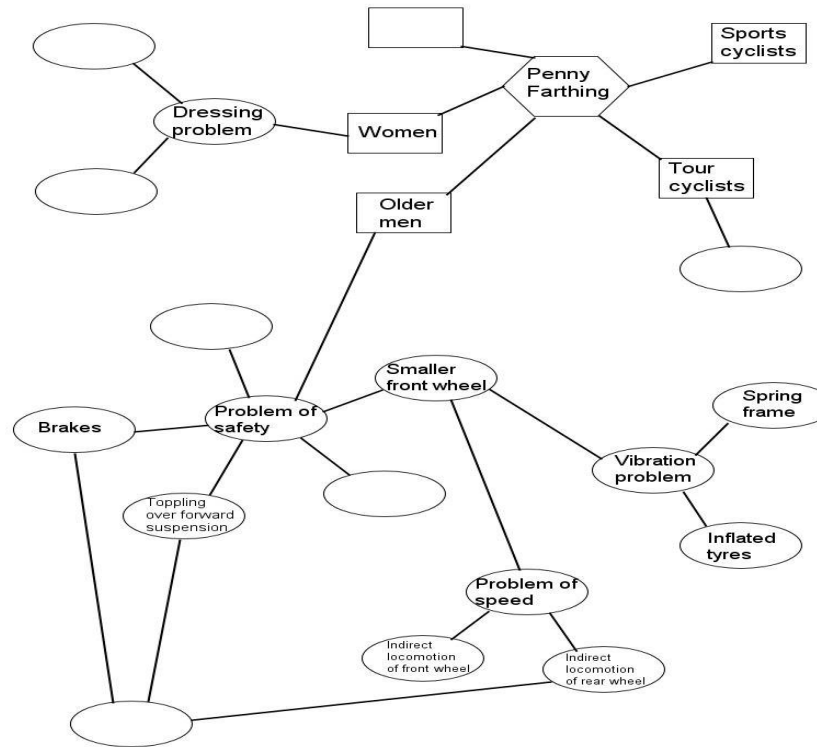


Determinism vs Constructivism



Karel Mulder

January 7, 2010

Determinism vs Constructivism

- Basic Question:

What drives technology?

Does the “progress” of technology drive history?

Or does history shape technology?

Or: is the change of technology something that nobody can control?

Determinism vs. Constructivism

Determinism

*Every new generation has some creative geniuses.
They invent some new technologies (by there more
than average intelligence or by pure coincidence).
The act of invention is independent of society.
Successful inventions diffuse in society and,
thereupon, transform society.*

Determinism vs. Constructivism

science

technology innovation is not accidental but depending on scientific progress. As scientific progress is the result of its own dynamics, and independent of societal change, technological change is independent of society.

(E.g. Dijksterhuis, 1950 and Koyre, 1943).

Determinism vs. Constructivism

Autonomous Technology

Scientific knowledge accumulates

Technology is applied science

Resources for technological innovation are growing forever

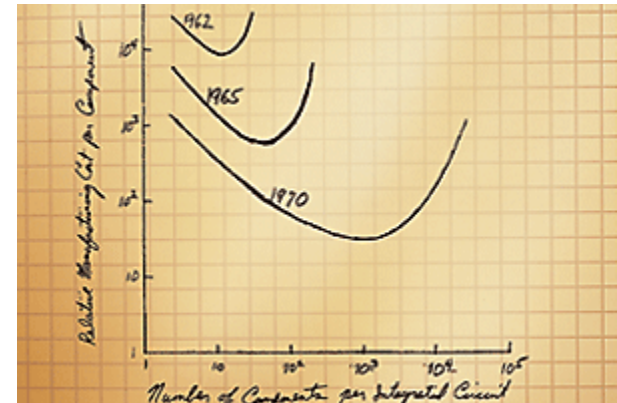
Technology is ever improving

Autonomous Technology

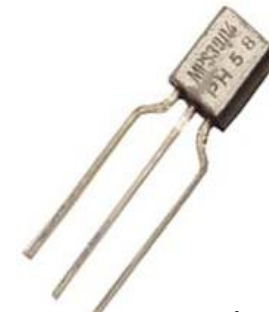
Moore's Law

the number of transistors that can be placed on an integrated circuit is increasing exponentially, and doubles approximately every two years

Gordon Moore, 1965, Cramming More components onto integrated circuits, Electronics vol. 38, 8, april 19, 1965.



