How Science inspires Science-fiction

Pascal Bernaud
Peter Schattschneider

CentraleSupelec Paris
and
Institute of Solid State Physics,
Vienna University of Technology

with contributions by
Ann-Lenaig Hamon, CSP

ATHENS course and LVA 138.027
summer term 2017, TU Wien

$$U = \frac{r'^2}{2} + \frac{l^2}{2r^2} - \frac{M\,G}{r}$$

TU 2017, LVA 138. 027 How Science inspires Science Fiction

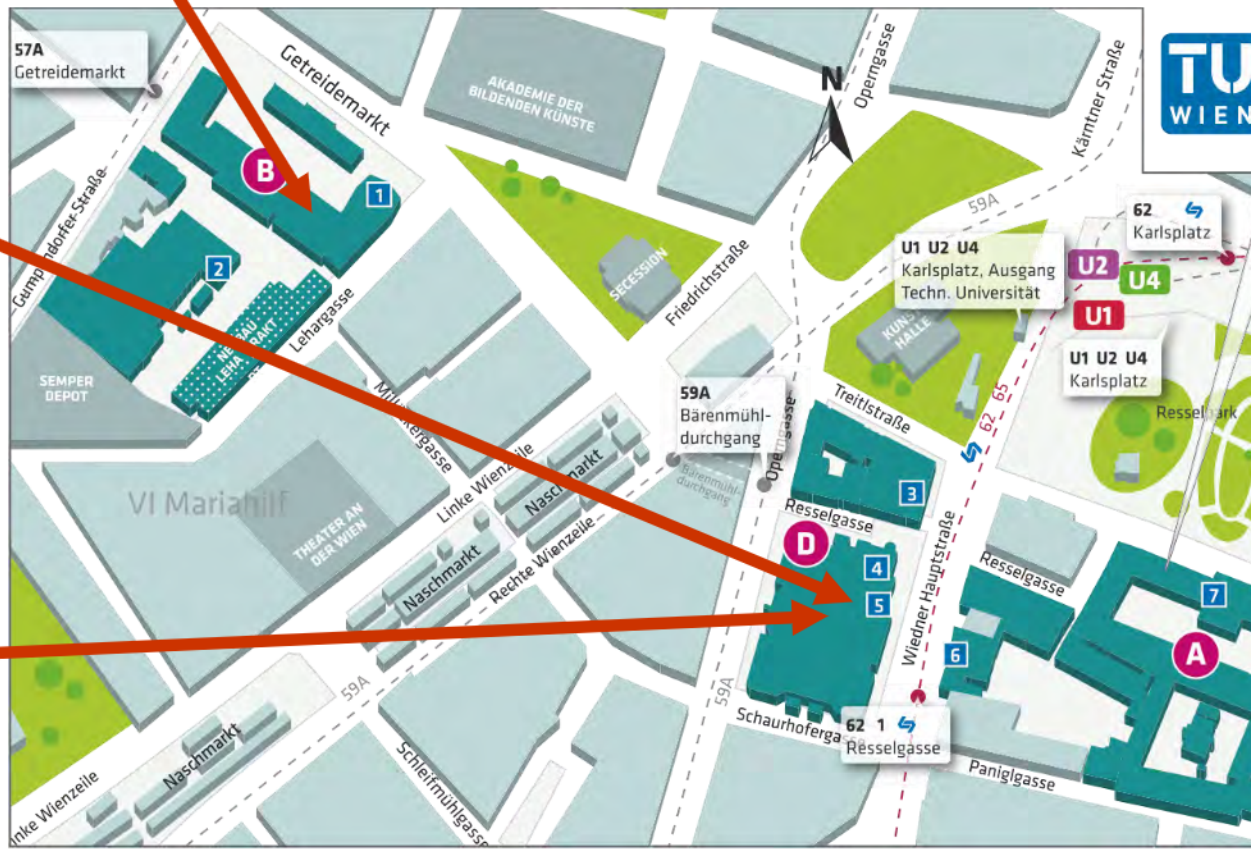
Lecture
Mon - Wed 13. - 15. 3. 12:30 - 16:30
Sem. room BA 10a G02
10. floor BA building, Getreidemarkt 9

ATHENS students

Preparation (self-contd.)
Thu 16.3. 10:00 - 12:00

Preparation of ppt
12:00 - 17:00
PC room ZID F2
2. floor Freihaus yellow
Wiedner Hauptstr. 8-10
user: to be announced
pwd: to be announced
assistance from 13:00

Exam: presentations
Fri 12:30 - 16:00
Sem. room DB 07 E11
7. floor Freihaus yellow
Wiedner Hauptstr. 8-10



