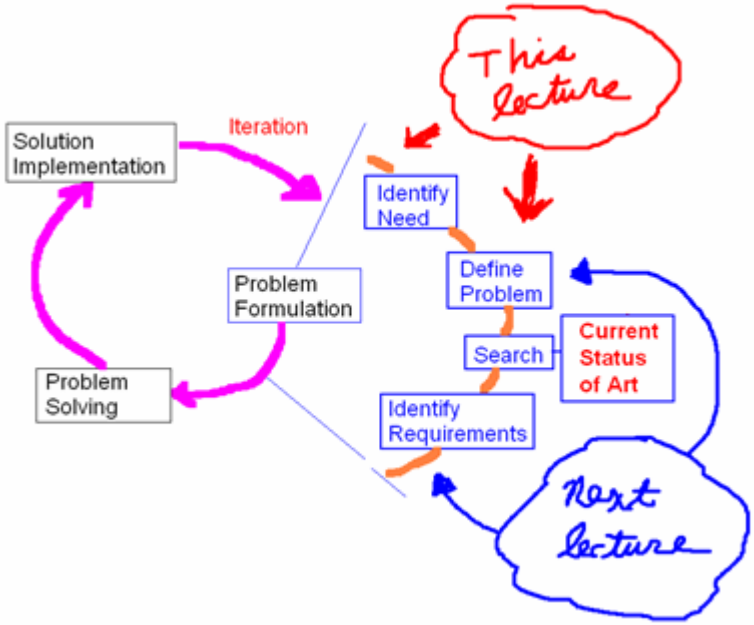
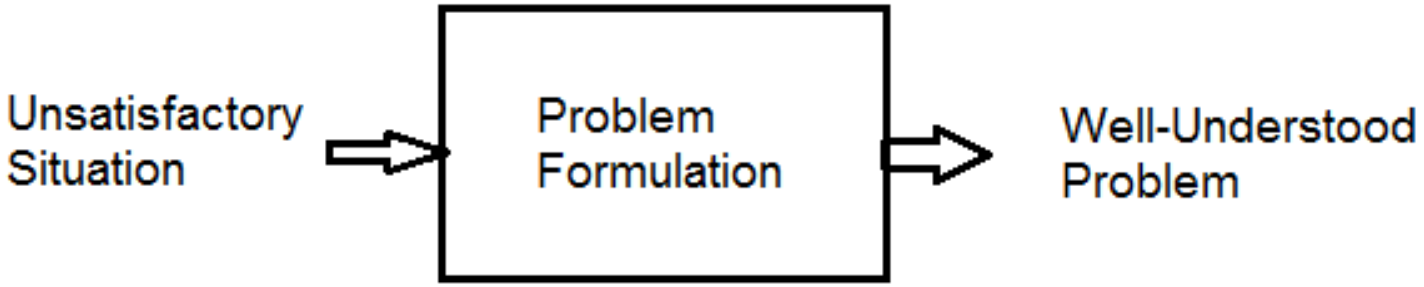
EECE401 Senior Design I

Problem Formulation





Projects and Teams

- **ASL2TEXT/VOICE ← Intel Cup 2015**
  - Dhungel, Clestino, Etinne, Ndzami, Yilma, Montgomery, Galani
  - Faculty Advisor: Dr. Mohamed Chouikha
  - Roshil Paudel (Jr, MATH) and Prajjwal Dangal (Sp, CS)
- **Circuit Bending for Voice Encryption (?) ← Intel Cup 2015**
  - Robinson, Clements, Jackson, Smith
  - Faculty Advisor: ? ?
  - Other participants
- **Niobium ← Northrop Grumman**
  - Woods, Ajayi, Chambers, Mahop, Mahadiow, Kourani, Haley
  - Faculty Advisor: Dr. Charles Kim
  - GR students: Trey Morris and Mpho Mussenga
- **Trojan ← Faculty Research Project & Intel Cup 2015**
  - Ross, Bratcher, Green, Lopera, Powell
  - Faculty Advisor: Dr. Hassan Salmani
  - GR students, Jr/Sp students
- **Android Wear ← Capital One**
  - Fisher, Edwards-El, McElwee, Monette
  - Faculty Advisor: Dr. Charles Kim
  - GR student: Samuale Ayele
  - JR students

,

Final Project Titles, Team Names, Team Leaders - 1

- **SLATE (Sign Language to English)**
  - Team Name : Slate8
  - Leader: Sarad Dhungel
  - Faculty Advisor: Dr. Mohamed Chouikha

- **Circuit Bending for Voice Encryption (?)**
  - Team Name:
  - Team Leader: Michael Robinson
  - Sponsor:
  - Faculty Advisor: ? ?

