Inventor Camp
Introduction to Design

July 2018

Course Overview by Week

Week 1:

Introduction to tools and design

Develop invention Ideas

Week 2:

Continued tool training

Mock-up invention

Week 3:

Finish invention and showcase

What is Design?

- What is Design?
  - Noun/Verb?
  - What is included in a design/ how are designs represented?
  - When are designs used?

What is Design?

A Definition:

"*a roadmap or a strategic approach for someone to achieve a unique expectation*. It defines the specifications, plans, parameters, costs, activities, processes and how and what to do within legal, political, social, environmental, safety and economic constraints in achieving that objective."

Key Features:

- A Design is a *Plan,* often for something *New* (*Process* & *Invention*)
- It takes into consideration *Constraints*
- It requires documentation
- It requires a *goal*

Design is part of many creative professions

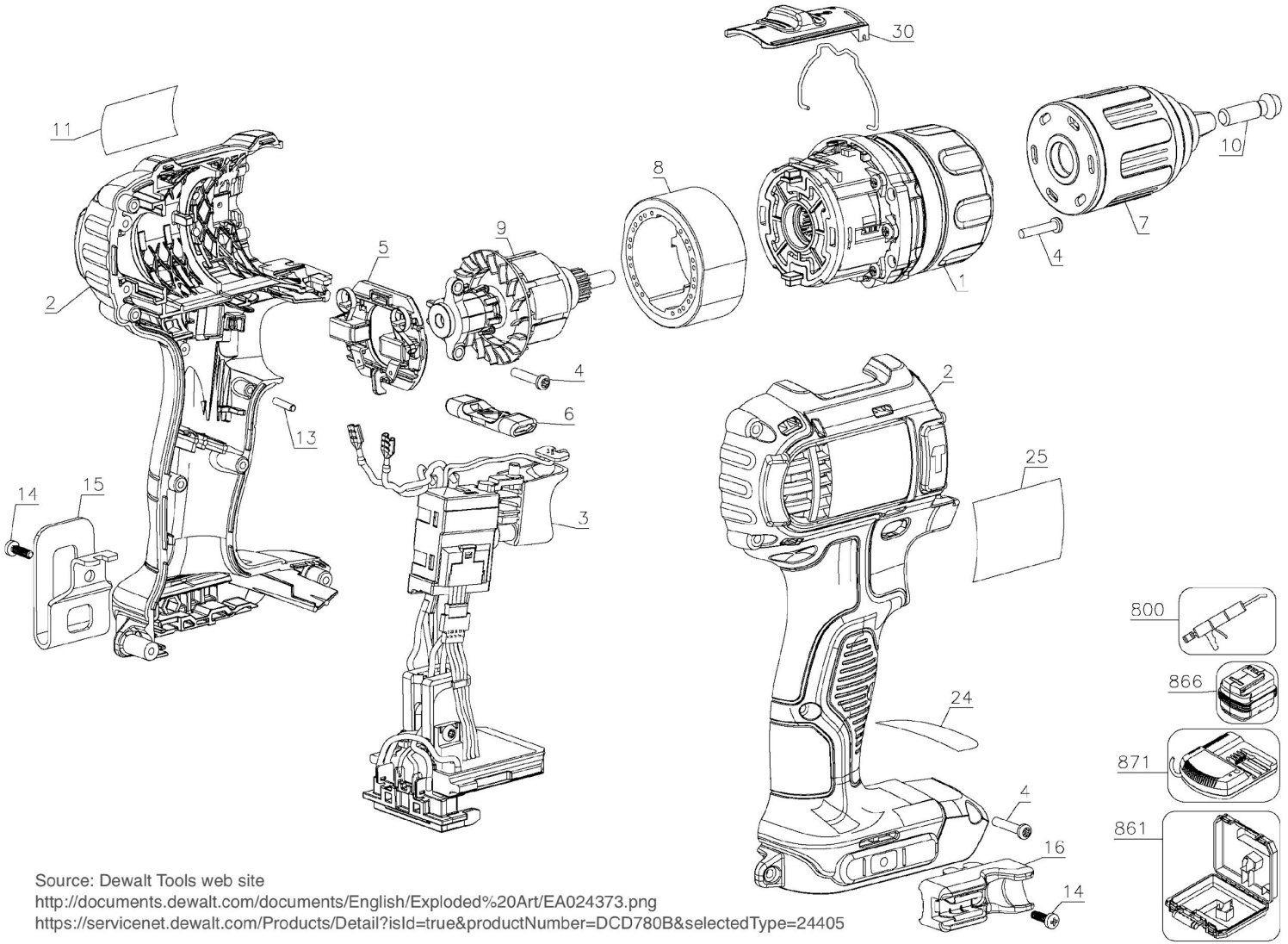
Within Product Design

- Mechanical design
- Industrial design
- Software design
  - User experience/user interface
  - Firmware
- Ergonomic design
- …

