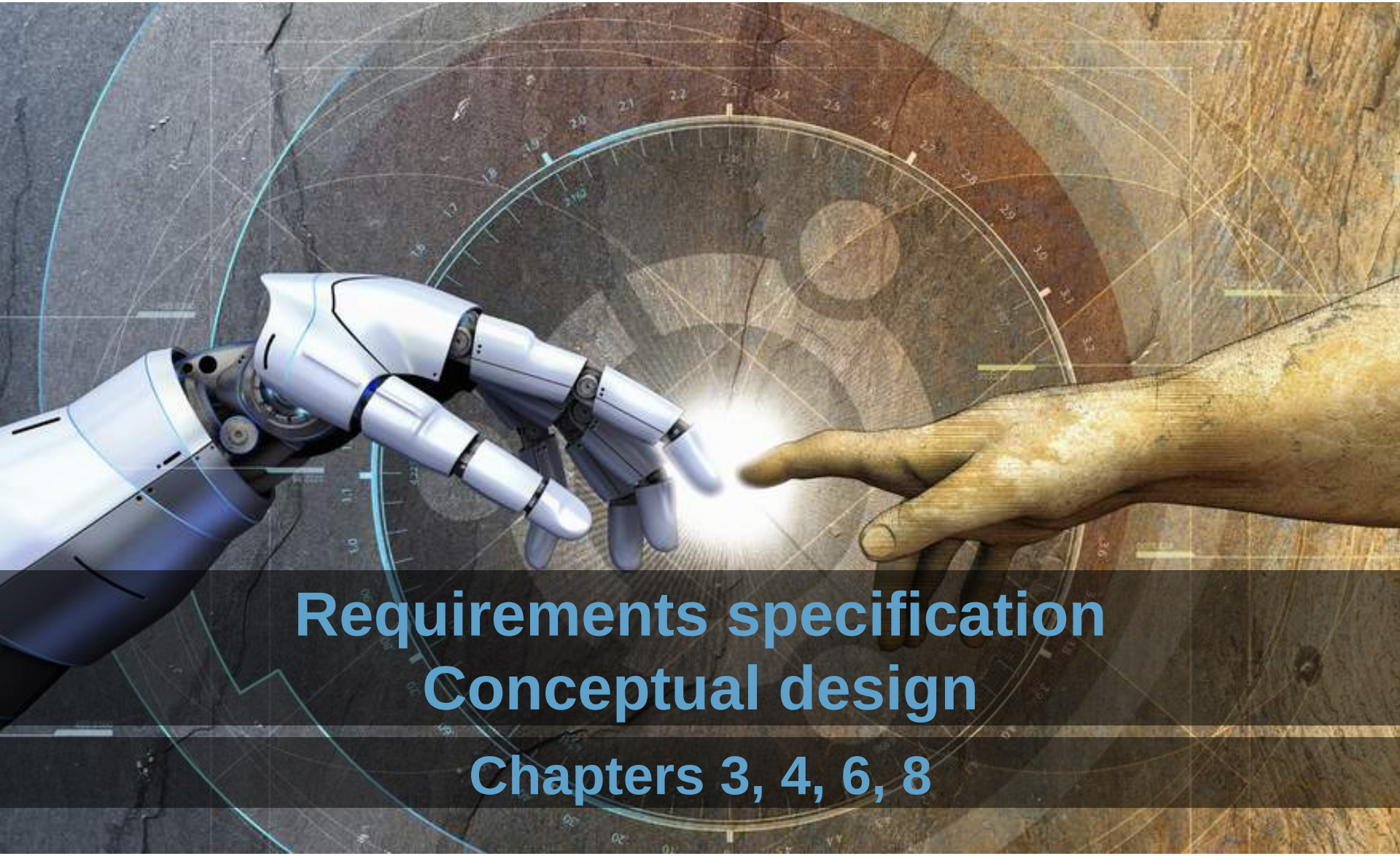


Requirements specification
Conceptual design
Chapters 3, 4, 6, 8

Lora Aroyo
Web & Media Group

This lecture

- Focus on specification techniques for requirements and conceptual UI design

- Next lecture: focus on the knowledge you need to make design decisions

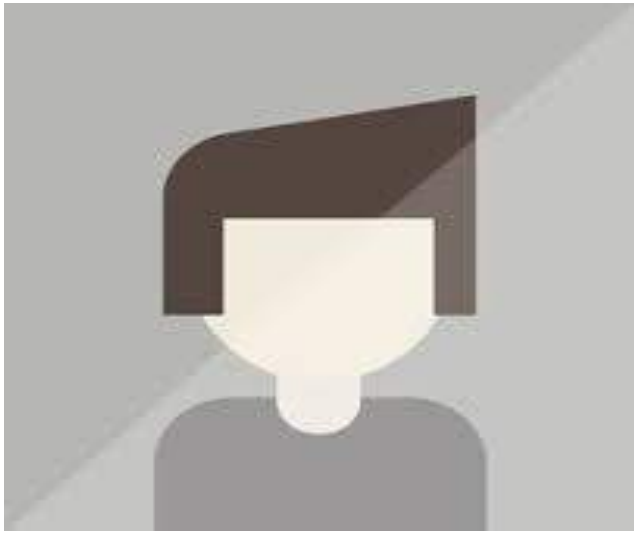
Analysis of User Profile, Context, and Tasks

Types of information about requirements

Focus of investigation	Information gathered
The domain	Wider specialist knowledge Specific knowledge for a computer system
The users	Who they are; focuses on the *real* (primary) users, but also considers other stakeholders (secondary users)
Characteristics of the users	Age, sex, culture, physical abilities and physical disabilities, educational background, computer/IT experience, motivation, attitude, enjoyment, satisfaction
Characteristics of the tasks	Are the tasks easy, complex, novel, variable, repetitive, frequent or infrequent, single tasks or multitasking, time critical, requiring individual or collaborative working? Are there safety issues in relation to the work?