- **Underwater Current Connector**
  - Team Name: UCC
  - Leader: Crepin Mahop
  - Faculty Advisor: Dr. Charles Kim
  - Industry Sponsor: Northrop Grumman

Final Project Titles, Team Names, Team Leaders - 2

- **Hardware Trojan**
  - Team Name:
  - Leader: Candace Ross
  - Faculty Advisor: Dr. Hassan Salmani
  - Sponsor: Faculty Research

- **Android Wear**
  - **Team Name: Watch Me Now**
  - Leader: Dhuel Fisher
  - Faculty Advisor: Dr. Charles Kim
  - Industry Sponsor: Capital One

Next step for Intel Cup2015 Contenders


MWFTR.COM MWFTR.COM MWFTR.COM MWFTR.COM MWFTR.COM MWF

MWF? TR? TOGETHER, V

Senior Design Class of 2014-2015

Announcement:

08-27-2014: New class hours: Wednesdays 1410 - 1700 (Classroom is 3121 LKD)

09-17-2014: Four (4) candidate projects will be presented, and project teams are to be formed.

09-25-2014: Deadline for Intel Cup 2015 Registration is Oct 13, 2014. Link to Intel Cup 2015 Competition, Competition Registration Site, the Summary of the Competition (Rules), and the past Howard University competitors.

Round #1, Intel Open

- Multiple teams from the same University can be selected to attend Round #2, the Intel-Cornell Cup Semi Finals
- Each faculty member advising less than 10 registered Intel Open teams will select 1 team to move on to the Intel-Cornell Cup Semi Finals
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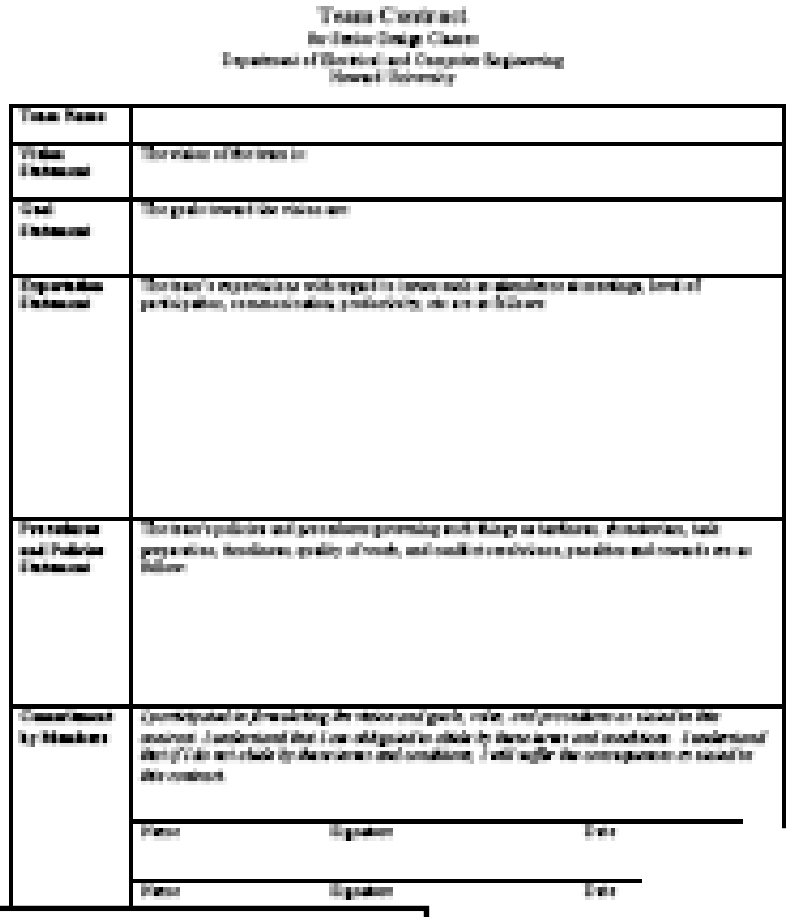
Register for the Intel Open (Round #1) Now!!

www.mwftr.com/SD1415.html

Team Contract

- Goal
- Expectations
- Rules and Policies
- Commitment

- **Fillable pdf form** is available from the class note Web page.



Lecture 3: Teamwork [Fillable PDF file for team contract form]

Team Contract: Goals and Expectations

- Goal Statement
  - Clear, measurable targets that indicates progress toward the purpose
- Expectation Statement
  - Team's expectation on team members in
    - Meeting attendance and on-time arrival
    - Activity participation
    - Communication
    - Productivity
    - Assigned task completion
    - Keep the deadline
    - Etc

Team Contract: Rules and Policies

- Rules and Policies
  - Ground rule for common area
  - Running of Meetings
    - Who runs the meeting?
    - Cell-phone policy
    - How team decisions and consensus will be reached
  - How meeting absenteeism and tardiness will be handled
    - Policies for missing one meeting or being late
    - Policies for contacting someone to contact
  - Expectations of quality works
    - How to handle late and incomplete work of a member?
    - How to reward team members who exceed expected performance
  - Relationship
    - What each member to bring to each meeting
    - Developing “can do” attitude
    - etc

First Team Assignment

- Team Contract Submission
  - Wednesday, October 1
  - Typed, printed out document
  - All should sign the contract
  - Make out this one (while working on the Intel Cup 2015 registration)
  - Later joiners can sign too (after handed back)

Team Webpage – future plan

- 2 options
  - (1) Bring your html file to me, then I post in the www.mwftr.com class note page.
  - (2) Maintain your own webpage and give me the link to the page
- Standard format
  - The format will be discussed and determined by the team leaders
  - Will soon be provided to all teams

