# Human Computer Interaction and Eye Tracking

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# Overview

- Human Computer Interaction (HCI)
- Eye tracking
- Eye tracking and HCI
- Eye tracking and eLearning

# What is Human Computer Interaction?

# Definition of HCI

- "Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them."

ACM SIGCHI Curricula for HCI
(Hewett et al. 1992)

"The process that ensures that the designs match the needs and capabilities of the people for whom they are intended"

~ Don Norman, The Design of Everyday Things, 2013 ed.


Image taken from http://guycookson.com/2015/06/26/design-vs-user-experience/

Something to think about…

"A user interface is like a joke, if you have to explain it, it's not that good"

# Multi-disciplinary

- Computer science
- Psychology
- Design
- Art
- Music
- Education
- … the list goes on, because technology is everywhere now!

# Design Considerations

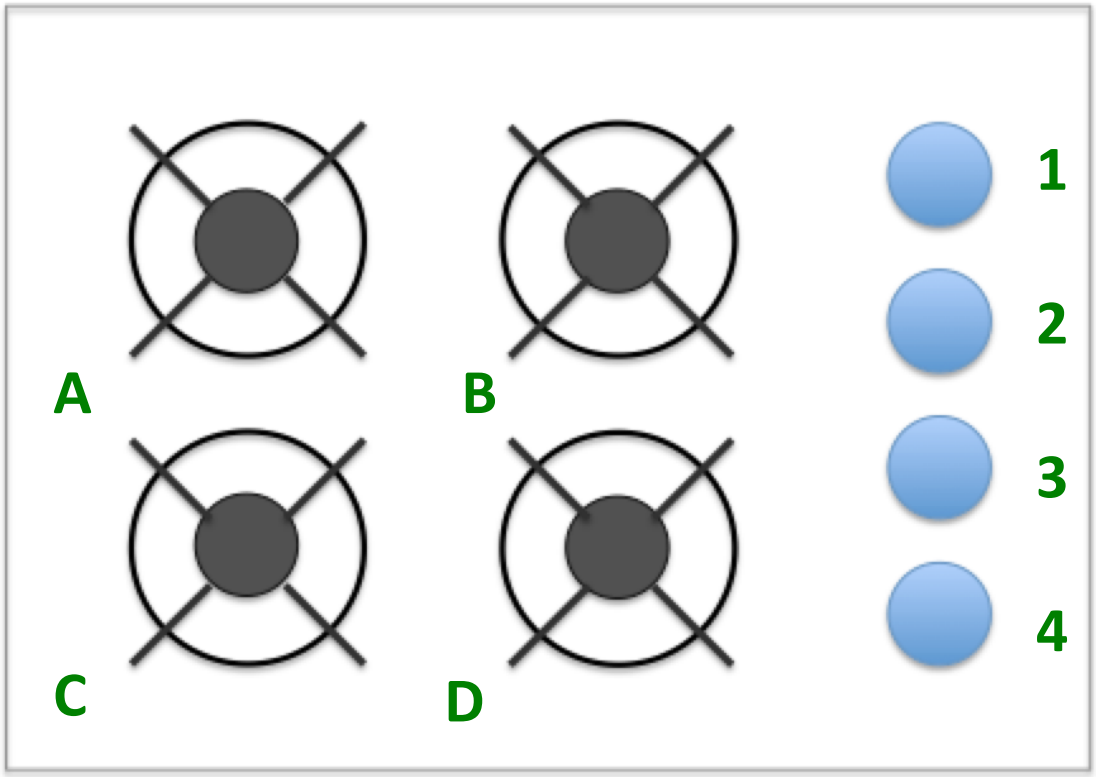
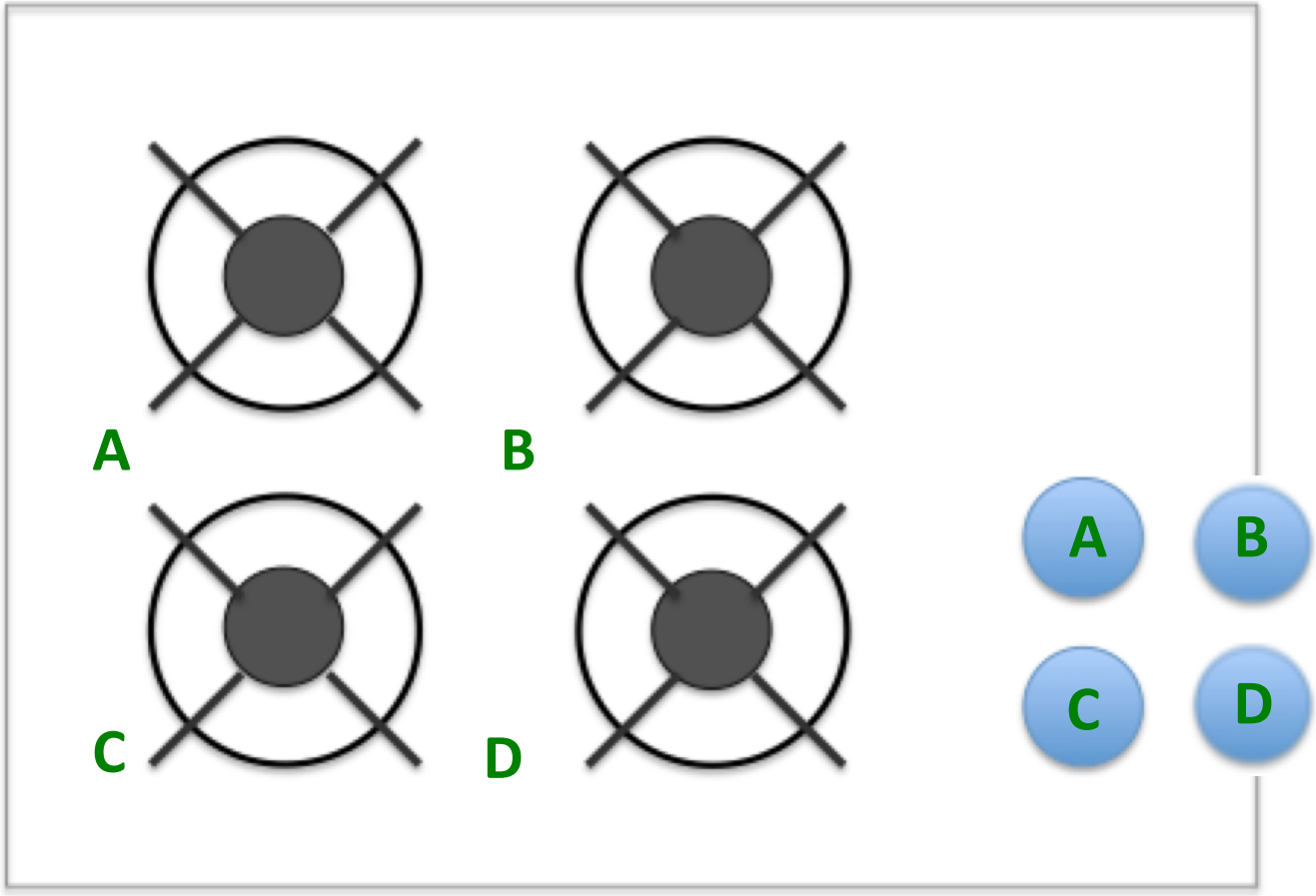



Image taken from: http://dataremixed.com/wp-content/uploads/2016/04/poorstovetopdesign.png

# Design Considerations

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# Everyday HCI

- iPhones
  - Pros
    - Quick and easy to learn to use
    - Pretty interfaces
    - Gestures
  - Cons
    - Features that most people don't realize exist
    - Doesn't always give good feedback (battery!)
    - Siri doesn't always understand me!

