Innovation Processes

Society and Economics

Karel Mulder

January 8, 2010

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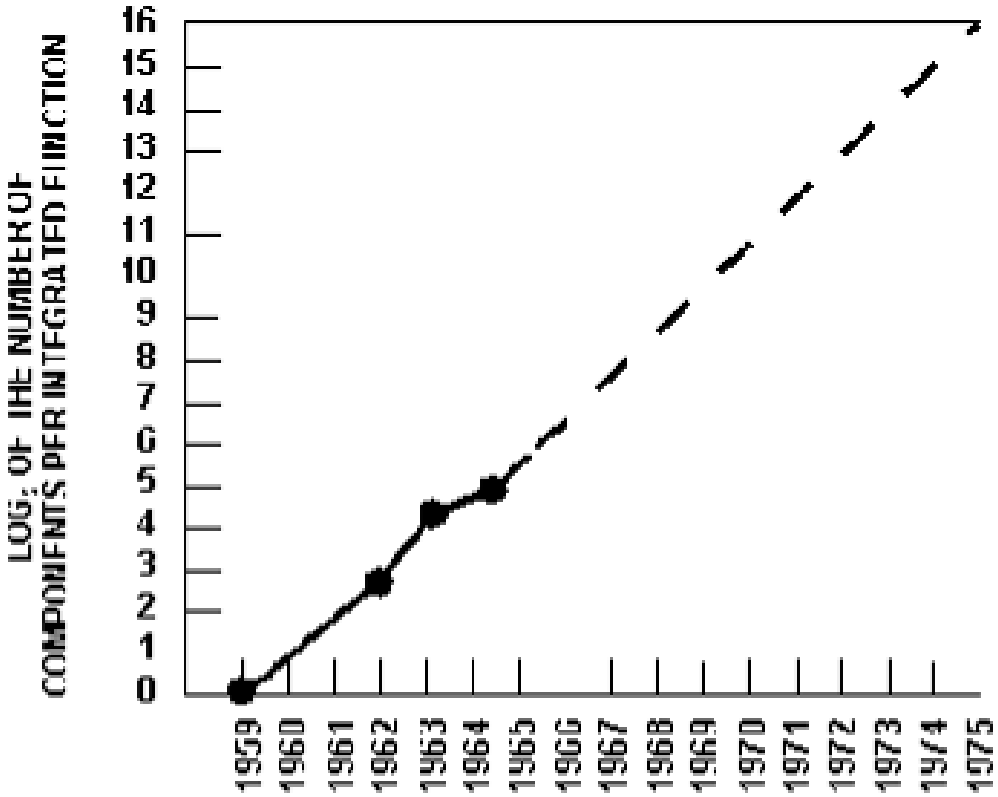
Technology and Society

Proof of Autonomous Technology?

Moore's Law

The original Moore's law plot



Electronics, April 1965

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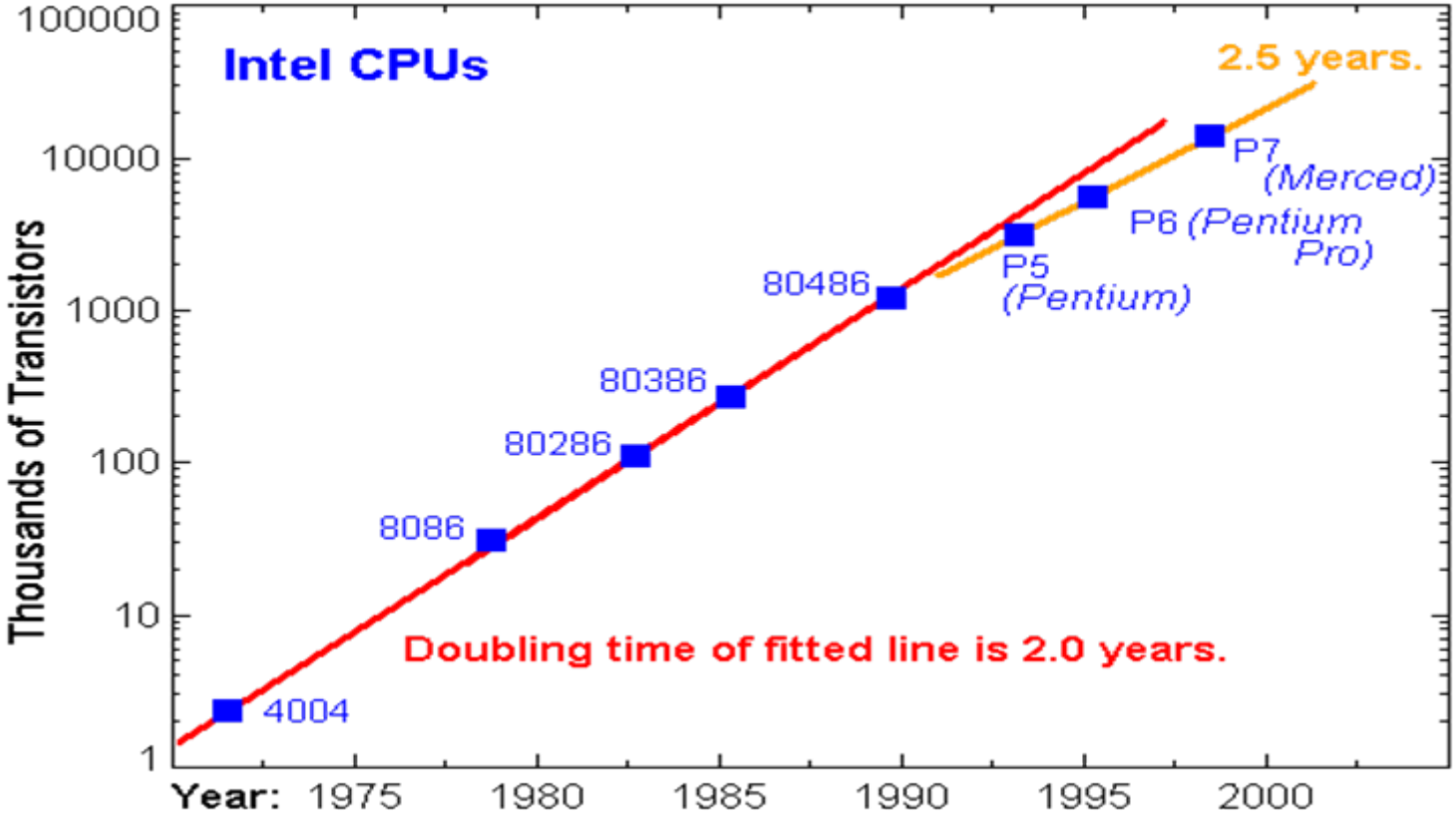
Proof of Autonomous Technology?