<http://www.intel.com/technology/mooreslaw/index.htm>

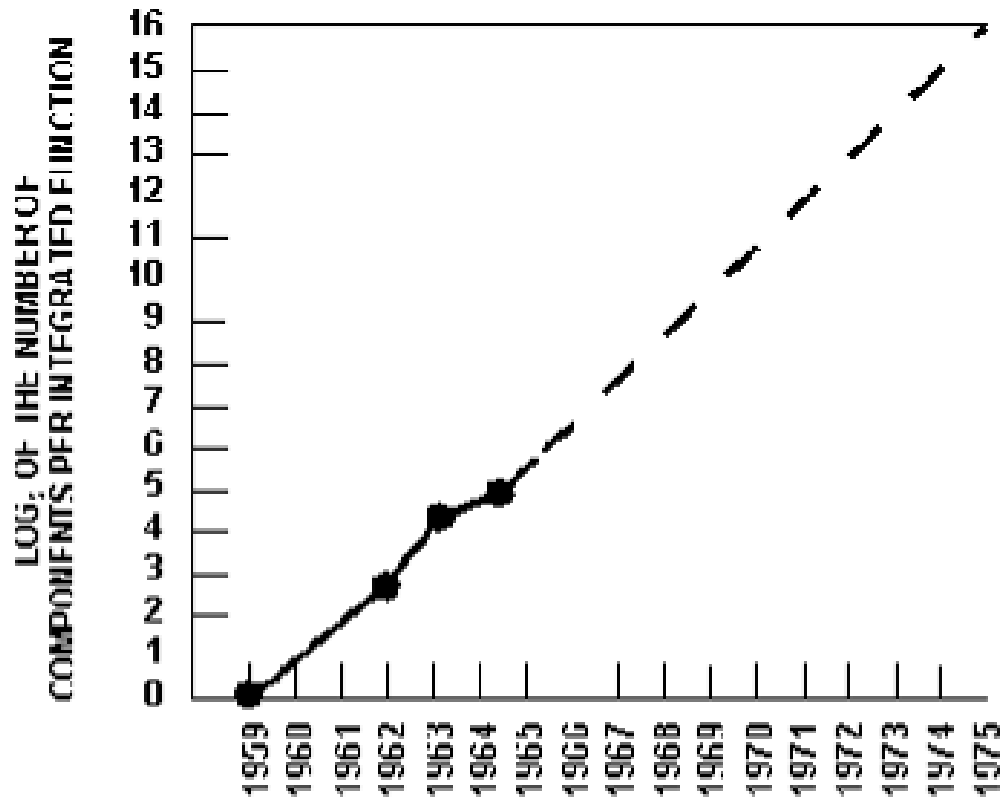


<http://www.opamp-electronics.com>

Autonomous Technology

Moore's Law

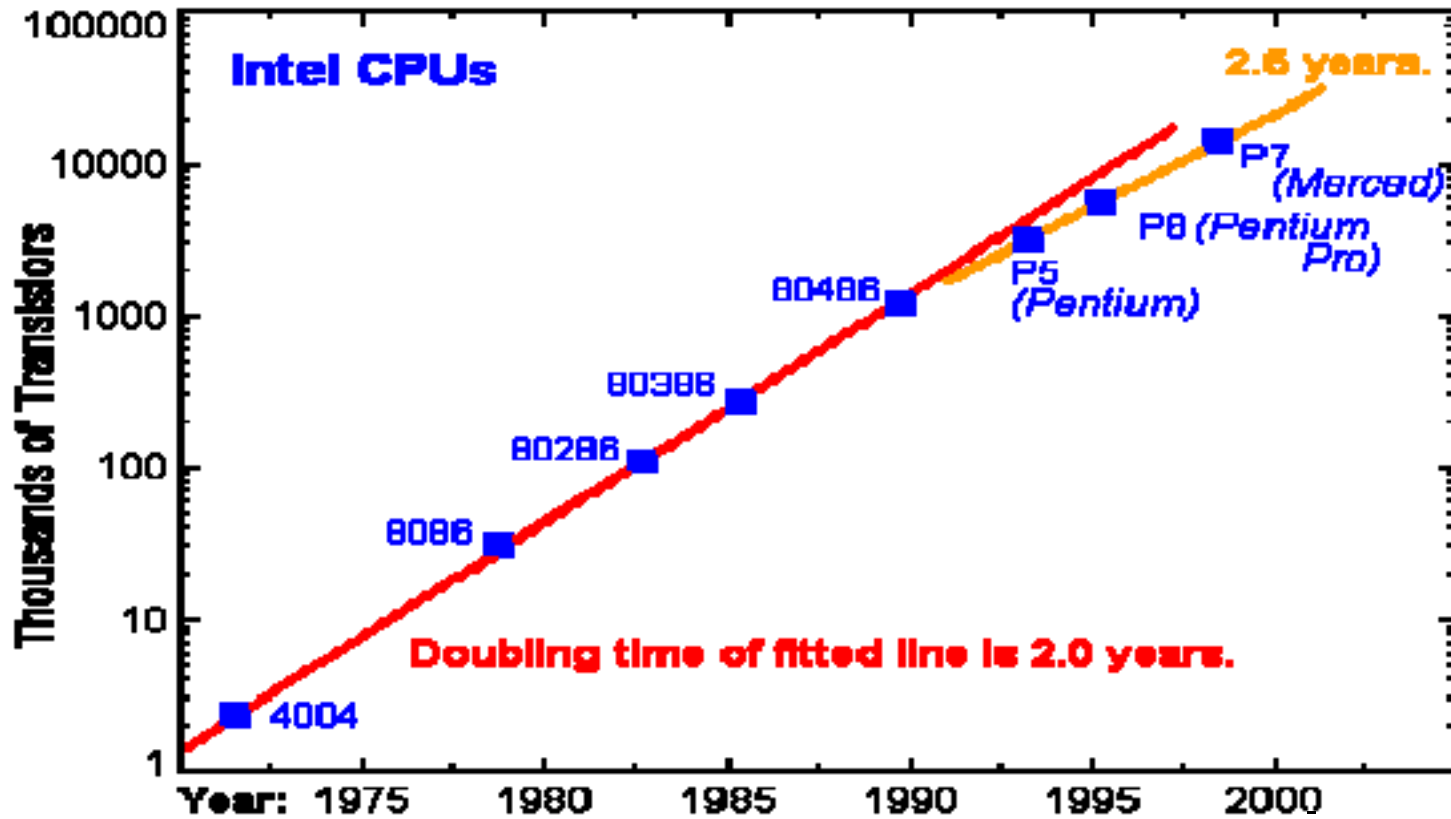
The original Moore's law plot



Electronics, April 1965

Autonomous Technology

Moore's Law



<http://www.physics.udel.edu/~watson/scen103/intel-new.gif>

Autonomous Technology

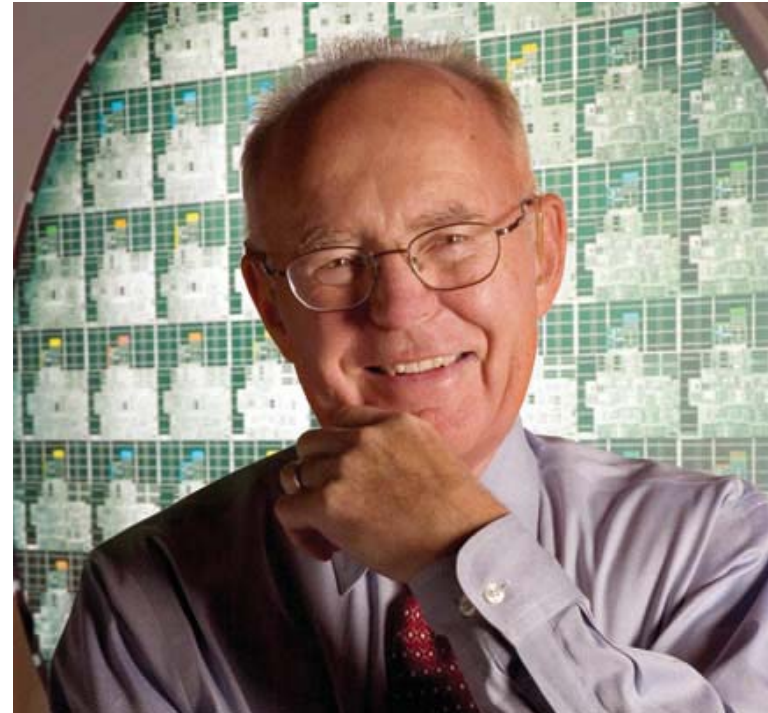
Moore, proof of Autonomous Technology?

Moore is not only an empirical description

Moore was the co-founder of Intel

It took 4-5 years to develop new chips

Companies used Moore's law in their research planning



www.automationnotebook.com

Technological innovation

Technological autonomy → Technological determinism

A positive sum game? Or a negative sum game?

Determinism vs Constructivism

From autonomy to determinism

Jacques Ellul

Traditional technology

vs.

Modern technology



<http://www.jacques-ellul.org/media/portrait.jpg>

From autonomy to determinism

Traditional Technology according to Ellul:

Limited in its application (technologies were often based on specific local resources and therefore hardly transferable);

Dependent on limited resources and on much 'skill' (skills like making and repairing tools, but also being able to judge weather conditions, or the tides);

Local in its character, i.e., technological solutions for specific problems were embedded in local culture and traditions.

