

Drones and the future (of aviation)

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

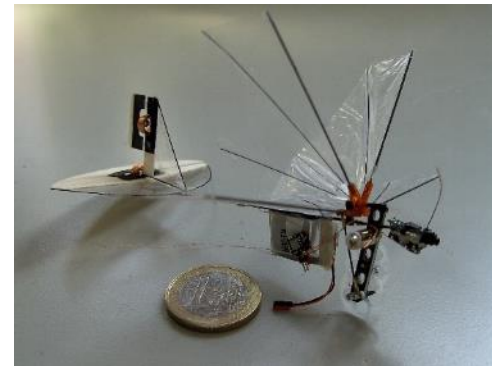
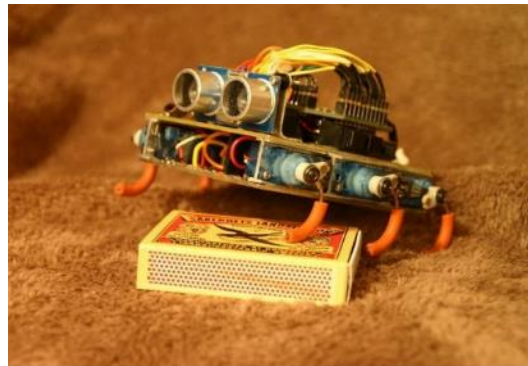
Associate Professor

TU Delft Robotics Institute / Theme leader Swarm Robots

TU Delft Space Institute / Theme leader Space Robots

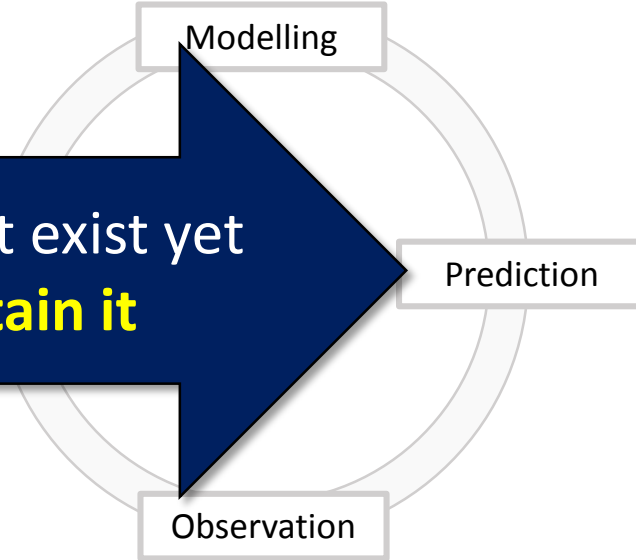
TU Delft Faculty of Aerospace Engineering / Dept. Space Engineering

