Legislation for technical systems?
Robotics, autonomous systems and Industry 4.0 are challenging Law
Wuerzburg, September 2013

Legal problems of modern robotics?

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A story

- An assistant robot, whose name is *AsRo*, is at work in a hospital.

- *AsRo* administers drugs to patients, gives first advice for simple problems, calls the physician when a serious problem occurs, checks if ventilators and feeding tubes are connected and working, fixes machines when small problems occur.

- An ill-intentioned person enters the hospital, goes to the bed of a patient and starts disconnecting the ventilator.

- *AsRo* detects the malfunctioning and intervenes in order to fix the machine.

- The ill-intentioned person attacks the robot.

- *AsRo* sends the alarm and resists the assault continuing his/its job.

- At the end the aggressor has personal injuries.

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A legal question

Who, if anyone, is responsible for such personal injuries?
Who should be charged for damages?

To attempt a response we have to assume that *AsRo* was designed
having *Asimov rules* as its ethical background. These well known rules are:

a. A robot may not injure a human being or, through inaction, allow a human being to be harmed.

b. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.

c. A robot must protect its own existence as long as such protection does not conflict with the First or Second

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Well, *AsRo* behavior *prima facie* violates the first rule, as *AsRo* has injured a human.

However, at a deeper level, it is clear that **if** *AsRo* had remained inactive during the assault of the ill-intentioned person, *AsRo* **would have violated the second part of the first rule**, where it is stated that a robot may not injure a human being even "**through inaction**", allowing a human being to come to harm.

- And it is worth noting that the ill-intentioned started to disconnect the ventilator (rather than directly assaulting *AsRo*).
- Thus, *AsRo* had an obligation to fix the ventilator!

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In the second part of his action the ill-intentioned turns directly against *AsRo*, busily fixing the ventilator.
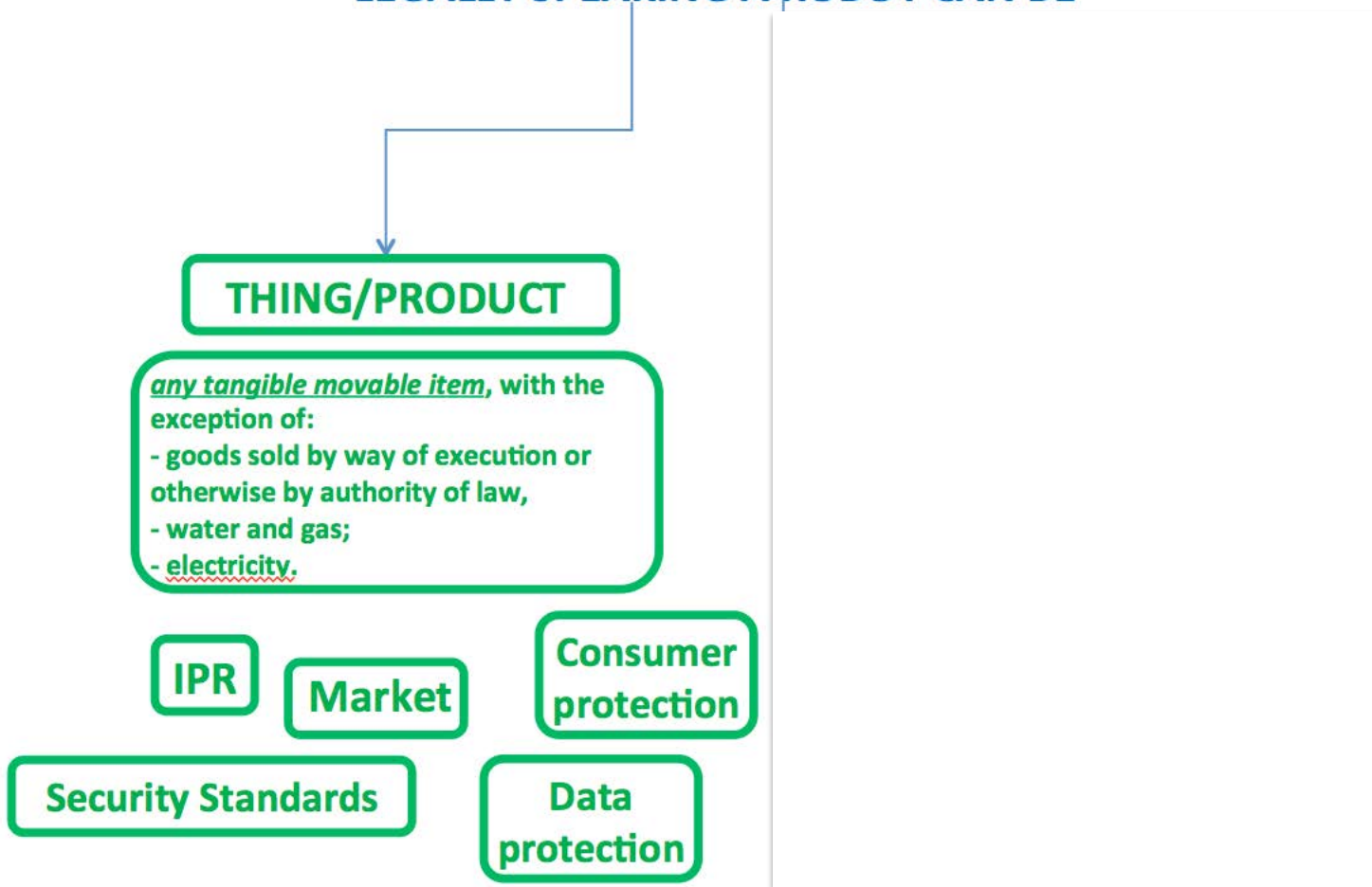During the scuffle between the robot and the human it is the human who came off worse.

