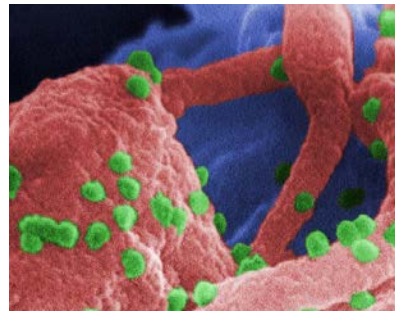


EE15N

The Art & Science of Engineering Design Winter Quarter 2019



PROFESSOR ANDREA GOLDSMITH
PROFESSOR MY T. LE
JANUARY 16, 2019



OUTLINE



- **Announcements**
 - EE15N Canvas is up
 - Pejman's Talk & Book List are posted
 - Problems to Solve Spreadsheet is posted: will discuss during break
- **Project deadline – Next Wednesday**
 - Form teams, decide project, 1 paragraph project problem statement due **1/23 at midnight!**
- **Lecture**
 - The Design Process
- **Speaker**
 - Martin Casado, Andreessen Horowitz

LECTURE

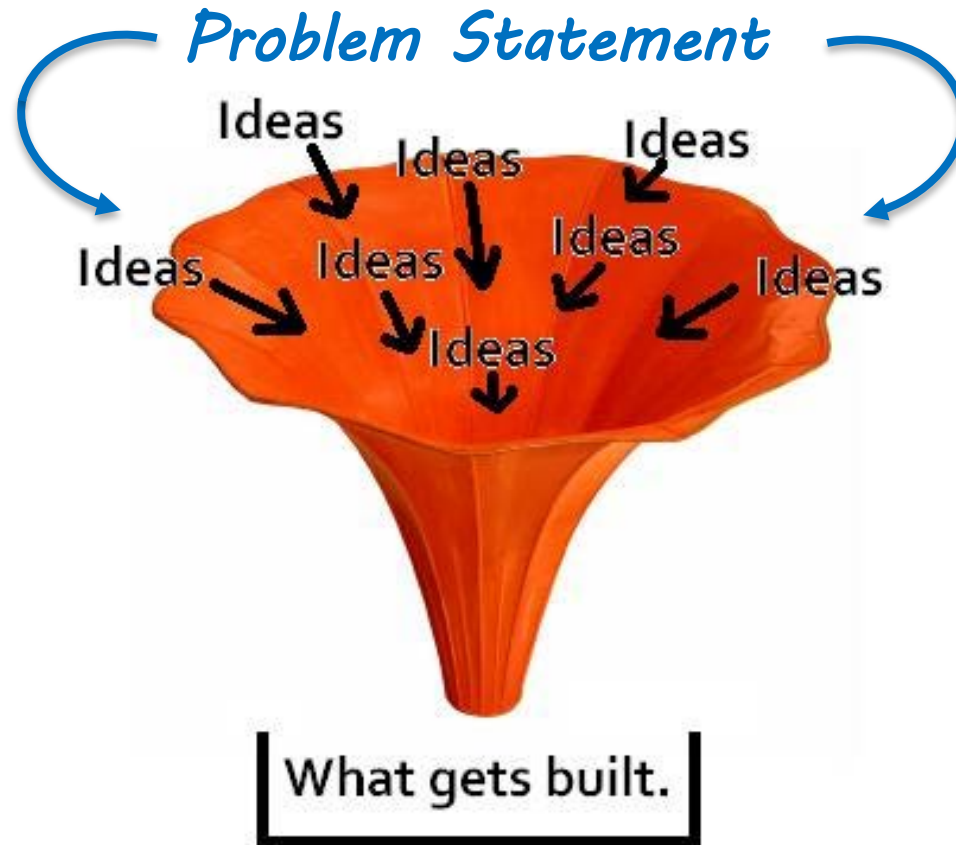


THE DESIGN PROCESS

IDEAS ARE NOT PRODUCTS

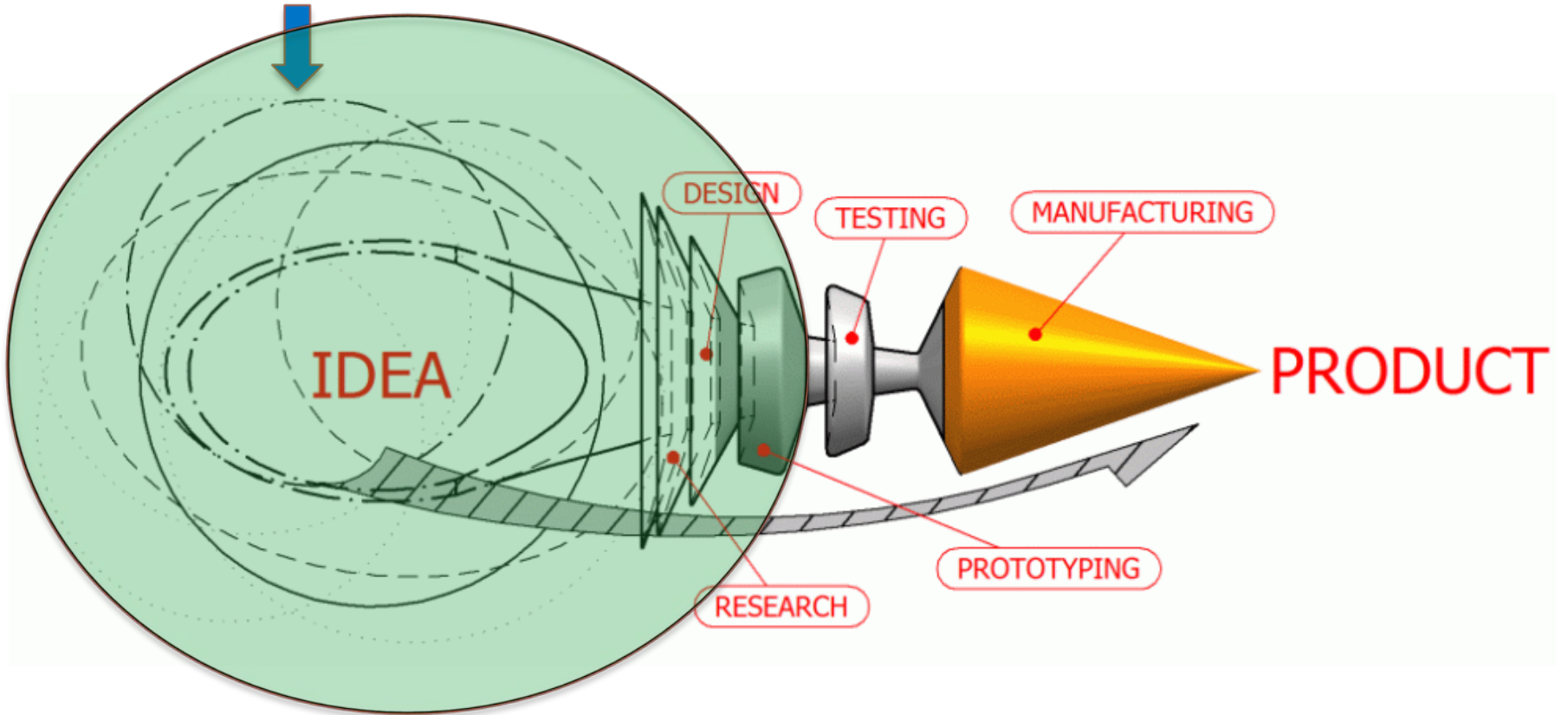


What is missing from this picture?