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

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An Alternate Vision: Social Constructivism

Various social groups are involved with technology

Every group has a specific view of a certain technology

Example: PC.

- secretary: type writer
- book keeper: administration tool
- at home: communication tool

Technologies are shaped by demand / influence of relevant social groups

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SCOT-model: Social Construction of Technology

Artifact

Relevant social groups

Interpretative flexibility

Inclusion of new groups

Technological frame

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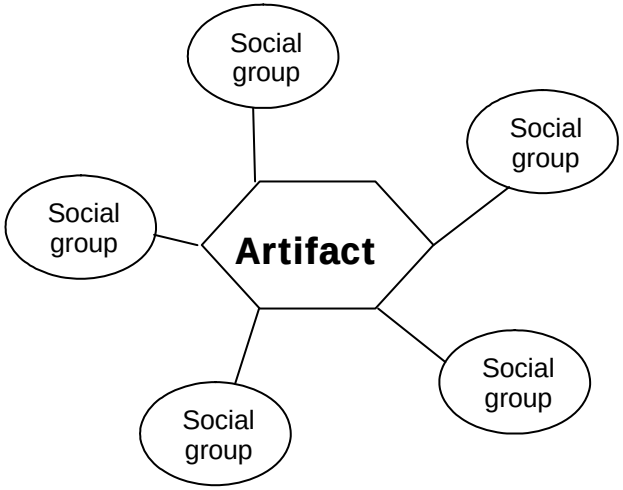
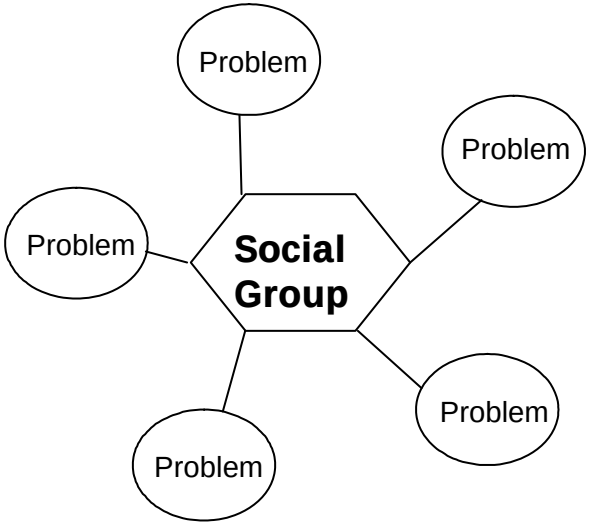
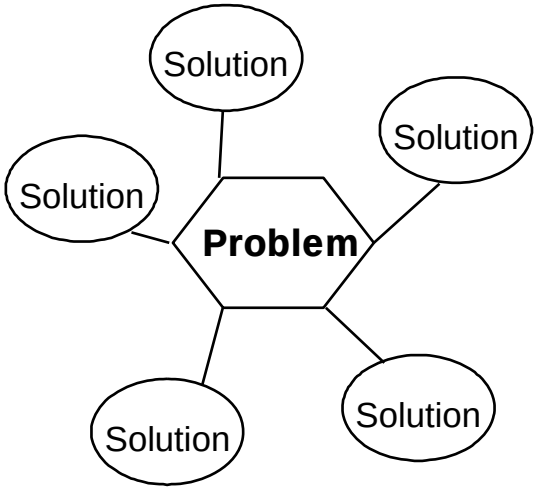
SCOT-model: Social Construction of Technology







