



# Design Thinking Approach to Ethical (Responsible) Innovation

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# Outline

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- Introduction
- Technological innovation and ethical concerns
  - Constraints and challenges
- Linear innovation processes and short comings
  - Circular innovation process as an improvement
- Welcome to the machines – machine ethics
- Design thinking approach
  - Suitability?
- Challenges and future direction(s)

**Why should we be concerned about  
ethical aspects of technological  
innovation?**

# Contentious technologies

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- “Technologies can be not only contentious – overthrowing existing ways of doing things – but also **morally contentious** – forcing deep reflection on personal values and societal norms.” (Cole & Banerjee, 2013)
- Technological innovations can have **undesirable consequences for society and environment**.
  - Examples: DDT as pesticide; the pharmaceutical thalidomide, prescribed as morning sickness treatment for pregnant; chlorofluorocarbons (CFCs) used as refrigerants and propellants; etc. (Bessant, 2013; Nathan, 2014)

# Morally contentious links

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- Organizational level decision-making during innovation processes can have **impacts on the linkages at macro level**
- These linkages can be towards the market, knowledge – the old solution vs. new solution and inclusion vs. exclusion of users within the socio-political-cultural context
- **These linkages therefore can be morally contentious** – leading to harmful effects on the society and the environment

Source: Hanekamp, 2010; Nathan, 2014.

# Innovation ethical blindness

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- Many innovation decision-making processes have been **blind to ethical impacts and concerns**; (Nathan, 2014)
- Examples:
  - the Dutch government had to cancel the EPRS (Electronic Patient Record System) due to unresolved privacy issues after the investment of 300 million Euros over a 15-year period;
  - the initiative to introduce smart electricity meters in every household within the Netherlands was rejected by the upper house of the Dutch parliament due to privacy concerns after some years of R&D efforts; (Van den Hoven, 2013).

# Innovations and social constructivism of reality – ethical implications

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- Reality is socially constructed and many innovations shape this reality
- However, this reality raises many ethical concerns and dilemmas
- Examples:
  - Social networks and cyber bullying and privacy
  - Surveillance camera for safety and privacy

Source: Nathan, 2014

# Technological innovation and impact on multiple fields

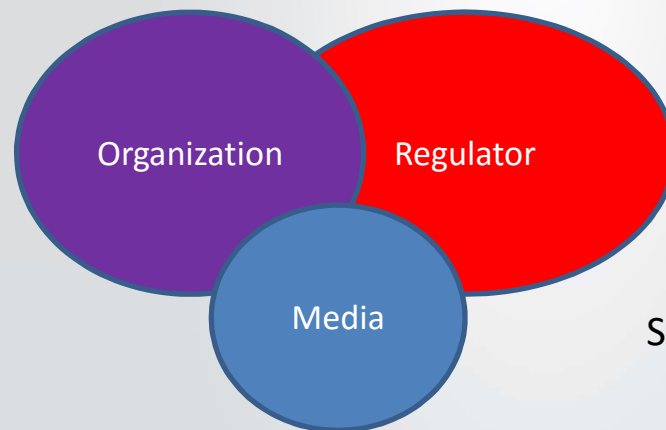
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- Technological innovation can have **impact on multiple fields**
- A field is constituted by an activity by an actor
- Activity can be **supportive or exploitative** of the focal technological innovation
- A field can become **morally contentious** – a potential to cause human &/ ecological harm!
- Example: 3D printer
  - Supportive: reconstructive surgery; prototypes of architectural designs
  - Exploitative: printing hand guns

# TFI contamination

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- TFI – Technology-Field Intersection – where technology intersects two different fields
- Any moral contestation in one field may contaminate the others!



Source: Cole & Banerjee, 2013; Nathan, 2014

# Emerging technologies

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- ICT
  - i) Affective Computing ii) Ambient Intelligence iii) Artificial Intelligence iv) Bioelectronics v) Cloud Computing vi) Future Internet vii) Human-Machine Symbiosis viii) Neuroelectronics ix) Quantum Computing x) Robotics xi) Virtual/Augmented Reality.
  - Ethical issues identified:
    - privacy, autonomy, digital divide, equity and informed consent
  - Predictable and less predictable ethical issues

Source: Matter, 2011; Nathan, 2014 & 2015

# Converging technologies

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- ICT and Nanotechnology -> Nanopharmacy / Nanomedicine
  - ‘anticipates illnesses by deploying predictive and preventive measures’ (see Bennett-Woods, 2008)
- Ethical issues include:
  - fundamental questions about our understanding of an illness and human capability, thereby questioning our concept of ‘what it means to be human’ (Bawa and Johnson, 2009) and human identity
  - concerns challenge us to rethink the preservation of human dignity (see Graur et al. 2011; Spagnolo and Dalloiso, 2009)
  - new ethical dilemmas and concerns over changing roles in medicine, potentially transforming ‘social relations, labour, economies and institutions’ (see Bennett-Woods, 2008)

