Technology, Leadership and American Culture: Training Manual for Mechanical Engineering Students of Zhejiang University of Technology (ZJUT), China March 20 – March 31, 2011

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Department of Mechanical Engineering
College of Engineering & Engineering Technology

International Training Office
Division of International Programs

Northern Illinois University

College of Engineering & Engineering Technology
Celebrating 25 Years
Technology, Leadership and American Culture:
Training Manual for Mechanical Engineering Students of
Zhejiang University of Technology (ZJUT), China

March 20 – March 31, 2011

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This publication is designed to provide accurate and authoritative information in regard to the subject matter covered.

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People in the Program

College of Engineering & Engineering Technology,  
Department of Mechanical Engineering  
Dean of the College    Dr. Promod Vohra  
Chair, Department of Mechanical Engineering  Dr. Shin-Ming (Simon) Song

Division of International Programs, International Training Office  
Associate Provost, International Programs  Dr. Deborah Pierce  
Director, International Training Office  Dr. Lina Ong

Presentations  
Department of Mechanical Engineering, NIU  Dr. Brianno D. Coller, Dr. Jenn-Terng Gau,  Dr. Nicholas A. Pohlman, Dr. Shin-Ming (Simon) Song  
International Training Office, NIU  Dr. Lina Ong, Rey Ty  
ELS Language Centers/DeKalb  Alex Jankiewicz, Dieter Zeschke  
Harold Washington College, Chicago  Dr. Kurt Sheu

Mechanical Engineering Field Visits  
Caterpillar  Dean A. Cahao, Byron D. Collis  
Fermi National Laboratory  Nancy Lanning

Events Planning and Resource Coordination  
Logistics  Lina Ong  
Training Manual  Rey Ty  
All Meal Arrangements  Leslie Shive  
Transportation  Nalika Diyadawa  
Airport Arrival and Departure  Rey Ty & Associates  
Campus Tour  Rey Ty, Amando Boncales  
Field Visits to Caterpillar and Fermi National Laboratory  Rey Ty  
Cultural Visit Tickets for Chicago  Nalika Diyadawa  
Cultural Visit Coordination for Springfield  Rey Ty  
Chicago Cultural Visit Escort  Rey Ty  
Flyers on Tour Sites  Amando Boncales  
Training Kits  Maimouna Konate, Amando Boncales  
Pizza for Interaction with NIU Students  Leslie Shive, Maimouna Konate  
Certificates of Completion  Nalika Diyadawa  
Certificate ceremony program design  Lina Ong  
Certificate Ceremony guest list from Dr. Song  Leslie Shive  
Name Tags  Amando Boncales

Cover Photo Credits  
Northern Illinois University  Zhejiang University of Technology
Professor from Zhejiang University of Technology
He Zuojing, Associate Professor, Associate Dean of Student Affairs

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Academic Status</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Li Bo</td>
<td>Junior</td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>Ying Li</td>
<td>Senior</td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>Shi Mengyue</td>
<td>Junior</td>
<td>F</td>
</tr>
<tr>
<td>4</td>
<td>Ren Bo</td>
<td>Sophomore</td>
<td>F</td>
</tr>
<tr>
<td>5</td>
<td>Wang Qiaonan</td>
<td>Junior</td>
<td>F</td>
</tr>
<tr>
<td>6</td>
<td>Ma Fangchao</td>
<td>Junior</td>
<td>M</td>
</tr>
<tr>
<td>7</td>
<td>Lou Xiaoying</td>
<td>Junior</td>
<td>F</td>
</tr>
<tr>
<td>8</td>
<td>Hong Si</td>
<td>Junior</td>
<td>M</td>
</tr>
<tr>
<td>9</td>
<td>Zhou Jie</td>
<td>Senior</td>
<td>M</td>
</tr>
<tr>
<td>10</td>
<td>Hu Luoke</td>
<td>Senior</td>
<td>M</td>
</tr>
<tr>
<td>11</td>
<td>Wu Yumeng</td>
<td>Freshman</td>
<td>M</td>
</tr>
</tbody>
</table>
Workshop on Technology, Leadership and American Culture for Mechanical Engineering Students of ZJUT

Simon Song 12/17/10

Duration: 10 days (March 20 - March 31, 2011)

Technology and Innovation: (8 sessions, 1.5 hours/session)
1. Advanced Computer Modeling and Simulation: Dr. Coller, 2 sessions
2. Micro-Manufacturing: Dr. Gau, 1 session
3. Energy, Economics and Environment: Dr. Pohlman, 1 session
4. Robotics and Walking Machines: Dr. Song, 2 sessions
5. Marketing and Insurance in the U.S.: Dr. Sheu, 4 sessions

Language and American Culture: (4 sessions, 1.5 hours/session)

Leadership: (4 sessions, 1.5 hours/session)

Orientation, Language and Culture: (4 sessions, 1.5 hours/session)
1. Welcome / Logistics / OneCard
2. Program Overview / Computer Orientation / Engineering Building Tour
3. Cultural Orientation / US-Chicago Geography/
4. Campus Tour / City Tour

Field Trips: (2 trips, ½ day per trip) to visit world class companies/national laboratories selected from the following:
1. Caterpillar Aurora (construction machines)
2. Fermi National Laboratory (accelerator, high energy physics)

Culture Trips: 3 trips (1 day per trip including weekend)
1. Northwestern University, Lake Shore Drive, China Town, Illinois Institute of Technology, Premium Outlet Mall
2. Chicago Downtown: Sears Tower, Millennium Park, The Magnificent Mile, Art Institute/Museums

Conclusion and Certificate Ceremony: (Luncheon)
Dr. Pierce, Dr. Song and International Training Office

Important Note for Instructors:
1. The International Training Office (ITO) will prepare a printed program notes that is a collection of all lecture slides and handouts for the students. Each instructor should send the electronic files of slides and handouts to Mr. Rey Ty at rty@niu.edu or reyty1@gmail.com by February 1, 2011, Monday, 12 noon. The file format should be either PowerPoint 2003 file or WORD 2003 file (do not send PDF file).
2. Language is a main issue in this summer program. Therefore, you must speak SLOWLY and use slides as much as possible. Students need to go over the lecture materials and use dictionary to find the meaning of each unknown vocabulary beforehand. The slides in the program notes should be identical to the slides you use in lecture.

**Other Activities:**
1. English conversation groups
2. Ball games (basketball, soccer)
3. Jog / track
4. Swimming / weight conditioning

**Blending with NIU Students:**
1. We will arrange one hour social time on a few selected days for NIU students who are taking summer classes to meet with the visiting students. The ITO will prepare pizza, drinks and snacks.
2. We will encourage NIU students to join the visiting students during their sporting events and other activities.
## Training Program from March 20 to March 31, 2011

Unless Specified Otherwise, Class Sessions are: 8:45–10:15, 10:30–12:00, 1:30–3:00, 3:15–4:45;  
All Class Sessions are in FR358.

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
</table>
| March 20     | March 21  
9:00 a.m.  
Welcome (Dr. Pierce, Dr. Vohra)  
Program Overview (Dr. Song)  
Logistics (Dr. Ong)  
Computer Orientation & LogOn ID (Shive, Chen)  
12:30–1:45 p.m. NIU OneCard  
2:00 p.m. Cross-Cultural Orientation & U.S. Geography (Rey Ty)  
Tour of NIU campus & DeKalb (Rey Ty) | March 22  
8:45am-12:00pm  
Session 1,2: English Language & American Culture | March 23  
8:00 a.m.  
Field Trip: Fermi National Lab  
Lunch at Premium Outlet | March 24  
8:45am-12:00pm  
Session 5,6: English Language & American Culture  
12:00-1:00 p.m. Pizza lunch meeting with NIU Baja Team  
2:00 p.m. Field trip: Caterpillar in Aurora | March 25  
8:45am-12:00pm  
Session 9,10: Marketing and Insurance Dr. Sheu | March 26  
8:45 a.m. Cultural trip Northwester University, Lake Shore Drive  
Lunch at China Town Illinois Institute of Technology  |
| Participants Arrive. NIU staff welcomes participants at O'Hare Airport | | | | | | |
| March 21     | 9:00 a.m. Welcome (Dr. Pierce, Dr. Vohra)  
Program Overview (Dr. Song)  
Logistics (Dr. Ong)  
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Lunch at China Town Illinois Institute of Technology  |

### March 21
- Welcome (Dr. Pierce, Dr. Vohra)
- Program Overview (Dr. Song)
- Logistics (Dr. Ong)
- Computer Orientation & LogOn ID (Shive, Chen)
- 12:30–1:45 p.m. NIU OneCard
- 2:00 p.m. Cross-Cultural Orientation & U.S. Geography (Rey Ty)
- Tour of NIU campus & DeKalb (Rey Ty)

### March 22
- 8:45am-12:00pm Session 1,2: English Language & American Culture

### March 23
- 8:00 a.m. Field Trip: Fermi National Lab
- Lunch at Premium Outlet

### March 24
- 8:45am-12:00pm Session 5,6: English Language & American Culture
- 12:00-1:00 p.m. Pizza lunch meeting with NIU Baja Team
- 2:00 p.m. Field trip: Caterpillar in Aurora

### March 25
- 8:45am-12:00pm Session 9,10: Marketing and Insurance Dr. Sheu

### March 26
- 8:45 a.m. Cultural trip Northwester University, Lake Shore Drive
- Lunch at China Town Illinois Institute of Technology

### March 27
- Leave 8:00 a.m. Chicago United Center Willis Tower Millennium Park Magnificent Mile Museum of Science & Industry

### March 28
- 8:45am-12:00pm Session 13,14: Leadership
- 12:00-1:00 p.m. Pizza lunch meeting with NIU student groups
- 1:30-4:45pm Session 15,16: Advanced Computer Modeling and Simulation Dr. Coller

### March 29
- 8:00 a.m. Cultural trip Springfield Lincoln Museum, Lincoln Library, Illinois State Capital

### March 30
- 8:00 a.m. Program Evaluation
- 12:15 p.m. University Suite Lunch
- Presentation of Certificates

### March 31
- Depart for China
- NIU Spring Break 2011: March 13 - 20
### Chicago Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1630–1818</td>
<td><strong>Illinois Indians settle in northern Illinois</strong></td>
</tr>
<tr>
<td>1679</td>
<td><strong>French coureurs de bois first come to area</strong></td>
</tr>
<tr>
<td>1673</td>
<td>Marquette and Joliet explore region, claim it for New France</td>
</tr>
<tr>
<td>1690</td>
<td><strong>Miami refugees settle temporarily</strong></td>
</tr>
<tr>
<td>1690</td>
<td><strong>Potawatomi migrate from Wisconsin</strong></td>
</tr>
<tr>
<td>1696–1699</td>
<td><strong>Mission of the Guardian Angel</strong></td>
</tr>
<tr>
<td>1701</td>
<td><strong>Grand Alliance of French and Iroquois</strong></td>
</tr>
<tr>
<td>1716</td>
<td><strong>French use Chicago as base for war against Fox Indians in Wisconsin</strong></td>
</tr>
<tr>
<td>1717</td>
<td><strong>Illinois transferred from New France to the government of Louisiana</strong></td>
</tr>
<tr>
<td>1717</td>
<td><strong>Fox Wars</strong></td>
</tr>
<tr>
<td>1754–1763</td>
<td><strong>French and Indian Wars</strong></td>
</tr>
<tr>
<td>1763</td>
<td><strong>Treaty of Paris cedes French territory, including Canada, to Britain</strong></td>
</tr>
<tr>
<td>1763–1764</td>
<td><strong>Warfare drives Ottawa and Ojibwa tribes west to Chicago area</strong></td>
</tr>
<tr>
<td>1776–1783</td>
<td><strong>American Revolution</strong></td>
</tr>
<tr>
<td>1779</td>
<td><strong>DuSable trades at Michigan City</strong></td>
</tr>
<tr>
<td>1783</td>
<td><strong>Treaty of Paris: British cede land to American control</strong></td>
</tr>
<tr>
<td>1785</td>
<td><strong>U.S. Land Ordinance; rectangular land survey system</strong></td>
</tr>
<tr>
<td>1787</td>
<td><strong>Northwest Ordinance</strong></td>
</tr>
<tr>
<td>1788</td>
<td><strong>Ratification of U.S. Constitution by minimum number of states</strong></td>
</tr>
<tr>
<td>1789</td>
<td><strong>French Revolution</strong></td>
</tr>
<tr>
<td>1790</td>
<td><strong>DuSable settles in Chicago</strong></td>
</tr>
<tr>
<td>1795</td>
<td><strong>U.S. acquires land at Chicago in Treaty of Greenville</strong></td>
</tr>
<tr>
<td>1800</td>
<td><strong>DuSable sells holdings at Chicago River</strong></td>
</tr>
<tr>
<td>1800</td>
<td><strong>Indiana Territory formed from part of Northwest Territory</strong></td>
</tr>
<tr>
<td>1803</td>
<td><strong>Fort Dearborn established</strong></td>
</tr>
<tr>
<td>1803</td>
<td><strong>Louisiana Purchase</strong></td>
</tr>
<tr>
<td>1803</td>
<td><strong>Trader John Kinzie moves to Chicago</strong></td>
</tr>
<tr>
<td>1808</td>
<td><strong>Napoleon invades Spain</strong></td>
</tr>
<tr>
<td>1808</td>
<td><strong>U.S. bans importation of slaves</strong></td>
</tr>
<tr>
<td>1808</td>
<td><strong>American Fur Company in Chicago</strong></td>
</tr>
<tr>
<td>1809</td>
<td><strong>Illinois Territory established from part of Indiana Territory</strong></td>
</tr>
<tr>
<td>1811</td>
<td><strong>Burning of Prophetstown (IN)</strong></td>
</tr>
<tr>
<td>1812–1814</td>
<td><strong>War of 1812</strong></td>
</tr>
<tr>
<td>1812</td>
<td><strong>Fort Dearborn destroyed</strong></td>
</tr>
<tr>
<td>1816</td>
<td><strong>U.S. Army rebuilds Fort Dearborn</strong></td>
</tr>
<tr>
<td>1816</td>
<td><strong>Indiana statehood</strong></td>
</tr>
<tr>
<td>1816</td>
<td><strong>U.S. obtains canal corridor land in treaty</strong></td>
</tr>
<tr>
<td>1818</td>
<td><strong>Chicago’s first chartered bank (closed 10 years later)</strong></td>
</tr>
<tr>
<td>1818</td>
<td><strong>Illinois statehood</strong></td>
</tr>
</tbody>
</table>
Illinois Facts and Trivia
Source: http://www.50states.com/facts/illinois.htm

