

## Chapter 2

# UNDERSTANDING AND CONCEPTUALIZING INTERACTION DESIGN

# Chapter 2

2.1 Introduction

2.2 Understanding the Problem Space and Conceptualizing Interaction

2.3 Conceptual Models

2.4 Interface Metaphors

2.5 Interaction Types

2.6 Paradigms, Visions, Theories, Models, and Frameworks



For Teams    For Individuals

Sign in    Download

# Put your creative energy to work, with Dropbox

Dropbox is a modern workspace designed to reduce busywork—so you can focus on the things that matter.

**Sign up**

or [sign in to your account](#)

First name

Last name

Email

Password

This page is protected by reCAPTCHA, and subject to the Google [Privacy Policy](#) and [Terms of service](#).

I agree to the [Dropbox Terms](#)

**Sign up**

Let's begin at the nuts and bolts level of design

- the **physical interface** and
- **technologies and interaction styles** to use. E.g. whether to use:
  - multitouch,
  - speech,
  - graphical user interface,
  - head up display,
  - augmented reality,
  - virtual reality
  - gesture-based,
  - face/finger recognition,
  - etc

- Example:
  - 3D printer
  - VR headset
  - Xe trò chơi điều khiển bằng tay (gesture-based):

<https://www.youtube.com/watch?v=nWze8TwSYFw>

- Robot surgery:

<https://www.youtube.com/watch?v=ebg20r3D9OI>

- Maika

<https://www.youtube.com/watch?v=4B6hfb0OeXY>

- Pokemon Go (thực tế tăng cường):

<https://www.youtube.com/watch?v=R04u9E5INTI>

- Trợ lý ảo, ngôi nhà thông minh (speed):

[https://www.youtube.com/watch?v=oMf\\_i1YBuMk](https://www.youtube.com/watch?v=oMf_i1YBuMk)

- Game

<https://www.youtube.com/watch?v=M52ID0I0zlw>

- Robot – Pet (gestured-base)

<https://www.youtube.com/watch?v= C1cRXy02g0>

- Google Map VR

<https://www.google.com/search?q=gg+map+ar&oq=gg+map&aqs=chrome.0.69i59j69i57j0i512l2j0i20i263i512j0i512l5.2609j0j4&sourceid=chrome&ie=UTF-8#fpstate=ive&vld=cid:9674f5f5,vid:F0e9D2qv4zQ,st:0>

# 2.2 Understanding the Problem Space and Conceptualizing Interaction

# Understanding the problem space

- What do you want to create?
- What are your assumptions?
- Will it achieve what you hope it will?



**Combined GPS and TV system available in Korea:**

- In-car entertainment
- Phone
- Navigation system (direction, find eating places)
- Watch TV
- Read emails



A hypothetical scenario from HP



## A hypothetical scenario: Cool Town

Reup: <https://youtu.be/s7A00XNgxxk>

Source: <http://www.ibiblio.org/jlillie/cooltown/lillie.htm>

# What is an assumption?

- taking something for granted when it needs further investigation
  - e.g. people will want to watch TV while driving



<http://www.ibiblio.org/jlillie/cooltown/lillie.htm>

# What is a claim?

- stating something to be true when it is still open to question
  - e.g. a multimodal style of interaction for controlling GPS — one that involves speaking while driving — is safe



# Assumption and Claim

- Writing down your assumptions and claims and then trying to defend and support them
- **Assumption:** taking something for granted when it needs further investigation
- **Claim:** meant stating something to be true when it is still open to question, e.g. a multimodal style of interaction for controlling a car navigation system
- Highlight those that are vague or wanting

# Differing perspectives on the problem space

- Team effort, ex:

Project manager: budgets, timelines, staffing costs  
Software engineer: specific technical concepts



# A framework for analysing the problem space

- **Are there problems** with an existing product or user experience? If so, what are they?
- **Why do you think** there are problems?
- How do you think your proposed **design ideas might overcome** these?
- If you are designing for a new user experience how do you think your proposed design ideas **support, change, or extend current ways of doing things**?