TU 2017, LVA 138. 027 How Science inspires Science Fiction

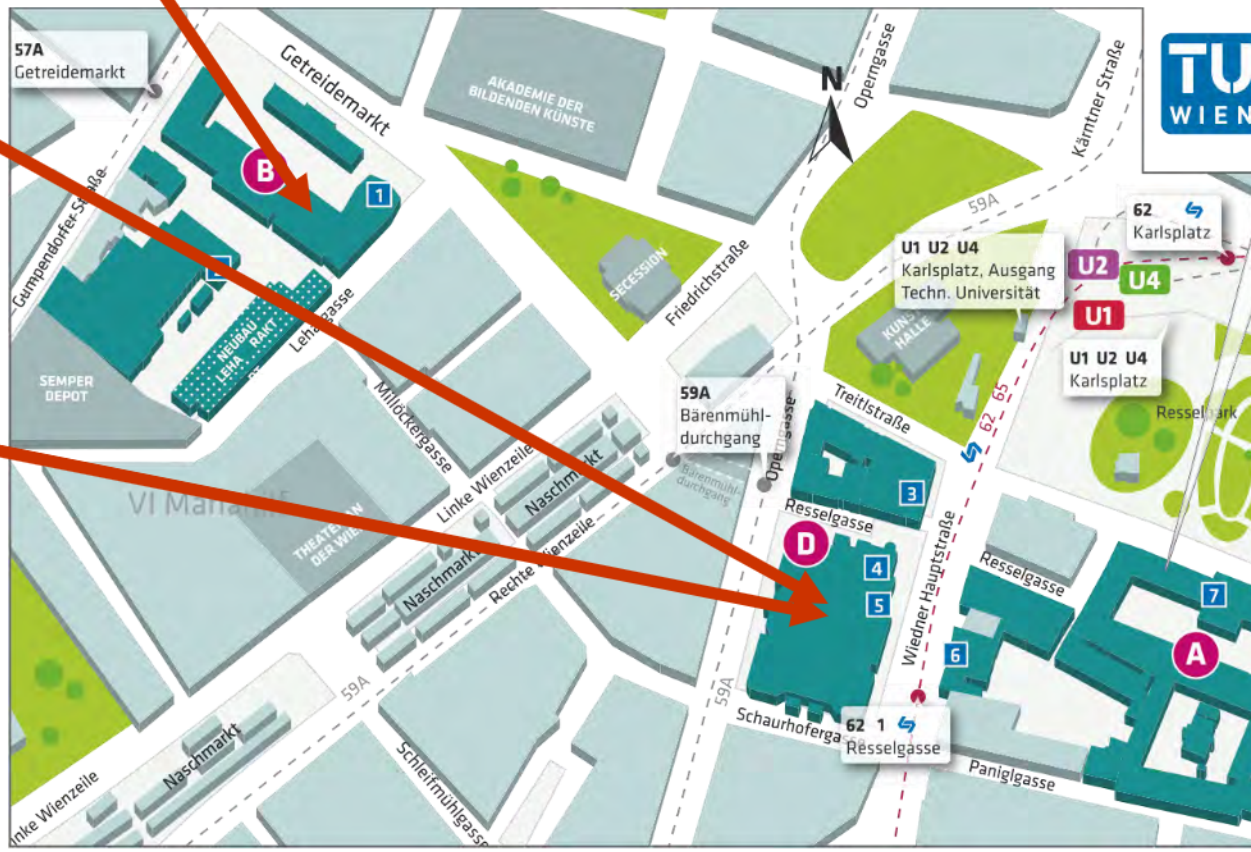
Lecture
Mon - Wed 13. - 15. 3. 12:30 - 16:30
Sem. room BA 10a G02
10. floor BA building, Getreidemarkt 9

Lecture
Thu 16.3. 14:00 - 16:00
Sem. room DB 07 E11
7. floor Freihaus yellow
Wiedner Hauptstr. 8-10

Preparation & questions
Tue 28.3. 12:00 - 14:00
Tue 4.4. 14:00 - 16:00

Exam: presentations
Tue 16.5. 10:00 - 15:00
Sem. room DB 09 E23
9. floor Freihaus yellow
Wiedner Hauptstr. 8-10

TU students



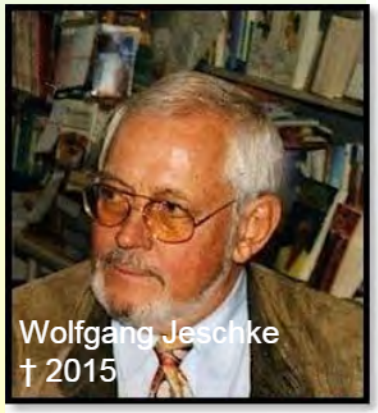
Contents

- Introduction: What is Science Fiction; predictions in science and SF; examples of calculations
- Readings and discussion:
  - H. G. Wells: The new accelerator
    - Scaling, similarity theory
  - A. C. Clarke: Wind from the sun
    - Space travel, propulsion
  - L. Niven: Neutron star
    - Gravity and theory of relativity
- Working examples (in small groups)
- Presentation

Definitions


Ben Bova, * 1932


John Brunner, † 1995


Wolfgang Jeschke
† 2015

- The ultimate role of Science Fiction: to act as an interpreter of science to humanity (B. Bova, SF author and editor)
- The raison d'être of Science Fiction is the simple business of entertainment (J. Brunner, SF author)
- Science Fiction is all that can be sold as Science Fiction (W. Jeschke, SF editor, private communication, and 28 others*)

*http://en.wikipedia.org/wiki/Definitions_of_science_fiction

SF and technology

Typical question from the public:

"When can we build something like this?"