Reminder

- Personal/Individual project note
  - Basis of scores and grading
  - Your knowledge-base
- Team Project Binder
  - Collection of ALL team activities
  - Basis of team scores

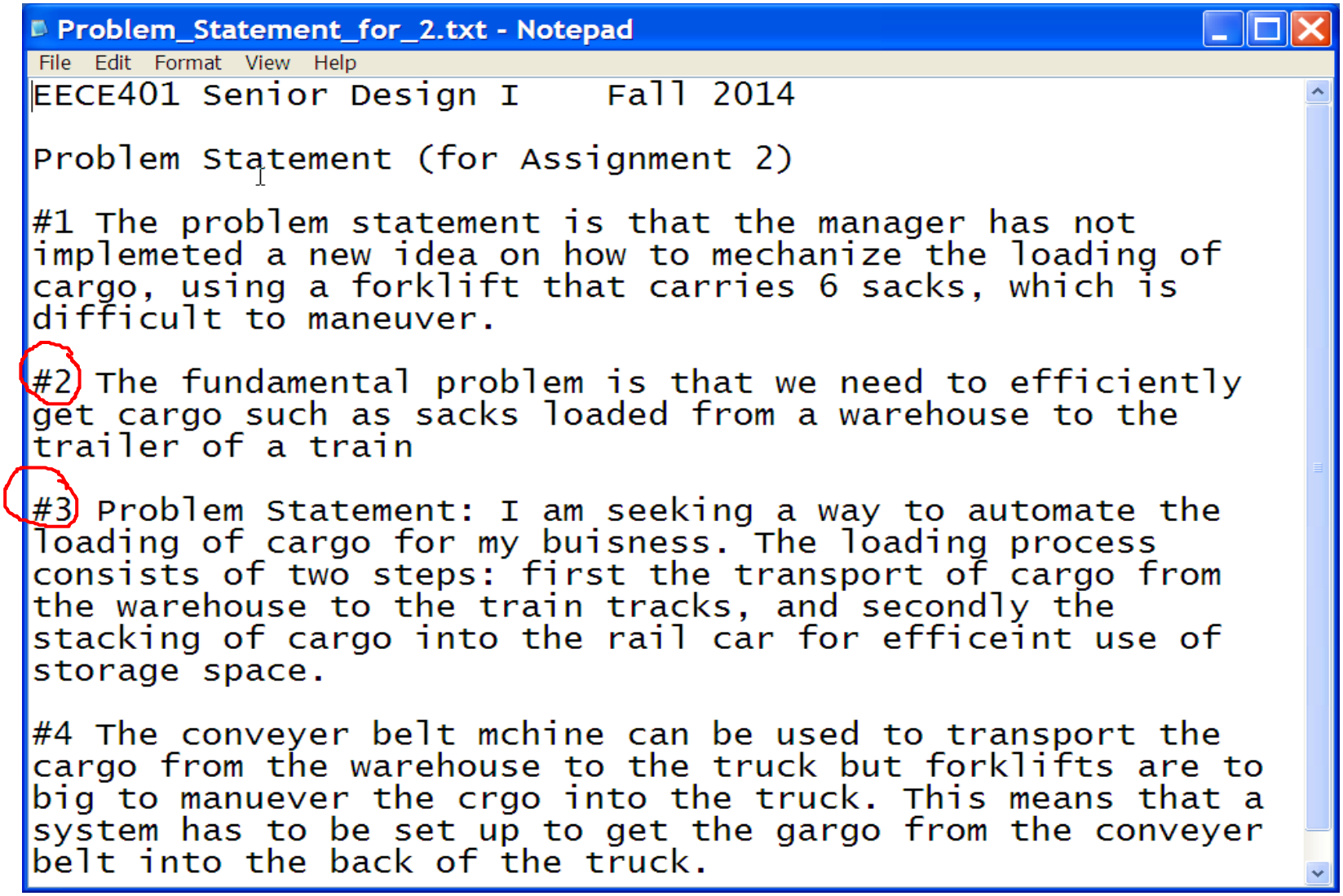
Let's Discuss about - Assignment #2

- No solution required – optional
- Only "Problem statement" – what is the problem the customer says to solve?
- Individual Work

Assignment #2*:A customer comes and demands by saying: "Devise a better concept to mechanize the loading of cargo (sacks) into railroad trucks from the manual loading, by which workers take one sack from a pallet in a warehouse, carry it to the truck, and place it on another pallet on the truck. The transport of cargo from warehouse to railroad truck can be easily mechanized – perhaps by using a conveyer belt. However, portable and compact machines that can stack cargo inside a railroad truck do not exist. Forklifts that carry six sacks on a platform have difficulty maneuvering inside a truck and, therefore, cannot provide the necessary productivity." Now, in meeting (solving) the customer need, we have to know the customer's problem precisely. Make a problem statement which includes (1) the goal (what must be achieved) and (2) the means (what must be done, improved, or changed) to be employed. **Bring and submit a typed report to the class of Wednesday, September 24, 2014**. *This assignment is based on "The Innovation Algorithm" by Genrich Aktshuller, pp.82-83.