In this case, *AsRo* can advocate the **third rule**, where it is stated that a robot must protect its own existence **"as long as such protection does not conflict with the First or Second Laws"**.
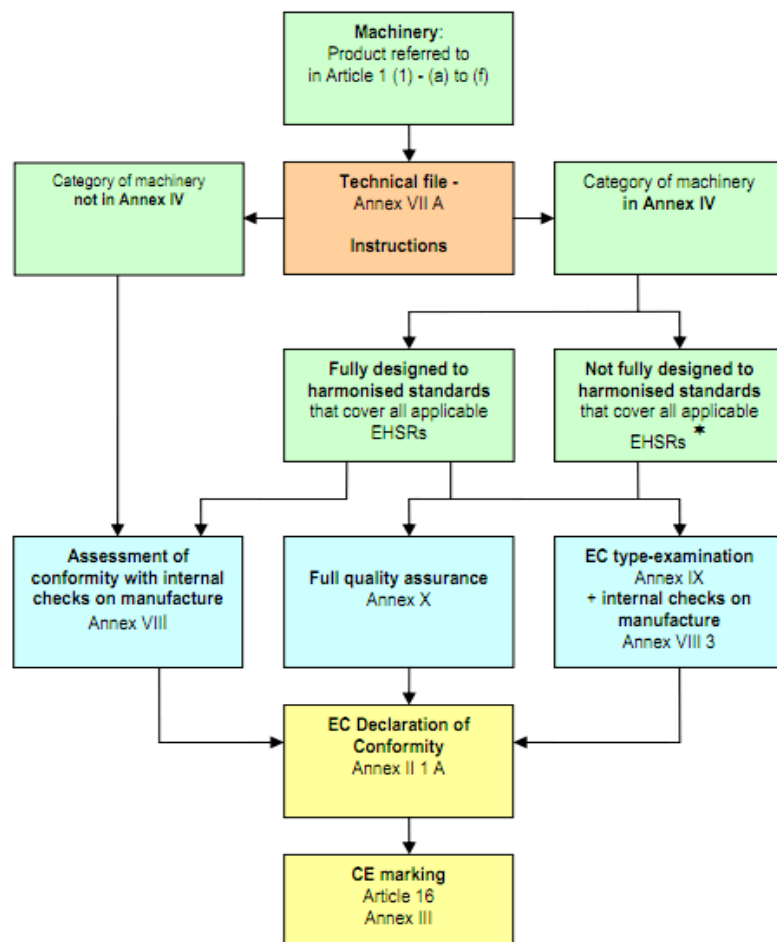
And, as we have seen, *AsRo* fully respected the two previous rules.

If all this is true, the **aggressor** who would try to collect damages for his injuries would lose his lawsuit against either the **producer** (who manufactured the robot according to a design consistent with internationally accepted ethical rules) or the **owner** of the robot (who used it in a proper way).

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A MATTER OF DEFINITION

LEGALLY SPEAKING A ROBOT CAN BE

THING/PRODUCT

any tangible movable item, with the exception of:
- goods sold by way of execution or otherwise by authority of law,
- water and gas;
- electricity.