# Activity 2.1

- Use the framework to explicate the main assumptions and claims made about 3D TV?



**Figure 2.2** A family watching 3D TV  
Source: Andrey Popov/Shutterstock.com.

- Do the same for curved TV screens

# Activity 2.1

## Assumptions: realistic or wish-list?

- People would not mind wearing the glasses that are needed to see in 3D in their living rooms – reasonable
- People would not mind paying a lot more for a new 3D-enabled TV screen – not reasonable
- People would really enjoy the enhanced clarity and color detail provided by 3D – reasonable
- People will be happy carrying around their own special glasses – reasonable only for a very select bunch of users

# From problem space to design space

- Having a good understanding of the problem space can help inform the design space
  - e.g. what kind of interface, behaviour, functionality to provide
- But before deciding upon these it is important to develop a conceptual model

# Benefits of conceptualising the design space

- Orientation
  - enables design teams to ask specific questions about how the conceptual model will be understood
- Open-minded
  - prevents design teams from becoming narrowly focused early on
- Common ground
  - allows design teams to establish a set of commonly agreed terms

## 2.3 Conceptual model

# Conceptual model

- A conceptual model is:
  - “...a high-level description of how a system is organized and operates” (Johnson and Henderson, 2002, p26)
- Enables
  - “...designers to straighten out their thinking before they start laying out their widgets” (Johnson and Henderson, 2002, p28)

# Components

- Metaphors and analogies
  - understand what a product is for and how to use it for an activity
- Concepts that people are exposed to through the product
  - task–domain objects, their attributes, and operations (e.g. saving, revisiting, organizing)
- The relationships between those concepts
- The mappings between the concepts and the user experience the product is designed to support or invoke

# First steps in formulating a conceptual model

- What will the users be doing when carrying out their tasks?
- How will the system support these?
- What kind of interface metaphor, if any, will be appropriate?
- What kinds of interaction modes and styles to use?
  - always keep in mind when making design decisions how the user will understand the underlying conceptual model

- Tủ thông minh
  - Người dùng (chủ nhà trong một căn hộ cao tầng)
  - Điều khiển đóng mở tủ từ xa
  - Để shipper gởi hàng hóa vào tủ
- 
- Các em đưa ra ý tưởng thiết kế: giao diện tương tác, kỹ thuật tương tác, cách hoạt động,....

# Conceptual models

- Many kinds and ways of classifying them
- We describe them in terms of core activities and objects
- Also in terms of interface metaphors

## 2.4 Interface Metaphors

# Interface metaphors

- Conceptualizing what we are doing, e.g. surfing the web
- A conceptual model instantiated at the interface, e.g. the desktop metaphor
- Visualizing an operation, e.g. an icon of a shopping cart for placing items into

# Activiy 2.2

Go to a few online stores and see how the interface has been designed to enable the customer to order and pay for an item.

How many use the ‘add to shopping cart/trolley/basket’ followed by the ‘checkout’ metaphor?

Does this make it straightforward and intuitive to make a purchase?

# Material Metaphors

- The card is a very popular UI
- Why?: Has familiar form factor
- Material properties are added, giving appearance and physical behavior, e.g. surface of paper