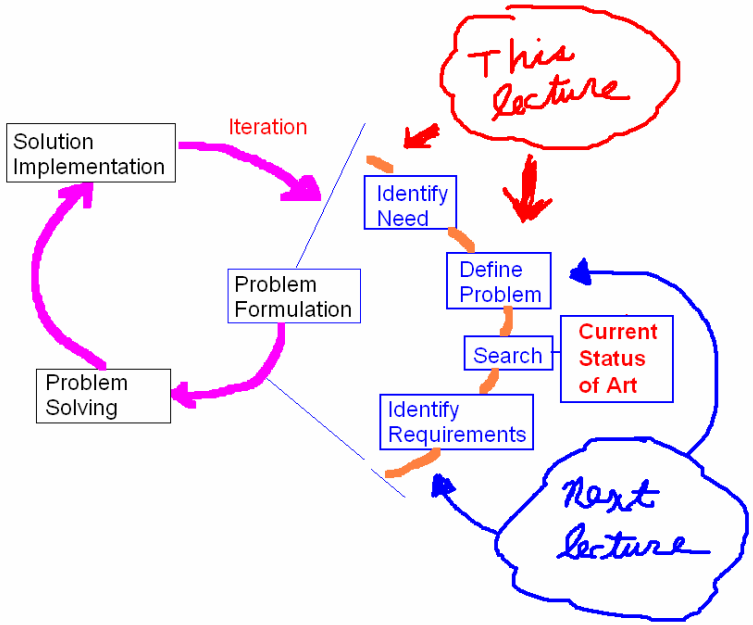
4 Student Problem Statements of Assignment #2

- Judge yourself which is a good problem statement.



Problem Formulation and Design Requirement

- **Contents**
  - **Identify Needs**
  - **Define Problems**
  - Current Status of Art
  - Identify Requirements



- **Goals**
  - Why need identification and problem definition are important
  - Strategies for gathering information about a problem
  - Make out a “Problem Statement”
  - Develop a set of requirements for a problem

Problem Formulation

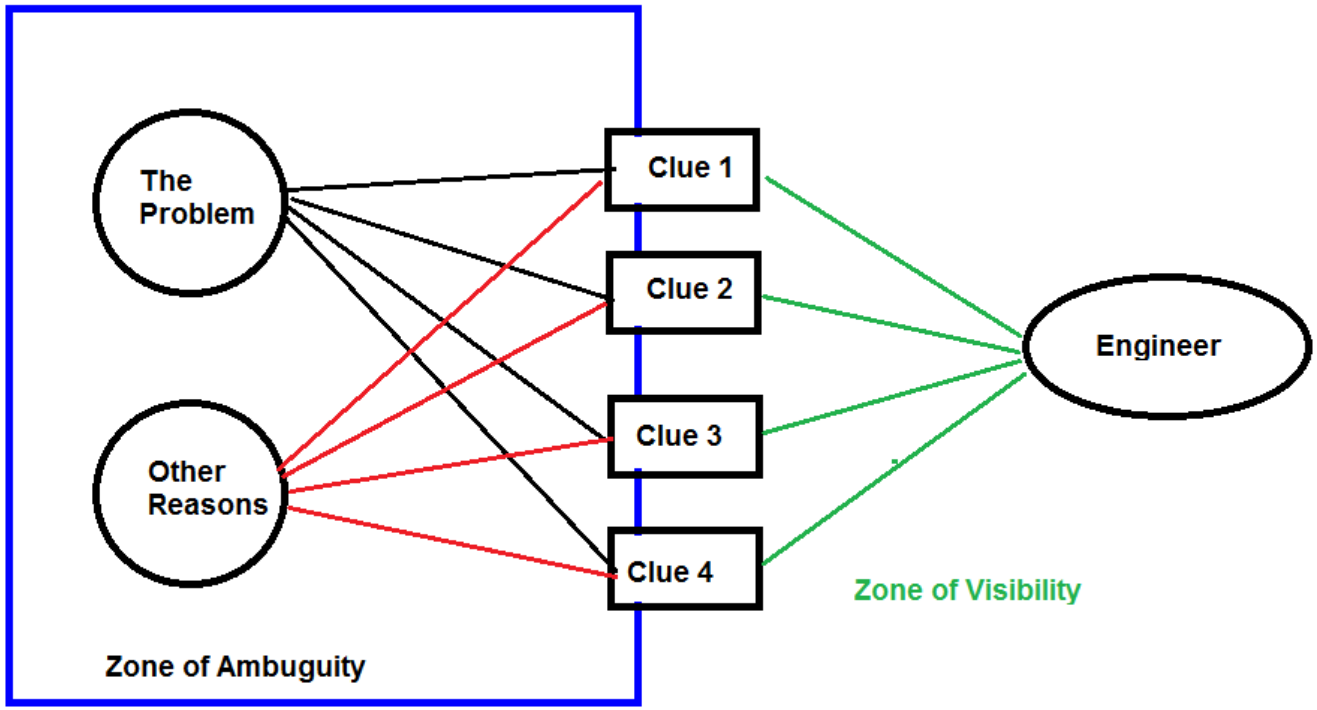
- "The process of converting a dissatisfied situation into a well-understood problem"
  - Understanding the problem, Not finding solution to the problem
  - Einstein: "*The mere formulation of a problem is far more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science*"
  - It's result?
    - TRUE Need Identification and CORRECT Problem Definition
    - Clear set of Requirements that can guide the design process through to its completion