Different design objectives

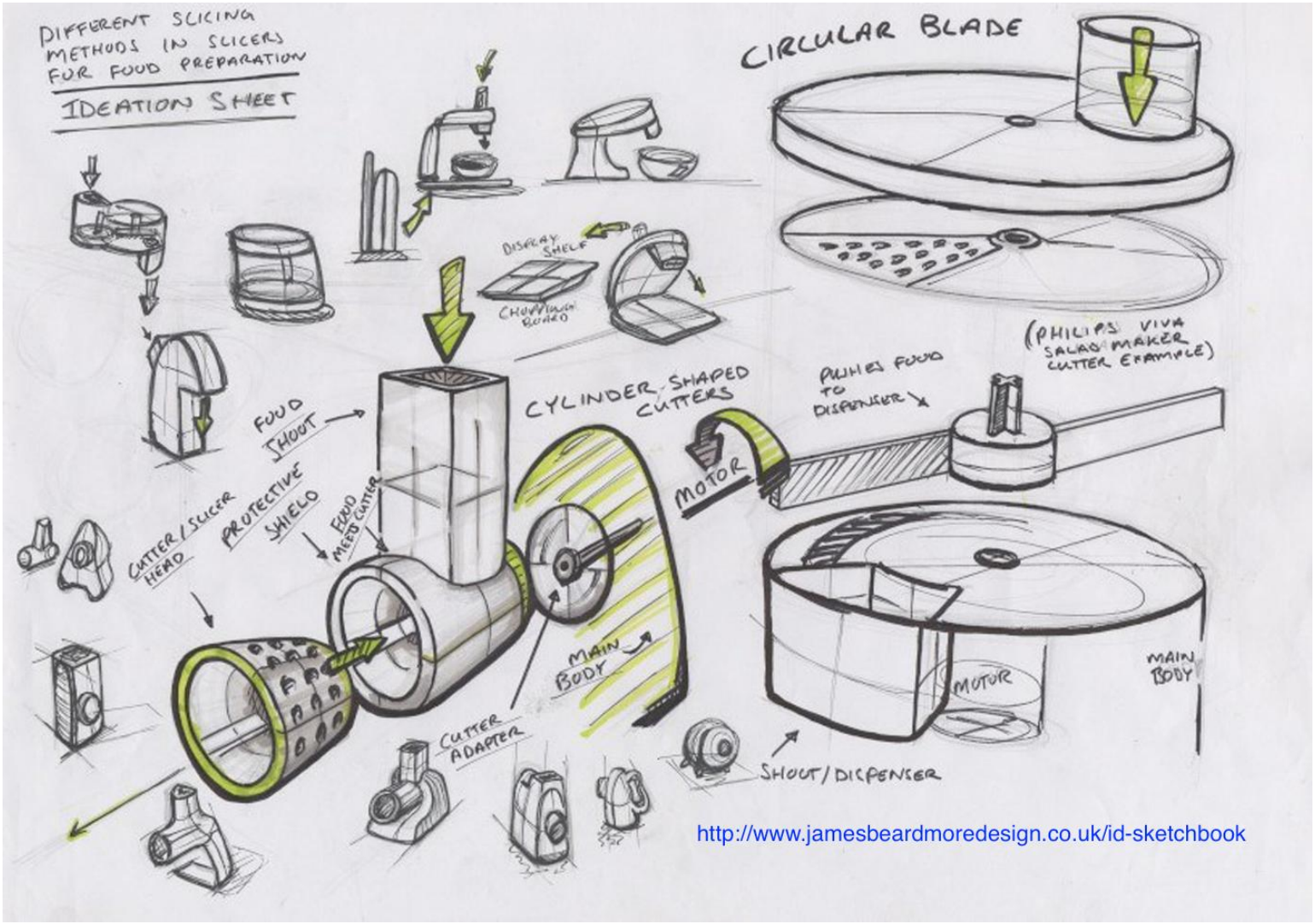
- Design for performance
- Design for manufacturing
- Design for remanufacture
- Design for sustainability
- …