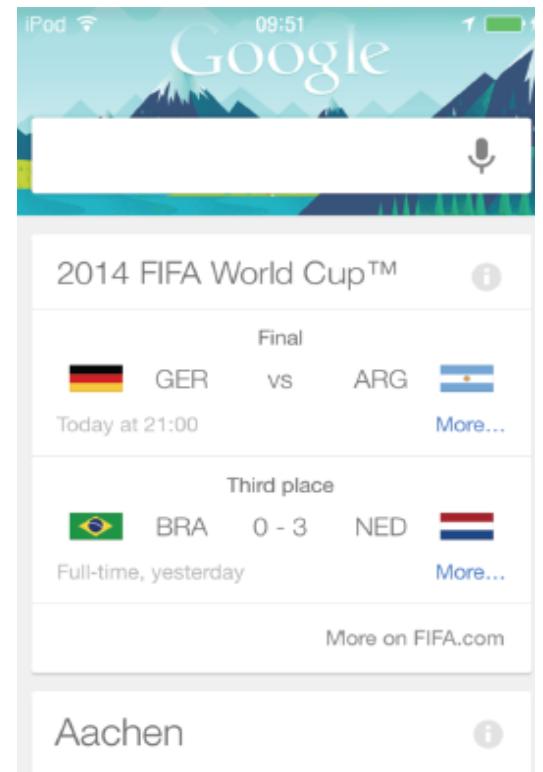


Figure 2.5 Google Now Card

Source: Google and the Google logo are registered trademarks of Google Inc., used with permission  
<http://www.google.com/design/spec/material-design/introduction.html>

# Activity

- Describe **the components of the conceptual model** underlying most online shopping websites, e.g.
  - Shopping cart
  - Proceeding to check-out
  - 1-click
  - Gift wrapping
  - Cash till

# Interface metaphors

- Interface designed to be similar to a physical entity but also has own properties
  - e.g. desktop metaphor, web portals
- Can be based on activity, object or a combination of both
- Exploit user's familiar knowledge, helping them to understand 'the unfamiliar'
- Conjures up the essence of the unfamiliar activity, enabling users to leverage of this to understand more aspects of the unfamiliar functionality

# Benefits of interface metaphors

- Makes learning new systems easier
- Helps users understand the underlying conceptual model
- Can be very innovative and enable the realm of computers and their applications to be made more accessible to a greater diversity of users

## 2.5 Interaction Types



[www.TechBoomers.com](http://www.TechBoomers.com)

Subscribe

## How to user Amazon

Source: <https://www.youtube.com/watch?v=vhpC4m61w-o>

# Interaction types

- Instructing
  - issuing commands and selecting options
- Conversing
  - Having a dialog with a system
- Manipulating
  - interacting with objects in a virtual or physical space by manipulating them
- Exploring
  - moving through a virtual environment or a physical space

# 1. Instructing

- Example
  - typing in commands,
  - Selecting options from menus in a windows environment or on a multitouch screen, speaking aloud commands,
  - pressing buttons,
  - using a combination of function keys.
- Instruct a system and tell it what to do
  - e.g. tell the time, print a file, save a file, remind the user of an appointment
- Underlying a diversity of devices and systems
  - e.g. writing a report using a word processors
- Main benefit is that instructing supports quick and efficient interaction
  - good for repetitive kinds of actions performed on multiple objects

# Which is easiest and why?



## 2. Conversing

- Underlying model of having a conversation with another human
- Range from simple voice recognition menu-driven systems to more complex ‘natural language’ dialogs
- Examples include timetables, search engines, advice-giving systems, help systems
- Also virtual agents, toys and pet robots designed to converse with you
- Ex: Apple’s speech system, Siri

'Thank you for calling St. Paul's Insurance Company. If you require house insurance press 1, car insurance press 2, travel insurance press 3, health insurance press 4, other press 5.'

<user presses 2>

'You have reached the car insurance division. If you require information about fully comprehensive insurance press 1, third-party insurance press 2 . . .'



