

CS 320 Interaction Design

1

DISCOVERY

Textbook:

**S. Heim, The Resonant Interface:
HCI Foundations for Interaction Design** [Chapter 4, continued]
Addison-Wesley, 2007

March 9, 2011

Outline

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- 1 What is Interaction Design?
- 2 Discovery Phase: Interpretation

1 What is Interaction Design?

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- ❖ Goals of Interaction Design
- ❖ Interdisciplinary Aspects
- ❖ Major Trends

Interaction Design

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- **Interaction Design (IxD)** is about helping users make the best out of their experience with computer systems



“Designing interactive products to support the way people communicate and interact in their everyday and working lives”

[Price, Rogers, and Sharp, 2007]

“*Interaction design* defines the structure and behavior of interactive systems. *Interaction designers* strive to create meaningful relationships between people and the products and services that they use, from computers to mobile devices to appliances and beyond”

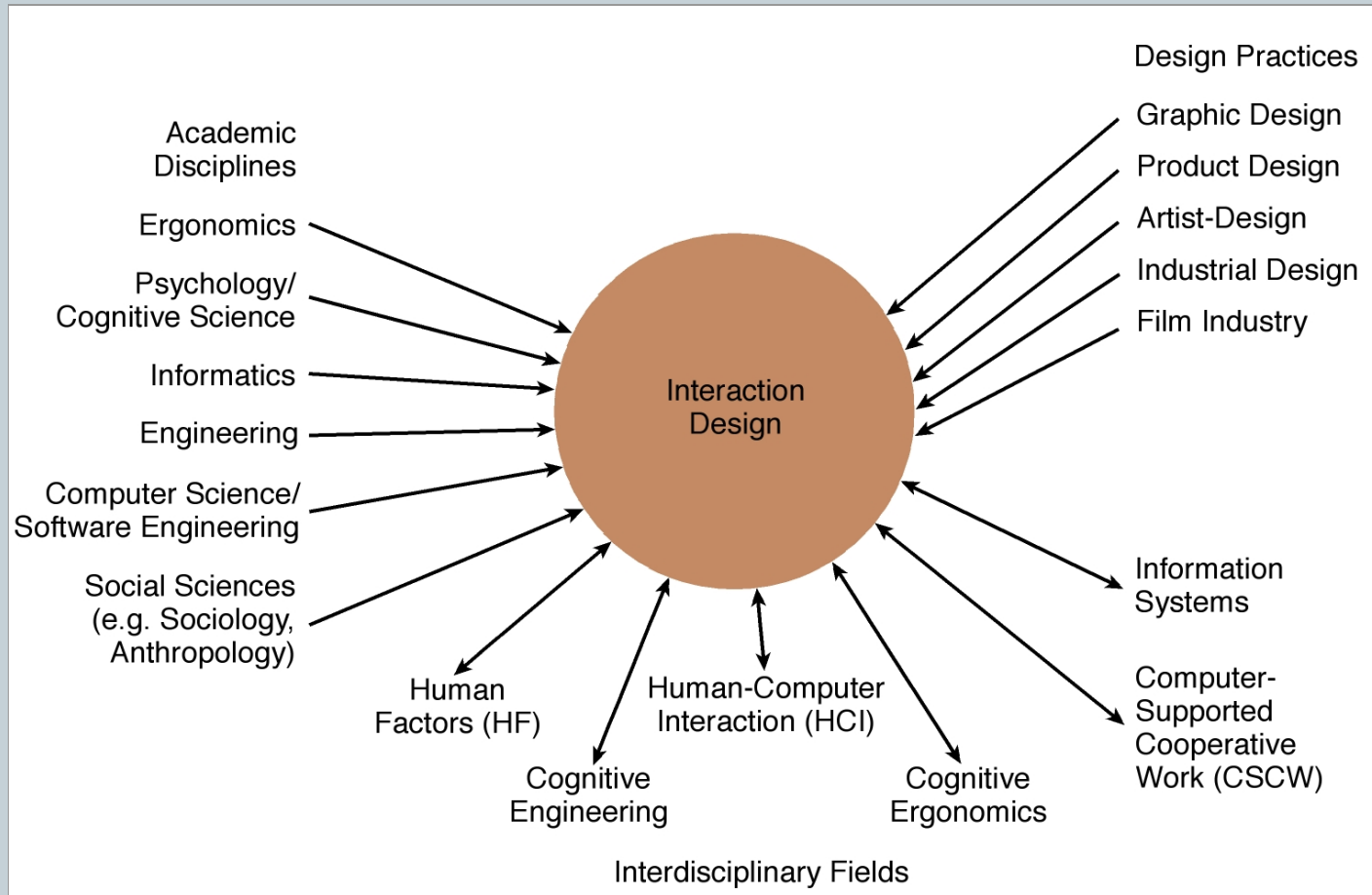
[Wikipedia 2011]

The practice typically centers on “embedding information technology into the ambient social complexities of the physical world”

[M. McCullough, 2004]

Interaction Design and Related Disciplines

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Interaction Design: Major Trends

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Mobile applications, smart phones (small screens)



Tablet PCs, multi-touch devices (touch screens)

Virtual reality
(immersive environments)



Very large displays
(big screens)

