Usability goals:

1. Effective to use (effectiveness)– how good it is

2. Efficient to use (efficiency)– how easy / fast it is

3. Safe to use (safety)

4. Have good utility (utility)

5. Easy to learn (learnability)

6. Easy to remember how to use (memorability)

User experience:

Desirable aspects

Satisfying Helpful Fun Enjoyable Motivating Provocative Engaging Challenging Surprising Pleasurable Enhancing sociability Rewarding

Exciting Supporting creativity Emotionally fulfilling

Entertaining Cognitively stimulating Experiencing flow

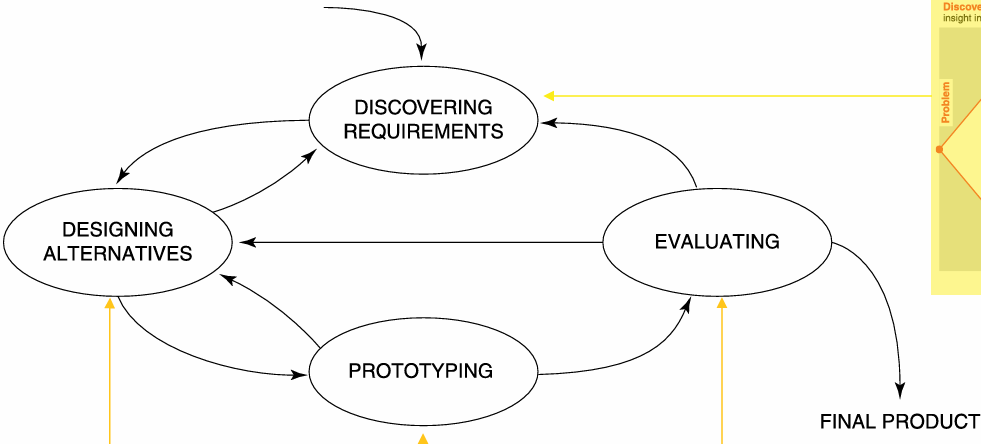
Undesirable aspects

Boring Unpleasant

Frustrating Patronizing

Making one feel guilty Making one feel stupid

Annoying Cutesy

Childish Gimmicky图示

AI 生成的内容可能不正确。图表

AI 生成的内容可能不正确。图示

AI 生成的内容可能不正确。

Practical issues with interaction design:

1. 不了解用户有哪些：用户还包含利益相关者，因此开发者或者说设计师也是用户的一部分。

2. 不了解用户需求有哪些：1.用户通常不知道什么是可能的 2.Explore the problem space、Investigate who are the users、Investigate user activities to see what can be improved、Try out ideas with potential users 3.Focus on peoples’ goals, usability, and user experience goals, rather than expect stakeholders to articulate requirements.

Six most common types of requirements:

1. Functional requirements: Describe what functions the system should do.

2. Data requirements:Describe what kinds of data need to be stored and how will they be stored.

3. Environment requirements or context of use:1.Physical:Under what physical conditions will the product operate.2.Social.3.Organizational.4.Techinical. On what technologies will it run or need to be compatible.

4. User characteristics:Nationality, educational background, attitude to computers. System user:novice--Prompted,constratined, clear. Expert--flexibility, access/power, frequent--shortcuts, casual/infrequent--clear menu paths. user profile

5. Usability goals:These goals focus on how the product can be effectively, efficiently, and safely used by users.

6. User experience goals:These goals focus on the overall user experience during the use of the product, including emotions, satisfaction, pleasure, etc.

Requirement gathering techniques:

1. Interviews:Obtain demand information through face-to-face conversations with users, stakeholders, or domain experts.

2. Observations:Directly or indirectly observe how users use products or perform tasks in natural environments to understand their behavior and needs.

3. Questionnaires:Collecting a large number of user opinions and feedback through distributing questionnaires, which can be in paper or electronic form.

4. Studying documentation:Refer to relevant documentation such as manuals, flowcharts, policy documents, etc. to obtain requirement information.

5. Researching similar products:Research existing similar products in the market, understand their features, user interface, and user experience.

Personas:

Capture a set of user characteristics (user profile)

Synthesised from real people based on user research

Typical, not idealised

Bring to life with name, characteristics, goals, and personal background

    Relevant to product under development

Two goals of persona

    Helps designer with design decisions and

    Reminds team about who will use the product

Develop a small set of personas with one primary

Scenario:

Defines when,where and how the story of the persona takes place.The scenario is the narrative that describes how the persona behaves as a sequence of events.

Prototype aims:

1. Understanding: Understanding avoid false assumptions. Prototype could help u to understand 1.Deisgn alternatives. 2. Strategy. 3. User-centred processes.

2. Communication: Communication increase the efficiency in making decision. Prototype could help u to comunicate with 1.Same "language" 2.Different stakeholder 3. No "maybe"

3. Test and rerflection(Main aim):Examine and improve the current design. Prototype could help u to test and reflect on 1.Hypotheses and assumptions. 2.Othere's comments

Tools:

1. Storyboards: 1.Often used with sceanrios, bringing more detail, and a chance to role play. 2. It is a seriers of  sketches shwoing how a user might progress through a task using the device. 3. Used eraly in design.

2. Sketching is important to low-fidelity prototyping. Same with the storyboard - Don't be inhibited about drawing the ability. Practice simple symbols with pencil and paper.

3. Index cards(3x5 inches): Each card represents one screen. Often used in 1.Website development 2. Application. 3. MiniProgram.

