UI Design – Guidelines and Principles (Part 1)

ITS290F

Introduction

1. **Theories**. High-level widely applicable frameworks to draw on during ***design*** and ***evaluation*** as well as to support communication and teaching. Theories can also be ***predictive***, such as those for pointing times by individuals or posting rates for community discussions.
2. **Principles**. Middle-level strategies or rules to analyze and compare design alternatives.
3. **Guidelines**. Low-level focused advice about good practices and cautions against dangers.

Guidelines

Guidelines

From the earliest days of computing, UI designers have written down guidelines to record their **insights** and to try to **guide the efforts of future designers**.

A guideline document offers a **shared language**, promotes **consistency** among designers in terminology usage, appearance, and action sequences. It records **best practices** derived from practical experience or empirical studies (research), with appropriate examples and counterexamples.

Guidelines

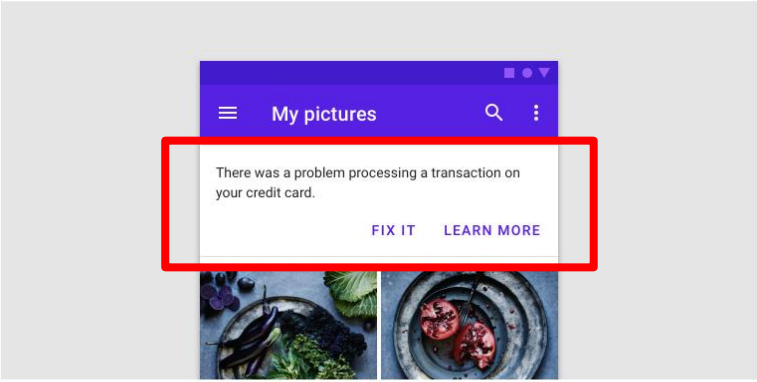
Guidelines fall into several groups, including these:

- Style – e.g., brand logos, colors
- Layout – e.g., grid or list structure
- User interface (UI) components – e.g., menus, buttons
- Text – e.g., font, tone, labels/fields
- Accessibility – e.g., Aria markup for disabled users
- Design Patterns – e.g., forms

Guidelines: Example (Google Material Design)

Banners

A banner displays a prominent message and related optional actions.



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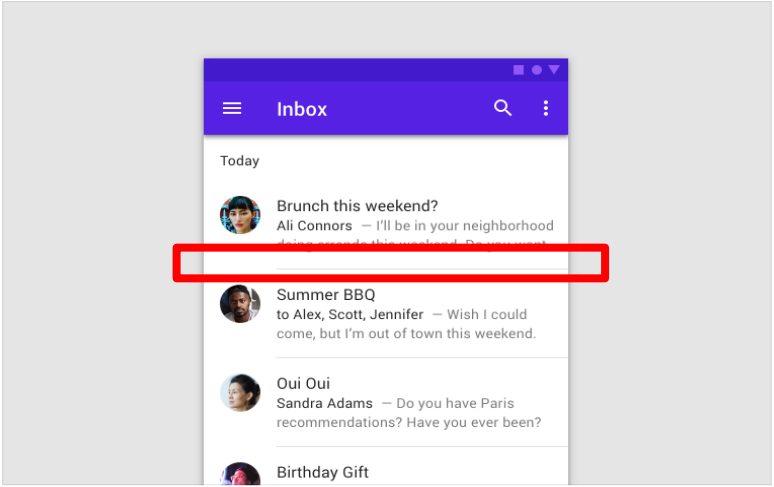
Dividers

A divider is a thin line that groups content in lists and layouts.



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Guidelines: Examples (US Government) - Navigation

Document Type: Guideline

Topic:

Navigation

Guideline:

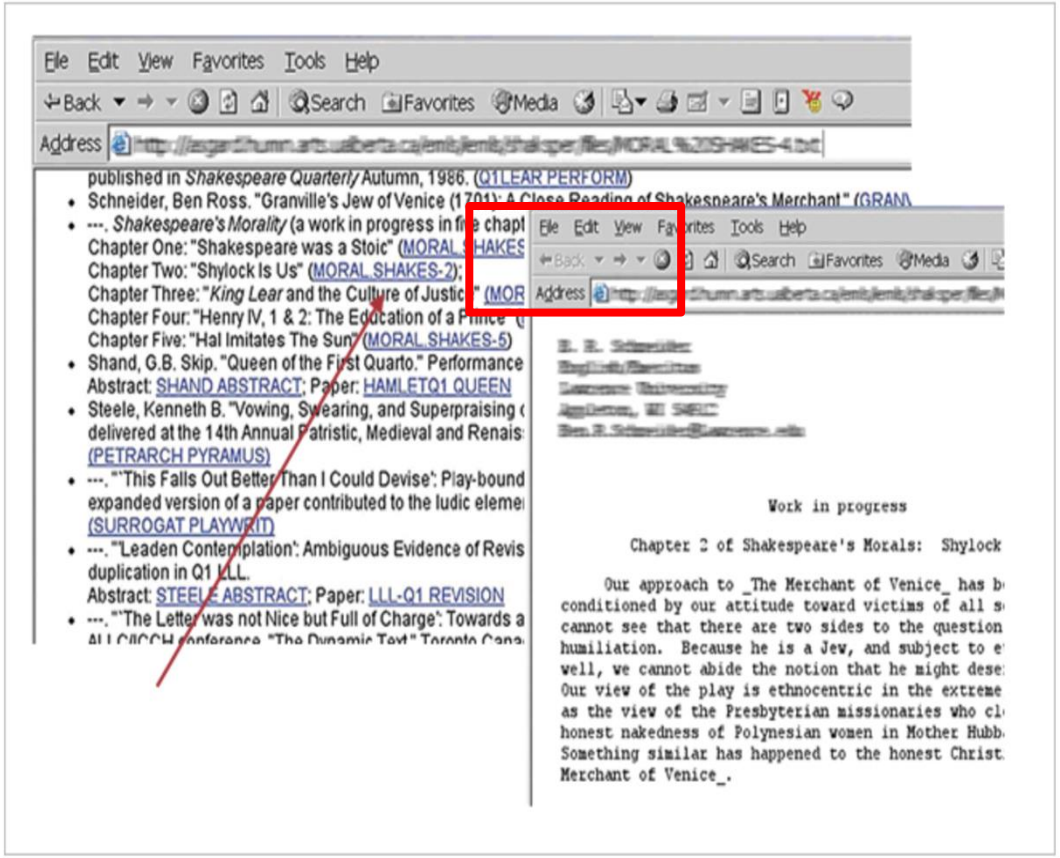
Do not create or direct users into pages that have no navigational options.