2 Discovery Phase

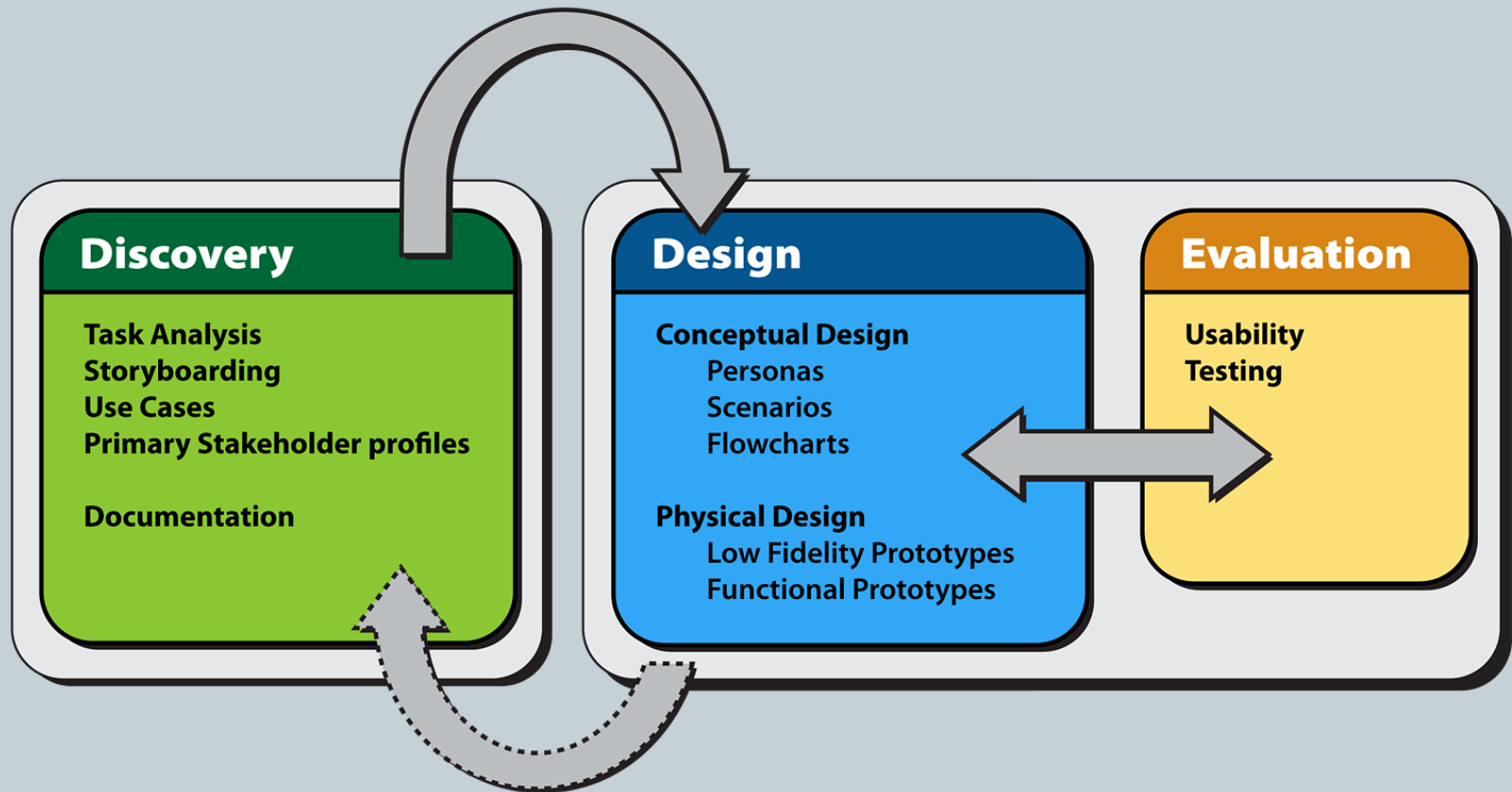
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- Discovery Phase = Collection + Interpretation
- Collection
 - ✦ Observation
 - ✦ Elicitation
- Interpretation
 - ✦ Task analysis
 - ✦ Storyboarding
 - ✦ Use cases
 - ✦ Primary stakeholder profiles
 - ✦ Documentation