4. ‘Wizard-of-Oz’:The user thinks they are interacting witgh a computer, but a developer is responding to output rather than the system. Usually done early in design to understand users' expectations. But it lacks of authenticity. It has scalability issues. Unable to test all aspects of the system. User feedback may be inaccurate.

Design Principles:

1.Visibility: Visibility refers to the ability of users to clearly see and understand all elements and operational options in the interface.

2.Feedback: Feedback refers to the system sending information to users about the results of their operations.

3.Constratins: Constraints refer to limiting the possible actions that can be performed to guide users in using a product or system correctly.

4.Consistency: Consistency refers to the use of similar operating methods and elements to accomplish similar tasks when designing user 2.interfaces.

4.1.Internal consistency: Internal consistency refers to maintaining consistency in the design of operational behavior within the same application.

4.2.External consistency: External consistency refers to maintaining consistency in the design of operations, interfaces, etc. across different applications and devices.

4.3.Aesthetic consistency: Aesthetic consistency refers to the repeated use of specific styles and appearances in design to enhance recognition, convey a sense of belonging, and set emotional tones.

4.4.Functional consistency: Functional consistency refers to maintaining consistency in the meaning and behavior of symbols, operations, and concepts in design, which helps improve user learning and comprehension.

5.Affordance: Availability refers to the property of an object that allows people to know how to use it.

由于虚拟界面没有实际的物理形态，因此他们不具备物理对象那样的自然可供性。因此虚拟界面的可供性是感知可供性（Perceived Affordance）It refers to the mapping relationship between interface operations and effects.

Shneiderman’s 8 golden rules:

1. Strive for consistency : Maintain consistency in interface elements and operations so that users can understand and use new features based on previous experience.

2. Enable frequent users to use shortcuts: Allow experienced users to improve efficiency through shortcut keys or operations

3. Offer informative feedback: The system should provide timely and clear feedback to users on their actions, letting them know whether their actions were successful and the current status of the system.

4. Design dialog to yield closure: Interface design should enable users to clearly know when a task or operation is completed, that is, when it reaches a closed state.

5. Offer simple error handling: When an error occurs, the system should provide a simple and intuitive error handling mechanism to help users correct the error and continue their tasks.

6. Permit easy traversal of actions: Users should be able to easily undo or redo operations in order to return or move forward when needed.

7. Support internal locus of control: Design should make users feel that they have control over the system, that is, users believe that their actions can directly affect the results of the system.

8. Reduce short-term memory load: Interface design should minimize the amount of information that users need to remember in the short term, and instead use interface prompts or tools to assist in memory.

There may not be a clear boundary or separation between low fidelity and high fidelity. But we have Prototype Fidelity Dimensions:

1.Visual: The visual design of prototypes, such as color, font, layout, etc.

2.Interaction: Prototype interaction design, such as button clicking, sliding, etc.

3.Breadth: The scope of functionality covered by the prototype, which refers to how much of the final product's functionality is included in the prototype.

4.Depth: The level of detail, complexity, and completeness of each feature in the prototype.

5.Content: The actual content contained in the prototype, such as text, images, data, etc.

Visual fidelity is one of the most direct dimensions of user perception of prototypes. But early users are more likely to focus on actions / programs / concepts rather than visual details. So it should be taken seriously in the later stages of design.

The high interaction fidelity prototype enables the team to quickly and cost effectively test hundreds of different variations or design solutions.

Assuming you are designing a prototype for a serious recruitment application, content fidelity is important.

Physical design: 尼尔森的启发式原则以及施耐德曼的八个黄金法则

1.Menu design:

1.1.The length of the menu:We need to decide how many items should be included in the menu. Too many menu items may make it difficult for users to find the desired options, while too few may not cover all functions.

1.2.Order of menu items:Determine the logical order of menu items, usually based on frequency of use, relevance, or logical grouping. For example, the most commonly used items may be placed at the top or in an easily accessible location.

1.3.The structure of the menu:Determine the structure of the menu, including whether to use submenus or dialog boxes to organize and display menu items. Submenus can be used to group related options, while dialog boxes may be used for more complex selection processes.

1.4.Categories used to group menu items:Determine the categories used to logically group menu items, which helps users find the desired functionality faster. For example, common categories such as files, editing, views, and help.

1.5.Grouping representation method:Determine how to visually distinguish different groups of menus, such as using different colors, separators, or other visual cues to help users identify and navigate menu items.

1.6.Number of menus:Determine how many menus are needed in an application or website. The number of menus should be based on functional requirements and the organizational structure of the user interface.

1.7.Terminology used:Identify menu items and the terminology used in the menu. The terminology should be clear, intuitive, and match the functionality and user needs of the application.

For example, if the project is about rock climbing, the terms may include "climbing type", "equipment", "techniques", etc.

1.8.How to adapt to physical limitations:Consider how to adapt the menu to the physical limitations of different devices, such as phone screen size, touch targets, etc.

For example, for mobile devices such as smartphones, menus may need to be optimized to fit smaller screens and may need to consider the usability of touch screens.

2.Icon design suggestions:

2.1.always draw on existing traditions or standards

2.2.concrete objects or things are easier to represent than actions

3.Screem design:

3.1.Split across screens: Task analysis as a starting point: Before starting the design, conduct task analysis to understand the tasks and operational processes that users need to complete.

When designing, consider whether each screen contains only one simple step to simplify user operations and improve usability. But if the functions are divided too finely, resulting in the need for too many screens, it may make users feel frustrated and inconvenient.

We also need to consider keeping information available:

Ensure that users can easily access relevant information when needed, even if it means sometimes opening multiple screens simultaneously.

3.2.Individual screen design: For a single screen design, we can use visual elements such as colors, dynamic effects, and boxing to attract users' attention to the most important parts of the interface. Ensure that key information and features are visible to users so that they can easily find and use them.