1. Ottawa, Freeport, Jonesboro, Charleston, Galesburg, Quincy and Alton hosted the famous Lincoln-Douglas debates that stirred interest all over the country in the slavery issue.
2. The first Aquarium opened in Chicago, 1893.
3. The world's first skyscraper was built in Chicago, 1885.
4. Home to the Chicago Bears Football Team, Chicago Blackhawks hockey team, Chicago Bulls basketball team, Chicago Cubs and Chicago Whitesox baseball teams, Chicago Fire soccer team.
5. The first Mormon Temple in Illinois was constructed in Nauvoo.
6. Peoria is the oldest community in Illinois.
7. The Sears Tower, Chicago is the tallest building on the North American continent.
8. Metropolis, the home of Superman really exists in Southern Illinois.
9. Cahokia Mounds State Historic Site--most sophisticated prehistoric native civilization north of Mexico.
10. Illinois had two capital cities, Kaskaskia, and Vandalia before Springfield.
11. The NFL's Chicago Bears were first known as the "Staley Bears". They were organized in 1920, in Decatur.
12. Illinois was the first state to ratify the 13th Amendment to the Constitution abolishing slavery. 1865.
13. On December 2, 1942, Enrico Fermi and a small band of scientists and engineers demonstrated that a simple construction of graphite bricks and uranium lumps could produce controlled heat. The space chosen for the first nuclear fission reactor was a squash court under the football stadium at the University of Chicago.
14. Des Plaines is home to the first McDonald's.
15. Dixon is the boyhood home of President Ronald Reagan.
16. Springfield is the state capital and the home of the National Historic Site of the home of President and Mrs. Abraham Lincoln.
17. Chicago is home to the Chicago Water Tower and Pumping Station, the only buildings to survive the Great Chicago Fire.
18. Before Abraham Lincoln was elected president he served in the Illinois legislature and practiced law in Springfield. Abraham Lincoln is buried just outside Springfield at Lincoln Tomb State Historic Site.
19. Carlyle is the home of the largest man-made lake in Illinois.
20. Illinois has 102 counties.
22. The highest point in Illinois is Charles Mound at 1235 feet above sea level.
23. The state motto is: State Sovereignty, National Union.
24. The ice cream "sundae" was named in Evanston. The piety of the town resented the dissipating influences of the soda fountain on Sunday and the good town fathers, yielding to this churchly influence, passed an ordinance prohibiting the retailing of ice cream sodas on Sunday. Ingenious confectioners and drug store operators obeying the law, served ice cream with the syrup of your choice without the soda. Objections then
was made to christening a dish after the Sabbath. So the spelling of "sunday" was changed. It became an established dish and an established word and finally the "sundae".

25. The round Silo for farm storage of silage was first constructed on a farm in Spring Grove.
26. The Illinois state dance is square dancing.
27. Illinois has more units of government than any other state (i.e., city, county, township, etc.). Over six thousand. One contributing reason may be the township governments, which are generally six miles square.
28. The worst prison camp during the Civil War in terms of percentages of death was at Rock Island.
29. Illinois boasts the highest number of personalized license plates, more than any other state.
30. The University of Illinois Conservatory is 37 feet high at its apex.
31. In 1905, president of the Chicago Cubs filed charges against a fan in the bleachers for catching a fly ball and keeping it.
32. Chicago's Mercantile Exchange building was built entirely without an internal steel skeleton, as most skyscrapers; it depends on its thick walls to keep itself up.
33. The abbreviation "ORD" for Chicago's O'Hare airport comes from the original name Orchard Field. O'Hare Airport was named in honor of Lieutenant Commander Edward H. "Butch" O'Hare.
34. The trains that pass through Chicago's underground freight tunnels daily would extend over ten miles total in length.
35. The slogan of 105.9, the classic rock radio station in Chicago: 'Of all the radio stations in Chicago...we're one of them.'
36. In Mount Pulaski, Illinois, it is illegal for boys (and only boys) to hurl snowballs at trees. Girls are allowed to do that however.
37. In Illinois Michael is the top name chosen for boys. Emily is the most chosen name for girls.
38. Illinois is known for its wide variety of weather. Major winter storms, deadly tornadoes and spectacular heat and cold waves.
39. The first birth on record in Chicago was of Eulalia Pointe du Sable, daughter of Jean-Baptiste Pointe du Sable and his Potawatomi Indian wife in 1796.
40. Chicago's Mercy Hospital was the first hospital opened in Illinois.
41. The first animal purchased for the Lincoln Park Zoo was a bear cub, bought for $10 on June 1st, 1874.
42. The University of Chicago opened on October 1, 1892 with an enrollment of 594 and a faculty of 103.
43. New York Sun editor Charles Dana, tired of hearing Chicagoans boast of the world's Columbian Exposition, dubbed Chicago the "Windy City."
44. Comedy showcase "Second City" was founded on North Wells Street in a former Chinese laundry in 1959.
46. The 4 stars on the Chicago flag represent Fort Dearborn, the Chicago Fire, the World's Columbian Exposition, and the Century of Progress Exposition.
47. The Chicago Public Library is the world's largest public library with a collection of more than 2 million books.
48. The Chicago Post Office at 433 West Van Buren is the only postal facility in the world you can drive a car through.

49. The Chicago River is dyed green on Saint Patrick's Day.

50. The world's largest cookie and cracker factory, where Nabisco made 16 billion Oreo cookies in 1995, is located in Chicago.

51. Thanks to: Sandy Kreutter, Lois Meldrum, TDanz44, ABRuns4892, L. Hallmark, Alison Pond, Barbara Ross, Jacobovitz
Where to Write Your Driving Code

Within your eduTorcsLocal directory, there is a folder called pilot322 which contains your driving code and all the other code necessary to interface with EduTorcs and with a joystick. Within the pilot322 directory, there is a pilot322 “solution file”. If you double-click on the solution file, Microsoft Visual C++ will launch and it will open up the pilot322 “project.”

The pilot322 project consists of several files. The only files which you should modify are the ones called myDriver.h and myDriver.cpp. If you modify any of the other files, you could really screw things up. If you would like to add more source files to the project you may. If you do not know how to do that, I will describe it later in this document.

When you open up myDriver.cpp for the first time, you will notice four blank methods (functions) called Driver::registration, Driver::commonInit, Driver::defaultInit, and Driver::defaultDriver. If you are new to EduTorcs you might want to focus on the last two for now. The first two are discussed in the section _______.

The Driver::defaultInit method (or another Driver::____Init method you may create) is the place where you place code that gets executed only once, at the beginning of the simulation. Examples of actions you might want to place in an init method are the following:

- Initializing user-defined variables;
- Setting display labels;
- Configuring the parameter manager;
- Selecting the joystick or other input device you are planning to use;
- Remapping joystick buttons and axes;
- Establishing plot channels;
- Setting various other parameters in the user interface and graphical interface;
- Performing initial driving calculations.

The Driver::defaultDriver() method (or another Driver::____Driver method you may create), is where you place commands that you want executed almost continuously. The active Driver::____Driver method gets called roughly every 0.02 seconds, or 50 times per second. Things you might want to do in the Driver::____Driver method might include the following:

- Sensing where the vehicle is on the road;
• Updating, steer, throttle, brake, gear, and/or cruise control settings;
• Sending data to be displayed or plotted onto the game screen;
• Performing on-the-fly driving calculations.

Units & Coordinates

In the EduTorcs interface, SI units are used exclusively. All lengths are in meters and times are in seconds. Therefore, speeds are measured and specified in meters per second. Furthermore, we measure angles in radians.

As described in the section titled Pre-Defined Constants, there are constants that you can use to conveniently convert between different units of measure.

In EduTorcs, coordinate systems are attached to vehicles, tracks, joysticks, and other objects. In general, they abide by the rules depicted in the figure to the right. That is, the positive z direction is always upward. The positive x direction is generally associated with the forward direction. In order to have a right handed coordinate system, the y direction generally points to the left. Positive angles and rotation rates about each of the axes are generally defined by applying the right hand rule to each of the coordinate axes.

Pre-Defined Variables

In the interface to EduTorcs, there are several pre-defined variables that make retrieving information about the vehicle and sending commands to the vehicle rather simple. Below, we list several such variables. More variables will be defined later when we discuss specific vehicles.

Driving Commands:

**throttle**: The driver shall place a value in this variable between 0.0 and 1.0. A value of 0.0 corresponds to the driver with her foot off the gas pedal. A value of 1.0 is equivalent to pushing the gas pedal all the way down. The value of this variable is ignored when the cruise control is used.

**gear**: The driver shall put an integer in this variable. Values of 1, 2, 3, ..., 6 correspond to first, second, third, through sixth gear respectively. A value of 0 corresponds to putting the car in neutral. A value of -1
corresponds to putting the car in reverse. The value of this variable is ignored when the cruise control is used.

**brake**: The driver shall place a value in this variable between 0.0 and 1.0. A value of 0.0 corresponds to the driver with her foot off the brake pedal. A value of 1.0 is equivalent to applying as much brake as possible. The value of this variable is ignored when the cruise control is used.

**steer**: This is the driver steer command. It takes values between -1.0 and 1.0. When it is set to -1.0, the car’s steering wheel is turned all the way to the right. When it is set to +1.0, the car’s steering wheel is turned all the way to the left. This sign convention is consistent with that defined on page 2. A value of 0.0 corresponds to the car’s wheels pointing straight ahead.

*Sensing the Car’s State:*

**toCenter**: This variable contains the distance of the car’s position sensor from the center line of the track. (See figure on the left below.) The units are meters. Positive values indicate that the car is to the left of the center line. Negative values indicate that the car is to the right. Normally, the car’s position sensor lies at the center of mass of the car. However, in some events the position sensor lies elsewhere.

![Diagram of toCenter and relAngle](image)

**relAngle**: This variables contains the difference between the angle that the car is pointing and the angle that the track is pointing. (See the figure above.) The angle is measured in radians. The value is positive when the car is oriented counterclockwise relative to the center line as shown. The angle is negative when the car is oriented clockwise relative to the center line.
**speed**: This variable contains the speed of the car in meters per second. However, this variable is usually not turned on. Therefore, it will usually contain useless information.

**dist**: This variable contains the distance of the car from the starting line of the track as measured along the center line of the track. Units are in meters. The variable takes on values between 0.0 and the length of the track.

### Pre-Defined Constants

The following are constants that you might find useful. In addition to p, there are constants that can be used to convert common units.

**pi**: 3.14159265358979.

**deg2rad**: To convert from degrees to radians, simply multiply by deg2rad.

**rad2deg**: To convert from radians to degrees, simply multiply by rad2deg.

**metersPerSec2mph**: To convert from meters per second to miles per hour, multiply by this constant.

**mph2metersPerSec**: To convert from miles per hour to meters per second, multiply by this constant.

### Cruise Control

This one is simple:

**setCruise(tgSpeed)**: This sets a cruise control for your car. In some events, this function is disabled. The supplied argument is the desired speed or “target speed” in meters per second. You may use the constant mph2metersPerSec to make the conversion from miles per hour.

This functions a little differently than a traditional cruise controller that one finds in a normal car. The method will apply the brakes when the car is going too fast. Also it chooses an appropriate gear to drive in.

### Run-Time Modifications
As EduTorcs is running, you may make modifications to certain parts of the simulation/game. They are listed here.