From autonomy to determinism

Ellul characterizes modern technology by:

Automatism, i.e. there is only one 'best' way to solve a problem, and this technology seems to be compelling, everywhere on the planet;

Self increase, i.e. a new technology reinforces the growth of other technologies: this leads to exponential growth;

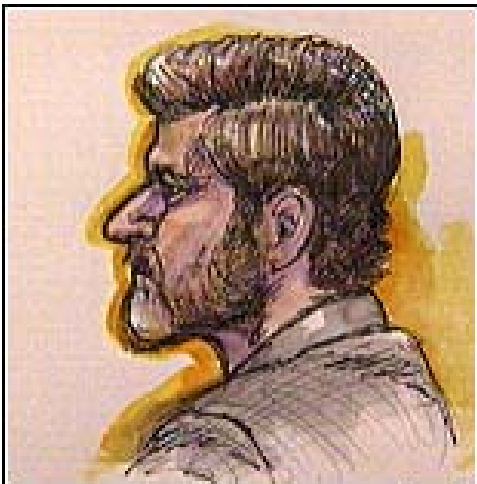
Indivisibility: the technological way of life must be accepted completely, including its good and bad sides;

Cohesion, i.e. technologies that are used in various different areas have much in common;

Universalism, i.e. technology is geographically as well as qualitatively omnipresent.

From autonomy to determinism

e.g Unabomber Attacks



Kaczynski

(CNN)



Unabomber Attacks

E.g. The Car

The car increases our freedom by increased freedom of movement

By having a car, we can do our shopping in Malls

Small neighborhood shops disappear

We therefore are forced to have a car

So a technology like the car curbs our liberty

UNABOMBER



Kaczynski arrested,
<http://images.encarta.msn.com/xrefmedia/shar/emed/targets/images/pho/t304/T304687A.jpg>

