林肯教育

FIT5152 20S2 期末复习资料

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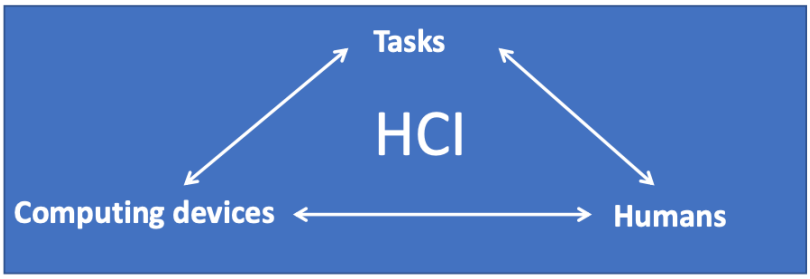
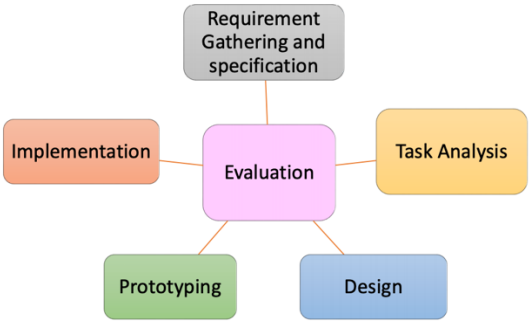
C1 Introduction to HCI and User Interface Design

- HCI deals with the interactions between **humans and computing devices**, where certain **tasks** are performed （HCI 概念）
- Tasks: set of activities undertaken in order to achieve a specific goal
- Computing devices include:
  - laptops, desktop computers, tablets, mobile phones, smartwatches, smart TV, ATM, vending machine, ticket machines, self-checkouts, the flight deck of an aircraft carrier, Google Home, Amazon Echo, …



图片一定要记住

- Design of Interactive Systems

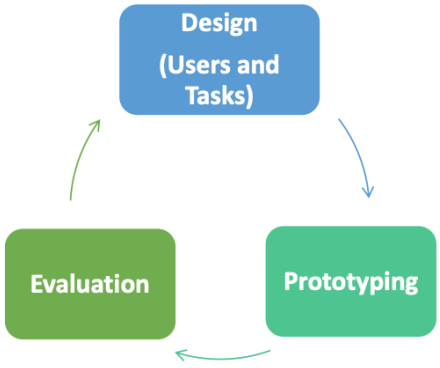


The Star Life Cycle Model (Adapted from Hix and Hartson 1993)

Waterfall Model

Lifecycle 会考简答题，对每一步进行概念解释+举例

- Three Main Aspects of HCI



HCI process (Adapted from Greenberg, 1996)

  - How do we design it?
    - Early design approaches:
      - Gathering data and defining requirements:
        - User analysis (know your user)
        - Task analysis
        - Environment/domain analysis

        - Data collection methods: interviews, questionnaires, focus groups, or observation
    - Conceptual design
        - Description of what the system should do and look like
    - Physical design
        - Considers the physical details of the system
- Prototyping techniques
    - Low-fidelity (paper) prototyping
        - Such as sketches, storyboards or scenarios
    - High-fidelity (digital) prototyping
        - Using development tools
        - Not the final product, but looks like the final product
    - Native prototyping
        - Prototyping using the native programming language
- Evaluation techniques:
    - Expert reviews
        - Heuristics evaluation
        - Cognitive walkthrough
    - Usability testing
    - Field studies
    - Observation

- Usability is '**a quality attribute of the UI**' (Norman & Nielsen)
- Usability Aspects 三大万能词汇
    - **Effectiveness**: the accuracy and completeness with which users achieve goals within a context
    - **Efficiency**: based on the resources expended (e.g. time and effort) to complete a task
    - **Satisfaction**: the level of the comfort and acceptability of the system to its users, and the extent to which the user experience that results from actual use meets the user's needs and expectations.
- Importance of UI Design
    - Good design will lead to user satisfaction, business success, and cost savings
    - Good design will help doctors and surgeons with better diagnosis, and pilots with flying airplanes safely
- **User-Centred Design**: …an approach that puts human needs, capabilities, and behaviour first
- Why to involve users?
    - Users bring important knowledge of work tasks
    - Designers can gain a better understanding of users' needs and goals
    - Greater acceptance of the system often results
    - Fewer problems during development
    - Lower maintenance costs over time
    - Products that are easier to learn
    - Reduction in errors
    - Users develop a feeling of ownership through contributing to the development
- Principles of **Human-Centred Design** by ISO
    - The design is based upon an explicit understanding of users, tasks and environments
    - Users are involved throughout entire development
    - The design driven and refined by user-centred evaluation
    - The process is iterative
    - The design addresses the whole user experience
    - The design team includes multidisciplinary skills and perspectives
- Human-Centred Design Activities by ISO
    - Understanding and specifying the context of use
    - Specifying the user requirements
    - Producing design solutions

  - Evaluating the design
- User experience: user's perceptions and responses that result from the use and/or anticipated use of a system, product or service

C2 Design Theories, Models and Principles

- Principles of Discoverability 五个方面的概念+例子必背
  - Affordances 示能
    - Physical objects (and their physical appearance) communicate the information about how we interact with them
    - Affordance is a relationship between the object and the user who discovers how the object can be used
    - Affordance of an object defines what actions we can perform on that object
    - Perceived Affordances
      - In effective design, affordances need to be discoverable and perceivable
      - To design perceived affordances, visible and strong visual clues must be used so we can easily discover how to interact with it.
  - Signifiers 指示符
    - When an affordance is not perceivable, signifiers need to be used
    - Signifiers communicate what actions we can do and where the action should take place
    - They signal the object's affordance
    - Signifiers can be signs, labels, arrows, icons or drawings to indicate how to operate on an object
  - Feedback 反馈
    - Feedback communicates the results of an action
    - Feedback tells us what is happening or/and what happened
    - It can be textual, visual, auditory, or as vibration (mobile)
    - Feedback must be informative
    - Poor feedback can be worse than no feedback
    - Immediate feedback (for inline validation)
    - Feedback is very important to evaluate the results of an action
  - Constraints 限制
    - Constraints provide different ways of restricting the kind of interaction that the user can have
    - They can limit the set of possible actions
    - They prevent user errors, and reduce memory load by minimising the information to be remembered
    - Examples: – using a list of options to select from – disabling a button or menu options – limiting the number of digits or letters in form fields – controlling the order of steps to complete a task
  - Mappings 图示
    - Mappings are the relationships between the elements of two sets of things – two sets include controls and what is being controlled
    - Mapping is important in the design and layout of controls and displays
    - Identifying mappings between the elements should be clear and easy
- Conceptual Models
  - Conceptual Models – Users
    - A conceptual model is our 'true understanding' of a product
    - A conceptual model tries to explain how a product works
    - Conceptual models in the user's mind are known as 'mental models'

