

# 4

## > A d a r e f l e c t i o n



**There are many different definitions of "intelligence," with each person having their own understanding of what it means. The opportunities and risks of technological simulation of the human brain are likewise viewed quite differently.**

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### **This chapter contains:**

- Information on applications and limitations of this research
- Statements from scientists
- Contrasting opinions on the topic from newspaper articles
- Recommendations for instruction

## A: Factual information

# Uses and limitations of intelligent technologies

### What is intelligence? What do we seek to achieve with technological simulation of the human brain and development of artificial intelligence?

Is it worth making investments in this area of research? What future opportunities and risks are associated with this new technology? These and similar questions can be discussed with the class.

#### Applications of Ada

Ada is an exhibition object. When Expo.02 is finished, parts of Ada can be utilised as illustrative material for schools and universities.

The Ada project is derived from fundamental research that takes elements from nature and especially from humans as a model. Although our “individual parts” are far from perfect (for instance, we cannot see as well as an eagle or detect smells as well as a dog), it is still fascinating to observe how we are able to adjust to and even shape the respective environmental conditions. The objective of the research activities consists of determining how the brain experiences and understands the world and how it makes use of this knowledge to influence its environment to its advantage. The new findings can be utilised, for instance, to enhance the interaction between humans and machines.

### Concrete applications

Potential applications of this fundamental research include:

- An intelligent floor as a directional system in public spaces. For instance, in airports where a personal symbol guides passengers where they need to go.
- Intelligent rooms in the home: Turning lights and heating on and off (environmental conservation); intelligent floor that reports when a person has fallen and is lying on the ground.
- Exercise room for the disabled (such as those suffering from autism) who have difficulties communicating with their environment.
- In the realm of technology, valuable information can be garnered for use in the control theory, which employs mathematical models for the targeted interaction of sensors and motors.

### Limitations of this branch of research

This project and the development of intelligent machines in general are subject to a number of limitations. On one hand, this is because many questions regarding the functioning of the brain remain open. On the other, the field of simulation is faced with certain technical limitations: A complex, powerful system like the human brain with billions of nerve cells cannot be reproduced with the currently available technology, as the dimensions of such an artificial system would be too great.

# Statements from the project leaders

## Visions

*“The project is a step toward intelligent machines that can set tasks and problems for themselves and then proceed to solve them.”*

**Prof. Rodney Douglas,  
Director of the Institute of Neuroinformatics**

*“The project is meant to demonstrate that technology will one day come to resemble us.”*

**Dr. Paul Verschure,  
Project Leader Ada, Institute of Neuroinformatics**

## Intelligence

*“Intelligence involves changing the world for the better.”*

**Prof. Rodney Douglas,  
Director of the Institute of Neuroinformatics**

*“We don’t exactly know what intelligence is. But it concerns how we solve problems and how we acquire knowledge about the world.”*

**Dr. Paul Verschure,  
Project Leader Ada, Institute of Neuroinformatics**

*“The unknown does not threaten us. It provokes our curiosity and reminds us of what we do not yet know. Today we are still unable to fully explain how the brain functions. And – consequently – we are not able to understand ourselves either. It is a challenge to answer the age-old question, posed long ago by Plotinus: And we, who are we anyhow?”*

**Dr. Paul Verschure,  
Project Leader Ada, Institute of Neuroinformatics**

## Fears

*“Something new always triggers a bit of fear. Will there be a sort of super robot someday that replaces humans? Heavens no! Why? Because this is a fantasy from the world of science fiction. I don’t see such a thing happening.”*

**Dr. Paul Verschure,  
Project Leader Ada, Institute of Neuroinformatics**

*“I believe there’s always something frightening about knowledge because it can be used for good and for evil.”*

**Prof. Rodney Douglas,  
Director of the Institute of Neuroinformatics**

## Future

*“I have a very positive view of how the world will change. For me, there’s no compelling argument as to why humans should necessarily be the most important creature.”*

**Dr. Paul Verschure,  
Project Leader Ada, Institute of Neuroinformatics**

*“Will it be possible to build machines that can interact intelligently with the world? Yes, by all means.”*

**Prof. Rodney Douglas,  
Director of the Institute of Neuroinformatics**

*“For instance, it will be possible for a person to have a difference of opinion with his car. You want to go left, while the car wants to go right. And you have to think it over. Why do you have to think it over and discuss it? So that the car will learn.”*

**Dr. Paul Verschure,  
Project Leader Ada, Institute of Neuroinformatics**

# Statements from optimists and pessimists

## Ray Kurzweil, Futurologist

“The first computers were monsters that filled the entire hall, while today we stow them in our bags, and in ten years we will project images from our eyeglasses or contact lenses directly onto the retina. The electronics for all this will be integrated in our clothing. We will walk about and always stay online. In 2030, we will send nanobots – robots the size of our blood cells – into our bloodstream where they will travel to our brain and communicate directly with our neurons.”

(From: NZZ Folio, December 2001, p. 51–56: **Der Griff nach dem Gehirn.** Interview with Ray Kurzweil.)

“In the year 2030, just one dollar’s worth of computing capacity will have the same functional ability as the entire human brain. As far as hardware is concerned, computers will hence possess much more computing power than humans. Yet in addition – using brain scanning or other methods – we will also develop software that reproduces all the facets of human intelligence in the computer, including the ability to understand and sense complex correlations and emotions. Machines will then be intelligent in the human sense.”