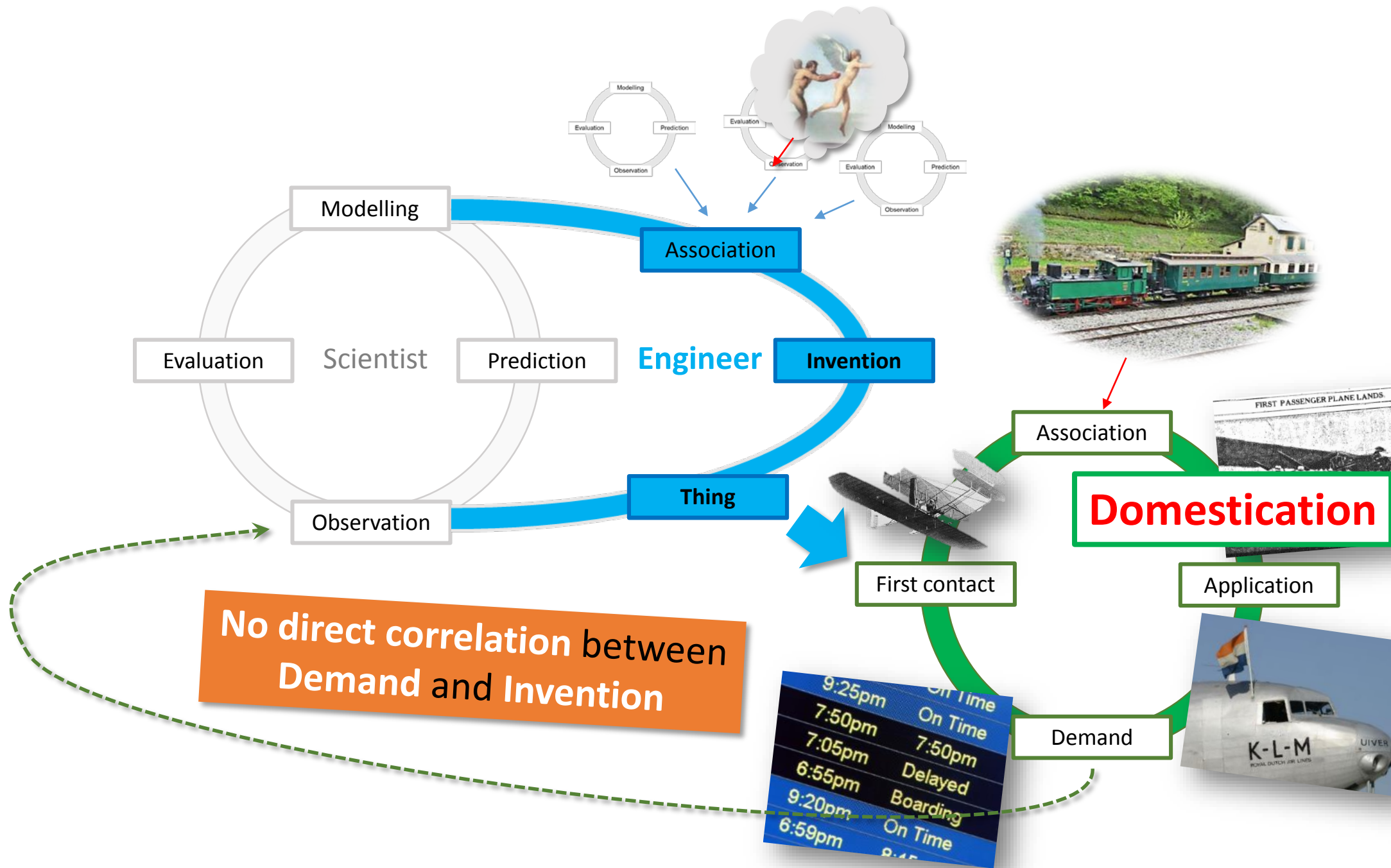
TU Delft Faculty of Electrical Engineering, Mathematics and Computer Science/ Dept. Micro Electronics