- Mental models are created by experience, training or interaction with the product
- Conceptual Models – Designers
  - The designer's conceptual model can be different from the user's conceptual model (mental model)
  - The designer's communication with users is limited to the system image:
    - 1. the physical structure of the product, and the discoverability through using affordances, signifiers, constraints and mappings
    - 2. technical manuals and documentations
- **Knowledge in the Head** 二者区别必考
  - Knowledge in the head is the knowledge in the human memory system
  - It requires learning
  - We can get the knowledge of the world and transfer it into our head
- **Knowledge in the World** 二者区别必考
  - Knowledge in the world is external knowledge
  - "Knowledge in the world is always there, waiting to be seen, waiting to be used"
  - Much of the knowledge we need to perform tasks can come from the information in the world (using affordances, signifiers, feedback and mappings)
- **Cognitive Process**
  - Cognition occurs through cognitive processes
  - Cognitive processes include: 注意简答题
    - attention (the first step) can be visual or auditory,
    - perception and recognition,
    - memory,
    - Learning (and then reading, speaking and listening)
    - reasoning and problem solving (reflective cognition)
  - When users interact with a system/product it involves a number of cognitive processes
- Different types of memory:
  - Sensory memory
    - very short (about milliseconds)
    - most sensory memory will be forgotten soon unless you get it into short-term memory by paying attention to it consciously –
  - Short-term (or working) memory (STM) 掌握例子——选择题
    - holds a small amount of information for a short period of time
    - limited in terms of time and the number of the items it can retain
  - Long-term memory (LTM) 掌握例子——选择题
    - It can retain the information for hours, months or years
    - It has unlimited capacity
- Memory and User Interface Design
  - Long Term Memory
    - Long term memory is the storage of our past experiences and knowledge
    - These memories can form our mental model of a product – This explains the difference between beginners and experts
  - Short Term Memory
    - When interacting with a new interface, the user needs to learn about new elements and how things work, and store them in their short-term memory (with limited capacity)
    - Good design aims to reduce the short-term memory load – E.g. using 'recognition rather than recall'

- Cognitive Load
  - External Cognition
    - We should minimise the need for users to remember things when they are interacting with a new product
    - External cognition can reduce the cognitive load
    - External cognition includes the ways that external representations and aids are used to augment the human's normal cognitive processes
  - External Cognition Categories
    - Externalising •
      - Transforming knowledge into external representations, e.g. using a calendar or diary (birthdays, appointments)
    - Computational offloading • e.g. a calculator
    - Annotating and cognitive tracing • such as Word Track Changes
- Reduce short memory load: 好的设计都要做到这一点
  - by minimising controls and including only those that are necessary we reduce short memory load
  - by minimising clutter and avoid including too much information
  - by making affordances visible, discoverable and perceivable
  - by providing feedback
  - by using natural mapping
  - by using constraints
  - by using consistency and redundancy
  - by considering users' mental models and knowledge in the head (designing based on what users know, and their previous knowledge)

C3 User Requirement Gathering and Analysis

- Data Gathering Methods 简答题——掌握各种数据收集方式的特点、优点、缺点
  - Studying existing documentation – Manuals, instruction books or training materials
  - Researching similar systems/products

*Data collection methods that involve users:

- Observation
  - Passive observation: watching and listening to users in their environments
  - Active observation: asking users questions and having a conversation
  - Hawthorne (or observer) effect: if users are aware of being observed, their behavior may be affected
- Interviews
  - Interviews involve asking users questions about a topic –
    - Close-ended questions: e.g. Yes/No questions, they limit the discussion and data elicitation
    - Open-ended questions: enable exploring, probing and learning more, and allow discussing complex topics
  - Different types of interviews:
    - Structured: using a list of predetermined questions
    - Semi-structured: using some predetermined questions but also allowing further elaboration and discovery
    - Unstructured: mainly using open questions
  - Interviews can be conducted at the user's workplace – It has the advantage of learning more about the user's workplace
  - Interviews can be conducted away from their workplace – It has the advantage of avoiding work related interruptions
- Focus groups or workshops
  - A focus group allows data collection through group discussions
  - Participants are usually key stakeholders

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        - Participants' selection is important
        - It allows participants to discuss their experiences and express their opinions and beliefs
        - An efficient and effective way to highlight the key areas
        - The role of the facilitator/moderator is very important – To lead and manage the discussions – To ensure all topics are covered – To ensure all participants contribute to the discussions
    - Questionnaire – More common in the evaluation phase (usability testing)
        - It can be paper-based or electronic (online)・It allows gathering data from a large group・It allows the user to provide anonymous feedback・It uses a set of standard questions・It can include closed and open questions – Likert scale questions・Questions should be carefully selected or designed・Questions should cover all the key variables and topics・The flow of questions should be right・The questions should be easy to understand・The wording should be clear
- User Skill Levels
    - "Novice or first-time users"
        - With little knowledge of the interface concepts・With little 'knowledge in the head'
        - Importance of providing online tutorials, help, informative feedback, meaningful error messages
    - "Knowledgeable intermittent users"
        - Knowledgeable but not regular users
    - "Expert frequent Users"
        - Very familiar with the task and interface concepts・With more knowledge of head
        - Look for completing tasks quickly and shortcuts
- **Design Personas**
    - A persona: typical example of a user (a user archetype)
    - Personas can provide us with better understanding of user needs, goals and behaviour patterns
    - Goal-directed design involves personas, goals and scenarios
    - Persona: "A precise description of our user and what he wishes to accomplish."
    - Goal: what the user wants to achieve
        - Each persona usually has 2-4 goals
        - Goals are different from tasks, which are performed to achieve goals
    - Scenario: is a narrative to describe the interaction of a persona with a product to achieve a goal in a particular situation
- Hierarchical Task Analysis (HTA)