Source: Roco and Bainbridge, 2002

Source: Nathan, 2015

# Top 10 emerging technologies - 2015

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- **Fuel-cell vehicles**
- **Next generation robotics**
- **Recyclable thermoset plastics**
- **Precise genetic-engineering techniques** (e.g. CRISPR)
- **Additive manufacturing** (from printable organs to intelligent clothes; 3D printing to 4D printing – new generation of products that can alter themselves to environmental changes)
- **Emergent artificial intelligence**
- **Distributed manufacturing** (final product is manufactured close to the end customer)
- **“Sense and avoid” drones** (sense and respond to the local environment)
- **Neuromorphic technology** (computer chips that mimic human brain)
- **Digital genome** (health care - genetic code in a USB stick)

Source: WEF, 2015

**What are the problems and constraints addressing ethical concerns?**

# Wicked problems

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- Ill-formulated
- Information is confusing
- Decision-makers and customers have conflicting values
- Contradictory and changing requirements
- Ramifications are confusing
  - Source: Buchannan, 1992
- Examples: climate change, resource depletion, poverty alleviation, aging societies (Lund Declaration, 2009)

# Collingridge dilemma

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- The dilemma here is that some of the ethical concerns may become clearer at the later stages of the innovation process, **but it may be difficult to remedy them**; (Collingridge, 1980)
- Therefore, it is important that we identify those ethical concerns and dilemmas at the early stages of innovation process;
- However, **these concerns may be difficult to identify**, given that we may not have adequate information about those ethical concerns, nor about how they may manifest, impacting certain stakeholders and the environment; (Nathan, 2015)

# Moral overload

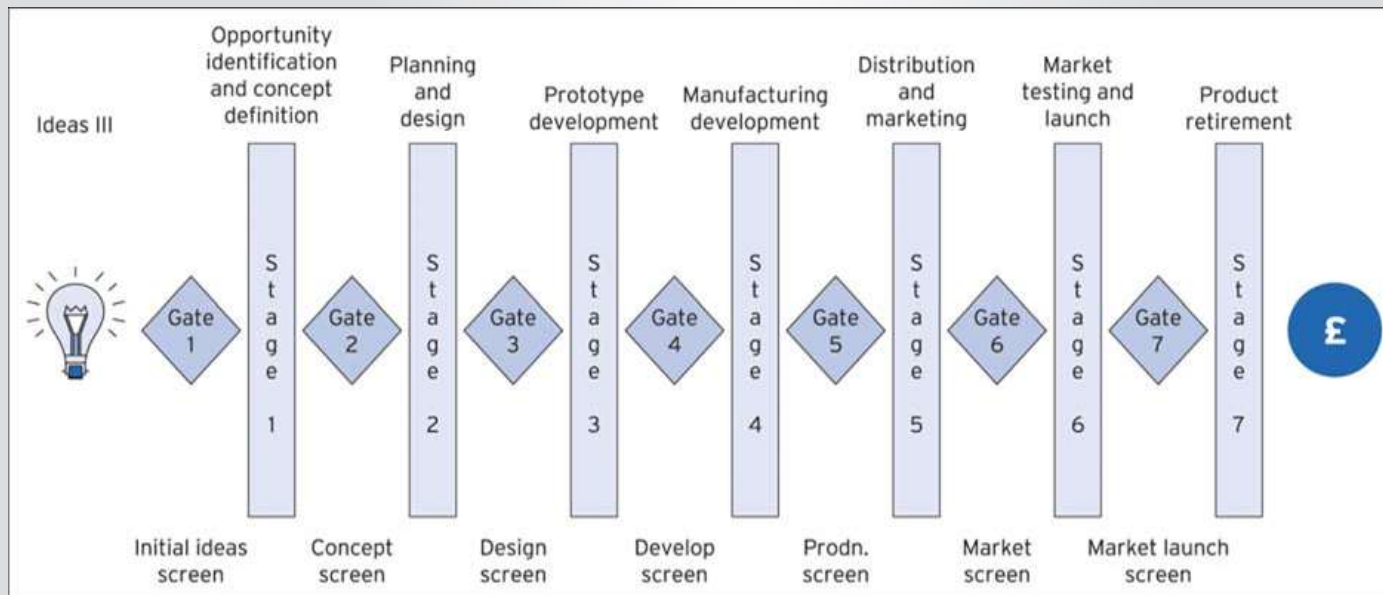
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- When one is **burdened with conflicting moral obligations or values**, it may be difficult to resolve them or implement both the values at the same time (Van den Hoven, 2013: 77)
- However, as Van den Hoven (2013: 78) asserts, '[w]e need to learn to think of **ethical considerations and moral values in terms of requirements in design and research and development at an early stage.**'

