The *ger* and engineering

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Participants’ Introduction
What is engineering?
The *ger*
The science and engineering of the *ger*
Participants’ Introduction

• About Marisol:
  • I am working on my Ph.D.
  • I was a Web programmer
  • I would like to learn more about you :- )
    (1) Name
    (2) What engineers do? What do they make?
What things I did?

- Software design and implementation
  - (Web-based and stand-alone programs)
- Database design and implementation
- Software testing
- Programming of hardware
- Computer repairing & maintenance
Some things about engineering

- Activities to design and produce technologies, systems, products, structures, etcetera.

... according to the engineers’ area of specialization.
Example of things that engineers do

- **Structures**
  Steel bridge structures

- **Systems - Equipment**
  Equipment to make and pack chocolate

[Video: http://www.youtube.com/watch?v=3K3-stVK0IM](http://www.youtube.com/watch?v=3K3-stVK0IM)

[Image: https://engineering.purdue.edu/CE/AboutUs/News/Features/CEs
tudentsplaceinSteelBridgeCompetition/steelBridge2.jpg](https://engineering.purdue.edu/CE/AboutUs/News/Features/CEs
tudentsplaceinSteelBridgeCompetition/steelBridge2.jpg)
Example of things that engineers do

- **Technology**
  Solar powered technology for a house

  ![Solar powered house](http://www.purdue.edu/apps/dpmanages/Resource/bilde2.jpg)

- **Products**

  ![Stapler](https://engineering.purdue.edu/ABE/InfoFor/CurrentStudents/be.html/images/tp.jpg/)
  ![Images of students](https://engineering.purdue.edu/ABE/InfoFor/CurrentStudents/be.html/images/tp.jpg/)
  ![Shipping boxes](http://www.zooly.org/images/stories/shipping-boxes/SB006.jpg)
Example of Engineering Design Projects

Robot that lifts aluminum cans

Building a ramp structure to understand motion.
http://ecrp.uiuc.edu/beyond/seed/zan.html

Testing a circuit
The Engineering Design Cycle

Source: http://www.mos.org/eie/engineering_design.php
Wheel of Engineering Design
(Source: Massachusetts Department of Education, 2006)
### Example of engineering projects

<table>
<thead>
<tr>
<th>Example of a projects</th>
<th>Engineering disciplines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web-based systems, sensor systems</td>
<td>Electrical and computer engineers</td>
</tr>
<tr>
<td>System to measure the efficacy of medical treatments</td>
<td>Biomedical engineers</td>
</tr>
</tbody>
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- **Eng. students showing their wireless home security system**
  [https://engineering.purdue.edu/ece477/Webs/S11-Grp07/index.html](https://engineering.purdue.edu/ece477/Webs/S11-Grp07/index.html)

- **Biosensor that measures efficacy of medical treatment**
  [https://engineering.purdue.edu/BME/AboutUs/Newsletter/PurdueBiosensormayMeasureEfficacyofEpilepsyandSeizu/porterfield-optrode.jpg](https://engineering.purdue.edu/BME/AboutUs/Newsletter/PurdueBiosensormayMeasureEfficacyofEpilepsyandSeizu/porterfield-optrode.jpg)
## Example of engineering projects

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<td>System to supply water</td>
<td>Civil engineers: Hydraulic engineers, environmental engineers</td>
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Sand filtration water treatment system  

Students examining a water distribution system  
https://engineering.purdue.edu/CE/Research
Example of engineering projects

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<td>Design of bridges and structures</td>
<td>Civil engineers: Structural and architectural engineers</td>
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Dormitory model being tested in an earthquake simulation

Assembling a steel bridge
The ger (yurt)
The *ger*: Traditional Mongolian home

- Walls are made up of lattice “fences”
- Roof is made of wooden poles:
  - One end has a peg to fit in the roof wheel
- Rawhide belts (or cords) are placed around the wall to support it
- Transportable -- mobile

Image source: Goldstein & Beall (1994)
The *ger*: Traditional Mongolian home

- Door always faces South
- Inside the *ger*:
  - North → altar
  - Fireplace at the center → has a sacred symbolism for many of them
- Grandparents, parents, and children usually live together
  - Close family connections
Mongolian ger set-up video 😊:
http://www.youtube.com/watch?v=OCKaKwwc9c4
The *ger* and engineering design

- Is like **civil engineering** (structural and architectural engineering)
- In engineering design we consider **constraints**:
  - What is the environment where the *ger* will be assembled?
  - What are the weather conditions? How about the soil conditions?
  - How can it be suitable for nomadic life of Mongolians?
    - Or a more sedentary life?
The *ger* and engineering design

- We also **solve problems** in engineering design:
  - What technologies do we need to have a solar powered stove?
  - What technologies do we need to have a satellite television?
  - What cultural symbols and art shall we paint?

CC http://www.flickr.com/photos/luigi_and_linda/4792865444

CC http://www.flickr.com/photos/magical-world/1377757520
The *ger* and engineering design

- More decisions to take into consideration in engineering design 😊:
  - It’s winter time! Should we put more wool-felt fabric?
  - How big our space needs to be?
How does it stand up?

- **Loadbearing** wooden lattices (wall) and wooden poles.
- Hardness level of the wood

Image source: Goldstein & Beall (1994)
How does it stand up?

• The walls of the *ger* can open and close (*collapse* and *expand*).
  • The drilling of bolts facilitates the *motion (rotation)* between the two wooden poles.
  • The design of the walls serve the function of store and move.
How does it stand up?

- Belts around the *ger* are applying forces to keep the fabrics and structure in place when the forces of the wind impact it.
- Function to give firmness to the walls

Image source: Goldstein & Beall (1994)
How does it stand up?

- **Vertical equilibrium**
  - Downward forces (weight of wool-felt) and upward forces (reaction forces of the wooden poles and floor) become balanced, thus, making the structure stable.
How does it keep a family warm?

• Through *heat insulation*
  • Heat can only flow from a warmer to a colder area
  • Wool-felt fabrics trap the heat
  • *Two poor heat conductors* (wool-felt and the air trapped inside) keep a family warm in the coldest months!

What have we learned? 😊

1) Engineers design and produce technologies, systems, products, processes, structures, buildings, etcetera.

... According to the engineers’ area of specialization, constraints, and the interrelated society we live.

• They solve problems
• Create new ideas or improve previous ones

2) Gers are examples of civil engineering (structural and architectural engineering)

• Designed under constraints, solve problems, improve or create new ideas

3) How does the structure of the ger stands up.

4) How does it keep a family warm: through heat insulation.
Thanks for your attention! 😊

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