

Making *Perfect* Life: Bio-engineering (in) the 21st century

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STOA project 2009 - 2012

dyname kennis in
veranderende
wetenschap
techniek & science

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European Technology Assessment Conference Prague 15 March 2013

Technology Assessment

European Technology Assessment Group (ETAG)



Final Study & Study Summary (Dec 2012)

<http://www.europarl.europa.eu/stoa/cms/studies>

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Background: NBIC convergence

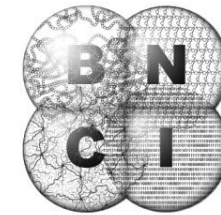


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NBIC convergence of four technologies
– nano, bio, info, cogno – originating
from the nanoscale and realigning
traditional disciplinary boundaries



- New categories of materials, devices and systems
- Visualising and manipulating nanostructures in living cell
- Advanced sensory, computational and communications systems
- Intelligent systems, including the human mind

Converging Technologies for Improving Human Performance (NSF, DOC 2002)



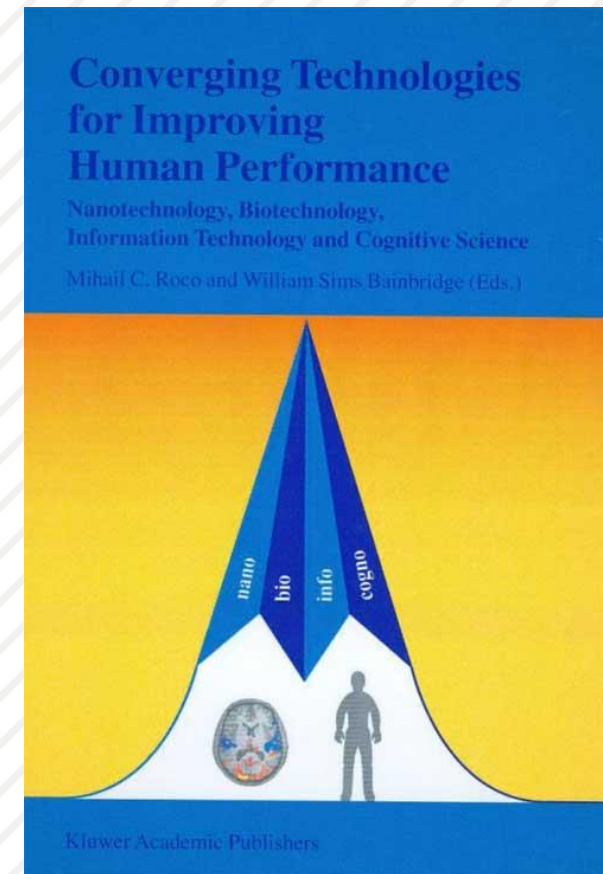
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How technological convergence may *transform human abilities* two decades and more in the future:

- Right of **each individual** to use new knowledge and technologies in order to achieve personal goals, as well as the right to privacy and choice, are at the core of the envisioned developments
- Convergence of the sciences can initiate a “new Renaissance” focussing on **enhancing human performance**



Converging Technologies – Shaping the Future of European Societies (EC Expert Group 2004)