Source: Nathan, 2015

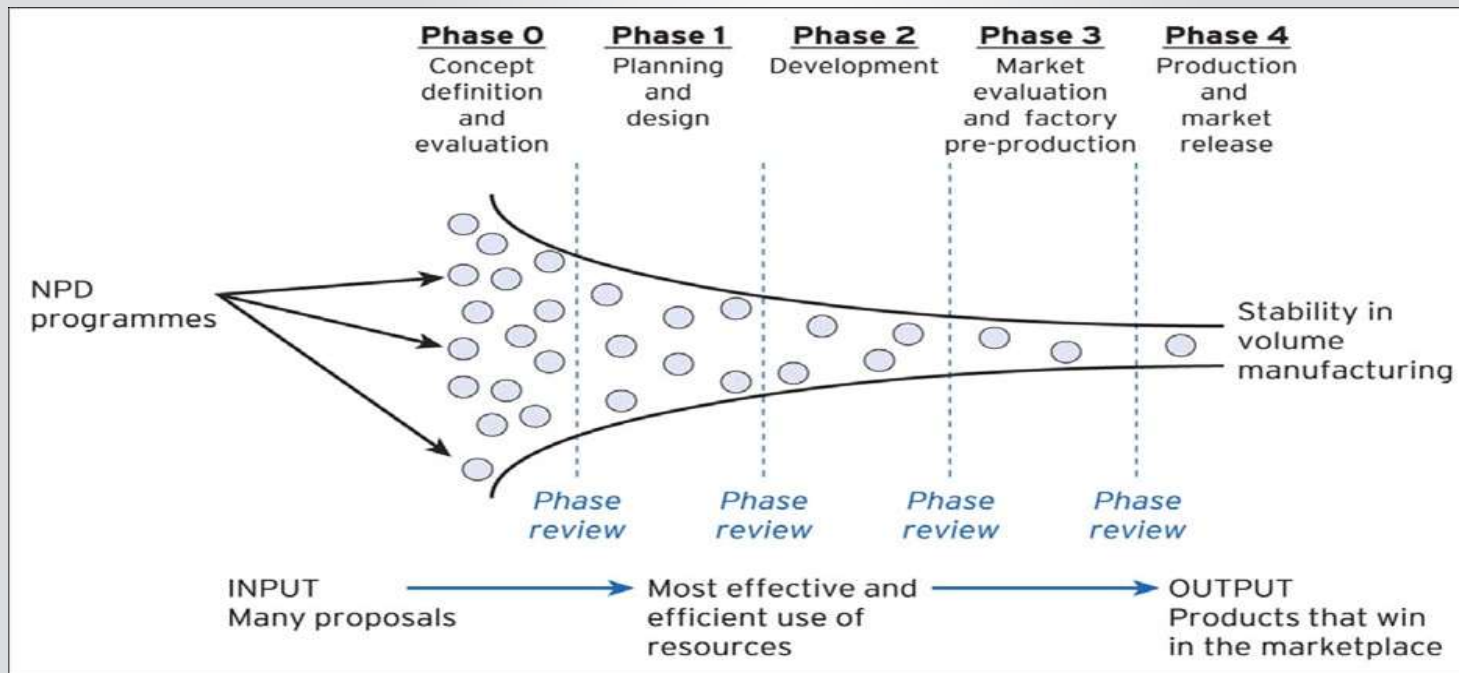
# Short comings of linear innovation process models