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An Alternate Vision: Social Constructivism
Example: Development of the Bicycle

1818
Draisienne

Two-wheeled
rider-propelled
machine

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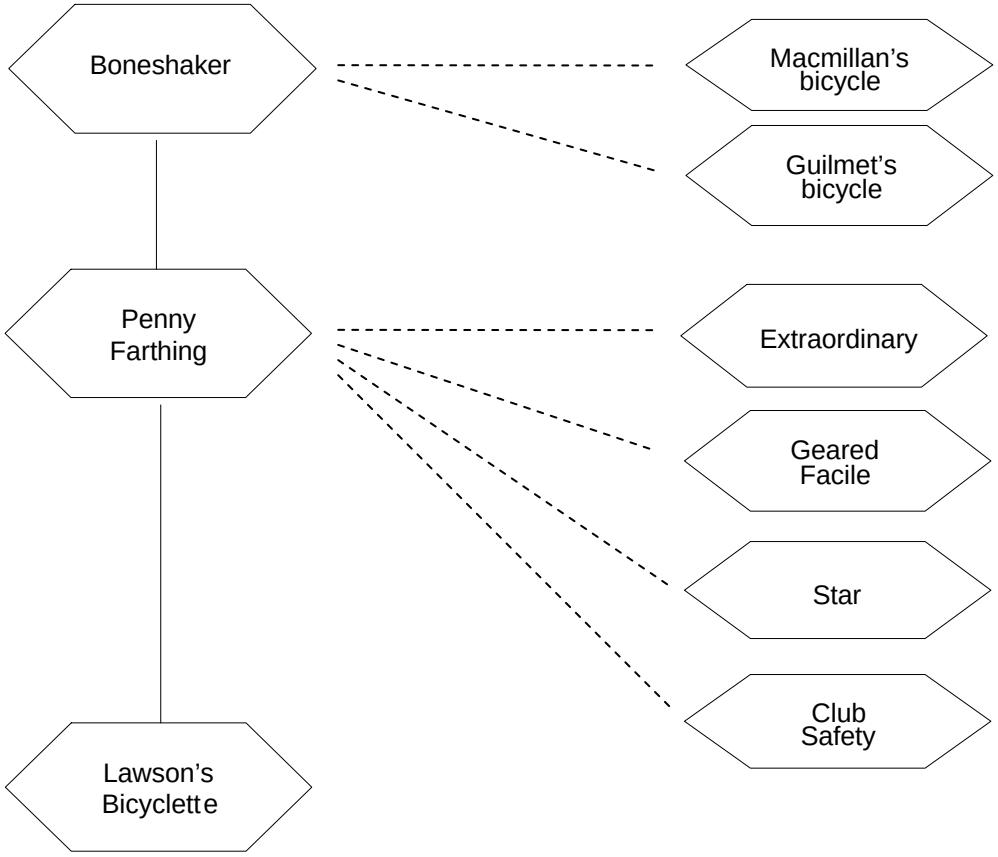
Social Constructivism - Development of the Bicycle



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Social Constructivism - Development of the Bicycle

1861
Michaux

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Social Constructivism - Development of the Bicycle

1874

Ariel

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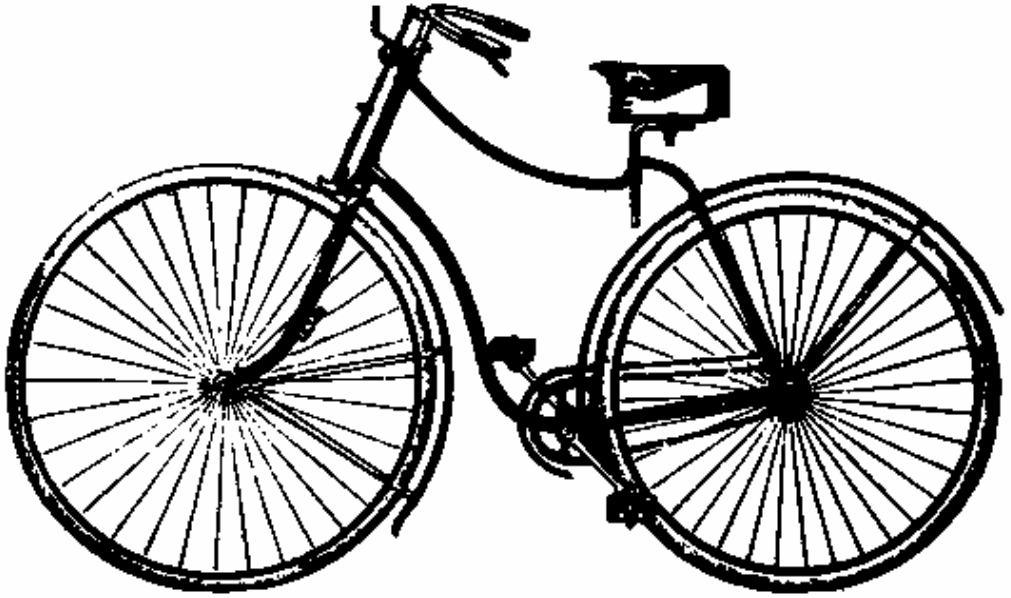
Social Constructivism - Development of the Bicycle

