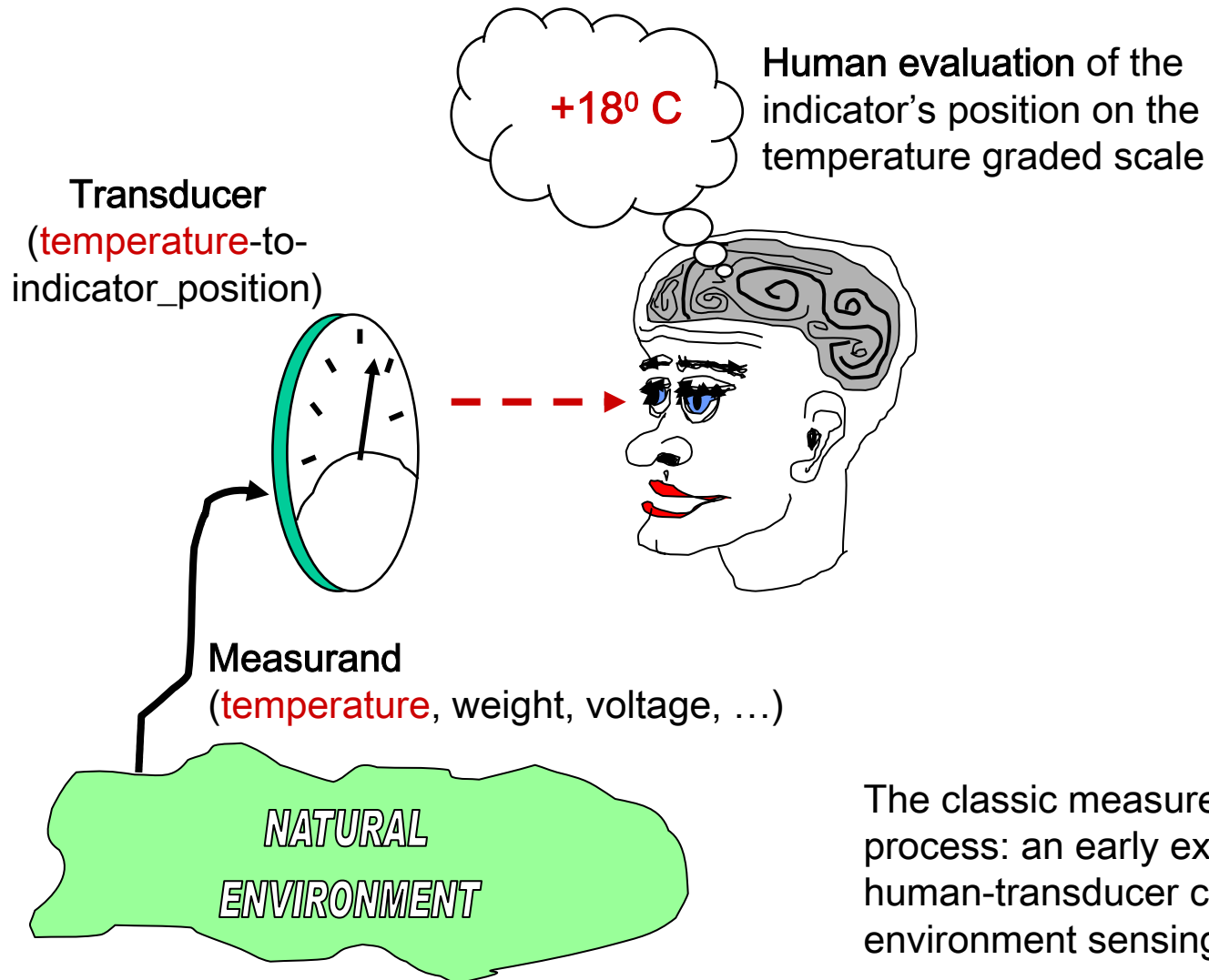


# Symbiotic Human-Computer Partnership

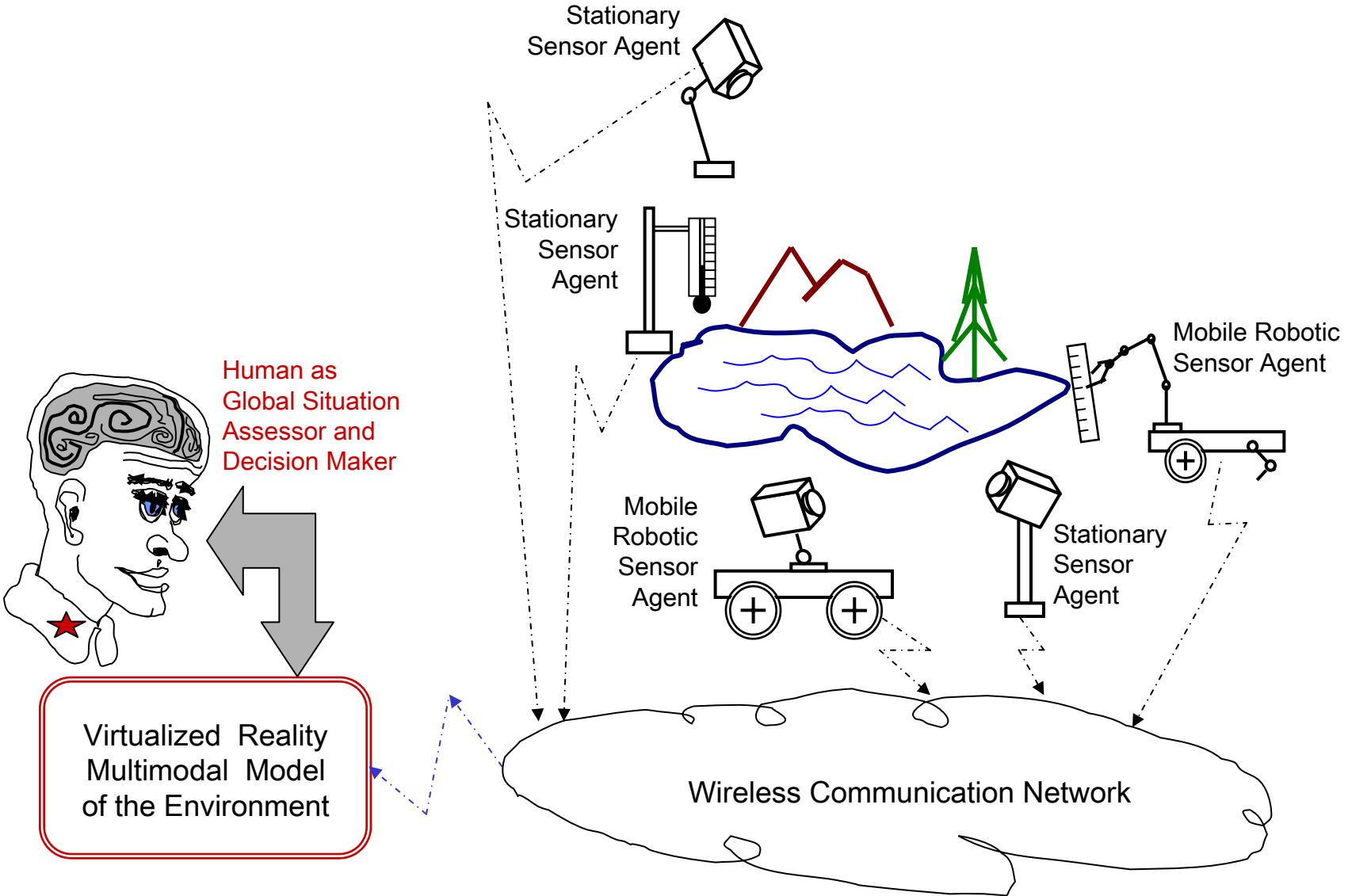
Emil M. Petriu, Dr. Eng., FIEEE  
Professor, SITE  
University of Ottawa, Ottawa, ON, Canada  
<http://www.site.uottawa.ca/~petriu>  
2009

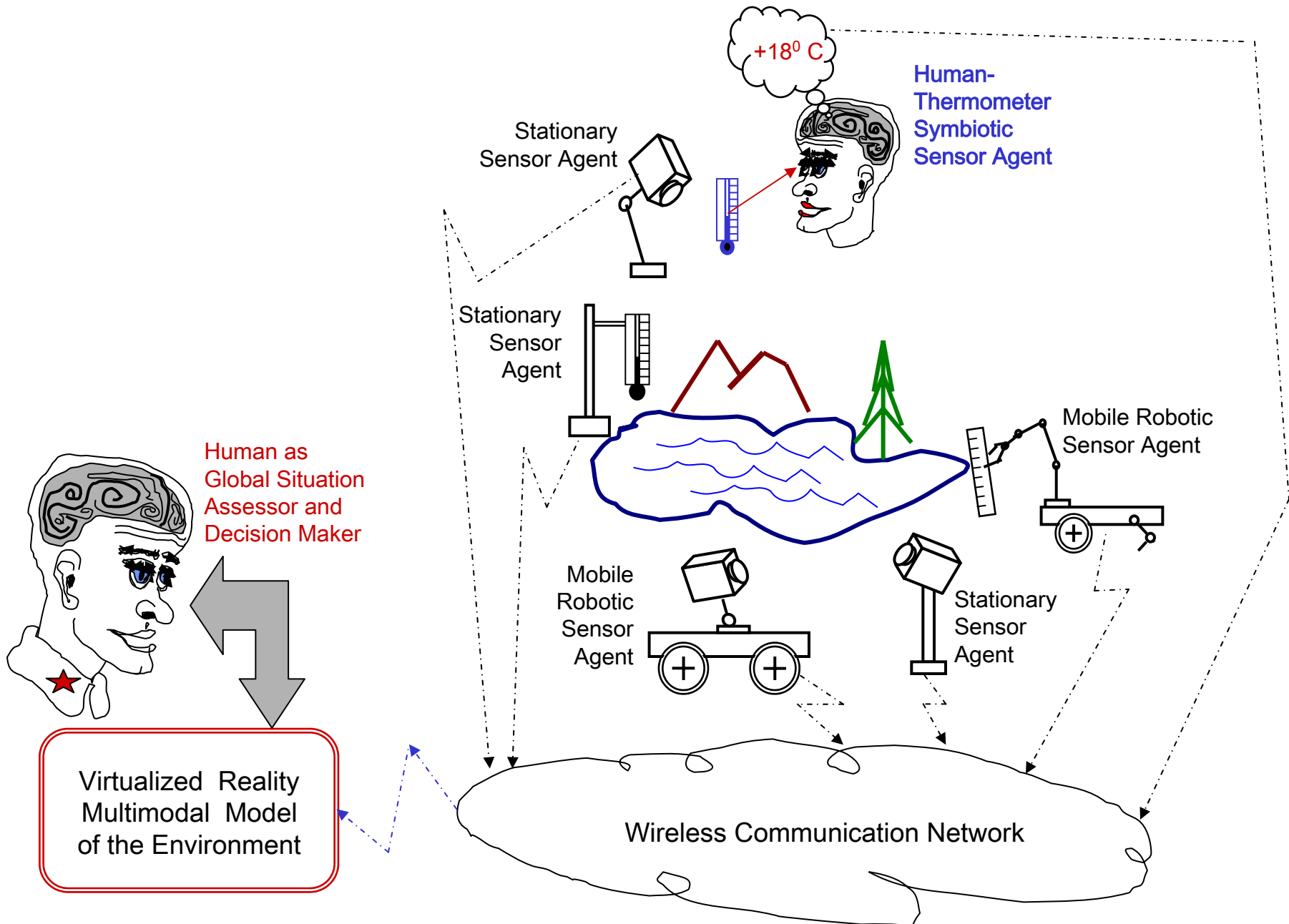
Discussing the aims of the human-computer symbiosis, **Licklider** writes in his seminal paper “**Man-Computer Symbiosis**,” *IRE Trans. on Human Factors in Electronics*, Vol. HFE-1, pp. 4-11, **March 1960**. “*It seems likely that the contributions of human operators and equipment will blend together so completely in many operations that it will be difficult to separate them neatly in analysis. That would be the case if, in gathering data on which to base a decision, for example, both the man and the computer came up with relevant precedents from experience and if the computer then suggested a course of action that agreed with the man's intuitive judgment.*”