Types of information about requirements

Focus of investigation	Information gathered
Physical environment	Noise, stress, comfort, dirt, dust, heating, lighting, ventilation, furniture, working space, individual offices, open-plan areas, equipment layout, hazards in the workplace
Social environment	Pressure of work, individual or collaborative working, individual offices or open-plan areas
Organizational environment	Organizational mission and aims, organizational attitude to IT, organizational policies, job design, and roles
User support environment	Availability of training, availability of colleagues/experts, availability of manuals or online help
Qualitative usability aspects	General, often unquantifiable goals, such as easy to learn, UI intuitiveness
Quantitative usability goals	Measurable goals, such as usability metrics
Constraints	Costs, timescales, budgets, technology hardware and software
Trade-offs	Conflicting/contradictory requirements



USER PROFILE

User Profile: Basic Steps

1. Gather **background information** about the work being performed

2. Collect and analyze data from **contextual observations** & **interviews** with users
   - during their real work in the actual environment
   - during user studies

3. **Construct & validate a model** of the user & user's current task organization

Identifying User Profile

- Stakeholders (categories of users)
  - primary users, secondary users
  - characteristics
    - age, sex, culture
    - physical abilities and physical disabilities
    - educational background
    - computer/IT experience
    - motivation
    - attitude, enjoyment, satisfaction

Identifying User Profile

- If you know who the real users are
  - ➢ questionnaire

- If you are unsure about who the real users are
  - ➢ interview knowledgeable people in the organization, e.g. domain experts, managers, work supervisors, personnel managers, and product development managers - to find out about the users

The result should be captured along the lines of the following examples

Step 1: Example of **Initial** User Profile

User Characteristics	Museum Professional
Age	22 to 54 years
Occupation **Role**	6 curators 5 registrars 5 researchers
Organization	10 from musea 6 from ICN
Tasks	Information search
Field of expertise	7 Ethnography 7 Classical Dutch Art 2 Contemporary Art

Step 2: Example of **Detailed** User Profile

User Characteristics	Museum Professional		
	Researchers	**Curators**	**Registrars**
Age	22-45	30-45	35-54
Field of expertise	Ethnography Contemporary Art	Ethnography, Contemporary Art, Classical Dutch Art	Ethnography Contemporary Art
Information tasks	a wide range of tasks develop guidelines, recommendations, articles and books, teach and give lectures	collection management and collection documentation management (e.g. arranging loans, acquiring objects and planning for exhibitions)	handle the digitization process of collections in the museum database; annotating collections; handle new entries and check if information is correct;
Attitude	actively looking for information and spreading knowledge into the cultural heritage community	search for interesting perspectives, links and unexplored aspects of artworks and creators	work with curators; prepare reports on the museum collection status
Motivation	improve the understanding and expertise within the cultural heritage domain	make texts accessible to the general audience	maintain collection, keep consistent and up-to-date

Step 3: Example of **Mapping** User Profile → Requirements

User Characteristics	Search UI Requirements
Age range 20-55+	The main UI needs to accommodate users of different ages (e.g. accessibility and levels of computer proficiency)
May be of different field of expertise	There need to be explanations and examples of different types of search input and results (e.g. basic search, /facet search, relational search)
May have different level of knowledge in different collections	There need to be an explicit presentation of the elements of different collections, also duplicates from different collections.
May have different attitude towards information	There need to be different (customizable) presentation of search results. There need to be clear explanation of the ranking and ordering mechanisms
May have different understanding of terminology and thesauri	There need to be term explanations (definitions). There need to be explanation of different search categories

Alternatively: Personas User Profile

- a precise description of a user and her usage wishes
- imaginary examples of real users
- *as specific as possible* details
- name and image (refer to them by name)
- project's "cast of characters"
- at least *one primary persona* - main focus of design
- likely to be robust, however - based on assumptions

➢ *provide shared basis for communication, enabling a broader range of information to be conveyed to all the project participants and stakeholders*

For each persona include:

- A ***name, age, defined lifestyle,*** workstyle
- A ***catchphrase*** to distinguish the persona from others
- ***Key attributes*** that affect use and expectations of the product, service, or website
- ***Frequently performed tasks***
- ***Tools*** and resources used

Example: Persona

Anne: Persona for the user group “curator”

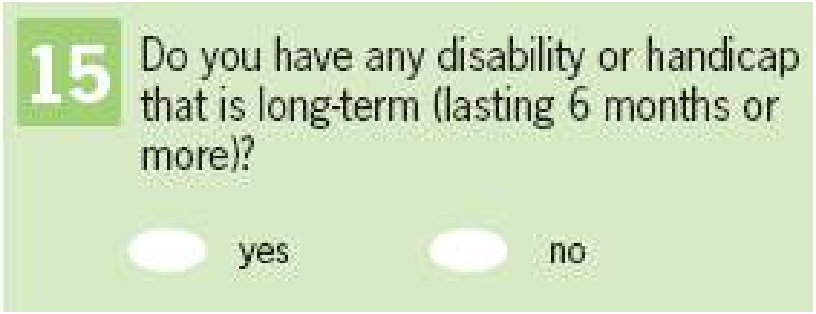
- Anne is 33 years old
- She performs a wide range of *information-related tasks*, ranging from researching conservation techniques to *building term classifications* for describing contemporary art
- She regularly *develops guidelines*, recommendations, articles and writes books
- She also *teaches* and gives lectures
- Anne is responsible for the *management of the museum collection* and the corresponding *documentation*. This sometimes extends to arranging loans, acquiring objects and planning for exhibitions

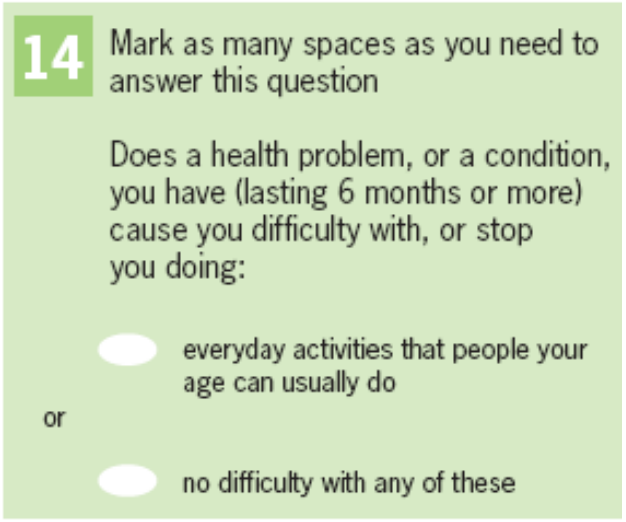
Additional Consideration

Disabilities

- about eight percent of the male population and one percent of the female population suffers from *color blindness*, e.g. red/ green or blue/yellow difficult to distinguish