# Stage-gate innovation model



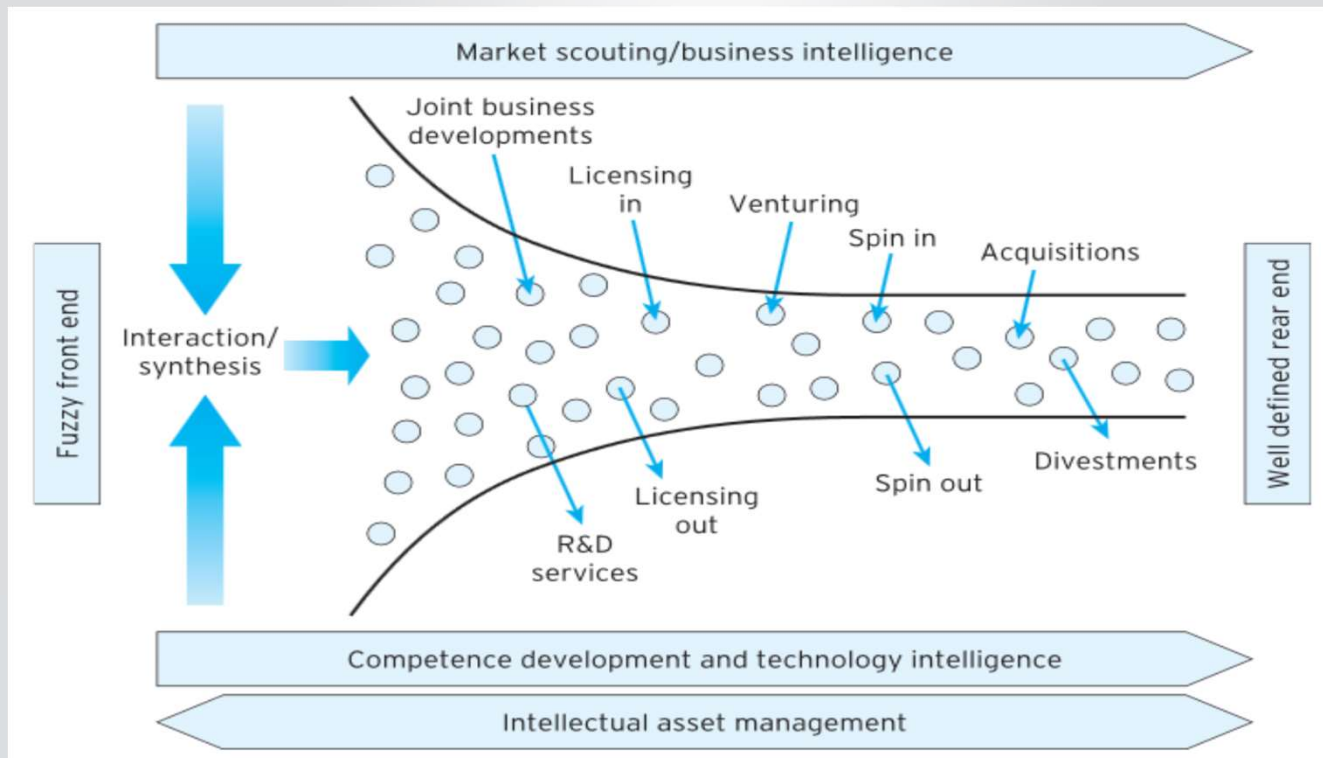
Source: (Ahmed and Shepherd, 2010; based on Cooper, 2000)

# Funnel phased approach



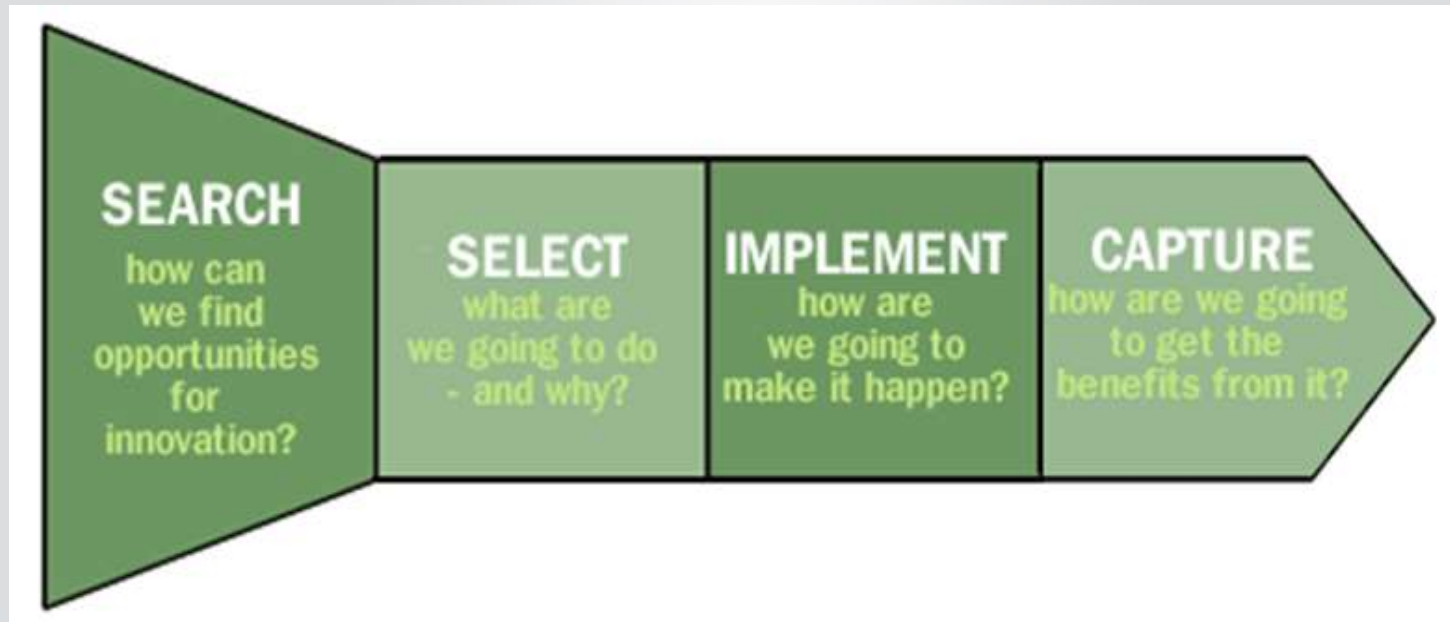
Source: Ahmed and Shepherd, 2010)

