The Social Construction of Technology



Central elements of this presentation come from the thoughts and ideas developed by Weibe Bijker in "The Social Construction of Technological Systems" (1987) and "Of Bicycles, Bakelites and Bulbs" (1992); as well as the work of Donald MacKenzie: "The Social Shaping of Technology" with Judy Wajcman (1985) and "Inventing Accuracy" (1993).



Main Focus:

* Understand links between social and technical processes
* Understand both as human (social) constructions
* Technology shaped by-
	1. [Human engineers](http://www.umsl.edu/~keelr/280/soctechchange/experts.html)
	2. Market forces
	3. Consumer needs and demands
	4. [Organizations](http://www.umsl.edu/~keelr/280/soctechchange/soctech16.htm)
	5. [Government Policies](http://www.umsl.edu/~keelr/280/soctechchange/soctech17.htm)
	6. All individuals and groups who are also social products
* Attempt to link the activity of individuals to wider social processes
* Power
* Internal Structure of Technology
* New ways to theoretically ground the relationship between Society and Technology in order to allow for Action (case studies=> theoretical formulations=> political analyses and change)

Constructionist Studies:

* Meaning of a technic does not lie *in* technology.
* SCOT/Actor-network/Technological Systems
* Avoid linear analysis of technological development
* Avoid asymmetry: include focus on failed technology: How a particular technic becomes seen as successful.
* Focus on the internal dynamics (details of technologies) and the social context in which these details come to have particular meaning
* The common evolution of Technology and Society
* Invention and Creativity as Social Processes. Individuals matter, yet only within particular social contexts- the inevitability of inventions (Ogburn)?

Theory Requirements

* Accounts for both change and continuity- specifies conditions in which either occurs
* Symmetry: Success and/or failure of a particular technic is explained as a result of socio-technological developments- not as a cause of these developments. Success does not equal an artifact that "works," what works is a product of the eye of beholder.
	1. Bakelite was ignored at first- only after WWI and the dumping of surplus phenols did the possibility of low cost production become a reality. Bakelite "became" a successful competitor to natural substances
	2. The criminalization of hemp in 1937 "allowed" for the synthetic fibers and solvents under development by DuPont to become commercially viable
* Actor/Structure Integration: Understand specific individual actors within particular situations, yet options and choices constrained by broad structural elements.
* Seamless Web: No a priori distinction between Society, Technology, Science, Politics, Economics, etc. "A good engineer is a good technician, sociologist, economists, and politician."

Net result will be the construction of an understanding of Socio-technical change which is Probabilistic: neither simply rational and goal directed nor purely idiosyncratic and spontaneous. Socio-technical change is contingent on a variety of factors, including systematic structural constraints (which are contingent factors, too!).

* Science and Technology as socially constructed sub-cultures
* Boundaries between them are the product of social negotiations
* The meaning of an artifact, the nature of Truth=> as a social construction. Focus on:
	1. Flexibility of interpretations
	2. Consensus building and closure mechanisms: Stabilization
	3. This activity within a socio-cultural milieu



The Safety Bicycle

* The role of the "Penny-farthing" in contrast to a variety of other models
* Many of the competing models had success, yet the Penny Farthing is seen as the "direct decendent" of the modern bicycle.
* Lawson's bicyclette (in linear terms the direct successor) was not successful, yet gave rise to the modern safety bicycle
* To understand the development: focus on the problems, interests and groups which influenced the bicycles development.
* Variety of groups- Interpretive flexibility: Engineers, consumers, anti-cyclists
* Heterogeneity: Users- male and female users
	1. Women's use of the high wheelers was viewed as inappropriate- moral concerns/dress codes
	2. Safety and stability was a central concern for women who had previously been restricted to the use of tricycles
	3. Some parts of the modern bicycle's development are due to the specific interests and perceived market influence of women bicyclists.
* Power and Economic strength of relevant groups and artifact's interpretation:
	1. Early users of high wheelers- young men, economically well off, concerned with bicycling as a sport rather than a means of transportation- focus on speed.