from 1879
Safety bicycles



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

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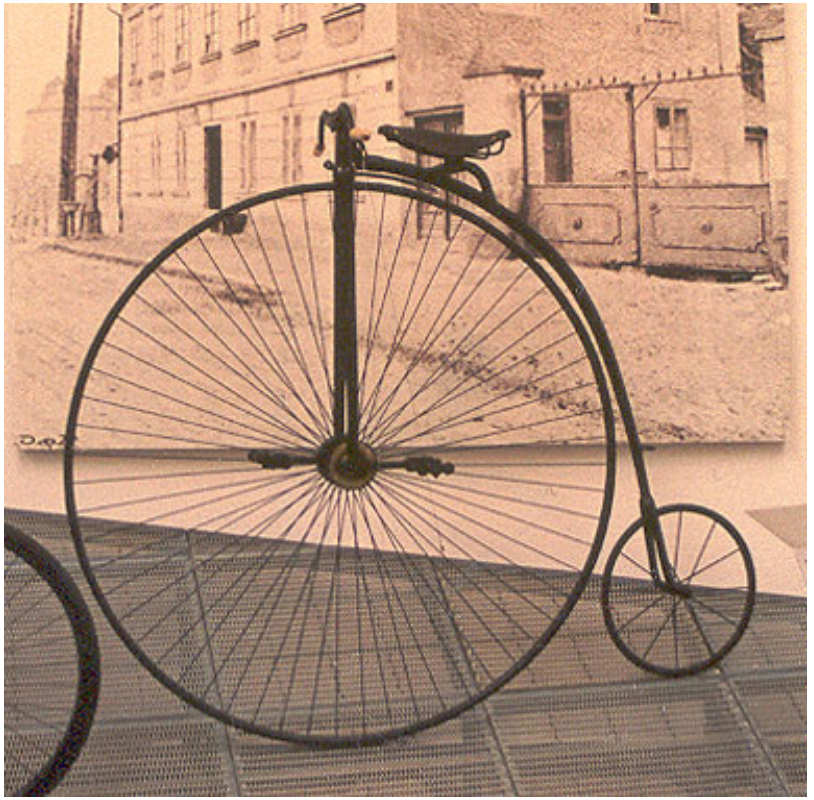
Social Constructivism - Development of the Bicycle

1890s

Ordinary



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

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Social Constructivism - 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/hi-wheeler-1-P3019443.JPG

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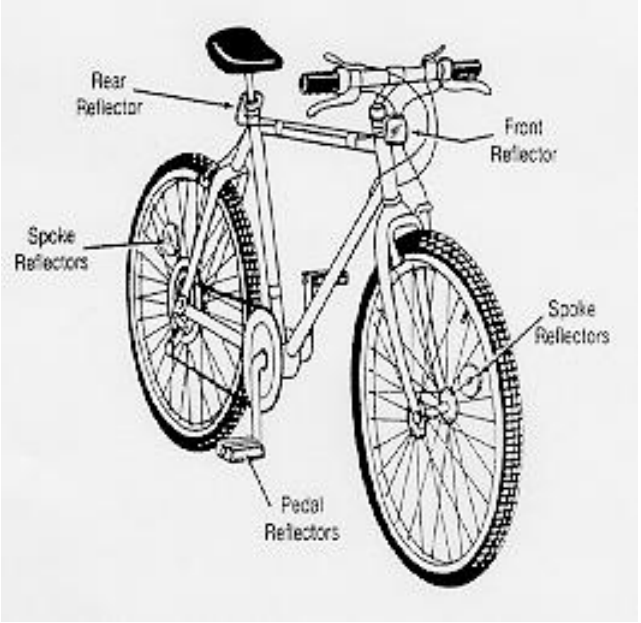
Social Constructivism - Development of the Bicycle