# Where do you see HCI?

- Choose one device you use in everyday life; list some of the HCI design choices and discuss with your neighbours the pros and cons.
  - Are there design choices you like? Why?
  - Are there design choices you don't like? Why?

Image taken from: http://abcofdesign.com/images/coffeepot.gif

# What is a more serious example?

- Three Mile Island accident
  - A partial nuclear meltdown in the US in 1979
  - A mechanical failure was misdiagnosed
  - The design of the human–machine interface was at least partly responsible for the disaster
    - "Error was inevitable!"

# Some Design Principles

Partly based on Don Norman's The Design of Everyday Things, 2013

- Affordances
- Signifiers
- Mappings
- Feedback
- Constraints
- Conceptual model

Image taken from: http://abcofdesign.com/images/coffeepot.gif

# Affordances

Image taken from: http://blogs.adobe.com/interactiondesign/files/2011/06/330.jpg

# Affordances

- What are some more examples of affordances?
- Have you got any examples of affordances that are incorrect?

# Signifiers

- Affordances determine what action is possible
- Signifiers signal what the action is
- Example:
  - The door must be pulled up, the signifier is the pull sign
  - The button must be pushed, the signifier is the text on the button, “Next” or “Enter”
- Perceived affordances act as signifiers

# Mappings

- What a control does
- Example:
  - Light switches, the stove top, turning pages in an eReader, scrolling on a mobile device
- Exploit natural mappings

# Feedback

- Give information to the user about an action
- Feedback comes in many forms
  - Errors
  - Input
  - Status
- Feedback has to be instantaneous
  - Too slow and the user can't learn
  - Errors can occur

# Feedback

- Poor feedback can be worse than no feedback
  - Distracting and uninformative
- Too much feedback can be annoying or overwhelming
- Feedback needs to be designed and planned

# Constraints

- Provide cues and limit the set of possible operations
- Necessary for indicating proper use
- E.g. in forms that require a date input
  - DD/MM/YY, DD/MM/YYYY, MM/DD/YYYY…
- Some constraints are close to feedback
  - Exit an application, would you like to save your document?
  - You can't access some functions

# Conceptual Model

- An explanation for how something works
- Conceptual model helps people understand the system and how to use
  - Bad design of an interface can mess with the conceptual model and therefore use!