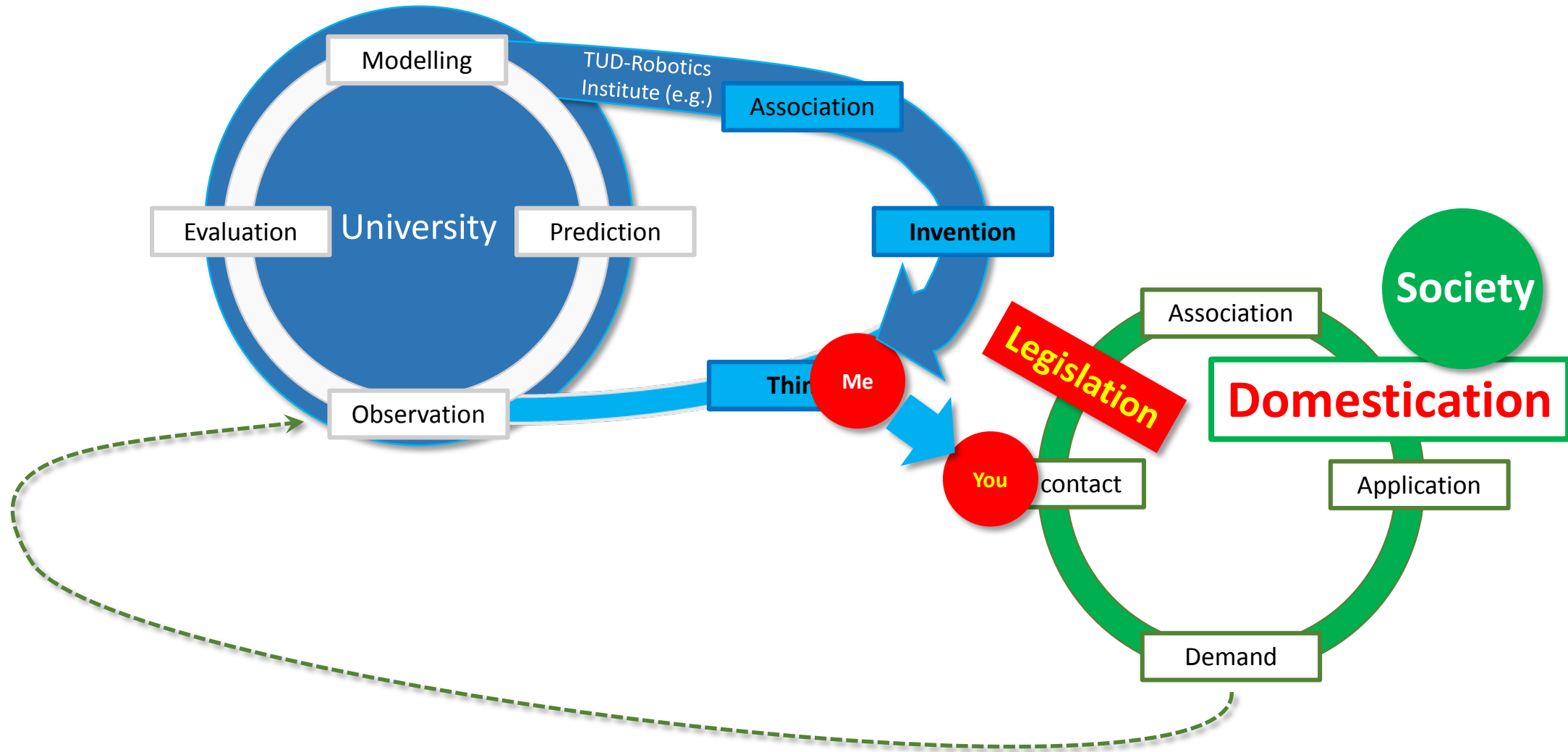
future

Since **the future** does not exist yet
a model cannot contain it

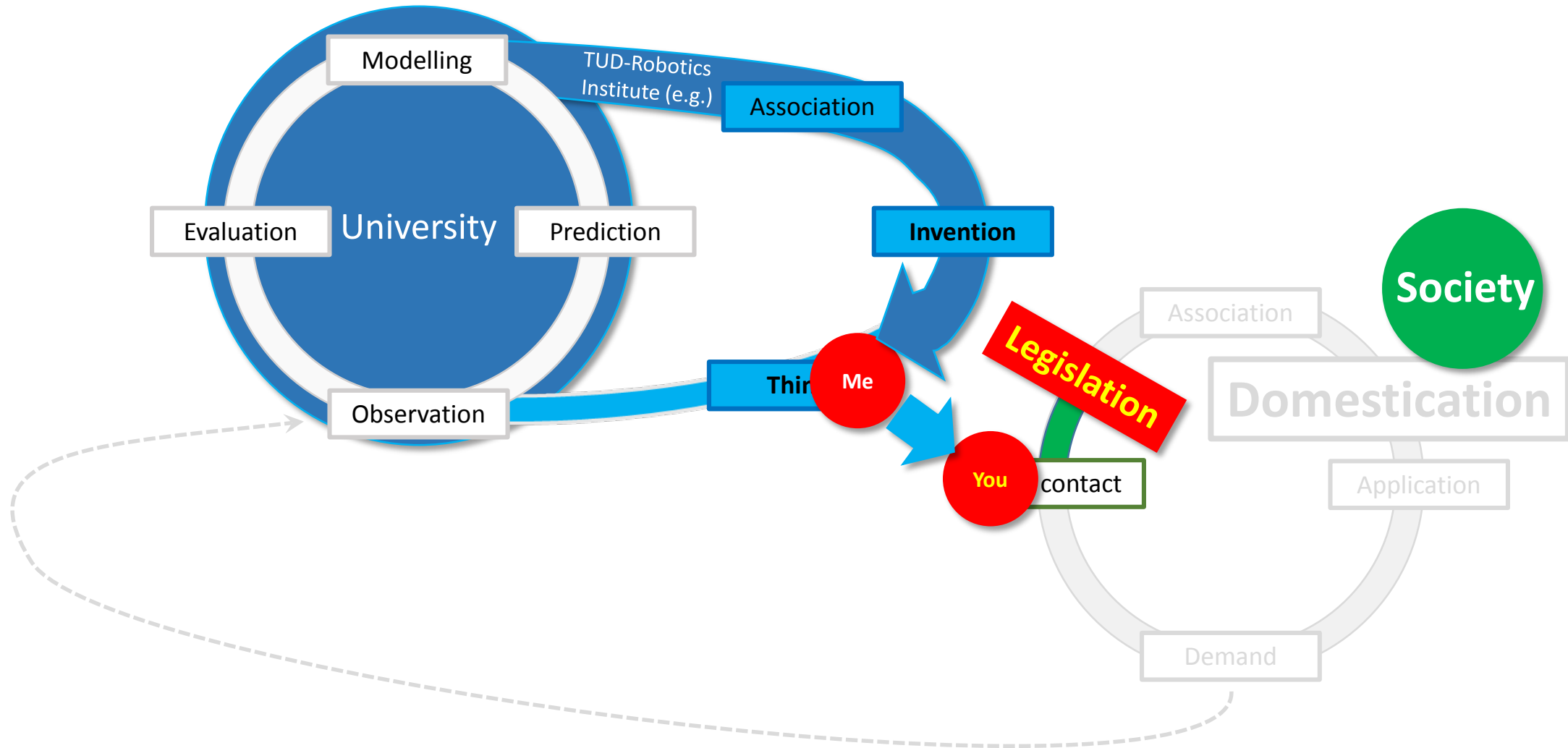