(From: Die Zeit, 3 January 2002, p. 20: **Zu Besuch in fremden Köpfen. Alles wird gut:** Der amerikanische Futurologe Ray Kurzweil über die virtuelle Welt der Zukunft. Ein ZEIT-Gespräch.)

## Peter Stamm, Writer and Journalist

“In the 1970s, recognised scientists prophesied that computer intelligence would overtake that of humans by the year 2000. Yet today, computers are still unable to do anything beyond what they used to: compute. Now they just do it faster. For there has never been a computer built that even approaches something like intelligence. Quite simply because no one has a clue regarding how intelligence functions, how emotions are created, what consciousness is.

Computers can play chess because chess functions according to simple rules. Yet the world does not function according to rules. When it comes to understanding a sentence or even having an emotion, computers fail miserably.”

(From: Peter Stamm: **Dumme Futurologen. Dumme Computer.** Column in “Metropol,” 7 January 2002, p. 7.)

“There is probably no other scientific field that has promised as much as Artificial Intelligence (AI). Back in 1971, a Cambridge University report delivered to the British Government stated: ‘In no area of AI have the discoveries to date actually led to the promised effects.’ At the time, recognised scientists prophesied ‘that the possibilities of the 1980s would include universal intelligence with a human knowledge base’ and that it should be kept in mind that computer intelligence would overtake that of humans by 2000 – a prophecy that had already been made fifteen years prior. Well, they were mistaken, these esteemed information technology experts. Yet that does not stop their successors today from making predictions that are equally preposterous. As long as the date is far enough in the future, the same sort of rubbish can be proclaimed again and again. Like the astrologists, the artificial intelligentsia merrily speculate away and trust that in twenty years no one will still remember their fantasies.”

(From: Peter Stamm: **Vielleicht werden sie gefährliche Dinge miteinander tun.** In “Nebelspalter,” 10 July 1995.)

## B: Recommendations for instruction



Sheets with border can be copied and distributed to students.

*In selecting texts, we recommend the following assignments and approach to the topic:*

### Role-playing

- One half of the class reads the excerpts from the Ray Kurzweil interviews, while the other half reads sections of the columns by Peter Stamm. The two groups each select a speaker to represent their respective viewpoint and then the two engage in a debate. They may interrupt the discussion for a “pit stop” to consult with the others in their group.
- The class pretends to be the board of directors for a large company that has to decide whether to invest in an artificial intelligence project.

### Essay

- The students write an argumentative text based on selected texts.
- The students write a letter to the editor regarding one of the newspaper texts.

### Discussion

- What is intelligence?
- Do we want machines to be intelligent?
- Opportunities and risks of artificial intelligence
- How can we influence the development of artificial intelligence?
- Which applications of these technologies are the students able to imagine?

### Further suggestions

The topic “human machine” can be addressed via literary texts, such as **"Der Sandmann"** by E.T.A. Hoffmann.

There are also a number of films that furnish a basis for discussion. One such example is Stanley Kubrick's science fiction film **"2001: A Space Odyssey"** from the year 1968, which possesses a certain artistic merit as well. In this film, which typifies the genre, an astronaut in a research spaceship is confronted with a computer programmed to give the impression it has emotions. This is confirmed at the conclusion of the film when the computer wants to stop the astronaut from turning it off.

It is also possible to discuss various (metaphorical) notions of the brain and their historical and social context. Düweke's **"Kleine Geschichte der Hirnforschung"** is quite helpful in this regard.

## Bibliographic information

- NZZ Folio: **Erinnern und Vergessen.** Blackbox Gedächtnis. Dezember 2001.
- Düweke, Peter: **Kleine Geschichte der Hirnforschung.** Von Descartes bis Eccles. München 2001.
- Goleman, Daniel: **Emotionale Intelligenz.** Aus dem Amerikanischen von Friedrich Gries. München 1997.
- E.T.A. Hoffmann: **Der Sandmann.** Ditzingen 2000.

## Newspaper articles

- Peter Stamm: **Dumme Futurologen. Dumme Computer.** Column in “Metropol,” 7 January 2002, p. 7.
- Peter Stamm: **Vielleicht werden sie gefährliche Dinge miteinander tun.** In “Nebelspalter,” 10 July 1995.
- Die Zeit , 3 January 2002, p. 20: **Zu Besuch in fremden Köpfen. Alles wird gut:** Der amerikanische Futurologe Ray Kurzweil über die virtuelle Welt der Zukunft. Ein ZEIT-Gespräch.
- NZZ Folio, December 2001, p. 51–56: **Der Griff nach dem Gehirn.** Interview with Ray Kurzweil.

The above excerpted newspaper texts can be downloaded from Ada’s website: [www.ada-exhibition.ch](http://www.ada-exhibition.ch)

Newspaper articles about Ada can be found at:

[www.ini.unizh.ch/~expo/1\\_1\\_1\\_0.html](http://www.ini.unizh.ch/~expo/1_1_1_0.html) under News/Media

## Links

### **Künstliche Intelligenz – Überlegungen zu Churchlands «Die Seelenmaschine»**

<http://amor.rz.hu-berlin.de/~h0444ixy/texte/intelligenz.html>

### **Künstliche Intelligenz – eine Einführung (mit Erläuterungen zu Eliza)**

[www.uni-bamberg.de/~ba2dp2/roboter/referate/schaub-ki.pdf](http://www.uni-bamberg.de/~ba2dp2/roboter/referate/schaub-ki.pdf)