# Conceptual model

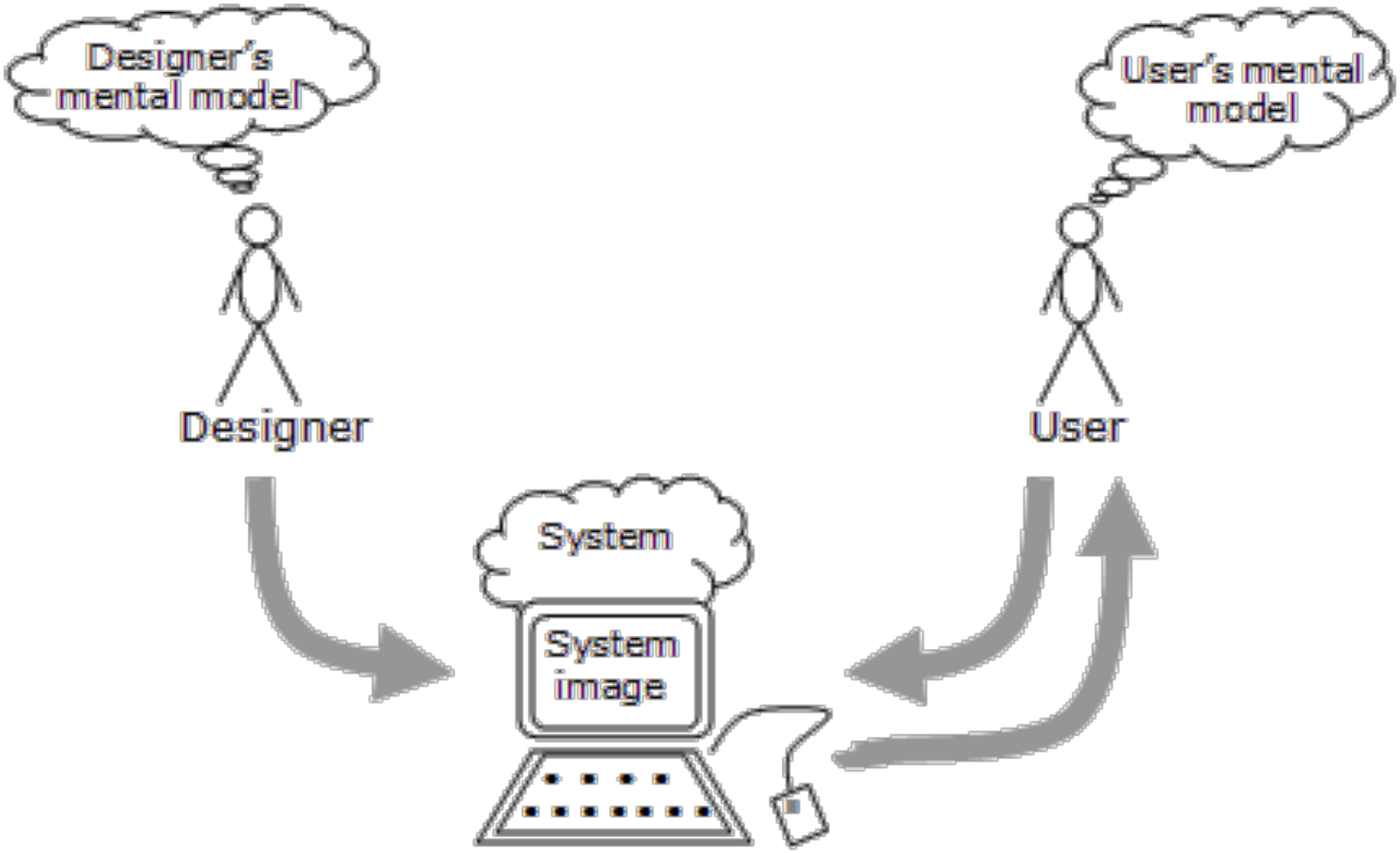
