

# Science, Technology and the Future of Ethics

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# Technology & Morality

- Technology is the whip that drives changes in: Morality, Law, and Political Theory.
- As the Technology changes, our concept of the morality of situations must change.
- Technological progress moves us to ever higher states of Morality.



# Morality?

- “We are discussing no small matter, but how we ought to live.”
  - ◆ Socrates
- Conforming to a standard of what is right and good.
- A simple uncontroversial definition of what morality is turns out to be impossible.



# A few examples are:

- The Telephone
- The Automobile
- The Television
- The Computer
- The Advances in Medicine
- The Internet.



# Methods of Communication

- Stone Tablets
- Papyrus
- Gutenberg
- Radio, TV - one  $\Rightarrow$  many.
- Telephone - one  $\Leftrightarrow$  one.
- Internet - many  $\Leftrightarrow$  many.
- The Internet represents the teleology of all communications systems.



# Technology ⇒ Morality

- The situation of Technology implying Morality is fuzzied by the fact that we have a history of Morality when the Technology changes.
- Technological advancements in reproductive Technology could change the landscape of the abortion debate.



# Computing History

- Mechanical Computing Devices
  - ◆ 1900 Analytical Engine
  - ◆ 1919 IBM Tabulator
- Electromechanical (Relay Based) Computers
  - ◆ 1939 Zuse 2
  - ◆ 1940 Bell Calculator Model 1
  - ◆ 1941 Zuse 3



# Computing History

- Vacuum-Tube Computers
  - ◆ 1943 Colossus
  - ◆ 1946 ENIAC
  - ◆ 1951 Univac I
  - ◆ 1953 IBM 701
  - ◆ 1955 IBM 704



# Computing History

## ■ Discrete Transistor Computers

- ◆ 1958 Datamatic 1000
- ◆ 1959 Mobidic
- ◆ 1960 IBM 1620
- ◆ 1961 DEC PDP-4
- ◆ 1964 CDC 6600
- ◆ 1965 DEC PDP-8