Answer:

"This is not in the *foreseeable* future. Today it is still unknown ***if*** such visions are even achievable ...

but ...

new possibilities continue to emerge from science. NASA established the '***Breakthrough Propulsion Physics Project***' to pursue these possibilities."

cancelled

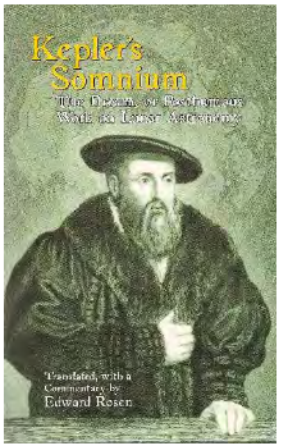
Space Transportation Project Office

Marc G. Millis
15-Jun-01

SF has not much to do with our future ...

... rather concerning actual dreams and fears

A short history: the predecessors



- Before 20. century:
  - 1200 B.C. Gilgamesch
  - 1518 Thomas Morus: Utopia
  - 1634 Johannes Kepler: Somnium
  - 1656 Cyrano de Bergerac: Histoire comique des états et empires de la lune
  - 1865 Jules Verne: De la terre à la lune

J. Verne vs. H. G. Wells

J. Verne, 1889; (Gilles Mermét, Bibliotheques Amiens Métropoles)

Technological extrapolation

What - if ?

JULES VERNE

BORN / DIED **1828-1905**

NATIONALITY **French**

KEY WORKS ***Voyage au centre de la terre, De la terre à la lune, Autour de la lune, Vingt milles lieues sous les mers, L'île mystérieuse, Paris au XXe siècle***

NOTABLE WORK

Published for the first time ninety years after its author died, *Paris au XXe siècle* [Paris in the 20th century] is an early and unusual Verne novel. It is set in a Paris where life revolves around the pursuit of wealth. People crowd onto an overburdened Metro system each day, communicate with each other by machines that closely resemble fax machines, and live impoverished lives. Hetzel rejected the novel, saying that it was too extreme and depressing, which may explain the optimistic tone of Verne's other work.

PARIS IN THE 20TH CENTURY

Alien colonists
The invading Martians of The War of the Worlds *were intended to parallel human empire-builders here on Earth, The oldest version of the alien invasion story, it has been used ever since.*

H.G. WELLS

BORN / DIED **1866-1946**

OTHER NAME **Reginald Bliss**

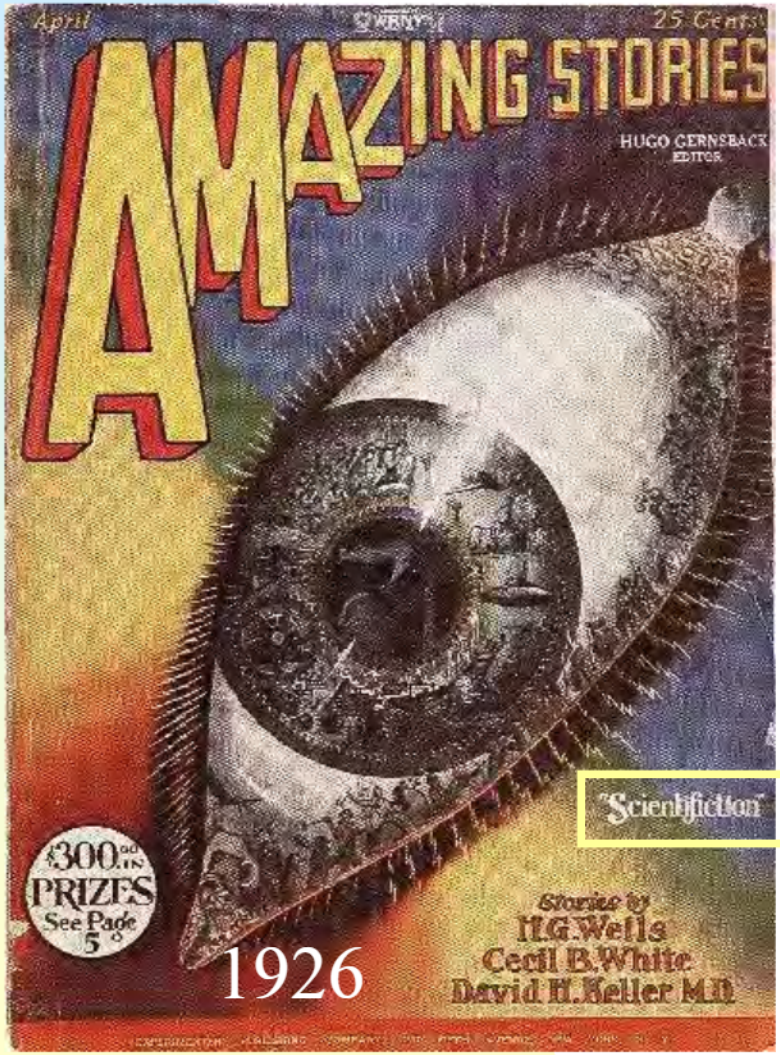
KEY WORKS ***The Time Machine, The Island of Doctor Moreau, The Invisible Man, The War of the Worlds***