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

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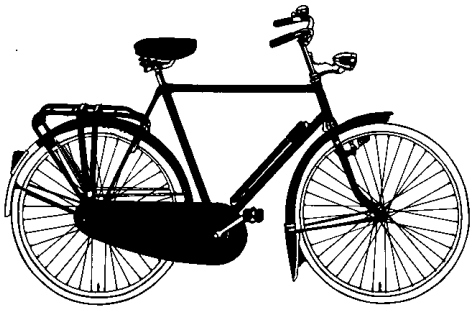
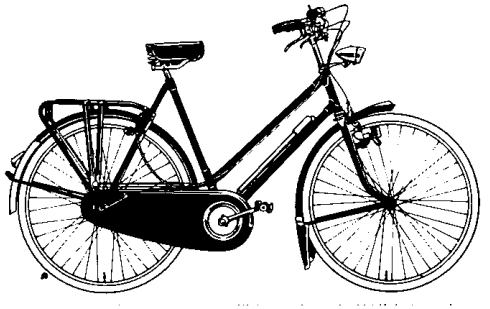
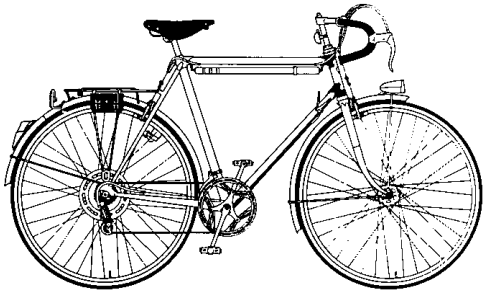
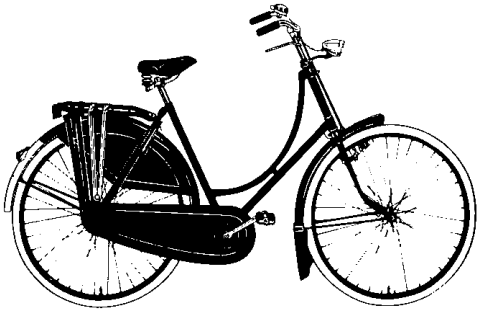
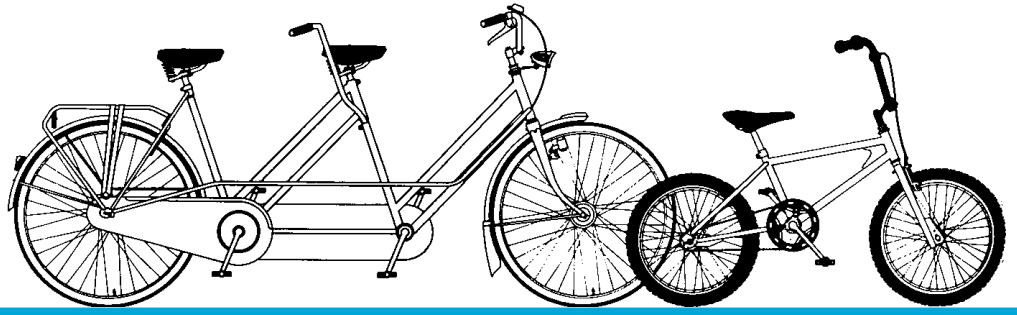
Social Constructivism - Development of the Bicycle











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Social Constructivism - Development of the Bicycle

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

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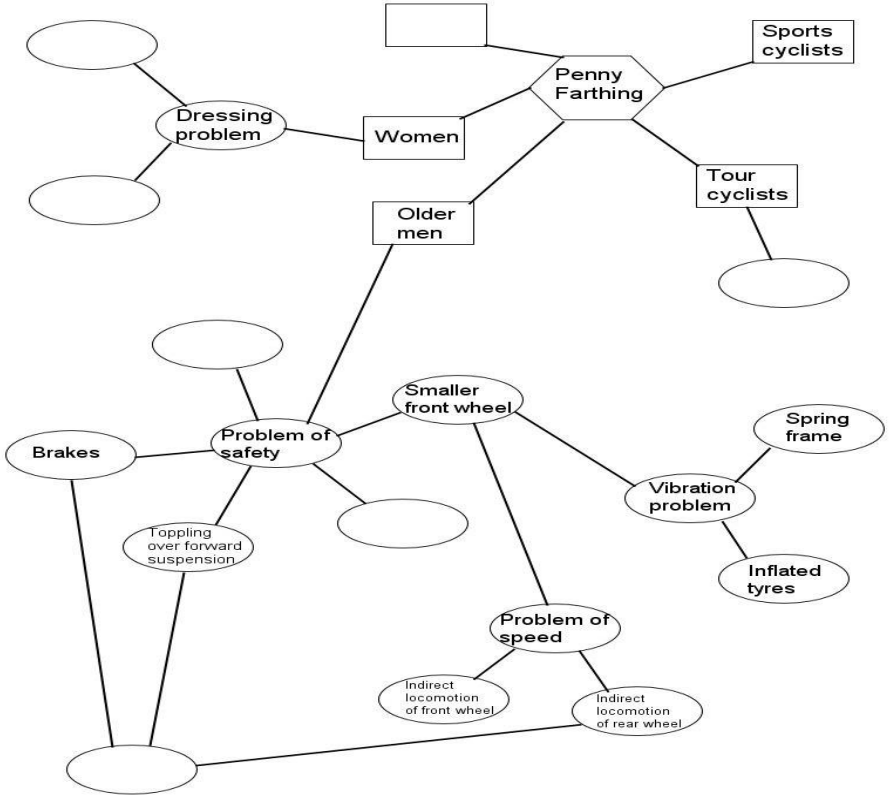
Social Constructivism - Development of the Bicycle