# Human-Instrument Symbiotic Partnership for Environment Perception

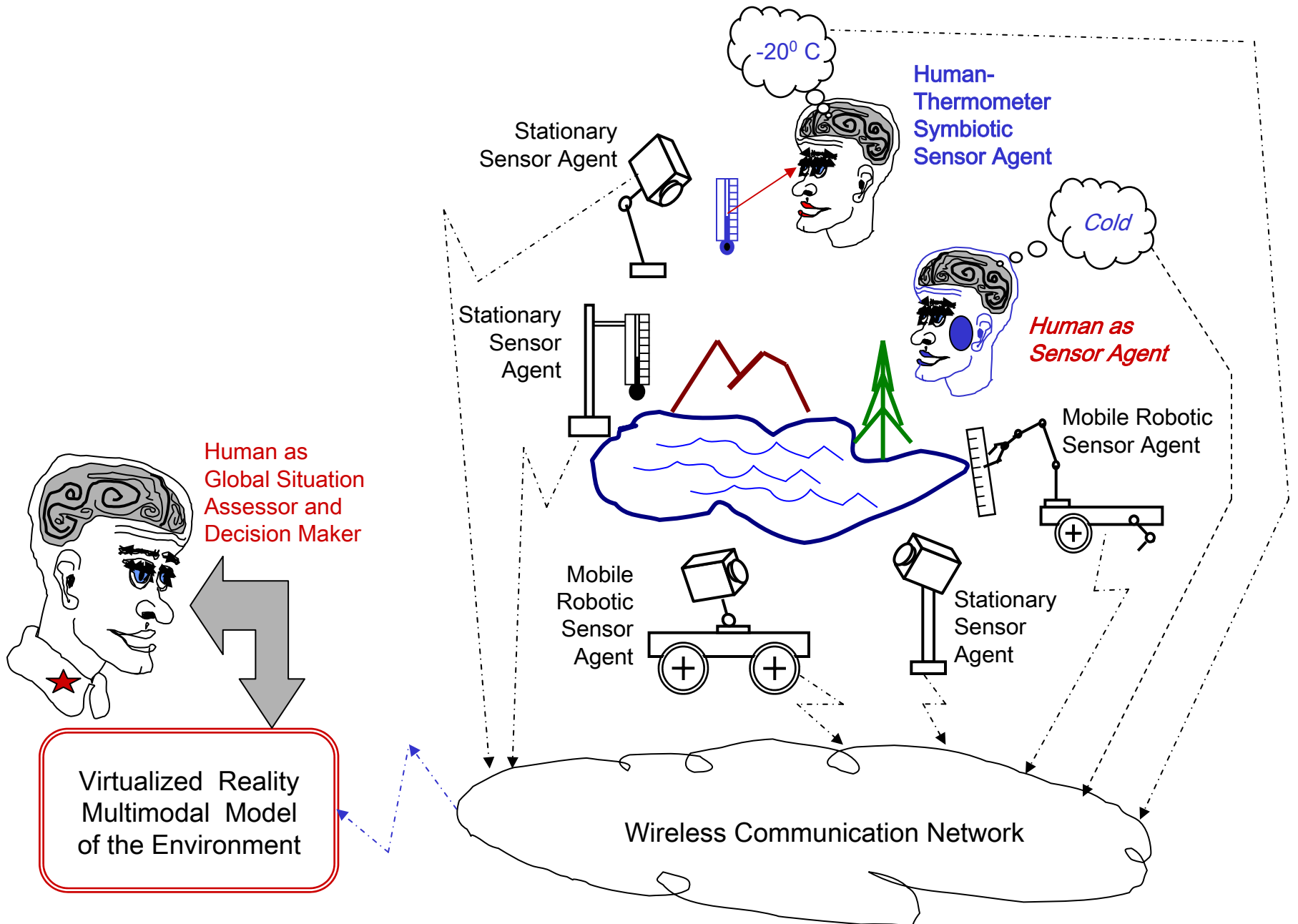


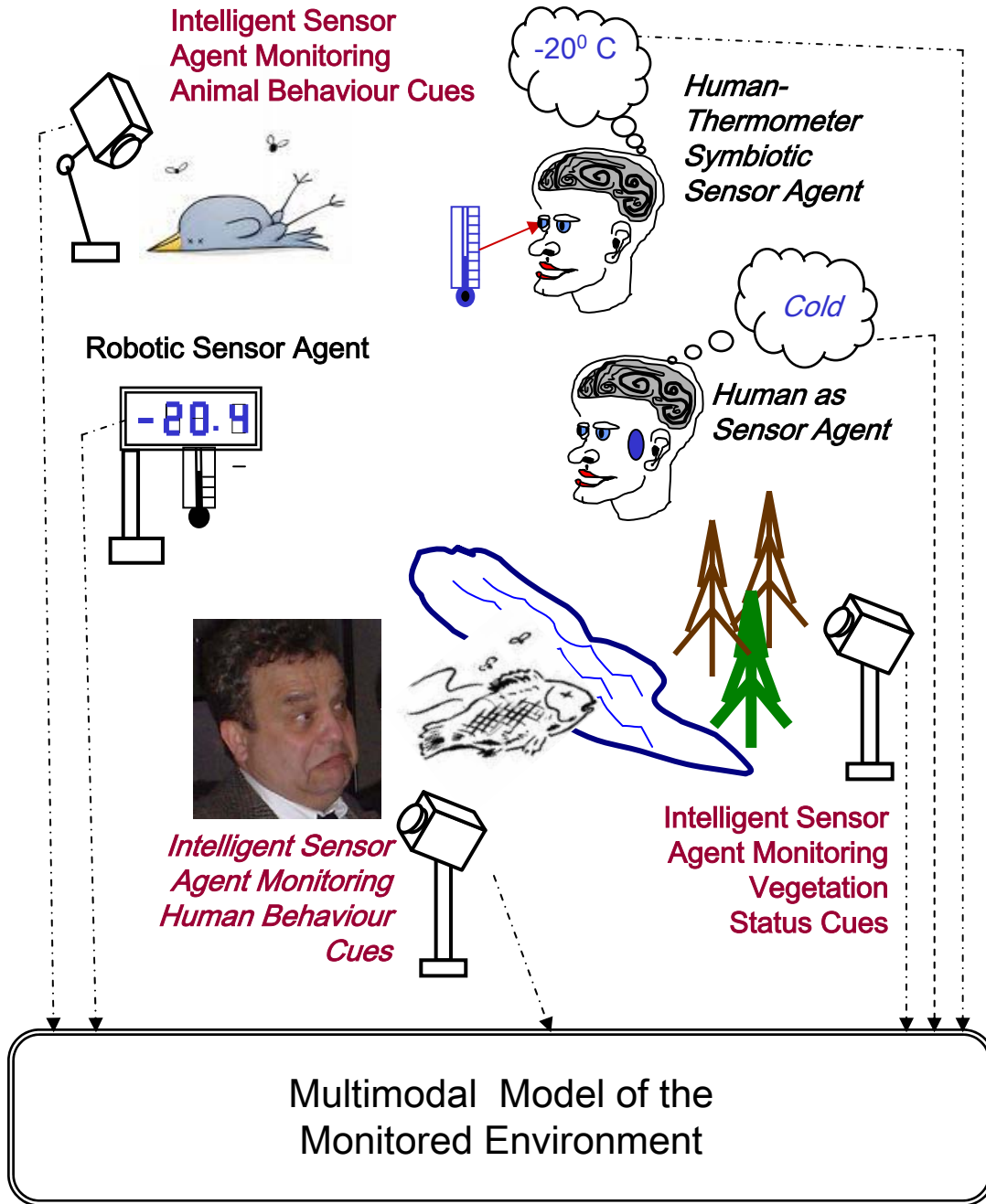
The classic measurement process: an early example of human-transducer cooperation for environment sensing.











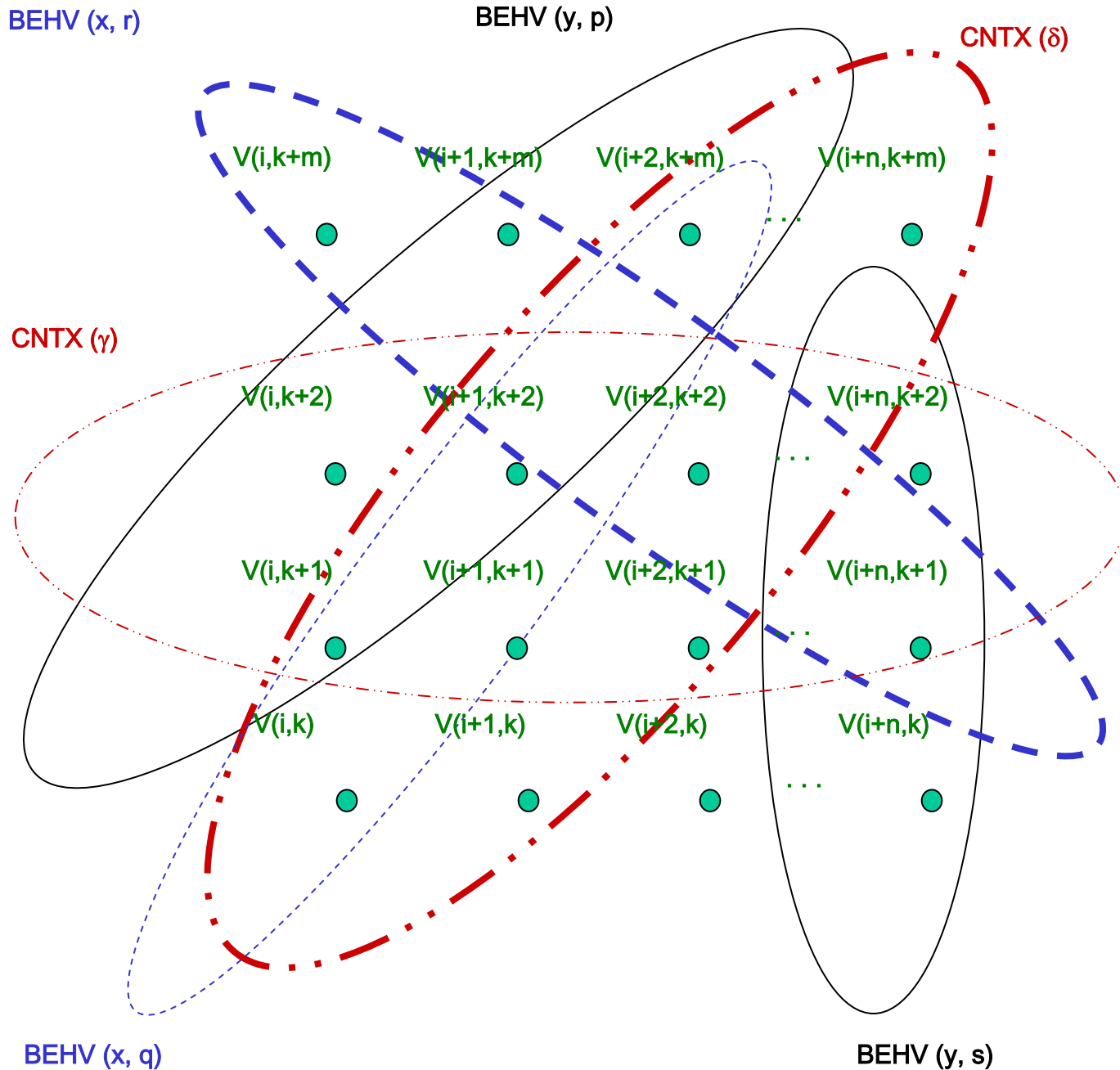
Heterogeneous network of robotic sensors, human-transducer symbiotic sensor agents, human sensor agents, and *intelligent sensor agents capable to comprehend human and animal behaviour, and vegetation status.*