1958 Univac II

1959 IBM 7090

1960 DEC PDP-1

1962 Univac III

1965 IBM 1130

1966 IBM 360 Model 75



# Computing History

## ■ Integrated Circuit Computers

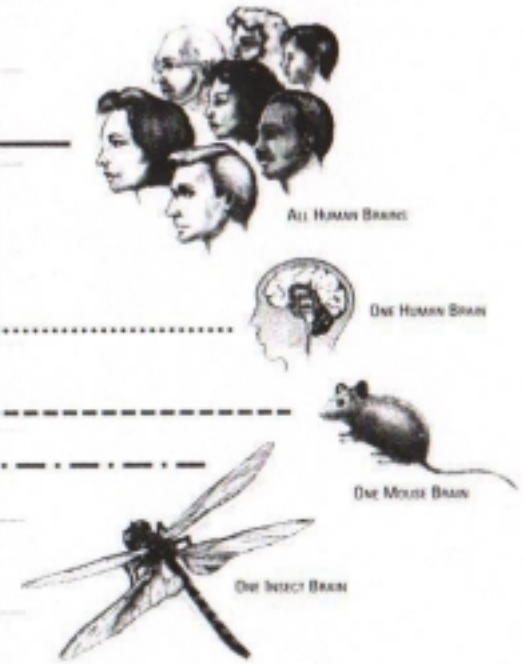
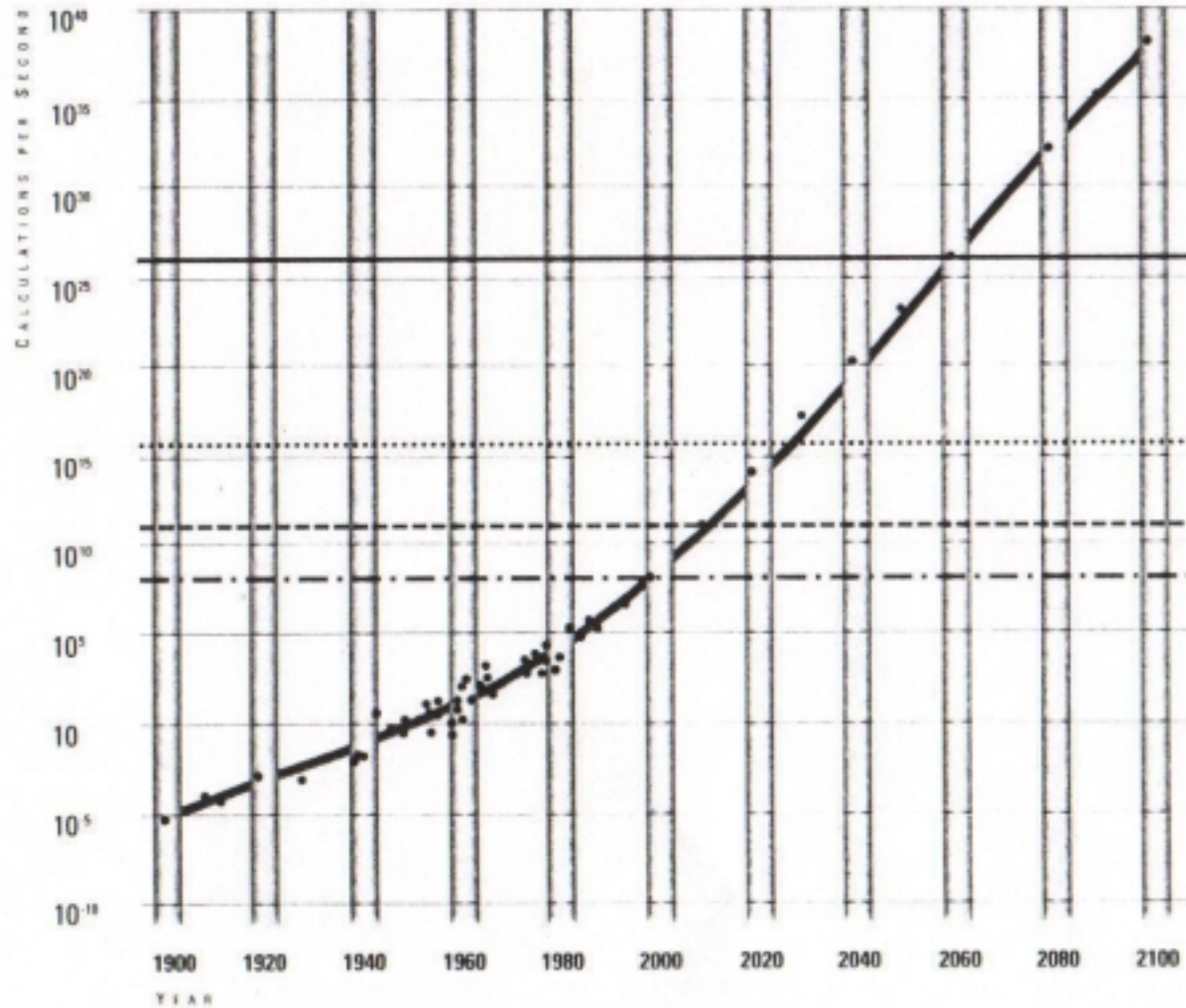
- ◆ 1968 DEC PDP-10
  - ◆ 1973 Data General Nova
  - ◆ 1976 DEC PDP-11 / 70
  - ◆ 1977 Apple II
  - ◆ 1980 Sun-1
  - ◆ 1982 Compaq Portable
  - ◆ 1984 Apple Macintosh
  - ◆ 1987 Apple Mac II
  - ◆ 1996 Pentium PC
- 1973 Intellec-8
  - 1975 Altair 8800
  - 1977 Cray 1
  - 1979 DEC VAX 11 / 780
  - 1982 IBM PC
  - 1983 IBM AT-80286
  - 1986 Compaq Deskpro
  - 1993 Pentium PC
  - 1998 Pentium II PC



# Exponential Growth in Computing

THE EXPONENTIAL GROWTH OF COMPUTING, 1900-2100

\$1,000 OF COMPUTING BUYS



# Technology Milestones

- **1953**
  - The chemical structure of the DNA molecule is discovered by James D. Watson and Francis H. C. Crick.
- **1959**
  - Xerox introduces the first commercial copier.
- **1971**
  - The first pocket calculator is introduced. It can add, subtract, multiply, and divide.



# Technology Milestones

- **1977**
  - For the first time, a telephone company conducts large-scale experiments with fiber optics in a telephone system.
- **1979**
  - Dan Bricklin and Bob Frankston establish the personal computer as a serious business tool when they develop VisiCalc, the first electronic spreadsheet.



# Technology Milestones

- **1989**
  - Intel introduces the 16-megahertz (MHz) 80386SX, 2.5 MIPS microprocessor.
- **1997**
  - Deep Blue defeats Gary Kasparov, the world chess champion, in a regulation tournament.



# Technology Milestones

- **1997**
  - Dolly.
- **1999**
  - DNA Structure of Chromosome 22 completely mapped.
- **2000**
  - One GigaHertz Processor by both AMD, Intel.



# Technology Predictions

- **2009\***
  - A \$1,000 personal computer can perform about a trillion calculations per second.
  - The majority of text is created using continuous speech recognition. Also ubiquitous are language user interfaces (LUIs).