Comments:

When creating links that open new browser windows, ensure that the ‘Back’ button is still available, and that the new window is setup to return the user to the original browser window. Disabling navigation is confusing and frustrating to users, and can negatively impact user satisfaction and task completion.

Guidelines: Examples (US Government) - Navigation (Cont'd)

The link for this document opens a new browser window that presents the user with a disabled 'Back' button. This can confuse users.

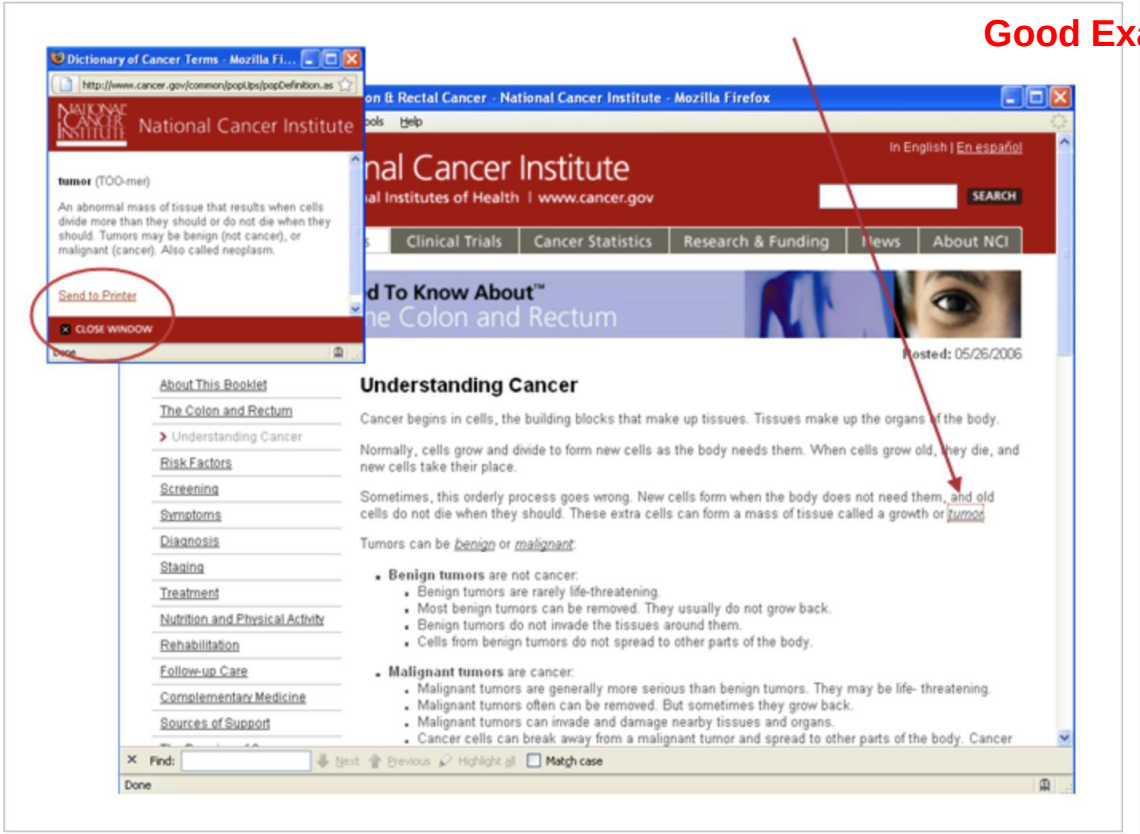


Poor Example

Guidelines: Examples (US Government) - Navigation (Cont'd)

This window does not block the original window, and provides an obvious place to close the window.

Good Example



Guidelines: Examples (US Government) - Controls and Widgets

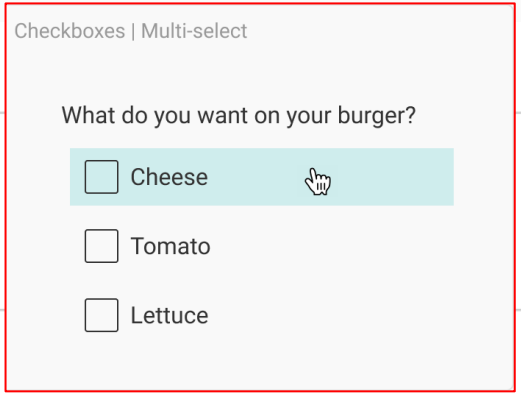
Document Type: Guideline

Topic:

Controls and Widgets

Guideline:

Use a check box control to allow users to select one or more items from a list of possible choices.



Comments:

Each check box should be able to be selected independently of all other check boxes. One study showed that for making multiple selections from a list of non-mutually exclusive items, check boxes elicit the fastest performance and are preferred over all other widgets. Users should be able to click on either the box or the text label.

Guidelines: Examples (US Government) - Controls and Widgets

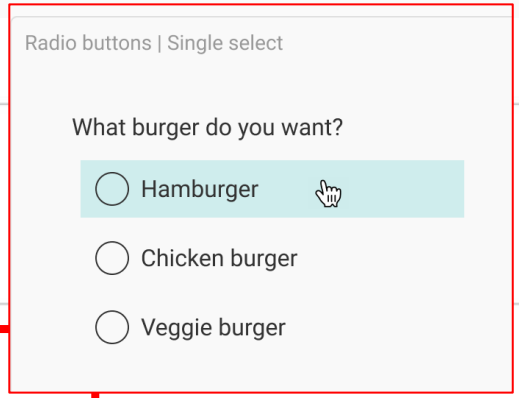
Document Type: Guideline

Topic:

Controls and Widgets

Guideline:

Provide radio buttons when users need to choose one response from a list of mutually exclusive options.



Comments:

Radio buttons should be used when there is a need to select from among mutually exclusive items. Users should be able to click on the button or its text label to make their selection. Assign one of the radio button choices as the default when appropriate. One study reported that for making mutually exclusive selections, radio buttons elicit reliably better performance than drop-down lists. Radio buttons are also preferred over both open lists and drop-down lists.

