



# Asistivní technologie a dohledové systémy

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Nature Inspired  
Technologies Group



## The Individuals with Disabilities Education Act (IDEA) defines AT as both a device and a service:

### ❖ Assistive Technology Device

Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a person with a disability:

- **Compensation tools**, incl. means for **alternative communication**
- **Rehabilitation tools**

### ❖ Assistive Technology Service

Any service that directly assists a person with a disability in the selection, acquisition, or use of an assistive technology device.

# What is the target group?



## Persons

- ❖ with **congenital** (vrozeny) **disorders** of communication, movement or cognitive functions,
- ❖ with **neurodegenerative diseases** (sclerosis multiplex - roztroušená skleroza, muscular atrophy, amyotrophoc lateral sclerosis, Parkinson, Huntington or Alzheimer disease),
- ❖ with central or peripheral **speech disorders**,
- ❖ with **neuropsychic disorders** (autism, ...),
- ❖ after accidents, cerebral palsy (obrna), stroke (cévní mozková příhoda), ...



SOCIAL PRESSURE: **Independent living movement**

<http://www.wvfil.org/>

- ❖ Independent living is participating in day-to-day life, living where you choose and making decisions that lead to self-determination.
- ❖ For many persons with disabilities, however, barriers in their communities take away or severely limit their choices. These barriers may be obvious, such as lack of **ramped entrances** for people who use wheelchairs, lack of interpreters or **captioning for people with hearing** impairments, or lack of **Braille or taped copies** of printed materials for people who have visual impairments.
- ❖ Other barriers-frequently less obvious-can be even more limiting to efforts on the part of people with disabilities to live independently, and they are caused by people's misunderstandings and prejudices about disability. These barriers result in low expectations about things people with disabilities can achieve.