- also *visually impaired*, e.g. require large fonts, less items on the screen



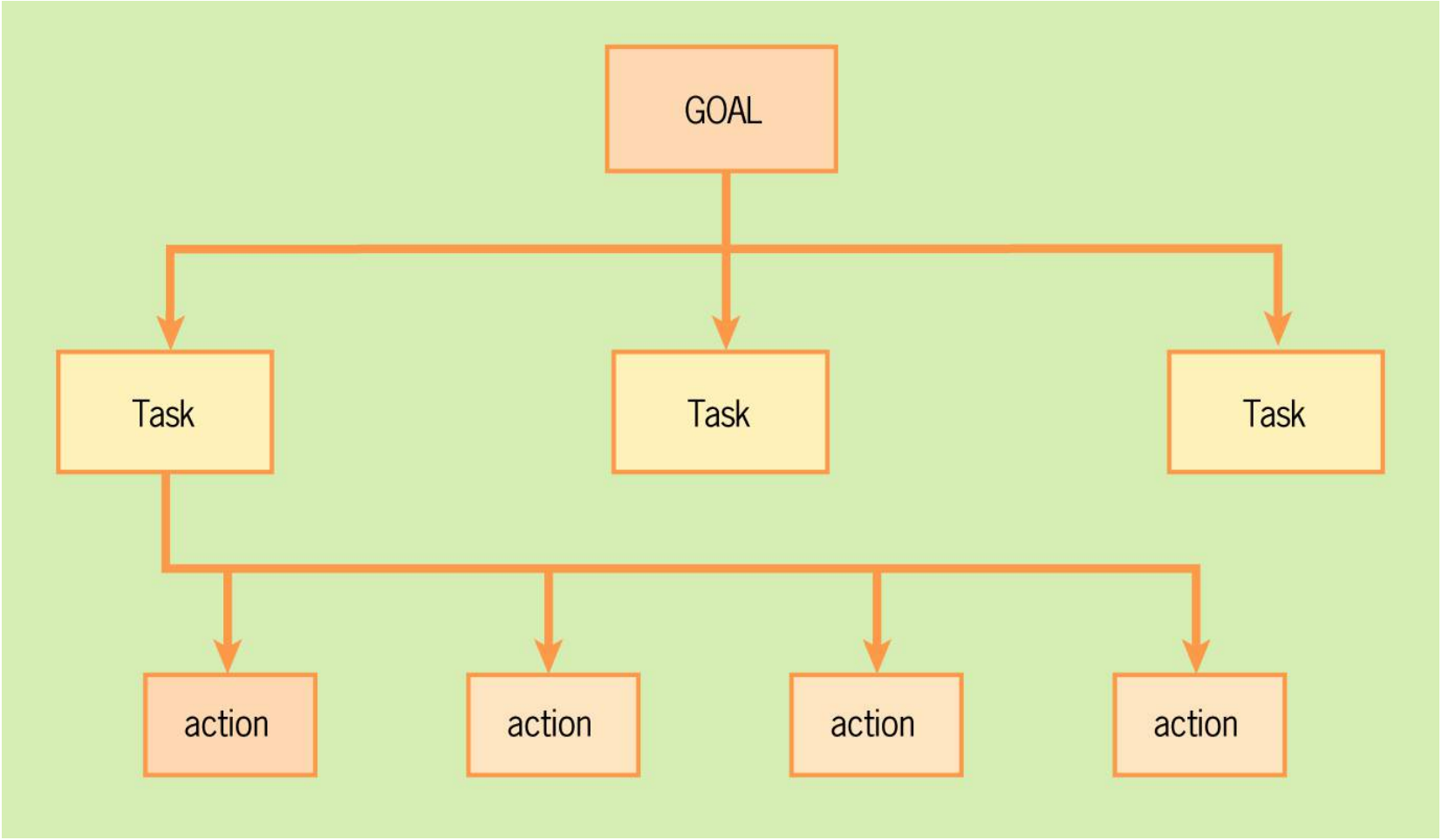


USER GOALS, TASKS, ACTIONS

Goal-Task-Action

- **Goal:** the **end result** to be achieved
- **Task:** **structured set of related activities** that are undertaken in some sequence
- **Action:** an **individual operation or step** that needs to be undertaken as part of the task

Goals, Tasks, Actions



Typical activities

- Identify the main work tools or objects
- Collect ***task scenarios*** or instances of ***use cases***
- Gain insight into users' work model
- Gain insight into users' goals
- Learn users' jargon
- Gather statistics about use cases
  - e.g. relative frequency, range, average time to complete, number and types of errors
- Gain insight into problems, bottlenecks, errors
- Gather data about work environment

Task scenario

Describes what users do now

Task scenario. Search and request resource

Julia, a lecturer in the department, is looking for a particular CD-ROM containing examples and exercises on Object Oriented Analysis and Design. She knows that Tom, another lecturer, mainly teaches Object Oriented Analysis and Design so she knocks on his door. Unfortunately he is not there, so she leaves a note on his door. Later he returns and searches for her, finding her in the coffee bar. He tells Julia that Geoff has the CD-ROM. Unfortunately Geoff is on leave, so Julia telephones him and he promises to post it to her.

Concrete use case

Tabular form of scenario of user behavior

User action	System response
The academic enters one or more of the search parameters for the CD-ROM: title, year and platform	The system displays the search results
The academic selects a search result	The system displays the full details of the CD-ROM and the contact sdetails for its ownerm who is a research student
The academic chooses the e-mail address	The system displays a message area
The academic writes and sends the e-mail request	The system confirms the sending of the request

Essential use case

Similar to UML use cases; abstracted form

User's purpose	System responsibility
Enter search parameters	Show results
Select a resource	Show the contact details of the owner of the selected resource
Send an e-mail	Confirm the send

Use scenario (used only in design!)

Scenario of the desired future interaction

Use scenario. Search and request resource

Julia is looking for a particular CD-ROM containing examples and exercises on Object Oriented Analysis and Design. She accesses the digital library from home and types in the key phrase 'Object Oriented Analysis'. The system retrieves one result. Geoff owns the appropriate CD-ROM. Julia then sends an e-mail to Geoff, asking to borrow the CD-ROM.

