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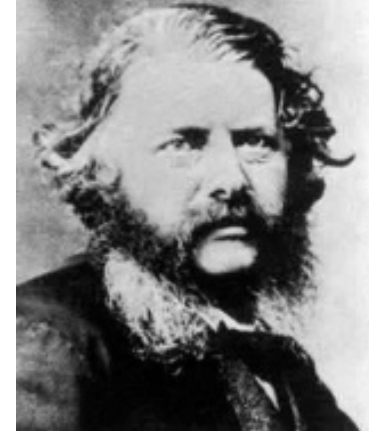


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Philosophy of Engineering Practice

Efficiency..

- ...is a **ratio of output over input**
- 19th C Engineering basis; Rankine's thermodynamic engine efficiency (2nd Law of Thermodynamics: 100% efficiency is impossible)
- A **dominant principle of modern society** and all its endeavours
 - not just engineering but economics, management, etc.
- Used for **quantification**, measurement and comparison
- Has come to be equated with **productivity, usefulness, progress** and **goodness**
- But, **not useful/desirable** for many important **social** and **ecological** activities; e.g. inspiration, creativity, innovation, flourishing, care, love, natural and biological systems (e.g. ecosystems, brain, kidneys), gastronomy, spirituality, etc.



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Development of principle of efficiency..

Neoclassical Economics

- 'Age of Efficiency' (ca. 1890-1930)
- **Homo economicus** (the **rational** economic human)
- **Prosperity** equates with (the economically **quantitative** measures of) **personal gain** (e.g. GDP per head) and **efficiency** (e.g. productivity) rather than (qualitative) social meaning, happiness and sustainability
- **William Stanley Jevons: Increased efficiency** leads to **increased consumption** due to lower costs
e.g. rail/air travel, lighting
- **Feeds growth** in outputs, economic growth and increased consumption





Development of principle of efficiency..

Scientific Management

- aka '**Taylorism**' - Frederick Winslow Taylor sought the '**one right way**' to manage production through stopwatched time and motion studies of disaggregated tasks
- Promotes **division of labour**
- **Separation of thinking/knowledge** from **doing/skills** while elevating the former
- Rise of **mass production** over **artisan**
- Tends to neglect **social** and **ecological** costs
- Greater **separation of designer/producer** from **user**
- Promotes ongoing increases in worker **productivity** –output per worker per day; hence greater organisational profits



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Efficiency as driver

- Increased productivity →
- No time to waste or spend doing non quantifiable (non productive) activities →
- Economies of scale and globalisation →
- Profits and wealth concentrated →
- Local unemployment →
- Fewer people work longer and more flexible hours →
- Globalisation →
- Reduced redundancy →
- Cheaper goods ..greater consumption →
- Intensification →
- Specialisation (division of labour) →
- Recycle →
- Economic development →
- Quantifiable economic wealth and growth over social and ecological aspects →

19th/20th
Century:

..tallied with idea of ongoing progress/development

..vs. Sufficiency

- Increased quality
- Time to think, reflect, develop new insights, be creative and enjoy work!
- Localisation and community involvement
- Profits and wealth distributed
- Local employment
- More people work fewer and more sociable hours
- Local community networks
- Redundancy and greater resilience
- More expensive goods ..reduced consumption
- Diverse
- Artisan
- Avoid/Reduce
- Social, ecological and economic sustainability
- Qualitative social, ecological and economic flourishing

21st Century
Rebalancing?

..since constrained by ecological/resource limits and need for resilience

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Professional engineering ethics and ethos

Are engineers 'value neutral'?

Yes?

No?

Should engineers be 'value neutral'?

Yes?

No?

If so,
why so?

If not,
what values should
engineering hold?



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Two Conceptions of Engineering*

1. Engineers as value neutral 'guns for hire' or 'paid hands'



2. Engineers as committed to a social good thus being constrained in some ways, privileged in others to achieve this

Engineers Without Borders: Engineering students from Dartmouth College (NH, USA) with a local child about to install a Pelton hydro turbine to generate electricity in Rwanda.



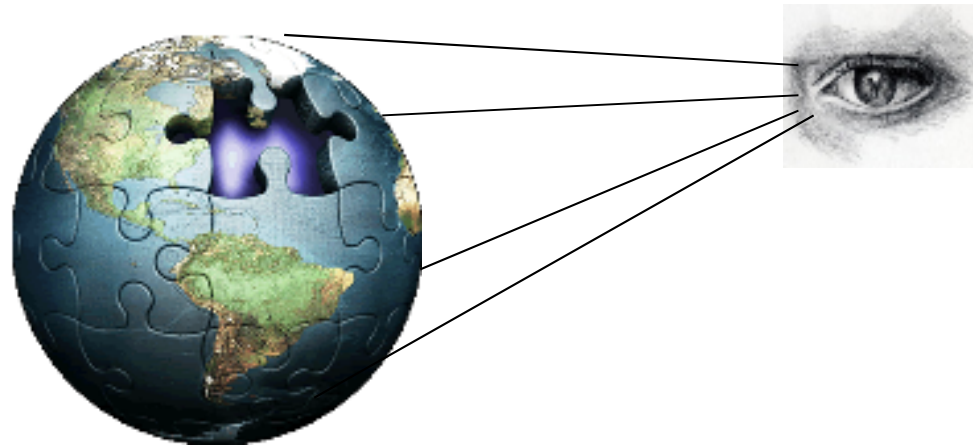
*Deborah Johnson, 'The Social/Professional Responsibility of Engineers' (1989)



Engineering and Values

*Louis Bucciarelli (MIT, 2008): “If you accept the vision of engineering practice promoted and sustained by the **object-world** notion then it follows that the profession is ‘**value neutral**’, that we are all but ‘guns for hire’.*

*But it is a **myopic vision**: **The profession of engineering is not value neutral.**”*



*“In engineering practice, **value judgements are made all the time**, often not explicitly – about the **user**, about **robustness**, about **quality**, about **responsibilities**, **safety**, **societal benefit**, **risks** and **cost**.”*

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Engineering and Values



Emphasis on Increasing Supply ↑
over Reducing Demand ↓



>1m kg plastic/hr enter world's oceans

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Factors influencing ethical behaviour?