Mechanical Design

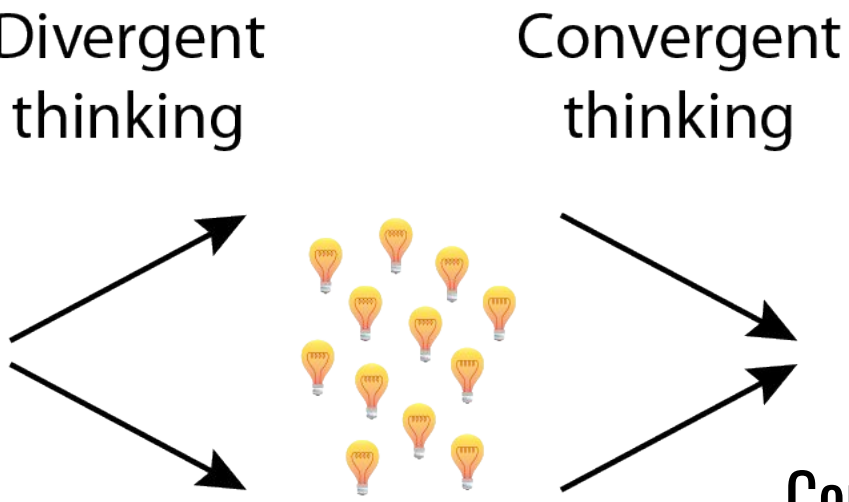


Source: Dewalt Tools web site
http://documents.dewalt.com/documents/English/Exploded%20Art/EA024373.png
https://servicenet.dewalt.com/Products/Detail?isId=true&productNumber=DCD780B&selectedType=24405

Industrial Design



Design Requires Divergent and Convergent Thinking



Divergent Traits

- Creative, playful
- Spontaneous, quick
- Non-judgemental
- Artistic, emotive
- Risk-taking
- Focus on possibilities
- Use low-fidelity models

Convergent Traits

- Reductive
- Deliberative, rule-based
- Analytical
- Scientific
- Rational, reality-based
- Risk-reducing
- Focus on accuracy
- Use high-fidelity models