**Pause.** You may pause the simulation by pressing the ‘p’ key. Pressing the ‘p’ key a second time will resume the simulation.

**Simulation Time.** Normally, EduTorcs runs in real time. This means that one second of simulation time corresponds to one second of real time. However, EduTorcs gives you the ability to slow the solution down (slow motion) or to speed it up. The minus key (-) slows the simulation down. By pressing the minus key multiple times the simulation slows down even more. The plus key (+) speeds the simulation up. Multiple pressing will speed it up further. The period key (.) causes the simulation to run in real time.

**View.** You can change the view on the game screen by pressing the keys F2 through F11. Some of the tracks are not set up to provide good multi-camera “track views” in options F8 and F9.

**Zoom.** You may zoom in and zoom out by pressing the < and > keys respectively. The asterisk key (*) restores the zoom level to the default value.

**Restart.** Press the ‘r’ key to restart an event, without having to quit EduTorcs and beginning all over again.

**Quit.** To quit, press the escape key, (esc).

**Parameter Manager**

When you design a controller, it will have several parameters that determine how well it works. As you are testing the controller, you may wish to examine the effects of changing the parameters. With the parameter manager, you may change the parameters “on the fly.”

As the simulation is running, you can launch the parameter manager by pressing the number 2 button (under your thumb if you are using the Logitech joystick). This will bring up an interface with which you may change the parameters with the hat switch. Pressing the number 2 button again sets those new parameter values.

Here are the methods to initialize and implement the parameter manager.

```
paramRegister(idx, “label”, defualtVal, incr): This function should be called within the init method. As the name suggest, it is used for registering a parameter. This may be called several times so that you can
```

18
register many parameters. The argument idx is an integer between 1 and 32. (You may register as many as 32 parameters). The function takes two more arguments: defaultVal, and incr. The initial value of the parameter will be defaultVal. When the parameter manager is activated, you will be able increase or decrease its values in increments of incr.

**double p(idx)**: This simple function returns the current value of the parameter. The argument idx matches the index specified by paramRegister.

**Displaying Runtime Information (Numbers) on the Race Screen**

It is possible to display values of important variables in the bottom left corner of the screen as the simulation is running. You may display as many as six values simultaneously. They have indices 1, 2, 3, 4, 5 and 6. Here are the relevant functions

**dispVal(index,val)**: This function tells EduTorcs what value to display on the screen. The function takes two arguments. The first, index, is an integer representing the index of the display. The second, val, is the actual value (a number) to be displayed. If the number is changing continuously, you should place this function in your defaultDriver function.

**dispLabel(index, “string”)**: Here’s where you give the value a label to describe what the label represents. The first argument, index, is the index which connects the label to the value displayed with the previous function. The second argument is the name of the label. Typically, this function is called in an init method, since it only needs to be set once. The label can have a maximum of 15 characters. By default, the label is yellow. However, you can change the color with the functions below.

**dispLabelWhite(index)**: This sets the label with the given index to the color white. Other similar functions are dispLabelRed, dispLabelGreen, dispLabelBlue, dispLabelCyan, dispLabelMagenta, dispLabelYellow.

**Displaying Runtime Information (messages) on the Race Screen**

You may also display messages on the race screen. You may display up to three messages simultaneously. The messages have indices 1, 2, and 3. Here are the relevant functions

**msgSet(index, “string”)**: You establish the message with this function. The index argument is the index of the message, ranging from 1 to 3. Argument “string” is the message you wish to display.
msgUnset(index): Removes message with supplied index from the screen.

Plotting Data onto the Screen

You are able to plot real-time data onto the screen. The plot will appear in the lower right corner. You may plot up to eight channels of data simultaneously. Furthermore, you may dump the data to a file so that you may examine it later.

plotSetChannelC(double llim, double ulim, bool refLine = true, double refVal = 0.0): Establishes a data channel for plotting to the screen. Arguments llim and ulim are the lower and upper plot axis limits for the data. If you wish, you may choose to only send these limits when you call the function: plotSetChannel(llim,ulim). In this case a dashed reference line at 0.0 will be displayed on the plot axes. If you wish to change the value of the reference line, then you call the method with plotSetChannelC(llim,ulim,true,val), where val is the new value of the reference line. If you do not wish to show the reference line, they execute the call plotSetChannelC(llim,ulim,false).

This function only needs to be called once. Therefore, you should put it in your init method rather than your drive method.

The command plotSetChannelC sets up the channel for a cyan (light blue/green) colored plot curve. To establish channels in other colors you may use the commands plotSetChannelM, plotSetChannelY, plotSetChannelR, plotSetChannelG, plotSetChannelB, plotSetChannelW, plotSetChannelK. The methods correspond to colors cyan, magenta, yellow, red, green, blue, white, and black respectively.

plotSetLimitsC(double llim, double ulim): If you wish to change the plot limits on the fly, you may use this function. The limits are supplied through the arguments. This should probably go in the drive method. The corresponding functions for other colors are plotSetLimitsM, plotSetLimitsY, plotSetLimitsR, plotSetLimitsG, plotSetLimitsB, plotSetLimitsW, plotSetLimitsK.

plotSetRefLineC(double val): If you wish to change the value of the reference line on the fly use this function. The new reference value is supplied as an argument. The commands for other colors are plotSetRefLineM, plotSetRefLineY, plotSetRefLineR, plotSetRefLineG, plotSetRefLineB, plotSetRefLineW, plotSetRefLineK.
**plotSubmDataC(double d):** Submit data for plotting. For each open channel, the corresponding function should be called each time your drive method gets called. Again, there is a function for each color channel: plotSubmDataM, plotSubmDataY, plotSubmDataR, plotSubmDataG, plotSubmDataB, plotSubmDataW, plotSubmDataB.

**plotSetDataWindow(double w):** Set the duration (in time) of the plot window. Valid values are 2.0 through 20.0, in increments of 2.0. The same window is used for all color channels.

As stated above, you may dump the plot data to a file, so that you may examine it later. Simply press the `d’ key as the simulation is running. The previous 20 seconds of data will be saved in a text file in your data directory. Columns in the file are data for time, and channel colors cyan, magenta, yellow, red, green, blue, white and black respectively. Only the active channels will appear in the file.

You may perform multiple data dumps in a single simulation. The files will be named dat1, dat2, dat3, ... The next time you run EduTorcs, though, data dumps will start over with the file dat1. So if you want to keep files, you should rename them.

**Joysticks and Game Pads**

In many of the events in EduTorcs, you have the ability to interact with the game using a joystick or game pad. In addition to the Logitech devices shown below, you may use an Xbox 360 game pad, and probably many others. The figure below define some terminology that we will use when describing the interface to these input devices.
A particularly useful feature of the joystick is the slider axis. It allows you to “dial in” a certain value and just leave it there. If you are using a game pad, you will not likely have an actual slider. However, you may use a virtual slider####. The joystick shown above also has a twist axis, whereas the game pad has two sets of horizontal and vertical axes via the two thumb sticks.

Sign conventions are also shown in the figure above. Except for the hat switch, all axes follow the sign convention discussed earlier.

The input devices also have buttons that can be accessed through the EduTorcs interface.

**Setting the device type**

By default EduTorcs assumes that you are using the Logitech Extreme 3D Pro joystick. However, if you are using a different joystick or game pad, you should declare it so that the axes and buttons get mapped to the appropriate methods. The device type should be set in an init method. You only need to call it once.

`stick.typeLogitechStickFreedom24();` Method for initializing the Logitech Freedom 2.4 cordless joystick. All buttons are labeled on the joystick except the trigger button which is button number 1.
**stick.typeLogitechPadDAction()**: Method for initializing the Logitech Dual Action Game Pad. All buttons are labeled on the game pad except for two. Button 11 is activated by pressing down on the left thumb stick. Button 12 is activated by pressing down on the right thumb stick.

**stick.typeXBox360()**: Method for initializing the XBox 360 game pad. All axes and buttons are mapped to methods, except for the two trigger-like inputs on the back side.

**stick.typeLogitechStick3DPro()**: Method for initializing the Logitech Extreme 3D Pro. Although this is the default input device, this method can be used to switch back to the Extreme 3D Pro if another device is set. All buttons are labeled on the joystick except the trigger button which is button number 1.

**Joystick/Game Pad Axes**

Except for the slider, joystick axes produce readings between -1.0 and 1.0 according to the sign convention depicted in the figure [here](#). When the stick axis is centered, it normally produces a reading of 0.0.

**stick.horiz()**: Retrieves the reading from the horizontal axis of the joystick.

**stick.vert()**: Retrieves the reading from the vertical axis of the joystick.

**stick.twist()**: Retrieves the reading from the twist axis of the joystick.

**stick.leftHoriz()**: Retries reading from the horizontal axis of the left thumb stick.

**stick.leftVert()**: Retries reading from the vertical axis of the left thumb stick.

**stick.rightHoriz()**: Retries reading from the horizontal axis of the right thumb stick.

**stick.rightVert()**: Retries reading from the vertical axis of the right thumb stick.

**Axis Dead Zones**

Normally, there is a “dead zone” on axis readings. The axis reading will remain at zero in a small neighborhood of the center position. Small
inaccuracies in the joystick make the actual joystick reading nonzero when it is in the center position. The dead zone ensures a zero reading when the joystick is in its center position.

The following methods set the dead zones for individual or all axes. For each of the methods takes an argument \( dz \) which is half the dead zone width in the figure to the right. If you want to get rid of the dead zone(s), set \( dz \) to zero.

\[
\begin{align*}
\text{stick.setDeadZoneHoriz}(dz) & : \text{Joystick horizontal axis.} \\
\text{stick.setDeadZoneVert}(dz) & : \text{Joystick vertical axis.} \\
\text{stick.setDeadZoneTwist}(dz) & : \text{Joystick twist axis.} \\
\text{stick.setDeadZoneLeftHoriz}(dz) & : \text{Left thumb stick horizontal axis.} \\
\text{stick.setDeadZoneLeftVert}(dz) & : \text{Left thumb stick vertical axis.} \\
\text{stick.setDeadZoneRightHoriz}(dz) & : \text{Right thumb stick horizontal axis.} \\
\text{stick.setDeadZoneRightVert}(dz) & : \text{Right thumb stick vertical axis.} \\
\text{stick.setDeadZoneAll}(dz) & : \text{Set dead zone for all axes.}
\end{align*}
\]

**Slider (Actual and Virtual)**

The slider produces a reading between 0.0 and 1.0. If the input device does not have an actual slider there is a virtual slider within the software. On game pads, the default virtual slider is the vertical axis of the right thumb stick. The axis with which one defines the virtual slider can be changed. One can even create a virtual slider on a joystick that has an actual slider.

\[
\begin{align*}
\text{stick.slider()} & : \text{Retrieves the reading of the slider, either actual or virtual.} \\
\text{stick.setVirtualSliderHoriz()} & , \text{creates virtual slider using horizontal axis.} \\
\text{stick.setVirtualSliderVert()} & , \text{stick.setVirtualSliderTwist()} \\
\text{stick.setVirtualSliderLeftHoriz()} & \\
\text{stick.setVirtualSliderLeftVert()} & \\
\text{stick.setVirtualSliderRightHoriz()} & \\
\text{stick.setVirtualSliderRightVert()} & \\
\text{stick.setVirtualSliderHatH()} & \\
\text{stick.setVirtualSliderHatV()} & \\
\text{stick.setVirtualSliderSpeedFac}(spdFac) & : \text{If the virtual slider responds too quickly (slowly), one can supply a speed factor in order reduce (increase) the response speed. A value of 0.75 (1.25) for the argument will reduce (increase) speed by 25%.
\end{align*}
\]

**The Pendu-Car**
One of the vehicles we can drive is the “Pendu-Car.” It’s a car with a pendulum on top. No, it’s not a common vehicle. However, it is a good control problem... so that’s why we have it.

To drive the pendu-car is exactly the same as driving the regular car. The pendulum is very light compared to the car, so the swinging pendulum does not affect the dynamics of the car. However, car’s motion affects the dynamics of the pendulum.

A classical control problem is to (attempt to) balance the pendulum in the upright position. The fact that our pendulum sits atop a car just makes it more interesting from a control perspective.

In the pendu-car events, the pendulum is initially fixed in the upright inverted position. It will remain fixed until you press the number 1 button (trigger). Then it will be free to rotate.

To design a controller which balances the pendulum, you need sensors which detect the pendulum position. These functions are provided below

**double getPendAngle();** This function returns the pendulum angle $\theta$ in figure. Units are in radians, and the range is $-\theta$ to $\theta$. The angle shown in the figure is a positive angle.

**double getPendAngleDot();** This function returns the time derivative of the pendulum angle. Units are radians per second.

**Bike**

Another vehicle you have available to you is the bike (motorcycle and bicycle). It is a brand new vehicle, so some aspects of it are still quite crude, including the graphics and the engine/drivetrain model. However, the balance dynamics of the bike should be very realistic. In the figure below, we define important quantities.
The bike consists of four masses: the masses of the two wheels, mass of the bike body, and mass of the rider’s upper torso. As indicated in the front view of the bike, the rider is allowed to lean.