FROM IDEA TO PRODUCT

Problem Statement

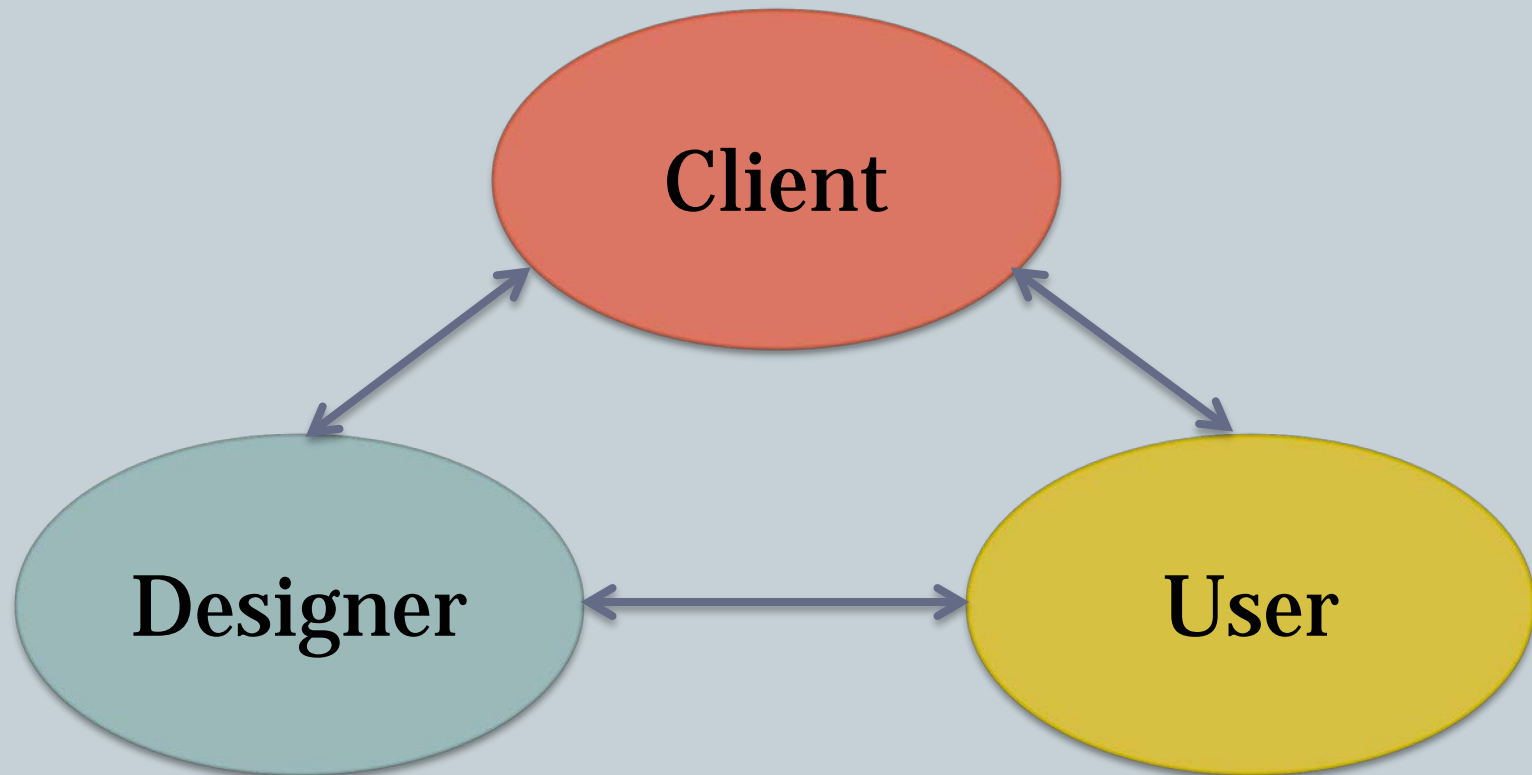


Design Process

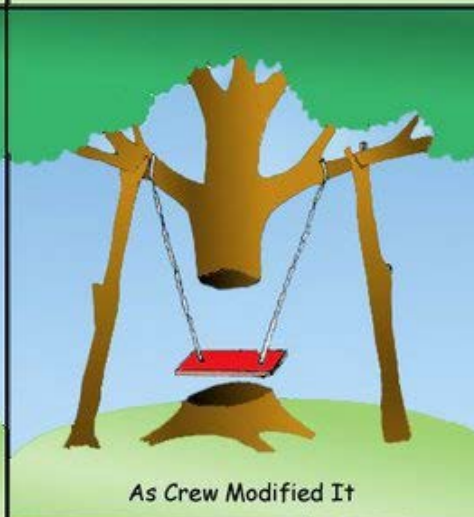