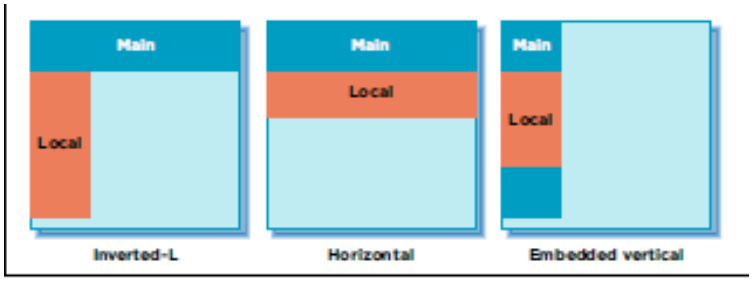
C4 Navigation, Menus and Design Guidelines

Navigation is about finding information by navigating through the interface. The main mechanisms for navigation are the **menus**. Menus are important for navigation.
结合例子掌握各种 menu 长什么样子

Web and Desktop
- Structural navigation: involves navigation between pages according to a hierarchy:

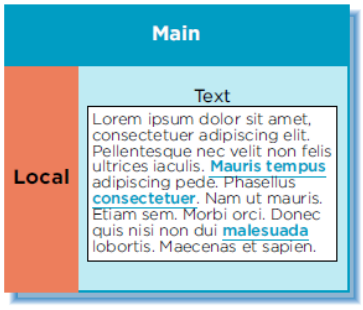
- Primary/main navigation between top-level pages
- Local/secondary navigation between lower levels of the hierarchy
    - Inverted-L

  - horizontal
  - embedded vertical navigation

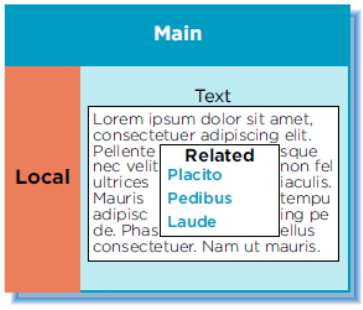


- Associative navigation

- Footer navigation
- quick links
- contextual navigation:
  - Embedded navigation (e.g. links within the text)
  - Related links
  - Adaptive navigation



Embedded navigation



Related links

- Utility navigation

How do we read a screen?

- Z pattern: common for the human eye's scanning
- F pattern: common for reading the contents of the page

Menus Types:

- Menu bar – menu items all displayed on one bar
- Ribbons – group different tasks
- Popup menus – cover part of the screen (when right-clicking)
- Cascading Menus should be avoided:
  - Cannot see all the options available
  - Requires precise mouse movements
  - Difficult to select items
  - Difficult to remember where items are located
- Drop Down Menus: the most common type

  - usually accessible from the top menu bar
  - help to save the screen space
  - use constraints to grey out the unavailable options
  - avoid deep list of options
  - vertical or horizontal menus
- Mega Menus: when there is a large number of menu options within multiple categories
  - They **improve visibility**
    - They provide users with a wider view and a big picture of the available options
    - They show all the lower level options within the hierarchy
    - The use of effective white/negative space
  - They **reduce memory load**
    - Users can easily find and compare the items in the menu at a glance
  - They **improve efficiency** and usability
    - Users can select options at any level without having to go through the hierarchy

Grouping Menu Items
- Alphabetic
- Physical properties
- Frequency (popularity)
- Importance and relevance

Hidden Menus: the menus that use a navicon (the hamburger icon)
- Helps to avoid cluttering the screen
- But it introduces usability problems (visibility)

Guidelines for Menu Design
- Strive to be consistent
- Use familiar and concise terminology to describe items
- Provide visibility
- Avoid long and complex menus, and reduce short term memory
- Meaningful grouping of items
- Structure the menu and organise the items relevant to user tasks
- Logical sequence of items
- Using effective negative spaces
- Provide an easy option to go back, and return to the main menu
- Consider knowledge in the head and the world
- Display menus such that they are effortless and natural to find and use
- Provide a number of different navigation options for items
- Limit the use of cascading menus for frequently used functions
- Reduce errors through disabling/greying out inapplicable menu items
- With mega menus, broad-shallow menus are preferred to narrow-deep ones

Mobile

Navigation based on the level of the hierarchy
- Primary navigation: Springboard
- Secondary navigation

Menu types:
- Permanent and fixed menus
- Transient menus

Mobile App Components:
- Springboard: a permanent menu and suitable for primary navigation
- Tiles: a variation of the Springboard design pattern, can be static or dynamic
- Galleries: dynamic tiles with live contents (e.g. news, movies)