The first thing to note is that when you start a bike simulation, the bike starts off by floating up in the air. Gravity for the bike is initially turned off. There is a really good reason for this. (If you ask me, I’ll tell you.) Nonetheless, you need to be able to switch gravity on. Once you switch it on, you cannot turn it off again.

**setBikeGravityOn()**: This is the function that turns gravity on. You might want to call this function when you click on a certain button on the joystick. (I like the trigger button.) Once you turn gravity on, you cannot turn it off again.

**bool checkBikeGravity()**: Sometimes it’s nice to check and see if bike gravity is turned on. This function does it. It returns true if gravity is on. It returns false if gravity is off.

The following variables are for getting the bike to go.

**gear**: Right now, the bike has a very simple engine model. It is not like a real motorcycle engine or a human pedaling a bike. For the gear variable, only three values make sense: 1, 0, and -1. A value of 0 is equivalent to the bike being in neutral. The “engine” is disconnected mechanically from the wheel. A value of 1 means that the “engine” will supply forward torque to the back wheel of the bike. This is what you choose if you want the bike to move forward. A value of -1 means that the “engine” produces a backward torque on the back wheel. It will send the bike backward. Bikes usually don’t have a reverse gear (for riding). Ours does. Once you get good at going forward, you should try going backward.

**throttle**: This works the same as with the car; it takes a number between 0 and 1.

In getting the bike to slow down or stop, we can actuate the front and rear brakes independently.
**bikeBrakeFront**: This is the brake on the front wheel of your bike. Just like the brake on your car, you give a number here between 0 and 1.

**bikeBrakeRear**: This is the brake on the rear wheel of your bike. You give it a number between 0 and 1.

You have two different ways you can steer the bike. One way is to specify the angle the front wheel should be turned. This is similar to how you steered your car. The other way is to specify how much torque to apply to your handlebar. This is new.

**setBikeSteerTypeAngle()**: By default, the bike simulation uses the “angle” type of steer command. However, if you switch to torque type and then want to switch back to angle type, you can call this command. You may switch back and forth as much as you like while the simulation is running.

**setBikeSteerTypeTorque()**: Call this command to switch to the “torque” type of steer input. You may switch between “angle” and “torque” as much as you like as the simulation is running.

**steer**: As with the car, this is the variable to which you assign your steer command. It takes a number between -1.0 and 1.0. A value of 1.0 is a command to steer to the maximum angle or to apply the maximum torque to the left, depending on whether you are in angle or torque mode. A value of -1.0 command the maximum angle or torque to the right. A value of 0.0 means zero angle or torque.

**riderLean**: Another way to influence the direction of the bike is the make the rider lean. You assign a variable between -1.0 and 1.0. Positive values correspond to positive angles \( \theta \) in the figure (rider leans to the right). Negative means leans to the left. Zero means upright.

To control the bike with feedback, you are going to need information about the state of the bike. Here are some useful quantities.

**double getBikeLean()**: This function returns the angle of the bike lean in radians. Bike lean corresponds to the angle \( \theta \) in the bike figure. Lean angle is always measures relative to vertical. Positive angles correspond to leaning to the right.

**double getBikeRollRate()**: This returns the rate, in radians per second that the bike is rotating about its x axis.
double getBikePitch(): This function returns the bike pitch angle in radians. It is the angle $\theta$ in the bike figure. Positive angle correspond to nose down as indicated in the figure.

double getBikePitchRate(): This returns the rate, in radians per second that the bike is rotating about its y axis.

double getBikeSteerAngle(): This returns the steering angle in radians. Positive angles correspond to steering to the left.

double getBikeSteerAngleDot(): This returns the time derivative of the steer angle.

Variables toCenter, and relAngle work for the bike just as they worked for the car.

Follow the Leader

There are some extra variables and methods associated with the “Follow the Leader” events. The variables and methods are not relevant in other events.

gap: This variable contains the gap length [in meters] between the rear bumper of the leader car and the front bumper of the rear car.

leaderSpeed: This variable contains the speed of the leader car [meters per second].

accelCoeff: In order to close the gap between cars, the follower car needs to accelerate. However, it is difficult to know how much throttle to apply in order achieve a certain acceleration. The acceleration for a given throttle command depends on current engine RPM and the current gear. The accelCoeff variable allows one to calculate the throttle command that will produce (approximately) the desired acceleration. If $aF$ is the desired acceleration, then the appropriate throttle command is throttle = $aF$/accelCoeff. Of course, this is only meaningful if the resulting throttle command is between 0.0 and 1.0.

brakeCoeff: This is analogous to accelCoeff, but for the brake. One would write brake = $aF$/brakeCoeff. Note that brakeCoeff is a negative number. So when $aF$ is negative, this produces a positive brake command.

setLeaderSpeed(): This method sets the speed of the leader car in the follow practice event. It is used primarily for testing.

Integrators
EduTorcs provides eight integrators that you may use to develop controllers. The integrators are labeled with indices 1 through 8. The general idea of the integrator is depicted in the figure below. The integrator has an input, the integrand. It also has an output, the integral.

Here are the relevant methods.

**void integratorInput(int idx, double val):** This method is used to provide the input (val) to the integrator with index idx.

**double integratorOutput(int idx):** This method returns the current value of the integral.

**void integratorSaturate(int idx, double llim, double ulim):** With this method, one can set lower and upper limits on the value if the output. The value of the integral will always be between the two limits.
Leadership
Rey Ty


I. Leadership
   A. Traits versus Process Leadership
   B. Assigned versus Emergent Leadership
   C. Leadership and Power
   D. Leadership and Management

II. Traits Approach
   A. Intelligence
   B. Self-Confidence
   C. Determination
   D. Integrity
   E. Sociability

III. Style Approach

IV. Situational Approach

V. Contingency Theory

VI. Path-Goal Theory: Leader Behavior
   A. Directive Leadership
   B. Supportive Leadership
   C. Participative Leadership
   D. Achievement-Oriented Leadership

VII. Leader-Member Exchange Theory

VIII. Transformational Leadership

IX. Team Leadership

X. Psychodynamic Approach
   A. Motivation or Individualism
   B. Dependence and Independence
   C. Repression and the Shadow Self
   D. Relational Analysis

XI. Women and Leadership

XII. Leadership Ethics
   A. Respect Others
   B. Serve Others
   C. Just
   D. Honest
   E. Build Community
Introduction of Micro Forming

Dr. Jenn-Terng Gau
Department of Mechanical Engineering
Northern Illinois University

Miniaturization
- Product
  - about 1/1000-1/2 inch in size
  - 3D with complex features
- Machines and Process
  - Micromachining
  - Microforming
  - Microinjection
  - Micro EDM
  - Micro Metrology
  - Micro Assembly
  - Micro Welding
- Factory
  - Energy
  - Efficiency
  - Accuracy

Applications of Micromanufacturing
- Homeland Security and Defense
- Healthcare
- Automotive
- Aerospace
- Energy
- Electronic Devices
- Consumer products
- Etc.

Micromachining Machines

More Examples on Micro Machines
NIU Micro Stamping Machine

See the demonstration at NIU lab.

Concepts of Microfactory

See the demonstration at NIU lab.

Concepts of Microfactory cont-

www.realco.com

Microfactory by MMC

Assembling Microfactory (Olympus Co.)

Portable Microfactory

A Micro Deep Drawing R&D at NIU

- As a basic process of production, deep drawing provides a great application potential for the manufacturing of parts with complex shapes. But the smaller the dimensions of the part the more difficult the manufacturing because of the size effect.

- Thickness to grain size ratio (T/D) influences will rise.
Experimental Setup for Micro Deep Drawing

- MTS Sintech 2/G with 1250 Newton load cells was used to conduct the tensile test and stretch bending experiments.

Microstructure of Specimens

<table>
<thead>
<tr>
<th>Thickness (μm)</th>
<th>Rolling Direct Grain Size (μm)</th>
<th>Trans. Direct Grain Size (μm)</th>
<th>Ave. Grain Size (μm)</th>
<th>T/D Ratio</th>
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<td>200</td>
<td>17.45 ± 3.36</td>
<td>16.43 ± 3.26</td>
<td>15.94 ± 3.24</td>
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<tr>
<td>100</td>
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<td>17.22 ± 3.35</td>
<td>17.77 ± 3.47</td>
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<tr>
<td>100</td>
<td>19.24 ± 3.63</td>
<td>20.15 ± 4.35</td>
<td>19.69 ± 4.08</td>
<td>10.08</td>
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Experimental Results

<table>
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<th>Blank Thickness</th>
<th>200μm</th>
<th>150μm</th>
<th>100μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>β*: Blank Diameter/Punch Diameter</td>
<td>IBHF**</td>
<td>IBHF</td>
<td>IBHF</td>
</tr>
<tr>
<td>2.3</td>
<td>all torn</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2.2</td>
<td>all torn</td>
<td>3-4.69</td>
<td>all torn</td>
</tr>
<tr>
<td>2.1</td>
<td>all torn</td>
<td>3-4.69</td>
<td>all torn</td>
</tr>
<tr>
<td>2.0</td>
<td>3-4.69</td>
<td>3-7.52</td>
<td></td>
</tr>
<tr>
<td>1.9</td>
<td>N/A</td>
<td>N/A</td>
<td>19.48</td>
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* IBHF: Initial Blank Holder Force (NEWTON)

Experimental Results -cont (2)

<table>
<thead>
<tr>
<th>Punch Radius</th>
<th>250μm</th>
<th>500μm</th>
<th>1000μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>β*: Blank Diameter/Punch Diameter</td>
<td>IBHF**</td>
<td>IBHF</td>
<td>IBHF</td>
</tr>
<tr>
<td>2.3</td>
<td>N/A</td>
<td>all torn</td>
<td>all torn</td>
</tr>
<tr>
<td>2.2</td>
<td>all torn</td>
<td>3-4.69</td>
<td>3-7.52</td>
</tr>
<tr>
<td>2.1</td>
<td>3-4.69</td>
<td>3-220</td>
<td>3-35.78</td>
</tr>
<tr>
<td>2.0</td>
<td>3-4.69</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* IBHF: Initial Blank Holder Force (NEWTON)

Experimental Results -cont (3)

H1: The Largest Cup Height
H2: The Smallest Cup Height
Experimental Results - cont (4)

<table>
<thead>
<tr>
<th>Thickness (T)</th>
<th>200μm</th>
<th>150μm</th>
<th>100μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Db (mm)</td>
<td>4.20</td>
<td>4.00</td>
<td>3.80</td>
</tr>
<tr>
<td>LDR</td>
<td>2.1</td>
<td>2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Hl (mm)</td>
<td>2.08 (0.07, -0.08)</td>
<td>1.79 (0.06, -0.03)</td>
<td>1.53 (0.04, -0.02)</td>
</tr>
<tr>
<td>Hs (mm)</td>
<td>1.84 (-0.02, -0.03)</td>
<td>1.57 (-0.03, -0.03)</td>
<td>1.47 (0.07, -0.08)</td>
</tr>
<tr>
<td>Hl-Hs</td>
<td>0.24</td>
<td>0.22</td>
<td>0.16</td>
</tr>
<tr>
<td>Hl/(Dp * T)</td>
<td>2.477</td>
<td>2.83</td>
<td>4.29</td>
</tr>
<tr>
<td>Hs/(Dp * T)</td>
<td>2.190</td>
<td>2.617</td>
<td>3.668</td>
</tr>
</tbody>
</table>

Experimental Results - cont (5)

<table>
<thead>
<tr>
<th>T=20μm</th>
<th>Punch Radius (P_r)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25mm</td>
</tr>
<tr>
<td>Max Db (mm)</td>
<td>4.20</td>
</tr>
<tr>
<td>Hl (mm)</td>
<td>2.08 (0.07, -0.08)</td>
</tr>
<tr>
<td>Hs (mm)</td>
<td>1.84 (0.02, -0.03)</td>
</tr>
<tr>
<td>Hl/Hs</td>
<td>0.24</td>
</tr>
<tr>
<td>Hl/(Dp * T)</td>
<td>2.70</td>
</tr>
<tr>
<td>Hs/(Dp * T)</td>
<td>2.190</td>
</tr>
</tbody>
</table>

Experimental Results - cont (6)

<table>
<thead>
<tr>
<th>Thickness (T)</th>
<th>200μm</th>
<th>150μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hl (mm)</td>
<td>1.86 (+0.05,-0.08)</td>
<td>1.79 (+0.06,-0.03)</td>
</tr>
<tr>
<td>Hs (mm)</td>
<td>1.62 (+0.07,-0.06)</td>
<td>1.57 (+0.03,-0.03)</td>
</tr>
<tr>
<td>Hl/Hs</td>
<td>9.30</td>
<td>11.93</td>
</tr>
<tr>
<td>Hs/T</td>
<td>8.10</td>
<td>10.47</td>
</tr>
</tbody>
</table>

Pr = 0.25mm & Dp = 4.0mm

Experimental Results - cont (7)

Drawn Cups with Earring (T=200μm)
(a) Dp=4.2mm, Pr=0.25mm
(b) Dp=4.4mm, Pr=0.5mm
(c) Dp=4.6mm, Pr=1mm

1mm and 2mm SS304 Cups
**Stainless Steel 304 Micro Cups with Different Thickness**

(a) 150μm (b) 100μm (c) 50μm (d) 20μm

---

**Micro Extrusion on Al**

---

**Questions**

---

**What is energy?**

A. A ubiquitous term unable to be harnessed in a single sentence

B. A drink I can purchase to battle sleepiness

C. A capacity to do work

D. An inherent foundation of life

---

**Energy definitions**

- Webster’s: 1. force of expression 2. inherent power; capacity for action 3. a resource from which energy can be produced 4. Physics the capacity for doing work

- Mechanical engineering directly relates to all aspects of definition

---

**Engineering impact on energy and environment**

*NICHOLAS A. POHLMAN, PHD
MECHANICAL ENGINEERING*
Describe your “Environment”
A. My dorm room and classrooms
B. All the places I have visited and will see in the future
C. It’s the air around us all that we breathe
D. The plants and trees and all the creatures within a space that co-exist
E. It has to be the whole wide world!!