Identifying Needs and Defining Problem

- **Identify the Needs (of the customer)**
  - 1. Outline why the situation is so dissatisfying
  - 2. Ask questions about it
  - 3. Compare it to other situations that are familiar or where experience already exists
  - 4. Gain an understanding of what might cause it
  - Don't consider Solution yet --- this is a trap !!!
- **Don't rush to get a solution** after Needs are Identified:
  - A wrong problem may be solved!
  - A symptom may be solved!
  - **A part** of the problem may be solved!
  - A partial solution is attempted

Problems may be hidden in a Zone of Ambiguity

- Problems are often imbedded in a zone of ambiguity and only accessible through a series of clues.
- Problems may exists by other reasons than seemingly apparent manifestation
- Take more time to adequately understand the entire problem and identify THE problem.



Misidentified Problem (Cause)

- Headache/Migraine – There are more than 200 types of headaches

The Blind Men and the Elephant

- Pillar? Rope?
  Tree branch?
  Hand fan?
  Wall? Pipe?
- Parts vs. Whole
- Need of communication

Hard “soft” skill?

- We find the “hard” things to be “easy”,

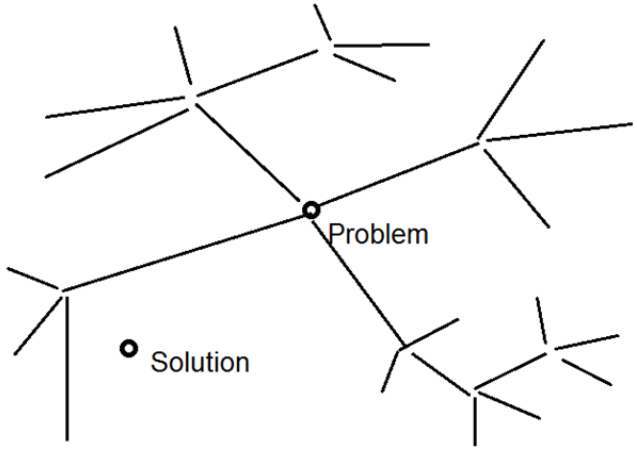
  It is the “soft” thing that are “hard” – A CEO of a manufacturing company in expression of concerns on applying technical skills to meet design needs.

  – Meaning?

- Problem formulation is one of those essential hard “soft” skills.

Mental Barriers and Inertia Vectors

- Mental Barriers
  - a collection of misconceptions, misunderstandings, biases, mindsets, predispositions, assumptions, and emotions that prevent a person from understanding, identifying, or comprehending a problem and solving it.
- Inertia Vectors
  - Direction of solution is following the Initial tendency
  - Use already existing devices or concepts
  - Usually lead away from the solution



Types of Mental Barriers

- Many different types of mental barriers, including, but not limited to:
  - False assumptions and nonexistent limitations
  - Typical solutions
  - Making things more difficult than they are: being overwhelmed
  - Incomplete or partial information
  - Information and sensory saturation
  - Misunderstanding
  - Emotions-, culture-, and environment-related barriers
  - Fear
  - Improper methods of solution
  - Over-abundance of resources

- Source: S. B. Niku

Attributes of Creative People

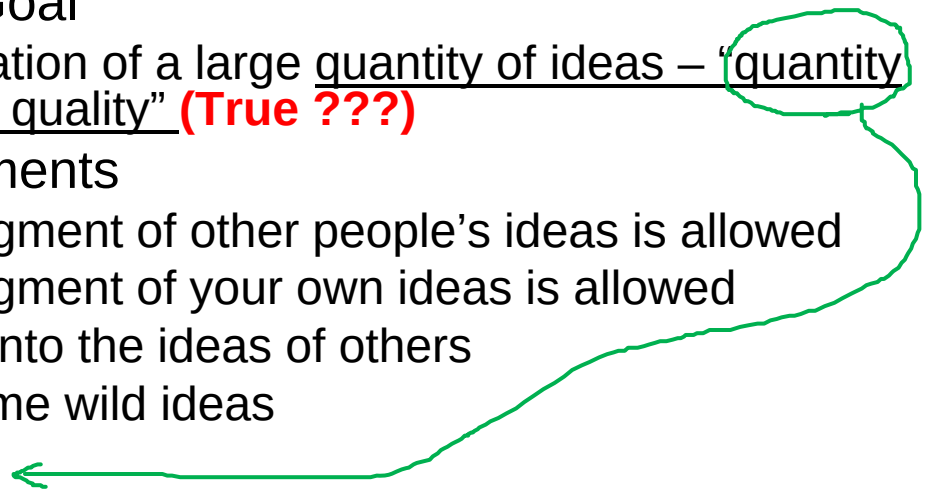
- Discipline and Self-Confidence
- Adaptability and Resilience
- Conceptualization and Recall
- Flexibility and Fluency
- Visualization Ability
- Curiosity
- Comfort with Complexity
- Mental Agility, detachment, and playfulness
- Skeptical of Accepted Ideas
- Persistence and Capacity
- Informality
- Originality

Approaches for Creative Solution

- Brainstorming
  - Creation of Affinity Diagram
  - Creation of Cause-and-Effect Diagram
- Synectics
  - “joining together different and seemingly irrelevant elements”
  - Analogy (Personal, Direct, Symbolic, Fantasy)
- TRIZ
  - The Theory of Inventive Problem Solving
  - Systematic method based on the hypothesis that creative innovations follow universal principles which can be followed.