Guidelines: **Organizing the Display** (Smith & Mosier, 1986)

1. Consistency of data display
2. Efficient information assimilation by the user
3. Minimal memory load on the user
4. Compatibility of data display with data entry
5. Flexibility for user control of data display

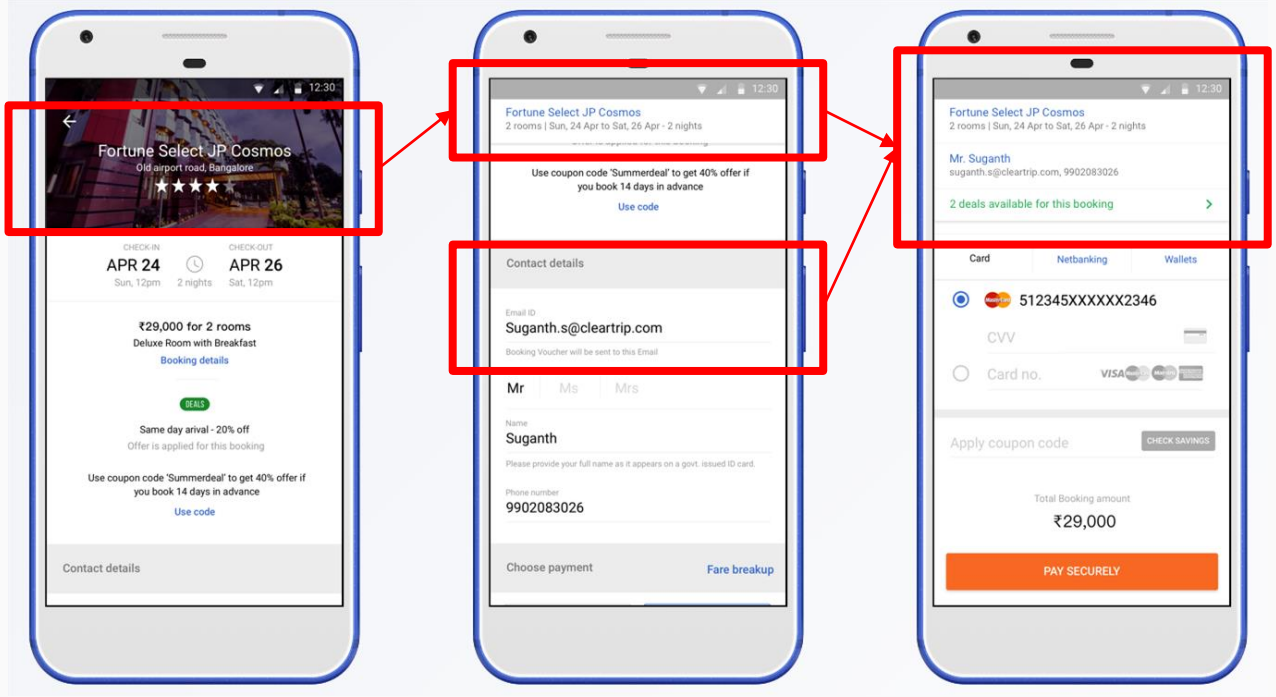
Example: Organizing the Display Guideline

1. *Consistency of data display.* During the design process, the terminology, abbreviations, formats, colors, capitalization, and so on should all be standardized and controlled by use of a dictionary of these items.

Example: Organizing the Display Guideline

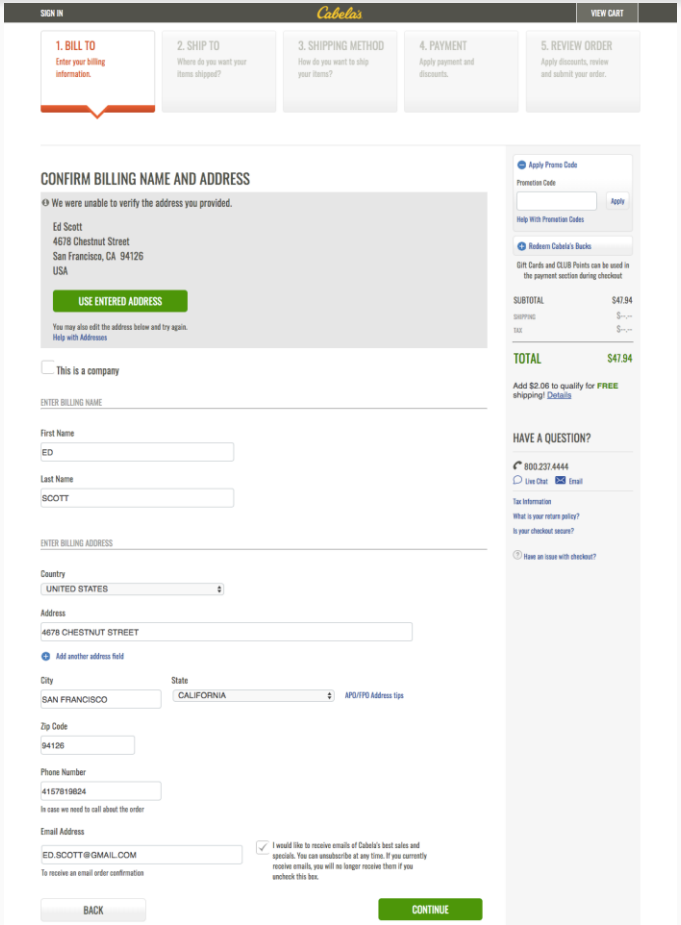
2. *Efficient information assimilation by the user.* The format should be familiar to the operator and should be related to the tasks required to be performed with the data. This objective is served by rules for neat columns of data, left justification for alphanumeric data, right justification of integers, lining up of decimal points, proper spacing, use of comprehensible labels, and appropriate measurement units and numbers of decimal digits.

Example: Organizing the Display Guideline

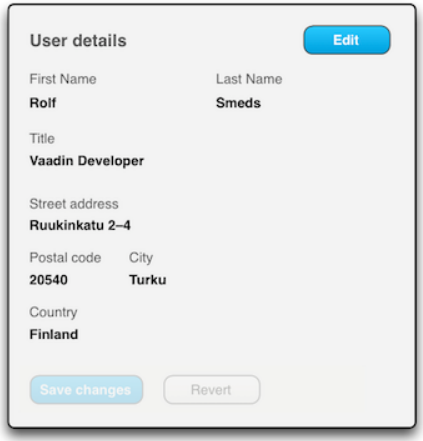


3. *Minimal memory load on the user.* Users should not be required to remember information from one screen for use on another screen. Tasks should be arranged such that completion occurs with few actions, minimizing the chance of forgetting to perform a step. Labels and common formats should be provided for novice or intermittent users.