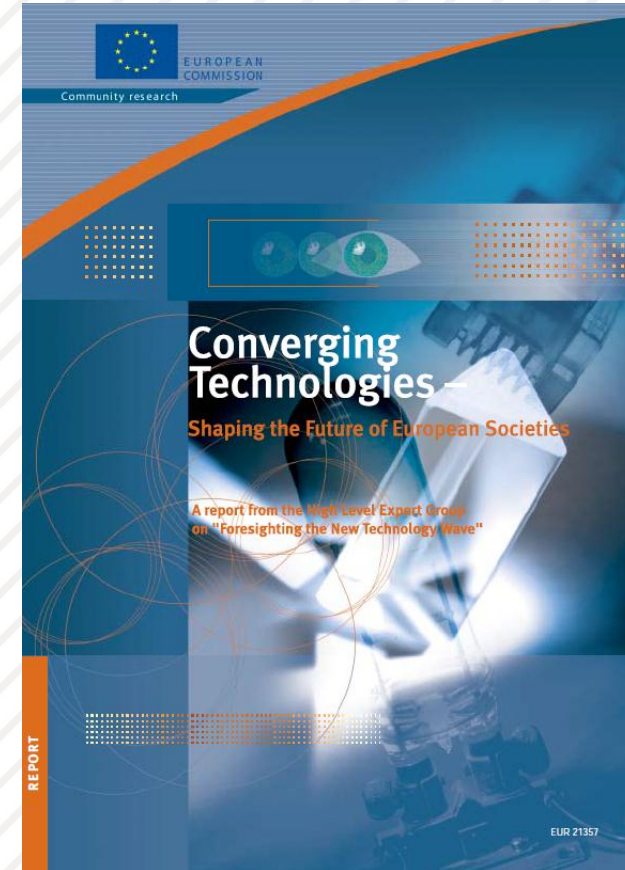
DRYNA kennis, wetenschap, onderzoek
verandering, innovatie, technologie, wetenschap, onderzoek

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- *Tremendous transforming potential* of “new technology wave”, **challenging traditional boundaries** between the self, nature and the social environment and coming with *tremendous anxieties* raised by trans-humanist ambitions to improve human performance by turning humans into machines
- *European approach* opening converging technologies to the deliberate inclusion of **public and policy concerns**: “widening the circles of convergence”



A New Techno-Human Condition?

Allenby and Sarewitz, MIT Press 2011

DRYNA kennissysteem
verandering in onderzoek
informatie
debat
technology & science
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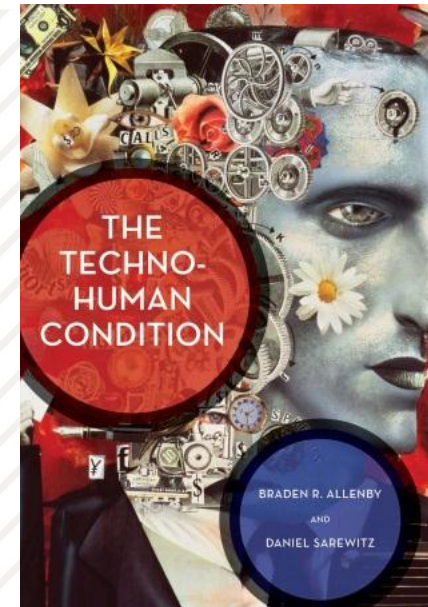
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Technologies inhabit different realities:

- **Level I** reality of the immediate effectiveness and reliability of the technology itself (airplane)
- **Level II** reality of the systemic complexity of embedded technology (the air transportation system)
- **Level III** of constellations of social, economic cultural, moral, institutional and political patterns associated with “long waves” of innovation (i.e. steel and electricity)

To understand the radical transforming power of technology in society we need to move away from an instrumentalist perspective on technology. *At level III technology can no longer be understood as a means but as a condition.*



STOA project Making *Perfect Life*: a multi-level TA perspective



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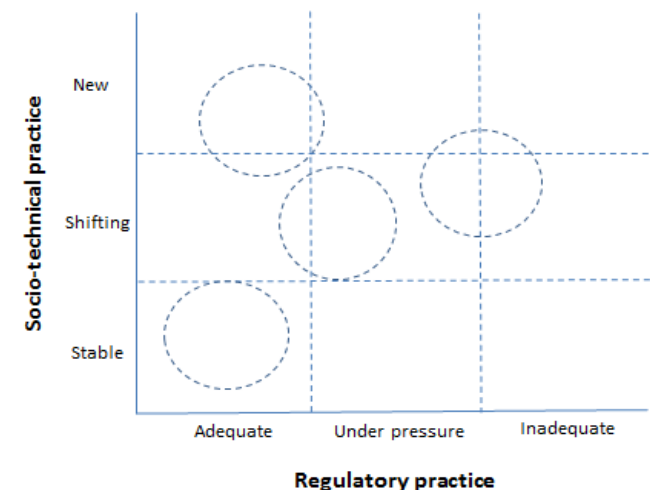
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Level III: mapping and discussing from a *trans-technological* perspective long-term **sociotechnical transformations** in four fields of 21st century bio-engineering and upcoming **policy challenges**

