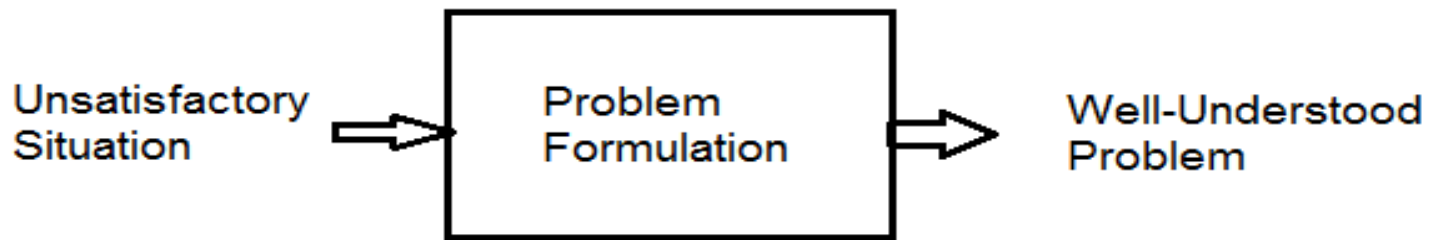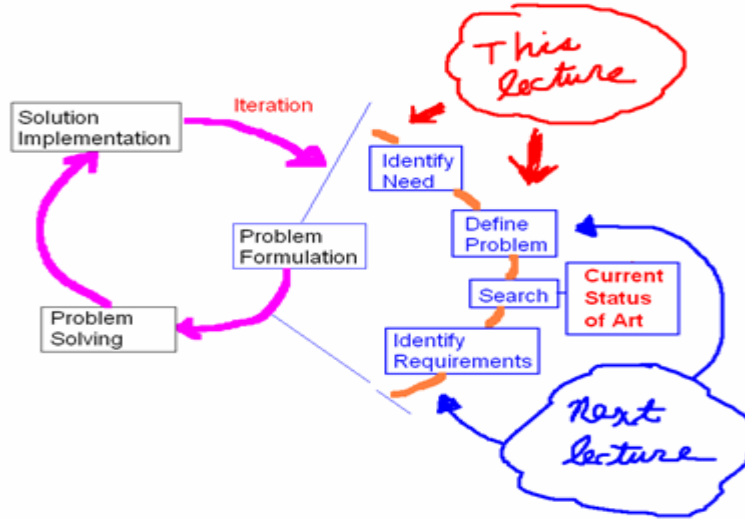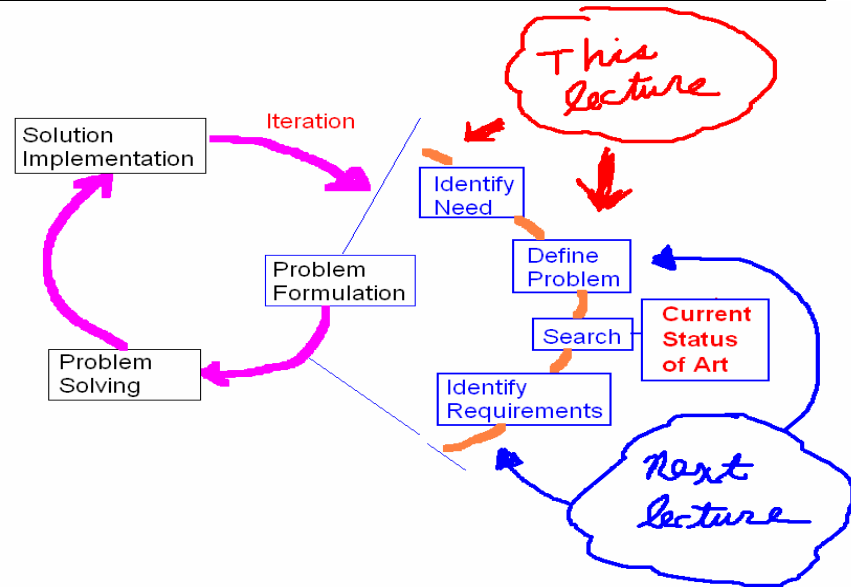# EECE401 Senior Design I

## Problem Formulation

# Problem Formulation

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

- **Goals**
  - <u>need identification</u> and <u>problem definition</u>
  - Strategies for gathering information about a problem
  - Next Step: Develop a set of requirements for a problem

# Problem Formulation: What it is

- "The process of converting a dissatisfied situation into a well-understood problem"
  - Understanding the problem ("Needs"), Not finding solution ("Approach") 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?
    - **Need Identification** and Problem Definition
    - Clear set of Requirements that can guide the design process through to its completion

# Identifying Needs and Defining Problem

- **Identify Needs**
  - Dissatisfied situation
  - Need exists
  - Don't consider Solution yet --- this is a trap !!!
- **No Rush to get a solution ("Approach")** after Needs Identified:
  - A wrong problem may be solved!
  - A symptom may be solved!
  - **A part** of the problem may be solved!
  - Or a partial solution is obtained

# The Blind Men and the Elephant

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

# Problem Formulation in the Context of Value Proposition

- **"Value Proposition"**
  - **Why I am the best person for the position**

- **Contents: NAB**
  - Customer's **N**eed
  - My **A**pproach
  - **B**enefits to the Customer
  - *Source: "Practice of Innovation" by C. R. Carlson

- It is the value proposition presented to a cable company executive for a video-on-demand system.

- "I understand that you are looking to expand your business. I think we might be able to help.