Human sensor information is “fuzzy quantized” while the machine sensor information, both the symbiotic analog\_ transducer & human, and the fully automated digital one, is “sharp & concatenated quantized”

It is possible to reduce the uncertainty of the measurements involving humans as sensors part of multisensor systems, by using Fuzzy Cognitive Maps, NNs, and Associative Memories.

Dempster-Shafer theory of evidence approach is used to incorporate human-like uncertainty management and inference mechanisms in our context-aware multi-sensor data fusion system. This approach allows us to incorporate time-variable weights representative of sensor precision which will improve the sensor fusion accuracy in dynamic environments.

Linguistic pattern recognition techniques and semantic model representations are used to develop a semantic level situation assessment system that will allow understanding of the dynamics of a complex scene based on multimodal sensor data streams.



*Context-based plausible meaning of the specific behaviour of a human agent.*

Estimating the value  $V$  of an environmental parameter of interest based on the specific behaviour *BEHV* of a human agent, which is function of the respective parameter and the context *CNTX*.

*In the previous figure* : the human agent “x” exhibits the *behaviour* BEHV (x, r), which may occur for any of the following environmental parameter values  $\{V(i, k+m), V(i+1, k+m), V(i+2, k+2), V(i+n, k)\}$ , in the *context* CNTX ( $\delta$ ) defined by the following values of the environmental parameter of interest  $\{V(i+2, k+m), V(i+n, k+m), V(i+1, k+2), V(i+2, k+2), V(i, k+1), V(i+2, k+1), V(i, k), V(i+1, k)\}$ .

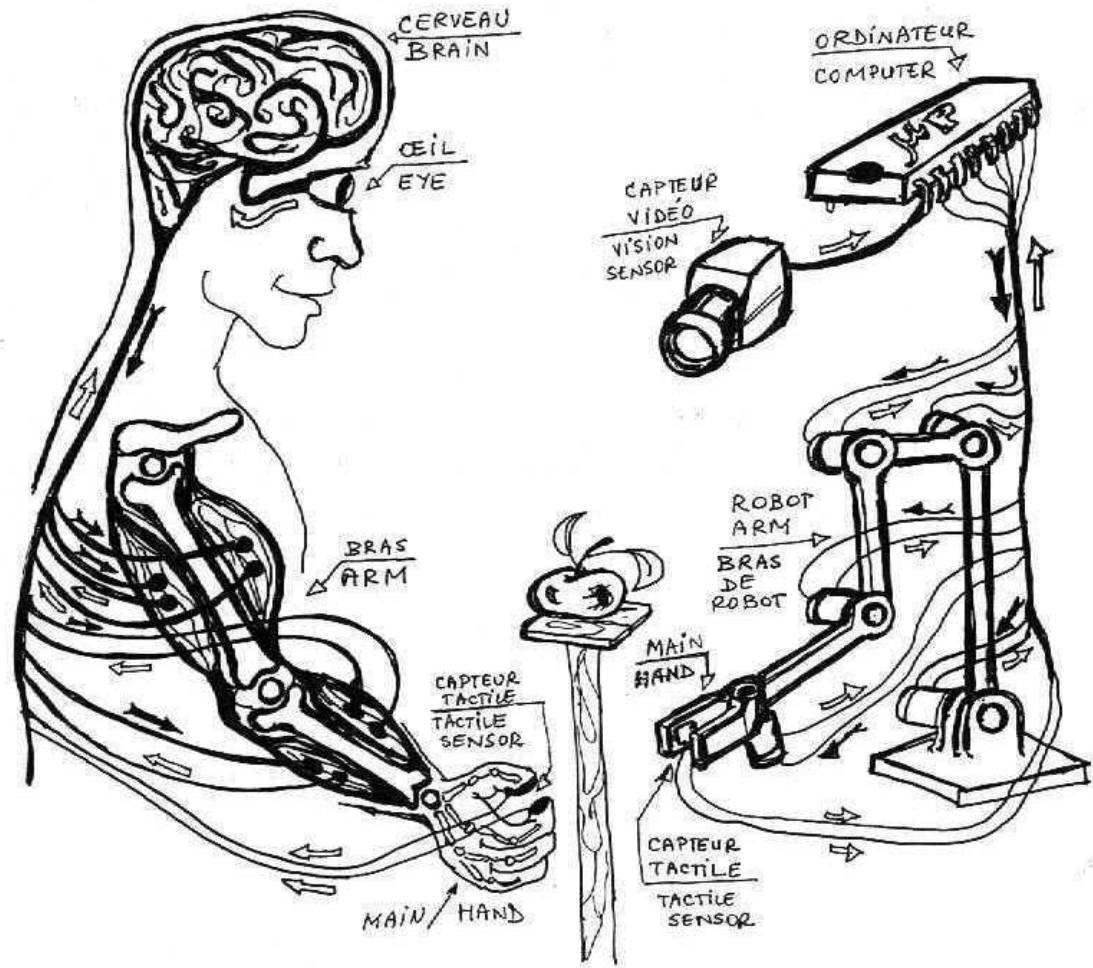
It can be concluded that this specific behaviour in the given context has occurred because of the value  $V(i+2, k+2)$  of the environmental parameter Of interest, which is the value that is shared by the definition domains of the behaviour BEHV (x, r), and the context CNTX (d).

We adopted a two-tier context definition: *1<sup>st</sup> tier* includes four basic object characteristics: location, identity, time, and activity; all other possible contextual characteristics belong to the *2<sup>nd</sup> tier* and are considered as attributes of the primary context properties.

## Human-Computer Interaction for Teleoperation

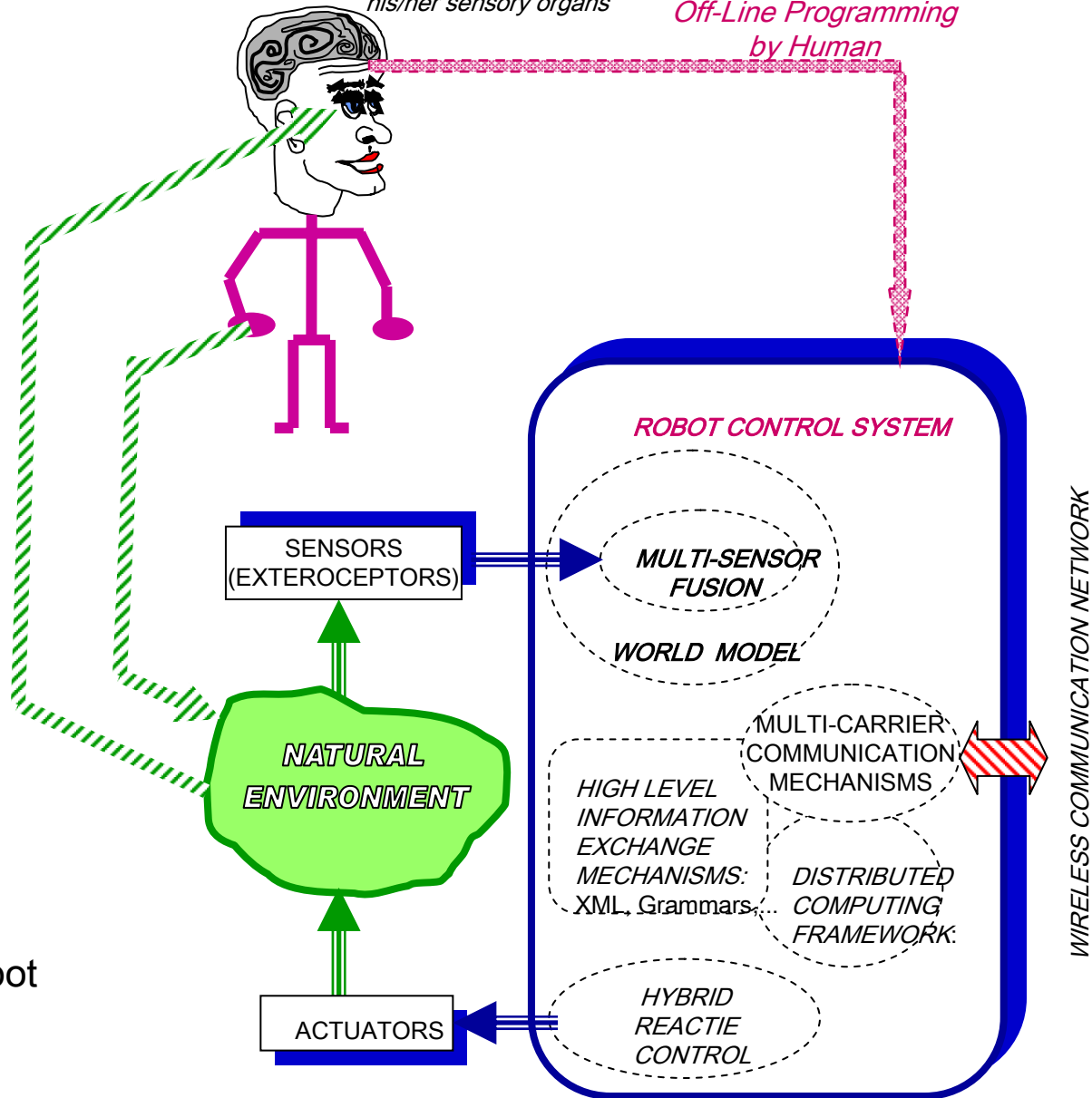
The *symbiotic teleoperation system* has a bilateral architecture allowing to connect the *human operator* and the *robotic partner* as transparently as possible.