The time machine

1956

2010

A short history: 20. century



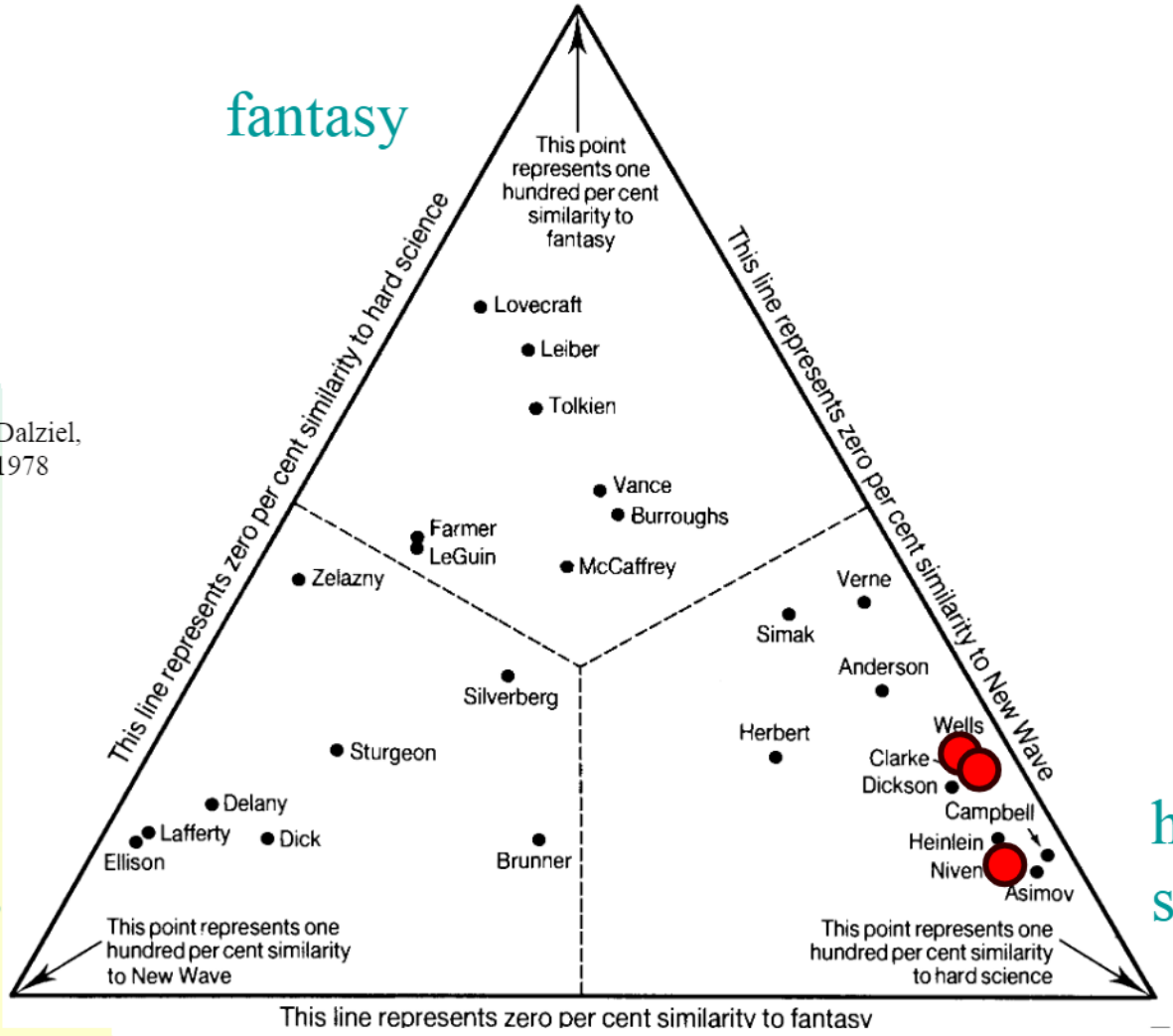
- 1911 Hugo Gernsback: Modern electrics
- 1926 Hugo Gernsback: Amazing stories
- 1940 - 1950: the golden age. Predominantly US authors:
  - I. Asimov
  - R. Heinlein
  - A. Clarke

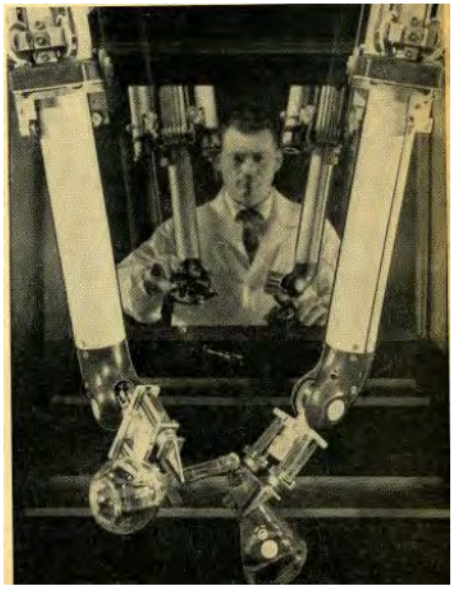
The big three

- .....