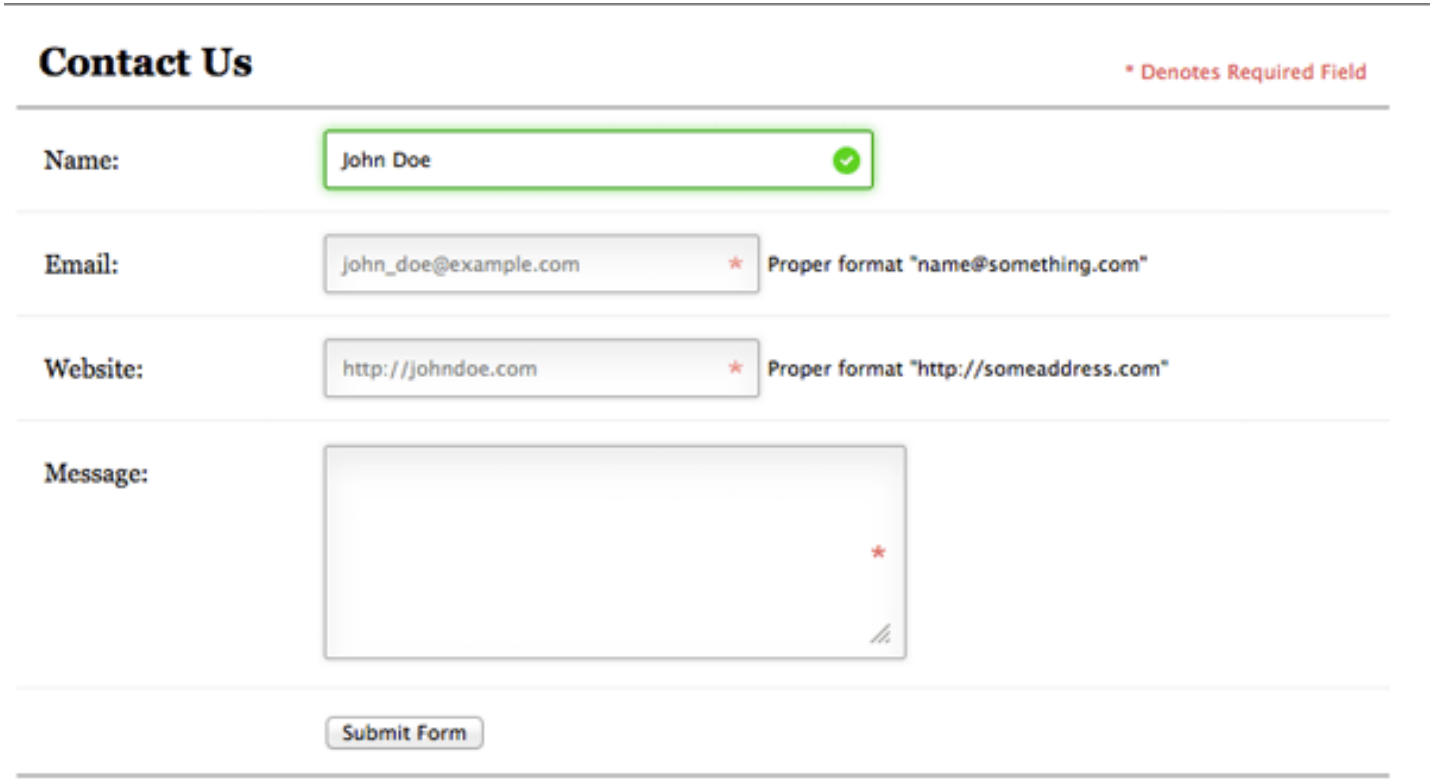