- Fixed bars: suitable for primary navigation; recommended when:
  - the number of options is limited (3-5)
  - the tab items are equally important
  - the items are viewed frequently
  - if you want the users to view all items at the same time
- Scrollable Tabs: for secondary navigation
  - use it if the items are closely related
  - limit the number of categories to 5-7 tabs to reduce navigational effort
- Side Tabs: usually on the left-hand side; can occupy the horizontal real estate
- Guidelines for Tab Menu Design
  - Be consistent in using (icons, text labels or both)
  - Do not use long labels
  - Avoid nested tabs
- Bottom Navigation Bars: for primary navigation
- List Menu: for both primary and secondary navigation
- Accordion: can cause usability problems such as visibility, disorientation and difficulty with navigation
- Transient Menu Structures: allow displaying long lists of options
- Side Drawer and Navicon: the triple bar icon used with side drawers
  - **Overlay menus**: partially cover the main screen
  - **Inlay menus**: push the main screen off-canvas
- Navigation Drawer in Material Design
  - A standard drawer: can be fixed or inlay menu
  - A modal drawer: overlay menu
  - A Bottom drawer is a specialised type of the modal drawer
- Design Guidelines for Side Drawers:
  - Use side drawers for primary navigation
  - Do not overload side drawers with many options
  - Do not make them scrollable
  - Use meaningful grouping
  - Be aware of the usability issue
- Transient Menus: Pie Menu
- Navigation in iOS
  - Hierarchical navigation
    - Select one option per screen to get to the final destination (e.g. settings)
    - For a different option, you must start over
  - Flat navigation
    - Switch between multiple options, e.g. using a tab bar
  - Content-Driven or Experience-Driven Navigation
    - Navigating through content, e.g. in games, ebooks

  iOS Navigation Guidelines
  - Always provide a clear path
  - Use a page control when you have multiple pages of the same type of content
  - Use a navigation bar to traverse a hierarchy of data: The navigation bar's title shows the current position in the hierarchy, and the back button to return to the previous location
  - Use standard navigation components (e.g. page controls, tab bars, table views)
  - Use a tab bar to present peer categories of content or functionality
  - Design an information structure that makes it fast and easy to get to content
  - Use touch gestures to create fluidity

C5 Form Design

表单设计是重点，简答题给一个表单，分析其存在的问题/缺陷，或是分析其设计好的地方。

Steps in Filling a Form for users:

1. Understand the question
   - Questions should be easy to understand
   - Use familiar concepts and words
   - Ask one question at a time
   - Long forms can be broken up by topic

2. Finding an answer ——简答分析题，记住概念及例子
   - **Slot-in** answers: answers that depend on our memory, e.g. address, phone number
   - **gathered** answers: that need to be personally collected and gathered or very distant memories, e.g. credit card number, the tax file number
   - **third-party** answers: that require asking other people, e.g. when you need to ask your partner about the dinner reservation (whether to book indoors or outdoors table)
   - **created** answers: require the least amount of memory

Jane using an online form for buying flowers for her mum		
Info the user needs	**How to find the answer**	**The answer type**
Name	In her head	Slot-in
Method of payment	Needs to get the credit card from her bag	Gathered
Time of delivery	Makes a phone call to check when her mum will be home	Third-party
Message	Thinks for a few seconds to make up something appropriate	Created

3. Judging an answer
   - Provide truthful explanations why this information is needed and how it will be used to reduce privacy errors, e.g. when a user does not want to provide phone number

4. Entering the answer on the form
   - Make it easy for users to enter the answer
   - Convenient and correct tab movement and order
   - Provide the options that match the user's knowledge in the head
   - Consider "other" as the last option for some questions
   - Keyboard entry can be sometimes faster than using the mouse

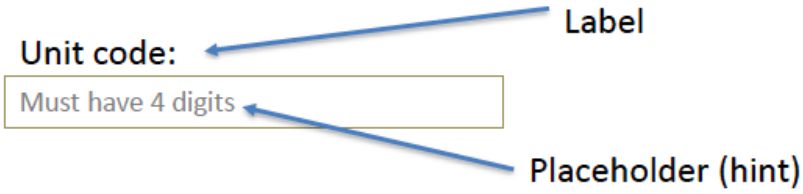
Form Design Guidelines ——结合这些原则分析表单设计的好坏
- Create a smooth and natural conversational flow, with logical and sensible order of options
- If the form requires gathered or third-party answers, try to store this information
- When the form is split across pages by topic, use a progress indicator
- Error prevention (e.g. through constraints, user selected data, hints and examples)
- Provide useful error messages
- Finish the form smoothly with a "thank you" or an acknowledgement
- Meaningful, familiar and standard field labels
- Consistent terminology and abbreviations
- Optional and required fields clearly marked
- Comprehensible instructions
- Use visible space and boundaries for data entry fields
- Differentiate grouped items
- Visually appealing layout (alignment)
- Use lists if possible to minimise errors
- Immediate and completion feedback

Labels: tell the user what information to provide in a form field

The number of places you have to look slows down and impedes filling in a form.
- Horizontal labelling: labels truncated or overlapped
- Vertical labelling: better spacing and better visual flow

Hints: help the user with data entry and clarifying the expected format

- Provide a hint text can reduce errors
- can reduce short term memory load
- Hints are commonly implemented using placeholders to reduce the clutter
- Placeholders shouldn't be used for labels as they will disappear



Placeholders' issues:

- If it disappears when the user moves to the field, the user might not remember it later (usability problem)
- If it remains after the user moves to the field, the user has to manually remove it (usability problem)
- It can be mistaken for automatically filled-in data
- It can also introduce accessibility issues as they are hard to read because of poor colour contrast, and some screen readers might not read the placeholder aloud

Forms and Material Design - Three principles:

- **Discoverable**
  - Text fields should be discoverable to indicate that users can input information
  - Using filled and outlined text fields to provide a perceived affordance, making the fields discoverable
- **Clear**
  - Text field states should be clearly differentiated from one another
- **Efficient**
  - Text fields should make it easy to understand the requested information and to address any errors

Mobile Form Examples

- Sign-in forms: have only few inputs
- Search forms
- Calculator forms
- Check-out forms: allow sign-in as a guest option

Mobile Form Guidelines ——结合这些原则分析移动端表单设计的好坏

- Replace horizontal labelling by vertical labelling
- Keep the input fields to a minimum and combine similar input fields
- Eliminate redundant and less important entries
- Use clear error messages
- Error correction: refocus on the field containing the error
- Consider all possible inputs by the user in the design
- Provide the user with the feedback on the current status and progress
- Inline feedback wherever appropriate
- Provide hint text using appropriate design pattern
- Reduce visual clutter
- Logical grouping of related items
- Shorten the list items to the most popular or primary options

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C6 Evaluation and Usability Testing

Types of Evaluation:

- Experts
  - Cognitive walkthrough
    - Preparation phase
    - Evaluation phase
    - Interpretation phase
  - Heuristic evaluation 两大理论必背，解释每条原则+例子
    - Nielsen's 10 heuristics
      - Visibility of system status (Provide feedback)
      - Match between system and the real world (Simple and natural dialogue, Speak the user's language)
      - User control and freedom
      - Consistency and standards
      - Error prevention
      - Recognition rather than recall
      - Flexibility and efficiency of use
      - Aesthetic and minimalist design
      - Help users recognize, diagnose, and recover from errors
      - Help and documentation
    - Shneiderman's Eight Golden Rules
      - Strive for consistency
      - Cater to universal usability
      - Offer informative feedback
      - Design dialogs to yield closure
      - Prevent errors
      - Permit easy reversal of actions (undo)
      - Support internal "locus of control"
      - Reduce short term memory

Nielsen's 10 Heuristics	Explanation
1. Visibility of system status (Provide feedback)	a. Provide users with meaningful and useful feedback about the system and tasks status b. Feedback should be visible, clear, concise and in a timely manner e.g. let the user know their interaction was successful when an action is performed; indicate progress or the path in multi-page processes; for longer operations, use a progress bar; indicate when the task is completed
2. Match between system and the real world	a. use of words (language), concepts, and objects familiar to the user (speak the user's language) b. follow real world conventions (skeuomorphic design)
3. User control and freedom	a. provide options of undo and redo b. allow users to confirm or cancel actions
4. Consistency and standards	a. follow common standards and conventions b. do not introduce different and unfamiliar words, icons and actions for the same objects.
5. Error prevention	a. use constraints b. use helpful suggestions (auto-suggest/ auto-complete features) c. user selected data d. provide examples of data entry format e. use of useful defaults, particularly for doing repetitive actions

	f. use validation of data entry
6. Recognition rather than recall	a. recognition reduces memory load by making actions and options visible b. menus are the typical example of recognition c. providing recognition gives the user extra help in remembering information d. recall requires the user to retrieve information from the memory e. recall can be error-prone and difficult
7. Flexibility and efficiency of use	support both novice and experienced users: e.g. provide keyboard shortcuts and advanced search options
8. Aesthetic and minimalist design	a. avoid including information that is irrelevant or might be rarely used b. avoid overloading and cluttering
9. Help users recognize, diagnose, and recover from errors	Error messages clearly specify what is the problem (in a language that any user can understand), and provide a useful option or solution.
10. Help and documentation	a. It is recommended to provide documentation b. provide effective and efficient search options to find information easy and fast according to the user task and keyword

Eight Golden Rules	Explanation
1. Strive for consistency	Consistency of terminology, colour, layout, fonts, or order of actions
2. Cater to universal usability	Design for diverse users, and consider different levels of experience, age difference, disabilities, and cultural differences
3. Offer informative feedback	a. For more frequent and minor actions, provide low level of feedback b. For infrequent and major actions, provide detailed feedback
4. Design dialogs to yield closure	Organize a series of actions into groups (the beginning, middle and end), and provide right feedback according to each stage
5. Prevent errors (offer simple error handling)	a. Design the system such that errors can be avoided b. Detect errors and handle the error in a simple way
6. Permit easy reversal of actions (undo)	
7. Support internal “locus of control”	a. Users should feel they are in charge of the interface b. Provide them with more flexibility and options c. Do not surprise them with unexpected results and behavious
8. Reduce short term memory	Similar to recognition rather than recall

- Users
  - Usability Testing
  - Field studies
  - Thinking aloud

The Severity of the Usability Problems

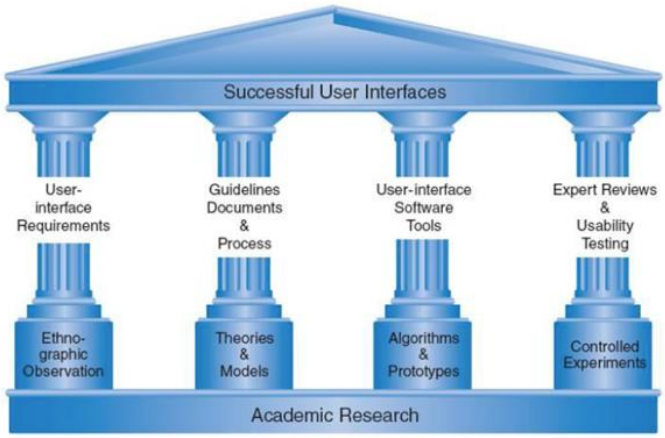
- Frequency
- Impact
- Persistence

Issues with Heuristic Evaluation

C7 Prototyping

Four pillars of successful User Interfaces:

- User interface requirements
  - Solicitation and definition of requirements
- Guidelines documents and processes
  - To establish design guidelines
  - Four Es process: Education, Enforcement, Exemption, Enhancement
- User-Interface software tools and prototyping
- Expert reviews and usability testing



Prototype:

- What
  - An incomplete and experimental design
  - A small-scale and limited modal of a product
  - Users can interact with a prototype and test its usability
- Importance
  - Enables designers to test their ideas,
  - test possible alternatives,
  - clarify requirements,
  - validate requirements,
  - solicit feedback,
  - identify problems,
  - and improve the final product
  - It reduces the cost and time by identifying problems and addressing them
- Classifications
  - Low-fidelity prototyping & High-fidelity prototyping
    - Low-fidelity prototype: with basic and limited functionalities; static
    - High-fidelity prototype: interactive, and similar to final product but not fully functional
  - Static prototypes & Interactive prototypes
  - Sketching and paper prototyping, Digital prototyping & Native prototyping
    - Advantages: It is easy and fast to create
    - It can show users paper-based screen images of a product
    - It can help with identifying usability problems of menus, task flow, and representations
    - Designers can ask users how they would interact with the different elements of the system and use this information to improve the interaction
  - Horizontal prototypes & Vertical prototypes
    - Horizontal prototyping focuses on high level screens and user interactions without considering low level functionalities; It provides a broad view of the entire product