Identifying User Tasks

- Tasks Characteristics & how are they supported by the systems
  - easy, complex, novel, variable, repetitive, frequent
  - single tasks or multitasking
  - time critical
  - requiring individual or collaborative work
- Task Sequences

Tasks Characteristics: Example

http://e-culture.multimedian.nl/demo/search

Task Characteristics for Information Search by Curators	
How frequently is the task carried out?	Several times every day
Is the task time critical?	Not necessarily, however the speed to find information is desirable
Will the user normally switch between several tasks?	Typically, yes. Searching for several things at the same time, as well as entering artworks annotations, label information, etc.
Is there a need for term classification during this task?	Depending on the level of expertise of the curator. Sometimes it is critical, sometimes not necessary
Is the task done alone or with others?	Most of the time is done alone

Task Analysis Questionnaire: Example

http://www.chip-project.org/demoUserStudy2/

9. How much time do you usually spend in a museum (excluding the line and the shop)?

- ○ less than 30 minutes
- ○ 30-60 minutes
- ○ 1-2 hours
- ○ more than 2 hours
- ○ 1 day

10. How many artworks do you usually see?

- ○ less than 10 artworks
- ○ 10-20 artworks
- ○ 20-50 artworks
- ○ 50-100 artworks
- ○ more than 100 artworks

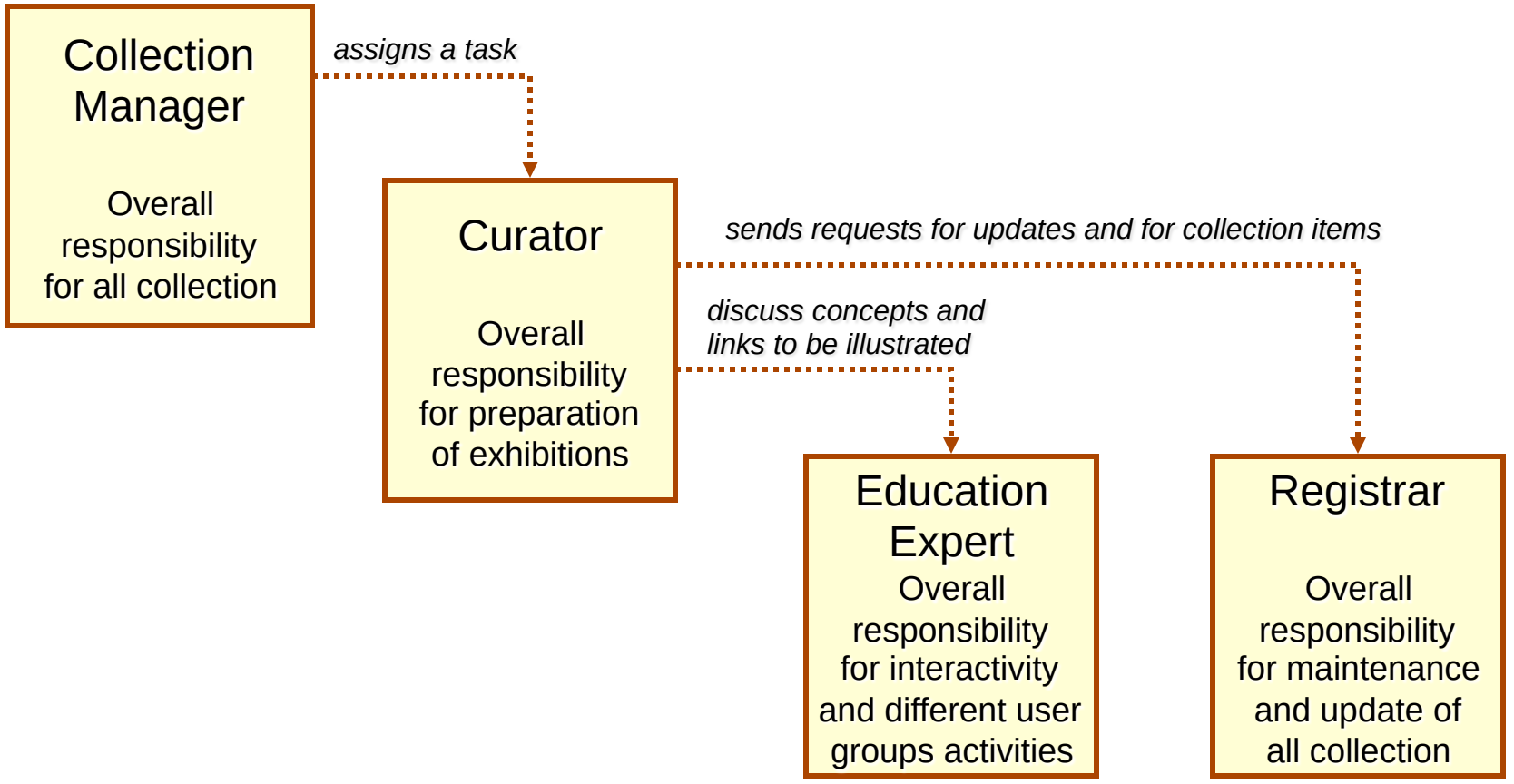
11. Do you usually visit museums alone or with others?

- ☐ alone
- ☐ with family
- ☐ a group of friends
- ☐ school group
- ☐ group tour
- ☐ other: _____

13. Do you usually prepare (refresh your knowledge) before visiting a museum

not at all ○ ○ ○ ○ ○ very much

Overview of Workflow Analysis



Mental Models

- Norman (1988, p.17):
  - … the models people have of themselves, others, the environment, and the things with which they interact

- Jameson (2000):
  - user's mental model of a system is a set of beliefs about:
    - system's (perhaps unobservable) structure
    - how system works
  - mental models are used to explain observable events in terms of unobservable structures and events

Characteristics of Mental Models

- Incomplete
- Partial
- Subject to change
- Possibly inconsistent
- Based on imperfect observation and inference

- What are mental models good for?
  - *predicting what will happen* when the user performs some action for the first time
  - understanding what has happened when the system shows some *unexpected behavior*

Mental model types

- Structural models
  - How is the composition of the “system”?
  - Example: stylized map London Underground
- Functional model
  - How does a system work?
  - What causes what?

Structural models are far more common in humans!

Example: London Underground

Usability requirements

- Effective
- Efficient
- Engaging
- Easy to learn
- Error tolerant

New model; old model was directed towards work place, not home environment

Specifying usability requirements

- Qualitative requirement
  - It should be easy to learn to how to order new books
- Quantitative (operational) requirement
  - 90% of the users in the 18-25 age group should be able to order a book within 2 minutes

You can use quantitative requirements for testing!