Environment depends upon the scope
• Each layer influences the next
  — Wearing a T-shirt or a sweater? (personal)
  — Determines thermostat setting (room)
  — Adjusts different HVAC system requires (building)
  — Conversion of energy from fundamental form [fuel] to usable form [mechanical work] (regional)
  — Harvest energy from storage location (global)

Conservation of Energy
• “Energy is neither created ... nor destroyed”
  • Therefore the efficiency and availability of transformation determine the value of energy resources

Classification of sources
• Non-renewable
  — Sources that have already gone through a transformative process
    • Coal
    • Petroleum
    • Natural Gas
  • Renewable
    — Relying on the immediate natural resources
      • Hydro
      • Wind
      • Solar
      • Biomass

Actual Origin: The Sun
• Imparts somewhere from 2.5 – 5.5 kilo-Watt hours of energy per day
  — More energy imparted in one hour than consumed by planet annually
  — Exceeds total needed by humans by factor of over 20,000
• Problem is the efficiency of transformation ...
Consuming energy

- Should we be more efficient or have more conservation?

- Efficiency:
  - Doing same task with less energy

- Conservation:
  - Behavior that reduces energy consumption

Energy must go into the environment

- Transformation is never ideal
  - Dumping heat into the air
  - Remaining ash after coal is burned
  - Spent fuel rods from fission reaction

- What to do with these secondary products?

Best current measure ...

- Green house gas emissions
  - Multiple types
    - Carbon dioxide ($\text{CO}_2$)
    - Methane ($\text{CH}_4$)
    - Nitrous Oxide ($\text{N}_2\text{O}$)
    - Industrial gases (fluorocarbons)

- Typically consider just “carbon”

Scientific correlations

- Increasing greenhouse gases have been measured in last 150+ years

- Climates with recent increase in average temperatures
  - Up by 1.1° to 1.6° in past century

- Indicator of “global warming” or new PC term “climate change”

Concern is in future consumption

- New emerging economies need energy
- Seek to emulate U.S. model
  - 84% of our energy is from fossil fuels
- How to reduce the slope?

Fuel types to be covered

- Hydrogen
  - Efficient, but difficult to purify
- Nuclear
  - Beneficial non-renewable
- Coal
  - Gasification technology

- Alternatives
  - Hydro
    - Rivers and waves
  - Wind
    - Dynamics of air
  - Solar
    - Radiant transfer
  - Biomass
    - Newest technology
Storing energy

- Batteries are inefficient transformation
- Easier to store as original resource
  - Carload of coal
  - Mounds of corn
  - Tanks of liquid fuel

Storage as Hydrogen?

- \( \text{H}_2 \) facts:
  - Single proton-electron atom
  - Therefore the smallest
  - Most abundant element on earth
  - Readily reacts/combines with other elements

Using hydrogen?

- Highest energy by weight 😊
- Smallest energy by volume 😊
- Readily burns
  - … violently

Latest idea

- Fuel cell technology
  - Initially used to power spacecraft
- Benefits
  - No moving parts
  - Output is \( \text{H}_2 \text{O} \)
- Challenges
  - Production
  - Storage

Separating hydrogen

- Breaking it from water
  - Electrolysis / lightning
  - More energy to pull apart
- Conversion by natural forms
  - Algae and bacteria
  - But production rate is too slow

Nuclear properties

- “Strong” forces hold protons and neutrons in nucleus of atom
- Changes in nucleus imply nuclear reaction
Reaction types

- Fusion
  - Combining nuclei to generate new more massive atom

- Fission
  - Breaking down nuclei to decrease the mass of the atom

Reaction requirements

- Fusion
  - Available fuels (free hydrogen)
  - Massive heat and pressure

- Fission
  - Radioactive materials with fairly unstable nuclei
  - Instigator to reaction ...

Initial attempts ...

- Fusion
  - "Cold fusion" by Fleischmann-Pons
    - Claimed success at fusion reaction (1989)
    - Results were not repeatable by scientific community

- National Ignition Facility ...
  - Based at Lawrence Livermore Lab
  - Inching toward main testing

Fission fuel rods

- Casing provides radioactive protection
  - Easily handled and stored
  - Exchanged in reactor core after 5% fuel consumed

Future outlook of fission

- Supports 20% of current electricity production in U.S.
  - Primary source for France
  - Nearly 25% for Germany and Japan

- Last plant came online in 1996

- Many approved ... costly to construct
- Considering recycling facilities

Coal for energy

- Solid form of fossil fuels
  - Same process of pressure and heating

- Leading source for electricity generation

Coal is unique to region

Coal impacts the Environment

- Direct combustion produces
  - Sulfur dioxide (SO₂)
    - Acid rain and respiratory illness
  - Nitrogen oxides (NOₓ)
    - Smog
  - Carbon dioxide (CO₂)
    - Greenhouse gas
  - Mercury (Hg)
    - Poisons in water and fish
  - Particulates
    - Ash particles that fill atmosphere

Why coal so prevalent?

- Abundance
  - Plenty throughout United States
  - Estimates predict 140-230 years of confirmed supplies remain

What about “clean” coal?

- Processing steps incorporated into output streams

Emission re-location program

- Sulfur to synthetic gypsum
  - Used in drywall manufacturing
- Particulates
  - Char used as soil additive for agriculture
- CO₂ sequestration
  - Place in old natural gas reserves or deep in ocean for dissolving

New technologies exist

- Integrated gasification combined cycle (IGCC)
  - Controlling temperature, fuel and oxygen content
- Produces syngas
  - Hydrogen
  - Carbon monoxide
  - Other gases
Gasification benefits link
• Environmental
  – Low SO₂, NOₓ and particulate emissions
  – Direct capture of CO₂
    • If source is pure oxygen, then no separation work from nitrogen
• Efficiency
  – Like natural gas combined cycle
    • Hot gases to turbine
    • Heat exchangers with water/steam
  – Syngas as fuel cell source
    • Achieve up to 70% efficiency!

Fuel types considered
• Hydrogen
  – Efficient, but difficult to purify
• Nuclear
  – Beneficial non-renewable
• Coal
  – Gasification technology
• Alternatives
  – Hydro
    • Rivers and waves
  – Wind
    • Dynamics of air
  – Solar
    • Radiant transfer
  – Biomass
    • Newest technology

Profile of a hydropower dam
• Change in height from top of reservoir gives fluid the high velocity to impact the turbine

Limited use
• Less than 3% of all dams in U.S. generate electricity
  – Most control flooding or irrigation
  – Scale of project requires government support
• Concentrated primarily on west coast (CA, OR, WA)
  – High mountains and wide rivers

Environmental impact
• No emissions of combustion
• However, reservoir causes ecological changes
  – Decreased land for vegetation
  – Wildlife habitats disrupted
    • Turbines making caviar
    • Spawning salmon can’t get upstream
  – Stagnant water causes methane build-up

Dual capture
• Research into methods for capturing CH₄ from water
Wind power

- Airfoil design to generate lift
- Place airfoil on hub to turn the rotor

Limiting rotation rate

- Steam turbines had fixed orientation
- Air blades
  - Adjustable pitch
  - Engage or disengage the wind
  - Maintain constant rotation rate

Steady mechanical input

- Spinning shaft to gear box
- High speed rpm
  - Drives wires and magnets of the generator
- Brake included as well ...

Wind is not uniform

- Yaw drive turns assembly
  - Points into prevailing wind
- Electrically driven instead of freely rotating

Wind availability

- A localized phenomena ... position is critical!

Environmental Effects

- Zero emissions
  - Approximately 45 trucks to deliver all components
  - Building deep structural foundations
### Disrupting environment?
- Visual eyesore?
- Destroying bird migration?
  - May be 6,400 birds per year
- Other structures already achieve this:
  - 130M in utility lines
  - 60M with automobiles

### Solar energy moves differently
- Three ways to move heat
  - Conduction: two solids of different temperature touching
  - Convection: exchange of energy through fluid molecules
  - Radiation: transfer through particles and waves requiring no medium
- All can happen on your stove

### Upon arrival to earth
- Radiant energy is absorbed
  - By atmospheric gases in air
  - By solid surfaces on ground
    - Plants
    - Roofs
    - Animals
- Plants
- Roofs
- Animals

### Converting to useful energy
- Electricity
  - Photovoltaics (PV)
  - Concentrating solar power plants
- Illumination
  - Windows and skylights
- Direct heat
  - Solar collectors increase water temperatures
  - “Power” greenhouses

### PV basics
- Light is made up of photons
  - Wave-like to transmit through radiation
  - Particle-like to impact a surface
- Three things can happen at surface
  - Reflect
  - Pass through
  - Absorb into material
- PV materials absorb photon energy

### PV Materials
- Semiconductors
  - Electron movement is not “free”
  - But holes exist to allow limited motion
- More photon energy absorption increases movement of electrons
  - Same feature of digital cameras
Benefits and Limitations

- Passive device
  - No moving parts beyond electrons
- Deployable
  - Sun hits surface everywhere
- Direct current
  - Supports basic electronic devices

- Inefficient
  - Approximately 10% of photonic energy converted
- Production costs
  - Raw materials are not abundant
- Conversion
  - Need alternating current for industry

New technology

- Biological inspired materials
  - Copy plant photosynthesis
- Integrated structures
  - Solar shingles

Solar to electric through heat

- Generating steam to rotate turbine

- Simple absorption not sufficient
  - Need concentration of energy
  - Use angle of reflection of light

Solar concentration methods

- Parabolic troughs
  - Multiply solar intensity by 100
- Solar dish
  - Collect ray paths in all directions
  - 2,000 times multiplier
- Power tower
  - Flat mirrors reflect to central point

Environmental impacts: good and bad

Great aspects:
- No emissions
  - All heat transfer is passive without combustion
- Few mechanical pieces
  - Active tracking can be self powered

Challenges:
- Low efficiency
  - Requires large spaces
- Not consistent
  - Atmospheric conditions absorb some energy
- Exotic materials
  - Lots of chemistry
Biomass materials

- Any organic material
  - Plants
    - Sugar converters in leaves
    - Structural components in stalks
    - Storage pieces in seeds
  - Animal waste
    - Dried livestock manure
- The natural conversion of heat and light to useful energy

New biomass resources

- Weed-like plants
  - Switchgrass
  - Water hyacinth
- Secondary materials
  - Corn stover
  - Sugar-cane bagasse
- Self-replicating organisms
  - Algae

How much energy in algae?

- Rapid growth is key
  - Some strains can double their weight in hours
- Doesn’t waste energy making cellulose

<table>
<thead>
<tr>
<th>Crop</th>
<th>Oil Yield (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>10</td>
</tr>
<tr>
<td>Cotton</td>
<td>30</td>
</tr>
<tr>
<td>Soybean</td>
<td>60</td>
</tr>
<tr>
<td>Mustard seed</td>
<td>102</td>
</tr>
<tr>
<td>Sunflower</td>
<td>50</td>
</tr>
<tr>
<td>Rapeseed/canola</td>
<td>12</td>
</tr>
<tr>
<td>Jatropha</td>
<td>20</td>
</tr>
<tr>
<td>Oil palm</td>
<td>65</td>
</tr>
<tr>
<td>Algae (15 g/mL/day at 10% TAG)</td>
<td>1,200</td>
</tr>
<tr>
<td>Algae (50 g/mL/day at 80% TAG)</td>
<td>10,800</td>
</tr>
</tbody>
</table>

(www.nrel.gov)

Benefits and Drawbacks

- No competition for land
- All types of water possible
- Balances greenhouse emissions
- Scalable
- High production cost
- Still finding ideal strain
- Open systems (ponds) have other environmental factors

Dried biomass not simple combustion

- Latest technology
  - Pyrolysis gasification
    - Heat fuel for breakdown of chemical bonds
    - Biogases mix with air (N₂ and O₂)
    - Biogas and air combustion

Pyrolysis components

- Heat fuel for breakdown of chemical bonds
- Biogases mix with air (N₂ and O₂)
- Biogas and air combustion
**Pyrolysis benefits**
- More effective consumption of fuel
  - Only 20% of weight remains
- Emissions of particulates and greenhouse gases minimized
  - Free and clear smoke stacks
- Remaining biochar acts as soil amendment (fertilizer)
- May use any type of biomass source

**Sources versus spending**
- Most buzz about new energy technologies
  - “Need to harness the sun, wind, and waves…”
    Any politician, 2011
- Greater impact can be achieved with methods to SAVE energy instead!