Example: Organizing the Display Guideline



4. *Compatibility of data display with data entry.* The format of displayed information should be linked clearly to the format of the data entry. Where possible and appropriate, the output fields should also act as editable input fields.



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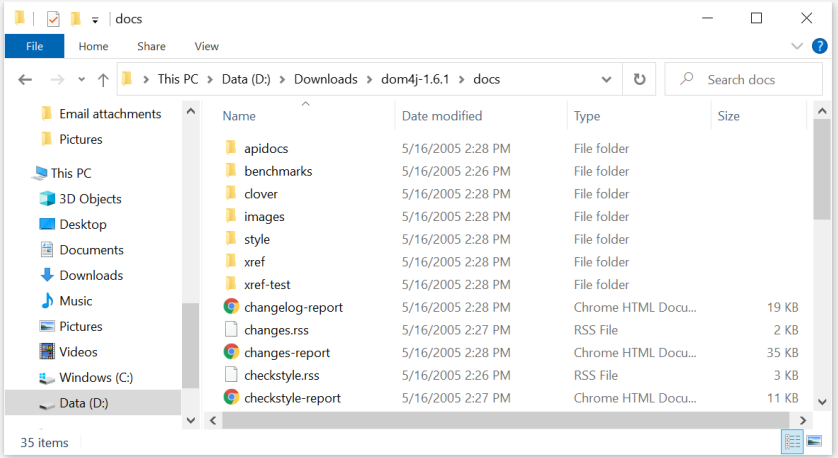

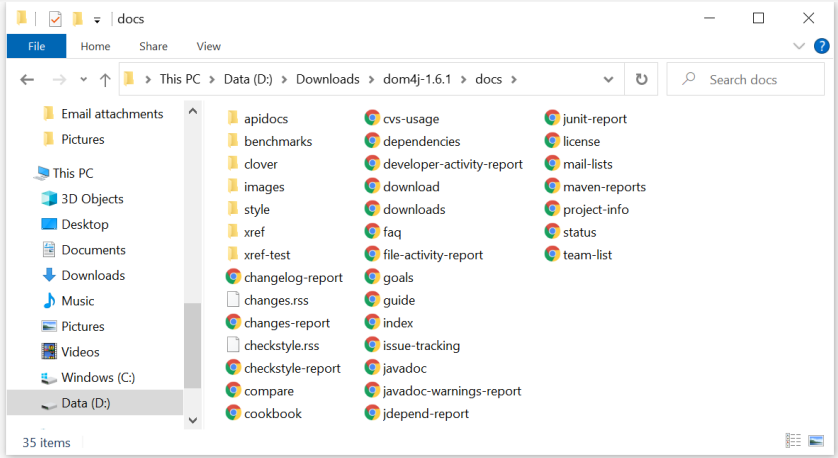

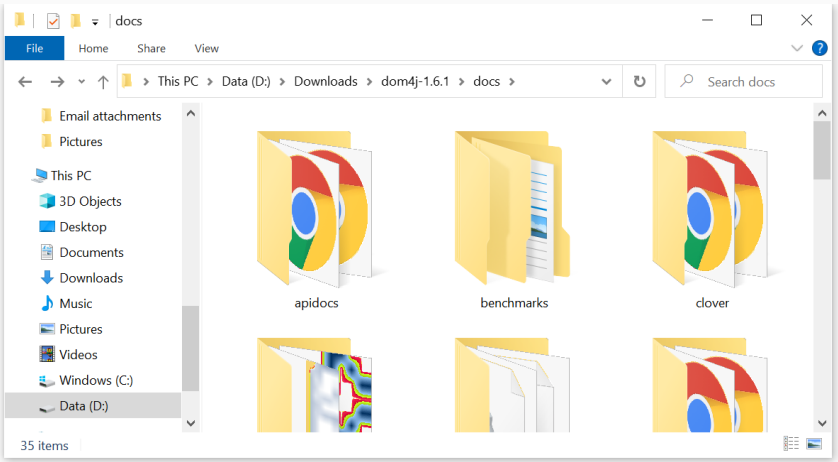

5. *Flexibility for user control of data display.* Users should be able to get the information from the display in the form most convenient for the task on which they are working. For example, the order of columns and sorting of rows should be easily changeable by the users.

Guidelines: **Organizing the Display** (Smith & Mosier, 1986)

1. *Consistency of data display.* During the design process, the terminology, abbreviations, formats, colors, capitalization, and so on should all be standardized and controlled by use of a dictionary of these items.
2. *Efficient information assimilation by the user.* The format should be familiar to the operator and should be related to the tasks required to be performed with the data. This objective is served by rules for neat columns of data, left justification for alphanumeric data, right justification of integers, lining up of decimal points, proper spacing, use of comprehensible labels, and appropriate measurement units and numbers of decimal digits.
3. *Minimal memory load on the user.* Users should not be required to remember information from one screen for use on another screen. Tasks should be arranged such that completion occurs with few actions, minimizing the chance of forgetting to perform a step. Labels and common formats should be provided for novice or intermittent users.
4. *Compatibility of data display with data entry.* The format of displayed information should be linked clearly to the format of the data entry. Where possible and appropriate, the output fields should also act as editable input fields.
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Guidelines: **Getting the User's Attention** (Wickens et. al., 2012)

- **Intensity**. Use two levels only, with limited use of **high intensity** to draw attention.
- **Marking**. Underline the item, enclose it in a box, point to it with an arrow,  or use an indicator such as an asterisk, bullet, dash, plus sign, or X.
- **Size**. Use up to four sizes, with larger sizes attracting more attention.
- **Choice of fonts**.Use up to **three fonts**.
- **Blinking**. Use blinking displays (2 - 4 Hz) or blinking color changes with great care and in limited areas, as it is distracting and can trigger seizures.
- **Color**. Use up to four standard colors, with additional colors reserved for occasional use.
- **Audio**. Use soft tones for regular positive feedback and harsh sounds for rare emergency conditions.

