Interaction Design
Basics & Prototyping

071010-1
2018년 가을학기
11/14/2018
박경신

What is Design?

"Achieving goals
within constraints"

- Goals - purpose
  - Who is it for, Why do they want it, …
- Constraints
  - Materials, Standards, …
- Trade-offs
  - Many goals to satisfy…
  - Need to know which to sacrifice

For Human–Computer Interaction

- **Golden rule of designs**
  - **Understand your materials!**
- Understand computers
  - Limitations, capacities, tools, platforms
- Understand users
  - Psychological, social aspects
  - Human error
- And their interaction … (How do they fit each other?)

To Err is Human

- Physical materials are treated better than people?
- Accident reports ..
  - Air crash, Industrial accident, Hospital mistake … blames … 'human error'
- But …
  - Concrete lintel breaks because too much weight
  - Blame 'lintel error' ? … no, design error!
  - *We know how concrete behaves under stress*
- Human 'error' is normal
  - *We know how users behave under stress*
  - So design for it!
- Treat the user at least as well as physical materials!

Central Message …

Put the user first,

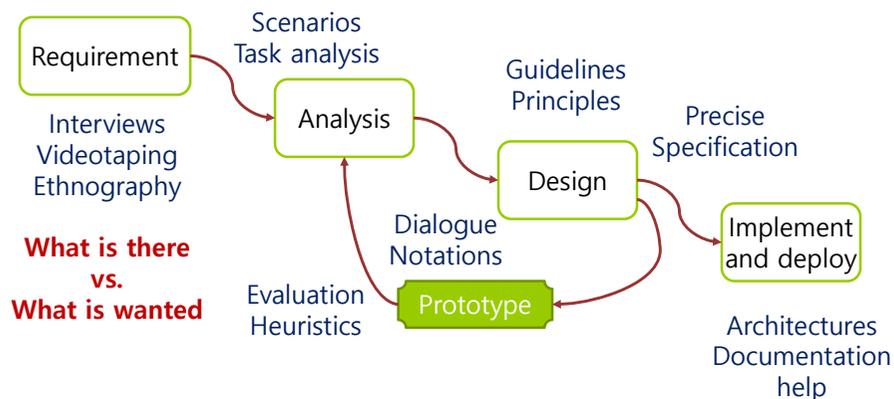**keep the user in the center,**

and remember the user at the end.

What is a User-Centered Approach?

- ❑ User-centered approach is based on
  - ■ **Early focus on users and tasks**
    - ❑ Directly studying cognitive, behavioural, anthropomorphic & attitudinal characteristics
  - ■ **Empirical measurement using quantifiable & measurable usability criteria**
    - ❑ Users' reactions and performance to scenarios, manuals, simulations & prototypes are observed, recorded and analysed
  - ■ **Iterative design**
    - ❑ When problems are found in user testing, fix them and carry out more tests

The Process of Interaction Design

Requirement

Interviews
Videotaping
Ethnography

**What is there
vs.
What is wanted**

Scenarios
Task analysis

Analysis

Guidelines
Principles

Design

Dialogue
Notations

Evaluation
Heuristics

Prototype

Precise
Specification

Implement
and deploy

Architectures
Documentation
help

The Process of Interaction Design

- ❑ **Requirements**
  - ■ What is currently happening, What is exactly needed …
- ❑ **Analysis**
  - ■ Ordering observations and understanding tasks
- ❑ **Design**
  - ■ From what you want to how to do it
- ❑ **Iteration and Prototyping**
  - ■ Getting it right … and **finding what is really needed!**
- ❑ **Implementation and Deployment**
  - ■ Making it and getting it out there

But How Can I Do It All !!

- Limited time $\Rightarrow$ Design trade-off
- **Usability study?**
  - **Finding problems and fixing them**
  - More about deciding "what to fix"
- "A perfect system is badly designed"
  - Too good $\Rightarrow$ Too much effort (time) in design
  - The best solution may not be in the limit of refinement

Who are the Users?

- Characteristics
  - Age, ability, background, attitude to computers
- System use
  - Novice, expert, casual, frequent
- Novice user
  - Step-by-step (prompted), constrained, clear information
- Expert user
  - Flexibility, access/power
- Frequent user
  - Short-cuts
- Casual/Infrequent user
  - Clear instructions, E.g. menu paths

What are the User's Capabilities?