**Another example of Interpretive Flexibility: The air tire**

* Solution to vibration problems of the low wheeler, (other designs used springs in the frame) or..
* A means of incresing speed, or..
* An ugly compromising of safety (side slipping)



**Different solutions to different problems are related to needs and concerns of specific groups.**



Stabilization:

* Invention of the safety bicycle was not an isolated event, but the culmination of a 19 year process
* At the end, 1898: The low wheeled, rear chain drive, diamond frame and air tire cycle emerged as "the" bicycle
* After 1898 these details became, "taken-for-granted.

Closure (problem being solved versus relevant groups perceiving it as being solved?)

* Rhetorical closure: just say the problem has been fixed. Advertising the improved safety features.
* Redefine the problem:
	1. Few liked the air tire- difficult enginneering and practicality, ugly
	2. Dunlop- thought it the best solution to vibration
	3. Sport cyclists- not concerned with vibration
	4. Increased speed afforded, won over significant groups
	5. Closure reached, not due to vibration issue but as a solution to the "need for speed."
* Closure is not a "natural" process, but a social construction.

**Read the Exchange between Bijker, Pinch, and Clayton concerning the revelance of SCOT and the case study of the development of the safety bicycle.**

* Nick Clayton, "[SCOT: Does It Answer](http://muse.jhu.edu/journals/technology_and_culture/v043/43.2clayton.html)"
* Pinch anf Bijker, "[SCOT Answers, Other Questions: A Reply to Nick Clayton](http://muse.jhu.edu/journals/technology_and_culture/v043/43.2bijker.html)"
* Clayton, "[Rejoinder](http://muse.jhu.edu/journals/technology_and_culture/v043/43.2clayton_rejoinder.html)"
* Bruce Epperson, "[Does SCOT Answer? A Comment](http://muse.jhu.edu/journals/technology_and_culture/v043/43.2epperson01.html)"
* All found in: "[Technology and Culture](http://muse.jhu.edu/journals/technology_and_culture/toc/tech43.2.html)," V43, N2, April 2002



Other Examples from Bijker:

* ["The Fourth Kingdom: The Social Construction of Bakelite"](http://www.umsl.edu/~keelr/280/class/plastic.html)
* ["The Majesty of Daylight: The Social Construction of Fluorescent Lighting"](http://www.umsl.edu/~keelr/280/class/flight.html)
* [Frames and Technological Frameworks](http://www.umsl.edu/~keelr/280/frames.html)



**Focus on the Interrelatedness of Technology and Everday Life**

* Ruth Schwartz Cowan: ["The Consumption Junction"](http://www.umsl.edu/~keelr/280/class/myngcon.html)
	+ Not technological determinism, but a recognition of interrelatedness.
	+ Review L. [Winner](http://www.umsl.edu/~keelr/280/class/anthtd.html) on the [politics of technology](http://www.umsl.edu/~keelr/280/class/corywinn.html), and ["Techne' and Politera"](http://www.umsl.edu/~keelr/280/class/winner.html)
	+ Marx: People construct (make) history, but they do so within the circumstances transmitted from the past. "The legacy of technology."
	+ Impact of technology on the environment (ecological critique as a significant voice in the shaping of technology



**What Shapes Technology**

Focus on Gender and Technological Development

* Cynthia Cockburn: ["Caught in the Wheels"](http://www.umsl.edu/~keelr/280/class/tracytd.html)
* Ruth Schwartz Cowan: ["Gender and Technological Change"](http://www.umsl.edu/~keelr/280/rokcowan.html)



Domestic Issues

* Ruth Schwartz Cowan: ["How the Refrigerator got its Hum"](http://www.umsl.edu/~keelr/280/refrig.html)



[Technological Systems](file:///C%3A%5CUsers%5Cclylton%5CDocuments%5CINFO%20SOC%202012-2%20%20aula%203%5CThe%20Social%20Construction%20of%20Technology.html#Technological%20Systems)