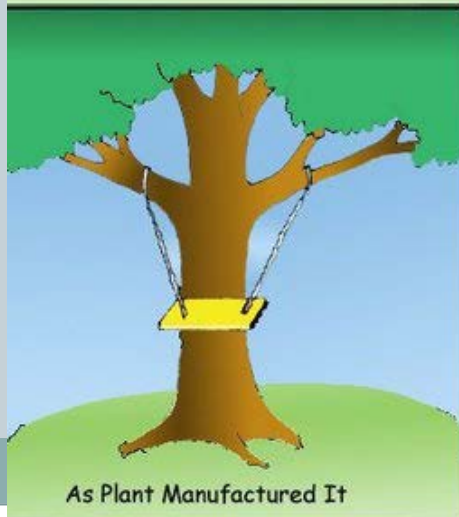
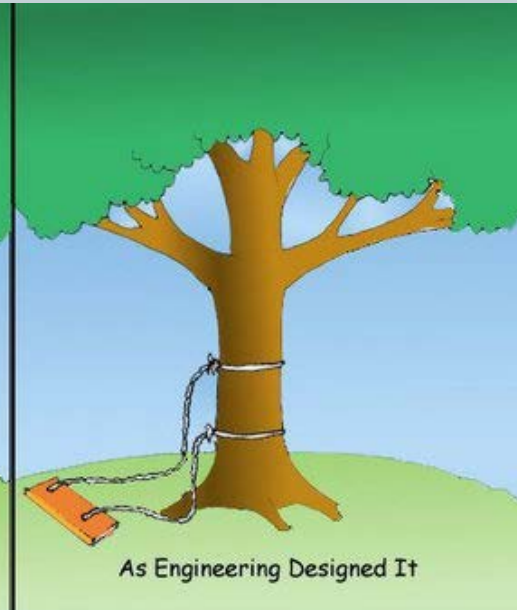
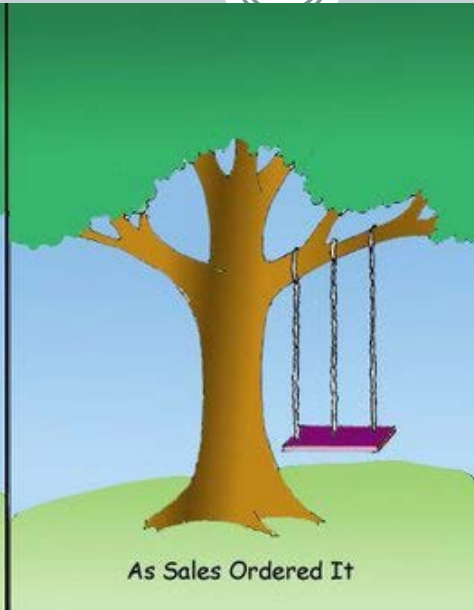
ORIGIN OF IDEA