For example, highlighting important information or features through highlight colors or animation effects.

Animation can effectively guide users' attention and provide feedback, but it may also distract attention. Therefore, it is necessary to use animation with caution to ensure that it enhances rather than interferes with the user experience.

Organizing interface elements through grouping and physical proximity can help users understand and use the interface faster.

We need to find a balance between the number of interface elements and space utilization.

Too few interface elements may make the screen look empty, while too many elements may make the interface appear crowded and chaotic.

4.Information display: The interface should always provide users with relevant information they need at all times to help them make decisions and complete tasks.

Different types of information mean different types of displays.

For example, text information may require clear fonts and layout, while images or charts may require appropriate size and contrast.

At the same time, consistency should be maintained between paper display and screen data input. This can help users understand and use the system more easily.

Interaction Types:

1. Instructing: The user tells the system what operation to perform through clear instructions. E.g. Tell the time, print a file, or save a file.

Very common conceptual model underlying a diversity of devices and systems. E.g. Word processors, and vending machines.

The main benefit is that instructing supports quick and efficient interaction. Good for repetitive kinds of actions performed on multiple objects.

2. Conversing: Underlying model of having a conversation with another human.

Ranges from simple voice recognition menu-driven systems to more complex ‘natural language’ dialogs.

Examples include timetables, search engines, advice-giving systems, and help systems, virtual agents, chatbots, toys, and pet robots designed to converse with you.

Pros:Allow users, especially novices, to interact with a system in a way that is familiar to them. It can make them feel comfortable, at ease, and less scared.

Cons:Misundersdtandings can arise when the system does not know how to parse what the user says. E.g. voice assistants can misunderstand what children say.

3. Manipulating: Exploits users ‘knowledge of how they move and manipulate in the physical world.

Involves dragging, selecting, opening, closing and zooming actions on virtual objects.

Can involve actions using physical controllers(e.g., Nintendo Switch) or air gestures(e.g., Microsoft Kinect) to control the movements of an on-screen avatar.

Tagged physical objects(e.g., balls) that are manipulated in a physical world result in physical/digital events(e.g., animation being played).

3.1. Direct Manipulation: Continuous representation of objects and actions of interest. Rapid reversible actions with immediate feedback on object of interest. Physical actions and button pressing instead of issuing commands with complex syntax.

e.g. Drag and drop to move files.

Pros:1. Novices can learn the basic functionality quickly 2. Experienced users can work extremely rapidly to carry out a wide range of tasks − even defining new functions 3.Intermittent users can retain operational concepts over time 4. Error messages rarely needed 5. Users can immediately see if their actions are furthering their goals, and if not, do something else 6. Users experience less anxiety 7. Users gain confidence and mastery and feel in control.

Cons:1. Some people take the metaphor of direct manipulation too literally E.g., playing guitar on iPad 2. Moving a cursor using a mouse or touchpad can be slower than pressing function keys to do the same actions E.g.,: find all and replace 3. Repetitive tasks are not well supported. 4. Some gestures can be more error-prone than typing. E.g., drag a drop a picture width to 2.00 cm.

4. Exploring: Involves moving through virtual or physical environments.

Users can explore aspects of a virtual 3D environment

Physical environments can also be embedded with sensors that when

detect the presence of someone will trigger digital or physical events to happen

Many examples of virtual environments, including cities, parks, buildings, rooms, and datasets. Enable users to fly over them and zoom in and out of different parts.

5. Responding: System takes the initiative to alert user to something that it “thinks” is of interest.

System does this by: 1. Detecting the location and-or presence of someone in a vicinity and notifies them on their phone or watch 2. What it has learned from their repeated behaviors.

E.g., Alerts the user of a nearby coffee bar where some friends are meeting. User’s fitness tracker notifies them of a milestone reached.

The core feature of responsive interaction is that the system actively pushes notifications or reminders to the user without requiring the user to actively request them.

Choosing an interaction type:

1.Direct manipulation is good for ‘doing’ types of tasks, for example, designing, drawing, flying, driving, or sizing windows.

绘图（Drawing）：用户可以直接在画布上绘制图形，如在绘图软件中使用画笔工具。飞行（Flying）：用户可以直接控制飞行器的操纵杆或按钮，如在飞行模拟器中控制飞机。驾驶（Driving）：用户可以直接操作方向盘、油门和刹车，如在赛车游戏中控制赛车。调整窗口大小（Sizing windows）：用户可以直接拖动窗口的边缘来调整大小，如在操作系统中调整窗口。

2.Issuing instructions is good for repetitive tasks, for example, spell checking and file management.

拼写检查（Spell checking）：用户可以选择拼写检查功能，让系统自动检查文档中的拼写错误。文件管理（File management）：用户可以通过命令或菜单选项来复制、移动、删除文件等，如在文件管理器中执行这些操作。

3.Having a conversation is good for certain services, for instance, finding information or requesting music.

查找信息（Finding information）：用户可以通过语音或文本与系统对话，查询天气、新闻、路线等信息，如使用语音助手或聊天机器人。请求音乐（Requesting music）：用户可以通过语音命令请求播放特定的歌曲或音乐，如使用智能音箱或音乐应用。

4.Hybrid conceptual models are good for supporting multiple ways of carrying out the same actions.

在一些复杂的软件中，用户可以通过直接操作、菜单命令或快捷键等多种方式来完成相同的操作，如在图像编辑软件中，用户可以通过拖动图层、选择菜单选项或使用快捷键来移动图层。

Interfaces:

1.Command line Interfaces: The command-line interface is an interface where users interact with a computer system through text commands.