Social Constructivism

SCOT-model: Social Construction of Technology

Non-linear dynamics

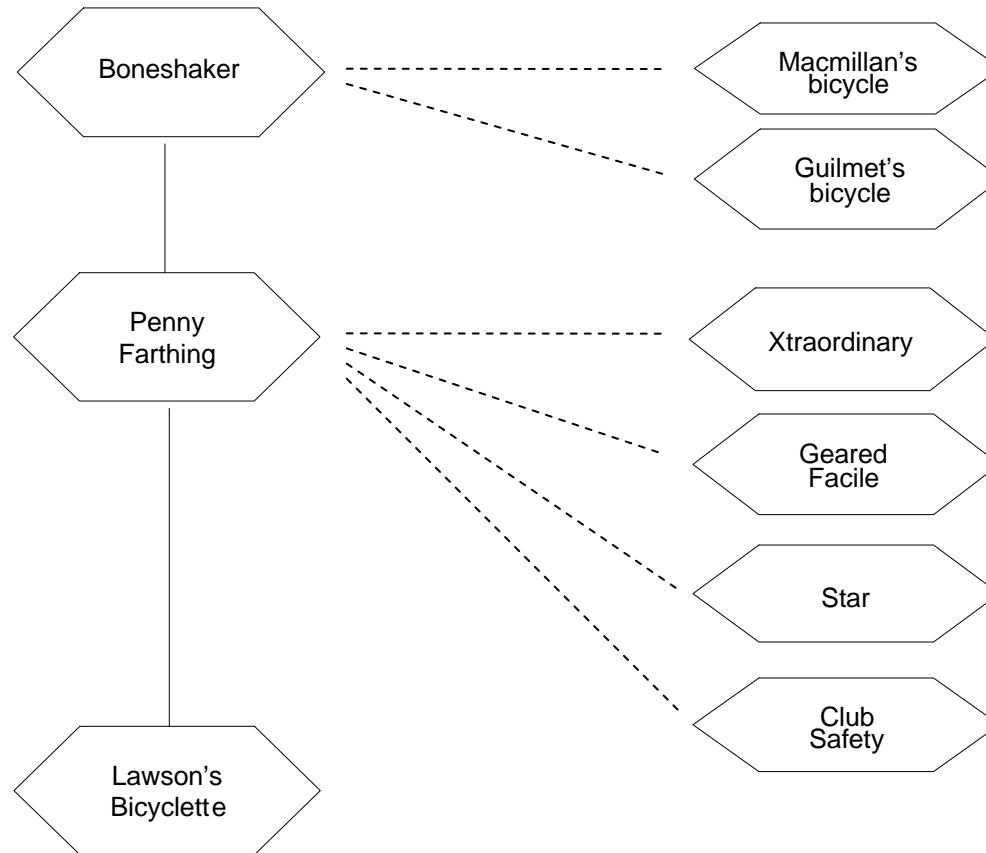
Relativism,

Flexibility of meaning

Relevant Social groups

Social Constructivism

Example: Development of the Bicycle



Social Constructivism

Example: Development of the Bicycle

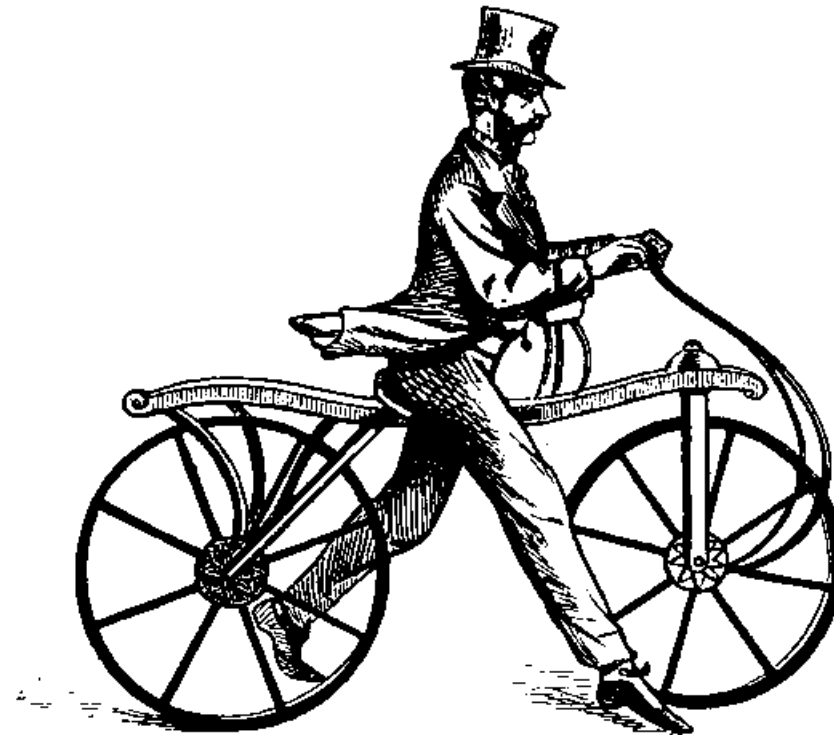
1818
Draisienne

Two-wheeled
rider-propelled
machine