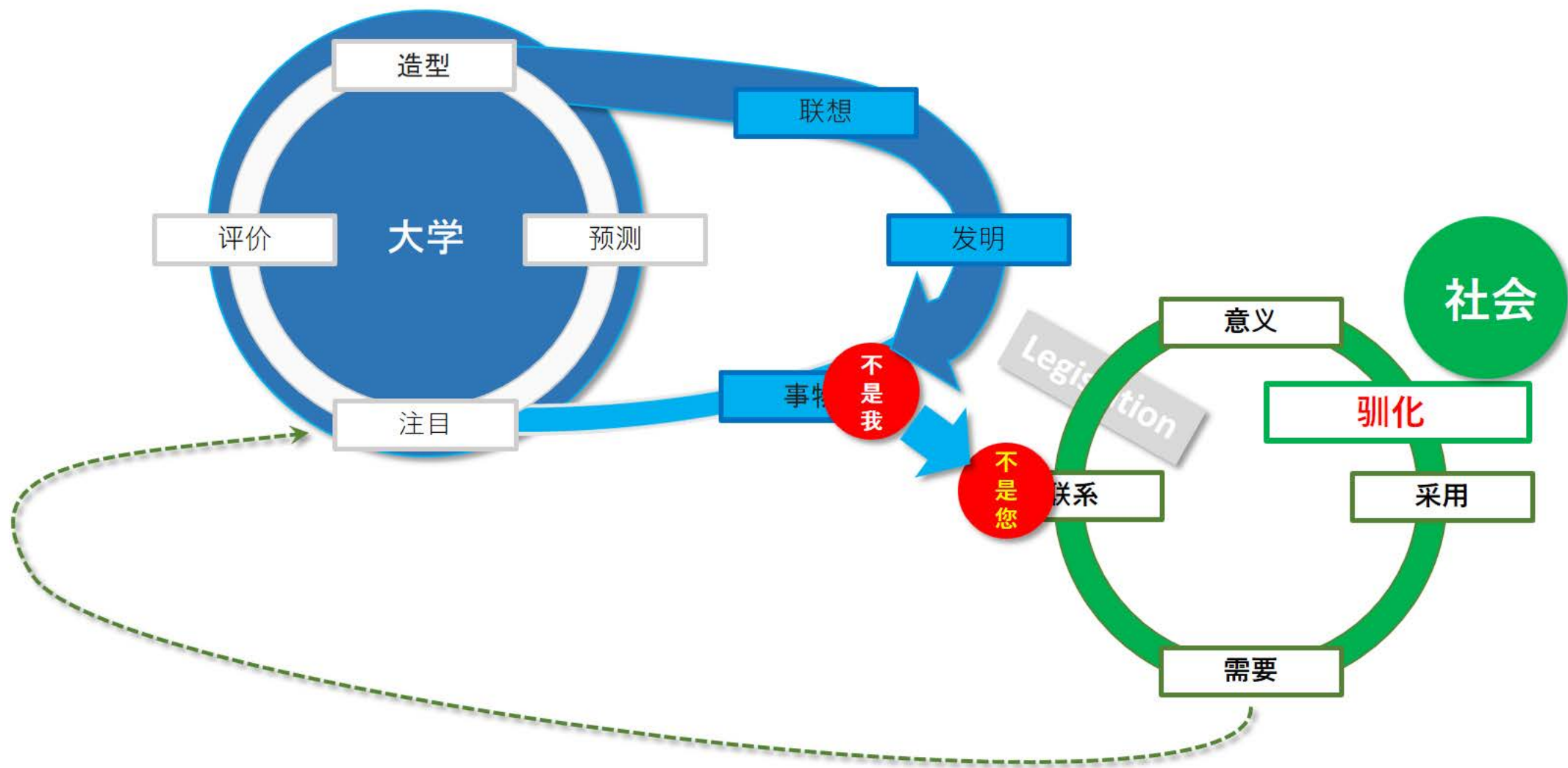
Actors



Actors



演员



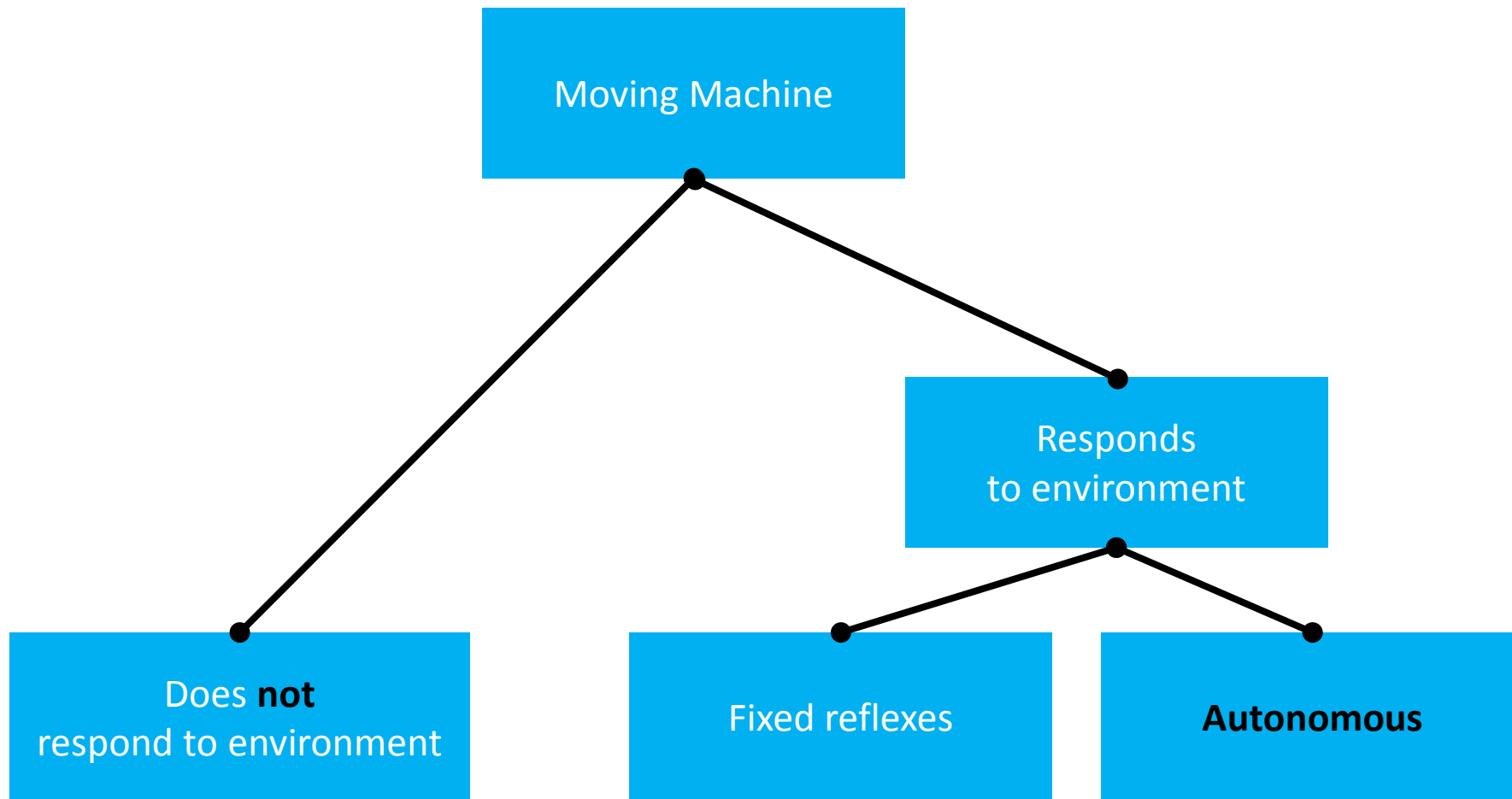


Legislation that enables Domestication
(application, demand, innovation, industrial boost)
Enable direct contact

Association

Domestication?

Robot?