The SF phase diagram

William Sim Bainbridge and Murray Dalziel,
Science Fiction Studies vol 5, part 2, 1978





Visions and predictions

Has SF been realized?

Waldo : a controlled robotic device, e.g. for treatment of nuclear material. (Marvin Minsky, MIT, from R. Heinlein 1942 « Waldo »)

Cyberspace : William Gibson 1984 « Neuromancer »

Virtual reality: Philip K.Dick 1966, -> « Total Recall »

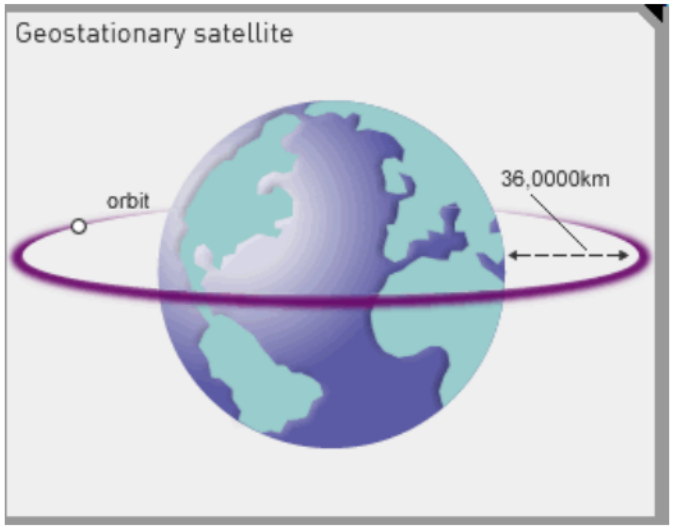
Moon landing: W. von Braun, referring to H. Dominik

Jules Verne: see later

Geostationary satellites

A. C. Clarke*

Still, I take pride in the fact that communications satellites are placed exactly where I suggested in 1945, and the name "Clarke Orbit" is often used (if only because it's easier to say than "geostationary orbit").
A. C. Clarke, 2001



*) Extra-Terrestrial Relays — Can Rocket Stations Give Worldwide Radio Coverage?" *Wireless World* magazine, 1945.

Cleve Cartmill (1908-1964) *Deadline*, 1944

During the Manhattan project (1942-1945) Astounding Science Fiction, edited by John W. Campbell.

Army of Sixa will get atomic bomb in Nilreb in Ynamre.

All is very similar of what we know about the atomic bomb. Fearing a security breach, the FBI began an investigation into Cartmill, Campbell and some of their acquaintances. It appears that the authorities eventually accepted the explanation that the story's material had been gleaned from unclassified sources, but as a precautionary measure they requested that Campbell should not publish any further stories about nuclear technology for the remainder of the war.

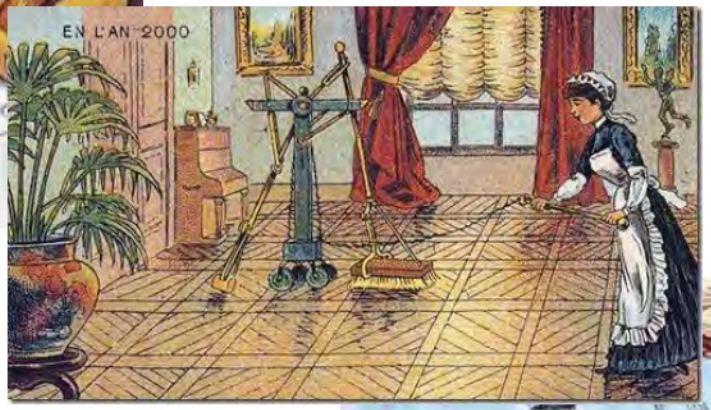
New devices invented from Sci-Fi

E-paper Newspaper	Minority Report (Movie)	Spielberg	2002
Epileptigenic Ray	Sixth Column	MacDonald	1941
EPR Phone	Mariposa	Bear	2009
Erased Memory - forget about it	We Can Remember It For You Wholesale	Dick	1966
Ersatz Window - fake view of outside	Galactic Pot-Healer	Dick	1969
Escalladder - a ladder you can ride	Crashlander	Niven	1994
Escape Pod - check the pod, Darth	Star Wars	Lucas	1976
E-Sheet - disposable LCD displays	Darwin's Children	Bear	2003
Esper Photo Analysis - zoom way in	Blade Runner	Scott	1982
Espionage Machine - reading minds scientifically	No, No, Not Rogov!	Smith	1958
E-Suit (Environmental Suit)	Chindi	McDevitt	2002
Eternity Drug	Far Centaurus	van Vogt	1944
Etherometer - check the ether for gravity waves	Spawn of the Red Giants	Long, Jr.	1937
Ether-Wall - an invisibility field.	Triplanetary	Smith	1934
Ethical Calculus	Alpha Centauri	Meier	1999

