

Social and Ethical Aspects in Engineering IME-251

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Week9 Agenda

- Engineering as Social Experimentation
 - Socially conscious engineering; Engineering, Ecology and Economics

March 2022

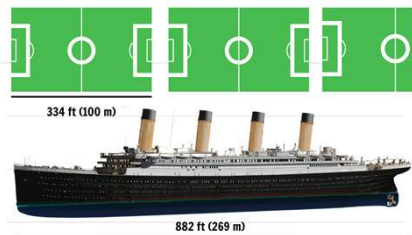
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Engineering as Social Experimentation

- Importance of Engineering as Social Experimentation
 - Story of Titanic (1912)

The Titanic Was as Long as: 2.6 Football Pitch



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Engineering as Social Experimentation

- Importance of Engineering as Social Experimentation
 - Story of Titanic (1912)
 - 1522 dead out of 2227
- Engineering: an experimental process
 - Laboratory experimentation
 - Social scale experimentation

Important Words:

- Voyage
- Maiden
- Ocean liner
- Tout
- Envisage
- Juncture
- Evacuate
- Foresee
- Crew
- Haunting
- Complacency

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Engineering as Experimentation

- Standard Experimentation
 - Design Level Experimentation and Testing
 - Production Level Experimentation and Testing
- Social Experimentation of Project
 - Engineering Project Level Experimentation and Testing
 - Similarities with Standard Experimentation
 - Uncertainty or Partial Ignorance
 - Uncertainty in Outcome
 - In-use (social) Monitoring
 - ...

Important Words:

- Benign
- Aqueduct
- Adequate
- Vulnerability
- Surveillance
- Dissident
- Endanger
- Unintended
- Venture

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Engineering as Experimentation

- Social Experimentation of Project (Cont'd)
 - Learning from Past
 - Hurdles
 - Lack of established channels of communication
 - Misplaced Pride
 - Embarrassment at failure
 - Fear of litigation
 - Plain neglect
 - Heedlessness is amongst the main causes of repetitive failure
 - Examples

Important Words:

- Litigation
- Embarrassment
- Impede
- Notorious
- Malfunction

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Engineering as Experimentation

- Social Experimentation of Project (Cont'd)
 - Contrasts with Standard Experimentation
 - Experimental Control
 - Standard Procedure
 - Natural experiment
 - Informed Consent
 - Importance of Consent
 - Necessary Knowledge of Product/Situation: required plus not required
 - Voluntariness of Participant: No Force, Fraud or Deception
 - A valid consent and its conditions:
 - The consent was given voluntarily.
 - The consent was based on the information that a rational person would want, together with any other information requested, presented to them in an understandable form.
 - The consent was competent (not too young, or mentally ill, for instance) to process the information and make rational decisions.
 - Information that a rational person would need, stated in understandable form, has been widely disseminated.
 - The subjects' consent was offered in proxy by a group that collectively represents many subjects of like interest, concerns and exposure to risk.

Important Words:

- Retrospective
- Mere
- Metaphor
- Deliberately
- Societal
- Albeit
- Inanimate
- Revelation
- Primacy
- Contemporary
- Vital
- Enormous
- Pertinent
- Avenue
- Disseminate

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Engineering as Experimentation

- Social Experimentation of Project (Cont'd)
 - Contrasts with Standard Experimentation
 - ...
 - Knowledge Gained
 - Scientific experiments are conducted to gain new knowledge whereas the engineering projects are experiments that are not necessarily designed to produce very much knowledge.

Important Words:

- Paradigm

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Discussion Questions

On June 5, 1976, Idaho's Teton Dam collapsed, killing eleven people and causing \$400 million in damage. The Bureau of Reclamation, which built the ill-fated Teton Dam, allowed it to be filled rapidly, thus failing to provide sufficient time to monitor for the presence of leaks in a project constructed with less-than-ideal soil.⁷ Drawing on the concept of engineering as social experimentation, discuss the following facts uncovered by the General Accounting Office and reported in the press.

Discussion Questions

- a. Because of the designers' confidence in the basic design of Teton Dam, it was believed that no significant water seepage would occur. Thus sufficient instrumentation to detect water erosion was not installed.
- b. Significant information suggesting the possibility of water seepage was acquired at the dam site six weeks before the collapse. The information was sent through routine channels from the project supervisors to the designers and arrived at the designers the day after the collapse.

Discussion Questions

- c. During the important stage of filling the reservoir, there was no around-the-clock observation of the dam. As a result, the leak was detected only five hours before the collapse. Even then, the main outlet could not be opened to prevent the collapse because a contractor was behind schedule in completing the outlet structure.
- d. Ten years earlier the Bureau's Fontenelle Dam had experienced massive leaks that caused a partial collapse, an experience the bureau could have drawn on.

Discussion Questions

Research the collapse of the Interstate 35W Bridge in Minneapolis on August 1, 2007, which killed 13 people and injured 100 more. In light of the social experimentation model, discuss its causes and whether it could have been prevented.

Debates over responsibility for safety in regard to technological products often turn on who should be considered mainly responsible, the consumer ("buyer beware") or the manufacturer ("seller beware"). How might an emphasis on the idea of informed consent influence thinking about this question?

Discussion Questions

Thought models often influence thinking by effectively organizing and guiding reflection and crystallizing attitudes. Yet they usually have limitations and can themselves be misleading to some degree. With this in mind, critically assess the strengths and weaknesses you see in the social experimentation model.

One possible criticism you might consider is whether the model focuses too much on the creation of new products, whereas a great deal of engineering involves the routine application of results from past work and projects. Another point to consider is how informed consent is to be measured in situations where different groups are involved, as in the construction of a garbage incinerator near a community of people having mixed views about the advisability of constructing the incinerator.