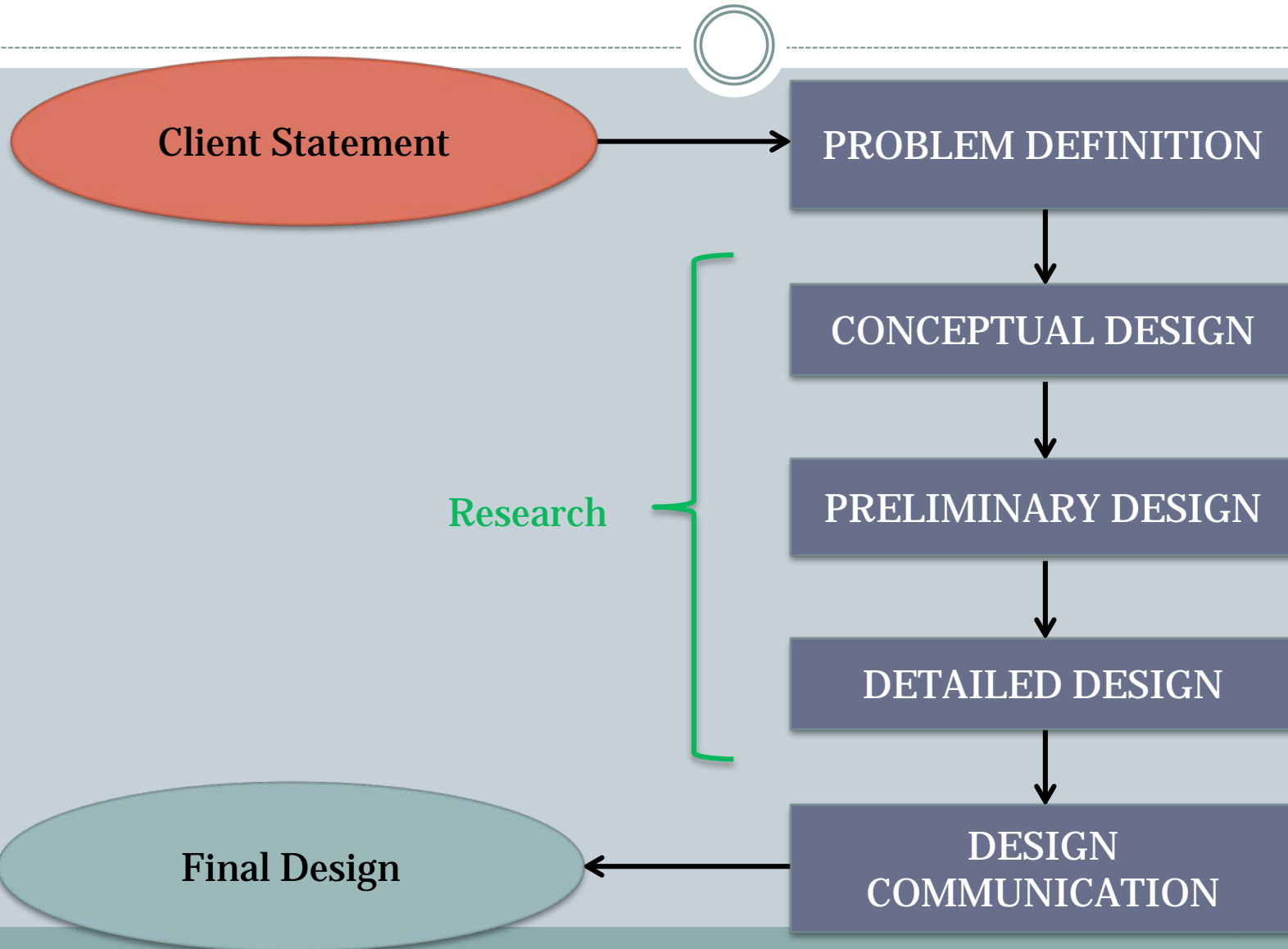
Designer – Client – User Triangle



CLIENT-DESIGNER-USER



THE DESIGN PROCESS: 5-STAGE DESCRIPTIVE MODEL



INFORMING A DESIGN PROCESS



- **Thinking Strategically**
 - Decompose larger problem into smaller sub-problems
- **Formal Design Methods**
 - Objective Tree
 - Pairwise Comparison Charts (PCC)
 - Metrics
 - Functional Specifications