\* “The Age of Spiritual Machines”, Ray Kurzweil, © 1999



# Technology Predictions

- **2009**

- Most routine business transactions (purchases, travel, reservations) take place between a human and a virtual personality. Often, the virtual personality includes an animated visual presence that looks like a human face.
- Although traditional classroom organization is still common, intelligent courseware has emerged as a common means of learning.



# Technology Predictions

- **2009**

- Translating telephones (speech-to-speech language translation) are commonly used for many language pairs.
- Bioengineered treatments for cancer and heart disease have greatly reduced the mortality from these diseases.



# Technology Predictions

- **2019**

- A \$1,000 computing device (in 1999 dollars) is now approximately equal to the computational ability of the human brain.
- Computers are now largely invisible and are embedded everywhere -- in walls, tables, chairs, desks, clothing, jewelry, and bodies.



# Technology Predictions

## ■ 2019

- High-resolution, three-dimensional visual and auditory virtual reality and realistic all-encompassing tactile environments enable people to do virtually anything with anybody, regardless of physical proximity.
- Automated driving systems are now installed in most roads.
- People are beginning to have relationships with automated personalities and use them as companions, teachers, caretakers, and lovers.



# Technology Predictions

- **2029**

- A \$1,000 (in 1999 dollars) unit of computation has the computing capacity of approximately 1,000 human brains.
- Permanent or removable implants (similar to contact lenses) for the eyes as well as cochlear implants are now used to provide input and output between the human user and the worldwide computing network.



# Technology Predictions

## ■ 2029

- Direct neural pathways have been perfected for high-bandwidth connection to the human brain. A range of neural implants is becoming available to enhance visual and auditory perception and interpretation, memory, and reasoning.
- Automated agents are now learning on their own, and significant knowledge is being created by machines with little or no human intervention. Computers have read all available human and machine-generated literature and multimedia material.



# Technology Predictions

## ■ 2029

- There is almost no human employment in production, agriculture, or transportation.
- There is a growing discussion about the legal rights of computers and what constitutes being "human."
- Machines claim to be conscious. These claims are largely accepted.



# Technology Predictions

- **By the year 2099**
  - There is a strong trend toward a merger of human thinking with the world of machine intelligence that the human species initially created.
  - There is no longer any clear distinction between humans and computers.
  - Machine-based intelligences (pseudo-humans) vastly exceeds those still using native neuron-cell-based computation.



# Technology Predictions

- **By the year 2099**
  - Even among those human intelligences still using carbon-based neurons, there is ubiquitous use of neural-implant technology, which provides enormous augmentation of human perceptual and cognitive abilities. Humans who do not utilize such implants are unable to meaningfully participate in dialogues with those who do.



# Technology Predictions

- **By the year 2099**
  - Because most information is published using standard assimilated knowledge protocols, information can be instantly understood. The goal of education, and of intelligent beings, is discovering new knowledge to learn.
  - Life expectancy is no longer a viable term in relation to intelligent beings.



# Deductions:

- We must get smarter at how we cope with technology.
- If we don't keep our eyes open and our senses tuned, we will be left in the dust by the railroad of technology. There is no stopping it. We **must** learn to deal with it.



# Deductions:

- Traditional ethical theories of Utilitarianism, Deontology, Rights, Justice, Virtue, etc. will get dimmed and blurred by the light of technology.
- We must reserve a certain percentage of our R&D budgets for analyzing the effects of technology on society.
- Our notion of Morality must evolve with the Technology.



# Morality?

- “We are discussing no small matter, but how we ought to live.”
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# Ethics?

- The systematic application of moral principles.



# Three key ethics questions

- How *should* I **be**? (What character traits should I display by habit?)
- How *should* I **act**? (How do I make the 'right' decisions?)
- What gets in the way?



# Key point for everyone

‘Ethics’ is not just something to consider *after* we make a moral mistake and have damaged our reputations, careers, families, or society.



# Ethics is an **opportunity** to

- do it right the first time
- avoid big problems later
- treat people well
- live our values and codes
- advance ourselves/others
- use technology to enhance our moral lives



# Developing personal ethics

**Values/Virtues:**

*Who am I?*

**Conscience:**

*How do I make decisions?*

Person

**Life Skills**

*What gets in the way?*



# 'Life Skills'

- skills to overcome stumbling blocks
- communication, anger control, managing impulses, refusal, coping, cooperating, overcoming, etc.



# 'Moral imagination' skills

- **Sensitivity:** recognize the ethical issue
- **Judgment:** decide 'the right thing'
- **Commitment:** do it
- **Courage:** do it, despite the cost





# Basics of Ethical Decision Making



# Conclusions:

- “Let us hope that a generation from now we will view the Internet as a blessing that provides every person with a trusted cyber-lieutenant and not as an Orwellian company store to which everyone is bound.” (Scientific American, Oct 1999, pg-115.)



# Thank You !!!

- <http://www.scu.edu/Ethics>