**"If you'd like to press 1, press 3.  
If you'd like to press 3, press 8.  
If you'd like to press 8, press 5..."**



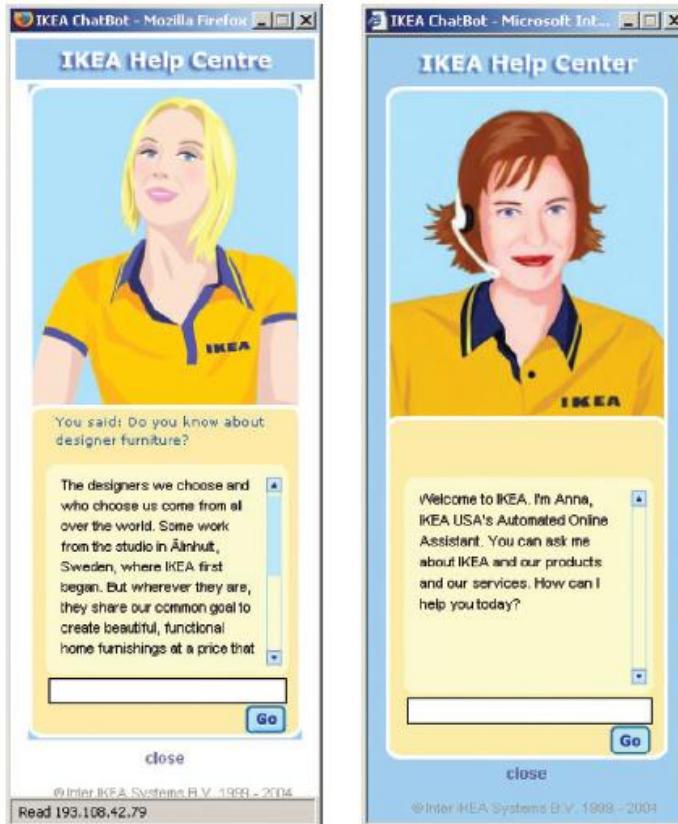
Figure 2.7 Siri's response to the question "Do I need an umbrella?"



## Automated phone-based system

<https://www.youtube.com/watch?v=WFhbiWhQd60>

# Would you talk with Anna?



**Figure 1.7** Anna the online sales agent, designed to be subtly different for UK and US customers. What are the differences and which is which? What should Anna's appearance be like for other countries, like India, South Africa, or China?

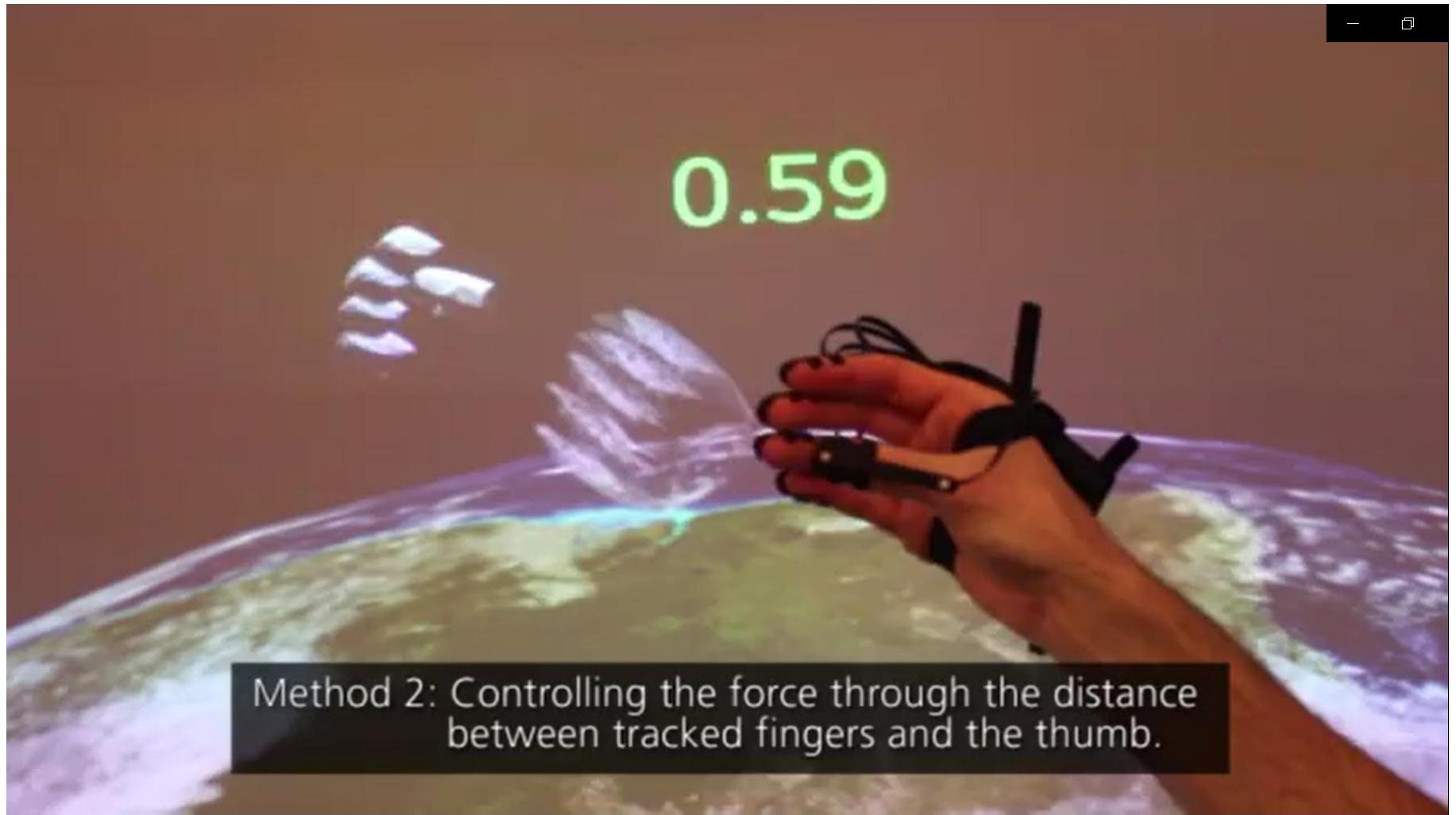
Source: Reproduced with permission from IKEA Ltd.