 - Performance Specifications
 - Morph Charts

INFORMING A DESIGN PROCESS (cont)



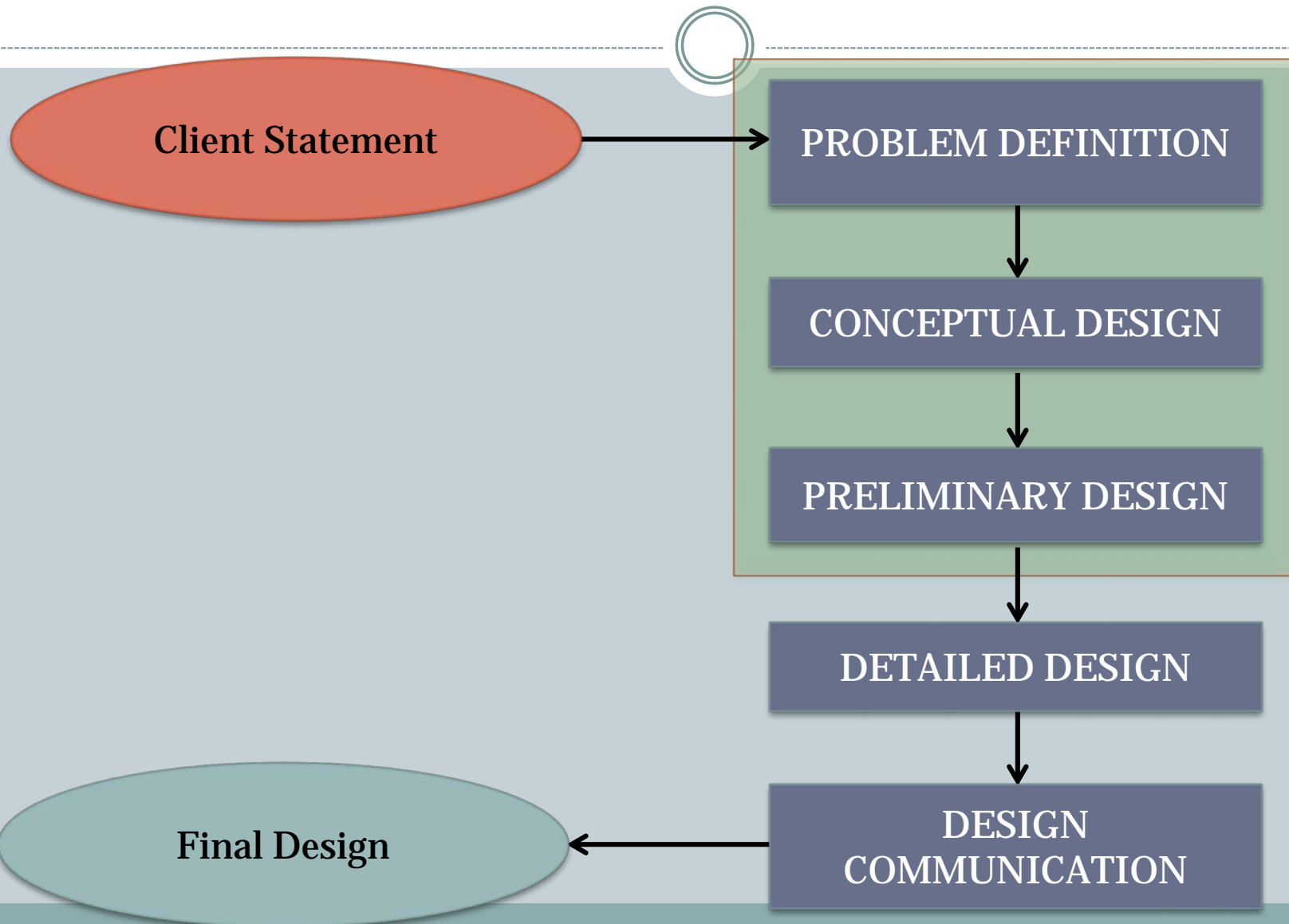
- **Acquiring Design Knowledge (Research)**
 - Literature – including Codes & Regulations, Patents, etc.
 - Benchmarking (competitive products)
 - Reverse engineering
 - Interviews – informal & formal
 - User surveys & questionnaires/Focus Group
 - Brainstorming