There is a danger of creating cluttered displays by overusing these techniques

Guidelines: **Facilitating Data Entry** (Smith & Mosier, 1986)

- **Consistency of data-entry transactions**. Similar sequences of actions speed learning.
- **Minimal input actions by user**. Fewer input actions mean greater operator productivity and—usually—fewer chances for error. Making a choice by a single mouse selection or finger press, is preferred over typing in a lengthy string of characters. Selecting from a list of choices eliminates the need for memorization, structures the decision-making task, and eliminates the possibility of typographic errors. A second aspect of this guideline is that redundant data entry should be avoided. It is annoying for users to enter the same information in two locations, such as entering the billing and shipping addresses when they are the same. Duplicate entry is perceived as a waste of effort and an opportunity for error.
- **Minimal memory load on users**. When doing data entry, users should not be required to remember lengthy lists of codes.
- **Compatibility of data entry with data display**. The format of data-entry information should be linked closely to the format of displayed information, such as dashes in telephone numbers.
- **Flexibility for user control of data entry**. Experienced users prefer to enter information in a sequence that they can control, such as selecting the color first or size first, when clothes shopping.

Guidelines

- Guidelines can be too specific, incomplete, difficult to apply, and sometimes wrong…
- Guidelines documents are a wonderful starting point to give designers the benefit of experience, but they will always need processes to facilitate education, enforcement, exemption, and enhancement.

Principles

Principles

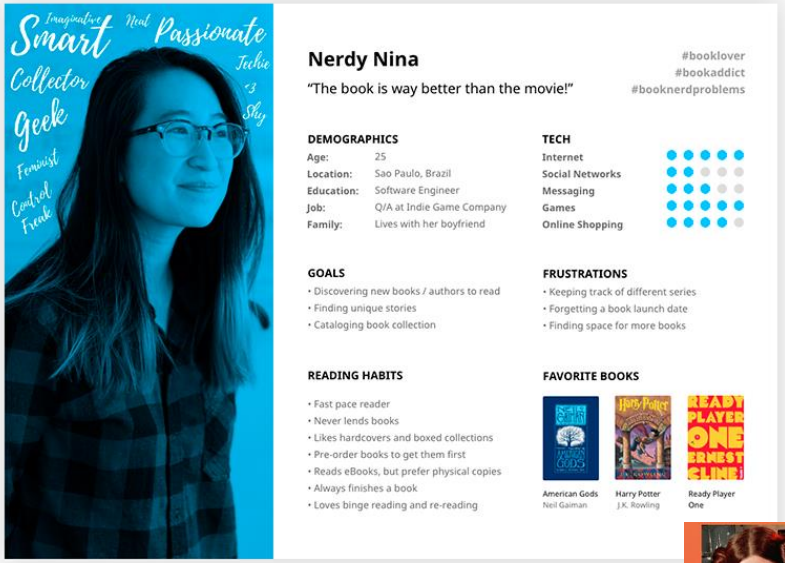
While guidelines are low-level and narrowly focused, principles are more **fundamental**, **widely applicable**, and **enduring**.

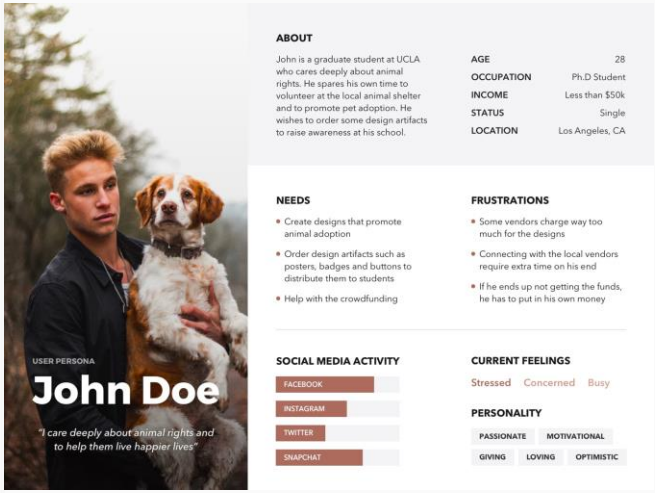
Example: ***the principle of recognizing user diversity***. Designers need to understand the differences in users' background knowledge, frequency of use, and goals as well as in the impact of user errors.

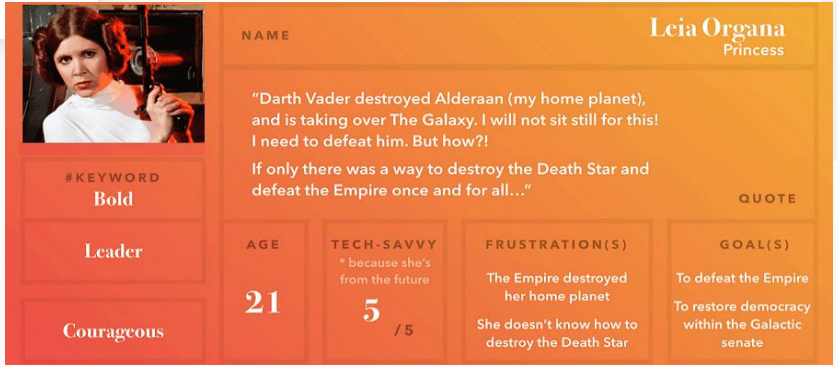
Principle: Determine users' skill levels

- People learn, think, and solve problems in different ways.
  - Some user prefer to deal with tables rather than graphs, with words instead of numbers, or with rigid structures rather than open-ended forms.
- Where / how to begin?
  - Begin with an understanding of the **intended users**, including population profiles (***demographics***) that reflect their age, gender, physical and cognitive abilities, education, cultural or ethnic backgrounds, training, motivation, goals, personality, location (urban vs. rural), economic profile, disabilities, attitudes toward using technology...
    - An interface for each community of users?
  - Prepare **user personas** -- nurses, doctors, storekeepers, high school students, children and etc.; each have various combinations of knowledge and usage pattern.
  - Prepare **user journey** for each persona -- **identify the tasks** (more on this later)
  - Personas and user journeys in health systems:
    - https://uxplanet.org/personas-and-user-journeys-in-health-b4f4596f428d