- Humans vary in many dimensions
  - Size of hands may affect the size and positioning of input buttons
  - Motor abilities may affect the suitability of certain input and output devices
  - Height if designing a physical kiosk
  - Strength: a child's toy requires little strength to operate, but greater strength to change batteries
  - Disabilities (e.g. sight, hearing, dexterity)
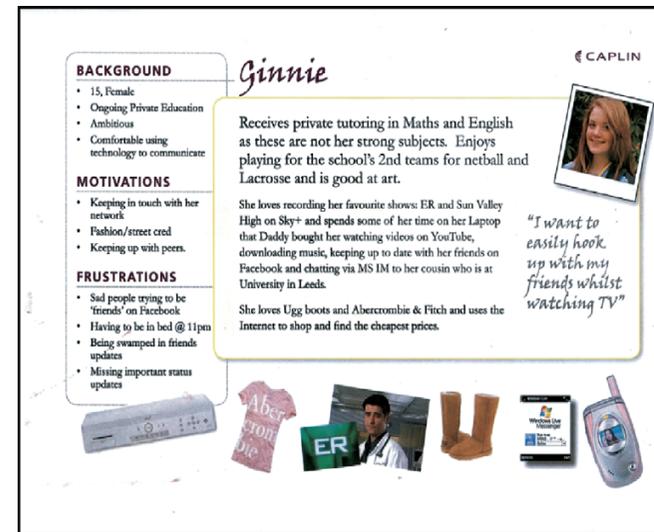
Know Your User

- Better with several specific users than a generic user
- **Probably not as obvious as you think!**
- Talk to them
  - Structured **interviews**, open-ended discussion,
  - Participatory design: better design + better users
- Watch them
  - **Observation** "The best trainer is not necessarily the best player"
  - Diary, artifacts, ...
- Use your imagination
  - Dangerous
  - Use several **personas**

Persona Helps Imagination

- **Persona capture user characteristics**
- Persona is a "rich" picture of an example user
  - Not necessarily a real person, but synthesised from real user characteristics
  - Bring them to life with a name, characteristics, goals, personal background
- Use as surrogate user
  - What would Ginnie think
- Details matter
  - Makes her 'real'

Example Persona

Data Gathering for Requirements

- Interviews
  - Props, e.g. sample scenarios of use, prototypes, can be used in interviews
  - Good for exploring issues
  - But are time consuming and may be infeasible to visit everyone
- Focus groups
  - Group interviews
  - Good at gaining a consensus view and/or highlighting areas of conflict
  - But can be dominated by individuals

Data Gathering for Requirements

- Questionnaires
  - Often used in conjunction with other techniques
  - Can give quantitative or qualitative data
  - Good for answering specific questions from a large, dispersed group of people
- Direct observation
  - Gain insights into users' tasks
  - Good for understanding the nature and context of the tasks
  - But it requires time and commitment from a member of the design team, and it can result in a huge amount of data
- Indirect observation
  - Not often used in requirements activity
  - Good for logging current tasks

Data Gathering for Requirements

- ❑ Researching similar products
  - ▪ Good for prompting requirements
- ❑ Studying documentation
  - ▪ Procedures and rules are often written down in manuals
  - ▪ Good source of data about the steps involved in an activity, and any regulations governing a task
  - ▪ Not to be used in isolation
  - ▪ Good for understanding legislation, and getting background information
  - ▪ No stakeholder time, which is a limiting factor on the other techniques

Know Your Task

- ❑ **Scenarios**
  - ▪ An informal narrative story, simple, 'natural', personal, not generalizable
- ❑ **Use cases**
  - ▪ Assume interaction with a system
  - ▪ Assume detailed understanding of the interaction
- ❑ **Essential use cases**
  - ▪ Abstract away from the details
  - ▪ Does not have the same assumptions as use cases

Scenario: Travel Organizer

"The Thomson family enjoy outdoor activities and want to try their hand at sailing this year. There are four family members: Sky (10 years old), Eamonn (15 years old), Claire (35), and Will (40). One evening after dinner they decide to start exploring the possibilities. They all gather around the travel organizer and enter their initial set of requirements – a sailing trip for four novices in the Mediterranean. The console is designed so that all members of the family can interact easily and comfortably with it. The system's initial suggestion is a flotilla, where several crews (with various levels of experience) sail together on separate boats. Sky and Eamonn aren't very happy at the idea of going on vacation with a group of other people, even though the Thomsons would have their own boat. The travel organizer shows them descriptions of flotillas from other children their ages and they are all very positive, so eventually, everyone agrees to explore flotilla opportunities. Will confirms this recommendation and asks for detailed options. As it's getting late, he asks for the details to be printed so everyone can consider them tomorrow. The travel organizer prints out a summary of the different options available."