Interaction Design Process: DDE Framework

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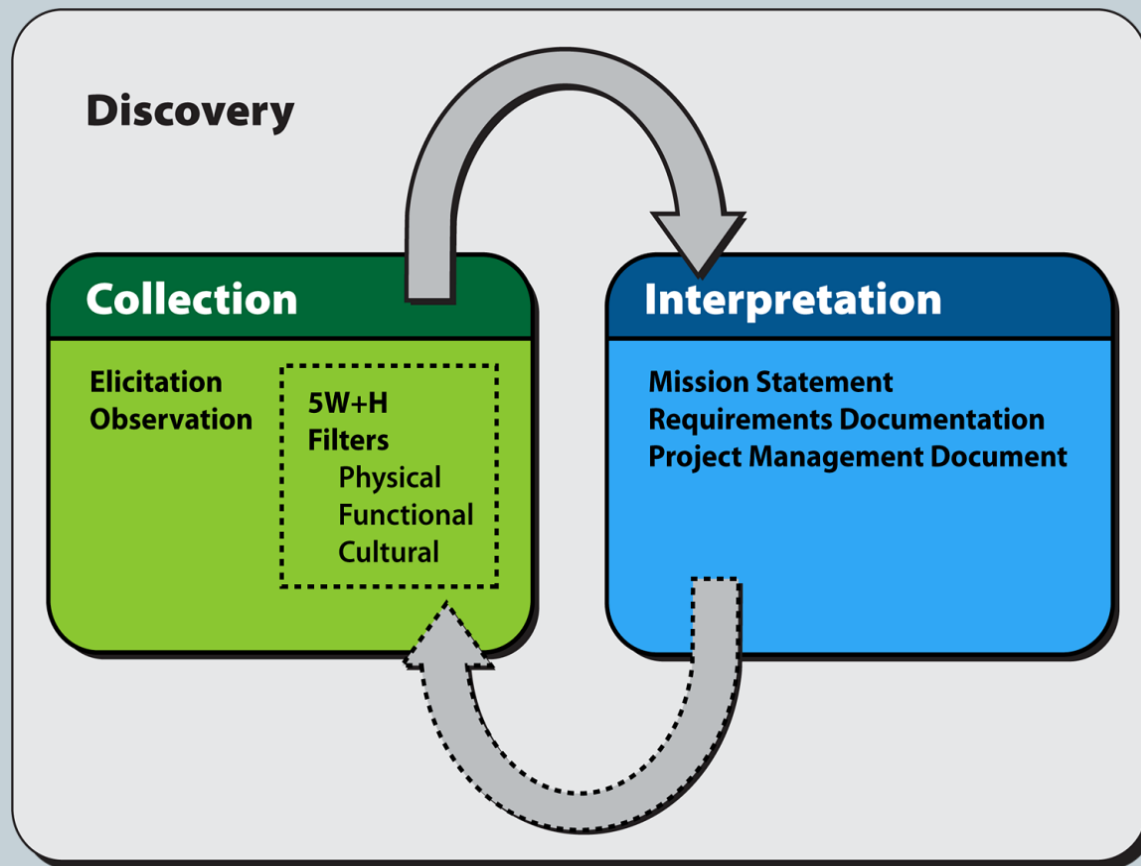
- General **DDE** Framework [Heim 2007]



Interaction Design Process: Discovery

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- General **DDE** Framework [Heim 2007] - Discovery



Interpretation

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- Task Analysis
- Storyboarding
- Use Cases
- Primary Stakeholder Profiles
- Documentation

Interpretation - *Task Analysis*

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- **Task analysis** is a way of documenting how people perform tasks
- A task analysis includes various aspects of the workflow
- The analysis is used to explore the requirements of the proposed system and structure the results of the data collection phase

Interpretation - *Task Analysis*

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- Task decomposition
 - A linear description of a process that captures the elements involved as well as the relevant contextual factors
- Hierarchical task analysis (HTA)
 - Provides a top-down, structured approach to documenting processes

Interpretation - *Task Analysis - Task Decomposition*

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- Identify the process
- Describe the process steps
- It is important to create a picture of the process segmented by the steps involved and to capture the dependencies among steps

Interpretation - *Task Analysis - Task Decomposition*

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- Task analysis items [e.g., **schedule a team meeting**]:
 - **Goal**— define the top-level goal for the analysis
 - ✦ **Schedule a team meeting**
 - **Plans** – describe the order and conditions required to proceed with subtasks
 - ✦ Reserve the conference room and A/V equipment based on the team members' available dates and times
 - **Information**—include all the information needed to perform the task
 - ✦ Team members' contact information
 - ✦ Conference room schedule
 - ✦ Audio/visual equipment use procedures
 - **Objects**—include all the physical objects used to find the information
 - ✦ Conference room calendar
 - ✦ Team address book
 - ✦ A/V sign-up sheet

Interpretation - *Task Analysis* - *Task Decomposition*

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- Task analysis items [e.g., **schedule a team meeting**]:
 - **Methods**—these are the various ways you can proceed
 - ✦ E-mail
 - ✦ Instant messaging
 - **Objectives**—these are the subgoals (subtasks)
 - ✦ Contact team members
 - ✦ Confirm responses
 - ✦ Coordinate schedules
 - ✦ Schedule conference room
 - ✦ Schedule A/V equipment
 - ✦ Confirm team member attendance

Interpretation - *Task Analysis* - *Task Decomposition*

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- Task analysis items [e.g., **schedule a team meeting**]:
 - **Procedures**—these are the triggers that may initiate contingency activities
 - ✦ Coordinate team schedules
 - ✦ Check conference room schedule
 - ✦ Check A/V sign-up sheet
 - **Contingencies**—these describe what needs to be done if one of the methods does not work
 - ✦ Check email replies
 - ✦ Monitor team members' online presence to confirm using IM
 - ✦ Speak directly with team members in close proximity
 - ✦ Phone members in other locations
 - ✦ Leave a note on a team member's desk