**Conservation in building**
- Humans have used buildings since emerging from caves
- Typically used local resources
  - Log cabins
  - Sod huts
  - Buffalo hide teepee
- Population growth leads to use of more resources

**Construction Numbers**
- Habitat for Humanity averages:
  - 1,000 – 1,200 ft² home
- Quantities:
  - 600 pieces of lumber (2"x4"x8")
  - 40,790 nails

**Increasing Scale**
- Commercial and industry have multiple users
  - 2,000 ft² home for 3-4 people
  - Stevenson and Grant Towers enclose 519,000 ft²
  - Barsema Hall has 130,000 ft²
- Need tools to help select most efficient commodities

**LEED Categories**
- Equivalency to caloric and nutrient intake for food
Certification levels

• Cumulative scores (similar to grading):
  – 40+ points
  – 50+ points
  – 60+ points
  – 80+ points

Categories for credits

• Sustainable sites:
  – Use already developed land
    • Reduces urban sprawl
    • Smaller impact on environment through preservation of natural ecosystem
  – Utilize existing infrastructure
    • Adjacent to rail terminal
    • Existing access roads
  – Control environmental parameters
    • Storm water run-off (Erosion)
    • Light, sound, air pollution

Categories for credits

• Water efficiency:
  – Need to cut 20% from baseline

• Possibilities
  • Efficient fixtures
    – Automatic shut-off valves
    – Hi-low volume flow toilet flush
  • Better fittings
    – Few pipe bends or network splits
  • Appliances
    – Front load washers
    – Instant heat water heaters

Categories for credits

• Energy & Atmosphere:
  – Confirm use of renewables
    • Solar, wind, biomass
    • On-site generation or explicit green power purchased from utility
  – Limiting CFCs
    • Managing refrigerant
    • Low-volatile organic compound (VOC) paints
  – Tracking performance and usage
    • Close loop to adjust operation

Categories for credits

• Materials & Resources:
  – Waste management practices
    • Re-using prior building material
    • Separation of waste-recycle streams
  – Selection of materials
    • Regionally produced
    • Rapidly renewable (not just wood)
  – Efficient use of raw materials
    • Not everything needs to be cut from a standard 8 foot piece of lumber
Categories for credits

• Indoor Environment:
  – Adjust comfort levels
    • Temperature, humidity, ventilation
    • Is 68° setting appropriate?
  – Lighting quality
    • Natural daylight is best
      – Skylights and automatic shades
    • Automated switches
  – Improved acoustics
    • Soundproof high decibel levels

Bonus points!

• Innovations:
  – Designs not included in prior categories
  – Flexibility to stay on cutting-edge of science
  – Freedom for creativity
  – Holistic approach
    • Integrate all aspects of planners, builders, and end users
  – Operational protocol that is part of closing the loop

Bonus points!

• Regional Priority:
  – Separated according to the local ZIP code and associate priority
  – Example: DeKalb (60115)
    • Reduction in Materials and Resources above 75% of baseline provides bonus
    • Improvement in water savings by 30%

Not limited to new construction

• Considers other types:
  – Core & Shell
    • Structure, HVAC, etc used by builder
  – Commercial Interiors
    • Selection by tenants for aesthetics
  – Schools
    • Different needs of learning space
  – Existing buildings
    • Operations and Maintenance
    • Confirm all is working effectively

Growth rate is substantial

In review

• Energy is important commodity to sustainable earth
• Much effort placed in generating new forms
  – Small return on investment
• Conservation is critical
  – Less materials consumed
  – Sustainable construction
  – Individual decisions leading to environmental impacts!
What is a Market?
- A public gathering held for buying and selling merchandise
- A place where goods are offered for sale
- The opportunity to buy or sell; extent of demand for merchandise
- Demand for goods

What is Marketing?
- The act or process of buying and selling in a market.
- The commercial functions involved in transferring goods from producer to consumer.

"Marketing is the art and science of creating and managing successful exchanges." - Northwestern University Kellogg School of Business, Professor Alex Chernev

- Marketing is a system of business activities
- Marketing is designed to plan, price, promote, and distribute

- Marketing is something of value want-satisfying goods and services
- Marketing is to the benefit of the market - present and potential household consumers or industrial users
• Why do people buy?
• Who pay list price?
• What products do people sell?

Exchange Between Buyer and Seller

Why are Distributors Necessary?

The Role of Marketing in Society

Reduced Transactions

Producers (Suppliers or Manufacturers)

• Process raw material or goods to produce brand-named products for customers
• Regulated by law from where they operate
• Compete with one another
Distributors (Retailers, Wholesalers and Sales Representatives)

- Supply customers with products more suited to their needs
- Research customer attitudes
- Sell, buy and set price
- Transport and inventory products
- Provide customer service and support locally
- Advertise at local level
- Share the risk of doing business

Customers

- The consumer is the most important single force in the external environment of the firm. Without a consumer there is no need for marketing.
- Consumer awareness (i.e. General Motors recalling specific models of cars)
- Cultural and social environment
- Lifestyle and quality of life
- Consumer behavior (i.e. consumers refer the product to other consumers)

The 5 P’s

Product

- First impressions are important, but performance of the product over time is more important for product repurchase and referrals.
- Product planning
- Quality control and assortment
- Breadth and depth of line
- Warranty and service
- Package
- Product development

Price

Why does a customer use your product?
- The list price is often an important element.
- Customers like discounts and special offers.
- Price / customer relationships
- Price / cost relationships
- Price / competitive relationships

Placement

When and where is your product available to customers?
- Timing, timing, timing
- Location, location, location
- Example: Wal-Mart
### Promotion

How do you communicate with your customers?
- Advertising
- Sales promoting
- Sales force: motivation, selection and training.
- Public relations
- Direct Marketing, i.e. HP, Dell, etc.

### Personnel or People

Almost all businesses offer a variety of human contacts to customers.
- Sales, service, collections shipping, billing repair and other personnel.
- Organization, i.e. Ford, Mazda, etc.
- Could have more Ps (politics, public opinion, policy, etc.)

### What should I do regarding those Ps?

- Analyze your Ps
- Determine what works best for each P
- Deciding which P is most important

### The 3 Cs (uncontrolled factors)

**Company**

?  

**Consumer**

**Competition**

Strategic Marketing

### Marketing Tactics

<table>
<thead>
<tr>
<th>Product</th>
<th>Brand</th>
<th>Promotion</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Price</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Which one should I choose?

- **McDonalds**
- **Burger King**
- **Wendy's**
- **Subway**
### Consumer Make-up by Income

Average Income per Family

- $15000: 6%
- $25000: 10%
- $35000: 17%
- $45000: 12%
- $55000: 10%
- $65000: 6%
- $75000: 10%
- $85000: 10%
- $95000: 6%
- $100000: 6%
- $110000: 6%
- $120000: 6%
- $130000: 6%
- $150000: 6%
- over $150000: 6%

### Marketing Research

- Hyundai
- Kia
- Toyota
- Ford
- Mazda
- Jaguar
- Honda
- BMW

### Tips: Do’s and Don’ts

- Do break down plan into simple sub-plans
- Do write an executive summary
- Do clarify and quantify your objectives
- Do prepare a situation analysis
- Do build a competitor analysis table
- Do combine strategies and objectives

- Don’t ignore the details
- Don’t imitate the competitors
- Don’t feel confined by last period’s budget and plan
- Don’t engage in unnecessary spending

### Global Marketing

- 40 Million Companies
- 200 Countries
- 3000 Headings
- 1 Friendly Database

### Regional Alliances

- European Union (EU)
- North American Free Trade Agreement (NAFTA)
- Asia-Pacific Economic Cooperation (APEC)
- Common Market of the Southern Cone (MERCOSUR)
Marketing on the Internet

- Addressability
- Interactivity
- Memory
- Control
- Accessibility
- Digitalization

Marketing in Changing Environment

- The environment includes natural and human
- The interrelationship of environment and marketing

Case Study

Q: How many automobiles are produced each year in China? If you are a manager of an automobile headlight company, what is your marketing strategy?

Insurance Industry in the U.S.A.
Dr. Kurt Sheu

Challenge - Growing Interdependencies

- We are more dependent on others’ operations
- The world is now so interdependent that actions taken today 3,000 miles away from you might affect you tomorrow
- Your actions will affect mine

Challenge - Things Change Faster

- Katrina: a one-week event (2005) 1,326 victims, $45 billion loss
- Southeast Asia Tsunami: a one-day event (12/2004) 280,000 victims
- 9/11 Attacks: a one-hour event (2001) 3,025 victims, $35 billion loss
- Disasters have caused severe insured losses in recent years
What is Insurance?

“A device for the elimination or reduction of an economic risk, to all members of a large group by employing a system of equitable contributions out of which losses are paid.”
- Webster’s Third International Dictionary

What is Insurance?

It is a method of shifting risk from you, one individual to a group. As people join this group in ever increasing numbers in order to avoid a particular type of risk to which all are exposed, the risk for the group becomes more and more certain.

What is Insurance?

“A plan by which large numbers of people associate themselves and transfer risks that attach to individuals to the shoulders of all.”
– David L. Bizkelhaupt

It means that insurance is an arrangement for paying for inevitable losses and is thus a risk financing method.

Its Development (17th Century)

The business of insurance as we know it in Great Britain and the United States grew out of what initially was risk-taking participation in the fruits of commercial enterprises. They were doing business for spices, tea, sugar, dyes, fabrics and other desired commodities. It evolved to insure the risks of loss of damage to others. The insuring entity, known commonly as Lloyd’s of London, grew up out of those risky commercial endeavors.

Its Development (18th Century)

The business of insurance found its roots in the growing peril of fire as urban centers developed in Great Britain and later in the American colonies. No running water existed at the time.

Example: mutual fire protection societies work part of bucket brigades when fire broke out

Its Development (19th Century)

Due to the importance of agriculture to the United States economy, agriculture was conducted largely by means of family farms – lenders required farmers to take out crop insurance when mortgaging their properties to obtain crop loans.
Its Development (Latter 19th Century & 20th Century)

The growth of the business of insurance came with the development of the internal combustion engine, the widespread ownership of cars and trucks and the risks of loss that operation of these vehicles posed.

Its Development (20th Century)

As society and industry grew, so did the risk of industrial injury and the resulting passage of workers compensation laws. When those laws were enacted, commercial insurers entered the market and began providing workers compensation insurance to employers.

Its Development (20th Century)

Recent times have seen the development and marketing of long-term care insurance and insurance policies aimed at e-business.

Its Development

There are at least three different kinds of business insurance.

- Property-casualty insurance, i.e. homeowners, auto and business property and liability coverage
- Life and disability insurance
- Health insurance

Its Organization

The business of insurance differs from most other businesses. Because insurers sell an intangible product – a promise to pay in the event of contingent losses – and because these promises potentially affect so many, the business of insurance is regulated more heavily than most other businesses.

- Capital stock company (corporation) such as AIG
- Mutual insurance company such as State Farm Mutual
- Reciprocal insurer such as Automobile Club of Southern California

Its Function – Risk Management

- Avoiding risk
- Reducing risk
- Retaining risk
- Transfer risk
Risk Management – Six Sigma

Six sigma at many organization simply means a measure of quality that strives for near perfection. Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects.

To achieve six sigma, a process must not produce more than 3.4 defects per million opportunities.

Risk Management – Six Sigma DMAIC Process

- Define the project goal and customer deliverables
- Measure the process to determine current performance
- Analyze and determine the root causes of the defect
- Improve the process by eliminating defects
- Control future process performance

Risk Management – Six Sigma DMADV Process

- Define the project goal and customer deliverables
- Measure and determine customer needs and specifications
- Analyze the process options to meet the customer needs
- Design the process to meet the customer needs
- Verify the design performance and ability to meet customer needs

Its Function – Using Automobile Insurance as an example

- Liability insurance – manage your lawsuit risk
- Uninsured Motorists: when the other driver is unidentified (hit and run) or has no liability insurance at all
- Under-insured Motorists: when the other driver has less auto liability coverage than you and the economic value of your injury exceeds the other driver’s liability limit.