Examples from http://technovelgy.com/ct/ctnlistalpha.asp

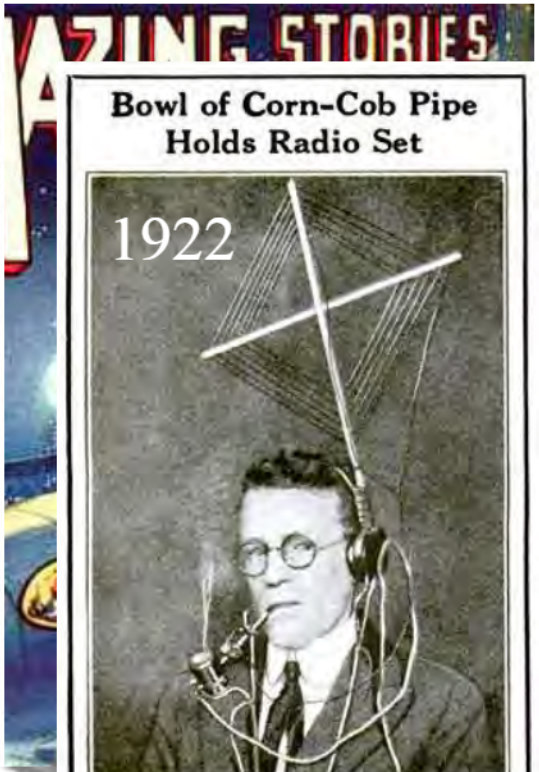
Albert Robida (1848 - 1926)

wrote future visions:
Le Vingtième Siècle (1883), etc.



"Nuclear powered vacuum cleaners will probably be a reality within 10 years."
A. Lewyt, CEO of Lewyt Vacuum Cleaner Company, 1955

Space travel is complete nonsense
R. van der Riet Woolley
British Royal Astronomer 1956



Bowl of Corn-Cob Pipe Holds Radio Set

https://commons.wikimedia.org/w/index.php?curid=7079928

of day and settle back for a smoke while he tunes in the radio stations that are "in the air."

For an aerial, Mr. Wilson uses a small loop attached to the headband of his 2000-ohm phone. The tuning coil is made of 100 turns of enameled wire—No. 26—wound around the bowl of the pipe. A piece of galena is balanced on the pipe stem, while the catwhisker is arranged to pivot on the stem. This small set has been remarkably successful in picking up concerts within 10 miles of the broadcasting stations.

In 2001 A. C. Clarke predicted :

- **2002** The first commercial device producing clean, safe power by low-temperate nuclear reactions goes on the market, heralding the end of the Fossil Fuel Age.
- **2003** NASA's robot Mars Surveyor is launched.
- **2004** First (publicly admitted) human clone.
- **2005** First sample sent back to Earth by Mars Surveyor.
- **2006** Last coal mine closed.
- **2009** The first quantum generators (tapping space energy) are developed. Available in portable and household units, from a few kilowatts upwards, they can produce electricity indefinitely. Central power stations closed.
- **2013** Prince Harry becomes the first member of the British royal family to fly in space.
- **2020** Artificial Intelligence reaches human level. From now on there are two intelligent species on Earth.
- **2021** The first humans land on Mars.

Predictions by experts

„ I am convinced that there is a world market for perhaps 5 computers“ (Thomas Watson, Direktor IBM, 1943)

- 1944 H. Aiken (cooper. Harvard / IBM)
- 1945 ENIAC 30 000 kg, 160 Kilowatt
- 1951 UNIVAC first commercial computer

„ One day we will realize that X-rays are a mystification“ *(Lord Kelvin 1895)*

„ [...] what remains to do in physics is to measure the constants of nature with ever better accuracy*“(Lord Kelvin 1905)*

„This is the biggest nonsense we ever undertook. The atomic bomb will never explode; I say that as an expert in explosives“
(Admiral W. Leary 1945)

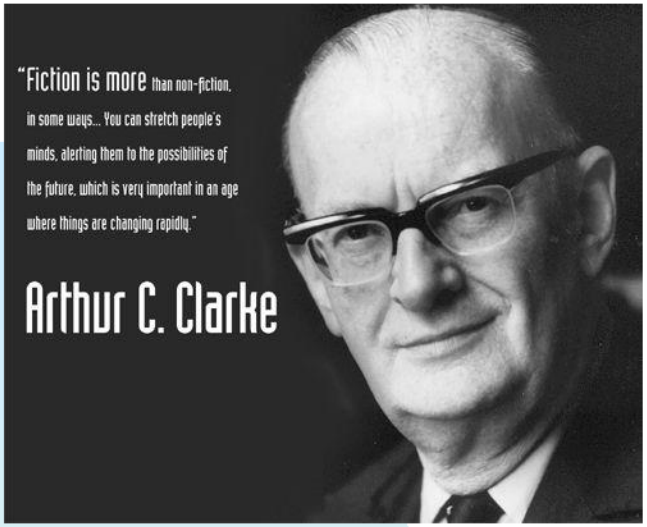
Nuclear powered vacuum cleaners will be reality in perhaps ten years