Use Case: Travel Organizer

1. The system displays options for investigating visa and vaccination requirements.
2. The user chooses the option to find out about visa requirements.
3. The system prompts user for the name of the destination country.
4. The user enters the country's name.
5. The system checks that the country is valid.
6. The system prompts the user for her nationality.
7. The user enters her nationality.
8. The system checks the visa requirements of the entered country for a passport holder of her nationality.
9. The system displays the visa requirements.
10. The system displays the option to print out the visa requirements.
11. The user chooses to print the requirements.

Essential Use Case: Travel Organizer

❑ Example: Retrieve Visa

User Intention	System Responsibility
Find visa requirements	Request destination and nationality
Supply required information	Obtain appropriate visa information
Obtain copy of visa information	Offer information in different formats
Choose suitable format	Provide information in chosen format

Scenarios

❑ **"Rich" stories of interaction**
- Communicate with others
- Validate other models (task models, dialog models)
- Understand dynamics

❑ Example
- "The user intends to press the save button, but accidentally presses the quit button so loses his work."

❑ A scenario is linear
- Because time is linear - our lives are linear
- But don't show alternatives
- Solution?

❖ **As a persona helps understand the user, a scenario helps understand tasks**. "Both are concrete."

Also Play Act

❑ Mock-up is a prototype if it provides at least part of functionality of a system and enables testing of a design

❑ **Pretend you are doing it using a mock-up**
- Example: Internet-connected Swiss army knife ...

But where is that thumb?

Use toothpick as stylus

Navigation?

❑ **In a set of actions**

❑ In a web of information

❑ Through stages of actions for a goal

❑ A good navigation design supports a better search for a goal

❑ A good navigation design let the user feel that he is approaching the goal

Navigation Support in Every Level of Interaction

- Widgets choice
- Screen design
- Application navigation design
- Design efforts for better navigation can come every level of interaction

Structures for Better Navigation

- Local structure
  - Looking from one screen or page out
- Global structure
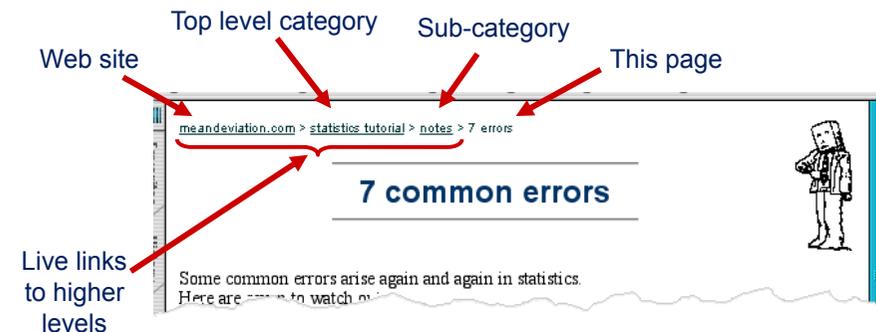 - Structure of site, movement between screen

Local Structure Helps

- Knowing where you are
  - **"Breadcrumb"**
- Knowing what you can do
  - Operation visibility
- Knowing where you are going
  - Or what will happen
  - Better if not having to use "undo"
- Knowing where you've been
  - Or what you've done
  - Especially important in the information space – where to search for more?

Breadcrumbs

- Shows path through web site hierarchy

Web site   Top level category   Sub-category   This page

meandeviation.com > statistics tutorial > notes > 7 errors

7 common errors

Live links to higher levels

Some common errors arise again and again in statistics. Here are ... to watch ou...
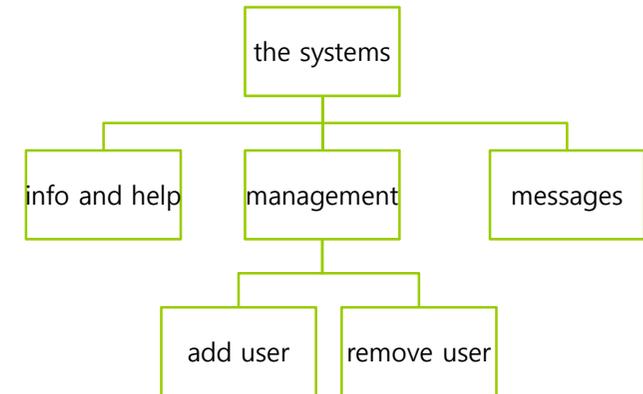
Global Structure