<table>
<thead>
<tr>
<th></th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability limit $300,000</td>
<td>$120</td>
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<tr>
<td>Medical payment $10,000</td>
<td>$12</td>
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<tr>
<td>UM / UIM</td>
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<tr>
<td>Comprehensive</td>
<td>$30</td>
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<tr>
<td>Collision</td>
<td>$125</td>
</tr>
<tr>
<td>$250 deductible</td>
<td>$25</td>
</tr>
<tr>
<td>Road service</td>
<td>$5</td>
</tr>
</tbody>
</table>
Its Operation

Insured - Product / Company - Agents

• Insured buy insurance from agent or directly through company
• Company sell products to insurer directly or through agent
• Insured report a claim to agent or company
• Company handle the claims and losses.

Its Operation (2)

Insured - Product / Company

Insured buy insurance directly through company, e.g. Geico

Its Operation (3)

• Underwriting/Customer Service department
• Claim/human resource department
• Financing/investment department
• Information/network department
• Risk control/legal department
• Actuarial/statistics department

Its Management (Cross Management)

• Chief executive officer (CEO)
• Chief operating officer (COO)
• Chief information officer (CIO)
• Chief risk officer (CRO)
• Chief financial officer (CFO)

Its Influence to Society

• Without insurance, local state, national and international businesses would quickly grind to a halt.
• Without insurance, a simple claim could put a small business owner out of business.
• Manufacturers could not sell products without liability insurance.
• Myth: All the insurance companies in the U.S.A own the country through its policies and investment.

Business Opportunities in USA

Dr. Kurt Sheu
What is Business?

1. A **business** (also known as **enterprise** or **firm**) is an **organization** designed to provide **goods**, **services**, or both to **consumers**.
2. Businesses are predominant in **capitalist economies**, in which most of them are **privately owned** and formed to earn **profit** to increase the **wealth** of their owners.

What is Business?

3. Businesses may also form **not-for-profit** or be **state-owned**.
4. A business owned by multiple individuals may be referred to as a **company**.

Definition of **OPPORTUNITY**

- A **favorable** or advantageous **circumstance** or combination of circumstances.
- A favorable or suitable **occasion** or time.
- A **chance** for progress or advancement.

Synonyms of **OPPORTUNITY**

- **Occasion** suggests the proper time for action.
- An **opening** is an opportunity affording a good possibility of success.
- **Chance** often implies an opportunity that arises through luck or accident.
- A **break** is an often sudden piece of luck, especially good luck.

Examples of **OPPORTUNITY**

- You'll have an **opportunity** to ask questions after the presentation.
- Studying abroad provides a great **opportunity** to learn a **foreign** language.

Business **OPPORTUNITY**

- A **business opportunity** involves the sale or lease of any product, service, equipment, etc. that will enable the purchaser-licensee to begin a business.
Is America the Land of Opportunity?

- United States of America is known as the land of opportunity for many immigrants who dare to dream of a better life.
- United States has focused more about equal opportunity than any other country.
- There are many people who strongly believe that once they come to United States it is guaranteed to find success to achieve their American Dreams.

Is America really the land of Opportunity?

- No
- A land is just a land
- It is the system that they practice is what gives opportunity to all American.

Testimony - How Apple make It

- Watch “Steve Jobs gave his personal testimony at Stanford University”

Entrepreneurship: A Perspective

- Entrepreneurship is more than the mere creation of business.
- Entrepreneurship is the symbol of business tenacity and achievement

Entrepreneurs: Challenging The Unknown

- Entrepreneurs are individuals who recognize opportunities where others see chaos or confusion
- They are aggressive catalysts for change within the marketplace

Our Entrepreneurial Economy: The Environment For Entrepreneurship

- Their sense of opportunity, their drive to innovate, and their capacity for accomplishment have become the standard by which free enterprise is now measured.
- We are experiencing an Entrepreneurial Revolution in the US.
Predominance of New Ventures
• During the past ten year, new business incorporations averaged 600,000 per year
• Only 15,000 employ 500 or more people
• More than half of all businesses employ fewer than 5 people

The Age of the Gazelles (New and Smaller Firms)
• Innovation: They produce twice as many products innovations per employee as larger firms.
• Growth: 30 millions firms exist today up from the 22.5 millions firms existing in 2000
• Survival: “None”, “Sooner or later all die”, “ 85% of all small start-up firms fail in the first year”

Emerging Trends
• The Internet Explosion
• The E-Commerce Challenge(200% annual growth rate)

Entrepreneurial Opportunities
• It means that any individual is free to transform an idea into a business.
• The opportunities for potential entrepreneurs are unlimited.
• The constantly economic changing environment provides a continuous flow of potential opportunities.

Consider the Following Facts
• Home-based business ownership represent at least 52 % of all small firms and 10% of all revenue.
• Women’s share of self-employment is equal to that of men.
• Business Opportunities will continue to arise for individuals willing to take risk.

Three Types of Person
• A visionary person invents a business and makes a business unique by imbuing it with a special and exciting sense of purpose and direction.
• The manager actualize vision through planning, implementation, and practice.
• The technician gets works done and provides input for improvement of systems and standard
Three Stages of Growth

- **Presence**: Build an excitement about the offerings of the venture in the marketplace
- **Penetration**: Gain market share and establish greater virtual integration
- **Profitability**: Increase operational efficiencies

Businesses owned by Immigrants

- Laundry, Restaurant, Grocery
- Garage, Construction
- Beauty Salon, Travel Agent
- Accounting, Medical Clinic
- Law Firm, Insurance Agent
- Educational Institute

Variables in New Business Creation

- Individual(s)
- Environment
- Organization
- Process

Businesses Owned by Immigrants – 21th Century

- Yahoo
- YouTube

Case Study – A Real Story

- An immigrant made a new business in United States of America.
- Pay attention to “Who, Where, What, How, Why” in the story

Robotics

by

Shin-Min (Simon) Song, Ph.D.
Professor and Chair
Department of Mechanical Engineering
Northern Illinois University
Robotics

• Manipulators
  – A robotic arm with a fixed base
• Mobile Robots
  – Walking machines
  – Flying robots with flapping wings
  – Swimming robots

Manipulators

• Kinematics
• Dynamics
• Robot design
  – Mechanism design: serial, parallel, hybrid manipulators
• Control
• Simulation

Robot Kinematics

• Forward (Direct) Kinematics
  – Given inputs (joint space), Calculate outputs (Cartesian space)
  – More difficult for parallel manipulators
• Inverse (Backward) Kinematics
  – Given outputs (Cartesian space), Calculate inputs (joint space)
  – More difficult for serial manipulators
• Trajectory Planning
Robot Dynamics

- Forward (Direct) Dynamics
  - Given inputs (joint forces/torques), Calculate outputs (motion)
- Inverse (Backward) Dynamics
  - Given outputs (motion), Calculate inputs (joint forces/torques)
Notations for Robot Kinematics

- Denavit-Hartenberg (D-H) Notation
- Zero Position Reference Notation
- Screw Notation
Future of Off-The-Road Locomotion: Legs

by

Shin-Min (Simon) Song, Ph.D.
Professor and Chair
Department of Mechanical Engineering
Northern Illinois University

Land Mobile Systems

- Wheels - for smooth/hard terrain
- Tracks - for smooth or mildly uneven/soft terrain
- Legs - for uneven/soft terrain
- Semi-walking wheels - for muddy field or swamp
- Graspers – for hanging and swing motion
- Snake robots – for narrow and crooked pathway
- Stair-climbing robots – for stairway; use tracks, legs or spoke-wheel system.
- Wall climbing robots – for wall; use suction cups, magnetic foot pods
- Combinations - e.g. planetary rovers with flexible (passive or active) chassis or active suspension system

Advantages of Legged Locomotion On Irregular/Soft Terrain

1. greater mobility
2. greater speed
3. better energy efficiency
4. smoother body motion
5. less environmental damage

1. Greater Mobility

- Percentages of area inaccessible to conventional tracked vehicles:
  * Europe (50%)  
  * Former USSR (55%)
  * Asia (45%)
  * Africa (25%)
  * South America (60%)
  * North America (55%)

- Greater back support

- Less climbing angle
2. Greater Speed

Average speed on rough, hard terrain:
- 3 - 5 mph for wheeled vehicles
- 5 - 10 mph for tracked vehicles
- up to 35 mph for animals


3. Better Energy Efficiency

- Irregular terrain:
  Discrete footprints allow smooth body motion; less energy is wasted in raising up the body.

- Soft terrain:
  Energy wasted in soil deformation is proportional to the size of deformed area
  \[ W = \int F ds \]

4. Smoothness of Body Motion

A legged system with discrete footprints is a better suspension system than a wheeled or tracked system with continuous tracks.

5. Less Damage to Environment

- Less deformed areas

- Friendlier soil deformation mechanics:
  Foot deformation: compression
  Wheel or track deformation: combination of compression and shear
  Compression usually gives better chance to the recovery of vegetation since the roots are usually buried under soil after deformation.

Major Research Areas of Walking Machines

1. Control: control algorithm (model based, neural networks...), integration...etc.
2. Gait study: periodic gaits, free (computer-generated) gaits, statically unstable gaits (dynamic gaits), gait transitions...etc.
3. Leg design: size, strength, energy efficiency...etc.
4. Actuation system: pneumatic, hydraulic, electrical, actuators, artificial tendons/muscles, energy storage and regeneration (e.g. flywheel system)...etc.
5. Vision and sensors: laser scanning systems, terrain analysis, proximity sensors, contact sensors...etc.
6. Navigation and artificial intelligence: to reduce or fully replace human’s functions.

History of Walking Machine Hardware Development

- Wooden ox, 220 AD: Used in transporting rice and cargo in Three Kingdoms, China; invented by Zhuge Liang.
Attempts to Remake the Wooden Ox

- Wang Jian has spent 40 years trying to rebuild the wooden ox.

Attempts to Remake the Wooden Ox

- Professor Yen Hung-sen applied computer synthesis to rebuild the wooden ox.

Wooden Ox

- It is possible to make a wooden ox that can carry heavy load on uneven terrain 1800 years ago.
- It is a great student project.
- With computers, sensors and low friction joints, we should be able build a more efficient wooden ox powered by human or animals.

History of Walking Machine Hardware Development (cont’d)

- GE Quadruped, 1968
- A few computer controlled walking machines were built in 1970s in USSR, Japan and USA
- Dozens of walking robots were built in 1980s; OSU ASV, 1988
- Hundreds of walking robots built in 1990s and 2000s
Walking Machine Catalogue

- Web site: http://www.walking-machines.org/
- One-legged systems

Two-legged Systems

- Honda Human Robot, 1997, Japan
Leg Design - Energy Efficiency

- Back driven system:
  - One actuator is doing negative work (acting as a brake) while another is doing positive work.
  - Resulted in poor efficiency.
  - Serial leg normally has back driven actuation.
  - Many legged robots have back driven actuation.

- Gravitationally decoupled actuation (GDA) system:
  - Actuators contributing in gravitational force are decoupled.
  - Resulted in good efficiency.
  - Single actuator straight-line mechanism is a GDA system.
Straight-line Mechanisms

- Exact Straight-line Mechanisms
  - Pantograph mechanism
  - Peaucellier inversor
  - Cam leg
- Approximate Straight-line Mechanisms
  - Four-bar linkage
  - Roberts linkage
  - Planetary gear mechanism

Figure 7.1: The three dimensional pantograph mechanisms used in PV II.
Concept of a Cam-Controlled Leg

(a) Overall Structure
(b) Principles of leg motion

Closed Form Cam With Extended Leg Follower
Leg Design (Cont’d)

- Size and interferences
- Weight distribution and inertia
- Load capacity
- Foot design
- Ankle design

Gait Study

- Periodic Gaits
  - Wave gaits
  - Equal phase gaits
  - Backward gaits
  - Continuous follow-the-leader (FTL) gaits
- Non-periodic Gaits
  - Discontinuous follow-the-leader gaits
  - Free gaits
  - Precision footing gaits
  - Large obstacle gaits
- Gait Transitions

Figure 3.1: Simplified dimensions of the ASV.

Figure 3.2: Stability ratios $S_h$ of a support pattern.

$S_h = \min \{d_1, d_2 \text{ and } d_3\}$

Figure 3.3: Longitudinal stability ratios $S_l$ of a support pattern.

$S_l = \min \{d_1 \text{ and } d_2\}$

Figure 3.5: A gait diagram of quadruped gait.

Figure 3.8: A stationary gait pattern of a quadruped gait.
Wave Gaits

- Symmetrical Gait: The phase difference between right and left legs is $\frac{1}{2}$.
  \[ \Phi_2 = \frac{1}{2} \]

- Optimum stability: The leg is placed at the same time when the leg ahead of it is lifted:
  \[ \Phi_3 = \beta \]

Continuous Follow-The-Leader Gait

- Symmetrical gait:
  \[ \Phi_2 = \frac{1}{2} \]
  \[ \Phi_4 = \Phi_3 + \frac{1}{2} \]

- Follow-the-leader: A leg is placed at the same footprint of the leg ahead of it.
  \[ \Phi_3 = (P/R)\beta \]
  \[ \Phi_5 = 2(P/R)\beta - 1 \]

Continuous Follow-The-Leader Gait

- Release Time: The time for a footprint to be released (not occupied) between two adjacent feet.
  \[ (P/R)\beta - \beta = (P/R - 1) \beta \]
  The release time should be sufficient so that the two adjacent feet will not collide.