Brainstorming

- A group process
- Popularized but misunderstood –
  - Not just “sitting down and thinking of ideas”
- A process with guiding principles
- Primary Goal
  - Generation of a large quantity of ideas – “quantity breeds quality” **(True ???)**
- Core Elements
  - No judgment of other people’s ideas is allowed
  - No judgment of your own ideas is allowed
  - Build onto the ideas of others
  - Welcome wild ideas
- Caveat
  - Quantity but not quality (toward solution)
  - Maybe a bunch of wrong directions (quantity)
  - No solution (quality)

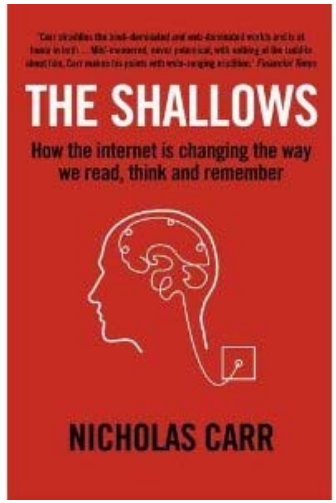


But can 'I' give a storm to my brain?

- "I'm, therefore, I'm right": Opinion by Jim Sollisch in *Christian Science Monitor,* July 21, 2011
  - The culture of 'I'
  - Base our thinking and behavior almost exclusively on personal experience
  - "I experience, therefore, I am right"
  - Result: Lack of critical thinking →may lead to Narcissism
  - What accelerated Americans to become shallow thinkers? Internet's segregation by their interests

But can 'I' give a storm to my brain?

- "***The Shallows***: What the Internet is doing to our brains" –by Nicholas Carr
  - "The Internet rewards shallow thinking: One search leads to thousands of results that skim over the surface of a subject."
  - People skim on line; they don't read.
  - And there is tangible evidence, based on studies of brain scans, that the medium is changing our physical brains, strengthening the synapses and areas used for referential thinking while weakening the areas used for critical thinking.



www.mwftr.com/SD1415.html

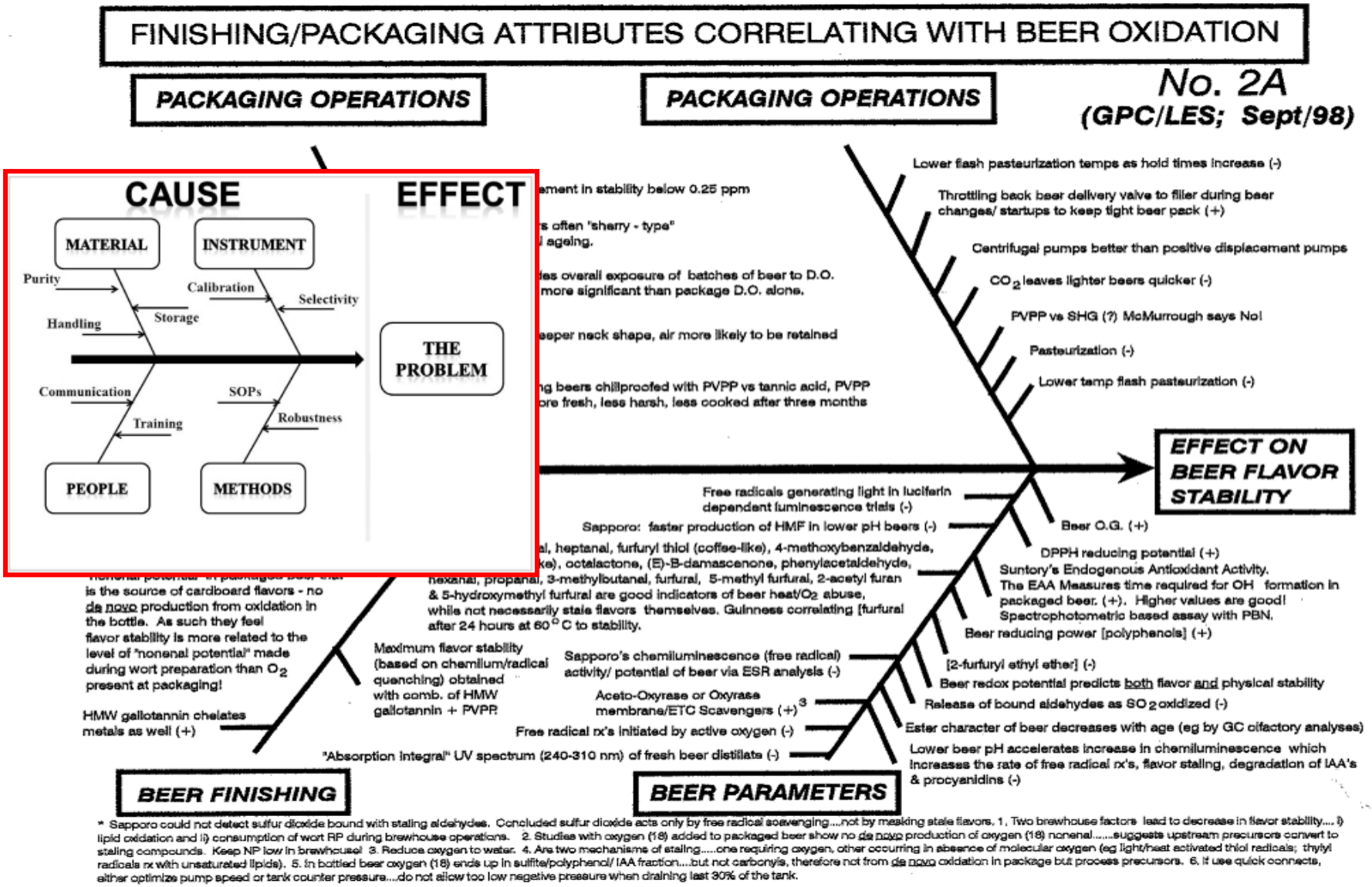
Practical Approach for Problem Identification