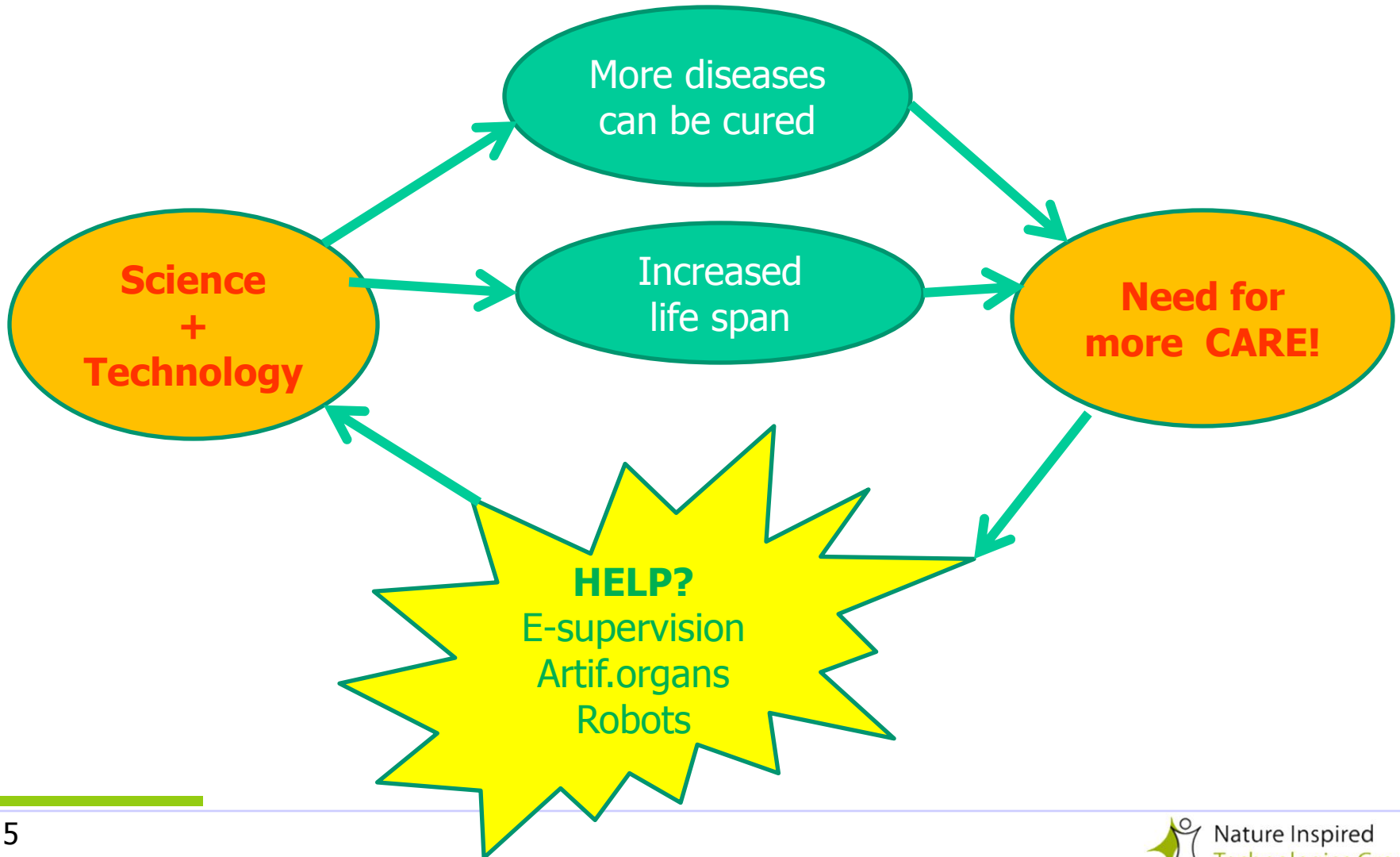


# Motivation ?

# Empathy!!!



## ❖ Economic pressure



# AT for Daily Activities – Seniors and Independent Living



## Low-tech

- ❖ Reacher
- ❖ Non-slip material
- ❖ Lever handles
- ❖ Slide or toggle switches
- ❖ Utensils with easy-grip handles
- ❖ Mirror mounted over the range

## High-tech

- ❖ Universal remote control
- ❖ Home automation systems
- ❖ Environmental control systems
- ❖ Screen magnification software
- ❖ Prosthetics
- ❖ Smart pills dispensers
- ❖ Robot companions
- ❖ ....

# Relevant sci/tech fields?



## Medical Bionics

- ❖ In medicine, Bionics usually means the replacement or enhancement of organs or other body parts by mechanical versions or electrical add ons.
- ❖ Bionic implants differ from mere prostheses by mimicking the original function very closely, or even surpassing it.

Aimee





# Example - Aimee



- ❖ Mullins was born with fibular hemimelia (missing fibula bones), and had both of her legs amputated below the knee when she was a year old.
- ❖ Her new legs, called Cheetahs, allow her to run at speed (100m in 15.77 seconds)
- ❖ She is now also an actress (see on [imdb](https://www.imdb.com/name/nm1511647/))

# Limits?

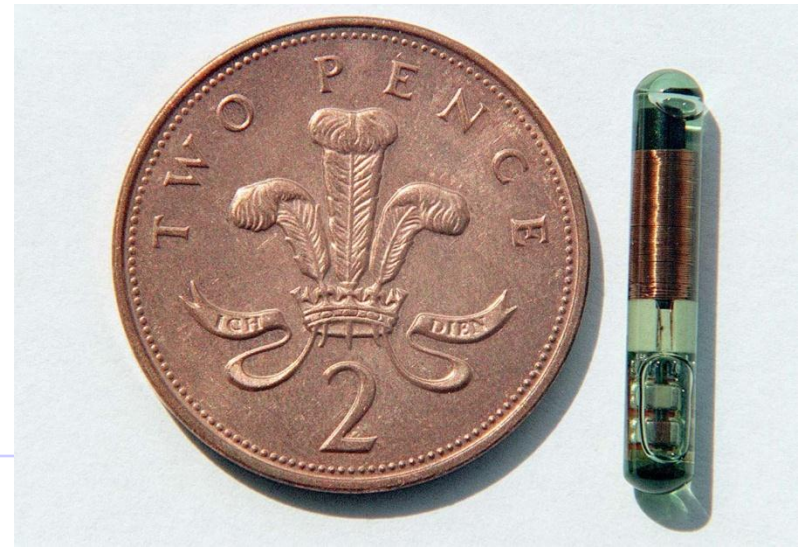


- ❖ Are Aimee's legs copies of human legs?
- ❖ How powerful can the springs be?
- ❖ Could she have wheels or rollers instead?
- ❖ She can change her legs – a pair for sports, a pair for acting, a pair for dining out etc.
  