Move

Moving Machine

Sense

Responds
to environment

Chemical thinking



Move

Moving Machine

Sense

Responds
to environment

Electro-chemical thinking



Move

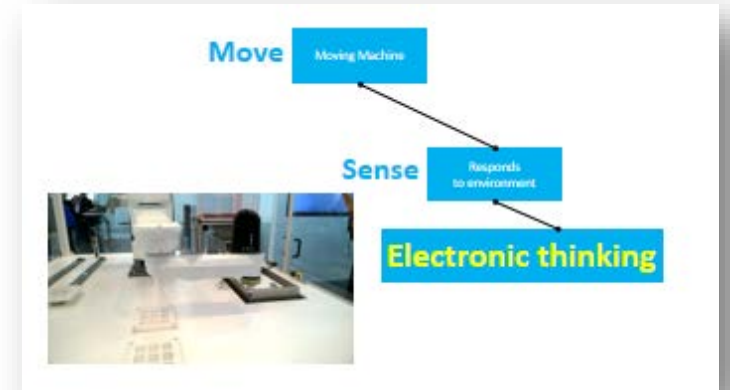
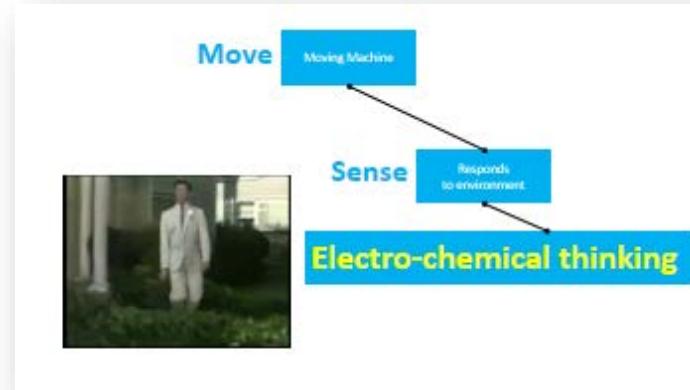
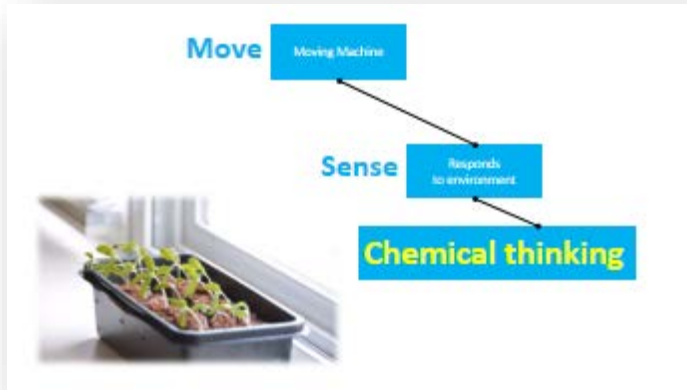
Moving Machine

Sense

Responds
to environment

Electronic thinking





Evolution



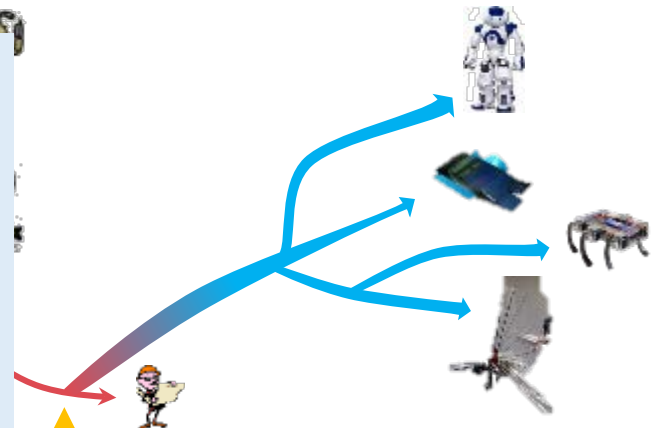
Robots *are* animals

Electroids

Faster : Electronic nervous system

Stronger : Electric muscles

Telepathic : Radio contact



Know all there is to know

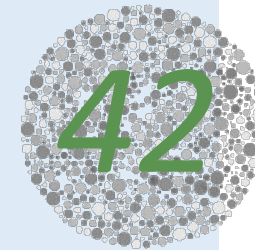
See all correlations

Perfect “**Fortune tellers**”

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Prediction

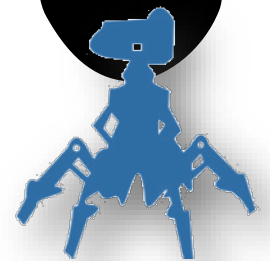
(Has nothing to do with intelligence)

Data

Correlation

Information

Big Data



Safe drones?



Actors



Credit: Jacom Stephens E+ Getty Images

Comment: Why we can't stop birds downing aircraft

By Paul Marks



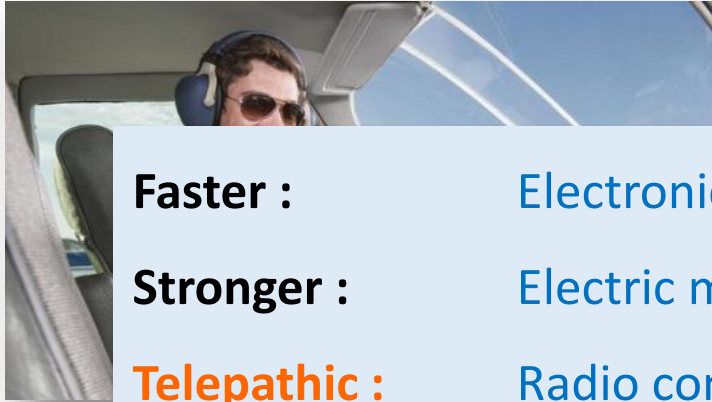
The Wright Brothers were inspired to take to the air by the sight of turkey vultures circling. Unfortunately, the history of birds and aircraft hasn't always been so productive.