- Suggested Approach:
  - Express the customer's need in your own words
  - Focus on the Root Cause (not symptoms or immediate Source)
  - Don't try to use existing devices in the statement
  - Think other industry and application for similar situation with precise problem definition
  - If any question, ask customers
- Helpful Tools
  - Brainstorming and Creation of Affinity Diagram
  - Cause-and –Effect Diagram ("fishbone" diagram): Effect → Need, and Cause→ Problem
  - Concept Map to gather the NEEDS directly from a customer

Affinity Diagram

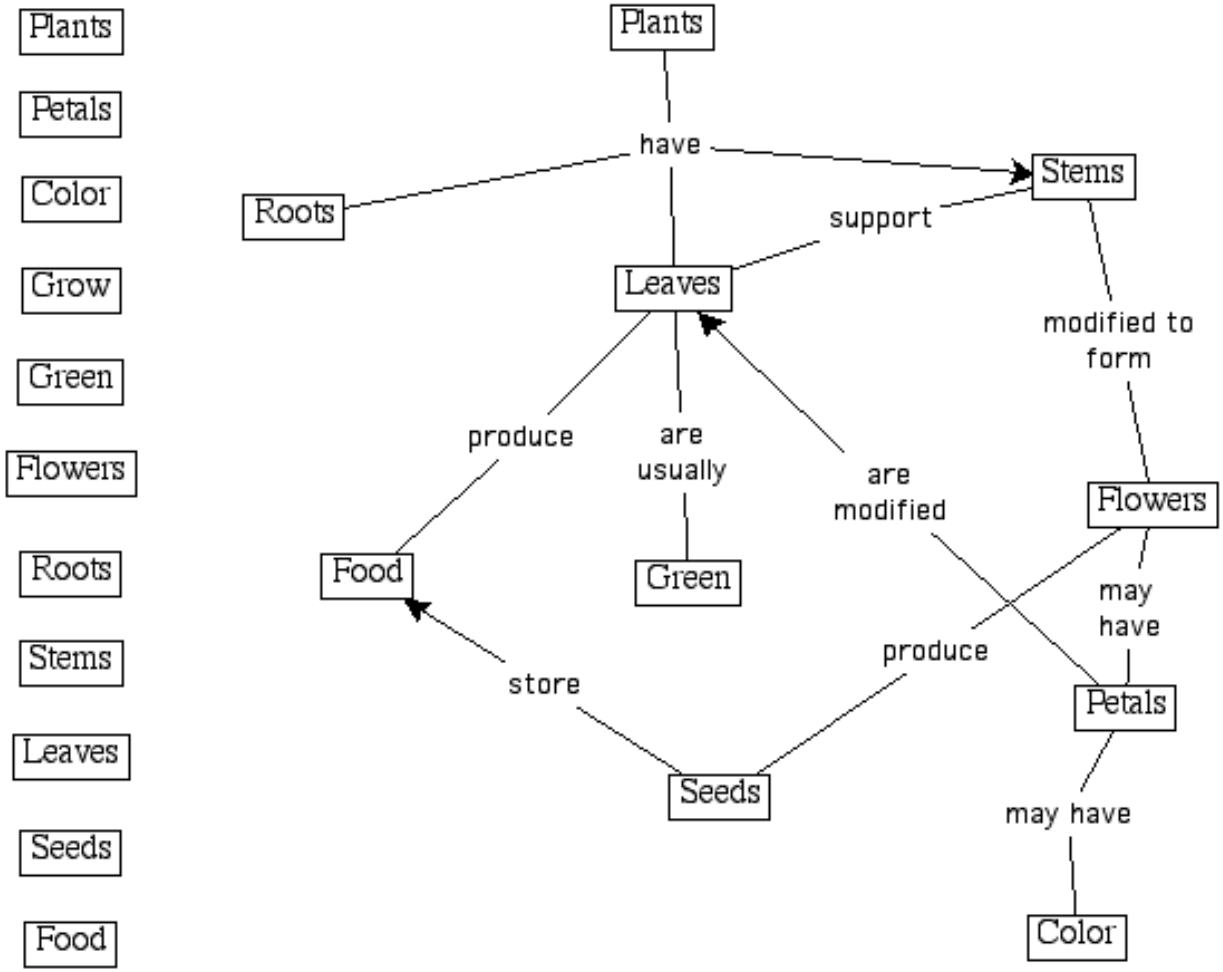
- The affinity diagram organizes a large number of ideas into their natural relationships.
- This method taps a team's creativity and intuition.
- It was created in the 1960s by Japanese anthropologist Jiro Kawakita.