Users enter specific commands (usually abbreviations or combinations of words) at the command prompt, and the system will perform the corresponding operation and provide feedback upon receiving the command.

Pros: Efficient, precise, and fast.

Command interfaces popular for web scripting

Cons: Large overhead to learning set of commands.

Form, name types and structure are key research que

stions Consistency is the most important design principle

2. Graphical user interfaces (GUIs): A graphical user interface is an interface where users interact with a computer through graphical elements such as windows, icons, menus, and the pointing device.

Windows (Window): A window is an area on the screen that can be scrolled, stretched, overlapped, opened, closed, and moved.

Icons: Icons are graphical symbols that represent applications, objects, commands, and tools.

Menus: A menu is a scrollable list of options from which users can choose different actions.

Pointing device: A pointing device (such as a mouse) is used to control the cursor on the screen, serving as the entry point for users to interact with windows, menus, and icons.

2.1. Window design:

The invention of windows was to overcome the physical limitations of computer displays.

Windows allow users to view more information and perform more tasks within limited screen space, improving work efficiency and flexibility.

The scrollbar in the window allows you to view more information.

To solve the problem from multiple windows:

列表（Listing）：显示所有打开窗口的列表，用户可以从列表中选择所需的窗口。例如，Windows操作系统中的“任务栏”就提供了这样的功能。选项卡（Tabbing）：使用选项卡来组织和管理多个窗口或文档，用户可以通过点击不同的选项卡来切换窗口。例如，许多现代浏览器都支持选项卡式浏览。缩略图（Thumbnails）：显示所有打开窗口的缩略图预览，用户可以通过查看缩略图来快速找到所需的窗口。例如，MacOS中的“Mission Control”功能就提供了这样的预览

2.2 Menu styles:

1.Flat list: All menu options are displayed in a list format at the same level.

Pros: Suitable for displaying a large number of options in situations where display space is limited, as all options are on the same plane and users can easily see all available commands or options at a glance.

2.Drop down (dropdown menu): Menu options are organized into a hierarchical structure, and when a user clicks or hovers over an option, more sub options will be displayed.

Pros: More options can be displayed in the same screen space, especially when menu options have hierarchical relationships (such as cascading menus).

3.Pop up (pop-up menu): When the user presses a command key or right-click, a menu containing relevant options will pop up.

Pros: Provides a quick way to access commonly used commands, especially those related to specific projects or tasks.

4.Contextual menu: Provide commonly used commands related to the user's current operation or selected item.

Pros: Improved efficiency as users can directly access the commands most relevant to their current task without having to search through multiple menus.

5.Collapsible menu: Menu items can be expanded or collapsed by clicking the+/- icon next to the title.

Pros: Allow users to display or hide menu items as needed, which helps save screen space and improve menu manageability.

6.Mega (Super Menu): All options are displayed in a two-dimensional drop-down layout, typically containing multiple levels and a large number of options.

Pros: Display all options in one menu, allowing users to quickly find the commands they need through a hierarchical structure without having to switch between multiple menus.

Window management refers to how users switch and navigate between multiple windows. It enables users to move smoothly between different windows (as well as monitors).

The design should consider how to keep users focused when switching between different windows, avoiding distractions caused by improper interface design.

When designing interfaces, some basic design principles should be followed, such as appropriate spacing, effective grouping, and maintaining simplicity of the interface to improve user experience and usability.

When designing menu options, it is necessary to consider which terms to use to describe operations, and these terms should be intuitive and easy to understand so that users can quickly understand and use them.

Generally speaking, super menus are easier to navigate than drop-down menus because they display all options in a more prominent way, while drop-down menus may require users to click multiple times to find the desired option.

2.3. Icon design:

Icons are assumed to be easier to learn and remember than commands.

Icons can be designed to be compact and variably positioned on a screen.

Now pervasive in every interface.（在每一个界面中普遍存在）

Modern icons can use colors, shadow effects, realistic images, 3D rendering, and animation to enhance visual effects and expressiveness.

This design not only makes the icons look more beautiful, but also effectively conveys information and functionality.

Through careful design, icons can stimulate users' curiosity and interest, generate emotional resonance, and give people a vivid and interactive feeling. This design helps to increase user attractiveness and engagement with the interface.

There is a wealth of resources for creating icons: Guidelines, style guides, icon builders, libraries, online tutorials.

Text labels can be used alongside icons to help identification for small icon sets.

For large icon sets (for instance, photo editing or word processing) can use the hover function.

3. Multimedia:

Combines different media within a single interface with various forms of interactivity. Including Graphics, text, video, sound, and animation.

Users click on links in an image or text—1.Another part of the program. 2. An animation or a video clip is played. 3. Users can return to where they were or move on to another place.

Can provide better ways of presenting information than a single media can.

Pros:1. Facilitates rapid access to multiple representations of Information.2. Can provide better ways of presenting information than can any media alone.3. Can enable easier learning, better understanding, more engagement, and more pleasure. 4. Can encourage users to explore different parts of a game or story.

Cons: 1. Tendency to plau video clips and animations while skimming through accompanying text or diagrams.

When designing multimedia interfaces, it is necessary to consider how to help users effectively process and integrate information from different media.

By providing highly interactive activities and simulations, users can learn and solve problems in practice.

Utilize tools such as quizzes, electronic laptops, and games to enhance users' learning experience.

Multimedia is particularly suitable for scenarios that require quick browsing and exploration of a large amount of information. But it's not ideal for long-term reading.

4. Virtual reality:

Virtual reality is a three-dimensional graphical simulation generated through computer technology, providing users with immersive experience.