# Pros and cons of conversational model

- Allows users, especially novices and technophobes, to interact with the system in a **way that is familiar**
  - makes them feel comfortable, at ease and less scared
- **Misunderstandings** can arise when the system does not know how to parse what the user says

# 3. Manipulating

- Involves dragging, selecting, opening, closing and zooming actions on virtual objects
- Exploit's users' knowledge of how they move and manipulate in the physical world
- Can involve actions using physical controllers (e.g. Wii) or air gestures (e.g. Kinect) to control the movements of an on screen avatar
- Tagged physical objects (e.g. balls) that are manipulated in a physical world result in physical/digital events (e.g. animation)
- Ex:  
[https://youtu.be/YVWgRjWfD9k?si=F17ipTHvfKnBcYR\\_&t=65](https://youtu.be/YVWgRjWfD9k?si=F17ipTHvfKnBcYR_&t=65)



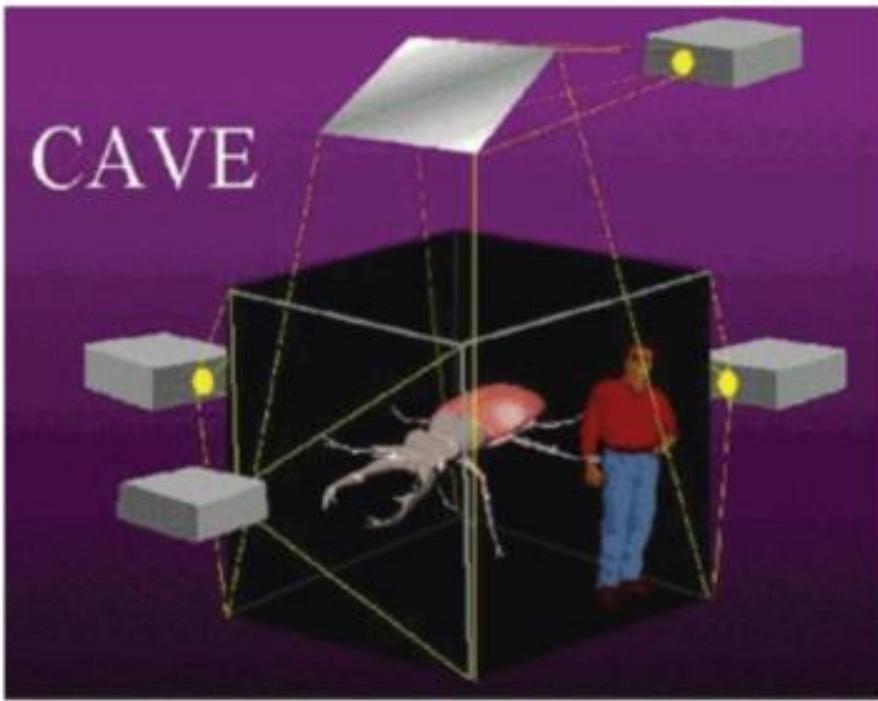
Method 2: Controlling the force through the distance between tracked fingers and the thumb.