User Persona: Examples







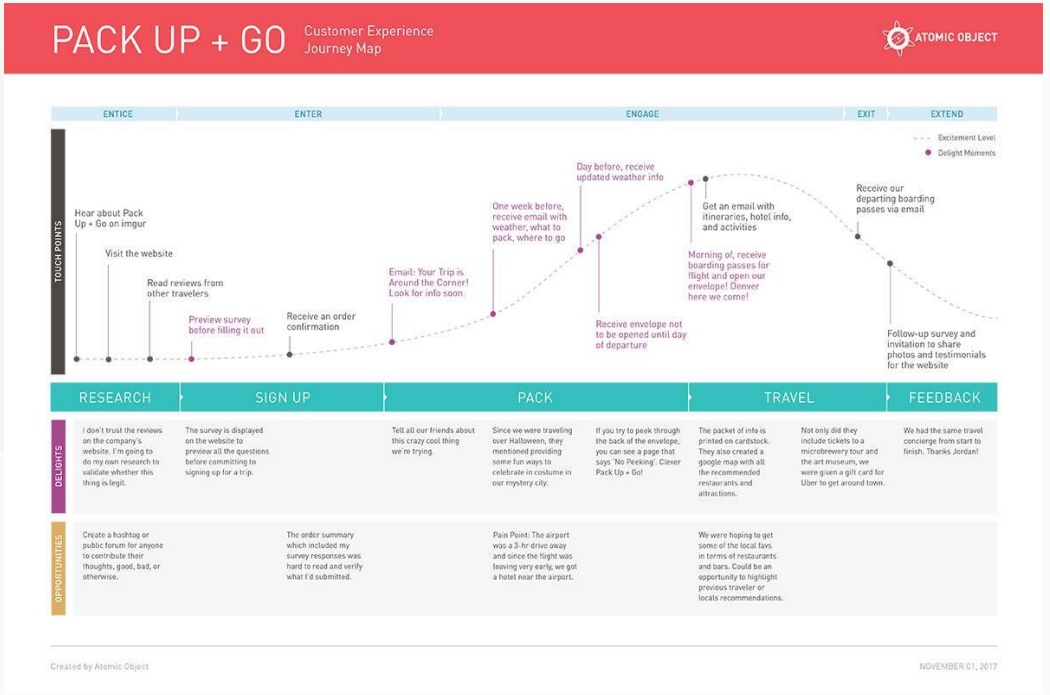
User Journey: Examples

ADAM ARTIST

Task
Adam registered and would like to sell his first product

Motivation
To earn money with his hobby
To popularize his art

Context
He is working on his computer in his studio



Alternatives...

The process of getting to know the users is never-ending because there is **so much to know** and because the **users keep changing**. Use generic groupings as a starting point:

1. Novice or first-time users
2. Knowledgeable intermittent users
3. Expert frequent users

Principles - Identify the Tasks

After carefully drawing the user personas, designers identify the tasks to be carried out.

- Perform **task analysis** (Hackos and Redish, 1998; Wickens et al., 2012)
- Involve long hours of **observing** and **interviewing users**.
- Understand **task frequencies** and **sequences** and make decisions about what tasks to support

Identify the Tasks – Word Processor Example

- **Frequent actions** might be performed by pressing hot keys, such as ***Ctrl-C*** and ***Ctrl-V*** for copy and paste, and ***Ctrl-B*** and ***Ctrl-I*** for bold and italics fonts

- **Less frequent actions** might be performed by a selection from the toolbar or pull-down menu, such insert shapes and tables.

- **Infrequent actions** or **complex actions** might require going through a sequence of menu selections or form fill-ins — for example, to change the paper margins and orgainze references and citations.

Identify the Tasks – Frequency Matrix

Frequency of Task by Job Title

Hypothetical frequency-of-use of data for a medical clinic information system. Answering queries from appointment personnel about individual patients is the highest-frequency task (****), and lower-frequency use is shown with ***, **, or *.

	TASK				
Job Title	**Query by Patient**	**Update Data**	**Query across Patients**	**Add Relations**	**Evaluate System**
Nurse	**	**			
Physician	**	*			
Supervisor	*	*	**		
Appointment personnel	****				
Medical-record maintainer	**	**	*	*	
Clinical researcher			***		*
Database programmer		*	**	**	*

Principle - **Choose an Interaction Style**

When the task analysis is complete and the tasks and actions have been identified, designers can choose from five primary interaction styles (to implement the actions):

1. Direct manipulation
2. Menu selection
3. Form fill-in
4. Command language
5. Natural language

Interaction Style - Direct Manipulation

By **pointing** at visual representations of objects and actions, users can carry out tasks rapidly and can observe the results immediately (for example, dragging and dropping an icon into a trash can).

Direct manipulation is **appealing to novices**, is **easy to remember for intermittent users**, and, with careful design, can be rapid for frequent users.

Context-aware, embedded, natural, and wearable user interfaces **often extend the capacity of direct manipulation designs** by allowing users to gesture, point, move, or even dance to achieve their goals.

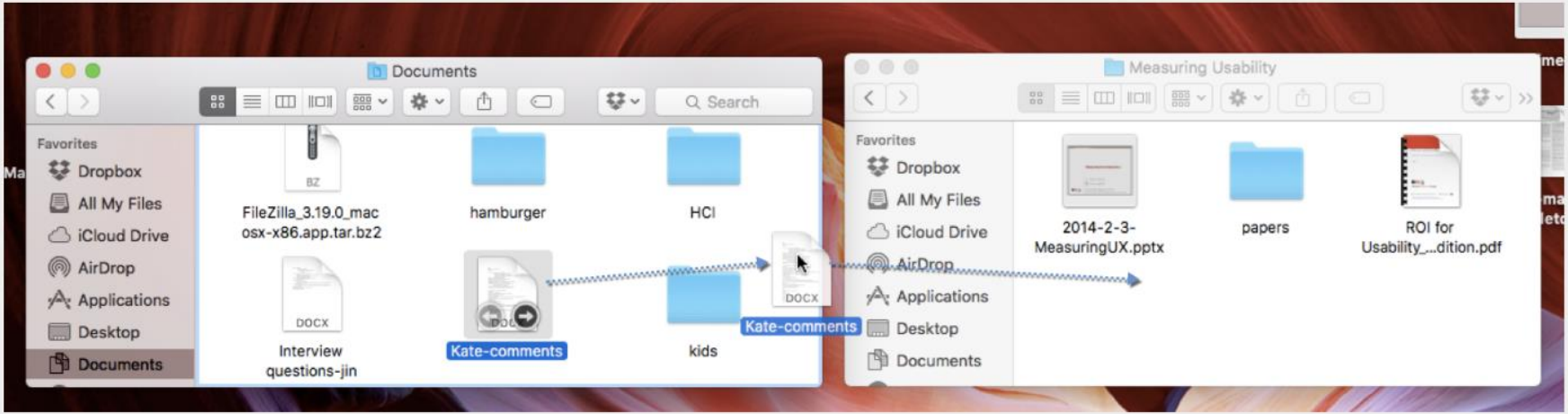
More about direct manipulation: https://www.nngroup.com/articles/direct-manipulation/

Interaction Style - Direct Manipulation Example

Let's say that you're looking at an image of yourself on a roller coaster and want to see if your terrified expression has been caught on camera. What do you do? Something like this?