- A simple structure affords better mental image of the whole system
- Hierarchical organization
- A simple structure supports easy understanding of "static view" of a system...
- But a task is not static but dynamic
- Guide the user through a procedure to the goal => Dialog design
  - Example: Placing a web order and creating an account

Hierarchical Diagrams

- Parts of application
  - Screens or groups of screens
- **Typically functional separation**

```
                  the systems
                       |
        ---------------+---------------
        |              |              |
  info and help   management     messages
                       |
                ------+------
                |           |
             add user   remove user
```

Hierarchies

- Deep is difficult!
- Beware of misunderstanding of Miller's 7 ± 2
  - It's about short term memory, not menu size
- Optimal?
  - Many items on each screen
  - But structured within screen

Dialog Design (Network Diagrams)

- What leads to what
- What happens when
- Including branches
- **More task oriented** then hierarchy

```
   main      remove
  screen ->  user   -> confirm
    ^
    |
  add user
```
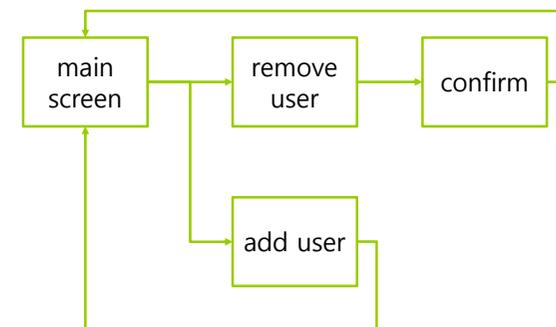
Tools for Layout

- Grouping of items
- Order of items
- Decoration - fonts, boxes etc.
- Alignment of items
- White space between items

Grouping and Structure

Logically together $\Rightarrow$ Physically together

Billing details:	**Delivery details**:		
Name	Name		
Address: …	Address: …		
Credit card no	Delivery time		
Order details:			
item	quantity	cost/item	cost
size 10 screws (boxes)	7	3.71	25.97
……		…	…
…			

Order of Groups and Items

- Think! What is natural order?
- Should match screen order!
  - Use boxes, space etc.
  - Set up tabbing right!
- Instructions
  - Beware the cake recipe syndrome!
    … mix milk and flour, add the fruit
        after beating them

Decoration

- Use **boxes** to group logical items
- Use **fonts** for emphasis, headings
- But not too many!!

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
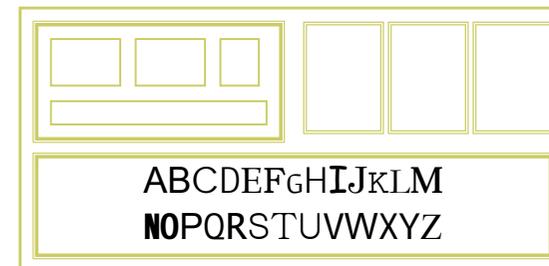
Alignment (Text)

- You read from left to right (English and European)
  - Align left hand side

Willy Wonka and the Chocolate Factory
Winston Churchill - A Biography
Wizard of Oz
Xena - Warrior Princess

Boring but readable!

Fine for special effects but hard to scan

Willy Wonka and the Chocolate Factory
Winston Churchill - A Biography
Wizard of Oz
Xena - Warrior Princess

Alignment (Names)

- Usually scanning for **surnames**

Alan Dix
Janet Finlay
Gregory Abowd
Russell Beale

❌

Alan   Dix
Janet   Finlay
Gregory   Abowd
Russell   Beale

✔

Dix , Alan
Finlay, Janet
Abowd, Gregory
Beale, Russell

✔

Alignment (Numbers)

- Think purpose!
- Which is biggest?

