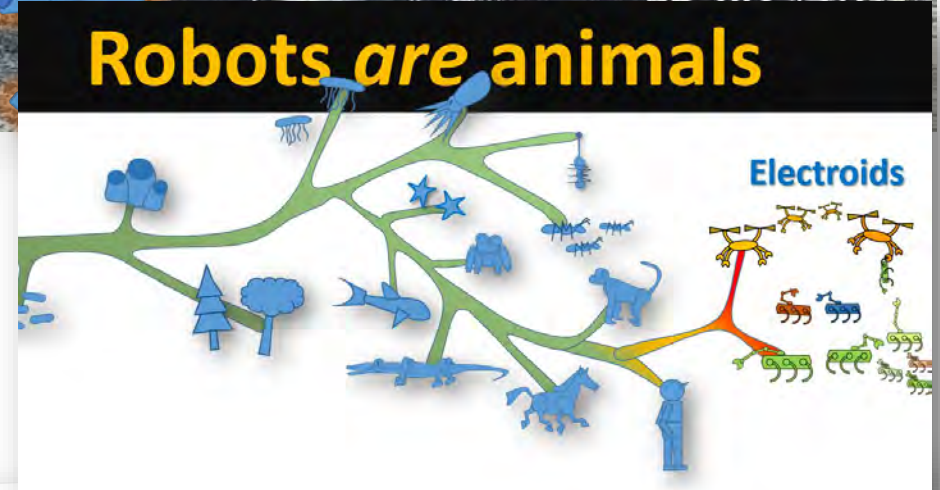
Do something stupid



Domestication



Robots are animals



ET L'HISTOIRE SE RÉPÈTE

1903

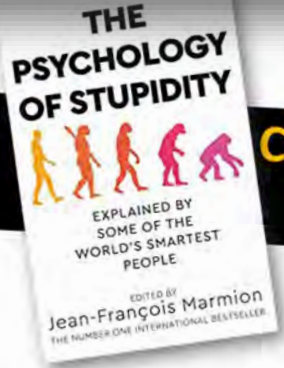
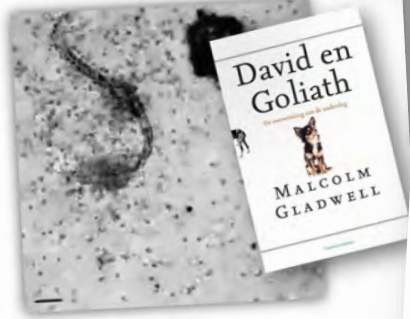


Wright flyer 1

John T. Daniels



HMS Hindustan



Wise people do clever things, ai..

Creative people do stupid things