# Open innovation model



Source: Chesbrough, 2003

# Simplified Linear Innovation Model

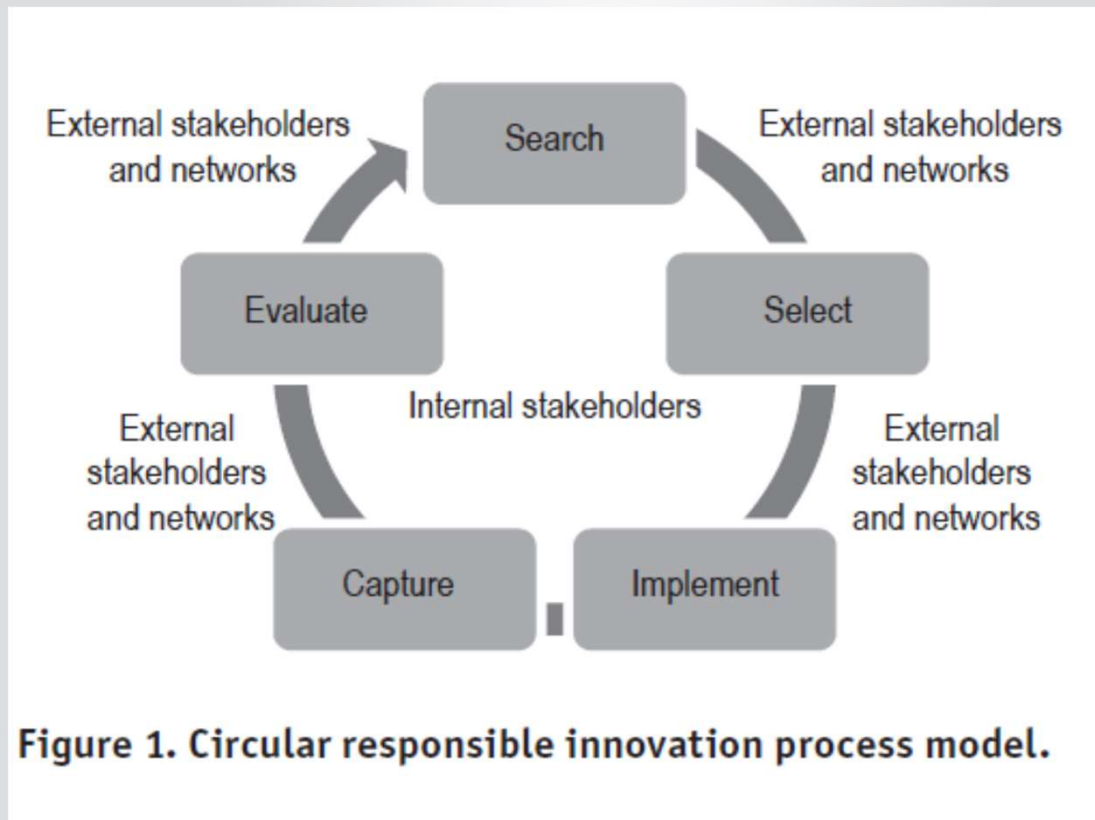


Source: Tidd and Bessant, 2009 & 2013

# Improved innovation process model



# Circular responsible innovation model



Source: Nathan, 2015

# Stakeholder map

Stakeholders	Type	Interests	Rights	Responsibilities/ duties	Ethical concerns/ dilemmas

Stakeholders	Type	Interests	Rights	Responsibilities/ duties	Ethical concerns/ dilemmas
directors	dominant	financial performance of the firm; bonus payments; power; prestige	make decisions in the interest of shareholders	fiduciary; legal compliance	moral hazard; product safety
customers /patients	dependent	products and services at affordable price with quality	product safety; fair price; good information; privacy	product usage according to the intended usage and procedure;	safety; equity in terms of affordability and accessibility; efficacy; data protection
Media	demanding	newsworthy publication; usually bad press	freedom of information	accuracy of information; timely information	accessibility; verifiability of information
government	dominant	well-being of the citizens	corporate tax	protect citizens and the environment	public interest