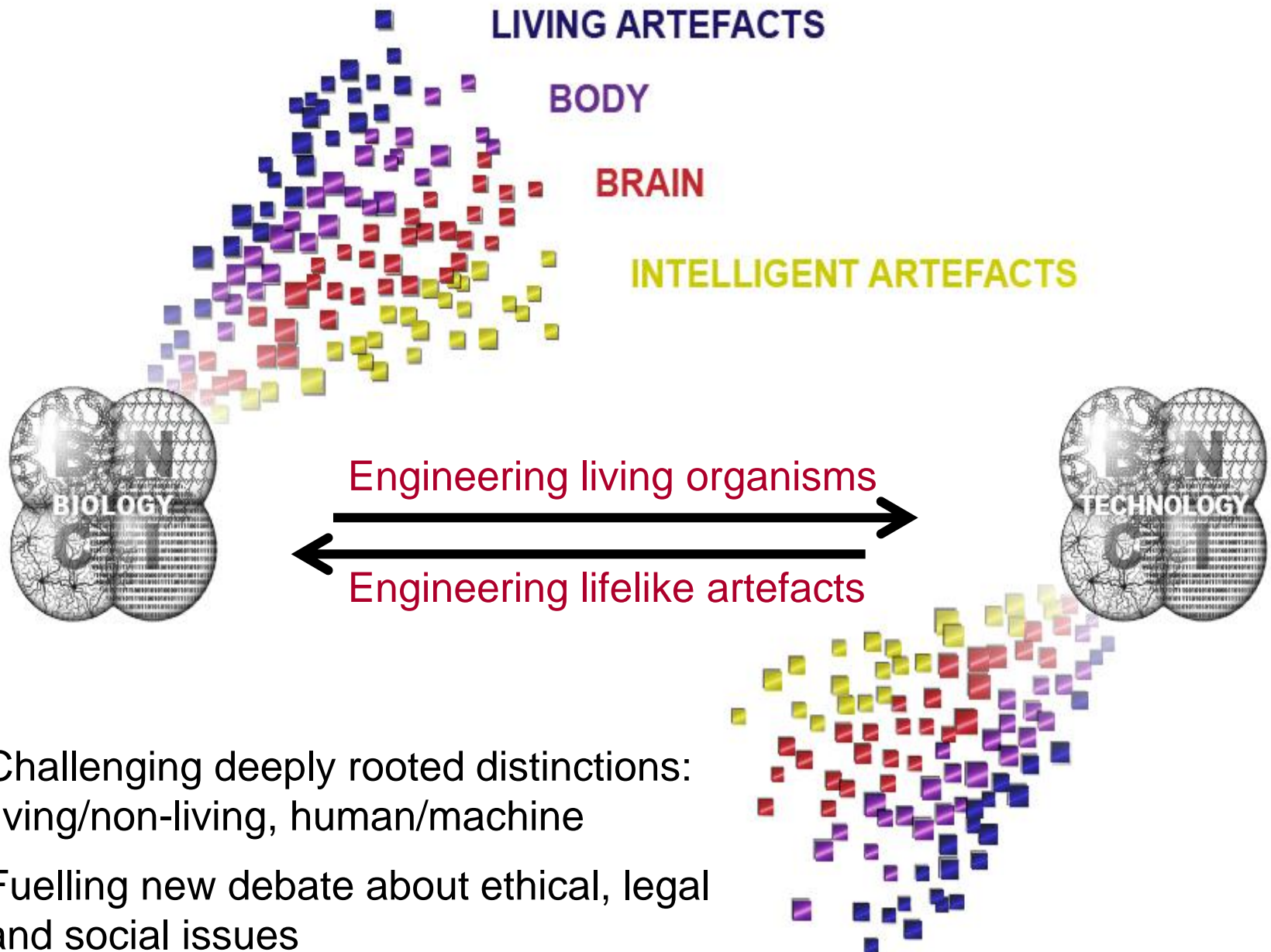
Level II: mapping and discussing the *embedding* of bio-engineering technologies in current and future **sociotechnical and regulatory practices**