- Wave gait is a special case of the continuous FTL gait with release time equals to zero.
Large Obstacle Gaits

- Ditch Crossing Gait
- Obstacle Crossing Gait
- Three phases:
  Phase 1: front legs move over
  Phase 2: middle legs move over
  Phase 3: rear legs move over
Why Are Cultures Different?

• Each society is unique.

• Some come from slave-owning societies with formal inequality.

• Each society has different historical experiences.

• Some come from feudal societies with formal inequality.
Why Are Cultures Different?

• Some come from capitalist societies with formal equality.

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Why Are Cultures Different?

• There’s a dominant culture.

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Why Are Cultures Different?

• There are minority cultures.

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Why Are Cultures Different?

• There are alternative cultures.

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Why Are Cultures Different?

• There are rich & poor people.

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V-Curve

Adjustment

Time

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In Some Societies
No real or effective minimum age to smoke & drink.

In Some Societies
Individuals blame themselves for mistakes.

In Some Societies
Individuals praise others for successes.

Mainstream U.S.A.
Individuals praise themselves for successes.
Mainstream U.S.A.
Individuals blame others for mistakes.

Mainstream U.S.A.
Tons of ice.

Mainstream U.S.A.
18 years old to buy cigarette.

Mainstream U.S.A.
21 years old to buy & drink alcohol.

Mainstream U.S.A.
Bottom-less iced tea & coffee in diners.

In Some Societies
Informality is rude.
In Some Societies
Being late is polite.

In Some Societies
Intimate friends forever.

In Some Societies
Hospitality is 24/7, unannounced.

In Some Societies
Slurping (喝東西時, 發出噗噗的聲音) & burping (打嗝) are polite.

In Some Societies
Blowing one’s nose is rude.

In Some Societies
Farting is not rude.
In Some Societies
Looking straight in the eyes is rude.

In Some Societies
Soft hand shake is polite.

In Some Societies
• Use tons of spices
多种的香料

In Some Societies
• Use tons of spices
• Exhaust “on” & all windows “open”

Mainstream U.S.A.
• Salt & Pepper
盐和胡椒。
• Or none, for health reasons!

Mainstream U.S.A.
Informality is polite. Formality could be too “cakey” & unwanted.
Mainstream U.S.A.
Being late is rude.

Mainstream U.S.A.
Mobility
– Office friends
– Soccer friends
– Neighborhood friends

Mainstream U.S.A.
U.S. folks are very hospitable, but by appointment only.

Mainstream U.S.A.
Slurping & burping are rude.

Mainstream U.S.A.
Blowing one’s nose is not rude.

Mainstream U.S.A.
Farting is rude.
Mainstream U.S.A.
Not looking straight in the eyes is rude.

Mainstream U.S.A.
Soft hand shake shows insincerity.

Relativism & Pluralism
Politeness & rudeness are historically, socially, politically & culturally determined.

What to do?
• Navigate
  – Do as the Romans do?
  – Do as you would normally do?
  – It depends!

Diversity in the U.S.A.
Native Americans

Diversity in the U.S.A.
European Americans
Diversity in the U.S.A.
Diverse Types of Families
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Respect Everyone!
• Factory & Office Workers
© 2011 Rey Ty

Respect Everyone!
• Director or Clerk
© 2011 Rey Ty

Respect Everyone!
• Custodian and President
© 2011 Rey Ty

Respect Everyone!
• Women & Men
© 2011 Rey Ty

Respect Everyone!
• Gay & Straight
© 2011 Rey Ty
Respect Everyone!
• Young & Old

Respect Everyone!
• Wait Staff & Cashiers

Respect Everyone!
• Without distinction of any kind, such as race, color, sex, language, religion, political or other opinion, national or social origin, property, birth or other status.

Amendment 1
• The Bill of Rights
• Amendment 1 - Freedom of Religion, Press, Expression.
Basic Words of Courtesy
In Some Societies
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Direct Style
• For Americans, yes means yes!
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U.S. Writing
Straight to the Point
© 2011 Rey Ty

Some Non-U.S. Writing
Flowery & circuitous
© 2011 Rey Ty

U.S. Writing
Short sentence. 2 pages = 1 chapter.
© 2011 Rey Ty

Some Non-U.S. Writing
Kilometric sentence. 1 sentence = 34 pages.
© 2011 Rey Ty
Some Non-U.S. Writing

I. Flowery Introduction: Land of the Rising Pluto...
II. Flowery Body
III. Flowery Conclusion
Lack References!

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Careful!

1. Academic Freedom
2. Academic Excellence
3. Academic Honor: No Plagiarism!

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Social Invitations

In Some Societies

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Social Invitations
Come any time & eat.
© 2011 Rey Ty

Social Invitations
Rude to ask if guests want food or drinks.
© 2011 Rey Ty

Social Invitations
Just offer food & drinks.
© 2011 Rey Ty

Social Invitations
U.S.A.
© 2011 Rey Ty

Social Invitations
Fixed hospitality time.
© 2011 Rey Ty

Social Invitations
Let’s have a drink together some day. = Goodbye!
© 2011 Rey Ty
ATTITUDES
1. Ethnocentrism
My culture is the best.
© 2011 Rey Ty

ATTITUDES
2. Romanticism
Your culture is the best!
© 2011 Rey Ty

ATTITUDES
3. Cosmopolitanism
There are good things in your & my cultures.
© 2011 Rey Ty

ATTITUDES
3. Cosmopolitanism
There are bad things in your & my cultures.
© 2011 Rey Ty
Thank You!
非常感谢你们！

Intercultural Orientation for New International Students
Rey Ty
Division of International Programs
International Training Office
Northern Illinois University
Carl Sandburg Auditorium
January 10, 2011

Communicating in Small Groups and Teams
Dieter Zeschke
ELS Language Center -- DeKalb

Overview
- Preparing to work with group and teams
- Understanding team development, roles, and conflict
- Characteristics of successful teams

Overview
- Organizing team-based written and oral presentations
- Planning and participating in productive meetings
- Using collaboration technology to facilitate meetings, manage projects, and make decisions
Objective 1

• Groups: 3 or more members who work independently to achieve goals
  – Quick solutions
  – Have 1 leader

Objective 1

• Teams: members who interact over time to achieve purpose (e.g., task force)
  – Self-directed
  – Have clearly stated goals, autonomy, decision-making authority, frequent communication, and ongoing training

Objective 1

• Reasons for groups and/or teams
  – Better decisions
  – Faster response
  – Increased productivity
  – Greater buy-in
  – Less resistance to change
  – Improved employee morale
  – Reduced risks

Objective 2

• Four phases of team development
  – Forming (similarities and bond)
  – Storming (define roles and responsibilities, rules for governing interaction)
  – Norming (tension subsides, roles clarify, information flows among members)
  – Performing (willing and can do attitude about progress)

Objective 2

• Group task roles
  – Initiator
  – Information seeker/giver
  – Opinion givers seekers
  – Direction giver
  – Summarizer
  – Diagnoser

Objective 2

• Group task roles (cont.)
  – Energizer
  – Gatekeeper
  – Reality tester
Objective 2

- Group relation roles
  - Participation encourager
  - Harmonizer/tension reliever
  - Evaluator of emotional climate
  - Praise giver
  - Empathic listener

- Dysfunctional group roles
  - Blocker
  - Attacker
  - Recognition seeker
  - Joker
  - Withdrawer

Objective 2

- Resolving conflicts
  - Avoidance/withdrawal
  - Accommodation/smoothing
  - Compromise
  - Competition/forcing
  - Collaboration/problem solving

- 6-step procedure for dealing with conflict
  - Listen
  - Understand other point of view
  - Show a concern for relationship
  - Look for common ground
  - Invent new problem-solving option
  - Reach an agreement based on what’s fair

Objective 2

- Avoid groupthink
- Reach group decisions
  - Majority
  - Consensus
  - Minority
  - Averaging
  - Authority rule with discussion

Objective 3

- Characteristics of successful teams
  - Are small and diverse
  - Agree on purpose
  - Agree on procedures
  - Able to confront conflict
  - Use good communication techniques
Objective 3

- Able to collaborate rather than compete
- Accept ethical responsibility
- Share leadership
- Demonstrate good workplace manners

Objective 4

- Preparing to work together
  - Name leader
  - Decide method of governance (majority, etc.)
  - Plan meeting times, places, etc.
  - Discuss value of conflict
  - Discuss how to hold accountable

Objective 5

- Plan document or presentation
  - Establish specific purpose
  - Decide on final format
  - Discuss audience
  - Develop work plan
  - Give each person assignment or responsibility
  - Decide how to compile final product

Objective 4

- Collect information
  - Brainstorm ideas
  - Assign topics
  - Establish deadlines for collecting information
  - Discuss ways to ensure accuracy

Objective 4

- Organizing, writing, revising
  - Review proposed organization
  - Compose 1st draft
  - Meet to discuss and revise
  - Coordinate parts
  - Make sure bridges between parts

Objective 4

- Edit, rehearse, evaluate
  - Merge documents (consistent voice, grammar, etc.)
  - Evaluate final document (purpose, needs)
  - Rehearse (preliminary and dress)
Objective 5

- Planning meetings
  - Decide if it is necessary
  - Decide who should be there
  - Create agenda/ground rules
  - Distribute meeting information
  - Start meeting (goal, length, background)
  - Handle conflict

- Manage dysfunctional group members
  - Lay down rules in opening statement
  - Strategic seating
    - Avoid direct eye contact
    - Assign dysfunctional members specific tasks
    - Ask to speak in specific order
    - Interrupt monopolizers
    - Encourage non-talkers
    - Give praise and encouragement

Objective 5

- End with plan
- Follow up actively
  - Review decisions
  - Distribute minutes
  - Remind people of action items

Objective 5

- Purpose and number of participants
  - Intensive problem solving 5 or fewer
  - Problem identification 10 or fewer
  - Information reviews/presentations 30 or fewer
  - Motivational unlimited

Objective 6

- Collaboration technology
  - Teleconferencing/audio conferencing
  - Web conferencing/internet relay chat (IRC)
  - IM/email
  - Folder sharing
  - Intranets
  - Project management software
  - Information organization software

Workplace Listening and Nonverbal Communication
Dieter Zeschke
ELS Language Center -- DeKalb
Overview

- Explain the importance of listening in the workplace and describe three types of workplace listening
- Discuss the listening process and its barriers
- Enumerate ten techniques for improving workplace listening

Overview

- Define nonverbal communication and explain its function
- Describe the forms of nonverbal communication and how they can be used positively in your career
- List specific techniques for improving nonverbal communication skills in the workplace

Objective 1

- Listening is not an automatic response
  - 30-45% of time spent listening (workers)
  - 60-70% of time spent listening (executives)
  - Listen at 25% efficiency rate

Objective 1

- Factors for not listening effectively
  - Lack of training
  - Competing noise
  - Process speech faster than individuals speak

Objective 1

- Listen to superiors
  - Focus
  - Take notes
  - Do not interrupt
  - Ask questions

Objective 1

- Listening to colleagues/teammates
  - Judge and evaluate what are hearing (critical listening)
  - Identify main ideas, connections, and purpose (discriminatory listening)
Objective 1

- **Dampening** – minimal response and maximum attention
- **Redirecting** – ask questions, restate ideas, keep speaker on track
- **Reflecting** – clarify content and feeling (interpret meaning)

Objective 1

- Listening to customers
  - Increase sales and profitability
  - Improve customer acquisition and retention
  - Ask questions
  - Show you care

  Customers feel better!!!!

Objective 2

- Listening process/barriers
  - Perception (hear and concentrate)
    - Message is important
    - Interested in listening
    - Mood to listen
  - Interpretation - decode
  - Evaluation
    - Analyze merits
    - Draw conclusions

Objective 2

- Action – store for future use or feedback
  - Enhancing retention (50% next/20% 2 days)
    - Decide to remember
    - Structure information to remember
    - Review

Objective 3

- Control external and internal distractions
- Become actively involved
- Separate fact from opinion
- Identify important facts

Objective 3

- Do not interrupt
- Ask clarifying questions
- Paraphrase to increase understanding
- Capitalize on lag time
- Take notes
- Be aware of differences (particularly gender)
Objective 4

• Nonverbal messages carry powerful meanings
  – Intentional
  – Unintentional

Objective 4

• Functions
  – Complement and illustrate
  – Reinforce and accentuate
  – Replace and substitute
  – Control and regulate
  – Contradict

Objective 5

• Forms
  – Eye contact
  – Facial expression
  – Posture and gesture
  – Time
  – Space
  – Territory
  – Appearance