*Conformal (1:1) mapping of human & robot sensory and perception frameworks*



*Model (human's image)  
of the real world as he/  
she perceives it trough  
his/her sensory organs*

*Off-Line Programming  
by Human*

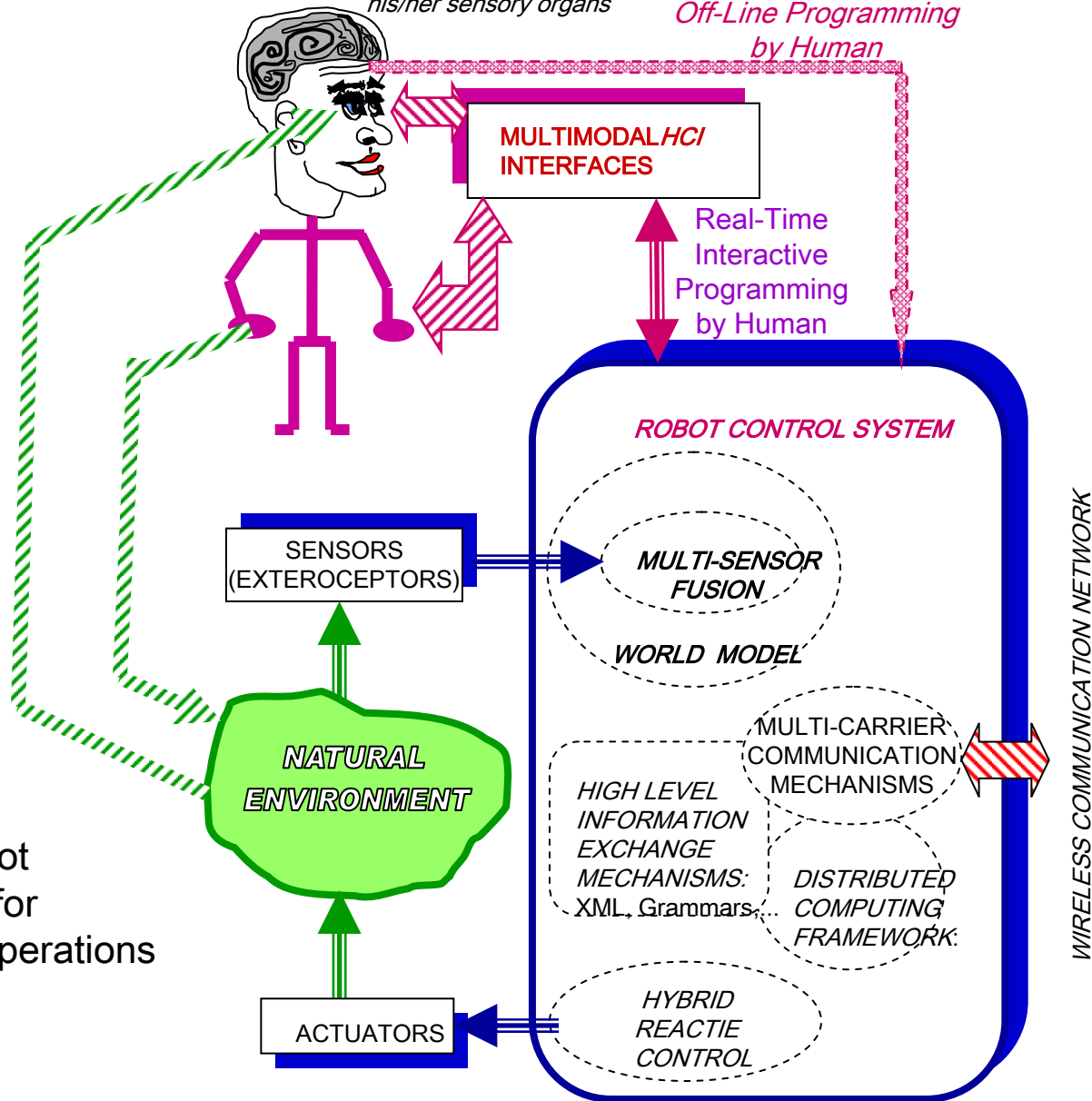


Traditional  
human-robot  
interaction

WIRELESS COMMUNICATION NETWORK

Model (human's image)  
of the real world as he/  
she perceives it through  
his/her sensory organs

Off-Line Programming  
by Human



Human-robot  
interaction for  
symbiotic operations

# Human-Computer Symbiont Systems

- Human operator and intelligent sensor-based systems work together as *symbionts*, each contributing the best of their specific abilities.



Proper control of these operations requires *human-computer interfaces* capabilities allowing the human operator to *experience the feeling of virtual immersion in the working environment.*



*Symbionts* combine intrinsic machine-sensing reactive behavior with higher-order human-oriented world-model representations of the immersive virtual reality.

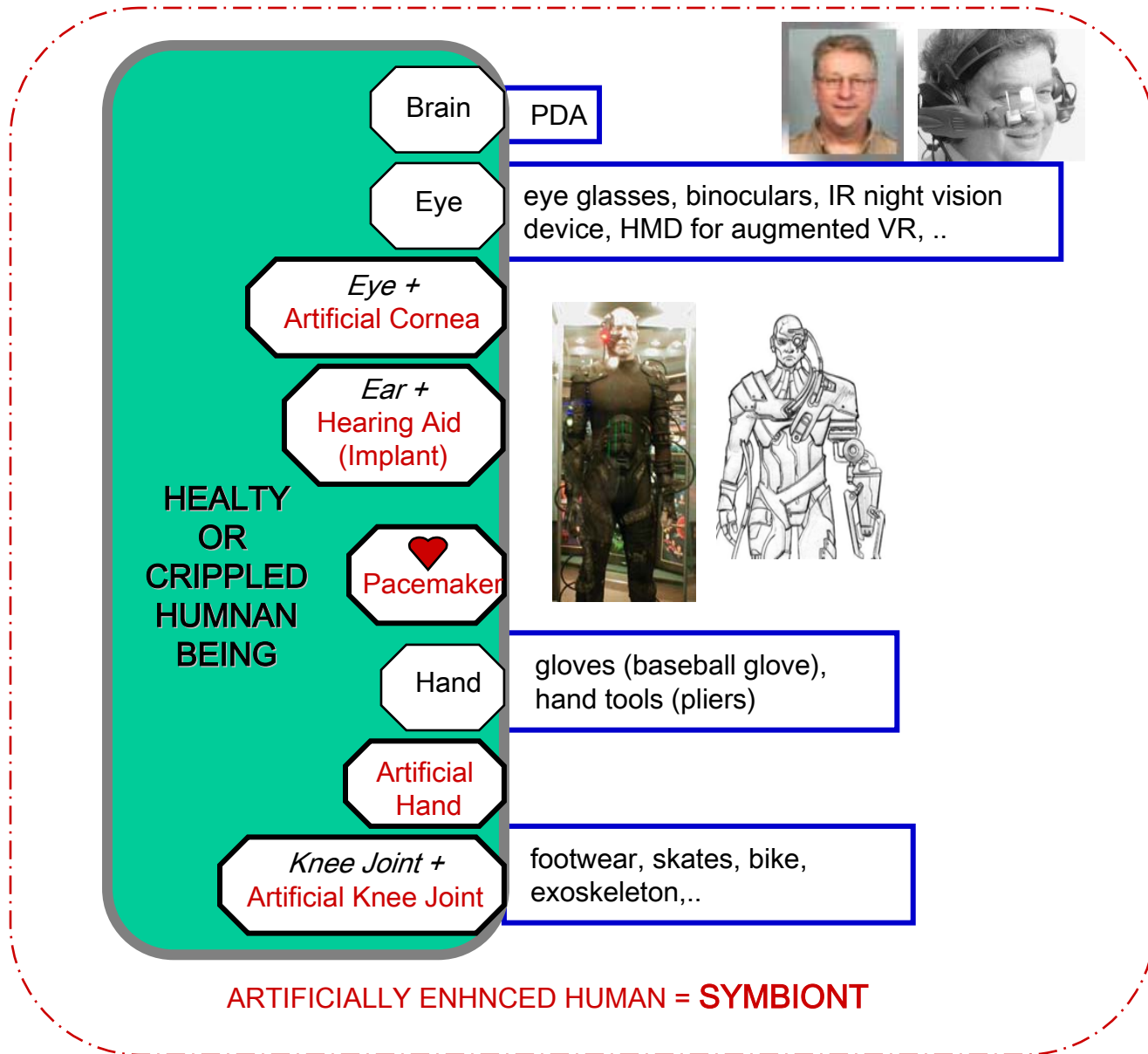
**Humans** are valuable in a symbiotic partnership to the degree that their capabilities complement those of the computers/machines.

*Humans* are very high-bandwidth creatures:

- their visual system is capable of perceiving more than a hundred megabits of information per second, and
- their largest sense organ, the skin is capable of perceiving nearly that much as well.
- human speech conveys information in the form of intonation and inflection as well as the actual words uttered.
- humans communicate through "body language" which includes facial expressions and eye movements.

- ❑ Human-sensor information is “fuzzy quantized” while the Machine-sensor information, both the symbiotic analog\_ transducer & human, and the fully automated digital one, is “sharp & concatenated quantized” [E.M. Petriu, G. Eatherley, “Fuzzy Systems in Instrumentation: Fuzzy Control,” Proc. IMTC/95, IEEE Instrum. Meas. Technol. Conf., pp.1-5, Waltham, MA, 1995.]
- ❑ It is possible to reduce the uncertainty of the measurements involving humans as sensors part of multisensor systems, by using Fuzzy Cognitive Maps, NNs, and Associative Memories.

# Enhancing Human Natural Capabilities (... including survivability)



<http://www.reuters.com/news/pictures/rpSlideshows?articleId=USRTXCF63#a=6>

Canada's filmmaker Rob Spence, who lost his right eye when he was a child, shows a prototype of a prosthetic eye which will be transformed into a video camera, during a conference in Brussels March 5, 2009. Spence, director and producer in Toronto, said he would use the eye-cam the same way he uses a video camera to carry out the so-called "EyeBorg Project". In using his eye as a wireless video camera, Spence wants to make a documentary about how video and humanity intersect especially with regards to surveillance.

REUTERS/Yves Herman



**A man who lost his sight 30 years ago says he can now see flashes of light after being fitted with a bionic eye.**

*<http://news.bbc.co.uk/2/hi/health/7919645.stm>*

Ron, 73, had the experimental surgery seven months ago at London's Moorfield's eye hospital.

He says he can now follow white lines on the road, and even sort socks, using the bionic eye, known as Argus II.

It uses a camera and video processor mounted on sunglasses to send captured images wirelessly to a tiny receiver on the outside of the eye.