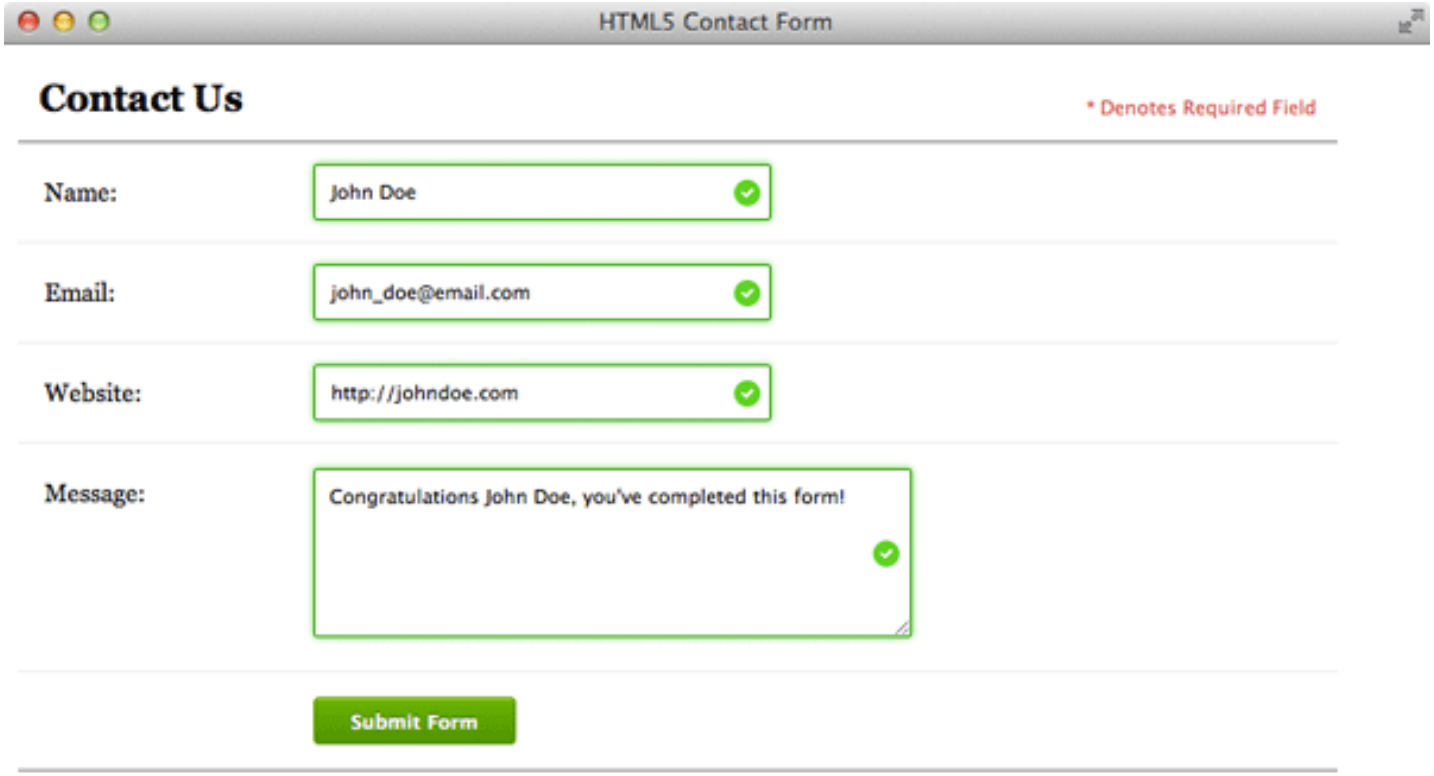