- Vertical prototyping models in-depth functionalities of few parts but with much detail; One part of the interface is implemented in detail

Participatory Design

- It involves users directly in the design
- It can include stakeholders (e.g. designers, business managers)
- Users help with determining requirements
- Users provide design ideas and feedback

Low-fidelity prototyping techniques used in **participatory design**: 单选题

- PICTIVE (Plastic Interface for Collaborative Technology Initiatives through Video Exploration)
  - PICTIVE is an experimental participatory design method to encourage users to participate in the design process
  - PICTIVE uses "low fidelity office items" and "a collection of design objects to investigate specific screen and window layouts for a system"
  - It focuses on what the system will do, and the tasks
  - It enables a non-technical user to suggest ideas and participate in the design process
  - It helps with understanding users' workflow
- CARD (Collaborative Analysis of Requirements and Design)
  - Uses printed cards
  - It focuses on tasks and workflow options
  - Cards can represent screens (or parts of a screen), goals or tasks related to screens, and the workflow
  - It involves workshop sessions where cards are moved around by the participants
  - Can be used in conjunction with PICTIVE
- Storyboards
  - A different type of card-based prototyping
  - Originated from the film industry
  - It includes a series of sketches and key screens in a certain order
  - It helps to understand how the user interacts with the system and their workflow while progressing through the tasks
- "Wizard-of-Oz" prototyping
  - It is used to evaluate an unimplemented product through simulating the response of a system by a "wizard"
  - It is a static type of prototyping
  - It can be used to test interfaces and system functionality before it is fully implemented, e.g. for testing AI-based systems
- Advantages of Low-fidelity prototypes 低保真模拟原型的优缺点——选择/简答
  - Simple, cheap and quick to create
  - Truly hands-on because the designers have to manually manipulate the content.
  - The process of cutting, pasting, sorting, labelling forces designers to become familiar with the content elements.
  - It can be constructed quickly and efficiently and portable.
  - Easy to refine in the final product
  - Prototypes appear to enhance teambuilding skills
  - With low-fidelity prototypes, users and designers are often more willing to suggest changes.
  - Users are more comfortable working with paper and criticizing it rather than the real system.
  - It allows for more iterations
  - It allows to test with more users and identify more problems

High-fidelity Prototypes 高保真模拟原型的优缺点——选择/简答

- Advantages:
  - Interactive
  - Enables testing navigation, graphical elements and colours, legibility, image quality, alignment and spacing
  - Looks and works more like the real product, resulting in more useful feedback
  - Designers can show and test real flow and interactions
- Disadvantages:
  - Not as cheap as low-fidelity prototypes
  - Not as fast as low-fidelity prototypes
  - Not as portable as low-fidelity prototypes
  - Cannot be refined as easy as low-fidelity prototypes

C8 Graphics and Visual Design

Visual Elements

- Line
- Shape
- Size and volume
- Position
- Negative/white space
- Colour
  - Three attributes:
    - Hue, Saturation, Value
  - Can be used to:
    - call attention, help comprehension, add cues, make the interface appealing, show relationships, facilitate recognition, and reduce memory load, improve navigation and scanning speed
  - Design Guidelines for Colour
    - Select colours carefully
    - Minimize number of colours
    - Reduce eye strain instead of increasing it
    - The conventional link colour
    - Be aware of accessibility rules
      - Be aware of colour blindness
      - Provide sufficient contrast between foreground and background
      - Don't use color alone to convey information
  - Colour in Material Design
    - **Hierarchy**: organize content according to their importance
    - **Brand**: use colour to emphasise the brand presence, and match its spirit
    - **Meaning**: represent a meaning
    - **State**: information about the current state of the elements or app
    - **Colour System**: used to create a color theme that reflects your brand or style
    - A **primary colour**: the most frequently used colour across the screens
    - **Dark and light primary variants**
    - A **secondary colour** is used to emphasise the parts that are selected in the UI (optional)
    - **Contrast**: between primary and secondary colours based on accessibility standards
    - **Theme**: provides a consistent tone to an app
    - **Colour Tool** allows designers to create, share and use **Colour Palettes**, measure the accessibility level of colour combinations

  Basic visual elements are used to create text, images, icons, textures, and animation
- Typography: is about legibility/readability and appeal of the written language
  - Design guidelines:

- Use more legible fonts
- Use fewer typefaces (generally 1-2, or 3 max)
- Italics, underline and bold can be used to emphasize points but should be used sparingly
- Minimize using different sizes (1-3 max)
- Support redundancy
- There should be sufficient spacing between text lines to make it easy to read, and to increase reading speed
- The size of the font should be large enough
- The text alignment is also important and better to use left or justified alignment

Visual Design Principles

- **Balance**: balance the distribution of objects on the screen/page
- **Contrast**: emphasize certain objects by using differences in colour, shape, size or position
- **Dominance**: One of the objects/elements dominating the others
- **Hierarchy**
  - It is used to show the difference in importance between objects
  - It can be created by using different sizes or colours, or based on their position on the screen
  - It affects the order in which our eyes perceive what we see
- **Alignment**
  - Order and organize objects and contents on the screen
  - Alignment of related elements and create a visual connection between them
- **Repetition**
  - Repeat the same colours, fonts, shapes, or images
  - Provide consistency
- **Unity**: Visual elements of a composition appear to belong together

Grouping and Gestalt Laws

- Law of **proximity**: We perceive objects close to each other as a group
- Law of **similarity**: We perceive elements that share visual characteristics as a group
- Law of **closure**: We perceptually tend to complete objects that are not complete
- Law of **continuity** (or good continuation)
  - We tend to perceive disconnected segments as a single uninterrupted object
  - We tend to follow a path and group lines or curves or a sequence of shapes, even if our eyes encounter other objects
  - We perceive the elements on a line or curve as a group of related objects
- Law of **figure-ground**: differentiate an object (figure) from its background (ground)