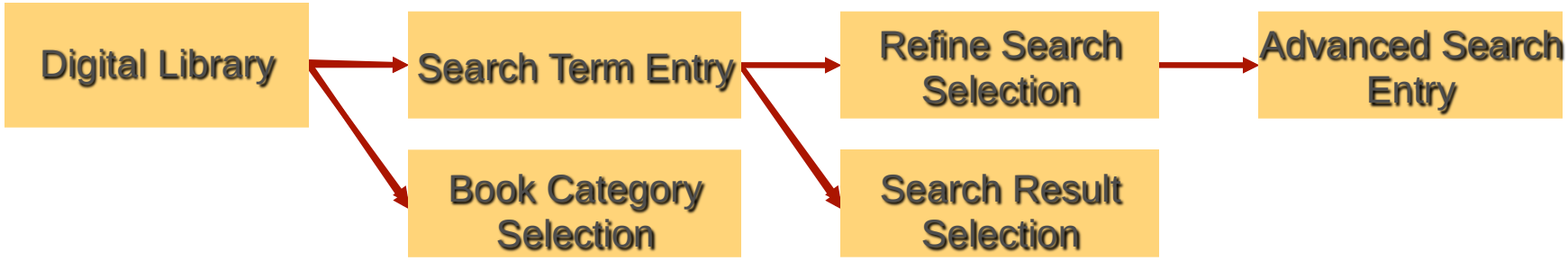
Mapping usability requirements to design tactics

Dimension	Key needs	Design tactics
Effective	Accuracy	Consider how many places in the interface are opportunities for error, and protect against them. Look for opportunities to provide feedback and confirmations.
Efficient	Operational speed	Place only the most important information in front of the user. Work on navigation that moves as directly as possible through a task. Be sure the interaction style minimizes the actions required.
Engaging	Draw users in	Consider what aspects of the product are most attractive and incorporate them into the design.
Easy to learn	Just-in-time instruction	Create step-by-step interfaces to help users navigate through complex tasks. Look for opportunities to provide small chunks of training.
Error tolerant	Validation	Look for places where selection can replace data entry. Look for places where calculators can support data entry. Make error messages include opportunities to correct problems.

Conceptual Design
Content Diagrams, Scenarios and Use Cases

Organization & Structure of UI

functions the screens should support



→ based on the requirements gathered & on concrete use cases

→ identifies the main functional areas & relationships between them

→ low-fidelity prototype of the organization & structure of UI from designer's perspective

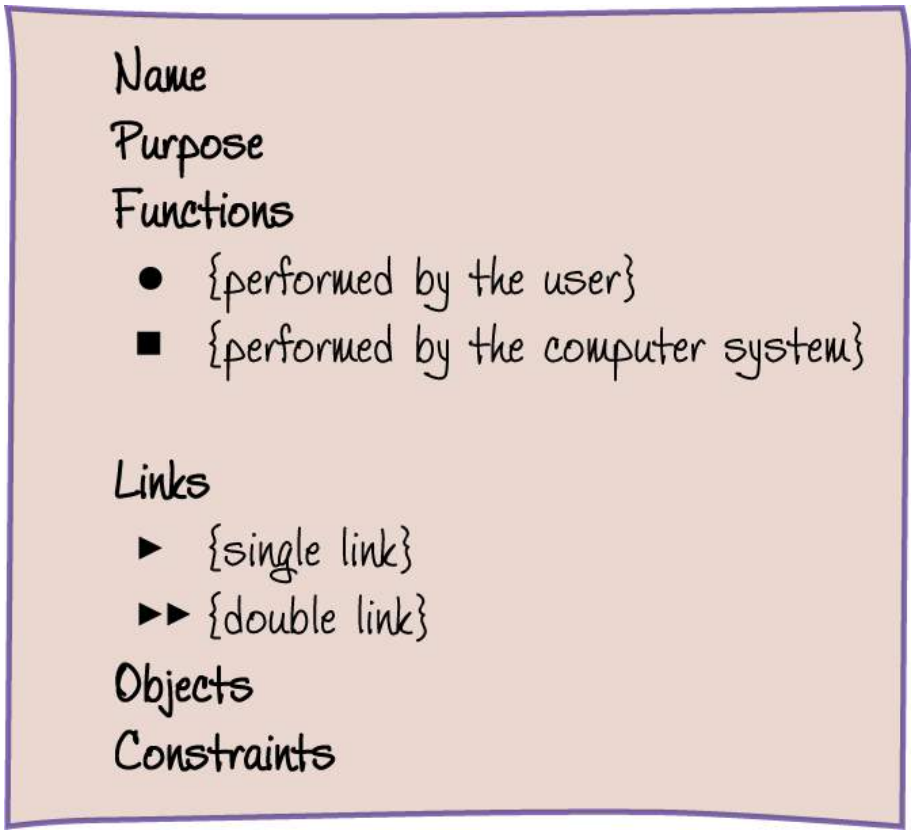
In the Final UI …

- containers → may become **screens**
  - links → **navigation** elements, e.g. hypertext links, selectable areas, menus
- containers → may become **windows**, dialog boxes, or message boxes
  - links → **buttons** and menu items
- navigation around the final UI may be slightly different → several containers may be combined to form a single screen

for example: in a voice messaging system containers become clusters of menus and their associated responses

Template for Containers

- **Name of the container**
- **Purpose** in supporting user's task
- **Functions**
  - invoked by user to perform her work
  - automatically invoked by the system
- **Objects**
  - task objects with attributes and actions required for users to complete their tasks
- **Constraints**
  - any constraints for that container, e.g. speed, reliability, and availability