Fishbone Diagram (Causes-and-Effect)



Concept Map

- Visual illustration of concepts and ideas



Now, Back to Problem Formulation

- Customer:
  - "My utility bill is too high. I paid $100 for water and $200 for electricity."
- Designer:
  - Uhm, this customer has an energy waste problem or is paying above the budget. (**Wrong!!)**
  - The **wrong problem definition** would lead a wrong solutions
    - Well, shut your A/C
    - Take a quick shower
    - Do laundry only once a month
- What is the correct problem statement?
  - Work !!

Problem Definition Exercise 1

- **Needs from customers:**
  - **"Actually, we need help figuring out how to fit everything in our room… it's**
- Process of Defining Problem
  - Outline why the present situation is so dissatisfying
  - Asking questions about it
  - Comparing it to other situations that are familia or where experience already exists
  - Gaining and understanding what caused it.
  - Then "one sentence problem statement" which includes every element – **complete set of customer needs**
- **And your problem statement is?**
- **Exercise: Write 1-sentence "Problem Statement"**

Problem Definition

- Problem Definition Example:
  - "The customers need to rearrange the contents of the room in such a way as to increase the efficiency of space usage and the convenience of item location"

How the class did - 1

I need a way to fit all of my things in a tight space without losing comfort or mobility throughout the room.

The customer needs both "she" and her roommates' belongings to fit comfortably in their shared space, while still allowing for open space and mobility.

There are six females living in a small dorm room and they would like our help in figuring out how to pack their belongings in the room as efficiently as possible. while maintaing their comfort and security for everyone.

How the class did - 2

How can we organize our room so that we can have a comfortable and efficient living area while everybody who lives there has their belongings organized for easy access?

The fundamental problem is to find the most efficient way to use a given space as our living quarters while maintaing comfort, organization, and moveable space.

Side Bar

Intel Cornell Cup 2015

Round #1 Details

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Register for the Intel Open (Round #1) Now!!

Side Bar

Intel Cornell Cup 2015

Round #1 Details

	Intel Open
	Round 1
What is it?	A college/university level competition where you can create a competition entry with your existing project from your engineering project course, capstone project, or Maker project. Eligible teams must use an Intel Atom board. Galileo board use is encouraged but not required (Schools that are not currently official Intel partner schools and have not recieved Intel boards already may apply to receive 2 free boards per advisor)
How do I enter?	1. create a team of 3-5 students (no duplicate people across teams) 2. Complete the team registration form which includes a 1 paragraph summary of your project description to be posted on-line
How are winners selected?	By the sponsoring professor/advisor will select the winning team from all teams at your college/university. If 10 or more teams are registered under the same advisor / school, 2 winning teams may be selected.

Side Bar

Intel Cornell Cup 2015

Round #1 Details

- Intel Open – Round #1

What is the judging criteria?	The sponsoring professor/advisor will select the winning team. Decisions are recommended to be based upon the criteria for the Final event (see Judging Criteria available on-line for details)
Project Expectation Level	Proof of Concept design
Awards/prizes	1. Advancement to the Semi-Finals 2. Team recognition certificate
Deadlines	team registration: Oct 13, 2014
	boards received by schools: Nov 3, 2014
	professors select winning teams: Dec. 8, 2014
	winners publically announced: Dec 12, 2014
	winners sign up for Semi-Final presentation: Dec. 19, 2014

Problem Formulation – Team Activity - 1

- Subject: Jimmy Hendrix and Eric Clapton said “I want my guitar amp wireless-ed”
- **Problem Statement Formulation**:
  - 1 Gather Information from within the team – Brainstorming (10 minutes)
    - Draw insight from previous experiences (in other industries or situations) to understand the need
    - Focus on customers needs; NOT your own needs
    - Use Creativity
  - 2 Construct an affinity map or fishbone or concept diagram (10 minutes)
  - 3 write a 1-sentence problem statement, covering the complete set of the customer needs (5 minutes)
  - 4 Submit (a) Diagram/Map and (b) 1-sentence problem statement. [Name the team members joined in the work]

Problem Formulation – Team Activity -2

- **Subject: Your own project**
- Problem Formulation
  - 1 Identify the needs by brainstorming (15 minutes)
    - Gathering Information from Within the Team
    - Draw insight from previous experiences or other situations and industry
    - Focus on customers needs NOT team's own needs
    - Use Creativity
  - 2 Draw an affinity or fishbone diagram or concept map (10 minutes)
  - 3 Make out the correct/comprehensive problem of your project (customer's point of view. Customer's need is to be focused) → Make into a 1-sentence problem statement (5 minutes)
  - 4 Submit (a) Diagram and (b) Problem Statement [Name the team members joined in the work]