Moving away from technological *instrumentalism* and *determinism*:

- seeing the development of NBIC technologies as an open-ended process
- showing there is more to NBIC convergence than human enhancement



Two bio-engineering megatrends

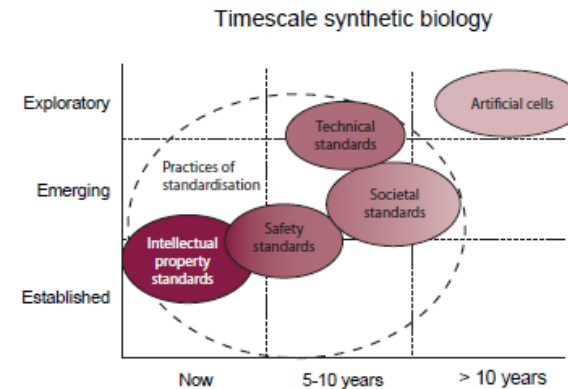
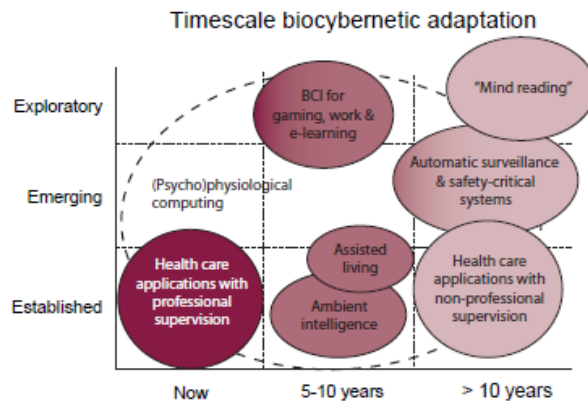
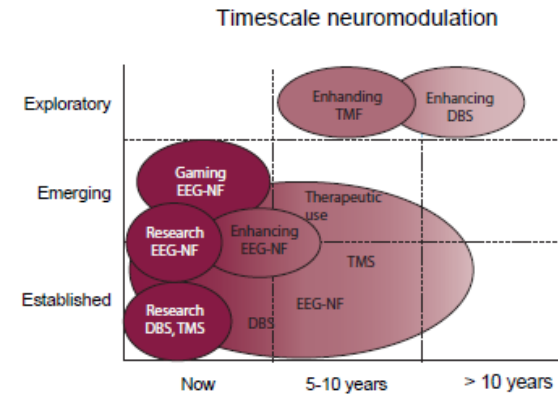
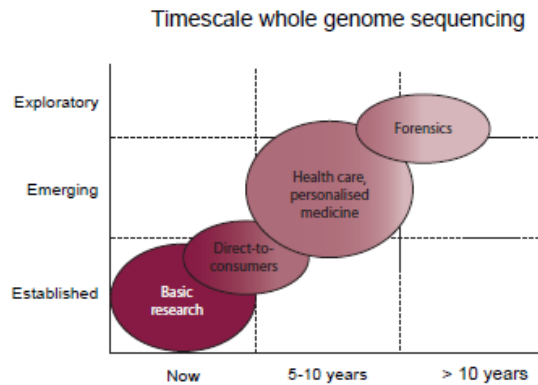


- Challenging deeply rooted distinctions: living/non-living, human/machine
- Fuelling new debate about ethical, legal and social issues