Social Constructivism

Example: Development of the Bicycle



<http://www.phys.uri.edu/~tony/bicycle/draisien.gif>

Social Constructivism

Example: Development of the Bicycle

1861

Michaux



Social Constructivism

Example: Development of the Bicycle

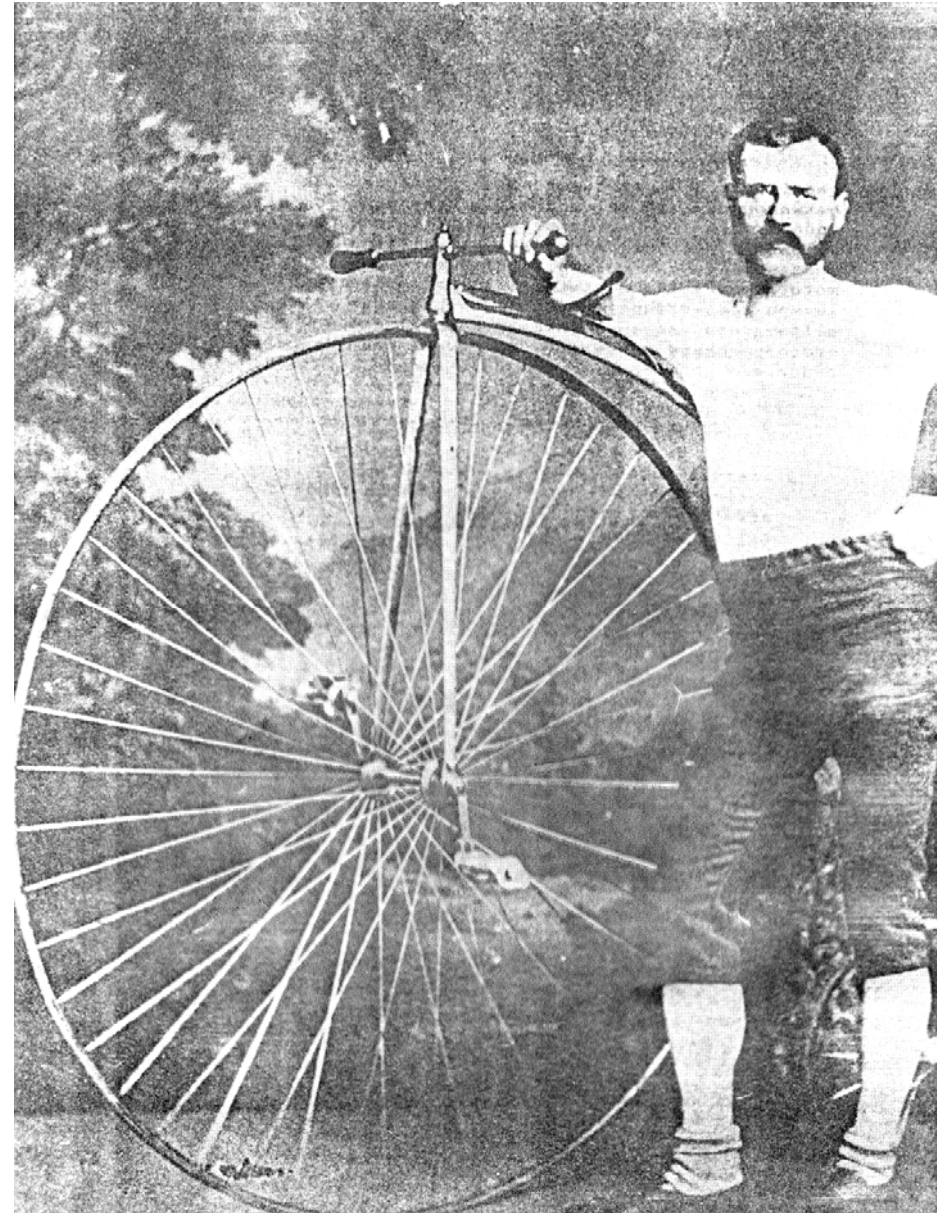
1890s

Ordinary

http://upload.wikimedia.org/wikipedia/commons/thumb/a/a7/Ordinary_bicycle01.jpg/180px-Ordinary_bicycle01.jpg