Icons in Material Design

- **Product icons** are the visual expression of a brand's products, services, and tools
- **System icons** are simple, modern and friendly, and represent common actions, or a command, file, device, directory
- **Animated icons** represent the action an icon performs in a way that adds polish and delight

Graphics and Imagery

- Graphics and images are an effective means of communication
- Ensure that graphics are comprehensible, consistent and contextually appropriate
- Provide visual structure and flow when using graphics
- Avoid clutter
- Accessibility guidelines
  - Use subtitles or captions
  - Use additional text to describe images
  - Use screen readers (blindness)

Imagery in Material Design

- Use bold, graphic, and intentional imagery to engage the user
- Imagery selection principles:
  - Relevant, context-based, and personal
  - Informative
  - Delightful
- Use appropriate resolution size of images
- Introduce alternative scales
- Make typography legible on top of imagery

Web Content Accessibility Guidelines (WCAG) 2.0

- **Perceivable**
  - Provide text alternatives for non-text content.
  - Provide captions and other alternatives for multimedia.
  - Create content that can be presented in different ways, including by assistive technologies, without losing meaning.
  - Make it easier for users to see and hear content.
- **Operable**
  - Make all functionality available from a keyboard.
  - Give users enough time to read and use content.
  - Do not use content that causes seizures.
  - Help users navigate and find content.
- **Understandable**
  - Make text readable and understandable.
  - Make content appear and operate in predictable ways.
  - Help users avoid and correct mistakes.
- **Robust**
  - Maximize compatibility with current and future user tools.

Mobile Accessibility and Guidelines

- Perceivable
  - Small Screen Size
  - Zoom/Magnification
  - Contrast
- Operable
  - Keyboard Control for Touchscreen Devices
  - Touch Target Size and Spacing
  - Touchscreen Gestures
  - Device Manipulation Gestures
  - Place buttons where they are easy to access
- Understandable
  - Change Screen Orientation (Portrait/Landscape)
  - Consistent Layout
  - Position import page elements before the page scroll
  - Group operable elements that perform the same action
  - Provide clear indication that elements are actionable
  - Provide instructions for custom touchscreen and device manipulation gestures
- Robust
  - Set the virtual keyboard to the type of data entry required
  - Provide easy methods for data entry
  - Support the characteristic properties of the platform

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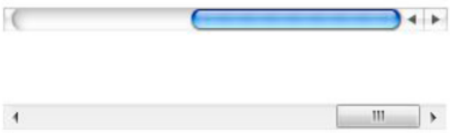
C9 Interaction Styles

Interaction Styles:

- Command line interfaces: Common around mid 1960s
- Direct manipulation
  - Indirect Pointing Devices: mouse, trackballs, joysticks
  - Direct Pointing Devices: stylus pens, touchscreens
  - Fitts's Law 选择，记住概念和例子: It takes more time to move the cursor and point at smaller targets that are further away, but it takes less time to hit bigger targets closer to you



    - e.g. for scroll bars
  - Hick's Law 选择，记住概念和例子: The amount of time it takes for the user to make a decision depends on the number of possible choices.
    - **KISS** (Keep it short and simple)
  - Gesture-based Interfaces
  - Auditory output

Natural language interaction

- NLP (Natural Language Processing) is usually used for processing, analyzing and understanding large amounts of natural language data
  - Data entry
  - Voice dialing
  - Selecting an option
  - Speech to text transcription, e.g. Google doc Voice Typing Tool
- Speech-based natural language interactions are preferred in certain situations:
  - When users have vision impairments
  - the speaker's hands are busy
  - users are on the move
  - the speaker's eyes are occupied
  - the keyboard can't be used
- Conversational Computing
- Amazon Lex
- Multiple Screen Interaction
- Human Robot Interaction: HRI focuses on interaction of humans with robotic technologies
- Multimodal Interfaces

Virtual reality and augmented reality

Haptic Human Computer Interaction

- Gaming and Entertainment
- Training
- Devices for those who are visually impaired

Selecting the right input and output devices depends on:

– Environment and context of use
– Speed of interaction (Games)
– Accuracy of actions
– Type of tasks (if it requires entering a large amount of text)
– Size (of screen)
– Complexity of the system
– Users?

- People with disabilities
- Their digital skills

• Their previous experience with the device
The most important thing is to meet the users' goals, but user preferences vary

C10 Design Languages and Styles

Different design languages and styles (strengths and limitations)

- Skeuomorphic Design 仿实设计 – limitations 优缺点
  - It might lead to **unnecessary visual clutter**
  - **Obsolete** and **less appealing**
  - It could lead to **false affordances and confusion**
  - Skeuomorphic interfaces include **many image files** that can **degrade performance**
- Flat Design 优缺点
  - It focuses on simplicity and minimalism
  - It offers a refined, simple aesthetic
  - It uses simple typography and iconography and bold colours
  - Flat 2.0 adds shadows and highlights to create a 3D experience
- Metro Design 地铁式设计(MDL), MDL2, and Fluent Design 流畅设计 优点
  - Microsoft Design Style Principles (Windows 8)
    - Pride in craftsmanship: maintain consistency across all applications
    - Be fast and fluid: Design for touch, Delight with motion; Be responsive and ready
    - Authentically digital
    - Win as one
    - Do more with less (limit the app to the core functionalities)
      - Be great at something
      - Inspire confidence
      - Put content before chrome
  - MDL2
    - It makes changes to UI elements such as buttons, sliders, and combo boxes
    - Thinner borders and lines
    - It uses textures and 3D effects
  - Microsoft's Fluent Design Principles
    - Adaptive: Fluent experiences feel natural on each device
    - Empathetic: Fluent experiences are intuitive **(to behave the way the user expects it)** and powerful **(global and universal)**
    - Beautiful: Fluent experiences are engaging and immersive **(using light, shadow, motion, depth, and texture)**

Material Design 材料设计 – principles

- Material is the metaphor
- Bold, graphic, intentional
- Motion provides meaning
- Flexible foundation
- Cross-platform

iOS Design

- Themes: Clarity, Deference, Depth
- Principles:
  - Aesthetic Integrity
  - Consistency
  - Direct Manipulation
  - Feedback
  - Metaphors
  - User Control