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Social Constructivism

Non-linear dynamics

Flexibility of meaning

Relativism

Relevant Social groups

Technology and Society

Conclusion

Technology is (in part) shaped by social forces, these forces might not reflect our feeling of justice

Complexity of innovation creates unforeseen outcomes

Results that have negative effects for third parties

Economic and Technological Change

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Economic and Technological Change

Economic Determinism

Technology is to design the most efficient solution to fulfill a need

Problems:

- Time scale of judgment/technological change?
- Innovations: Need only exists after the innovation
- Need can be manipulated
- New technology is often not most efficient
- Availability of innovative resources (knowledge, etc) important?

Economic and Technological Change

Creating economic growth

Needed:

- Growth labor
- Growth capital
- Quality of labor
- Rest: innovation, residue method

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Economic and Technological Change

Market failure: Role of Governments?

- Appropriation is never total
- International competition (level playing field)
- (semi-) public sector, monopolies
- Long term research
- Diffused sector (agriculture)
- Moral reasons (health care)
- Risk of non compliance (health care)
- Public good (defence, justice)
- ‘Costs’ externalized, ‘profits’ internalized

Economic and Technological Change

Business cycles

Period 8-9 years

Kondratieff waves

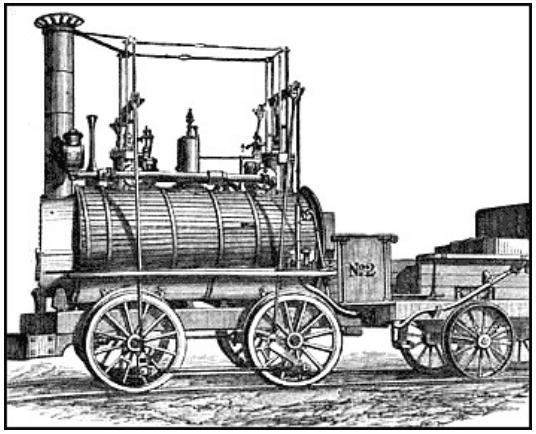
40-50 years

Cluster of innovations that transforms society

Economic and Technological Change

Examples

Cotton, iron, steam	1790-1840
Railroads	1840-1890
Electricity, cars, steel	1890-1940
Chemistry, electronics	1940-1980
Information, comm.	1980-



Blücher, an early railway locomotive built in 1814 by George Stephenson. http://www.answers.com/topic/railway

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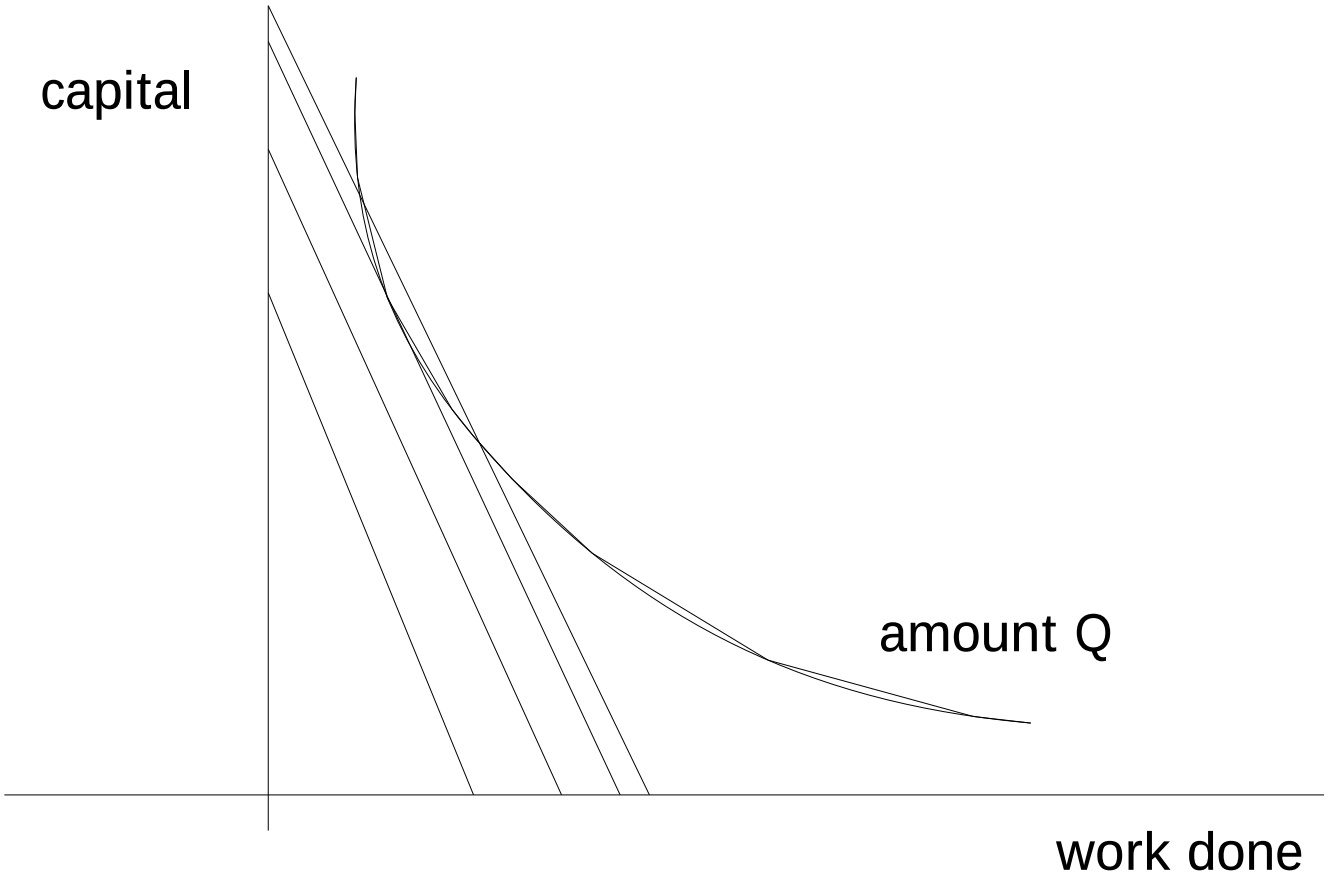
Economic and Technological Change