Dynamics of sociotechnical practices in 21st century bio-engineering

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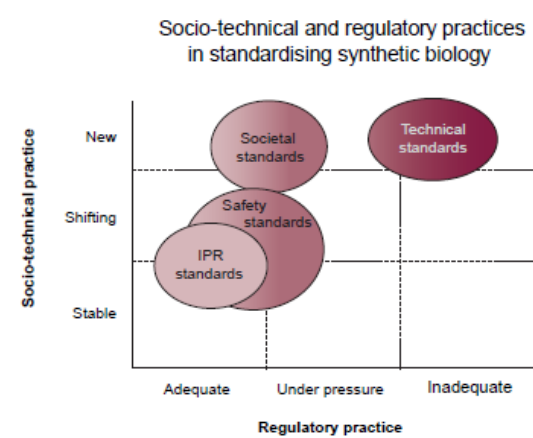
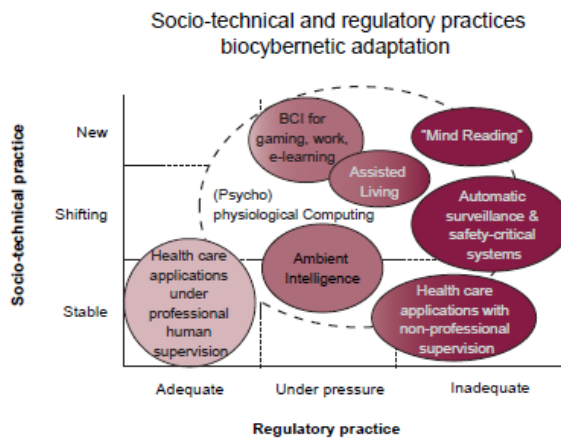
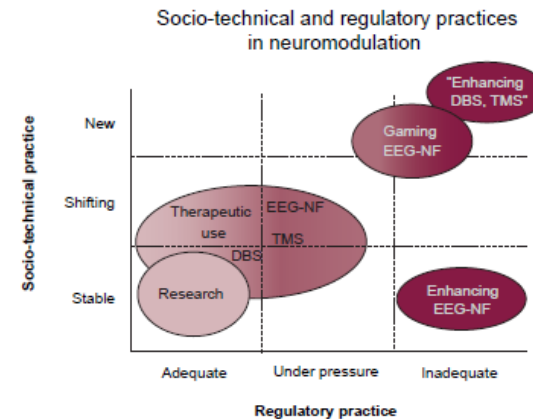
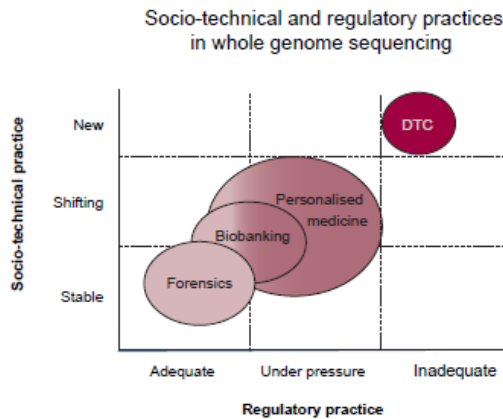
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Regulatory challenges in 21st century bio-engineering

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Need for bioethics and biopolitics



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General recommendations for European policymaking:

- Need to **broaden the bio-ethical debate** in our society in response to NBIC convergence
- Besides bioethics, also **biopolitics** is required, that is the political regulation of shifting and newly emerging socio-technical practices in society

European governance challenges in 21st century bio-engineering



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How to align socio-technical and regulatory practices in 21st bio-engineering?

Whole genome sequencing	Biocybernetic adaptation	Neuromodulation	Standardising SynBio
<p>Biobank research: existing frameworks for data-protection and informed consent need to be revised and harmonised</p> <p>Health care: need for broader/generic forms of consent, without compromising patient autonomy / how to deal with unsought for findings?</p> <p>Outside health care: need for new models for regulation DTC testing</p> <p>Forensic databases: regulation forensic databases patchy and unharmonised</p>	<p>Non-professional health care, gaming: current data and privacy protection framework no longer matches current situation in the field of IT</p> <p>Automatic surveillance: will raise new issues with regard to both privacy protection and autonomy of users</p>	<p>EEG-neurofeedback:</p> <ul style="list-style-type: none"> • therapeutical (medical) device? • intended purpose? • device for non-medical purposes? (enhancement, gaming) <p>Transcranial magnetic stimulation: tension between regulated research and unregulated (off-label) clinical use</p> <p>Other issues:</p> <ul style="list-style-type: none"> • reimbursement • quality control • regulatory transparency 	<p>Synthetic biology: will it be a real game changer, implying new issues of standardisation?</p> <ul style="list-style-type: none"> • technical • safety, • intellectual property • societal