In turn, the receiver passes on the data via a tiny cable to an array of electrodes which sit on the retina - the layer of specialised cells that normally respond to light found at the back of the eye. When these electrodes are stimulated they send messages along the optic nerve to the brain, which is able to perceive patterns of light and dark spots corresponding to which electrodes have been stimulated.

The hope is that patients will learn to interpret the visual patterns produced into meaningful images.

The bionic eye has been developed by US company Second Sight. So far 18 patients across the world, including three at Moorfields, have been fitted with the device.

## Honda to Showcase Experimental Walking Assist Device at BARRIER FREE 2008

<http://world.honda.com/news/2008/c080422Experimental-Walking-Assist-Device/>

TOKYO, Japan, April 22, 2008– Honda Motor Co., Ltd. will showcase an experimental model of a walking assist device which could support walking for the elderly and other people with weakened leg muscles(\*), at the International Trade Fair on Barrier Free Equipments & Rehabilitation for the Elderly & the Disabled (BARRIER FREE 2008) which will be held at Intex Osaka, Friday, April 25 through Sunday, April 27, 2008 (Organizers: Osaka Prefecture Council of Social Welfare and Television Osaka Inc.)

Honda began research of a walking assist device in 1999 with a goal to provide more people with the joy of mobility. Currently, the device has entered into the feasibility stage.

The cooperative control technology utilized for this device is a unique Honda innovation achieved through the cumulative study of human walking just as the research and development of technologies was conducted for Honda's advanced humanoid robot, ASIMO. Applying cooperative control based on the information obtained from hip angle sensors, the motors provide optimal assistance based on a command from the control CPU. With this assist, the user's stride will be lengthened compared to the user's normal stride without the device and therefore the ease of walking is achieved.

The compact design of the device was achieved with flat brushless motors and a control system developed by Honda. In addition, a simple design to be worn with a belt around the hip and thigh was employed to help achieve overall weight as light as approximately 2.8kg. As a result, the device reduces the user's load and can be fit to different body shapes.

(\*) This device is designed for people who are still capable of walking on their own.

### Key specifications of the experimental walking assist device

*Size* 3 sizes (Small, Medium, Large)

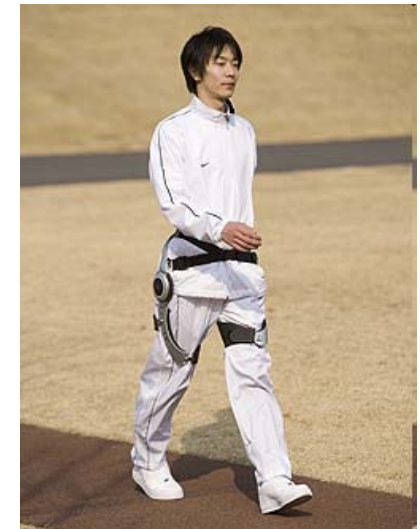
*Distance between motors* (S)312mm,(M)342mm,(L)372mm

*Weight* 2.8kg (Medium size)

*Drive system* (motor/reduction ratio) Brushless DC motor /10

*Battery* (type/capacity) Lithium ion battery/ 22.2V-1Ah

*Operating time* per charge 2 hours (when operated at 4.5km/hour walking)



The research of this device is being conducted by the Fundamental Technology Research Center of Honda R&D Co., Ltd. in Wako, Saitama.



The i-LIMB, a prosthetic device with five individually powered digits, beat three other finalists to win 2008 MacRobert award.

<http://news.bbc.co.uk/2/hi/science/nature/7443866.stm>

"The hand has two main unique features," explained Stuart Mead, CEO of Touch Bionics.

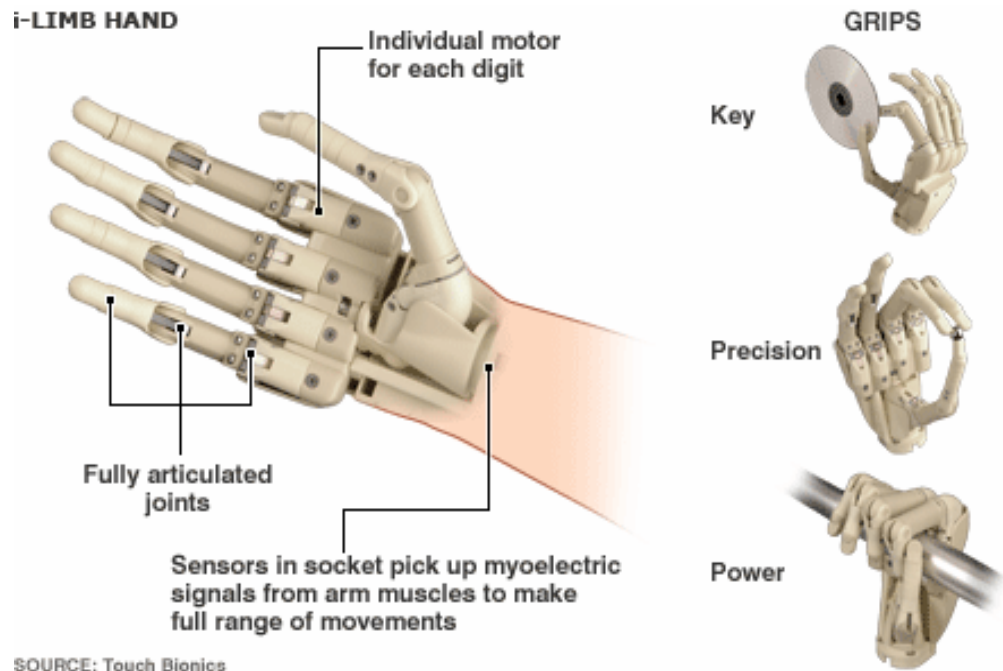
"The first is that we put a motor into each finger, which means that each finger is independently driven and can articulate.

"The second is that the thumb is rotatable through 90 degrees, in the same way as our thumbs are.

"The hand is the first prosthetic hand that replicates both the form and the function of the human hand."

Other companies and organisations, such as the US space agency (Nasa) and the country's military research arm, Darpa, have developed more advanced hands. "All of those are laboratory-based - ours is commercially available," said Mr. Mead.

The hand does not require surgery to be fitted to the patient's stump, according to Mr Mead. "There are two electrodes that sit on the skin that pick up myoelectric signals," he explained. These impulses are created by the contraction of muscle fibres in the body. "They are used by the computer in the back of the hand, which does two things: it interprets those signals and it controls the hand," he told BBC News.



SOURCE: Touch Bionics

## **Bionic legs give soldiers a boost**

<http://news.bbc.co.uk/2/hi/science/nature/3502194.stm>

US researchers have developed strap-on robotic legs to allow people to carry heavy loads over long distances. The Berkeley Lower Extremity Exoskeleton, or Bleex, is part of a US defence project designed to be used mainly by infantry soldiers.

The device consists of a pair of mechanical metal leg braces including a power unit and a backpack-like frame. More than 40 sensors and hydraulic mechanisms calculate how to distribute weight just like the nervous system. These help minimise the load for the wearer. A large rucksack carried on the back contains an engine, control system and space for a payload.

"There is no joystick, no keyboard, no push button to drive the device," said Homayoon Kazerooni, director of the Robotics and Human Engineering Laboratory at the University of California.

The Bleex exoskeleton has a small, purpose-built combustion engine built into it. On a full tank the system should be able to run for up to two hours. The device's leg braces are attached to a modified pair of army boots and connected to the user's legs. In the lab, subjects have walked around in the 45kg (100 lbs) exoskeleton plus a 31.5kg (70 lbs) backpack and reported that it felt like they were carrying little over 2kg (5 lbs). "The design of this exoskeleton really benefits from human intellect and the strength of the machine," said Dr Kazerooni. The project has been funded by the US Defense Advanced Research Projects Agency (Darpa). But Dr Kazerooni thinks the exoskeleton could be used with equal success by firefighters. "They're really good, it turns out, at enabling firefighters, soldiers, post-disaster rescue crews to carry heavy loads over great distances for hours," he said.



## Robo-skeleton lets paralysed walk

<http://news.bbc.co.uk/2/hi/health/7582240.stm>

A robotic suit is helping people paralysed from the waist down do what was previously considered impossible - stand, walk and climb stairs.

ReWalk users wear a backpack device and braces on their legs and select the activity they want from a remote control wrist band.

Leaning forwards activates body sensors setting the robotic legs in motion.

Users walk with crutches, controlling the suit through changes in centre of gravity and upper body movements.



*Radi Kaiof has been paralysed for the last 20 years*

The device, which is now in clinical trials in Tel Aviv's Sheba Medical Centre, is the brainchild of engineer Amit Goffer, founder of Argo Medical Technologies, a small Israeli high-tech company. It was Goffer's own paralysis that inspired him to look for an alternative to the wheelchair for mobility. The company claims that by maintaining users upright on a daily basis, and exercising even paralysed limbs in the course of movement, the device can alleviate many of the health-related problems associated with long-term wheelchair use.

Kate Parkin, director of physical and occupational therapy at NYU Medical Center in the US said the potential benefits to the user were two-fold. "Physically, the body works differently when upright. You can challenge different muscles and allow full expansion of the lungs. "Psychologically, it lets people live at the upright level and make eye contact."

## Rat-brain robot aids memory study

<http://news.bbc.co.uk/2/hi/technology/7559150.stm>

• *A robot controlled by a blob of rat brain cells could provide insights into diseases such as Alzheimer's, University of Reading scientists say.*

The project marries **300,000 rat neurons** to a robot that navigates via sonar. The neurons are now being taught to steer the robot around obstacles and avoid the walls of the small pen in which it is kept. By studying what happens to the neurons as they learn, its creators hope to reveal how memories are laid down.

• *Hybrid machines*

The **blob of nerves forming the brain of the robot was taken from the neural cortex in a rat foetus and then treated to dissolve the connections between individual neurons**. Sensory input from the sonar on the robot is piped to the blob of cells to help them form new connections that will aid the machine as it navigates around its pen. **As the cells are living tissue, they are kept separate from the robot in a temperature-controlled cabinet in a container pitted with electrodes. Signals are passed to and from the robot via Bluetooth short-range radio.**

The brain cells have been taught how to control the robot's movements so it can steer round obstacles and the next step, say its creators, is to get it to recognise its surroundings.

• Once the robot can do this the researchers plan to disrupt the memories in a bid to recreate the gradual loss of mental faculties seen in diseases such as Alzheimer's and Parkinson's. Studies of how neural tissue is degraded or copes with the disruption could give insights into these conditions. "One of the fundamental questions that neuroscientists are facing today is how we link the activity of individual neurons to the complex behaviours that we see in whole organisms and whole animals," said Dr Ben Whalley, a neuroscientist at Reading. "This project gives us a really useful and unique opportunity to look at something that may exhibit whole behaviours but still remains closely tied to the activity of individual neurons," he said.

• The Reading team is not the first to harness living tissue to control robots. In 2003, Dr Steve Potter at the Georgia Institute of Technology pioneered work on what he dubbed **"hybrots" that marry neural tissue and robots**. In earlier work, scientists at Northwestern University Medical Center in the US wired a wheeled robot up to a lamprey in a bid to explore novel ways of controlling prosthetics.