* Technology shaping technology with the structure of socially constructed technological systems
* [McGinn](http://www.umsl.edu/~keelr/280/invent.html) on invention and innovation
* [Thomas Hughes on Edison](http://www.umsl.edu/~keelr/280/class/edison.html)
	1. Edison's work is perhaps best seen as minute and paistaking modification of existing devices
	2. His imagination=> looking at what exists in new ways and combinations
	3. Design and development of the light bulb- as a part of a system of electrical generation and distribution. The system designed the bulb!
	4. As system expands and new elements are placed within it- we encounter "reverse salients": Products of uneven development, technological lags. Attention is directed there- defined as "critical problems"
	5. Example: electrical supply- transmission requires high voltage, power is lost through the lines: development of alternating current, transformers, power stations, etc.
	6. The light bulb? In order to make electric lighting competitive with gas systems, Edison had to find a way to get lots of light from lower current levels (and lower current allowed for less copper in the wires). Reverse salient (goal oriented system)- unprofitabiltiy. Scientific research on electrical resistance (Ohm's and Joule's laws)- search for the proper filament.
	7. Edison: Good grasp of the system.



**Economic Factors and Technological Change**

* Understanding technological change as within, rather than outside of, society.
* Power of "market forces"
* Economic shaping of technology is the social shaping of technology, and is particular to specific societies and their social relations of production. Economic System<=>Social System<=>Technological System
	1. Bhaduri's study of agriculture in India. Limiting technological change limited productivity and kept peasants tied up in a cycle of debt- reiforcing their dependency on the landowners. Resistance to technological change cannot be explained by "cultural backwardness," but by "rational calculation" on the part of land owners (within a different "frame" than industrial capitalism. (I.e. socio-economic sytem=> rate of innovation)
	2. Type of society: Type of technology, yet many analyses suggest that technological development is, in one way or another, a means to embody control (owners over workers, producers over consumers)



**Economics, Social Relations and the State**

1. [Gender issues](http://www.umsl.edu/~keelr/280/rokcowan.html) and other social relations shape technological development.
2. Other needs: State determined out weigh rational economic calculations (Germany and synthetic petrol during WWII).
3. 17th and 18th Century France and England: Technology as source of power, population and wealth- yet in France- "work must be found for the largest number of hands." Brocade loom vs English plain-cloth loom (Former required twice as many workers)
4. Military operations: The state's military interest in new technologies is often the critical element that allows change in the face of overwhelming costs or other obstacles
	* Nuclear power: Military development, economic drawvbacks overridden by "need for autonomous" energy supply
	* Jet airliners- technology directly descented from military developments
	* Electronics- especially computers and the internet



[**Conclusions: from Bijker**](http://www.umsl.edu/~rkeel/280/class/bijker.html)



**Extensions of The Constructionist Perspective:**

**Actor-Network Theory**

* "An actor network is simultaneously an actor whose activity is networking heterogeneous elements and a network that is able to redefine and transform what it is made of."
* An actor-network includes both human and non-human elements
* An actor-network is not fixed or stable- it is capable of redefining its identity and relationships in new ways.
* (From: Michel Callon, "Society in the Making: The Study of Technology as a tool for Sociological Analysis" in The Social Construction of Technological Systems)



* ["Society in the Making: The Study of Technology as a Tool for Sociological Analysis," by Michel Callon.](http://www.umsl.edu/~keelr/280/class/callon.html)
* ["Technology and Heterogeneous Engineering: The Case of Portuguese Expansion," by John Law](http://www.umsl.edu/~keelr/280/class/actor.html)



Technological Systems

* "Technological systems contain messy, complex, problem-solving components."
* "They are both socially constructed and society shaping."
* They contain: artifacts, organizations, and institutions
* They are shaped by their components.
* They are goal oriented and evolve over time.
* "Reverse Salients"
* (from: Thomas P. Hughes, "[The Evolution of Technological Systems](http://www.umsl.edu/~keelr/280/techsys.html)" in The Social Construction of Technological Systems



**McGinn: Interactivity- Technically induced social change:** IDUAR Model

* **Innovation and Diffusion (as above- shaped by SCES)**
* **Pattern of Use: purposes, how much, how widely shapes social reality**
* **Adaptation (may or may not require changes, similar in ways to Hughes' idea of momentum)- example of the automobile**
* **Resistance**

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[**Technology, Power and Social Control: Marx and Conflict Theory**](http://www.umsl.edu/~keelr/280/critical.html)

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***URL: http://www.umsl.edu/~keelr/280/soconstr.html
Owner: Robert O. Keel:*** ***rok@umsl.edu******Last Updated: Monday, March 7, 2011 15:05***

Bijker: Understanding Socio-Technical Change

Weibe Bijker: "Conclusion: The Politics of Sociotechnical Change".