On a mobile phone you can pinch out to zoom into an image and pinch in to zoom out.

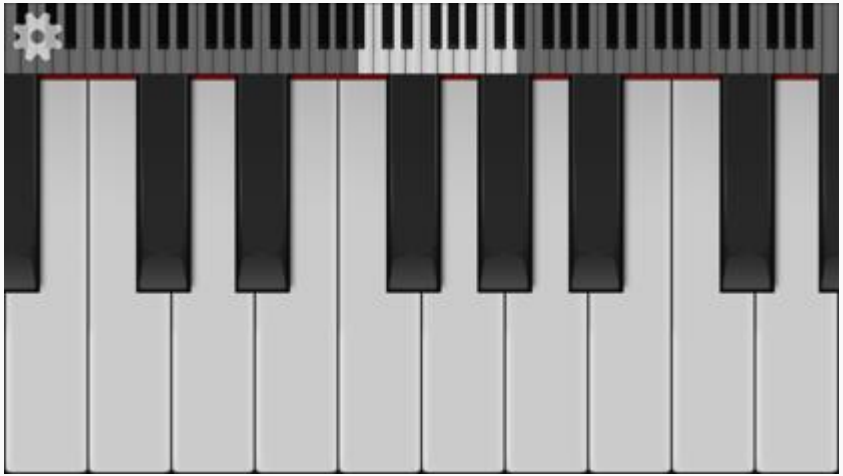
Interaction Style - Direct Manipulation Example



Moving a file on MacOS using direct manipulation involves dragging that file from the source folder and moving it into the destination folder.

Skeuomorphism

UI based on **resemblance** with a physical object in the real world.



A skeuomorphic direct-manipulation interface for “playing” the piano on a phone

Disadvantages of Direct Manipulation

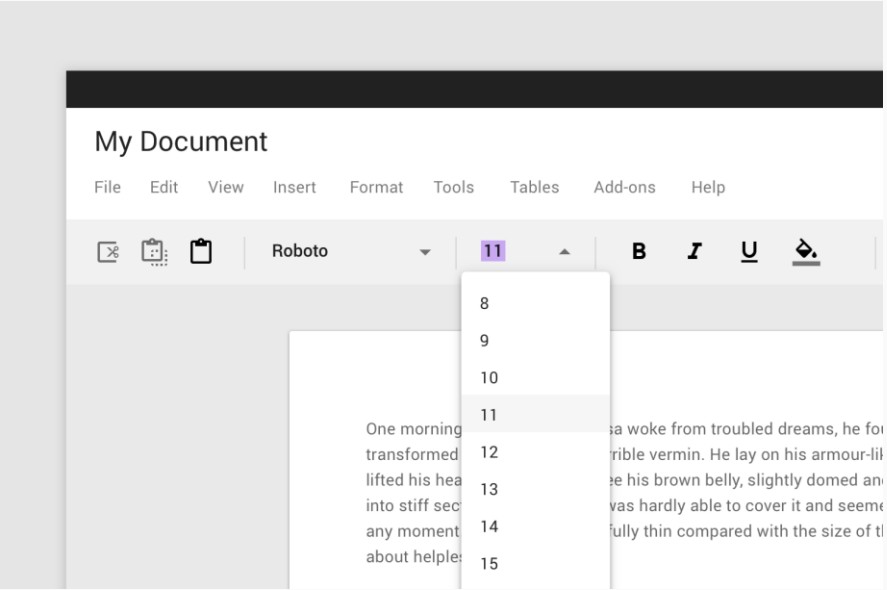
1. Direct manipulation is (can be) slow.
   If the user needs to perform a large number of actions, on many objects, using direct manipulation takes a lot longer than a command-line UI (more on this later)
2. Repetitive tasks are usually not well supported.
   DM interfaces are great for novices because they are easy to learn, but because they are slow, experts who have to perform the same set of tasks with high frequency, usually rely on keyboard shortcuts, macros, and other command-language interactions to speed up the process. For example, when you need to send an email attachment to one recipient, it is easy to drag the desired file and drop it into the attachment section. However, if you needed to do this for 50 different recipients with customized subject lines, a macro or script will be faster and less tedious.
3. Some gestures can be more error-prone than typing.

Interaction Style: Navigation & Menu Selection

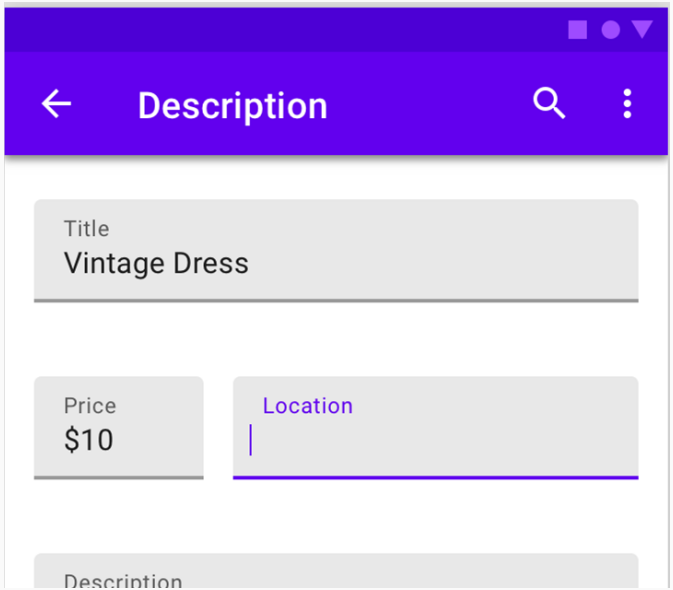
In navigation & menu selection, users **review choices, select the one most appropriate** to their task, and observe the effect.