## Brain chip research aims for future movement

*<http://www.cnn.com/2006/TECH/02/22/brain.gate/index.html> Thursday, March 2, 2006;*

(CNN) -- Matthew Nagel awoke from a two-week coma in the summer of 2001 to learn he was paralyzed from the neck down. "My mother was right by my side and explained that I got stabbed," he recalled. He faced a future of never being able to walk again and having to breathe with a ventilator. But things changed temporarily for then 25-year-old Nagel when he became the first person to have a device implanted in his brain designed to connect his thoughts and convert them to actions.

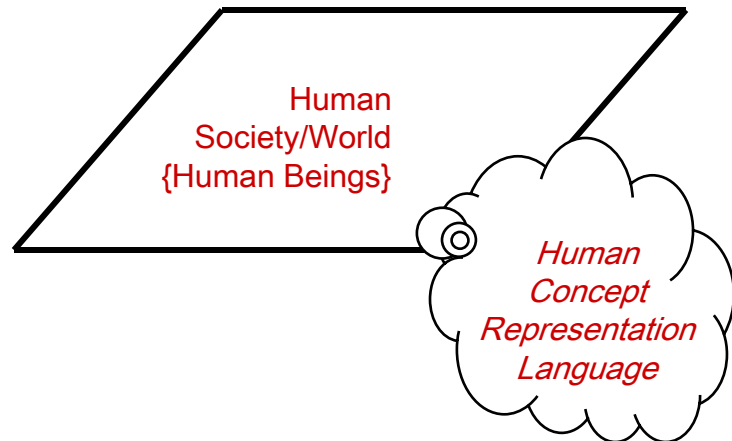
### How it would work

The **BrainGate Neural Interface** is being developed by Cyberkinetics Neurotechnology Systems Inc. in Foxborough, Massachusetts. The device is a 4 by 4 millimeter arrangement of 100 electrodes. It is surgically implanted in the motor cortex, the part of the brain responsible for creating movement in the limbs. The implanted chip connects to a small platform protruding from the patient's skull that is linked to an external processor. If the system works as hoped, the chip detects and sends signals from the motor cortex to the processor, which interprets them and feeds them into a computer.

After doctors implanted the device in Nagel's brain, they saw some encouraging signs. "Within the first three days I was able to control the cursor pretty much," Nagel said. "When I think back on it, it's kind of a trip to think that my brain signals was controlling a mouse, changing channels on my TV, adjusting the volume, opening e-mails."

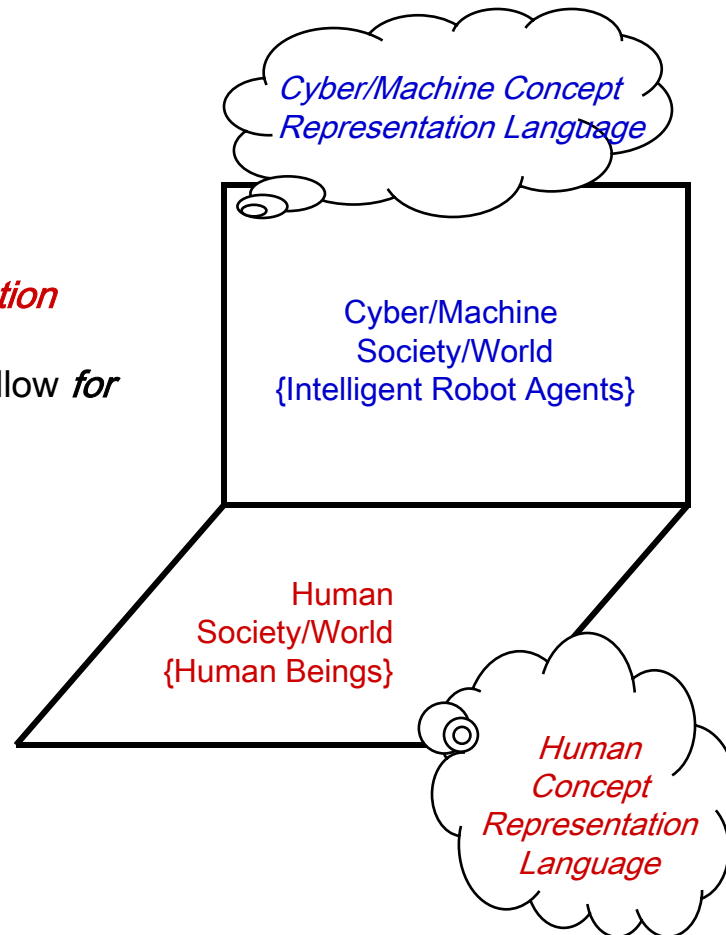


*Human-to-human communication and cooperation* require a *common language and an underlying system of shared knowledge and common values*.





*Human-to-human communication and cooperation* require a *common language and an underlying system of shared knowledge and common values*. In order to achieve a similar degree of *human-to-machine interaction and cooperation*, a *symbiotic framework* should be developed to allow *for the management of heterogeneous functions and knowledge*.



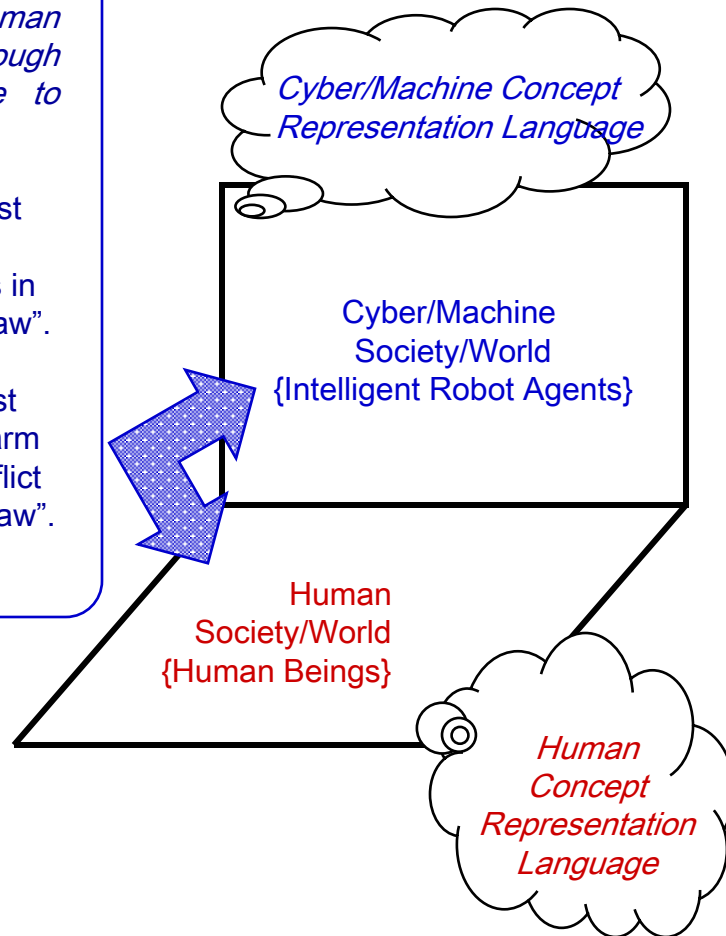


***Asimov's laws of the robotics:***

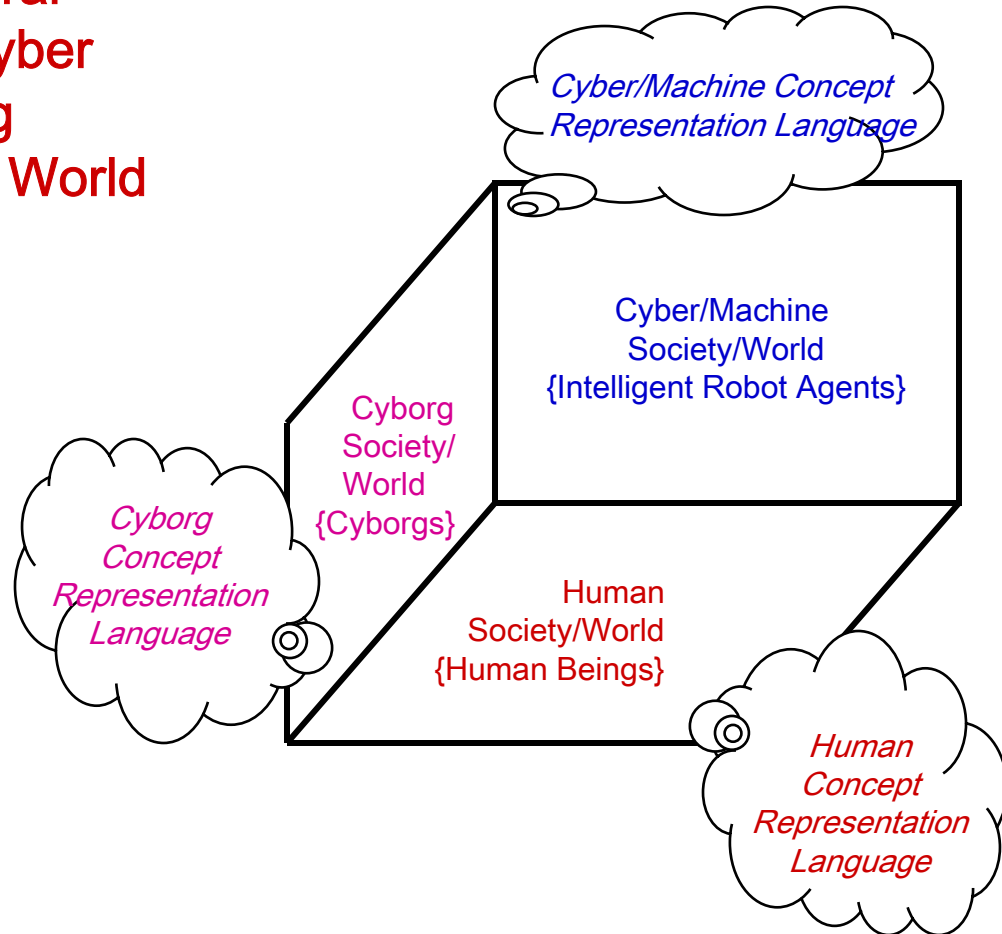
*1<sup>st</sup> law: "A robot must not harm a human being or, through inaction allow one to come to harm".*

*2<sup>nd</sup> law: "A robot must always obey human beings unless that is in conflict with the 1<sup>st</sup> law".*

*3<sup>rd</sup> law: "A robot must protect itself from harm unless that is in conflict with the 1<sup>st</sup> and 2<sup>nd</sup> law".*