Yesterday's (thankfully nonfatal) [splashdown of a jet](#) in the Hudson River has thrown the modern aircraft into sharp relief.

Since 1988, 219 people have died worldwide in air crashes caused by birds choking jet engines. [Strike Committee](#), an advocacy group trying to alleviate the problem. In 2001, a UK study estimated that birds cost aviation [\\$1.3 billion globally](#) by damaging and delaying planes.

The toughened turbine blades in a jet engine are immensely strong, but there's little they can do when confronted with a flock of fat Canada geese, each weighing up to 6kg.





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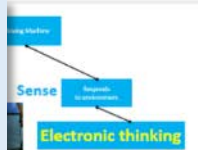
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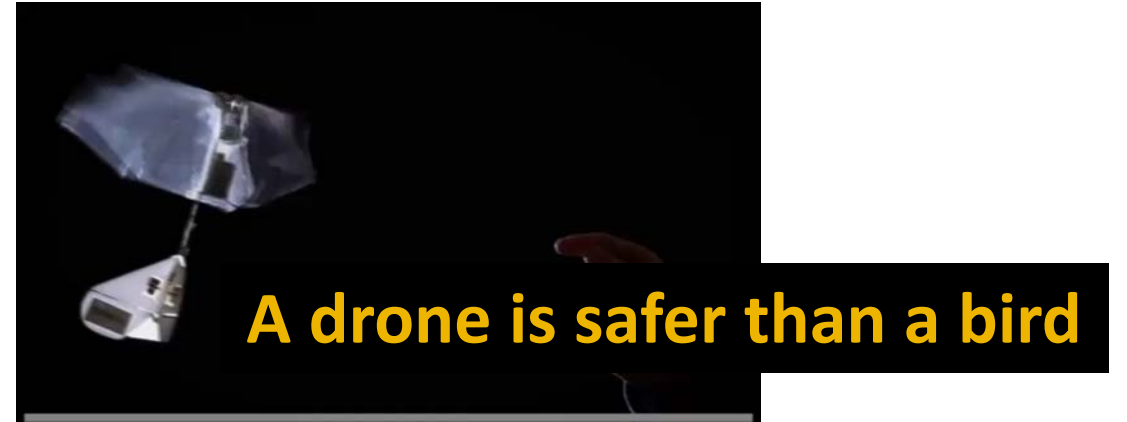
A drone is safer than a bird



Fully autonomous drones will safely avoid aircraft

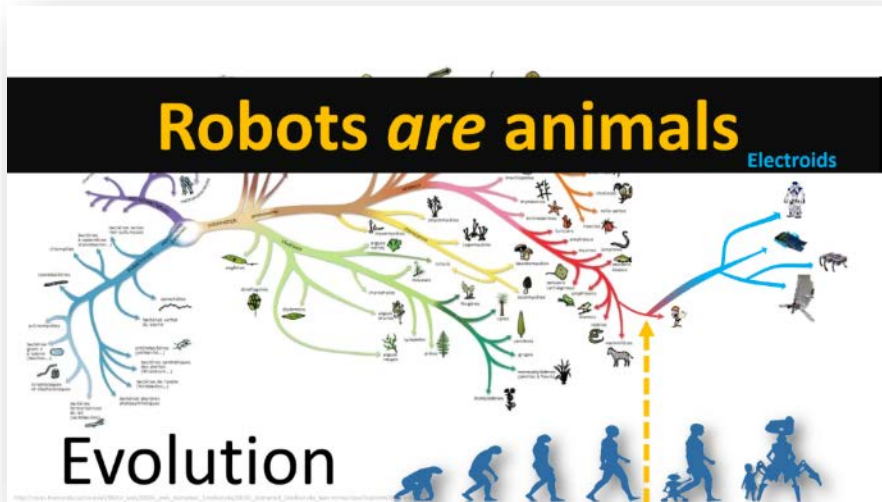
Perfect “**Fortune tellers**”