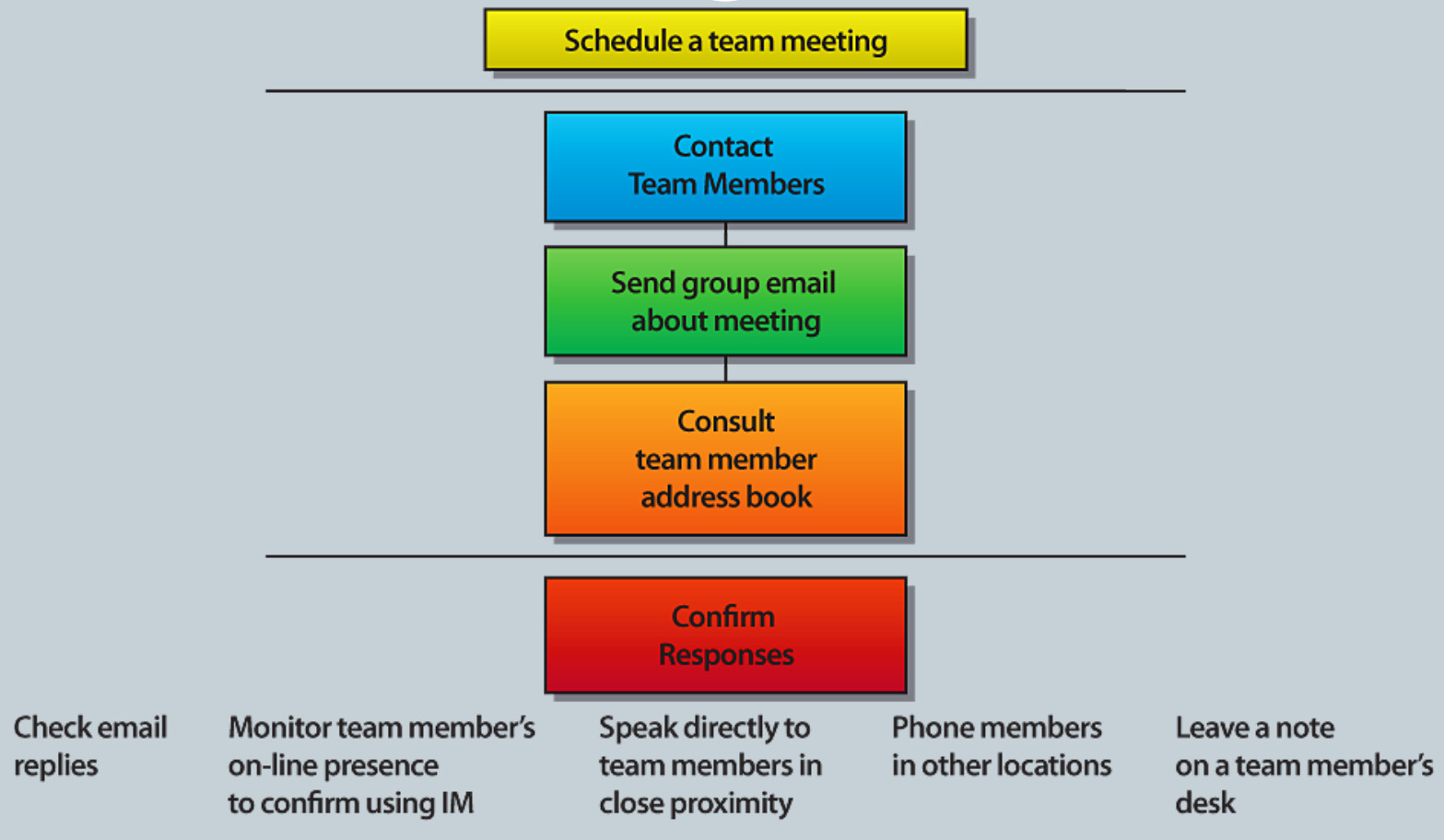
Interpretation - *Task Analysis - HTA*

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- Hierarchical task analysis (**HTA**)
 - Start with a specific goal (task) and then add subgoals (subtasks) required to achieve that goal
 - Organize tasks and subtasks hierarchically (through decomposition)
 - An HTA is read as follows:
 - ✦ A box on top of another box describes what we want to do (subgoal)
 - ✦ The box below another box describes how it is done
 - ✦ Plans control the flow between subgoals