Provide new kinds of experience, enabling users to interact with objects and navigate in 3D space.

Create highly-engaging user experiences.

Pros:1. Can have a higher level of fidelity with objects that they represent compared to multimedia. 2. Induces a sense of presence where someone is totally engrossed by the experience. 3. Provides different viewpoints: first and third person.

Cons:1. Early head-mounted displays were uncomfortable to wear and could cause motion sickness and disorientation. It was solved by lighter VR headsets.

Researchers are exploring how to create both secure and realistic virtual reality environments to enhance the effectiveness of training. Or help people overcome phobias.

Designers need to consider:1.how users move and navigate in virtual environments, as well as whether to use first person (users feel like they are in the environment) or third person (users feel like they are observing a character) perspectives.2.how users interact with the virtual environment, including how to use body movements such as head and hand movements to control virtual characters or interface elements. 3.how users receive and manipulate information, including using various input devices such as keyboards, mice, and joysticks to interact with the virtual environment. 4. In order to create a sense of presence, designers need to determine the level of realism of the virtual environment, so that users feel that they truly exist in the virtual environment.

5. Website design:

Nowadays, more emphasis is on making pages distinctive, striking, and aesthetically pleasing. Need to think of how to design information for multiple platforms—keyboard or touch?

A simple, intuitive, and easy-to-use design is acceptable to most people.

More complex, creative, and visually impactful designs may attract attention, but they may not be easy to understand and use.

When designing a website, it is necessary to find a balance between the convenience of users finding information and the aesthetic and pleasant experience provided by the website.

The reading habits of users on the website are fast and rough.

Designers need to consider how to attract users' attention and maintain their interest through branded design.

Breadcrumbs are category labels: 1.Enable users to look at other pages without losing track of where they have come from 2. Very usable 3. Enable one-click access to higher site levels 4. Attract first time visitors to continue to browse a website having viewed the landing page

Consideration: Where am I? Where can I go? What’s here?

6. Mobile interfaces:

Handheld devices intended to be used while on the move. It includes phones, fitness trackers, tablets, and smartwatchs.

Mobile interfaces can be cumbersome to use for those with poor manual dexterity or ‘fat’ fingers.

Key concern is hit area:1. Area on the phone display that the user touches to make something happen, such as a key, an icon, a button, or an app. 2. Space needs to be big enough for all fingers to press accurately. 3. If too small, the user may accidentally press the wrong key.

4. Fitts’ law can be used to help design right spacing. -- Minimum tappable areas should be 44 points x 44 points for all controls.

7. Appliances:

It is used for short periods. E.g. starting the washing machine, watching a program, buying a ticket, changing the time, or taking a snapshot.

Need to be usable with minimal. If any, learning.

Need to design as transient interfaces with short interactions.

Simple interfaces.

Consider trade-off between soft and hard controls. 硬控制（Hard controls）：如按钮、旋钮、拨盘或物理开关等，它们是物理的、固定的，用户可以直接触摸和操作。软控制（Soft controls）：如触摸屏上的虚拟按钮、滑动条等，它们是通过软件实现的，可以根据需要动态变化。

8. Voice User interfaces:

Involves a person talking with a spoken language app, for example, timetable, travel planner, or phone service. It is used most for inquiring about specific information, e.g., flight times or to perform a transaction, such as buying a ticket. It is also used by people with visual impairments. E,g. , speech recognition word processors, page scanners, web readers, and home control systems.

‘barge-in’用于允许Users can choose an option before the system has finished listing all of the options available.

Structuring VUI dialogs: Directed dialogs are where the system is in control of the conversation.

Voice assistants allow all to use rather than being single use. It supports families playing games, interactive storytelling, jokes, and so forth. But young children(<4), is difficult to be understood which will frustrate them.

Design systems that can keep conversation on track:1. Help people navigate efficiently through a menu system.2.Enable them to recover easily from errors.3.Guide those who are vague or ambiguous in their requests for information or services.

Consider type of voice actor: Do people prefer to listen to and are more patient with a female or male voice, a northern or southern accent?

9. Pen-based devices:

Enable people to write, draw, select, and move objects at an interface using light pens or styluses.

It capitalizes on the well-honed drawing skills developed from childhood.

Pros: 1.Allows users to annotate existing documents quickly and easily.2.Can be used to fill in paper-based forms that can readily be converted to a digital record using standard typeface.3.Can be used by remote teams to communicate and work on the same documents.

10. Touchscreens:

Single touchscreens are used in walk-up kiosks (such as ticket machines and ATMs) to detect the presence and location of a person’s touch on the display.

Multi-touch surfaces support a range of more dynamic finger tip actions, for example, swiping, flicking, pinching, pushing, and tapping.

They do so by registering touches at multiple locations using a grid. And be widely used now. It supports one and two hand gestures, including tapping, zooming, stretching, flicking, dwelling, and dragging.

Provides fluid and direct styles of interaction involving freehand and pen-based gestures for certain tasks.

Core design concerns include whether size, orientation, and shape of touch displays effect collaboration.

Much faster to scroll through wheels, carousels, and bars of thumbnail images or lists of options by finger flicking.

Gestures need to be learned for multi-touch, so a small set of gestures for common commands is preferable.

More cumbersome, error-prone, and slower to type using a virtual keyboard on a touch display than using a physical keyboard.

11. Gesture-based systems:

Gestures involve moving arms and hands to communicate.

Uses camera recognition, sensor, and computer vision techniques to recognize people’s arm and hand gestures in a room. Gestures need to be presented sequentially to be understood (compare with the way sentences are constructed).