Two sample containers

Main

Supports most frequent tasks

Functions

- Search resources
- View current updates
- Contact support team

Links

- Enter search details
- View updates
- Contact

Objects

Constraints

Enter search criteria

User can specify the search criteria for a resource

Functions

- Enter keywords, title, author
- Check search criteria

Links

- View search results

Objects

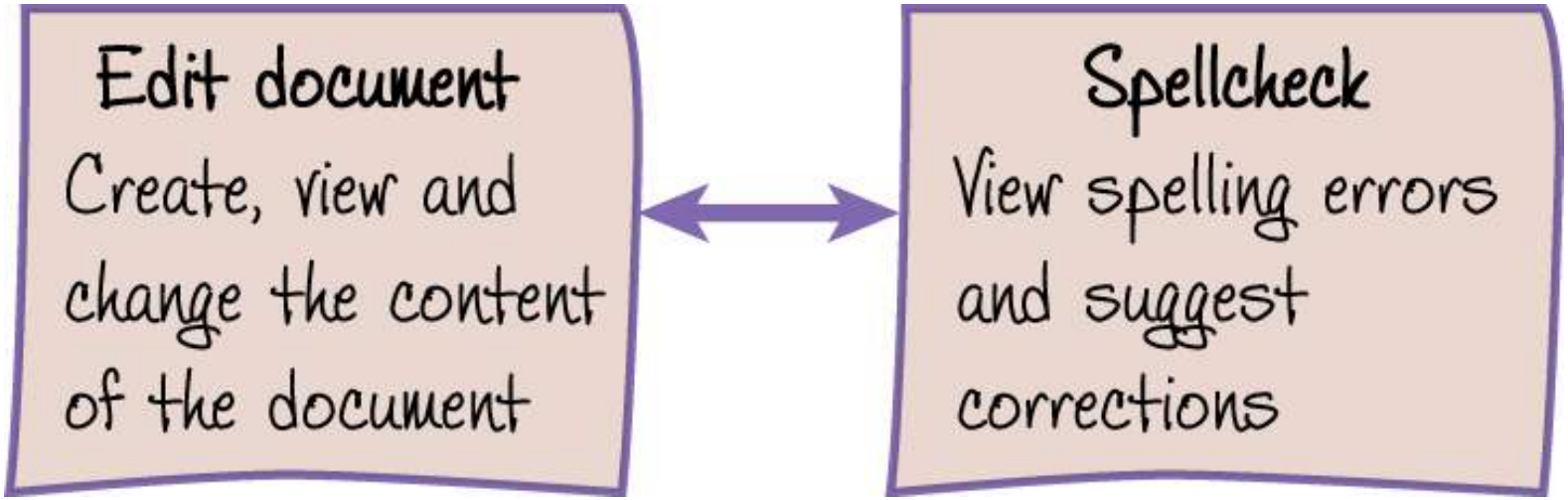
Resource

Constraints

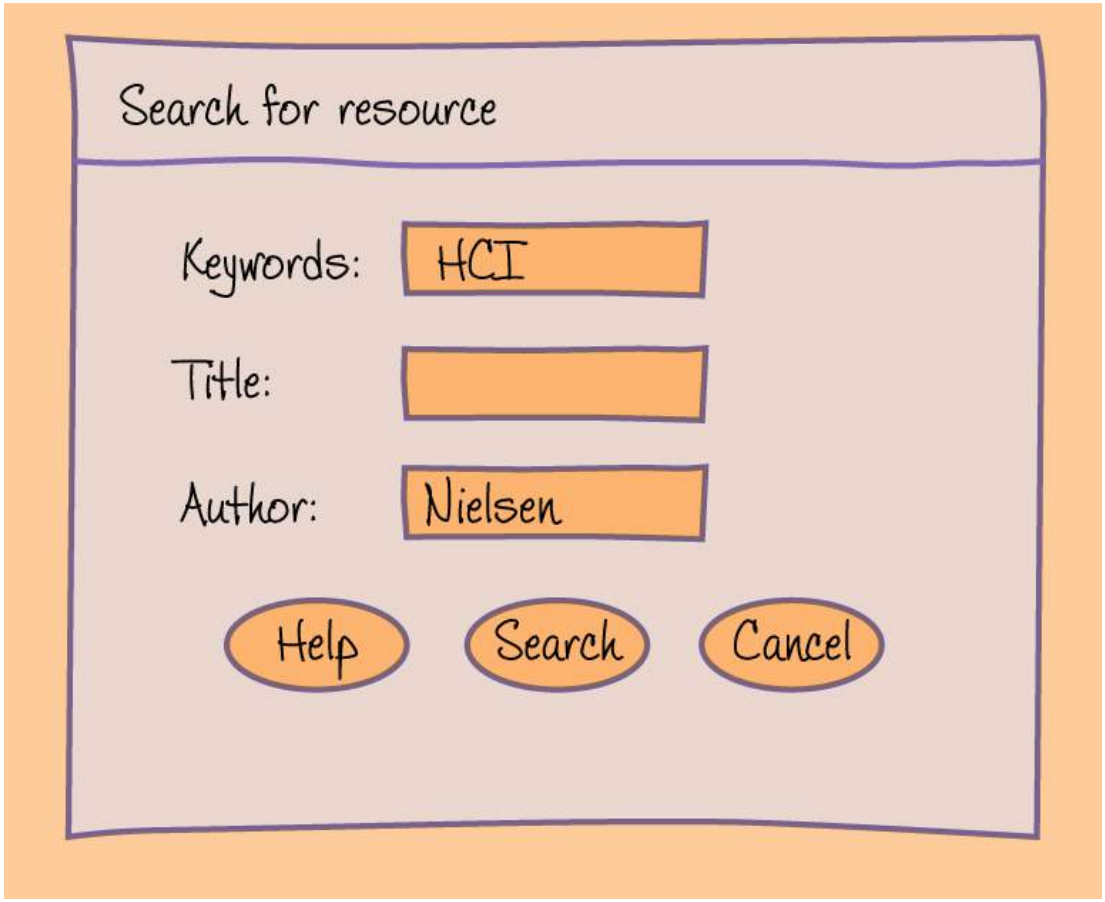
Search needs to take less than one second

Link associate containers with other containers

Double link means user gets back to source container after completion of task



Drawing sample screen for container



To Produce Content Diagram …

you need to do:

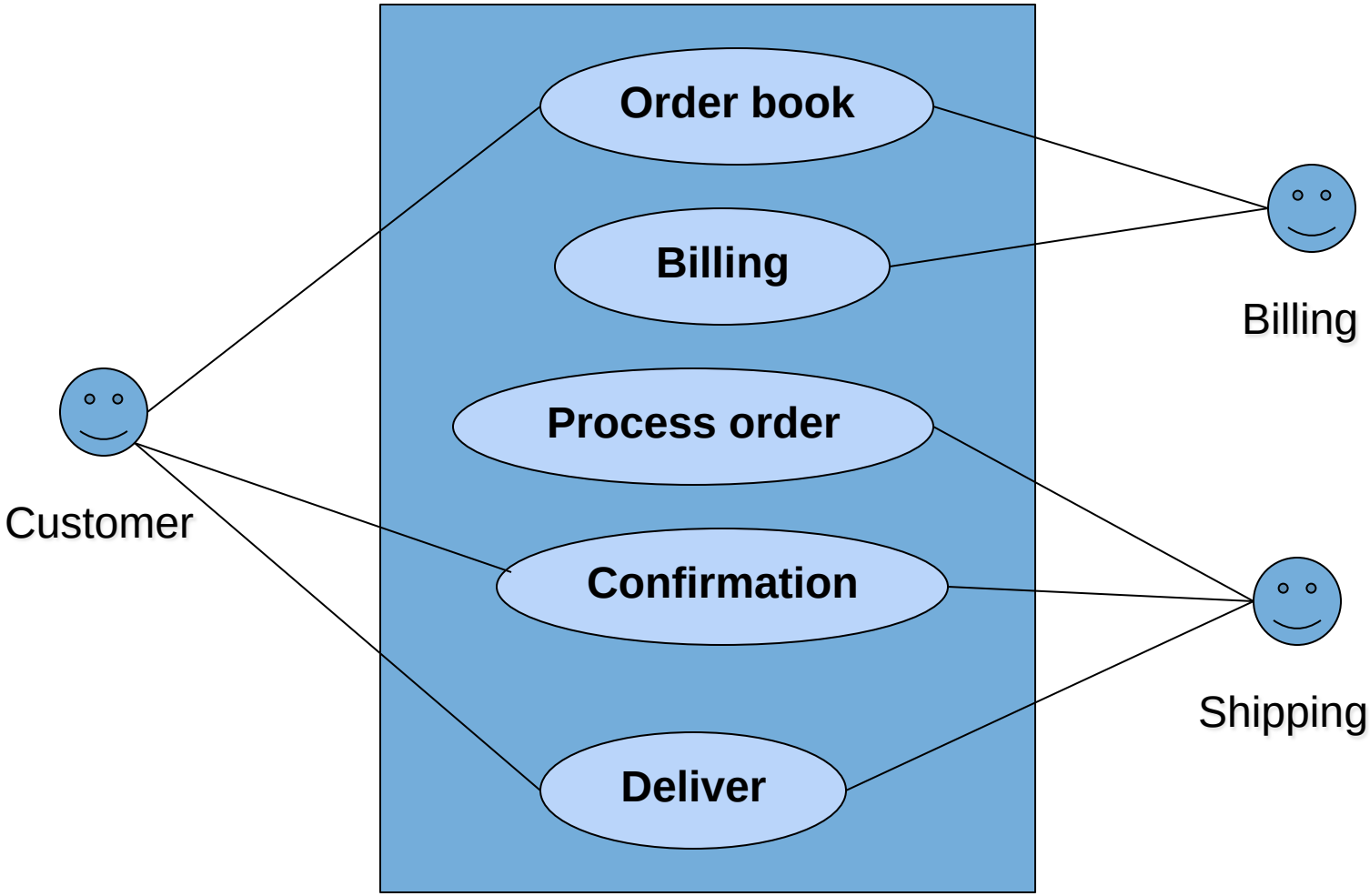
- derive concrete use cases from the essential use cases
- identify primary task objects, attributes, and actions
- identify different containers and task objects that go in
- link the containers to show the navigation flow

Use Case Description Example (1/2)

Buy a Book Scenario:

- Customer orders a book using ISBN
- **Actors**: customer, system
- 'complete order' additional use case
- **Steps**:
  - Customer locates search field
  - Customer enters ISBN in search field
  - Customer press search button
  - System displays description page of the book
  - Customer verifies and press 'order' button
  - Customer completes the order
- **Alternatives**: ISBN incorrectly entered

Use case diagram



Scenarios and use cases

Task scenario. Search and request resource

Julia, a lecturer in the department, is looking for a particular CD-ROM containing examples and exercises on Object Oriented Analysis and Design. She knows that Tom, another lecturer, mainly teaches Object Oriented Analysis and Design so she knocks on his door. Unfortunately he is not there, so she leaves a note on his door. Later he returns and searches for her, finding her in the coffee bar. He tells Julia that Geoff has the CD-ROM. Unfortunately Geoff is on leave, so Julia telephones him and he promises to post it to her.

Julia is looking for a particular CD-ROM containing examples and exercises on Object Oriented Analysis and Design. She accesses the digital library from home and types in the key phrase 'Object Oriented Analysis'. The system retrieves one result. Geoff owns the appropriate CD-ROM. Julia then sends an e-mail to Geoff, asking to borrow the CD-ROM.

ts

the full details of the
ontact sdetails for its
search student

a message area

the sending of

Identifying Task Objects (1/3)

- Task Objects = Primary Task Objects
- Task Objects = Units of information or data with which users interact to carry out tasks
  - high-level objects
  - only a few primary task objects, and easy to identify

if you were designing UI for hotel registration system → only two primary task objects:

- *one corresponding to the customer*
- *another one corresponding to the room*

Identifying Task Objects (2/3)

- Group task objects into classes, for example:
  - resource is a class, containing book, CD-ROM, video, and journal.
  - attributes that are common to all the resource types, e.g. keywords, title, and author
- Classes = type of task object, because users can interact with them
- Group classes into higher-level classes and creating a hierarchy

Identifying Actions

- When users carry out their tasks
  - perform various actions on the task objects in the concrete use cases
  - view, create, delete, copy, save, edit, print

Mark-up Concrete Use Cases

Markup convention:

- Single-underline nouns → correspond to task objects
- Double-underline → attributes of these task objects

User action	System response
Academic enters one or more of the search parameters for the CD-ROM: title, year and platform	The system displays the search results
The academic selects a search result	The system displays the full details of the CD-ROM and the contact details for its owner, who is a research student
The academic chooses the e-mail address	The system displays a message area
The academic writes and sends the e-mail request	The system confirms the sending of the request