Design Requires Creative and Analytical Thinking

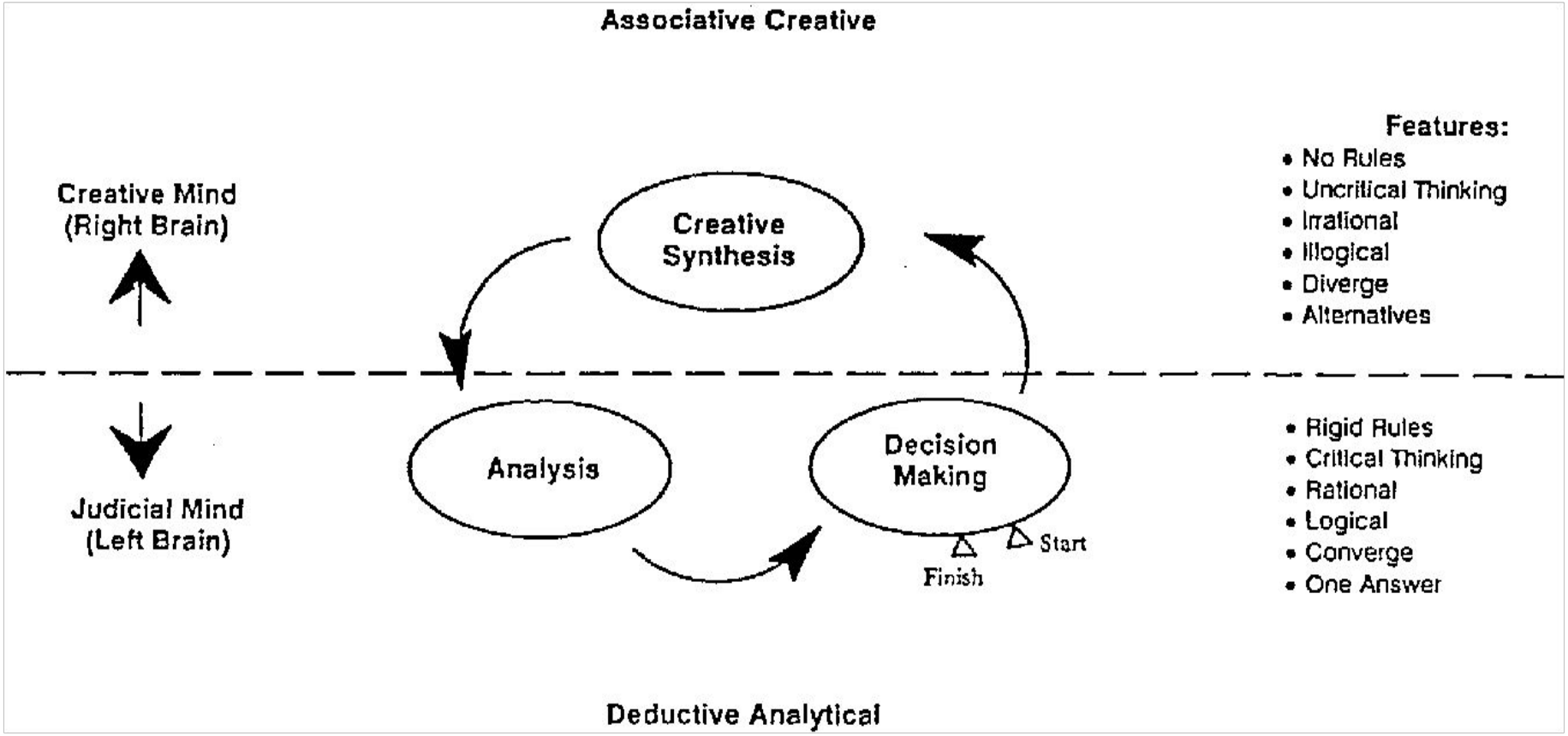


Fig. 4. The design process is an open-ended problem where the engineer has to flip from left brain, to right brain and back again.

Leland M. Nicolai, *Viewpoint: An industry view of engineering design education*, International Journal of Engineering Education, vol. 14, no. 1, pp. 7–13, 1998.

Design process frameworks: Three ways of guiding design

Human-centered design

- Design choices and solutions focus on the client/customer, not the technology
- Engage client/customer in evaluating potential solutions

Design thinking

- Apply design process in problem-solving, not just product design
- Iterate and test ideas early: Not a single-pass process

Universal design

- Seven principles to guide design process
- Seek solutions that help everyone, hence universal, while making sure there are no biases in favor of physical ability, age, aptitude,

Human-centered design

Human-centered design focuses on the needs of the user

Human-centered design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, usability knowledge, and techniques.

– https://en.wikipedia.org/wiki/Human-centered_design

See also

- http://www.designkit.org/human-centered-design
- https://www.nngroup.com/articles/design-thinking/