How does computer recognize and delineate user’s gestures? 1.Start and end points. 2.Difference between a deictic gesture (a deliberate pointing movement) and hand waving (an unconscious gesticulation). The mirrored graphical representation must be realistic.

12. Haptic interfaces:

Provide tactile feedback by applying vibration and forces to a person’s body, using actuators that are embedded in their clothing or a device they are carrying, such as a smartphone.

Vibrotactile feedback can be used to simulate the sense of touch between remote people who want to communicate.

Ultrahaptics creates the illusion of touch in midair using ultrasound to make the illusion of 3D shapes.

Where best to place actuators on body. Whether to use single or sequence of ‘touches’. When to buzz and how intense. How does the wearer feel it in different contexts? What kind of new smartphone/smartwatch apps can use vibrotactile creatively? E.g. slow tapping to feel like water drops meant to indicate that it is about to rain, and heavy tapping to indicate a thunderstorm is looming.

13. Multimodal interfaces:

Provide enriched user experiences by multiplying how information is experienced and detected using different modalities, such as touch, sight, sound, and speech. It supports more flexible, efficient, and expressive means of human computer interaction.

Most common is speech and vision.

It can be combined with multi-sensor input to enable other aspects of the human body to be tracked. E.g., eye gaze, facial expression, and lip movements. It can provides input for customizing user interfaces.

Need to recognize and analyze user behavior, for example, speech, gesture, handwriting, or eye gaze.

Much harder to calibrate these than single modality systems.

What is gained from combining different input and outputs.

Is talking and gesturing, as humans do with other humans, a natural way of interacting with a computer?

14. Shareable interfaces

It is designed for more than one person to use:1. Provide multiple inputs and sometimes allow simultaneous input by co-located groups.2. Large wall displays where people use their own pens or gestures.3. Interactive tabletops where small groups interact with information using their fingertips.

Pros:1.Provide a large interactional space that can support flexible group working. 2.Can be used by multiple users:Can point to and touch information being displayed.Simultaneously view the interactions and have the same shared point of reference as others. 3.Can support more equitable participation compared with groups using single PC.

1.Core design concerns include whether size, orientation, and shape of the display have an effect on collaboration. 2.Horizontal surfaces compared with vertical ones support more turn taking and collaborative working in co-located groups. 3. Providing larger-sized tabletops does not improve group working but encourages more division of labor. 4. Having both personal and shared spaces enables groups to work on their own and in a group.

15. Tangible Interfaces:

1. Type of sensor-based interaction, where physical objects, for example, bricks, are coupled with digital representations. 2. When a person manipulates the physical object/s, it causes a digital effect to occur, e.g., an animation. 3. Digital effects can take place in a number of media and places, or they can be embedded in the physical object.

表格

AI 生成的内容可能不正确。Pros: Can be held in one or both hands and combined and manipulated in ways not possible using other interfaces:1.Allows for more than one person to explore the interface together. 2.Objects can be placed on top of each other, beside each other, and inside each other.3.Encourages different ways of representing and exploring a problem space.

People are able to see and understand situations differently:1.Can lead to greater insight, learning, and problem-solving than with other kinds of interfaces. 2.Can facilitate creativity and reflection.

1.What kinds of conceptual frameworks to use to help identify novel and specific features.2.What kind of coupling to use between the physical action and digital effect: If it is to support learning, then an explicit mapping between action and effect is critical. If it is for entertainment, then it can be better to design it to be more implicit and unexpected. 3. What kind of physical artifact to use: Bricks, cubes, and other component sets are most commonly used because of flexibility and simplicity. Stickies and cardboard tokens can also be used for placing material onto a surface. 4.With what kinds of digital outputs should tangible interfaces be combined? E.g.,animations,sounds,visual effects.

16. Augmented Reality:

Augmented reality: Virtual representations are superimposed on physical devices and objects. E.g.,Pokémon go and other applications including medicine, navigation, air traffic control, games, and everyday exploring.

1.What kind of digital augmentation: When and where in physical environment?Needs to stand out but not distract from ongoing task.Needs to be able to align with real world objects.What happens if the AR is slightly off? 2.What kind of device? Smartphone, tablet, head up display or other?

17. Wearables

It enables user to record what was seen and to access digital information. Applications include automatic diaries, tour guides, cycle indicators, and fashion clothing.

1. Comfort: Needs to be light, small, not get in the way, fashionable, and preferably hidden in the clothing. 2. Hygiene: Need to be easy to clean to maintain hygiene. 3.Ez of wear: Need to be ez to wear and take off. 4. Usability: Users need to be able to easily control devices embedded in clothing.

18. Robots:

1.Remote robots used in hazardous settings. 2.Domestic robots helping around the house. 3. Pet robots as human companions. 4. Sociable robots that work collaboratively with humans.

1. Study how people interact with physical robots that exhibit human like behavior, such as facial expressions, and how they differ from virtual robots. 2. When designing, it is necessary to consider whether the appearance and behavior of robots should imitate humans, or whether they should look and behave like robots, in order to clearly convey their purpose. 3. When designing, it is necessary to decide whether the interaction method is more like natural communication between people or more like traditional human-computer interaction (such as through buttons or screens). 4. This involves ethical and privacy issues related to the use of drones.

19. Brain-computer interfaces: Brain-computer interfaces (BCI) provide a communication pathway between a person’s brain waves and an external device, such as a cursor on a screen. Person is trained to concentrate on the task, e,g,, moving the cursor.

