Constraints on Design

CMPE 349 E.F.C. LaBerge

**This lecture is based on the work of
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Ohio Northern University and Dr.
Kenneth Reid at Virginia Tech**

**Anyone can design a product; good design involves
making a product both useful and understandable. This
is why those who want to become engineers attend a
university and not a trade school.**

D. Estell/J. Hurtig

- **A constraint is a restriction on the freedom we have
to provide a solution to our design problem**

- **All designs are constrained in some way**

  - **Business Factors (schedule, budget)**

  - **Technical Fundamentals (resources, technology)**

  - **Customer Demands (functionality, cost, safety)**

  - **Societal Values (environmental, safety)**

- **Some (maybe most) of the constraints may be codified in the specification/requirements...**
- **...but some may not...**
- **...or may not be explicit.**
- **All engineering projects have a set of attributes**
- **Estell and Hurtig classify these attributes**
  - **General Attributes that probably aren't specified**
  - **Criteria that determine an acceptable product, which are specified**
  - **Constraints, which are noticeable realistic limitations representing externally-sourced influences**
- **Look at typical constraints in the four dimensions just mentioned**

Example Technical Constraints

- **Accuracy (not precision)**
- **Capacity**
- **Environmental**
- **Manufacturability**
- **Mechanical**
- **Physical**
- **Precision (not accuracy)**
- **Reliability**
- **Size**
- **Thermal**

Example Customer Constraints

- **Accessibility**
- **Aesthetics**
- **Efficiency**
- **Ergonomics**
- **Health**
- **Learnability**
- **Maintainability**
- **Physical (size weight shape,etc.)**
- **Process**
- **Risk/Safety (!!)**

Example Business Constraints

- **Competition**
- **Ethical practice**
- **Internal Resources**
- **Labor**
- **Liability**
- **Manufacturability**
- **Regulatory**
- **Schedule**
- **Supply Chain**
- **Sustainability**

Example Societal Constraints

- **Affordability**
- **Customs/Traditions**
- **Environmental**
- **Health**
- **Manufacturability**
- **Policy**
- **Regulatory**
- **Safety**
- **Sustainability**

Constraints as Requirements

- **Constraints are often requirements**
  - **Customer is aware and wants to enforce**
    - **Examples from AHPLS?**
  - **Producer is aware and wants to enforce**
    - **Examples from AHPLS or elsewhere?**
- **Constraints are often areas for innovation**
  - **Can you design break the constraint?**
    - **Dial Phone → Keypad → Cordless → Cell → Wireless**
    - **IPOD → IPHONE → IPAD**
  - **Can you innovatively incorporate the constraint?**
- **Constraints may be imposed by your own organization!**
- **Constraints often aren't even stated**

What about your design?

- **Constraints that are requirements?**

- **Constraints that are not requirements?**

- **Constraints that offer opportunities for innovation?**

- **Constraints that may not be explicitly stated**

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