Interpretation - *Task Analysis - HTA*

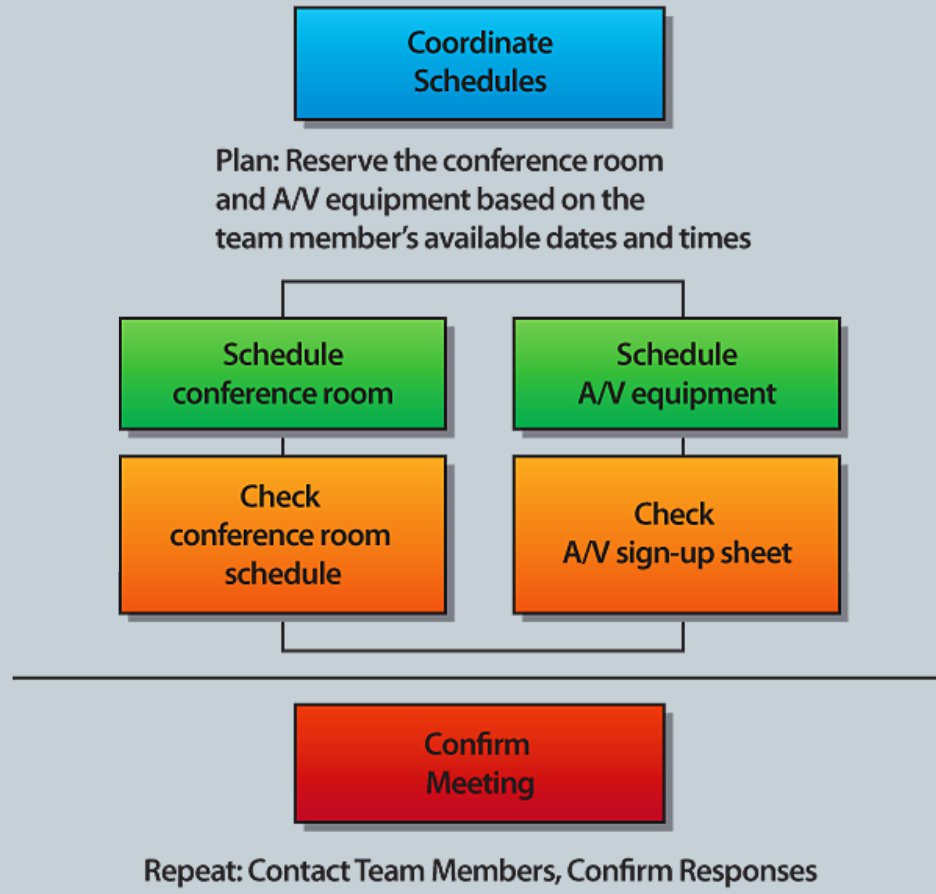
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First part of the HTA of the "schedule a team meeting" task

Interpretation - *Task Analysis - HTA*

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Second part of the HTA of the "schedule a team meeting" task

Interpretation - *Storyboarding*

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- **Storyboarding** involves using a series of pictures that describes a particular process or work flow
 - Can be used to study existing workflows or generate requirements
 - Can facilitate the process of task decomposition
 - Used to brainstorm alternative ways of completing tasks

Interpretation – *Use Cases*

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- **Use case modeling** represents a structured approach for describing workflows and processes
 - Use cases depict the interaction between the users and the system
- Jacobson *et al* (1992)
- Incorporated into the Unified Modeling Language (**UML**) standard

Interpretation – *Use Cases*

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- The two main components of use case modeling are the **actors** and the **use cases**
- An **actor**:
 - Is always external to the system
 - Interacts directly with the system
 - Represents a role played by people or things, not specific people or specific things

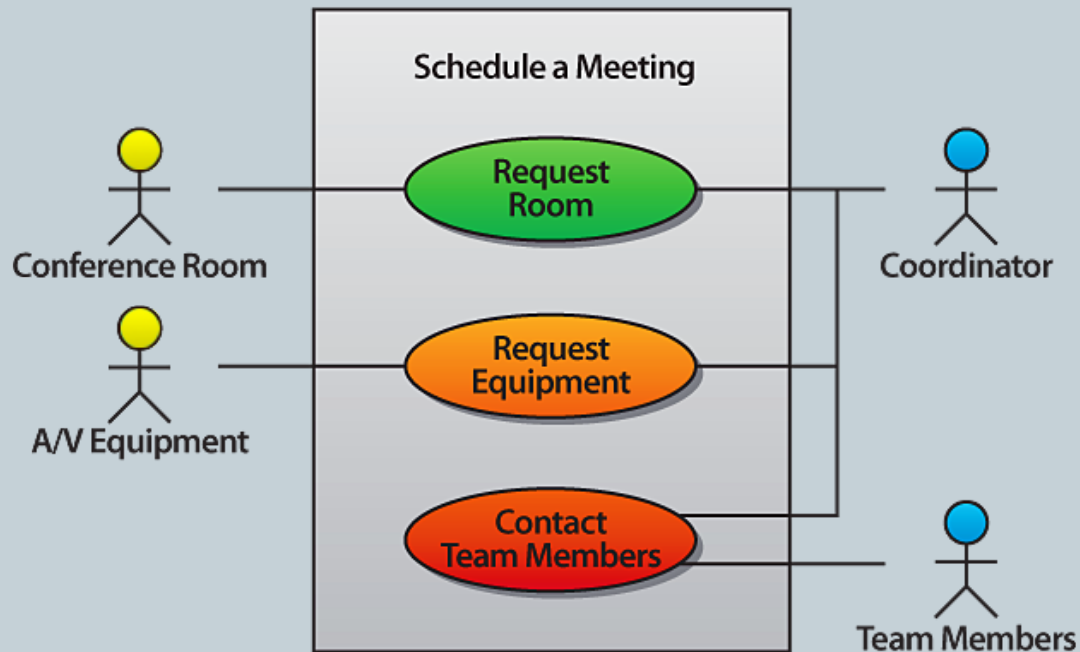
Interpretation – *Use Cases*

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- According to Rumbaugh, a *use case* is “a specification of sequences of actions, including variant sequences and error sequences, that a system, subsystem, or class can perform by interacting with outside actors”
- Use cases:
 - Are always started by an actor
 - Are always written from an actor’s point of view