Source: Nathan, 2015



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# Welcome to the Machine

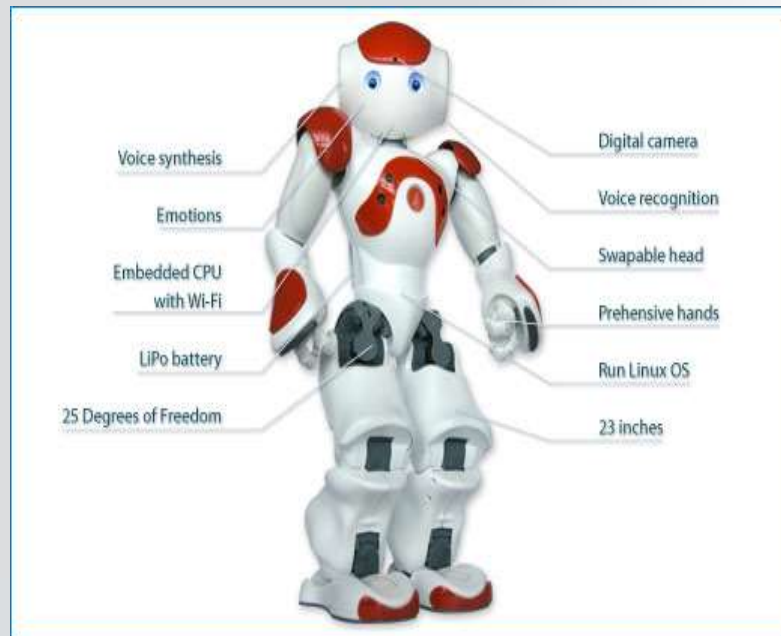
Pink Floyd

# Machine ethics and challenges

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- It has been **emerging** as a new field over the last decade (Anderson & Anderson, 2006)
- It is becoming **increasingly important** as we innovate and develop intelligent autonomous machines!
- **Challenge of creating ethical intelligent agent** – both explicit and implicit (Anderson & Anderson, 2007)
- Building ethical robots is a challenge; embedding rule based ethical decision-making in predictable situations **may not be effective in unpredictable situations** and machine-learning to make ethical decisions in new situations **may create a problem of trust** (Deng, 2015).

# Robot ethics / Moral machines ?



58 cm in height, NAO is our first humanoid robot. He has continually been evolving since the beginning of his adventure in 2006. Currently in his 5th version, 7,000 NAOs have already been sold throughout the world. NAO is an endearing, interactive and personalizable robot companion. Everyone can construct his own experience with specific applications based on his own imagination and needs.

<https://www.aldebaran.com/en/cool-robots/nao>

symo



# Ethical issues in many situations and dimensions

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- Human-robot interaction
  - Health care, surgery and rehabilitation
- Robots as co-inhabitants
  - For house keeping, child care, secretarial duties, elderly care
- Socially interactive robots
  - Human-robot interaction – love and care?
  - Robot emotions (artificial emotions) – authenticity?
- Military robots
  - Many ethical dilemmas
- Sex robots and slaves

Sources: Wallach et al. 2009; Lin et al. 2014

# Ethical issues and concerns

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- Artificial moral agents
  - Issues of empathy, sociability etc.
- Ethical decision-making
- Privacy
- Access
- Social meaning
- Anthropomorphization
- Emotional bond