C11 Reports and Error Messages

Reports

- Four types of reports:
  - **Detailed reports** – reports that contain specific information on business transactions
  - **Summary reports** – reports that summarise detail or recap periodic activity
  - **Exception reports** – reports that contain detail or summary information about transactions or summary results that fall outside of a predefined normal range of values.
  - **Executive reports**
    – reports that contain summary information from different operations/sources within or outside an organisation.
    – used by top-level managers to assess overall health and performance of the organisation.
    – can show comparative performance with industrywide averages
- Guidelines 考试形式和表单一样，
  - Use meaningful titles of the report
  - Include meaningful information
  - Balance the layout
  - Design an easy navigation system for a multi-page report
  - All important information should be highlighted
  - For text in a report
    - use mixed uppercase and lowercase
    - avoid using overly fancy fonts
    - use enough spacing between paragraphs
    - left-justify text and leave a ragged right margin
    - use abbreviations and acronyms only when they are widely understood and are significantly shorter than full text
  - For tables and lists in a report
    - all columns and/or rows should have meaningful labels
    - labels should be separated from other content by highlighting
    - redisplay labels when the data extend beyond a single screen/page
    - sort in a meaningful order
    - avoid using overly fancy fonts
    - **right-justify numeric data**
    - **left-justify textual data**
    - break **long sequence of alphanumeric data** into small groups of 3 to 4 characters each

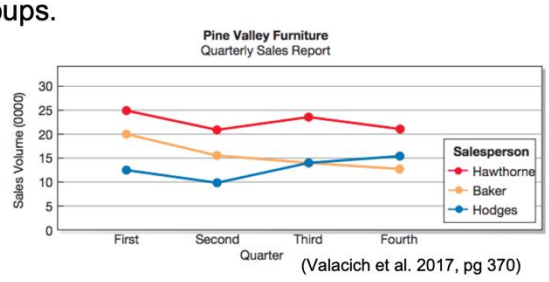
Pine Valley Furniture
Salesperson Annual Summary Report, 2016

January 10, 2017 Page 1 of 2

Region	Salesperson	SSN	Quarterly Actual Sales First	Second	Third	Fourth
Northwest & Mountain						
	Baker	999-99-9999	195,000	146,000	133,000	120,000
	Hawthorne	999-99-9999	220,000	175,000	213,000	198,000
	Hodges	999-99-9999	110,000	95,000	170,000	120,000
Midwest & Mid-Atlantic						
	Franklin	999-99-9999	110,000	120,000	170,000	90,000
	Stephenson[1]	999-99-9999	75,000	66,000	80,000	80,000
	Swenson	999-99-9999	110,000	98,000	100,000	90,000
New England						
	Brightman	999-99-9999	250,000	280,000	260,000	330,000
	Kennedy	999-99-9999	310,000	190,000	270,000	280,000

[1]Sales reflect July 1, 2016 – December 31, 2016.

- For displaying data with visuals, use the right type of visual with the data in the report to turn report data into knowledge.
  - Use line graph to track changes over a period of time. Line graph is preferred over bar graph when changes are smaller. Line graph is also useful to compare changes over the same time period for multiple groups.



(Valacich et al. 2017, pg 370)

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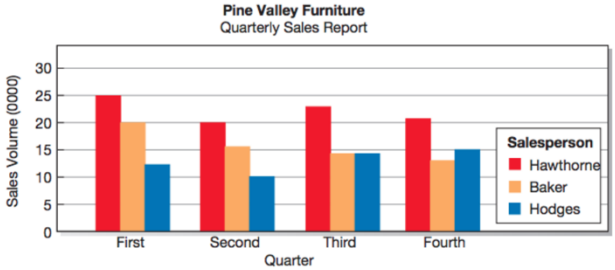
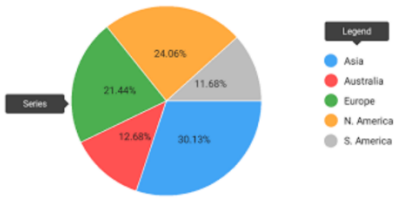
  - Use bar graph when comparing things between different groups or when tracking changes over a period of time. When tracking changes over a period of time, bar graph is preferred over line graph when changes are larger.



(Valacich et al. 2017, pg 370)

– Use pie chart when comparing different parts of a whole. Pie chart should not be used to show changes over a period of time.



docs.devexpress.com

▪ If there is a lot of data to display in a report that requires scrolling, apply filters and make use of hierarchies/drill-downs.

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Errors

- User Errors

	Mistakes	Slips
Sternberg	Errors in choosing an objective or specifying a method of achieving it	Errors in carrying out an intended method for reaching an objective
Norman	A person establishes an intention to act. If the intention is not appropriate, this is a mistake.	If the action is not what was intended, this is a slip.
Example	For finding the word "mistake" in a document, the user chooses the wrong option "Find and Replace" when only "Find" option was to be used.	For finding and replacing all the words "slips" with a blank in a document, the user chooses the right option "Find and replace" but types in the wrong word "mistakes" in the text field.

- Error Messages
  - Error messages provided by an interface that are not helpful not only **affect user experience** but also **reduce productivity**.
- Error Messages Guidelines
  - Be as specific and precise as possible.
  - Choose user-centered phrase. State problem, cause and solution.
  - Consider multiple levels of messages.
  - Use a positive tone. Be courteous. Avoid condemnation.
  - Use modal **dialogs** for important warnings to **prevent or correct critical errors**.
    - Use modal dialogs **only** when there is a need to draw extra attention to an error that can lead to some irreparable consequences.
    - Modal dialog boxes are disruptive as they disable the main content and do not allow the user to continue interacting with the interface until the dialog box is open, thereby, interrupting the user from completing their task.
  - Maintain consistent grammatical forms, terminology, and abbreviations.
  - Keep error messages next to fields in forms.
  - Use color to differentiate errors from normal field states.
  - Add iconography or subtle animation for easy scanning.
  - Maintain consistent visual format and placement.