- (**Need**)

    – Movie rentals represent a $5 billion business opportunity that you currently cannot access.

    – The only parts of rentals that people really dislike are the obligation to return the tapes plus the late fees.

    – Customers find that it is inconvenient and wastes time.

    – *Source: "Practice of Innovation" by C. R. Carlson

# Example of Value Proposition - 1

- (**Approach**)
  - We have developed a system that allows you to provide videos on demand to your customers using your cable system, with access to all the movies of Blockbuster.
  - Our approach makes use of one of your currently unused channels, with no changes to your system. In addition, you do not need to invest any capital. Each movie costs your customers $6.99, the same cost as a rental at a video store.

- (**Benefits**)
  - You will receive $5 of new revenue per movie rented, with a margin of 20 percent after paying for the movie costs.
  - Your customers will have all the pause and fast forward functions of a VCR when watching the movie, and they do not have to return the movie when done. Late fees are gone.
  - We estimate you could capture a market share of 20 percent.

  - *Source: "Practice of Innovation" by C. R. Carlson

- **Hands-Free Car Phone**
  - *Source: "Practice of Innovation" by C. R. Carlson

**NEED**
- Cell phones are difficult and dangerous to use when you are driving.
- There are more than 500 million cell phones in use around the world.
- Because of the driving risks, many U.S. states and other foreign governments are legislating against the use of cell phones by drivers of moving cars, which would limit cell phone usage in cars.
- Consumers want to continue to be able to use their phones while driving.

**APPROACH**
- Use voice-activated dialing with a headset.
- Provide additional software for existing phones.
- Make the software "downloadable" to existing phones with a $10-per-year subscription for the "in-car service."

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# Example of Value Proposition - 2

- ## Hands-Free Car Phone
    - *Source: "Practice of Innovation" by C. R. Carlson

CUSTOMER BENEFITS PER COSTS
- Convenience
    - Allows increased phone usage.
    - Safe, comfortable, and easy to use: does not require a new phone.
- Quality
    - Excellent speech recognition for voice-activated dialing: 99 percent accuracy with untrained users.
    - Supports twelve different languages.
    - Robust performance in noisy environments—better than human performance.
- New applications: the speech interface allows access to the Internet and other services.
- Cost: $10 per phone per year.

- **Needs from customer:**
  - **"Actually, we need help.... it's"**

- Process of **Defining Problem**
  - Outline why the present situation is so dissatisfying
  - Comparing it to <u>other situations</u> that are familiar or where experience already exists
  - Gaining and understanding what caused it.
  - Then "*one sentence problem statement*" which includes every element <u>**– complete set of customer needs**</u>

- **And your problem statement (Need) is?**
  - **Specific, Quantitative, and Illustrative**

- **Group Exercise:**
  - **Write "Problem (need) Statement"**
  - Submit with all group members' names

# Problem Definition

- **Problem Definition**:

# Problem Formulation Exercise - 2

- Customer:  Jimmy Hendrix and Eric Clapton said "I want my guitar amp wireless-ed"
- Exercise Focus:  What is the problem?
  - Draw insight from previous experiences (in other industries or situations) to understand the need
  - Focus on customers needs; NOT your own needs
  - Do not touch "Approach" yet.
  - Then, write a 1-paragraph (or 1-sentence) **problem statement**, covering the complete set of the customer needs
  - Specific, Quantitative, and Illustrative
- Submit with all team member names
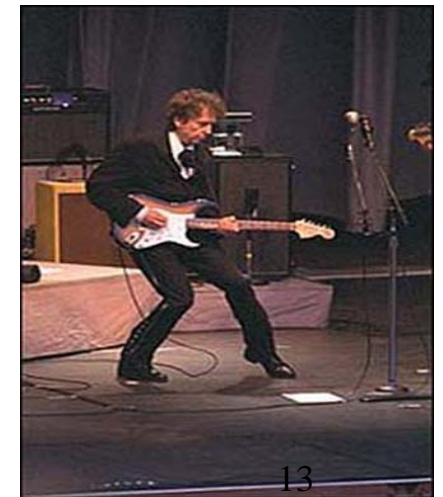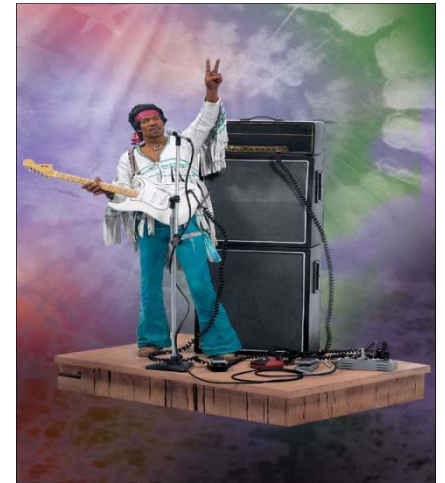
## Team Activity 1: What is your team's Problem/Need Statement?

## Team Activity Assignment

- Discuss this problem in your team's 1st weekly meeting
- Complete the activity
- Submit the <u>Problem Statement</u> which includes all 6 items listed below
1. **Team Name/Team Project Title:**
2. **Team Members:**
3. **Team Members of Senior Design Class:**
4. **Project's Long-Term Goal:**
5. **Project's 2017-2018 Academic Year Goal:**
6. **Problem statement**
   a. Dissatisfied situations – list them all
   b. Describe the Needs specifically and quantitatively
   c. Final summary for 1-sentence (or 1-paragraph) problem/need statement