Unlikely to identify all task objects and attributes

→ should give most

Object-Action-Attribute Table

Table 8.1 Object–Attribute–Action Table CD-ROM Task Object

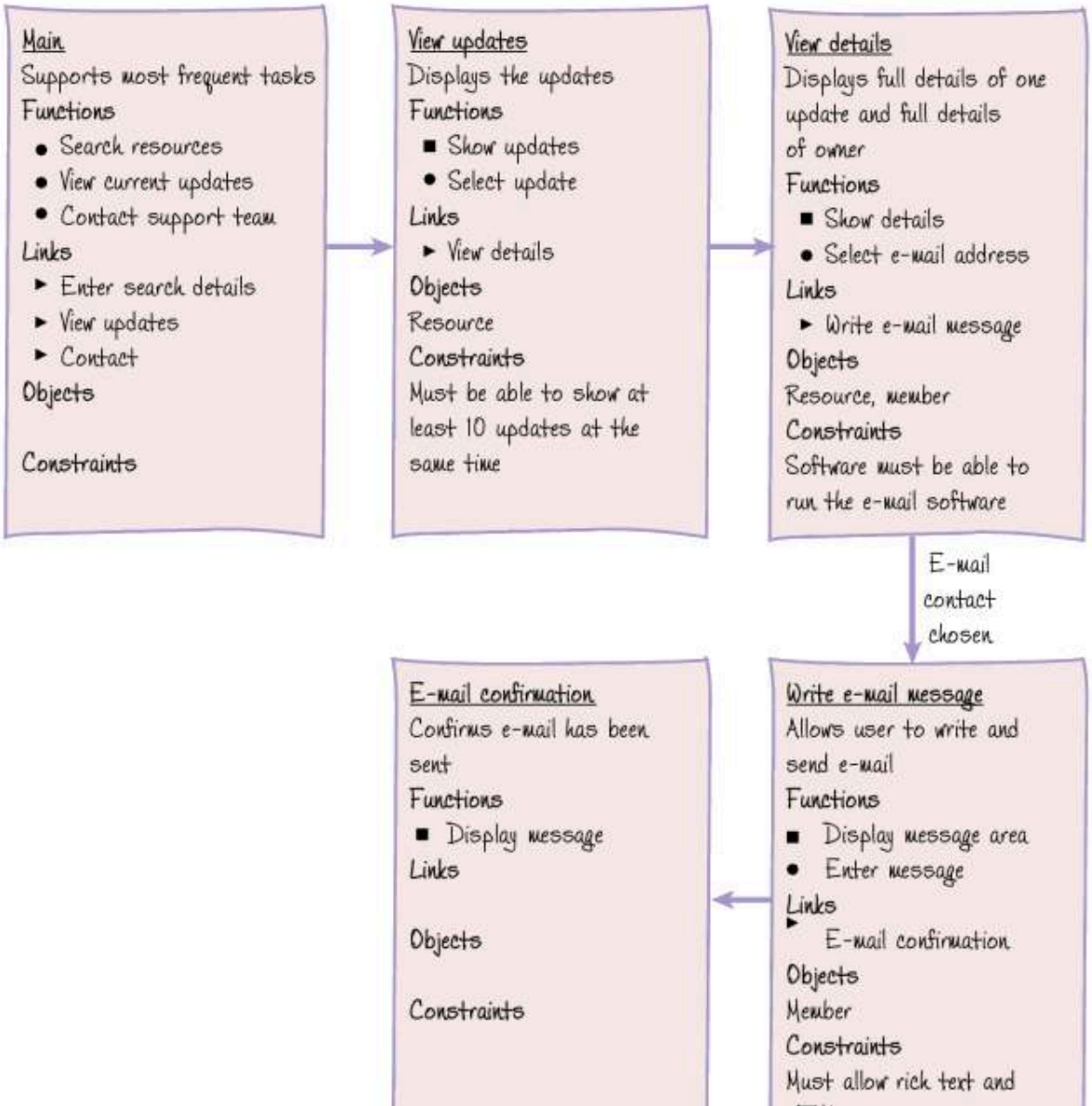
Task object	Attributes	Actions
CD-ROM	Keywords Title Author Year Platform Owned by (academic, researcher, or research student)	View Add Print Delete Save Reserve Edit

Table 8.2 Object–Attribute–Action Table: Academic Task Object

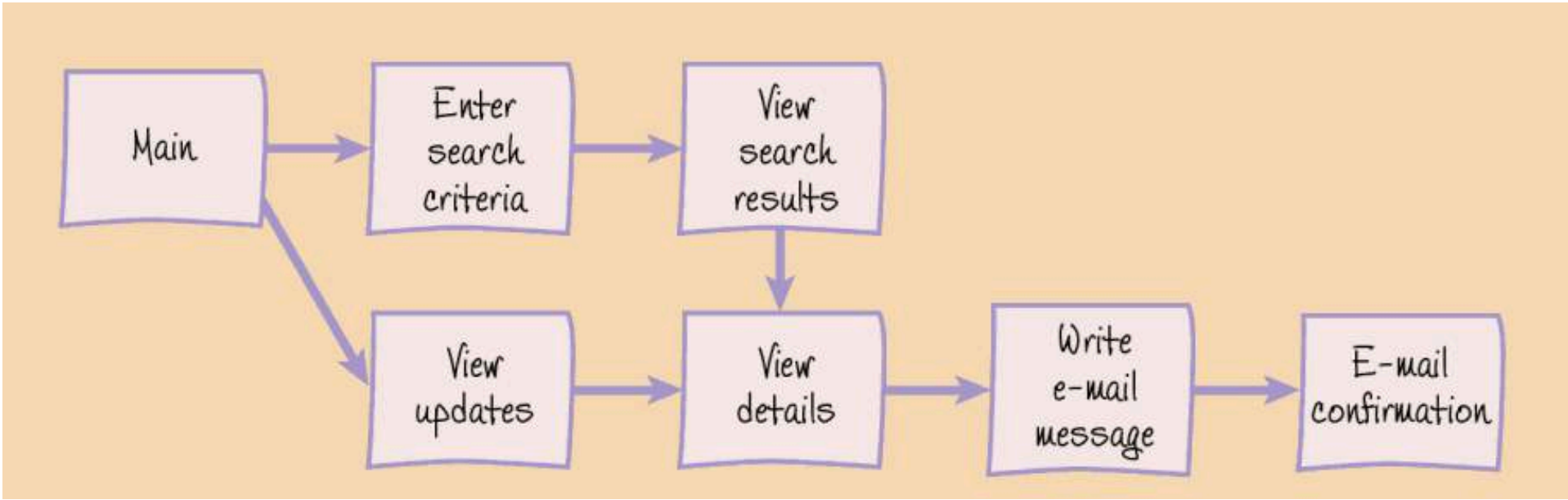
Task object	Attributes	Actions
Academic	Name Phone number Office number E-mail address	View Add Edit Print Save Delete

Containers for search use case

Containers for view-updates use case



Resulting content diagram: merging common containers



IN SUMMARY

In this lecture …

- You saw
  - Different ways of describing UI requirements
  - Notations for specifying the conceptual design of UI

- Next time:
  - Design knowledge: how to make design decisions