Production Function



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Economic and Technological Change

Production Function

Explains substitution labor, capital, resources

Explains development of different economies

Limited to on the shelf (process) technology

Economic and Technological Change

1940, Schumpeter

Technology is endogenous to economy: Companies might invest more in their research and thereby achieve higher profits

Example Du Pont: innovation as part of economic strategy

What drives technology?

Market demand or technology push

Background: is Basic Research or Applied Research to be stimulated?

http://en.wikipedia.org/wiki/Image:1schumpeter.jpg

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Technology Push vs. Market Pull

Technology push vs Market pull
as determinants of technological change

Technology Push:

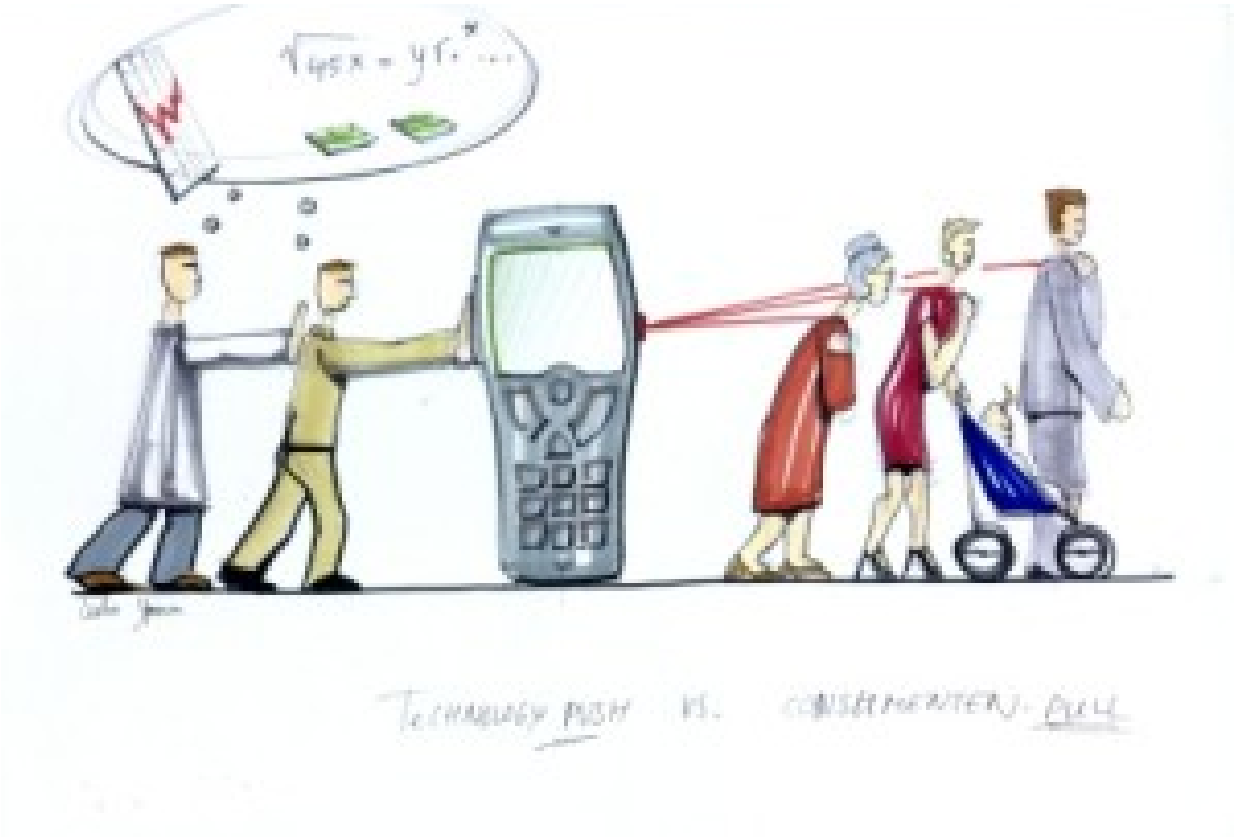
Stirling Motor, Tracy Kidder: The soul of a new machine, DSM lysine