IPR

Market

Consumer protection

Security Standards

Data protection

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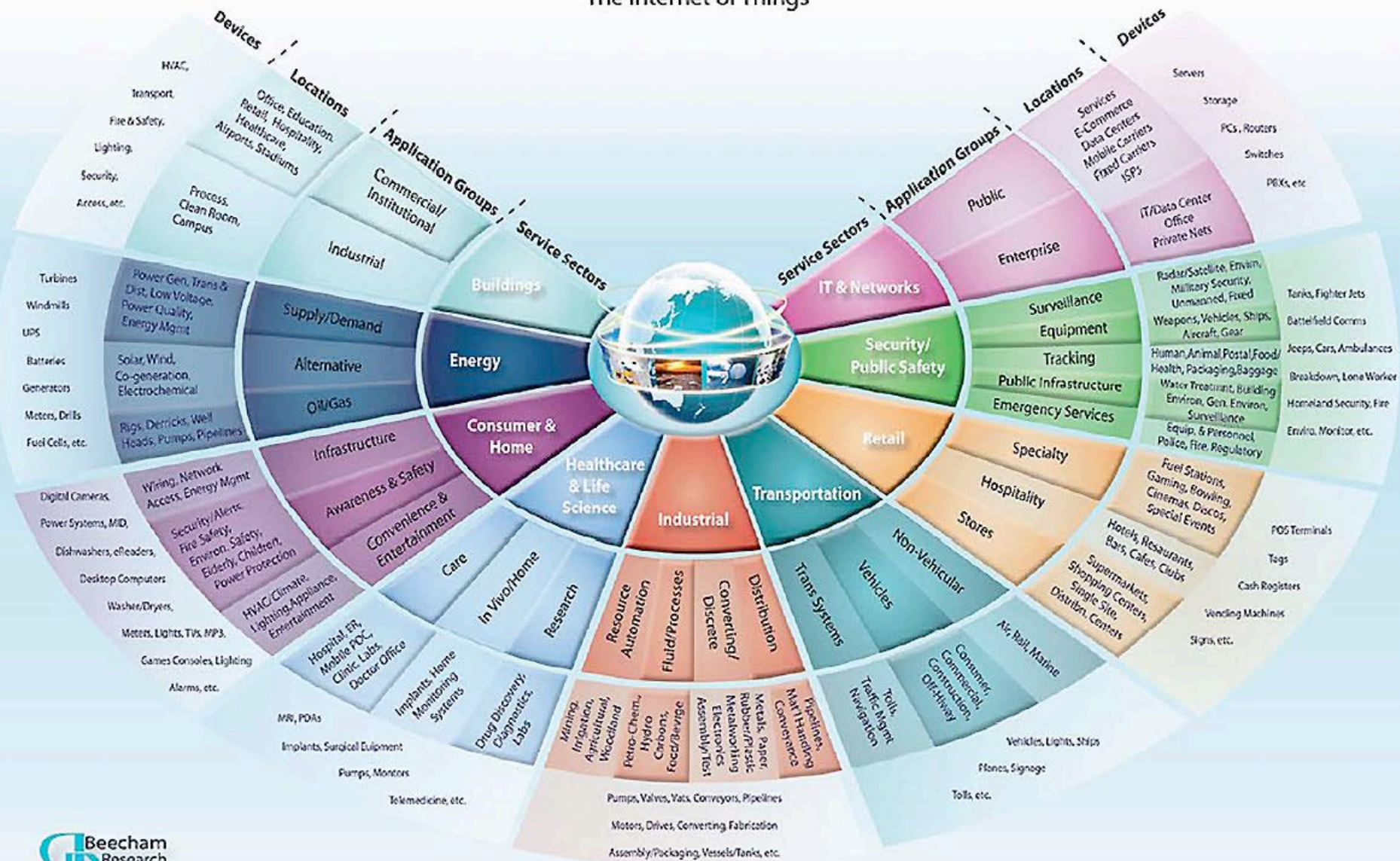**N**ew **T**echnologies

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- **Robots**
- **Software agents**
- **Clouds**
- **Any kind of automatic system**

are things and NOT persons

Robot ethics

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The Internet of Things

Beecham Research

Thing does not necessarily mean passive

Connected machines are
INCREASING EFFICIENCY,
MINIMIZING WASTE,
and helping the people
operating them make smarter
decisions.

←   →

Minds + Machines

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Minds + Machines 2012: Jeff Immelt Keynote

For decades, technology has connected people and businesses globally.
This is just the start. The Internet will also transform global industries,
joining human insight with machine intelligence. Bringing minds and
machines together has created something wholly new – the Industrial
Internet – an open, global network that connects machines, people, and
data.