## Manipulating

Reup: [https://youtu.be/q\\_Nd5Du6Okk](https://youtu.be/q_Nd5Du6Okk)

# 4. Exploring

- Involves users moving through virtual or physical environments
- Physical environments with embedded sensor technologies



(a)



(b)

**Figure 2.8** (a) A CAVE that enables the user to stand near a huge insect, e.g. a beetle, be swallowed, and end up in its abdomen; and (b) NCSA's CAVE being used by a scientist to move through 3D visualizations of the datasets

Source:(a) Reproduced with permission. <http://home.comcast.net/~sharov/3d/cave.html> (b) Image courtesy of Kalev Leetaru, National Center for Supercomputing Applications, University of Illinois.



## CAVE virtual reality system

Reup: <https://youtu.be/-Lf0CZkcGt4>

# Which conceptual model is best?

- Issuing instructions is good for repetitive tasks, e.g. spell-checking, file management
- Having a conversation is good for children, computer-phobic, disabled users and specialised applications (e.g. phone services)
- Hybrid conceptual models are often employed, where different ways of carrying out the same actions is supported at the interface - but can take longer to learn

# Conceptual models: interaction and interface

- Interaction type:
  - what the user is doing when interacting with a system, e.g. instructing, talking, browsing or other
- Interface type:
  - the kind of interface used to support the mode, e.g. speech, menu-based, gesture

# Many kinds of interface types available including...

- Command
- Speech
- Data-entry
- Form fill-in
- Query
- Graphical
- Web
- Pen
- Augmented reality (thực tế tăng cường)
- Gesture