Interpretation – *Use Cases*

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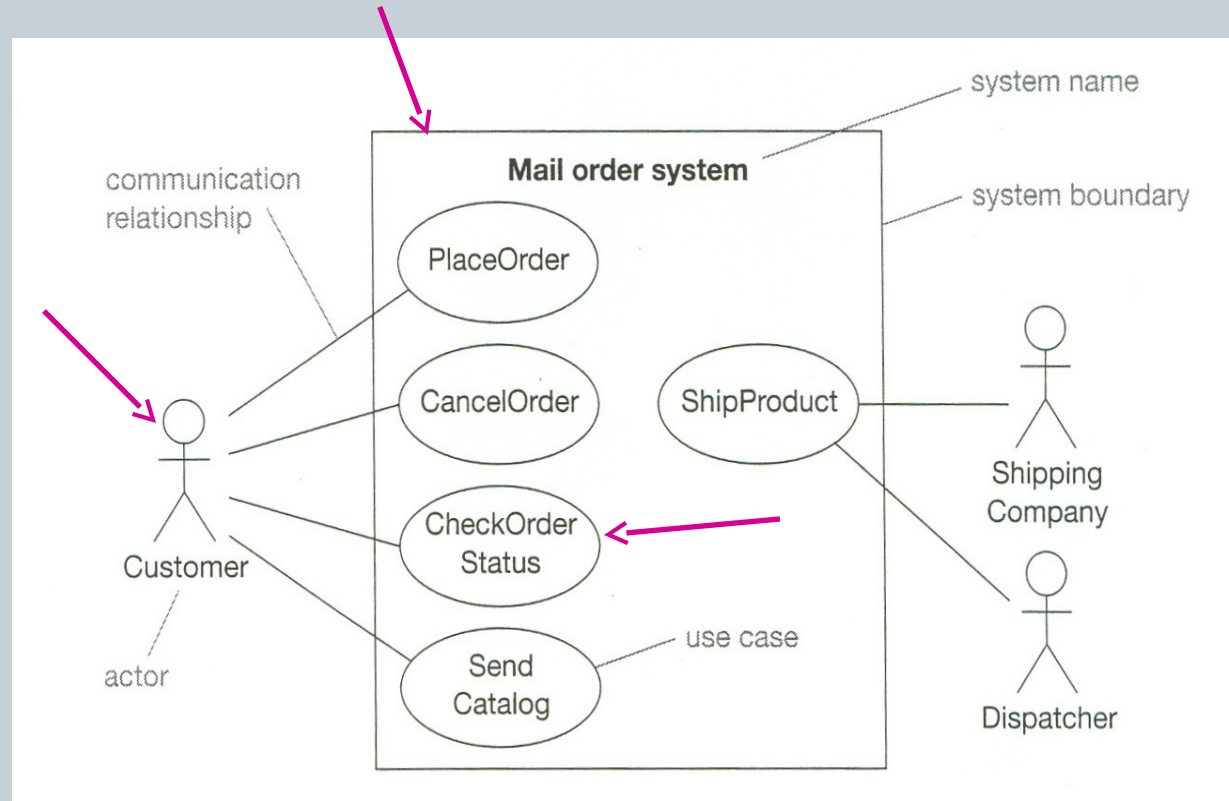


Use case diagram of "schedule a meeting" process

Interpretation – *Use Cases*

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- The use case diagram shows the **system boundary**, the **use cases** internal to the system, and the **actors** external to the system, e.g. [Fig.4.6, Arlow & Neustadt 2005]



Interpretation – *Use Cases*

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| | |
|---|---|
| use case name | Use case: PaySalesTax |
| use case identifier | ID: 1 |
| brief description | Brief description: Pay Sales Tax to the Tax Authority at the end of the business quarter. |
| the actors involved in the use case | Primary actors: Time |
| | Secondary actors: TaxAuthority |
| the system state before the use case can begin | Preconditions: 1. It is the end of the business quarter. |
| the actual steps of the use case | Main flow: <i>implicit time actor</i> 1. The use case starts when it is the end of the business quarter. 2. The system determines the amount of Sales Tax owed to the Tax Authority. 3. The system sends an electronic payment to the Tax Authority. |
| the system state when the use case has finished | Postconditions: 1. The Tax Authority receives the correct amount of Sales Tax. |
| alternative flows | Alternative flows: None. |

Interpretation – *Use Cases*

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| Use case: FindProduct |
|--|
| ID: 3 |
| Brief description: The system finds some products based on Customer search criteria and displays them to the Customer. |
| Primary actors: Customer |
| Secondary actors: None. |
| Preconditions: None. |
| Main flow: <ol style="list-style-type: none">1. The use case starts when the Customer selects "find product".2. The system asks the Customer for search criteria.3. The Customer enters the requested criteria.4. The system searches for products that match the Customer's criteria.5. If the system finds some matching products then<ol style="list-style-type: none">5.1 For each product found<ol style="list-style-type: none">5.1.1 The system displays a thumbnail sketch of the product.5.1.2 The system displays a summary of the product details.5.1.3 The system displays the product price.6. Else<ol style="list-style-type: none">6.1 The system tells the Customer that no matching products could be found. |
| Postconditions: None. |
| Alternative flows: None. |