INFORMING A DESIGN PROCESS (cont)



- **Analysis & Testing**
- **Getting Internal Feedback**
 - Regular Scheduled Meetings & Formal Design Reviews
- **Getting External Feedback**
 - External experts
 - Focus groups

FUZZY FRONT-END



EXAMPLE: DESIGN A SAFE LADDER



Simple, straight-forward design objective

?

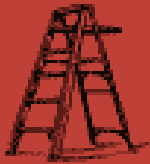
LADDER TYPES



9 Types of Ladders according to the American Ladder Institute:

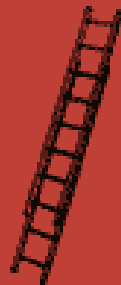
- Articulated Ladder
- Combination Ladder
- Extension Ladder/Extension Trestle Ladder
- Fixed Ladder
- Job-Made Wooden Ladder
- Mobile Ladder
- Platform Ladder
- Single Ladder
- Step Ladder/Step Stool Ladder

LADDER TYPE BY DUTY RATING



Type 3
200lbs

Light-Duty
Household
Ladder

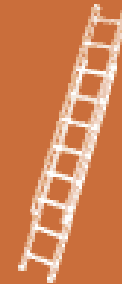
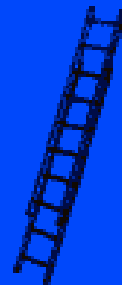


Type 2
225lbs
Medium-Duty
Commercial
Ladder

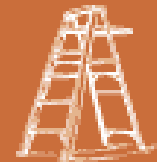


Type 1
250lbs

Heavy-Duty
Industrial
Ladder



Type 1A
300lbs
Heavy-Duty
Industrial
Ladder



Type 1AA
375lbs

Extra
Heavy-Duty
Industrial
Ladder



METAL LADDER TYPES BY LENGTH



LADDER TYPE	MAX LENGTH	SPECIAL REQS
Single Section Ladder	30'	Wider than 12"
Extension Ladder		Overlap stops required. Wider than 12"
2-Section	48'	
> 2-Section	60'	
Step Ladder	20'	Insulating, nonslip pads. Locking device.
Platform Ladder	20'	
Trestle Ladder/Extension	20'	

LADDER MARKET



A Quick Check on lowes.com website:

- Over 300 Types of Ladder
- Least Expensive Ladder - \$29.98
- Most Expensive Ladder - \$1,949.99

Suddenly designing a safe ladder seems much more complicated than it first appeared...

PROJECT PROBLEM STATEMENT



- 1 Paragraph statement: What is the problem your project is solving?
- Choose appropriate scope
- Be specific
- Do not include the solution in the problem description
- Due Next Wednesday – 1/23 – at midnight

THIS WEEK'S ASSIGNMENT



- **Form Team**
- **Choose Project**

TODAY'S SPEAKER



MARTIN CASADO
Andressen Horowitz