A. Lewyt, CEO of Lewyt Inc. 1955 (New York Times)

Space travel is complete nonsense

R. van der Riet Woolley

British Royal Astronomer 1956



- "When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is probably wrong "

Sir Arthur Charles Clarke, 1972

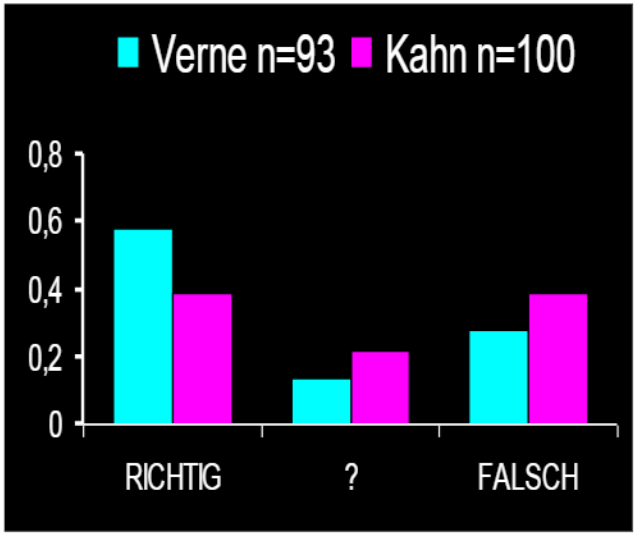
Experts vs. SF

- Jules Verne (ex 1863 - 1910)

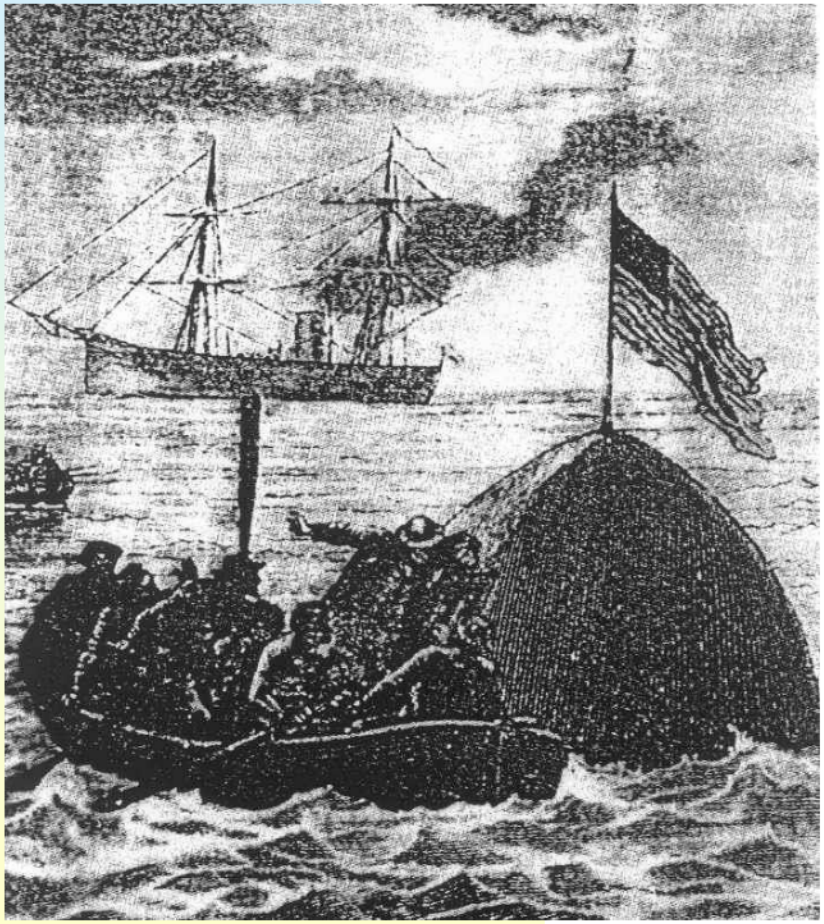
  TV, Supraconductors, submarine pneumatic post, absolute vacuum

- Herman Kahn, Anthony Wiener (ex 1967, Realisation before 2000)

  life expectancy, space shuttle, nuclear blasts for mining operations, SDI, brain-computer connections, infectuous diseases exterminated in 1980