**Multi-Cultural  
Human & Cyber  
& Cyborg  
Hyper-Society World**



***Asimov's laws of the robotics:***

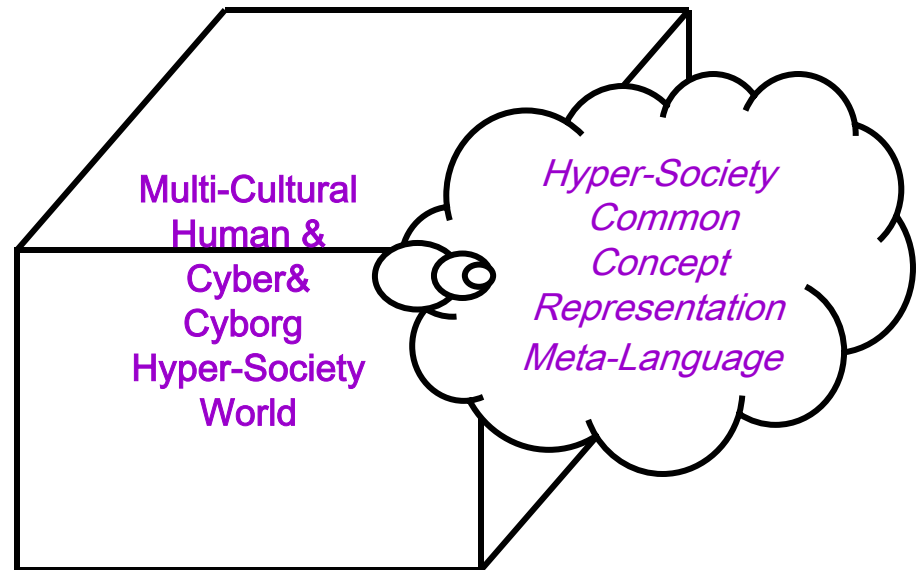
*0<sup>th</sup> law: "A robot may not injure humanity or, through inaction, allow humanity to come to harm."*

*1<sup>st</sup> law- updated: "A robot must not harm a human being or, through inaction allow one to come to harm, unless this would violate the 0<sup>th</sup> law."*

*2<sup>nd</sup> law: "A robot must always obey human beings unless that is in conflict with the 1<sup>st</sup> law".*

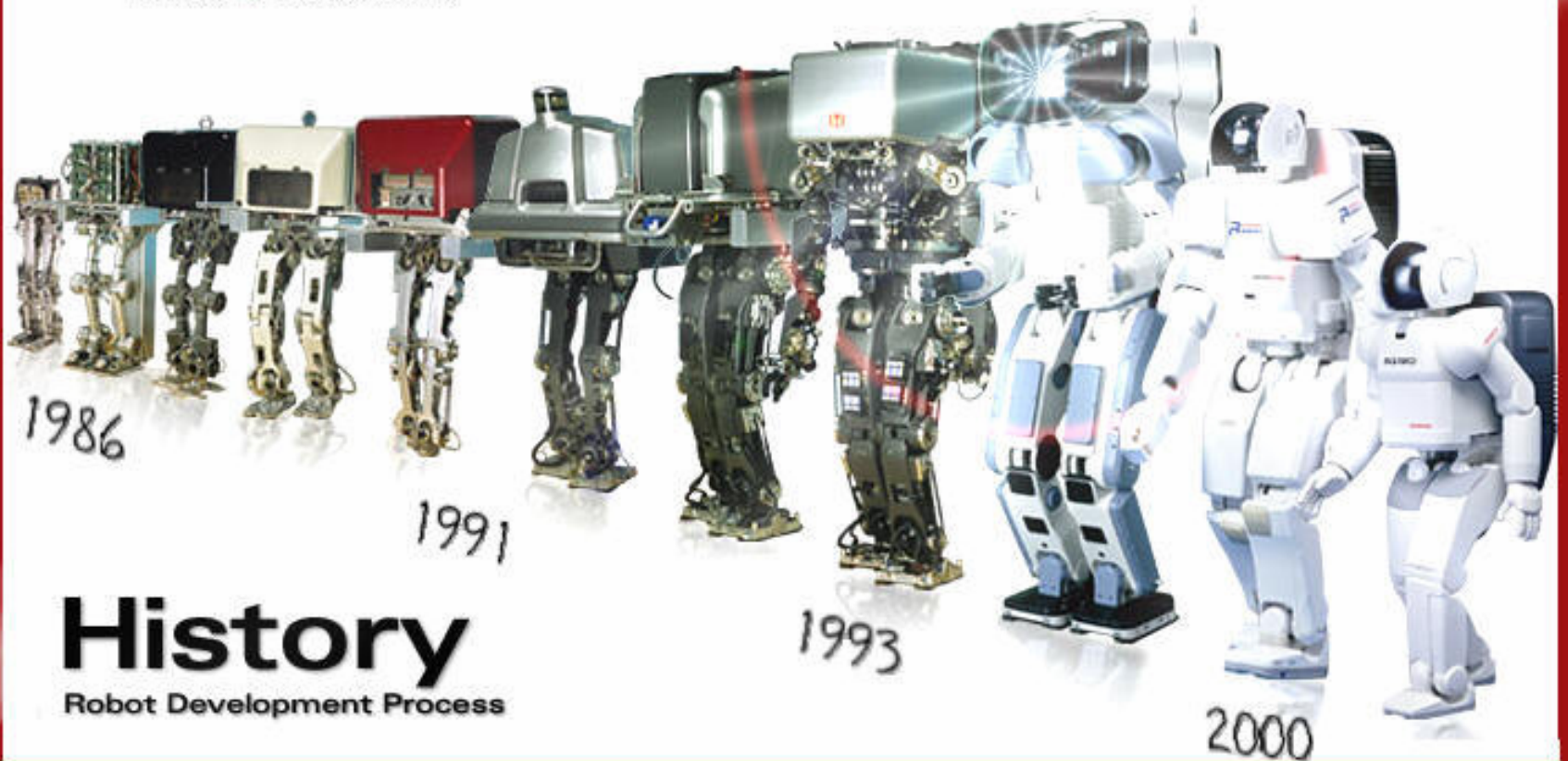
*3<sup>rd</sup> law: "A robot must protect itself from harm unless that is in conflict with the 1<sup>st</sup> and 2<sup>nd</sup> law".*

[\*] I. Asimov, *Robots and Empire*, Doubleday & Co., NY 1985, p.291

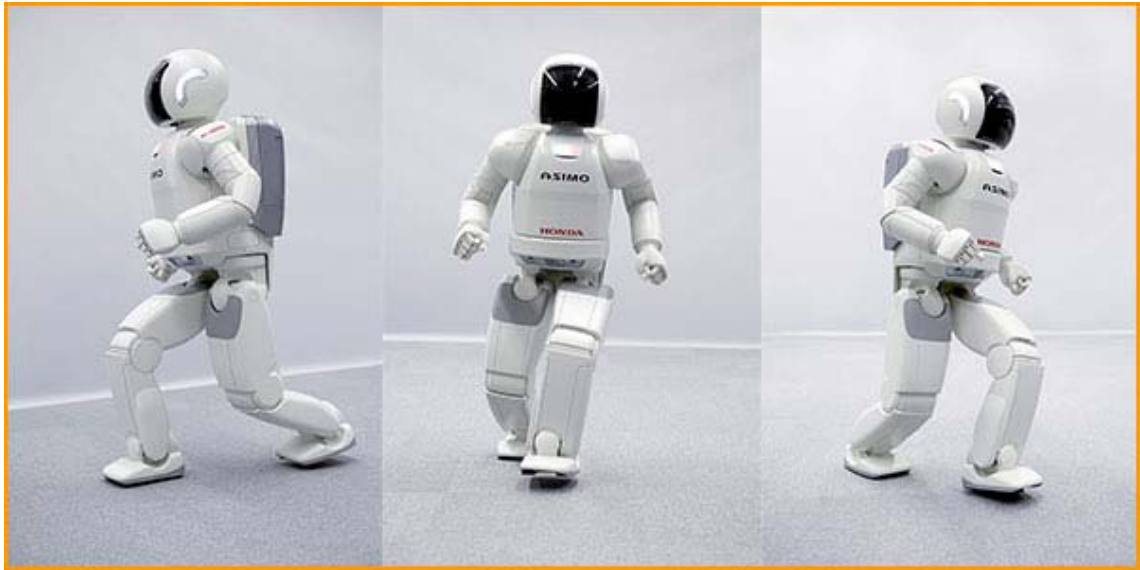


**ASIMO**  
The Honda Humanoid Robot ASIMO

*"While we were sleeping"*



**History**  
Robot Development Process



## Robot with soft hands chats, serves meal

<http://www.reuters.com/article/email/idUSN2747274920071>

127 (Tue Nov 27, 200)

TOKYO (Reuters) - A pearly white robot that looks a little like E.T. boosted a man out of bed, chatted and helped prepare his breakfast with its deft hands in Tokyo Tuesday, in a further sign robots are becoming more like their human inventors.

- Twendy-One, named as a 21st century edition of a previous robot, Wendy, has soft hands and fingers that gently grip, enough strength to support humans as they sit up and stand, and supple movements that respond to human touch.

It can pick up a loaf of bread without crushing it, serve toast and help lift people out of bed. "It's the first robot in the world with this much system integration," said Shigeki Sugano, professor of mechanical engineering at Waseda University, who led the Twendy-One project (<http://twendyone.com>) and demonstrated the result on Tuesday. "It's difficult to balance strength with flexibility."

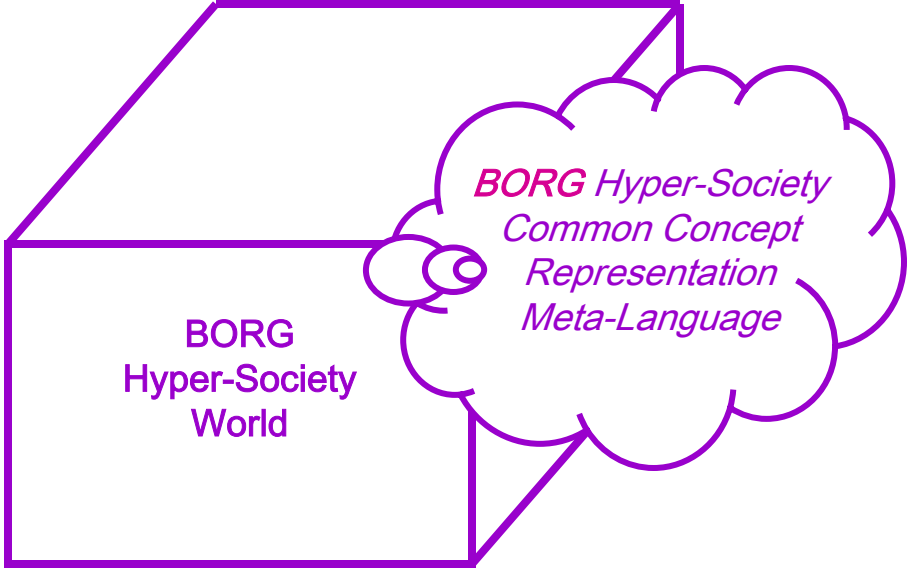


The robot is a little shorter than an average Japanese woman at 1.5 m (5 ft), but heavy-set at 111 kg (245 lb). Its long arms and a face shaped like a giant squashed bean mean it resembles the alien movie character E.T. Twendy-One has taken nearly seven years and a budget of several million dollars to pull together all the high-tech features, including the ability to speak and 241 pressure-sensors in each silicon-wrapped hand, into the soft and flexible robot.

