Defining Problems

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- What is a problem statement?

    - A problem statement is a clear, concise description of the issue(s) that need(s) to be addressed by a problem solving team

        * Do <u>not</u> write about multiple problems, tackle one thing at a time
        * No broad or overly ambitious problems (break into components)

    - Should answer the following questions:

        * What is the issue?
        * Is there a need for this issue to be addressed?
        * Why is this issue worth my attention?

    - Problem statements are important communication tools with the customer and among the team

- What can a good problem statement do?

    - Align efforts towards a common goal
    - Define that goal
    - Establish value in the goal

- Bad Problem Statements

    - Too precise
    - Too vague

- Clients rarely provide well-stated problems

- A good problem statement provides useful information to guide your design process:

    - The issue

- The user
- The real need
- Why we care
- Form and function
- Objective
- Constraints

- Errors, Biases, and Implied Solutions

  - Errors — Incorrect information, faulty or incomplete data, or even simple mistakes
  - Biases — Presumptions about the situation that may prove inaccurate because the client or the users may not fully grasp the entire situation
    * *Ex. "Design a bicycle to transport four people on city streets"*
      · Bicycle is limiting
      · City streets is vague
      · And more. . .
  - Implied Solution — The client's best and current guess at the answer; these frequently appear in a problem statement
    * *Ex. "Develop a material that is able to withstand the extremely high temperatures of space capsule re-entry"*
      · Rewritten: "Protect the astronauts during re-entry into Earth's atmosphere"

- Understanding Stakeholders

  - User
    * A person who will operate what is designed
  - Client
    * A person or group or company that wants a design, usually to solve an existing problem
  - Engineer
    * Hired by the client to find a solution to the problem

- Understanding Objectives, Functions, and Constraints

  - Often requires asking a series of questions
  - These lead to lists of desired attributes
  - Objective — A feature or behavior that the design should have or exhibit
  - Function — Those things that a designed device or system is supposed to do

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- Constraint — A limit or restriction on the design's behaviors and attributes

- Cause and Effect (Fishbone)

  - Identify potential factors causing an issue

- A very common tool

  - Service (4 S's)
    * Surrounding
    * Supplies
    * Systems
    * Skills
  - Mfg (5 M's)
    * Measurements
    * Materials
    * Manpower
    * Methods
    * Machines
  - Product (5^1 P's)
    * Product (or service)
    * Price
    * Promotion
    * Place
    * Process
    * People (personnel)
    * Physical evidence
    * Performance

- Fresh Eye Approach

  - Explain the initial problem to someone outside of your design team
    * Provides a new perspective
    * Identifies what aspects draw attention
    * What may be given too much attention

- Kepner-Tregoe (KT) Approach

  - Seeks to reveal four dimensions of the problem:

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[1]Was initially 5, number has still not changed despite an increase in list size

* Identify — What?
* Timing — When?
* Location — Where?
* Magnitude — How Much?

- Duncker Diagram

  - Present State → Desired State
    * General Solutions which "Make it OK not to..."
    * Functional Solutions
    * Specific Solutions