Watch Now

**White Paper: Pushing the Boundaries
of Minds and Machines**

http://www.ge.com/mindsandmachines
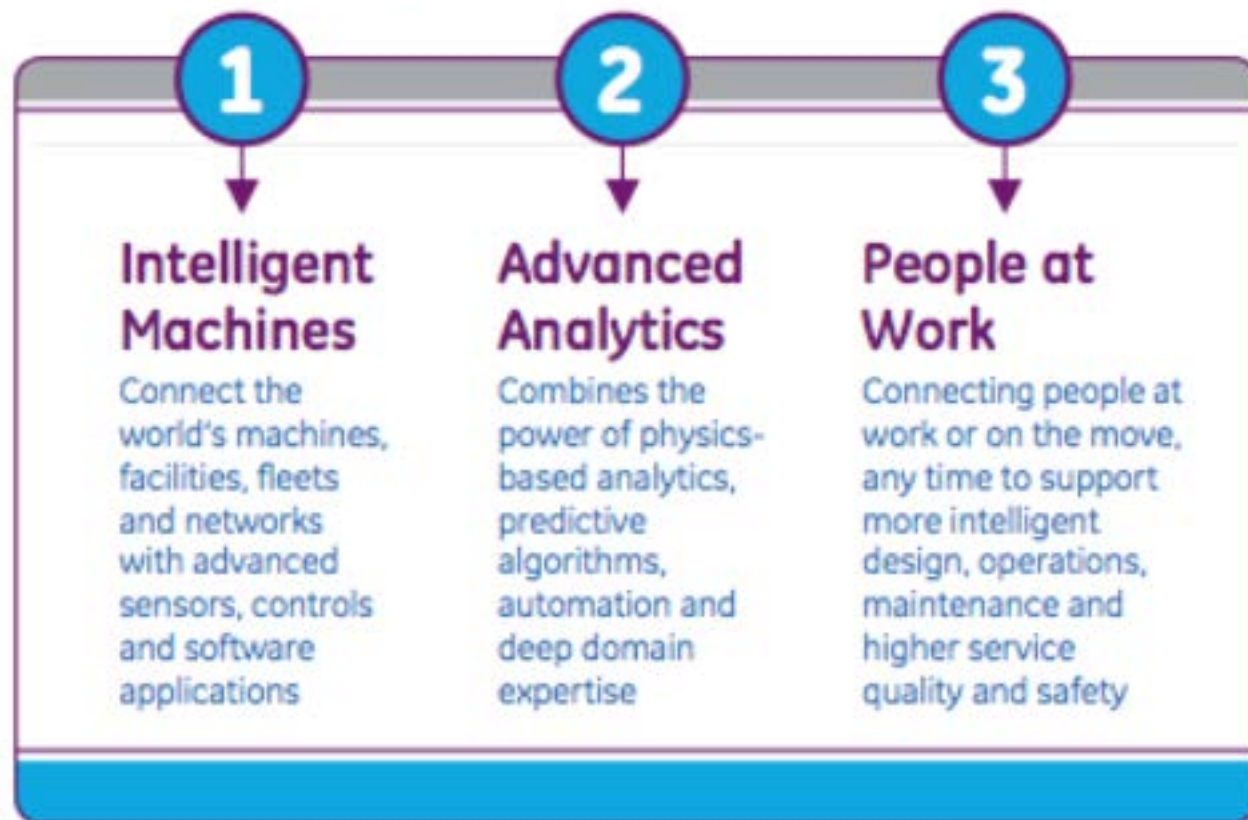
Pushing the Boundaries of Minds + Machines