Flexibility of Meaning

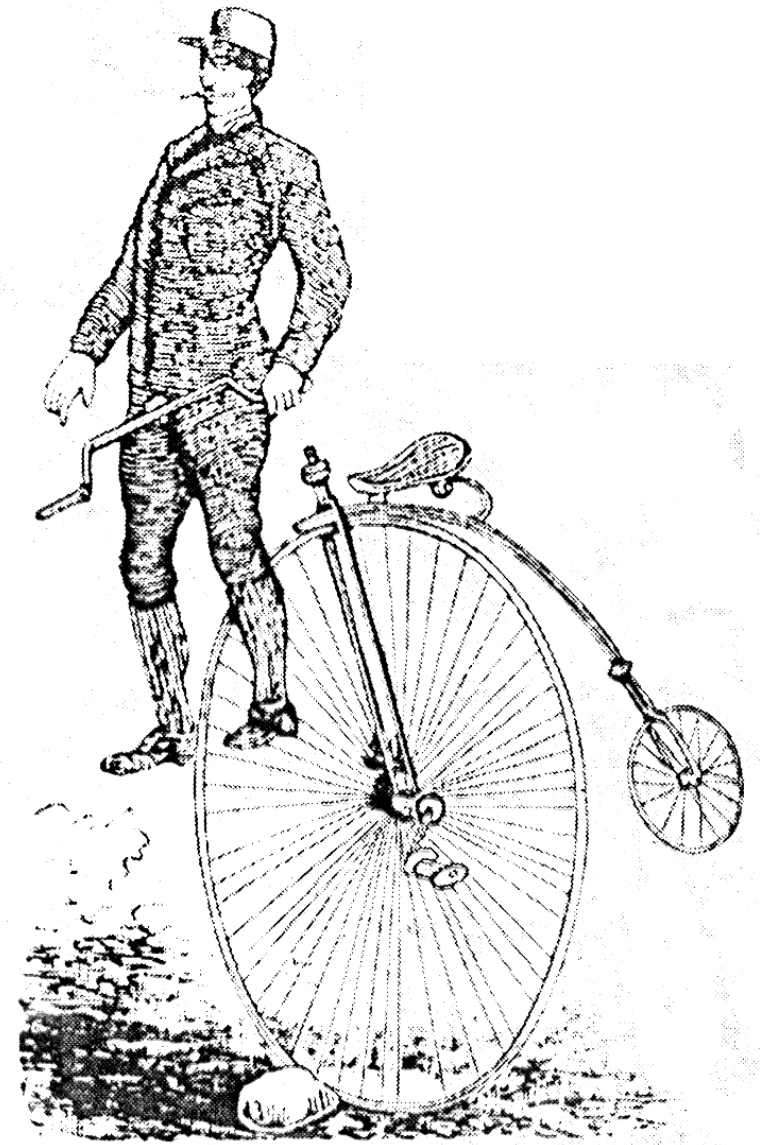


Flexibility of Meaning

The dangerous machine



New designs



New Designs

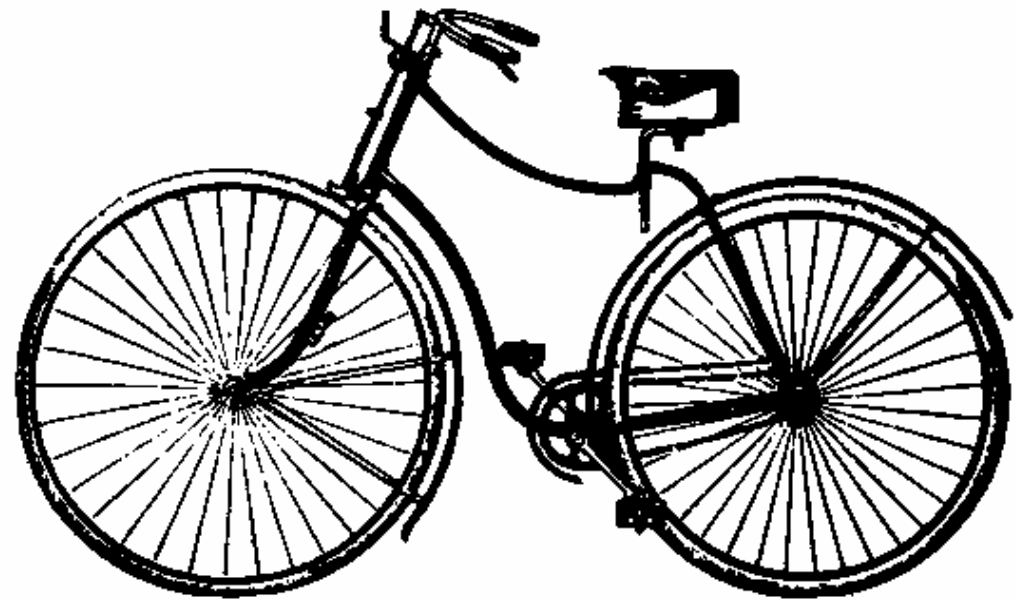
1874
Ariel



Social Constructivism

Example: Development of the Bicycle

from 1879
Safety bicycles



1885 Rover Safety Bicycle <http://www.phys.uri.edu/~tony/bicycle/rover.gif>

Social Constructivism

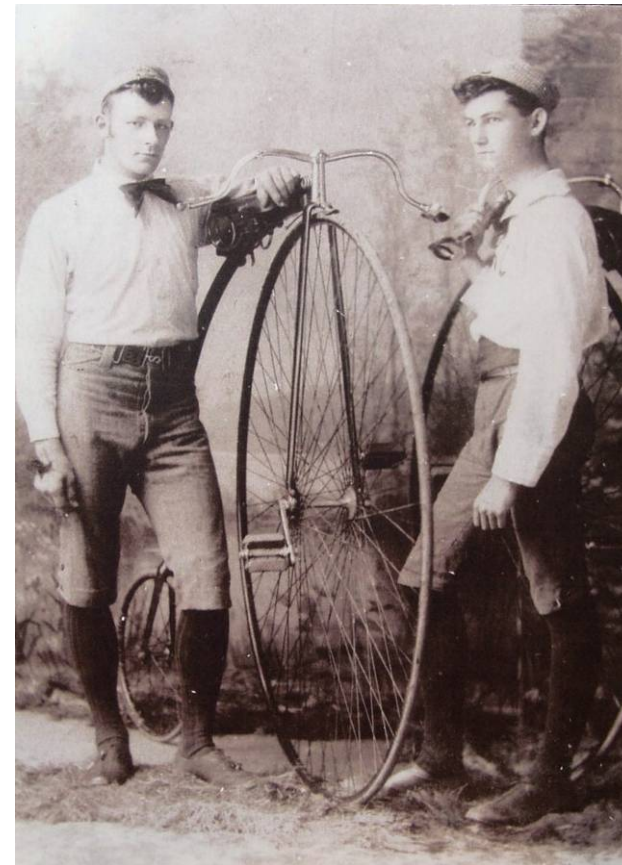
Example: Development of the Bicycle

Penny farthing, up to 1.5 m

Line of development guided by a speed wish sustained by young, sportive men for whom the danger of falling was part of the fun