Market Pull:

Replacement for silk, indigo dye, continuous catalitic cracking

Economic and Technological Change

Technology Push vs. Market Pull



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Schmookler:

Patents are filed after the introduction of new products

Research follows a need discovered by an individual

Project Hindsight etc

Economic and Technological Change

Push vs. Pull undecided

Problem:

What is need?

Initial stages push, later pull?

Both important:

market is crucial, but a pushing project champion too

Economic and Technological Change

Evolutionary Theory of Technological Change

variation / selection

Biological metaphor:

random variation based existing technology,

(market) selection,

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Evolutionary Theory of Technological Change

Variation guided by:

- Dominant concepts (Kuhn)
- Exemplar
- Experiences of the past
- Future expectations
- Adjacent technologies

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Evolutionary Theory of Technological Change

Selection guided by:

- Cost/performance
- Expectations
- Regulation
- Interconnection to other technologies
- Demographic & cultural change

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Technological trajectories

Guided by:

- Technological regime,
- Paradigm
- Cultural matrix
- Methods, equipment, heuristics (rules that guide new developments), examplars, education

Examples:

- DC 3, but also application of aluminium in aircrafts

Economic and Technological Change

What is wrong with the biologic comparison ?

Lamarck, purposeful change?

Coupling between variation and selection:

- Steering of selection environment
- Anticipating changes in selection environment

Quasi evolutionary model

Economic and Technological Change

Quasi Evolutionary Model

Nexus: a link between variation and selection

advertizing, standardization etc influ-selection

marketing, insurance, etc influ-variation

Niche: a separate (protected) part of the selection environment

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Mechanisms, behind trajectories:

Positive Feedback

Arthur, 1988

Entrenchment

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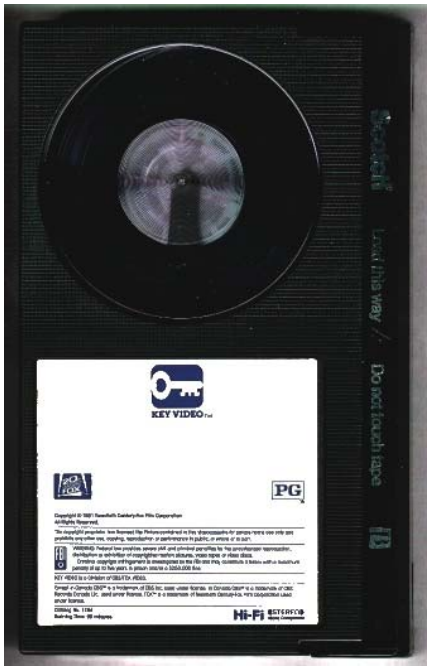
Economic and Technological Change

e.g. Video Recorder

3 systems:

- VHS (JVC/Matsushita),
- Betamax (Sony)
- Video2000 (Philips-Grundig)

Until 1974 no recording for ordinary consumers



Sony Beta Max Tape
http://en.wikipedia.org/wiki/Image:Beta_Max_Tape.jpg

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Economic and Technological Change

e.g. Video Recorder

1974 Sony offers JVC licence for Betamax

1975 Sony has monopoly: 30.000 video recorders sold in USA

1976 VHS (JVC) en V2000 (Philips) introduced on market

1977 Sony - Zenith, JVC - RCA

- RCA pushes more recording length
- VHS reaches 3 hrs
- Betamax-Philips only 1 hr

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Economic and Technological Change

e.g. Video Recorder

Market experts expect 3 standards like record player (33, 45, 78)

Disney and Universal lose legal battle against video recording and start selling/renting movies on video

1978 Betamax market share only 19 %, VHS 36 %

Price war, video recorders become 3-4 times cheaper

Lots of pornography

10-1-1988 Sony starts production of VHS

Philips had done so before

VHS is standard,

betamax only 1 % market share in USA, V2000 0%

Economic and Technological Change

Mechanisms behind positive feed back

Expectations (based on reputation)

Economies of scale

Hardware software connections

Marketing & logistics

Learning curve

Economic and Technological Change

Regime Shifts Possible?

Factors

- Belief in progress of current regime is low (Tenax)
- Availability of accumulated knowledge and experience for a new alternative
- Presence of niche markets
- Scope for considerable ‘learning effects’
- Network creation