532.56
179.3
256.317
15
73.948
1035
3.142
497.6256

Alignment (Numbers)

- Visually, long number = big number
- Align decimal points
- Or right align integers

627.865
1.005763
382.583
2502.56
432.935
2.0175
652.87
56.34

Multiple Columns

- **Scanning across gaps hard** (often hard to avoid with large data base fields)

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

Multiple Columns

- Use leaders

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

- Or greying (vertical too)

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

Multiple Columns

- Or even (with care!) 'bad' alignment

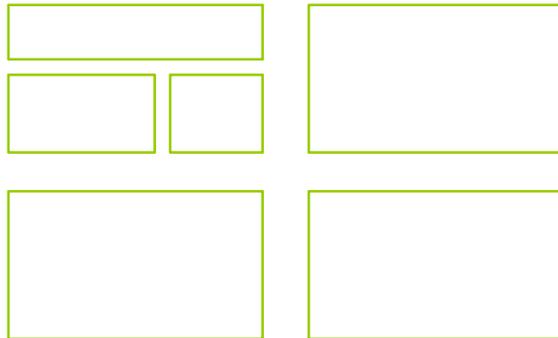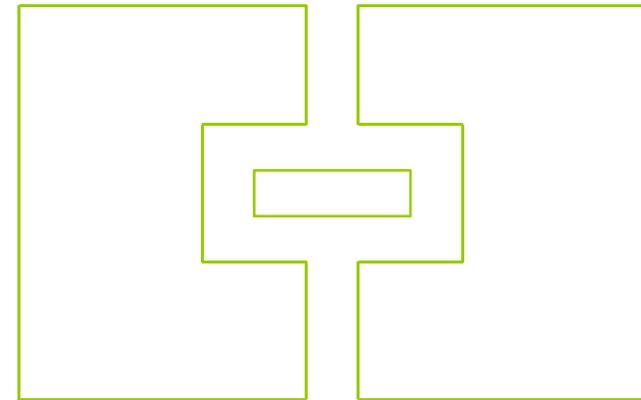|	
sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

Space to Separate

Space to Structure

Space to Highlight

Physical Controls

- Grouping of items

Defrost settings

Type of food

Time to cook

Physical Controls

- Grouping of items
- Order of items

1) Type of heating

2) Temperature

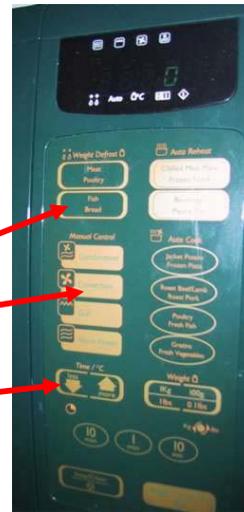3) Time to cook

4) Start

Physical Controls

- Grouping of items
- Order of items
- Decoration

Different colours for different functions

Lines around related buttons (temp up/down)

Physical Controls

- Grouping of items
- Order of items
- Decoration
- Alignment

Centered text in buttons

Easy to scan ?

Physical Controls

- Grouping of items
- Order of items
- Decoration
- Alignment
- White space

Gaps to aid grouping

Appearance

Appropriate

appearance

- Presenting information
- Aesthetics and utility
- Colour and 3D
- Localisation & internationalisation

Presenting Information

- ❑ Purpose matters
  - ■ Sort order (which column, numeric alphabetic)
  - ■ Text vs. Diagram
  - ■ Scatter graph vs. Histogram
- ❑ **Use paper presentation principles!**
- ❑ But add interactivity
  - ■ Softens design choices
   - ❑ Example: Re-ordering columns
    - ❑ 'Dancing histograms'

name	size
chap10	12
chap5	16
chap1	17
chap14	22
chap20	27
chap8	32
...	...

Aesthetics and Utility

- ❑ **Aesthetically pleasing designs**
  - ■ Increase user satisfaction and improve productivity
- ❑ Beauty and utility may conflict
  - ■ Mixed up visual styles $\Rightarrow$ easy to distinguish
  - ■ Clean design, little differentiation $\Rightarrow$ confusing
  - ■ Backgrounds behind text … good to look at, but hard to read
- ❑ But can work together
  - ■ Example: The design of the counter
  - ■ In consumer products – key differentiator (e.g. iMac)

Colour and 3D

- ❑ Both often used very badly!
- ❑ Colour
  - ■ Older monitors limited palette
  - ■ Colour over used because 'it is there'
  - ■ Beware colour blind!
  - ■ Use sparingly to reinforce other information
- ❑ 3D effects
  - ■ Good for physical information and some graphs
  - ■ But if over used …
    - ❑ Example: Text in perspective!! 3D pie charts
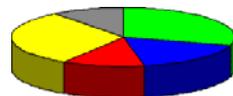
Across Countries and Cultures

- ❑ Localisation & Internationalisation
  - ■ Changing interfaces for particular cultures/languages
- ❑ Globalisation
  - ■ Try to choose symbols etc. that work everywhere
- ❑ Simply change language?
  - ■ Use 'resource' database instead of literal text
    … But changes sizes, left-right order etc.
- ❑ Deeper issues
  - ■ Cultural assumptions and values
  - ■ Meanings of symbols
  - ■ Example: Tick and cross … +ve and -ve in some cultures
    … but … mean the same thing (mark this) in others

What is a Prototype?