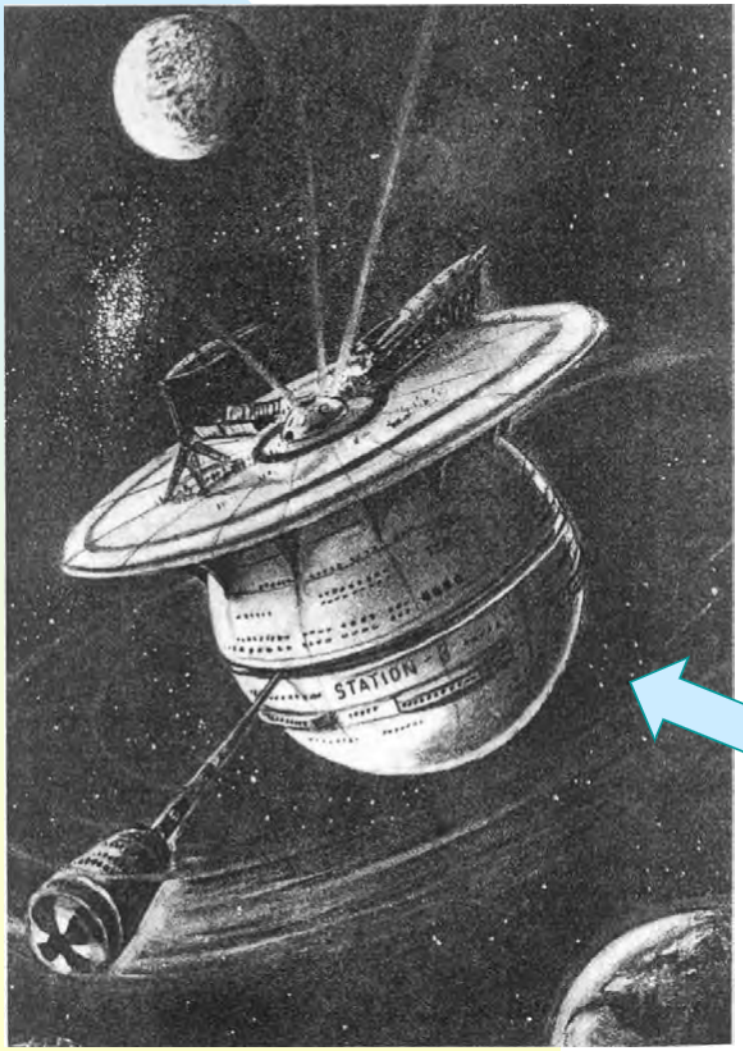


Capsule recovery



J. Verne (1828-1905)

How to check predictions?



Impossible a priori.

But we can check the "What if?" game

Is there a problem here?

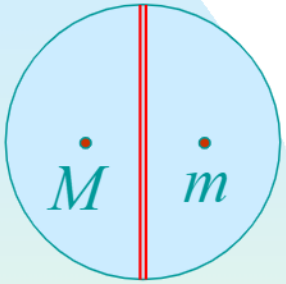
Practical physics

Similarity problem: scaling up (down) changes properties of a system.

⇒ Dimensional analysis

Star Wars:
How much energy is needed to destroy an earthlike planet?

Make an intelligent guess:



$$E_{pot} = \frac{GmM}{r}\Big|_{R}^{\infty}$$

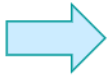
$$M \sim 0.5\, M_T\,,\; R \sim 0.5\, R_T$$

$$E = \frac{G(0.5M_T)^2}{0.5\,R_T} \approx \frac{7\,10^{-11}\left(310^{24}\right)^2}{3\,10^6} \approx 2\cdot 10^{32}\,J$$

Give this value in EYE units (Europe's Yearly Electricity production)

0.5 billion citizens, 18 kWh / person day -> 1.2 10^{19} J/year

Official value 2009: 1.3 10^{19} J



E=2 10^{13} EYE

Texts for group work

- Discuss stories as we do, make ppt-presentation
  - Give contents for audience
  - C^4 - be Curious, Creative, Criticize, Calculate
  - Add background info
  - Conclude
- You may change between groups

Texts for group work

- Clarke: Rendez-vous with Rama
  mechanics, gases, atmospheric physics
- Clarke: Fountains of paradise
  mechanics, meteorology
- Clarke: Songs of distant earth - Ice shield episode
  relativistic space travel, chemistry, phase transitions, radiation hazards
- Dick: The indefatigable frog
  scaling, similarity, infinite series
- Forward: The flight of the dragonfly (3 pax)
  space propulsion, optics, lasers, relativistic space travel
- Klein: Dreaming of forests
  chemistry, mechanics
- Niven: The hole man
  general relativity, mechanics

Schedule reminder

TU-Lecture 138.027 How Science Inspires Science Fiction 2017						
When	Monday	Tuesday	Wednesday	Thursday		Friday
	13.03.2017	14.03.2017	15.03.2017	16.03.		17.03.
					10:00 - 13:00	
	12:30-17:00	12:30-17:00	12:30-17:00	14:00-16:00	13:00-17:00	12:30 - 17:00
Who	All	All	All	TU	ATHENS	ATHENS
Where	SEM 212-232 oder SEM BA10A	SEM 212-232 oder SEM BA10A	SEM 212-232 oder SEM BA10A	SEM DB gelb 07 DB07E11	ZID-Schulungsraum FH 2	SEM DB gelb 07 DB07E11
What	Lecture			Lecture	Internet, preparation	Control

Who	TU students				
Where	Sem FH 9.OG yellow tower DB09E23				
What	Preparation, questions		Presentations		
When	Tuesday	Tuesday			
	28. 3.	4. 4.			
	12:00-14:00	12:00-14:00			
			Tuesday	Tuesday	
			16. 05.	16. 05.	
			10:00-12:00	13:00-15:00	

Database access

ATHENS

http://www.ai.tuwien.ac.at/international/index.php/athens-2016.html

user: athens

pwd: athens2017