- ❖ More about these subjects – lectures of prof. Warwick

# Physical/Mental



- ❖ The Bionic elements could be physical (as for Aimee) or mental or a combination.
- ❖ So they could be replacement body parts
- ❖ They could be replacement/alternative mental parts
- ❖ A combination of the above
- ❖ What about simple technical additions? e.g. RFID



# RFID Implants

- ❖ First human RFID implant carried out on 24<sup>th</sup> August 1998 – in Reading (Dr. George Boulos)
- ❖ Provides identification/information
- ❖ Allows/denies access
- ❖ Certainly something extra
- ❖ Like an implanted smart card
- ❖ But is it Bionic?



# Use



- ❖ Identified individual to the building computer
- ❖ Opened doors, switched on lights, said “Hello Mr. Chip”
- ❖ All in response to the RFID being identified
- ❖ Remember – that was in 1998
  - ❖ Several thousand in place in humans
  - ❖ Best known perhaps Amal Graafstra – see IEEE Spectrum magazine March 2007 for 2 recent articles.
  - ❖ Mexican Government
  - ❖ Baja Beech Club
  - ❖ 2004 OK by US Food & Drug Admin – Diabetes, Epilepsy etc

# Human Tracking



- ❖ Either cell phone or GPS
- ❖ Cell phone technology potentially implantable – GPS still rather large
- ❖ Cell phone – accurate to 10 metres?
- ❖ GPS – accurate to 0.5 metres?
- ❖ Implantable cell phone tech perhaps suitable for humans – needs cooperation of cell phone companies
  - ❖ Does a tracking device make someone Bionic?
  - ❖ Is there any difference between a device being implanted and one being worn?
  - ❖ Should we bother with such questions?

# Desires?



- ❖ I'm not a scientist or engineer or whatever – Just a concerned mum which would like to be able to track my baby in case of kidnapping etc.
- ❖ Can the chip alert the person that they are trying to be located? (schoolfriends)
- ❖ We are very interested in having a tracking device implanted in our child. We are absolutely terrified of the idea of our child being kidnapped and want to protect him.

# Other Implants X Problems



- ❖ Breast, Hair
- ❖ Heart Pacemaker
- ❖ Artificial Heart
- ❖ Artificial Hips
- ❖ Implants linked with the nervous system/brain
- ❖ Percutaneous – v – Implant (not to be confused with Transcutaneous pacing)
- ❖ Material used (hermetic sealing) – eventually Titanium casing
- ❖ Battery used (ultimately Lithium-iodide)
- ❖ Pacing used (how often to stimulate?) – depends on nature of problem



# Therapy/Enhancement



- ❖ Important questions here as to whether the Bionic elements are purely therapeutic or actually enhance the individual
- ❖ Even enhancement can be regarded in different ways!
- ❖ This raises all sorts of **ethical questions**.
  - ❖ Implants, Biomedical Engineering
  - ❖ BCI, Sensory Substitution
  - ❖ Human Enhancement
  - ❖ Cyborgs
  - ❖ Telepathy !!!

# Sentient Robot Companions for Citizens (RCC)



❖ ...

RCC should understand its “boss” :

- ❖ how he/she feels (including his/her **health condition**)
- ❖ what he/she wants to indicate using speech or **alternative communication means**

RCC for assistive services should support its “boss” :

- ❖ in control of home environment – **smart places**
- ❖ by offering personalized health services, e.g. **rehabilitation**

**Migrating companions** can be embodied within a household or workplace robot, car computer, ... and act as a proxy.

# Weeks Ahead



- ❖ e-supervision/monitoring/rehabilitation systems
- ❖ user centred design principles
- ❖ high-tech in the loop
- ❖ role of AI
- ❖ ...