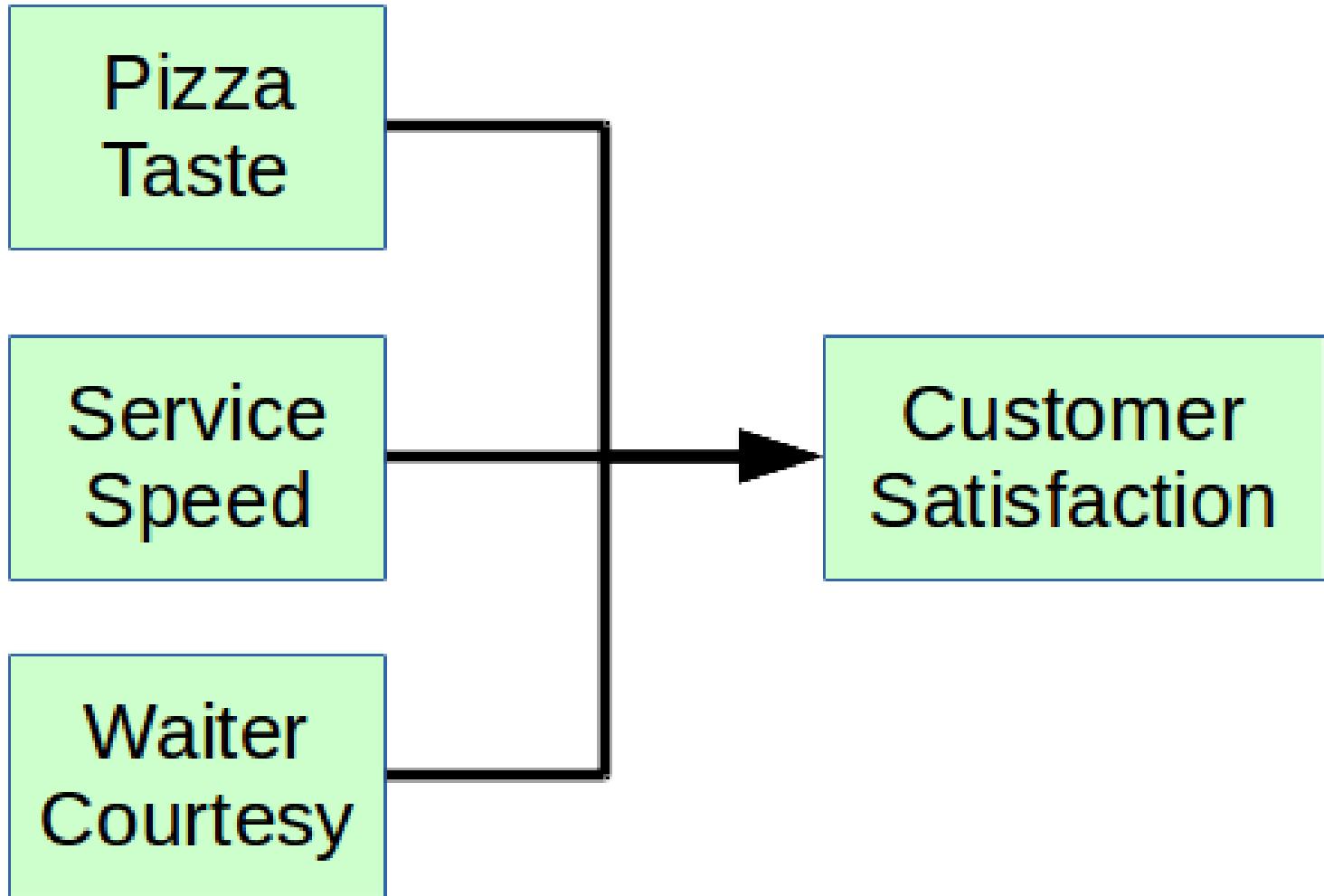
# Which interaction type to choose?

- Need to determine requirements and user needs
- Take budget and other constraints into account
- Also will depend on suitability of technology for activity being supported
- This is covered in course when designing conceptual models

## 2.6 Paradigms, Visions, Theories, Models, and Frameworks

# Paradigm

- Inspiration for a conceptual model
- General approach adopted by a community for carrying out research
  - shared assumptions, concepts, values, and practices
  - e.g. desktop, ubiquitous computing, in the wild



*The paradigm of the pizza study showing the independent and the dependent variables.*



Examples of new paradigms: Pervasive computing

Source: <https://www.youtube.com/watch?v=vOIVTEAb0Eg>

# Visions

- A driving force that frames research and development
- Invites people to imagine what life will be like in 10, 15 or 20 years time
  - e.g. Apple's 1987 Knowledge Navigator
  - Smart Cities, Smart Health
- Provide concrete scenarios of how society can use the next generation of imagined technologies
- Also raise many questions concerning privacy and trust



bao gồm hạn hán ảnh hưởng đến thực phẩm  
sản xuất ở châu Phi và tăng

## Apple Knowledge Navigator

Source: <http://youtu.be/HGYFEI6uLy0>



# The Internet of Things



## IBM's Internet of Things

Source: <http://youtu.be/sfEbMV295Kk>

# Theory

- Explanation of a phenomenon
  - e.g. information processing that explains how the mind, or some aspect of it, is assumed to work
- Can help identify factors
  - e.g. **cognitive**, social, and affective, relevant to the design and evaluation of interactive products

# Models

- A simplification of an HCI phenomenon
  - intended to make it easier for designers to predict and evaluate alternative designs
  - abstracted from a theory coming from a contributing discipline, e.g. psychology, e.g. keystroke model
  - For example: **model of user interaction, Newell's keystroke model, user models, model of emotional design (Chapter 5)**