The world is on the threshold of a new era of innovation and change with the rise of the Industrial Internet. It is taking place through the convergence of the global industrial system with the power of advanced computing, analytics, low-cost sensing and new levels of connectivity permitted by the Internet. The deeper
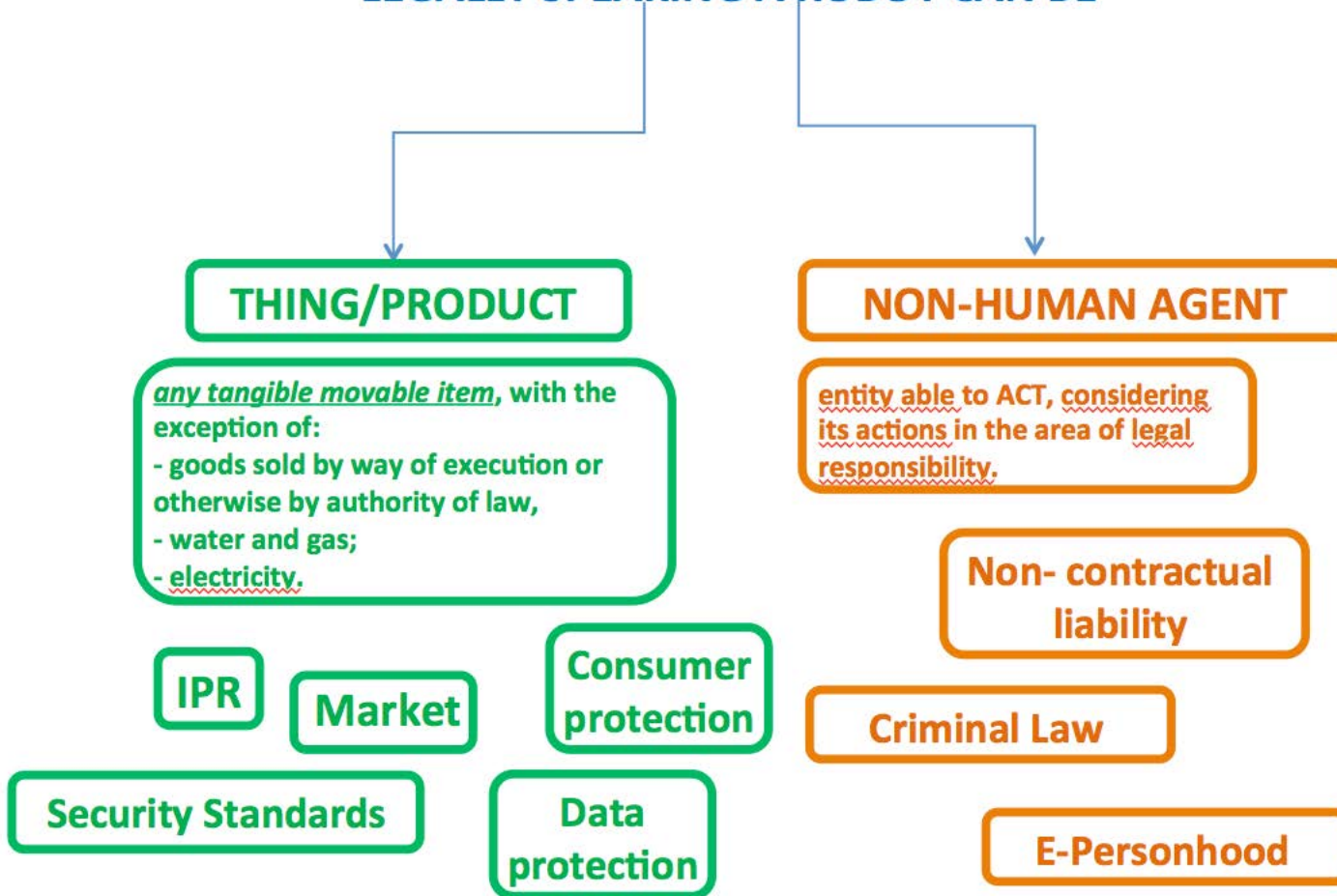

over the next twenty years through the power of compounding it could raise average incomes by an impressive 25-40 percent of today's level over and above the current trend. And as innovation spreads globally, if the rest of the world could secure half of the US productivity gains, the Industrial Internet could add a sizable $10-15 trillion to global GDP – the size of today's U.S. economy – over the same horizon. In today's challenging economic environment, securing even part of these productivity gains could bring great benefits at both the individual and economy-wide level.

Figure 1. Key Elements of the Industrial Internet

1. Intelligent Machines

Connect the world's machines, facilities, fleets and networks with advanced sensors, controls and software applications

2. Advanced Analytics

Combines the power of physics-based analytics, predictive algorithms, automation and deep domain expertise

3. People at Work

Connecting people at work or on the move, any time to support more intelligent design, operations, maintenance and higher service quality and safety

A MATTER OF DEFINITION

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IPR

Market

Consumer protection

Security Standards

Data protection

NON-HUMAN AGENT

entity able to ACT, considering its actions in the area of legal responsibility.

Non- contractual liability

Criminal Law

E-Personhood

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- Original brain and body
- Traditional prosthesis
- New prosthesis
- Brain-machine interfaces
- Brain-computer web
- Human-companion robot
- …

Who is the agent ?
What legal frame ?

+ Internet connection

+ Big Data

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About the word *agent*

agent
1. a person or thing that acts (e.g. detergents and other cleaning agents).

NOT

2. a person who acts for someone in business

Agent (law)
One who agrees and is authorized to act on behalf of another, a principal, to legally bind an individual in particular business transactions with third parties pursuant to an agency relationship.

West's Encyclopedia of American Law, edition 2. Copyright 2008

Game Theory applies whenever the actions of several **agents** are interdependent (individuals, groups, firms, etc..)
Complex adaptive systems

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Corporations are things

Corporations are subjects in civil law cases, contracts/tort/damages

Corporate misconduct has been addressed by civil, administrative, and criminal laws.

Most countries agree that corporations can be sanctioned under **civil and administrative** laws.

The **criminal liability** of corporations has been more controversial.

While several jurisdictions have accepted and applied the concept of corporate criminal liability under various models, other law systems have not been able or willing to incorporate it.

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Objections

The principle ***societas delinquere non potest*** in the 19th century (Malblanc and Savigny).

A corporation is a **legal fiction** which, lacking a **body** and **soul**, is not capable of forming the criminal ***mens rea*** or to act *in propria persona*.