- The robot put toast on a plate and fetched ketchup from a fridge when asked, after greeting its patient for the demonstration with a robotic "good morning" and "bon appetit." Sugano said he hoped to develop a commercially viable robot that could help the elderly and maybe work in offices by 2015 with a price tag of around \$200,000. But for now, it is still a work in progress. Twendy-One has just 15 minutes of battery life and its computer-laden back has a tendency to overheat after each use. "The robot is so complicated that even for us, it's difficult to get it to move," Sugano said. (Reporting by Yoko Kubota; Editing by Jerry Norton)



A humanoid robot, without its facial skin, is displayed at Japan's largest robot convention in Tokyo on Nov. 28, 2007.

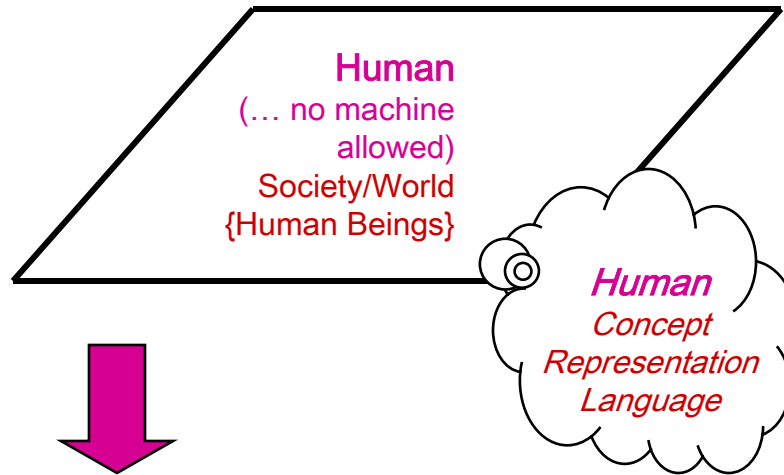


BORG  
Hyper-Society  
World

*BORG Hyper-Society  
Common Concept  
Representation  
Meta-Language*

... or an alternative →

*No Robots !!! No Cyborgs !!!*



***The GALACTIC EMPIRE:***

- ❑ Robots banned !.... but Eto Demerzel.
- ❑ Hari Seldon's Psychohistory.
- ❑ The FOUNDATION => ***SECOND GALACTIC EMPIRE***

- **IEML** could be used to describe relations and behaviours in the SEM (SentienceEnergyMatter) space, e.g. for the description/design of *iRobots* and *iRobot* Sentience and of *Cyborgs* and cyb-Sentience.
  
- **Melding Mind and Machine Mind** control is generally regarded as scary, conjuring up "The Manchurian Candidate" and other depictions of brainwashing. But recent refinements of brain-machine interfaces may redefine the expression to mean something totally different. Read about this technology at <http://bmsmail3.ieee.org:80/u/11957/02337053>

L.E. Modesitt Jr., Adiamante, Tom Doherty Associates, Inc., NY, 1996

*ISBN: 0-812-54558-3*

pp. 44 => "Soon there was no telling where the thoughts of the human ended and the thoughts of the machine began, and the new human-cybs sent their thoughts along the wires and the circuits and around all of Old Earth, and they began to insist that everyone send thoughts and ideas along the fibrelines."

- **Study into near-death experiences** = A large study is to examine whether cardiac arrest patients really do have near-death; out of body; experiences.

***<http://news.bbc.co.uk/go/em/fr/-/2/hi/health/7621608.stm>***

- **Can robots 'think' like humans?** Computers take the Turing Test to see if judges believe the machines are human during instant message conversations. Scientist Alan Turing devised the experiment in the 1950s. Judges having text conversations must guess whether they are talking to a human or computer. If a computer is mistaken for a human more than 30% of the time it passes the test and can be assumed to have passed a significant milestone in artificial intelligence.

***<http://news.bbc.co.uk/2/hi/technology/7666836.stm>***

***Les automates intelligente robotique, vie artificielle, réalité virtuelle***

<http://www.admiroutes.asso.fr/larevue/2003/40/espece.htm>

**2003 Odyssée de l'espèce**

par *Jean-Paul Baquiast et Alain Cardon*

*09/012/03*

L'homme descend de primates aujourd'hui disparus, ses si proches ancêtres, et la société humaine actuelle, extraordinairement technologique, a suivi une progression qui est remarquable à deux égards, à la fois par sa rapidité de développement et par son amplitude. Il y a deux évolutions : l'une génétique, qui permet l'émergence de nouveaux genres, et une autre, sociale et technologique, qui permet le développement de multiples structures et de multiples objets, par accumulation, transformation, combinaison, en maîtrisant l'espace et en utilisant le temps.

>> **Nous, les hommes d'aujourd'hui, nous avons le choix - que n'ont sans doute pas eu en leur temps les néandertaliens confrontés aux sapiens.** Nous pouvons vouloir rester tels que nous sommes, émerveillés de nos technologies très utilitaires, contents de nos défauts comme de nos qualités, et songeant à nous cloner à répétition. Nous pouvons au contraire choisir le saut dans un avenir encore inconnu, mais qui promet d'être tout autre. ....

Si on veut éviter que face à ces nouveaux mutants le reste des humains actuels ne subisse inexorablement le sort des néandertaliens - sauf à se révolter et à tout détruire - il est donc fondamental que dès maintenant ceux qui commencent à construire le nouveau monde ne le fassent pas en se mettant au service de vieux intérêts égoïstes, avec de vieux réflexes d'exclusion et de meurtre.

**L'homo artificialis est en train de naître. Il faut absolument qu'il ne soit pas mis au service d'intérêts économiques ou militaires destructeurs, mais au service de l'évolution vers l'intelligence de la biosphère et de l'écosphère tout entière. .... Sinon, ce sera sans doute nous qui seront leurs néandertaliens. <<**

**Machines will achieve human-level artificial intelligence by 2029, a leading US inventor has predicted.**

*<http://news.bbc.co.uk/2/hi/americas/7248875.stm>*

Humanity is on the brink of advances that will see tiny robots implanted in people's brains to make them more intelligent, said Ray Kurzweil.

The engineer believes machines and humans will eventually merge through devices implanted in the body to boost intelligence and health.

....

### **Man versus machine**

"I've made the case that we will have both the hardware and the software to achieve human level artificial intelligence with the broad suppleness of human intelligence including our emotional intelligence by 2029," he said.

"We're already a human machine civilisation; we use our technology to expand our physical and mental horizons and this will be a further extension of that."

"We'll have intelligent nanobots go into our brains through the capillaries and interact directly with our biological neurons," he told BBC News.

The nanobots, he said, would "make us smarter, remember things better and automatically go into full emergent virtual reality environments through the nervous system".

**Mr Kurzweil** is one of 18 influential thinkers chosen to identify the great technological challenges facing humanity in the 21st century by the US National Academy of Engineering. => <http://www.kurzweilai.net/>



*Tiny machines could roam the body curing diseases*

## *Will Machines Become Conscious?"*

<http://www.kurzweilai.net/meme/frame.html?main=memelist.html?m=4%23688>

*Suppose we scan someone's brain and reinstate the resulting 'mind file' into a suitable computing medium," asks Raymond Kurzweil. "Will the entity that emerges from such an operation be conscious?"*

### **Gelernter, Kurzweil debate machine consciousness**

<http://www.kurzweilai.net/meme/frame.html?main=memelist.html?m=4%23688>

By Rodney Brooks, Ray Kurzweil, and David Gelernter

Are we limited to building super-intelligent robotic "zombies" or will it be possible and desirable for us to build conscious, creative, volitional, perhaps even "spiritual" machines? David Gelernter and Ray Kurzweil debated this key question at MIT on Nov. 30. (Added December 6th 2006)

### **Cyber Sapiens**

<http://www.kurzweilai.net/meme/frame.html?main=memelist.html?m=4%23688>

By Chip Walter

...We will no longer be Homo sapiens, but Cyber sapiens--a creature part digital and part biological that will have placed more distance between its DNA and the destinies they force upon us than any other animal ... a creature capable of steering our own evolution.... (Added October 26th 2006)

.....

*<http://www.kurzweilai.net/meme/frame.html?main=memelist.html?m=4%23688>*

## **Are We Spiritual Machines?**

**Introduction: Are We Spiritual Machines?**

By George Gilder and Jay W. Richards

Two philosophers, a biologist, and an evolutionary theorist critique Ray Kurzweil's prediction that computers will attain a level of intelligence beyond human capabilities, and at least apparent consciousness. Kurzweil responds to these critics of "strong AI." (Added June 18th 2002)

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*Moral, Ethical, Theological, Legal,  
Biological, Psychological Social, Economic,....  
Challenges in a BORG Hyper-Society World*

[Normal Human Partner] + [Pacemaker-fitted Human Partner]  
= [Acceptable Married (incl. Lovers) Couple]

[Normal Human Partner] + [Advanced Augmented Symbiont Partner]  
= [Acceptable Married (incl. Lovers)\_Couple] ?

[Normal Human Partner] + [Robot Partner]  
= [Acceptable Married (incl. Lovers)\_Couple] ??

**[Normal Human Partner] + [Robot Partner]  
= [Acceptable Married (incl. Lovers)\_Couple] ??**

***Will we humans one day truly love robots just like we love other humans?***

[http://blogs.spectrum.ieee.org/automaton/2008/04/08/will\\_we\\_humans\\_one\\_day\\_truly\\_love\\_robots\\_just\\_like\\_we\\_love\\_other\\_humans.html](http://blogs.spectrum.ieee.org/automaton/2008/04/08/will_we_humans_one_day_truly_love_robots_just_like_we_love_other_humans.html)

***Sex and marriage with robots? It could happen  
Robots soon will become more human-like in appearance, researcher says***

<http://www.msnbc.msn.com/id/21271545/>

By Charles Q. Choi

Special to LiveScience, updated 6:05 p.m. ET, Fri., Oct. 12, 2007

Humans could marry robots within the century. And consummate those vows.

"My forecast is that around 2050, the state of Massachusetts will be the first jurisdiction to legalize marriages with robots," artificial intelligence researcher David Levy at the University of Maastricht in the Netherlands told LiveScience. Levy recently completed his Ph.D. work on the subject of human-robot relationships, covering many of the privileges and practices that generally come with marriage as well as outside of it.

At first, sex with robots might be considered geeky, "but once you have a story like 'I had sex with a robot, and it was great!' appear someplace like Cosmo magazine, I'd expect many people to jump on the bandwagon," Levy said.

***Rent an Actroid to love and marry***

[http://blogs.spectrum.ieee.org/automaton/2008/04/09/rent\\_an\\_actroid\\_to\\_love\\_and\\_marry.html](http://blogs.spectrum.ieee.org/automaton/2008/04/09/rent_an_actroid_to_love_and_marry.html)

***Kokoro offers the Actroids for rent to greet customers and provide information  
in up-market coffee shops, office complexes, and museums or "old houses".***

<http://www.kokoro-dreams.co.jp/english/robot/act/gallery.html>

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