Image taken from: https://www.interaction-design.org/images/figures/mental_models.gif

# Example


Contact Us
* Denotes Required Field
Name:
John Doe
Email:
john_doe@example.com
Proper format "name@something.com"
Website:
http://johndoe.com
Proper format "http://someaddress.com"
Message:
Submit Form

# Example


HTML5 Contact Form
Contact Us
* Denotes Required Field
Name:
John Doe
Email:
john_doe@email.com
Website:
http://johndoe.com
Message:
Congratulations John Doe, you've completed this form!
Submit Form

# User centred design

- System centred design
  - Functionality driven
  - Emphasis on correct system
  - No consideration to the user
- User centred design
  - Emphasis on the end user tasks
  - Usability considered
  - Highly iterative

MOST END-USERS ARE NOT COMPUTER SCIENTISTS!

# Usability

- Definitions :
  - "a measure of the ease with which a system can be learned and used, its safety, effectiveness and efficiency, and attitude of its users towards it"
    (Preece et al., 1994)
  - "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use"
    (ISO 9241-11)

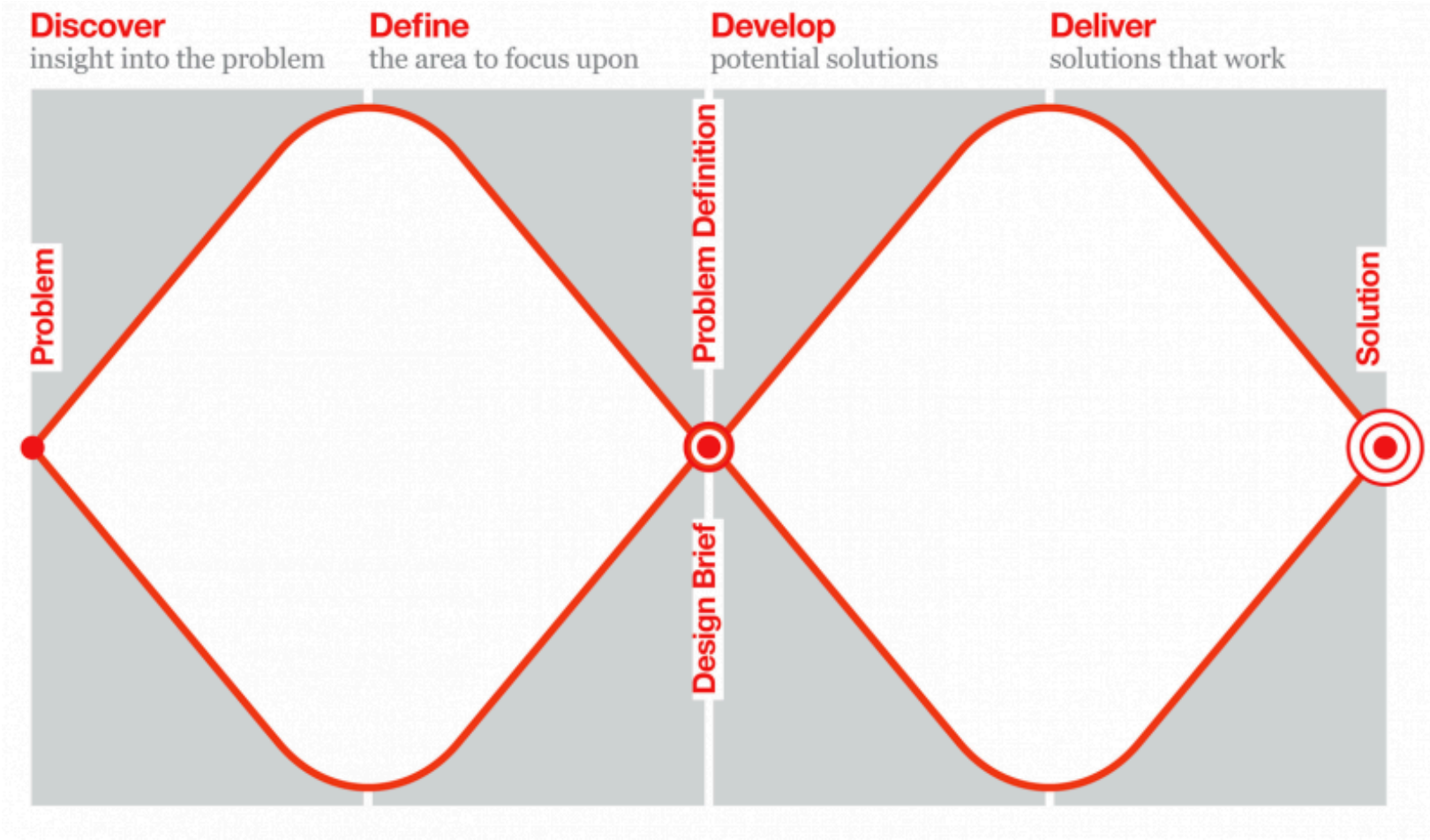
# How to measure usability

- What are good metrics?
- Qualitative
  - Ask users
- Quantitative
  - Error rate
  - Speed

# Design Thinking

- Don’t take problems at face value, find the root problem
- Get the right requirements, test, refine, repeat

# Double-Diamond Model of Design



# Iterative cycle of Human Centred Design

1. Observation
2. Idea generation
3. Prototyping
4. Testing
5. Start again…

# Observation

- How you get more accurate requirements!
- Often the people who commission for something to be made are not the end users
- Actually see how the user base performs the task
  - Find the true needs, motives, interests

# Idea generation

Image taken from: http://www.presentable.es/wp-content/uploads/2013/01/post-it-wall.jpg

# Prototyping

- Very useful for checking your requirements
- Can be quick and rudimentary
  - Pencil sketch, spreadsheet, PowerPoint slides, cardboard or foam models, Lego,…
- Wizard of OZ trials

Image taken from:
http://tse2.mm.bing.net/th?id=OIP.M70befa61e79454592a39ed590ebbea1eo0&pid=15.1

# Testing

- Get people to try out the solution
- Gather quantitative and qualitative data
- How good were your requirements?

NOW START AGAIN!!

# What is HCI?

- Understand how humans interact with technology
- Ensuring the needs of people are met
- Creating understandable and usable products