Source: Lin et al. 2014

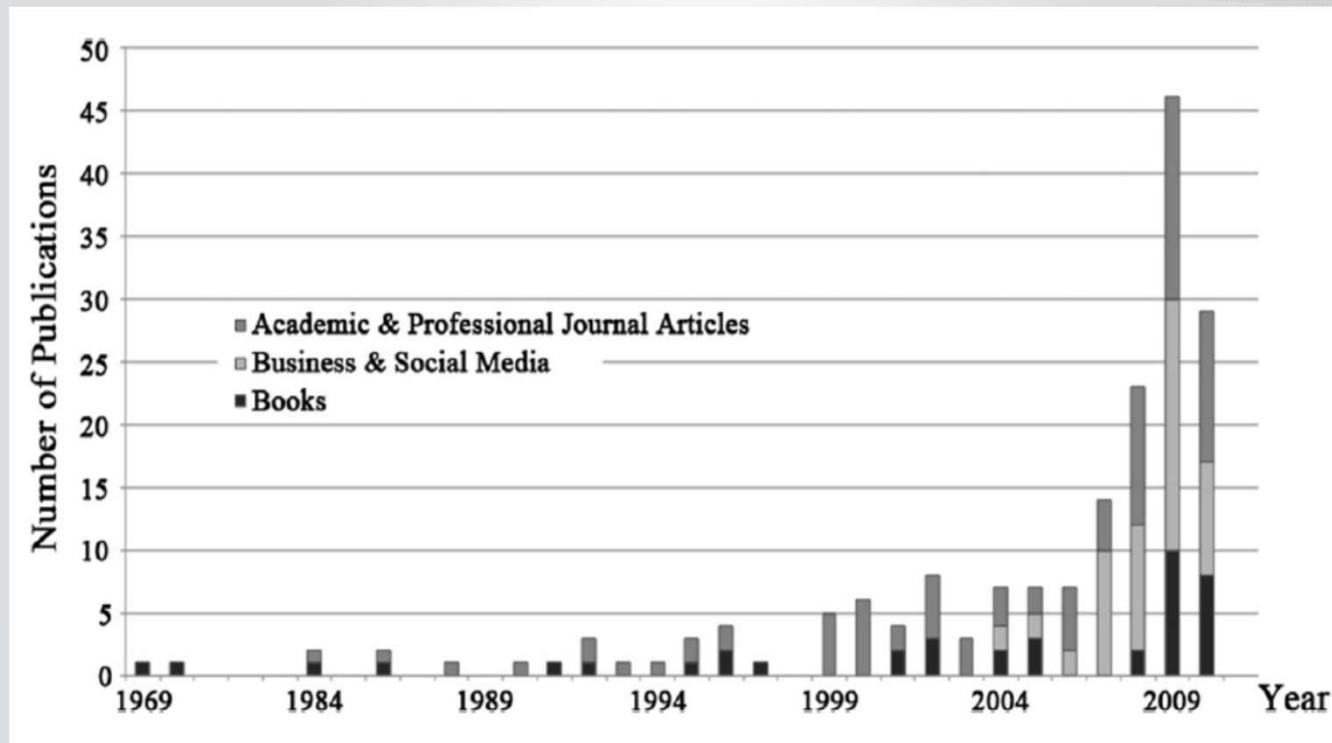
# What is design thinking approach?

# Design movements evolution

Year	Design Movement	Design Approaches
2010s	Design Thinking	Experience design Creative class
2000s	Service Design	Human Centred Design
1980s	Cognitive Reflections	User Centred Design

Source: Adapted from Curedale, 2013

# Trend in publications about design thinking



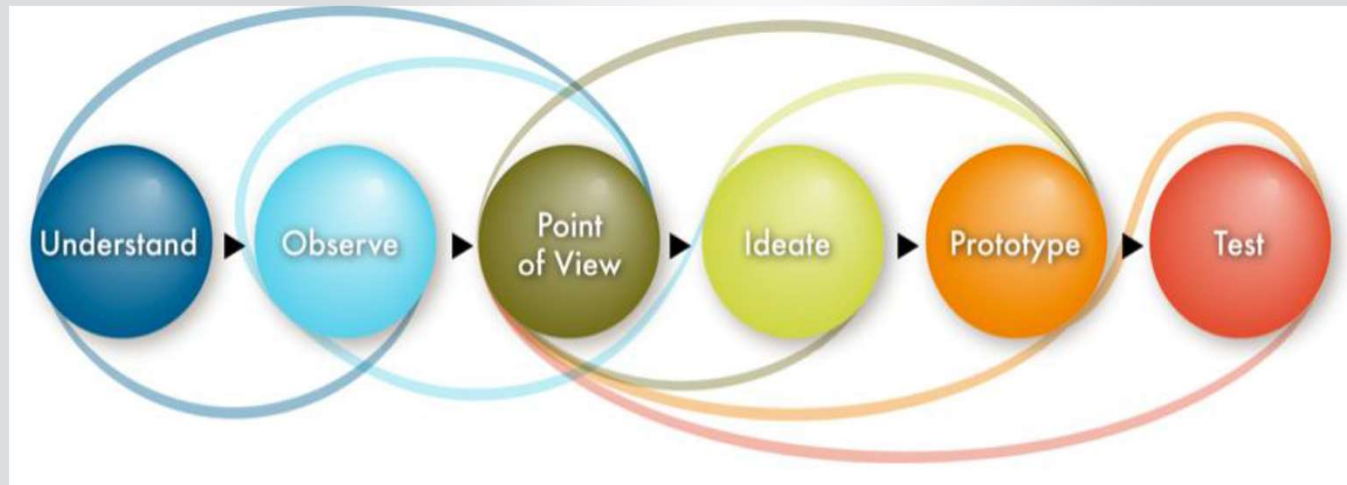
Source: Johansson-Sköldberg, Woodilla and Çetinkaya (2013: 123)