# Norman's model of interaction

(to help understand the interaction between human user and computer)

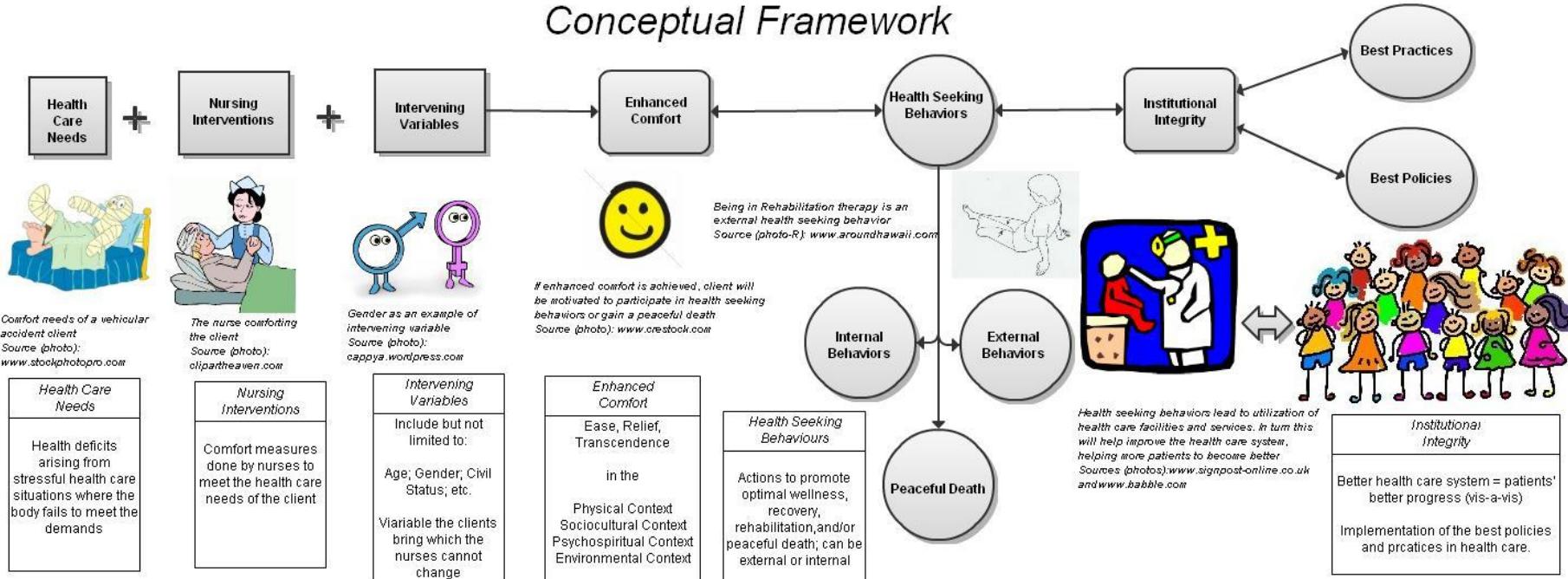
Norman's Seven Stages of Action / Norman's Execution-Evaluation cycle



# Framework

- Set of interrelated concepts and/or specific questions for ‘what to look for’
- Many in interaction design
  - e.g. Norman’s conceptual models, Benford’s trajectories
- Provide advice on how to design
  - e.g. steps, questions, concepts, challenges, principles, tactics and dimensions

## Conceptual Framework



## An example of conceptual framework

<http://black.dgfitness.co/conceptual-framework-nursing/>

# Summary

- **Developing a conceptual model** involves good understanding of the problem space, specifying what it is you are doing, why, and how it will support users
- A **conceptual model** is a high-level description of a product in terms of what users can do with it and the concepts they need to understand how to interact with it
- **Interaction types** (e.g. conversing, instructing) provide a way of thinking about how best to support user's activities
- **Paradigms, visions, theories, models, and frameworks** provide different ways of framing and informing design and research