Moreover, corporate criminal liability would violate the **principle of individual criminal** punishment.

Corporations cannot be held criminally liable because, unlike human beings who are true subjects of law, corporations are **legal fictions**.

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What legal frame for all this?

Things and persons

Persons (for the law), even physical persons, are legal artifacts

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"to define the physical (natural) person as a human being is incorrect, because man and person are not only two different concepts but also the results of two entirely different kinds of consideration.
Man is a concept of biology and physiology, in short, of the natural sciences.
Person is a concept of jurisprudence, of the analysis of legal norms"

Kelsen 1945, Part One, Chapter IX, A-B, pp.93-95.

"since the concept of the so-called physical (natural) 'person' is only a **juristic construction** and, as such, totally different from the concept of 'man', the so-called 'physical' (natural) person is, indeed, a **'juristic' person**.
If the so-called physical (natural) person is a juristic person, **there can be no essential difference between the physical (natural) person and what is usually exclusively considered as a 'juristic' person"**.

Kelsen 1945, Part One, Chapter IX, A-B, pp.93-95

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To summarize

(a) the human being, as a *biological entity*, is a different entity than the physical person in legal terms;

(b) the human being is the basis of the physical person in legal terms as a *symbolic and linguistic unity;*

(c) the *biological* human being is only the *enclosing line* (Kelsen uses the word compass, in double quotes) of a physical person in legal terms;

(a) the human being exists for the law only for the limited extent to which rights and duties refer to him;

(b) the physical person in legal terms and the juristic person (i.e. corporation) are both legal creations having in common the character of artificiality.

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a human being

Physical person **IS NOT**

a natural entity
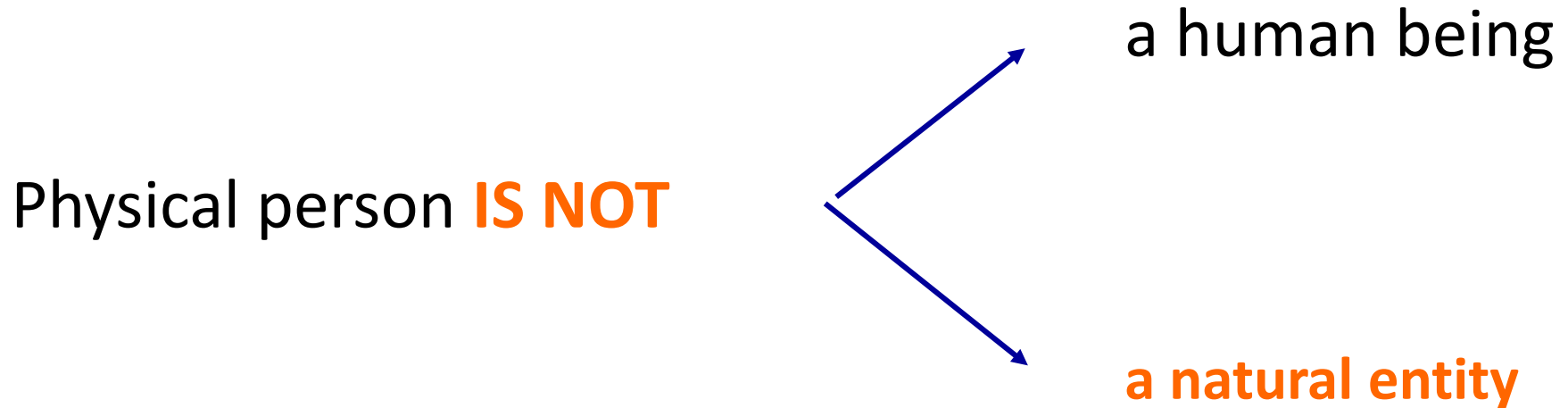
Physical person   **IS**

- **A construction of legal theory**
- **in a specific historical situation and**
- **according to scientific knowledge of that moment**

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Thus, IF even physical persons are legal artifacts, we should not be surprised because of the question:

may something different than a human being be a legal agent?

The IF changes into

- **UNDER WHAT CONDITIONS**

- **WHAT REQUIRED FEATURES AND ABILITIES**

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Cognitive robots

Cognitive robot: an autonomous robot that exploits processes analogous to cognitive processes.

Reasoning: process of modification of the knowledge base of the robot through (logical) manipulation of the available knowledge.

Planning: computation and selection of tasks, policies and procedures for goal-directed robot behaviour

Learning: process of modification of the knowledge base of the robot gained through the interaction with the environment (including people) that may produce a persistent change in the robot behaviour.