# Design thinking

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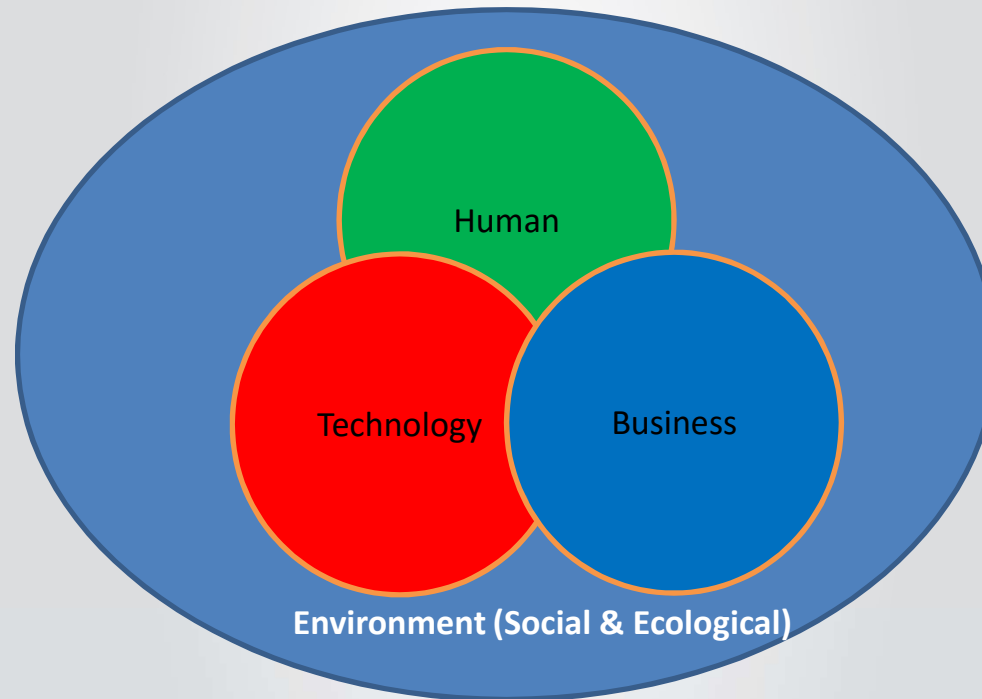
- It can be considered in many different ways
- There are many core attributes

# Design Thinking to Innovation



Source: Lazarovitch (2012) based on IDEO

# Design Thinking Elements



# Core attributes of design thinking

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- Ambiguity
- Collaborative
- Constructive
- Curiosity
- Empathy
- Holistic
- Iterative
- Non judgemental
- Open mindset

Source: Baeck & Gremett, 2011

# Design thinking principles

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- Action oriented
- Comfortable with change
- Human centric
- Integrates foresight
- A dynamic constructive process
- Promotes empathy
- Reduces risks
- Creates meaning

Source: Mootee, 2013

# Moral imagination, multiple perspectives and system thinking approach

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- Moral imagination
  - Potential to seek variety of possibilities and moral consequences
- What kind of perspectives design thinking could incorporate?
- How can system thinking approach be integrated?
  - Understand structure and interrelationships – consider normative consequences

# Multiple perspectives and levels

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- Multiple perspectives
  - Legal
  - Ethical
  - Economic
- Different levels
  - Systemic – market
  - Organizational – management
  - Individual – employee
  - Machine

# Analysis from multiple perspectives and at different levels

Levels / Perspectives	Legal	Ethical	Economic
Systemic – Market			
Organizational - Management			
Employee - individual			
<b>Machine</b>			

# Minimal and common conditions for social participation and deliberation for justice

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- Freedom as non-domination
  - No arbitrary interference
- Recognition in three dimensions
  - Acknowledgement (in their identities)
  - Authorization (of different view points)
  - Endorsement (of practices)
    - This shall not violate any of the above conditions

Source: Nathan, 2010; 2014

# Integrating ethical decision-making and design thinking approach

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- Ethical decision-making should be embedded at all levels
- Analysis is required at multiple perspectives and at different levels
- It is an iterative process – some ethical issues and concerns may not be easy to understand or even if we do, it may be difficult to implement
- Prototypes and continuous assessment
- Stakeholder deliberation is required – to understand their rights, responsibilities and ethical concerns
- Ethicists to be part of the innovation process – at early stages

# Challenges to machine ethics

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## To be:

- Reflexive
- Evaluative
- Creative

## Problematic context:

- Strong AI without conscious experience (mind)
- Epistemological versus ontological decision-making
- Artificial Consciousness (AC)?

# Challenge to integrate

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- How can we effectively integrate both organizational ethical decision-making and at the machine level?
- It is challenge, although design thinking approach to innovation shows some aspects of ethical aspects may be integrated at both levels!

# Future research directions

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- Integrated approach
  - Design thinking & Philosophical
- Philosophical
  - Phenomenology
  - Existentialism
  - Philosophy of mind
- Any other suggestions are welcome!

# Main references

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You can get access to some of my final versions of articles, book chapters etc., on SSRN (Social Science Research Network):

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A white circular logo with a slight gradient and shadow, containing the text "symorg 2016". The word "symorg" is in a dark blue font, and "2016" is in a green font.

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Thank you

Q&A