Interpretation – *Use Cases*

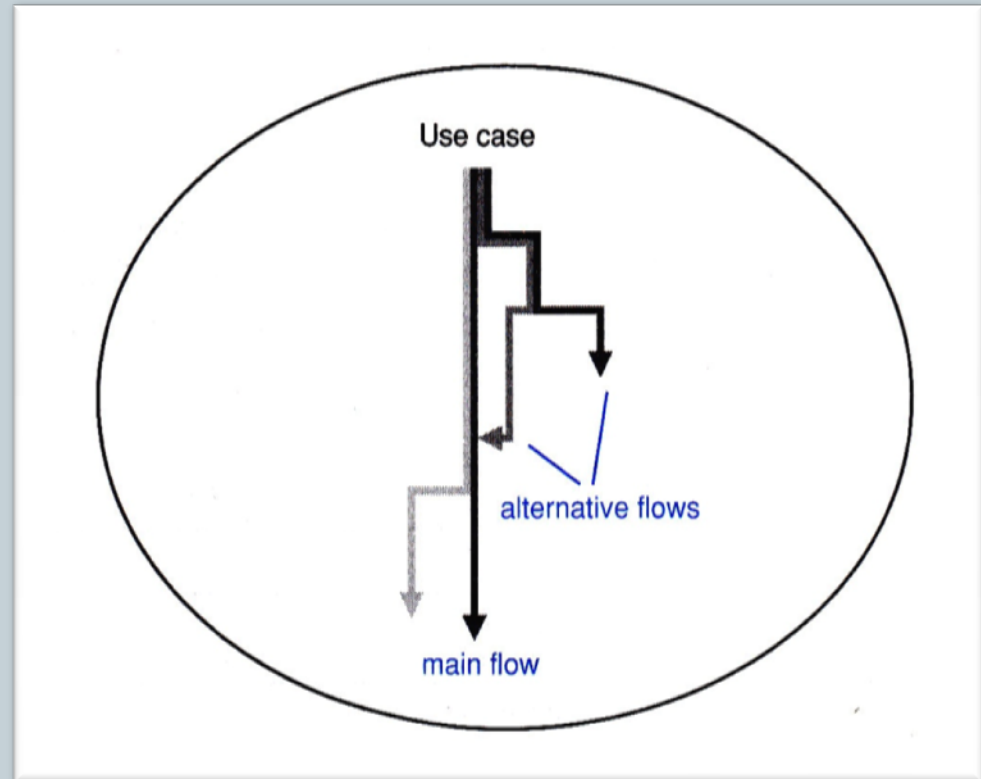
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- There are diverse flows (paths) through a use case
 - **Main flow:** The main path through the use case is the one that is completed without any diversions from error conditions or other accidental circumstances
 - **Alternative flows:** Alternative paths describe the exception-handling capabilities of the system. They capture, for example:
 - Premature termination of a process
 - Possible error conditions
 - Unusual exercising of a use case

Interpretation – *Use Cases*

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- **Scenarios:** Each unique path through the use case is called a scenario



Interpretation - *Primary Stakeholder Profiles*

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- **Primary Stakeholder Profiles** are used to define the target user
- The constructs covered include:
 - Context of use
 - Cognitive ability
 - Physical ability
 - Individual profile

Interpretation - *Primary Stakeholder Profiles*

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Context of Use

Motivation

- ☐ Discretionary
- ☐ Mandatory

Frequency of Use

- ☐ Non-User
- ☐ Infrequent
- ☐ Frequent

User Category

- ☐ Beginner
- ☐ Intermediate
- ☐ Expert

Task Nature

- ☐ Mission Critical
- ☐ Calm

Interaction Mode

- ☐ Direct
- ☐ Indirect
-
- ☐ Continuous
- ☐ Intermittent

Social Environment

- ☐ Public
- ☐ Personal
-
- ☐ Collaborative
- ☐ Individual
-
- ☐ Work
- ☐ Entertainment
-
- ☐ Synchronous
- ☐ Asynchronous

Physical Environment

- ☐ Indoor
- ☐ Outdoor

Auditory (Noise Level)

1 = Low 5 = High
1 2 3 4 5

Visual Quality

1 = Poor 5 = Good
1 2 3 4 5

Haptic

- ☐ Constrained
- ☐ Free

Technical Environment

- ☐ Networked
- ☐ Isolated
-
- ☐ Wired
- ☐ Wireless
-
- ☐ Intranet
- ☐ Extranet
- ☐ Internet
-
- ☐ PAN
- ☐ LAN
- ☐ MAN
- ☐ WAN
-
- ☐ Fixed
- ☐ Mobile
-
- ☐ Peripherals
- ☐ Contained