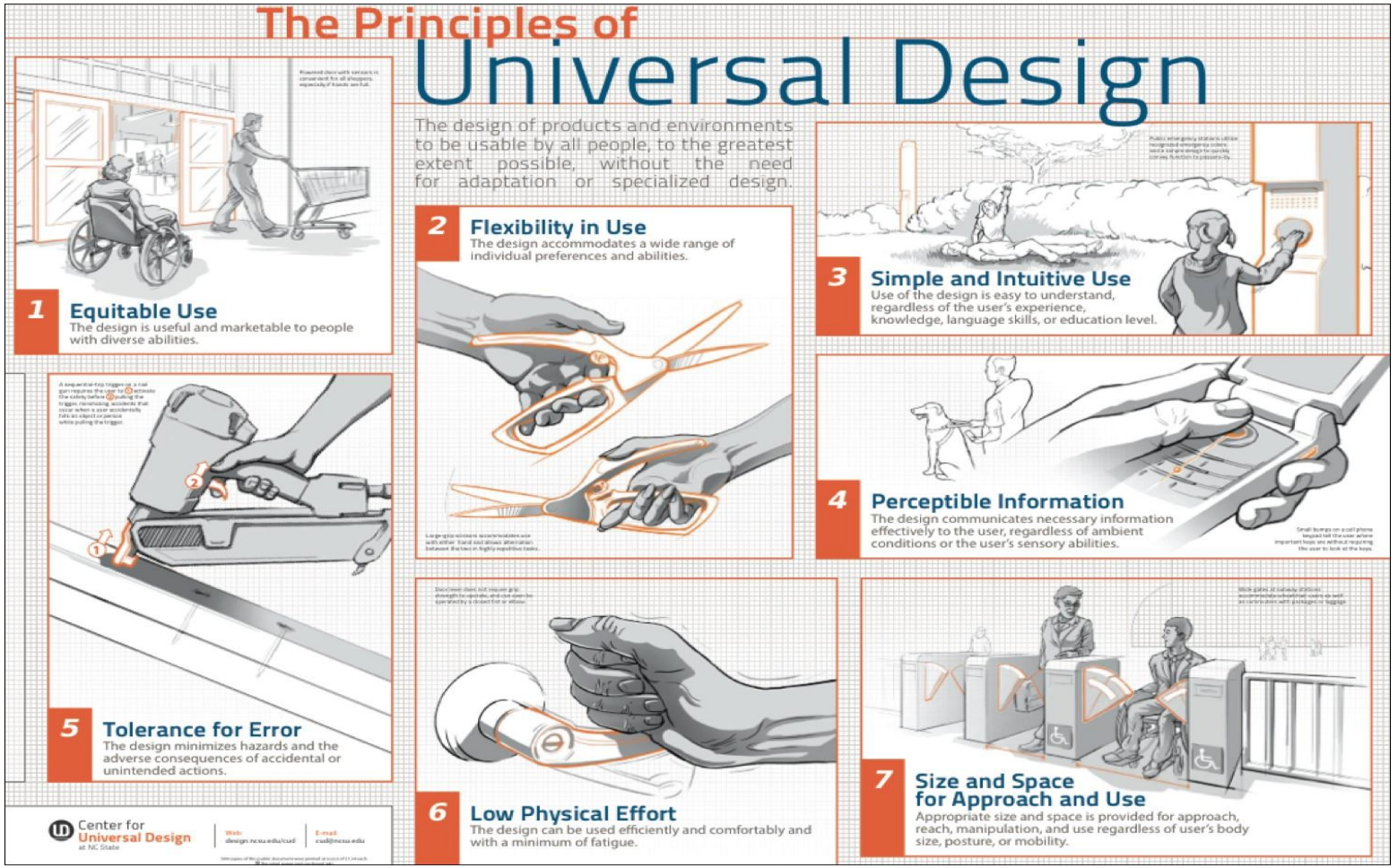
Seven Principles of Universal Design

1. Equitable Use
2. Flexibility in use
3. Simple and intuitive use
4. Perceptible information
5. Tolerance for error
6. Low Physical effort
7. Size and space for approach and use

See

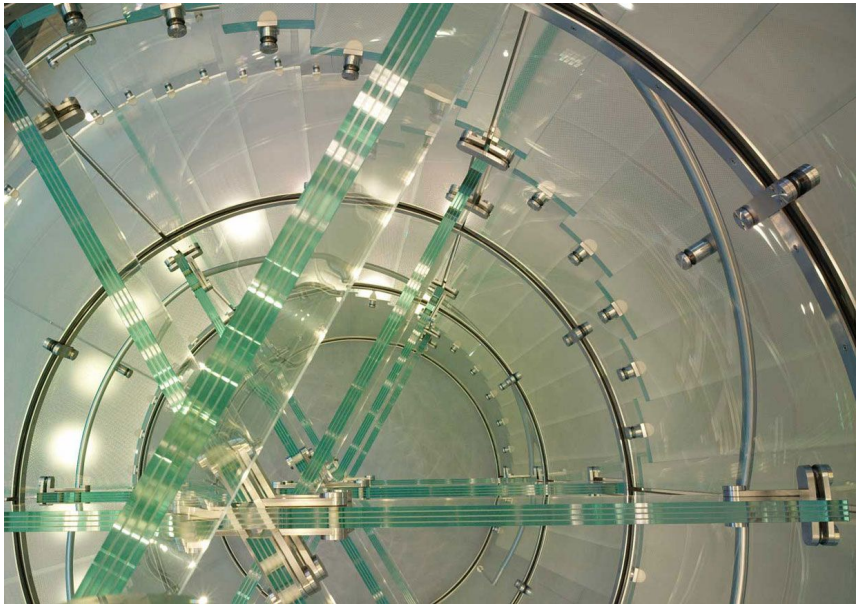
http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/

