

Cyborgs

Humanity's future?

SINTEF Seminar 2018

Philip Turk

Cyborgs

cybernetic organism

Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

What is a cyborg?

- Wikipedia: *"a being with both organic and biomechatronic body parts"*
- Artificial parts are not necessarily visible



Fuzzy range of definitions

clothing, shoes,
cars, tools,
drugs,...?



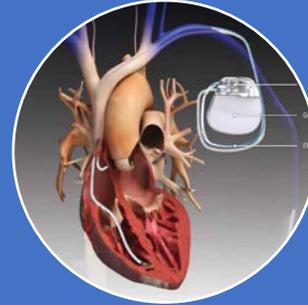
A human who
(permanently) depends
on **technology**

- hearing aid devices, wheelchairs, dentures
- smartphones, glasses



A human with **technology**
permanently implanted
into or onto their body

- artificial hips, prostheses, artificial teeth



A human with ~~electronics~~ ^{"smart" technology}
permanently implanted
into/onto their body

- pacemakers, artificial hearts, nanobots, implanted credit cards



A true hybrid being
between human and
machine

- brain-machine interfaces, robotic skeletons

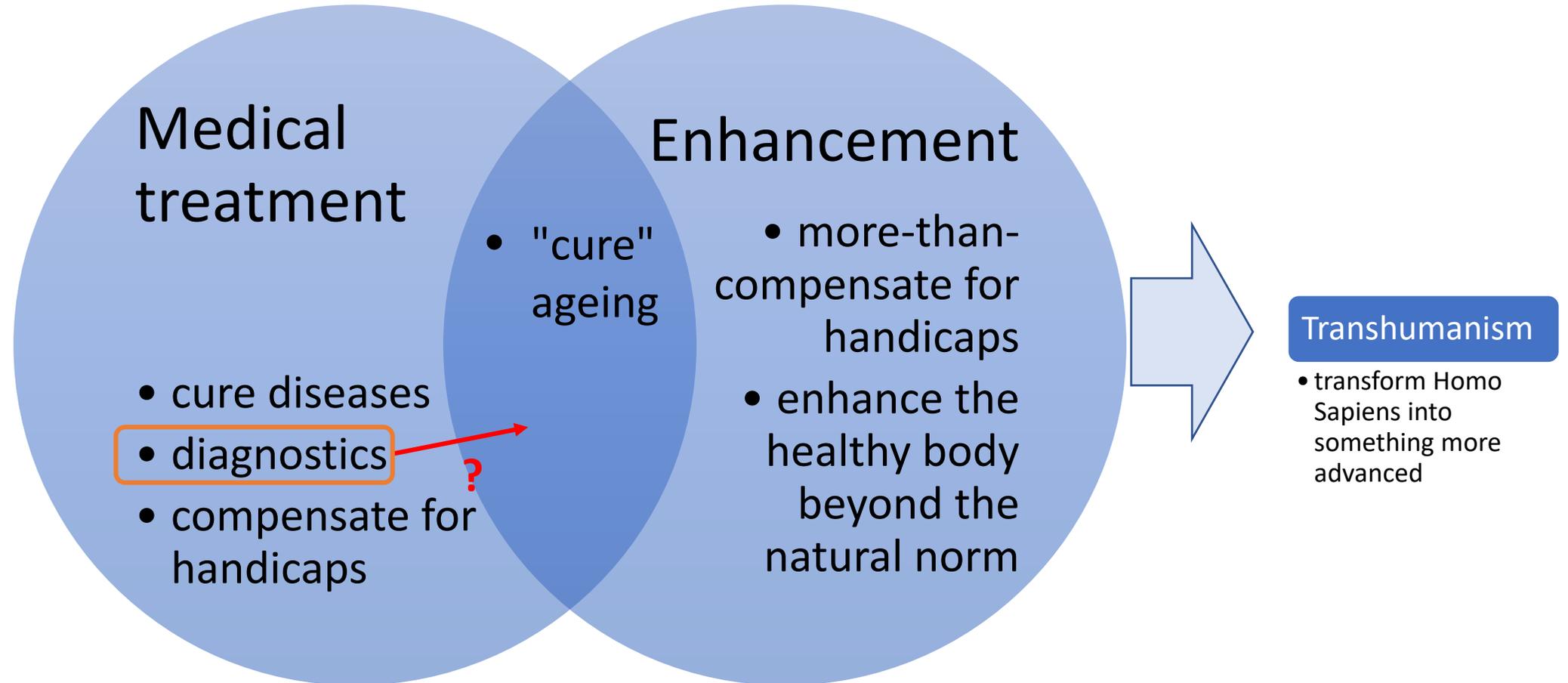
broader definition

Cyborg

narrower definition

artificial (but organic!) implants?