Analysis by: Anne Brady

-This article was a summary of his first four chapters,

-In this chapter he basically talks about the ways in which technology is a social process.

-He introduces the terms "interpretative flexibility" and "relevant social groups". You can not explain technology solely by an artifacts' intrinsic properties, but rather by also including the meanings attributed to an artifact by relevant social groups. This is the process of interpretative flexibility--how an artifact is interpreted, or what meanings are given to it. Interpretative flexibility decreases when the meanings attributed to an artifact become less ambiguous and more stable. The interpretation of a relevant social group finally becomes dominant, and closure occurs.-- society has come to a consensus on the meaning of an artifact (see bicycle case as an example).

-Technology is a process of social construction, as it occurs in steps while continuously changing between the steps, either becoming more or less stabilized.

-Non-technical factors are important in understanding and analyzing the development of technology. Here he introduces the term "sociotechnology". Technology is socially constructed and society is technically constructed. The construction of society and the construction of science and technology should be explained in the same way, not as one causing or being a by-product of another. So now artifacts are "sociotechnical ensembles". They are socially as well as technically constructed.

- Different processes of sociotechnical change occur. In general,

1. When there is no dominant relevant social group then there are no vested interests and there are many different innovations that can be made. In this case all social groups are important, so the success of an innovation often depends on "problem redefinition"--redefining a problem in order to please groups that do not find the "real" problem important.

2. There is one dominant group that is able to insist upon its definitions as being the appropriate ones. When this situation occurs, innovations tend to be conventional.

3. There are two or more groups, each having arguments that carry little weight in some situations and more weight in others. The closure process in this case becomes a battle between relevant social groups, and nobody wins.

-\*\*He refers to "technological frames", but I do not know what he is talking about. I think this is something he talked about thoroughly in Chapter 3.

-Bijker believes that we should develop a new field of study called "sociotechnology".

-Technology is embedded in modern culture as well as culture is embedded in technology.

-Seems against the deterministic way of thinking--A constructivist analysis is instead necessary for sociotechnology. We must not take a deterministic approach to technology, but instead realize that because of interpretative flexibility, choice and change are possible. If the public feels that they have no control over technology, then they will turn their backs on it and then it will slip out of control. What constitutes technology as working is socially constructed (based on choices), therefore, we cannot "blame the hardware".

-The fixing of meanings that occur during a technological frame is a form of power in that meanings become hardened or fixed. Previous meanings given to an artifact limit the flexibility of other new meanings. Relevant social groups have invested so much in defining an artifact that its meaning can not easily be changed. In this sense, an artifact may have power in determining social development. (But we must remember that social processes also determined the artifact).

Artifacts in this sense are also called "exemplary artifacts".

-Artifacts can also be boundary objects. Inclusion is used as an example to state the boundaries of inside and outside. For example, willing participants in the florescent light business were required by G.E. to accept the high-intensity florescent lamp as the only daylight florescent lamp in the game. Those who complied with this were let inside of the frame and those who did not were left outside. To put it another way, those who complied were of the relevant social group whose meanings became dominant. The meanings of those who did not comply, were, for lack of a better term, ignored. So those outside were "forced" to take the artifact as it was, without being able to modify it.

-sociotechnical ensembles that constitute a semiotic power structure can become softened by deconstructing their obduracy. For example, the bicycle was at first part of a structure that prevented women from using it. This structure was deconstructed, however, when new ensembles such as low-wheeled bicycles and bloomers allowed for women to use them, and to become a part of its structure. Perhaps a better word than deconstructed would be reconstructed. In any case, the meanings which were once fixed to the bicycle which disallowed women from using them were softened or replaced by new meanings which allowed women to use them.

The basic point Bijker seems to be saying is that technology is socially constructed, and he is trying to show the different ways in which this is so by using the examples above.