Humans must **leave the control loop**
Humans must **stay in command**

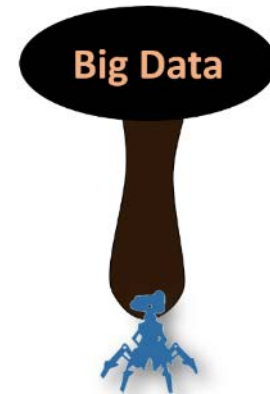


Humans must **leave the control loop**
Humans must **stay in command**

Conclusions



Faster : Electronic nervous system
Stronger : Electric muscles
Telepathic : Radio contact
Know all there is to know
See all correlations
Perfect "Fortune tellers"



Legislation must enable domestication

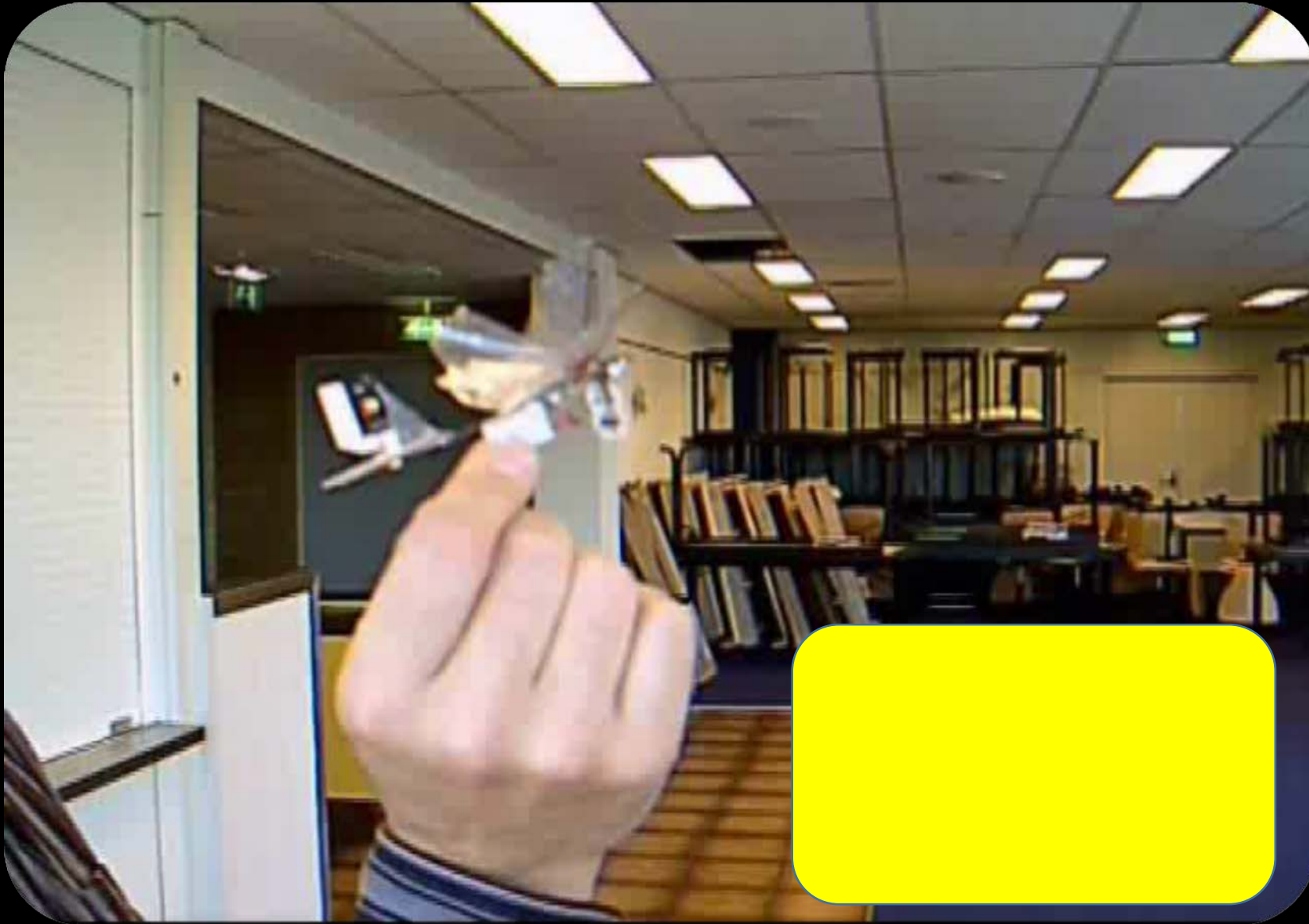
Enable direct contact (let the new species enter society)

Autonomous drones are safer than birds

Humans must leave the control loop

Humans must stay in command





<https://www.youtube.com/watch?v=L17Ox4FQTkM>

Self-deploying sensor network