1893 High wheeler

<http://www.bikes.msu.edu/history/web/high-wheeler-1-P3019443.JPG>



Social Constructivism

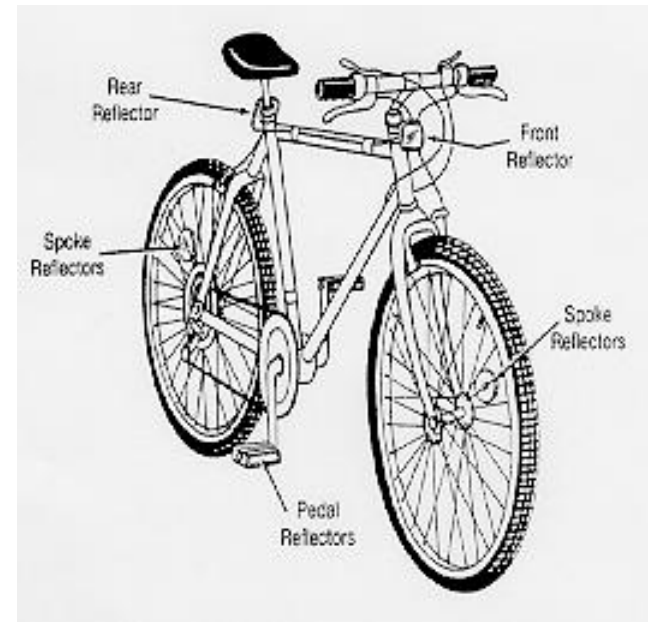
Example: Development of the Bicycle

Safety bike

Reflectors for night riding

Women, recreation cyclists, older people were all interested in the development of a safe and comfortable bike (with brakes, rear wheel drive, pneumatic tires etc.)

Ultimately, interpretative flexibility declined: one (safety) bike, used by all actors, the old and the (included) new actors



<http://en.wikipedia.org/wiki/Image:Bicycle.jpg>

Social Constructivism

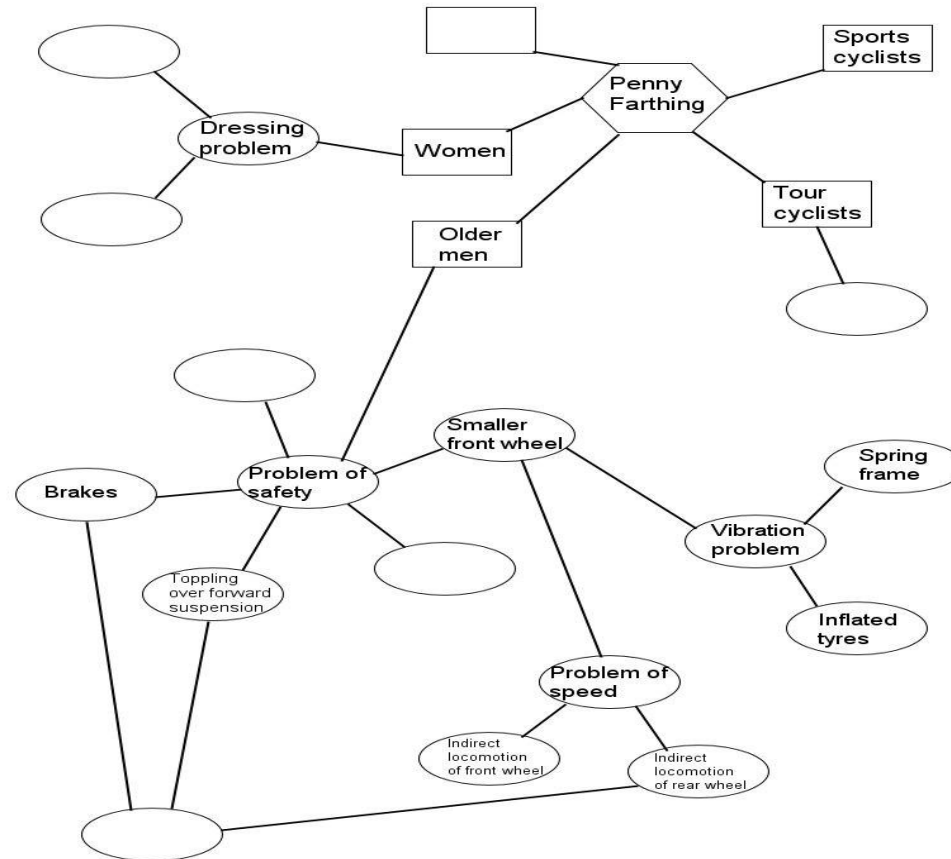
Example: Development of the Bicycle



<http://marcphoto.files.wordpress.com/2007/11/gele-fietser.jpg>

Social Constructivism

Example: Development of the Bicycle



Social Constructivism

Example: Development of the Bicycle

Lessons for analyzing technological change:

- identify Relevant Social Groups

- identify their problem perceptions

- evaluate 'solutions' through the eyes of social groups

There is not one best technology for all. However, our options become limited by positive feedback and entrenchment.