Universal Design

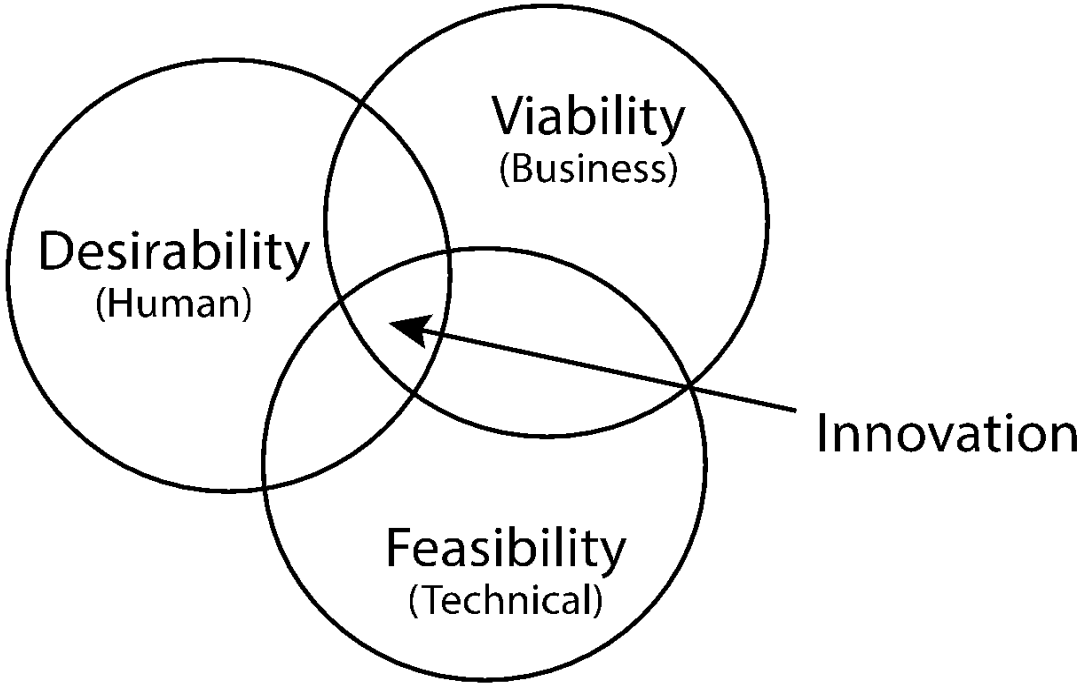


"Copyright © 1997 NC State University, The Center for Universal Design."
https://projects.ncsu.edu/design/cud/about_ud/udprinciples.htm

Failure to Consider the User



Design thinking model of IDEO



"Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." —Tim Brown

Notice that the role of technology is limited to feasibility, namely, "Can it be made"?

Image and quote from https://designthinking.ideo.com/?page_id=1542

Empathize with a bug list

What bugs you? What bugs your friends and family? What problems does the community face?

A bug list is a tool for collecting ideas

1. What problems do your clients face?
2. How can problems we translated into opportunities?
3. Focus is on the client or end-user: what bugs *them*?

In collecting bugs, embody the learning personas

- Anthropologist – Observant
- Experimenter – Persistent
- Cross-Pollinator – Curious

Empathize with a bug list

Reflect on your daily experiences.

Write down all ideas and thoughts throughout each day.

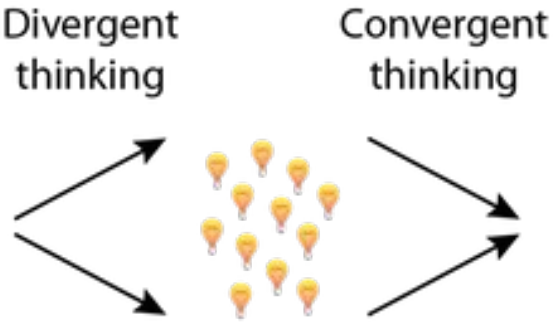
Talk to friends, family, acquaintances, and experts in a given field.

Explore current and emerging technology and products.

Stay aware of current events.

Set aside designated time for reflection and thinking about ideas.

Don't worry about a solution; focus on idea generation. We'll converge later



Summary

Design is manifest in many organizations and many ways

Empathy is important to understand clients and end-users

- Human-centered design focuses on the end-user
- Universal design seeks solutions for the widest range of people

Creativity is important in developing possible solutions

- Divergent thinking suspends judgment to create possibilities

Analytical engineering tools aid comparison and selection between competing ideas

- Convergent thinking uses rational tools to reduce options to those that are most viable

User-Centered Design Exercise

User-Centered Design Exercise

1. Introduction.
2. Customer Needs (Quiet Activity) - Write out words or phrases that describe the customer needs (one idea per post-it note)
3. Read each others' ideas (Quiet Activity)
4. Draw 5 Chair Designs (Quite Activity)
5. Share With Group - Decide on 5 Final designs
6. Build Chair Models
7. Present to Class

User-Centered Design Exercise

Presenting:

- Who is your customer?
- Describe your designs.
- How does your Design meet customer needs?