20. Smart interfaces: Smart refers to having some intelligence and connected to the internet and other devices. It includes context-aware(Understand what is happening around them and execute appropriate actions, for example, a Nest thermostat) and human-building interaction(Buildings are designed to sense and act on behalf of the inhabitants but also allow them to have some control and interaction with the automated systems).

Evaluation:

Data gathering：

1. Questionnaire：1.封闭式问题（Closed-ended questions）：这些问题通常有固定的答案选项，如选择题、是非题等。回答者需要从给定的选项中选择一个或多个答案。

2.开放式问题（Open-ended questions）：这些问题允许回答者自由表达他们的想法和意见，没有固定的答案选项。回答者可以详细描述他们的观点。

Pros for closed-ended:1. Easier to analyze. 2. May be distributed and analyzed by computer. 3. Can be administered to large populations. 4.

Disseminated by paper, email and the web.

Design: 1. The impact of a question can be influenced by question order.

2.You may need different versions of the questionnaire for different populations.

3.Provide clear instructions on how to complete the questionnaire.

4.Avoid very long questions and questionnaires.

5.Decide on whether phrases will all be positive, all negative, or mixed.

6.Strike a balance between using white space and keeping the questionnaire compact.

Pros:1. Can collect data from a large number of people, at a relatively low cost.2. You can get an overview of a population of users in a short amount of time. 3.Surveys do not require any special equipment. 4.Surveys are generally approved by institutional review boards because they are typically non-intrusive.

Cons:1. Surveys are good at getting shallow data from a large number of people, but are not good at getting “deep” data.

2. Since surveys are usually self-administered, it is usually not possible to ask follow-up questions.

3.Surveys can lead to biased data when the questions are related to patterns of usage, or feelings about a previous experience, rather than clear factual phenomena. E.g.,recall question: how many times did you use this software application over 6 months?

2.Interviews:1. Unstructured: Not directed by a script. Rich but not replicable. 2. Structured: Tightly scripted, often like a questionnaire. Replicable but may lack richness. 3. Semi-structured: Guided by a script, but interesting issues can be explored in more depth. Can provide a good balance between richness and replicability. 4.Focus groups: A group interview.

Question types:1. Closed questions: have a predetermined answer format, e.g., yes/no. 2. Open questions: do not have a predetermined format. Closed questions are easier to analyze.

Avoid: 1. Long questions. 2. Compound sentences. 3. Jargon and language that the interviewee may not understand. 4. Leading question that make assumptions. 5. Unconscious biases.

Procedure: 1. Introduction: Introduce yourself, explain the goals of the interview, reassure about the ethical issues, ask to record, and present the informed consent form. 2. Warm-up: Make first questions easy and non-threatening. 3. Main body: Present questions in a logical order 4. A cool-off period: Include a few easy questions to defuse tension at the end. 5. Closure: Thank interviewee, signal the end, for example, switch recorder off.

Pros: 1. Go deep: encourage reflection and consideration. 2. Flexible: open-ended and exploratory.

Cons: 1. Skill to manage. 有效的访谈需要访谈者具备良好的沟通技巧和引导能力，以确保访谈的顺利进行。2. Time and resource intensive. 访谈通常需要较多的时间和资源投入，包括准备、实施和后续的数据分析。3. Data analysis. 访谈产生的数据通常是非结构化的，需要进行复杂的定性分析，这可能既耗时又具有挑战性。4. Recall problems.受访者可能难以准确回忆过去的事件或经历，这可能影响数据的准确性。5. Separated from the task and context under consideration.访谈通常在受访者执行任务或处于特定环境之外进行，这可能导致受访者的回答与实际情况有所偏差。

可以使用原型（prototypes）和场景（scenario）去丰富访谈过程。

3. Observation：1.Direct observation: In the field/ in controlled environments. 2. Indirect observation: tracking users’ activities, interaction logging, video and photographs.

Direct observation in the field: 1. Devide on how involved you will be (passive observer/active participant). 2.How to gain acceptance. 3. How to handle sensitive topics, e.g., culture, private spaces. 4. How to collect the data(What data to collect, What equipment, When to stop).

表格

AI 生成的内容可能不正确。Choosing and combining techniques: 1.研究的重点（Focus of the study）：研究的具体目标和问题。2.参与者（Participants involved）：研究中涉及的人群。3.技术的性质（Nature of the technique(s)）：所选技术的特点和适用性。4.可用资源（Resources available）：进行研究时可用的资源，包括资金、设备、人员等。5.可用时间（Time available）：完成研究的时间限制。

Types of evaluation methods: 1. Controlled settings that directly involve users. E.g., usability and research labs. 2. Natural settings involving users. E.g. online communities and products that are used in public places. 3. Any setting that doesn’t directly involve users. E.g., consultants and researchers critique the prototypes, and may predict and model how successful they will be when used by users.

Heuristic evaluation: It is an evaluation technique based on Nielsen’s heuristics, mainly used to discover usability issues in user interfaces.

1. Visibility of System Status: The design should always keep users informed about what is going on, through appropriate feedback within a reasonable amount of time.

2. Match Between System and the Real World: The design should speak the users' language. Use words, phrases, and concepts familiar to the user, rather than internal jargon. Follow real-world conventions, making information appear in a natural and logical order.

3. User Control and Freedom: Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action without having to go through an extended process.

4. Consistency and Standards: Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform and industry conventions.

5. Error Prevention Good error messages are important, but the best designs carefully prevent problems from occurring in the first place.

6. Recognition Rather than Recall: Minimize the user's memory load by making elements, actions, and options visible. The user should not have to remember information from one part of the interface to another.