Interpretation - *Primary Stakeholder Profiles*

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- Context of use for a common office desktop system

| Context of Use | | |
|---|---|--|
| Motivation <input type="checkbox"/> Discretionary <input checked="" type="checkbox"/> Mandatory | Social Environment <input checked="" type="checkbox"/> Public <input type="checkbox"/> Personal | Technical Environment <input checked="" type="checkbox"/> Networked <input type="checkbox"/> Isolated |
| Frequency of Use <input type="checkbox"/> Non-User <input type="checkbox"/> Infrequent <input checked="" type="checkbox"/> Frequent | <input checked="" type="checkbox"/> Collaborative <input checked="" type="checkbox"/> Individual <input checked="" type="checkbox"/> Work <input type="checkbox"/> Entertainment | <input checked="" type="checkbox"/> Wired <input type="checkbox"/> Wireless <input checked="" type="checkbox"/> Intranet <input checked="" type="checkbox"/> Extranet <input checked="" type="checkbox"/> Internet |
| User Category <input type="checkbox"/> Beginner <input checked="" type="checkbox"/> Intermediate <input type="checkbox"/> Expert | <input checked="" type="checkbox"/> Synchronous <input checked="" type="checkbox"/> Asynchronous | <input type="checkbox"/> PAN <input checked="" type="checkbox"/> LAN <input checked="" type="checkbox"/> MAN <input checked="" type="checkbox"/> WAN |
| Task Nature <input type="checkbox"/> Mission Critical <input checked="" type="checkbox"/> Calm | Physical Environment <input checked="" type="checkbox"/> Indoor <input type="checkbox"/> Outdoor | <input checked="" type="checkbox"/> Fixed <input type="checkbox"/> Mobile |
| Interaction Mode <input checked="" type="checkbox"/> Direct <input checked="" type="checkbox"/> Indirect | Auditory (Noise Level) 1 = Low 5 = High 1 2 3 4 5 | <input checked="" type="checkbox"/> Peripherals <input type="checkbox"/> Contained |
| <input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent | Visual Quality 1 = Poor 5 = Good 1 2 3 4 5 | |
| | Haptic <input type="checkbox"/> Constrained <input checked="" type="checkbox"/> Free | |

Interpretation - *Primary Stakeholder Profiles*

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- The **cognitive abilities** of the target users affect the design
- The cognitive abilities of the target users may be specific (e.g., an educational game for a specific grade level) or more general (e.g., a web site for a broader audience)

Interpretation - *Primary Stakeholder Profiles*

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MAXIM

Domain expertise may not correlate with computer literacy

Cognitive Ability

Educational Level

- ☐ Elementary
- ☐ Middle School
- ☐ High School
- ☐ Undergraduate
- ☐ Graduate School
- ☐ Post Graduate

Typing Skill (Words per Minute)

Novice _____
Intermediate _____
Expert _____

Domain Knowledge

1 = Novice 5 = Expert
1 2 3 4 5

Computer Literacy

System

1 = Low 5 = High

1 2 3 4 5

Application

1 = Low 5 = High

1 2 3 4 5

Cognitive Style

- ☐ Visual
- ☐ Auditory
- ☐ Graphical
- ☐ Linguistic

Interpretation - *Primary Stakeholder Profiles*

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- The human condition includes wide ranges of **physical abilities**
 - Visual
 - Auditory
 - Haptic

Physical Ability

Visual

- ☐ Blind
- ☐ 20/200
- ☐ 20/100
- ☐ 20/70
- ☐ 20/50
- ☐ 20/40
- ☐ 20/30
- ☐ 20/25
- ☐ 20/20

Color Vision

- ☐ Trichromatic
- ☐ Protanomaly
- ☐ Deuteranomaly

Auditory 1 = Deaf 5 = Normal
1 2 3 4 5

Haptic

- ☐ Disabled _____
- ☐ Fully Functional

Interpretation - *Primary Stakeholder Profiles*

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- There are situations when personal user information is required

Individual Profile

Age

- ☐ Early Childhood
- ☐ Childhood
- ☐ Preteen
- ☐ Teen
- ☐ Young Adult
- ☐ Adult
- ☐ Middle Age
- ☐ Senior

Gender

- ☐ Male
- ☐ Female

Occupation

Interests

Country

Region

Language

Ethnicity

Religion

Socio-Economic

Documentation

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- Documentation as outcome of the Discovery phase consists of
 - Mission statement (project concept)
 - Requirements document
 - Project management document

Documentation

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- **Mission Statement**

- **Project goals**

- ✦ What needs will the new system address?
 - ✦ How will it address these needs?
 - ✦ What is the utility of the proposed system?

- **Project scope**

- ✦ What does the proposed design include or exclude?
 - ✦ What are the external constraints such as time and finances?
 - ✦ How will you decide when it satisfies the design proposal?

Documentation

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- **Requirements Document**
 - Detailed requirements, on several levels of priorities (recommended, 3 levels)
 - ✦ Functional
 - ✦ Non-functional
 - Inputs/outputs

Documentation

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- **Project Management Document**
 - Definition of the tasks involved in the project
 - People assigned to tasks
 - Risk assessment
 - Evaluation criteria and methods
 - Implementation timeline
 - Training
 - Maintenance
 - Future needs

Video Selection

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- HCI videos

[Sketch furniture by Front] [High-speed robot hand]

[MIT's Nexi robot] [Honda Asimo] [Corning - glass]

[Augmented reality by Hitlab] - Nitish

[MS surface patient consultation] - Andrew

[Augmented maps] - Rakib

[Microsoft Kinect] - Warren and Parth

[BumpTop] - Nitish