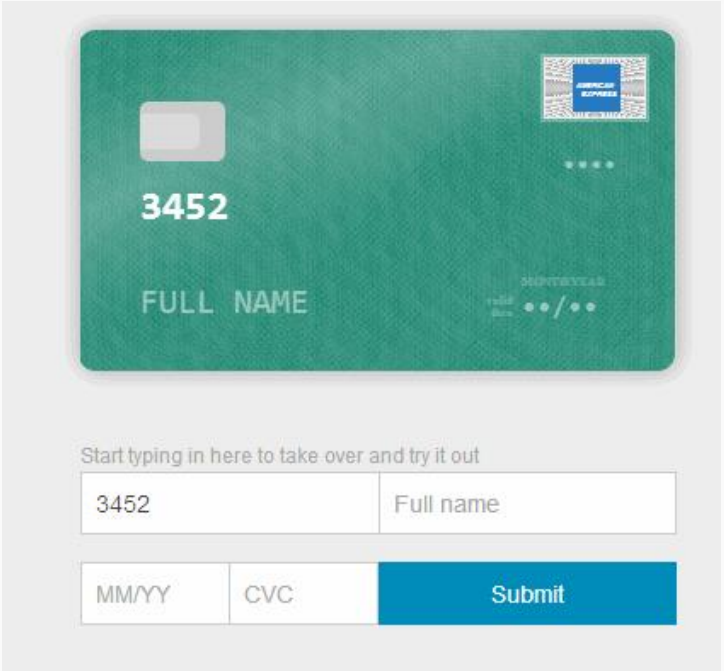
There is a clear structure to decision making, since all possible choices are presented at one time.

Appropriate for novice and intermittent users can be appealing to frequent users if the display and selection mechanisms are rapid.

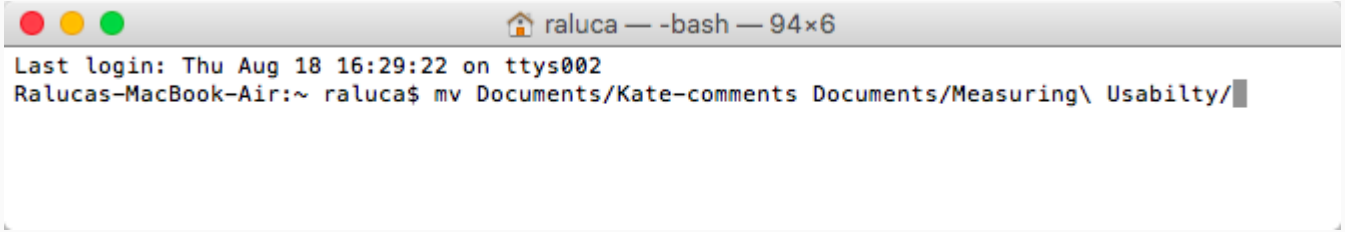


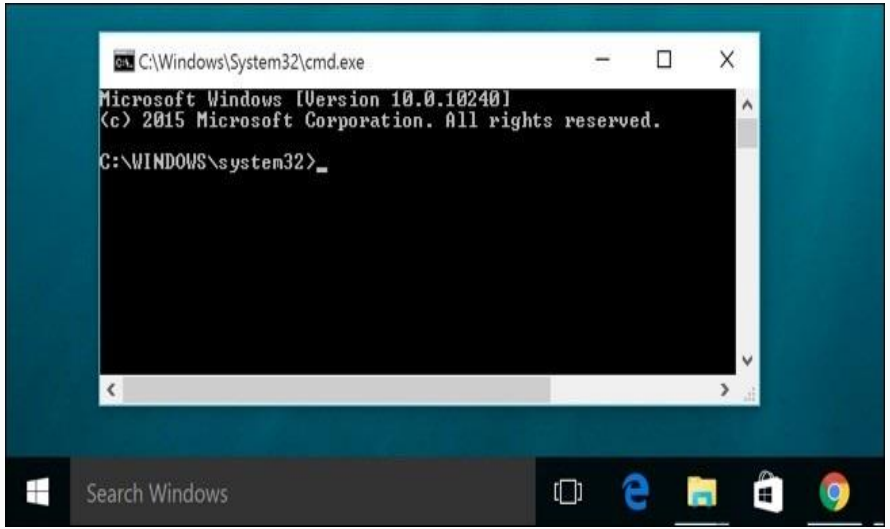
Interaction Style: Form Fill-in

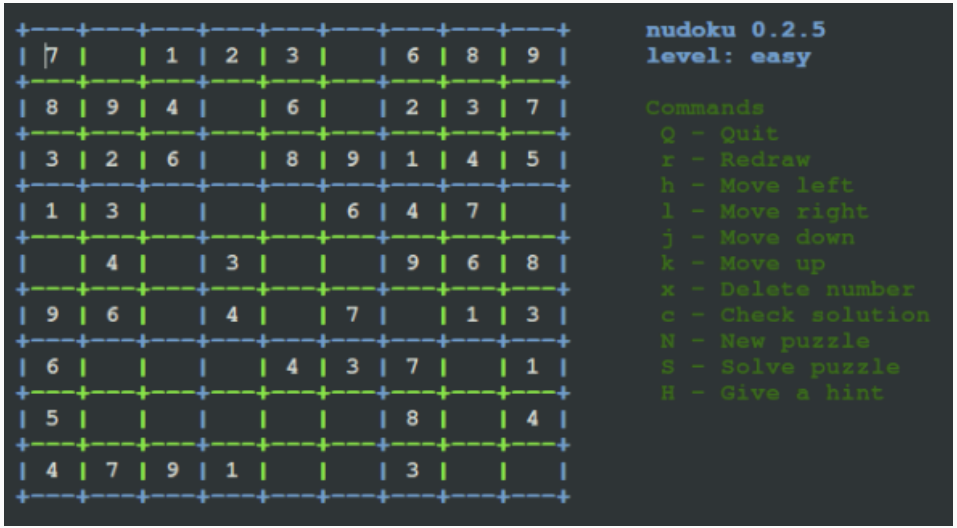




Interaction Style: Command Language







Interaction Style: Natural Language

Advantages	Disadvantages
Direct manipulation	
• Visually presents task concepts • Allows easy learning • Allows easy retention • Allows errors to be avoided • Encourages exploration • Affords high subjective satisfaction	• May be hard to program • Accessibility requires special attention
Navigation and menu selection	
• Shortens learning • Reduces keystrokes • Structures decision making • Permits use of dialog-management tools • Allows easy support of error handling	• Presents danger of many menus • May slow frequent users • Consumes screen space • Requires rapid display rate
Form fill-in	
• Simplifies data entry • Enables convenient assistance • Permits use of form-management tools	• Consumes screen space
Command language	
• Powerful • Allows easy scripting and history keeping	• Requires learning and retention • Error-prone
Natural language	
• Relieves burden of learning syntax	• Requires clarification dialog • May not show context • May require more keystrokes • Unpredictable