7. Flexibility and Efficiency of Use: Shortcuts hidden from novice users may speed up the interaction for the expert user such that the design can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

8. Aesthetic and Minimalist Design: Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

9. Help Users Recognize, Diagnose, and Recover from Errors: Error messages should be expressed in plain language (no error codes), precisely indicate the problem, and constructively suggest a solution.

10. Help and Documentation: It’s best if the system doesn’t need any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks.

Procedure: 1. Know what to test and how–Whether it’s the entire product or one procedure, clearly define the parameters of what to test and the objective. 2. Know your users and have clear definitions of the target audience’s goals, contexts, etc. User personas can help evaluators see things from the users’ perspectives. 3. Select 3–5 evaluators, ensuring their expertise in usability and the relevant industry. 4. Define the heuristics(around 5–10) – This will depend on the nature of the system/product/design. Consider adopting/adapting the Nielsen-Molich heuristics and/or using/defining others. 5. Brief evaluators on what to cover in a selection of tasks, suggesting a scale of severity codes (e.g., critical) to flag issues. 6. 1st Walkthrough–Have evaluators use the product freely so they can identify elements to analyze. 7. 2nd Walkthrough–Evaluators scrutinize individual elements according to the heuristics. They also examine how these fit into the overall design, clearly recording all issues encountered. 8. Debrief evaluators in a session so they can collate results for analysis and suggest fixes.

Pros: 1. Few ethical and practical issues to consider because users are not involved.

Cons: 1. Can be difficult and expensive to find experts. 2. Best experts have knowledge of application domain and users. 3. Biggest problems: Important problems may get missed. Many trivial problems are often identified, such as false alarms. Experts have biases.

Usability testing: 1. Controlled settings. 2. Users are observed and timed. 3. Data is recorded on video, and key presses are logged. 4. The data is used to calculate performance times and to identify and explain errors.5. User satisfaction is evaluated using questionnaires and interviews. 6.Field observations may be used to provide contextual understanding. 7.Involves recording performance of typical users doing typical tasks.

Testing conditions: 1.Usability lab or other controlled space. 2. Emphasis on: Selecting representative users, developing representative tasks. 3. 5-10 users typically selected. 4. Tasks usually around 30 minutes. 5. Test conditions are the same for every participant. 6. Informed consent form explains procedures and deals with ethical issues.

CSUQ/SUS

Experiments: 1. Test hypothesis. 2. Predict the relationship between two or more variables. 3. Independent variable is manipulated by the researcher. 4. Dependent variable influenced by the independent variable. 5. Typical experimental designs have one or two independent variables. 6. Validated statistically and replicable.

The goal of an experiment is to find statistical evidence to reject the null hypothesis (no difference between experimental treatments) in order to support the alternative hypothesis (mutually exclusive with the null hypothesis).

Types:1.Between subjects designs:

Different participants.

Single group of participants is allocated randomly to the experimental conditions. Pro: no order effects. Cons: Many subjects and individual differences is a problem.

2.Within-subjects:

Same participants.

All participants appear in all conditions. Pro: Few individuals, no individual differences. Cons: Counter-balancing needed because of ordering effects(use Latin Square Design).

Procedure:1. Identify a research hypothesis 2. Specify the design of the study 3. Run a pilot study to test the design, the system, and the study instruments 4. Recruit participants 5. Run the actual data collection sessions 6. Analyze the data 7. Report the results

可用性测试：

1.改进产品：可用性测试的主要目的是通过发现和解决用户在使用产品时遇到的问题来改进产品。

2.少量参与者：可用性测试通常只需要少量的参与者（例如5-10人），因为测试的目标是发现显著的可用性问题，而不是进行统计分析。

3.结果指导设计：可用性测试的结果直接用于指导产品的设计和改进，帮助开发者了解用户的需求和问题。

4.通常不能完全复制：由于可用性测试的条件（如参与者、任务等）可能因测试而异，因此结果可能不完全可复制。

5.尽可能控制条件：尽管可用性测试的条件可能因测试而异，但仍然会尽可能控制变量，以减少外部干扰。

6.计划好的程序：可用性测试通常有详细的计划和程序，包括任务、问题和评估方法。

7.结果报告给开发者：可用性测试的结果直接报告给产品开发者，以便他们根据反馈进行设计改进。

研究实验：

1.发现知识：研究实验的主要目的是通过测试假设来发现新知识，而不仅仅是改进产品。

2.大量参与者：研究实验通常需要大量的参与者，以便进行统计分析，验证结果的显著性。

3.结果通过统计验证：研究实验的结果需要通过统计方法进行验证，以确保发现是可靠的。

4.必须可复制：研究实验的结果必须是可复制的，即其他研究者在相同条件下应该能够获得相同的结果。

5.严格控制条件：研究实验的条件必须严格控制，以确保结果的可靠性和可复制性。

6.实验设计：研究实验需要精心设计的实验方案，包括自变量、因变量、控制变量等。

7.向科学界报告：研究实验的结果需要以科学报告的形式向科学界公布，以便其他研究者进行评估和验证。

Field Study: 1. Field studies are done in natural settings. 2. “In the wild” is a term for prototypes being used freely in natural settings 3. Seek to understand what users do naturally and how technology impacts them 4. Field studies are used in product design to: Identify opportunities for new technology. Determine design requirements. Decide how best to introduce new technology. Evaluate technology in use.

图形用户界面, 文本, 应用程序, 网站

AI 生成的内容可能不正确。A/B testing: 1. A large-scale experiment (thousands of participants or more). 2.Offers another way to evaluate a website, application of app running on a mobile device. 3. Often used for evaluating changes in design on social media applications. 4. Compares how two groups of users perform on two versions of a design. 5.May create ethical dilemmas if users don’t know they are part of the test.