Classification



Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

What is possible already today?

Pacemakers

- cardiac pacemaker against arrhythmia
- deep brain stimulation against Parkinson's, chronic pain, depression,...

Artificial limbs/prostheses

- increasingly sophisticated
- very rapid development

Mechanical hearts

- don't work very well yet

What is possible already today?

Implanted
hearing aids

Retinal implants

- very low resolution
- only rudimentary sight

Diagnostic
implants

- measuring blood sugar, temperature,...
- diagnosing cancer



Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

What might be possible in 30 years?

Artificial organs

- hearts, lungs, eyes, ears,...

Fully functional artificial limbs

- mostly arms and legs

Nanobots

- diagnostics
- repairing damage
- destroying cancer

"Proper" brain-computer-interfaces

- for paralyzed patients
- to compensate for brain damage

Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

What might be common in 30 years?

Microchips in/under your skin for various purposes

- ID, credit card, etc. -> already possible today, but not common
- implanted "smartwatch" or similar devices

VR/AR enhancement

- implanted earphones
- retina implants

Decoration

- moving/changing "tatoos"
- LEDs in/under your skin

QUESTION: Will we do it, just because we can?

Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

(E

a



Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

What might be possible in 30 years?

Brain- computer- interfaces (BCI)

- direct mental access to the internet or other information sources
- remote-controlling (humanoid) robots
- direct connection to other people ("telepathy")
- intelligence and memory enhancement through "smart" brain implants

QUESTION: If a human mind lives in a brain-machine hybrid, can we still call it human?

Outline

1. What is a cyborg?
2. Cyborgs today
3. Cyborgs tomorrow
 1. Medical applications
 2. Convenience implants
 3. Physical enhancement
 4. Cognitive enhancement
4. Summary

Summary

- A cyborg in the broad sense is "*a being with both organic and biomechatronic body parts*"
- We have to differentiate between medical treatment and true enhancement – though the lines are blurry
- Most of what is done today focuses on medical treatment, but rudimentary enhancement is already possible
- In the near future, enhancement might play a bigger role, as technology becomes cheaper, smarter, more powerful and more reliable
- Enhancement can challenge our understanding of what it means to be human

References

- Testing a soft artificial heart: https://www.ethz.ch/en/news-and-events/eth-news/news/2017/07/artificial_heart.html
- Anderson RJ, Frye MA, Abulseoud OA, et al. (September 2012). "[Deep brain stimulation for treatment-resistant depression: efficacy, safety and mechanisms of action](#)". *Neurosci Biobehav Rev.* **36** (8): 1920–33.
- Schlaepfer, TE; et al. (2013). "Rapid effects of deep brain stimulation for treatment-resistant major depression". *Biological Psychiatry.* **73** (12): 1204–12.
- G. Chader; J. Weiland; M. Humayun (2009). "Artificial vision: needs, functioning, and testing of a retinal electronic prosthesis". *Progress in Brain Research.* **175**: 0079–6123.
- Cancer diagnosing skin implant: <https://www.bbc.com/news/health-43821914>
- Artificial lungs: http://www.news.pitt.edu/artificial_lung_grant

References

- Artificial limbs with sensory feedback: <https://www.technologyreview.com/s/608366/prosthetics-you-can-feel/>
- Cancer fighting nanobots: <https://phys.org/news/2018-02-cancer-fighting-nanorobots-tumors.html#jCp>
- Sabathiel, Nikolaus; Irimia, Danut C.; Allison, Brendan Z.; Guger, Christoph; Edlinger, Günter (2016-07-17). "[Paired Associative Stimulation with Brain-Computer Interfaces: A New Paradigm for Stroke Rehabilitation](#)". *Foundations of Augmented Cognition: Neuroergonomics and Operational Neuroscience*. Lecture Notes in Computer Science. Springer, Cham: 261–272.
- RFID implants: <https://www.bbc.com/news/technology-30144072>
- "[Wearable Robots: Biomechatronic Exoskeletons - José L. Pons](#)". Wiley. 2001-12-04. Retrieved 2016-02-20.
- Tressoldi, Patrizio E.; Pederzoli, Luciano; Bilucaglia, Marco; Caini, Patrizio; Fedele, Pasquale; Ferrini, Alessandro; Melloni, Simone; Accardo, Agostino Patrizio (24 May 2014). "Brain-to-Brain (Mind-to-Mind) Interaction at Distance: A Pilot Study".

Takk for deres oppmerksomhet!