Source: Suggestion for a green paper on legal issues in robotics - Contribution to Deliverable D3.2.1 on ELS issues in robotics

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… their action as a society

"Social robots are embodied agents that are part of a heterogeneous group: a society of robots or humans. They are able to recognize each other and engage in social interactions, they possess histories (perceive and interpret the world in terms of their own experience), and they explicitly communicate with and learn from each other" (Dautenhahn and Billard, 1999)

→ Strong interaction between humans and robots as non-human agents

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- Aim: understand the human intelligence

- Studies on cognitive system

- Learning through experience

- Interaction with objects in the environment

- Body is essential for learning

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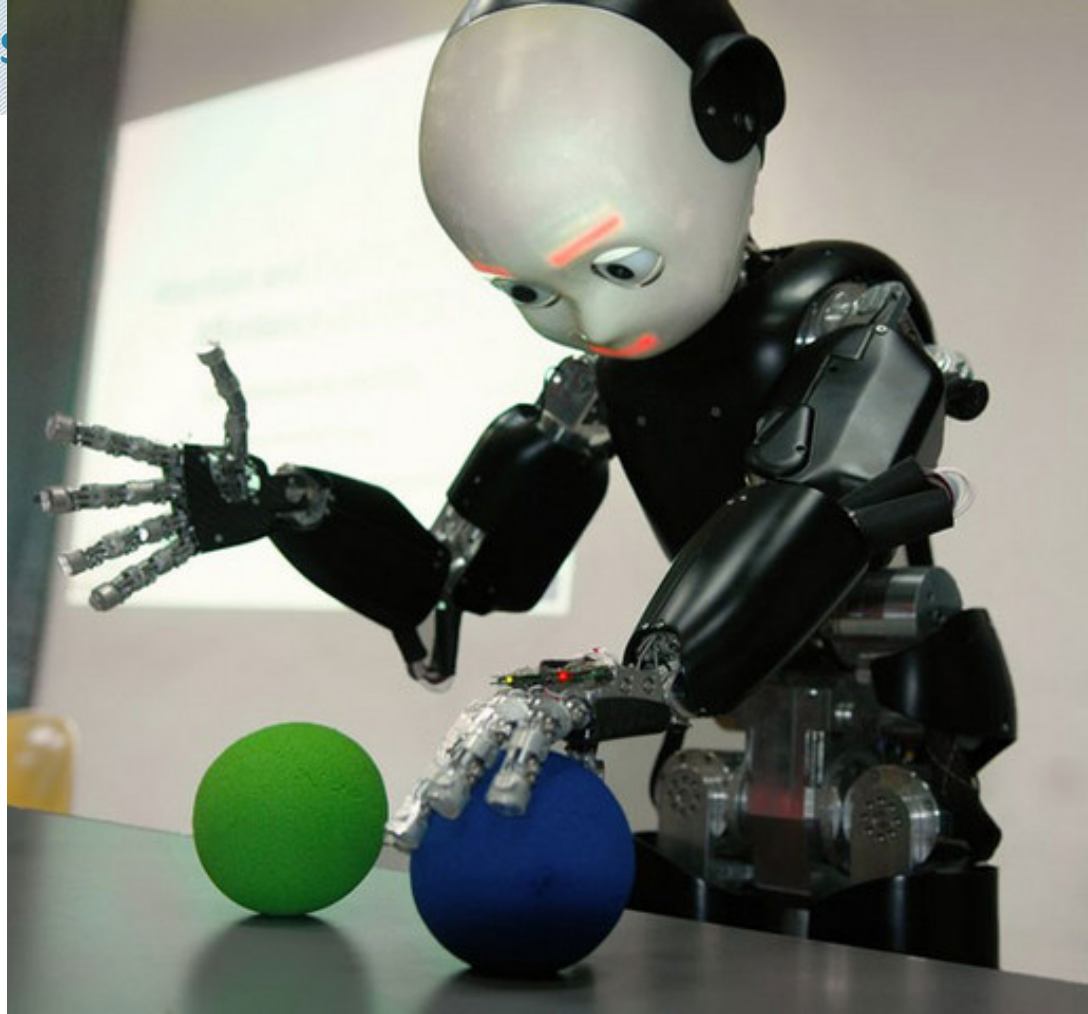
Adaptive robots

- Evolutionary and/or Developmental methods that allow to synthesize **robots that evolve/develop their skills autonomously in interaction with the physical, and eventually social, environment** on the basis of an adaptive process driven by the ecological condition in which the robot operate and on the basis of an utility function designed by the experimenter

- Body need: they are able to exploit the opportunities that their embodied and situated nature provides to them.

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Robot – human interaction

Studies involving state-of-the-art technology already indicate that **humans interact differently** with social robots than they do with every other objects (Breazeal, 2002).