- In other design fields, a prototype is a small-scale model
  - A miniature car, building or town
- **In interaction design, it can be (among other things)**
  - A series of screen sketches
  - A storyboard, i.e., a cartoon-like series of scenes
  - A PowerPoint slide show
  - A video simulating the use of a system
  - A lump of wood (e.g., PalmPilot)
  - A cardboard mock-up
  - A piece of software with limited functionality written in the target language or in another language
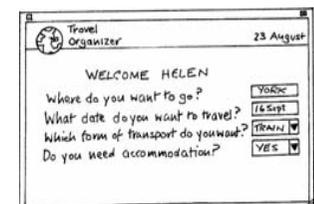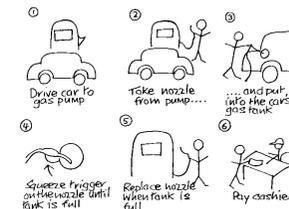
Why Prototype?

- Evaluation and feedback are central to interaction design
- Skakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- Team members can communicate effectively
- You can test out ideas for yourself
- It encourages reflection: very importance aspect of design
- Prototypes answer questions, and support designers in choosing between alternatives

What to Prototype?

- Technical issues
- Work flow, task design
- Screen layouts and information display
- Difficult, controversial, critical areas

Low-Fidelity Prototyping

- Uses a medium which is unlike the final medium, e.g. paper, cardboard
- Is quick, cheap, and easily changed
- Examples
  - Sketches of screens, task sequences
  - Post-it notes
 - Storyboards
  - Wizard-of-Oz

High-Fidelity Prototyping

- Uses material that you would expect to be in the final product
- Prototype looks more like the final system than a low-fidelity version
- For a high-fidelity software prototype common environments include Macromedia Director, Visual Basic, and Smalltalk
- Danger that users think they have a full system... see compromises

Iteration & Prototyping

- You never get it right first time
- If at first you don't succeed ...

Design → Prototype → Evaluate → OK? → Done!
Prototype → Re-design → Evaluate
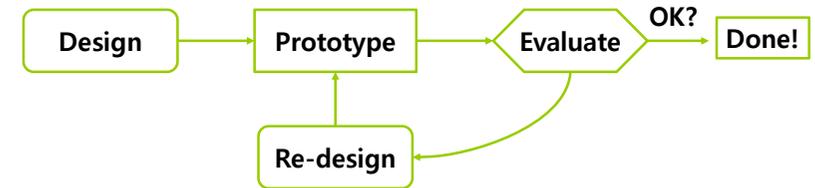
Exemplifies a user-centered design approach

Pitfalls of Prototyping

- Design can be constrained by prototyping!
- Improvement by iteration... but it starts from the current prototype
- Moving little by little ... but to where
- Malverns (hill) or the Matterhorn (peak)?
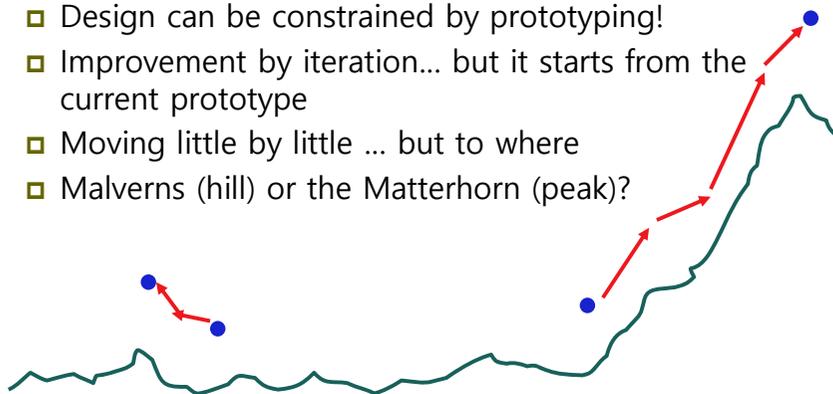
1. **Need a good start point**
2. **Need to understand what is wrong**
3. **...**

References

- Preece, Rogers & Sharp, Interaction Design: Beyond Human-Computer Interaction, Chapter 9,10,11
  http://www.id-book.com