Embodiment and **human shape** encourage the projection of emotion and affectivity: <u>similar body means similar experiences</u>, arousing more understanding and closeness

→robots arouse empathy and this makes them take the status of *companion* (Coeckelbergh,2012)

→ the emotional feeling created is the base of the attribution of rights to animals (Darling, 2010)

→at some point fundamental human rights like **privacy, due process, and bodily integrity** may be claimed by and/or attributed to non-human agents (Kops et al, 2010)

Competitive co-evolution system

- The survival probability of a species is affected by the behaviour of other species.

http://www.youtube.com/watch?v=IOTYb05PGjw

Robot – robot interaction Evolutionary robotics (ER)

- ER is a methodology that uses *evolutionary computation* to develop controllers for autonomous robots.

- Inspired by the Darwinian principle of *selective reproduction of the fittest*

- ER views robots as autonomous artificial organisms that develop their own skills in close interaction with the environment and without human intervention

- ER uses the tools of neural networks, genetic algorithms, dynamic systems, and biomorphic engineering

→ The resulting robots share with simple biological systems the characteristics of robustness, simplicity, small size, flexibility, and modularity.

The Molecular Computer

1950: Turing→ simulate the human brain as a whole, up to the prospect of having an intelligence without body.

2012: Molecular robotic brains → reverse approach : artificial brain in which everything is hardware consisting of organic matter. Robot with brain made of neural cells.

- o Programming becomes obsolete
- o Learning ability and "real" intelligence. It is no longer building something artificial simulating humans, but using organic molecules to reproduce them.
- o Neural networks
- o Embodiment

Are human beings disappearing?

May we say robot/automatic system = human being?

Chain of responsibilities becomes longer

The social and legal systems become more complex (non linear connections)
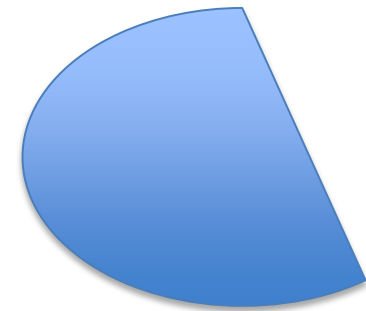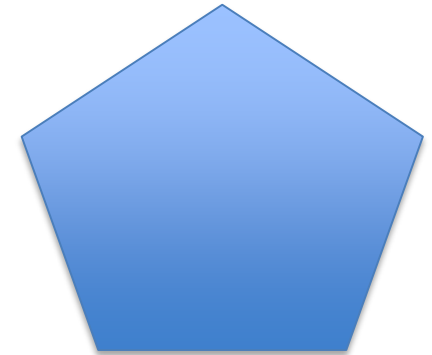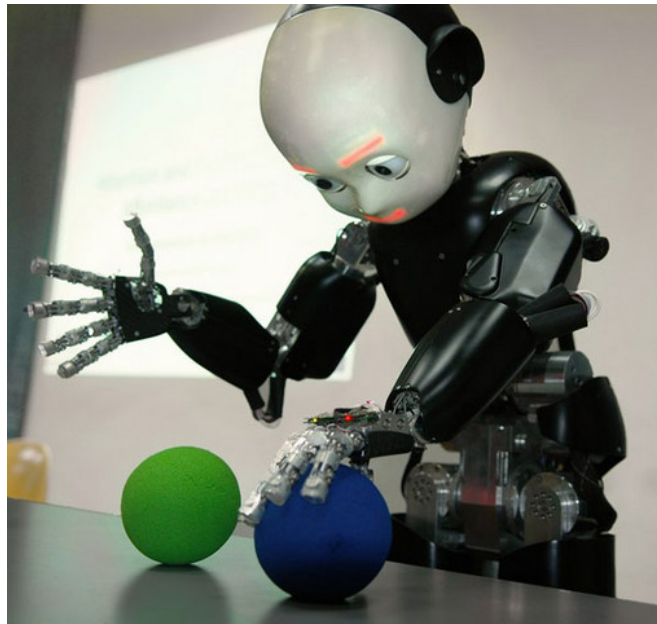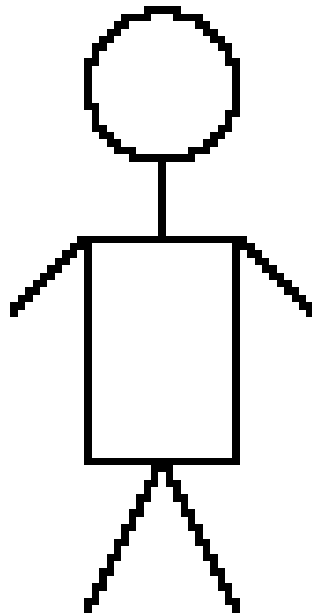
... and more !

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Thank you !

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