

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

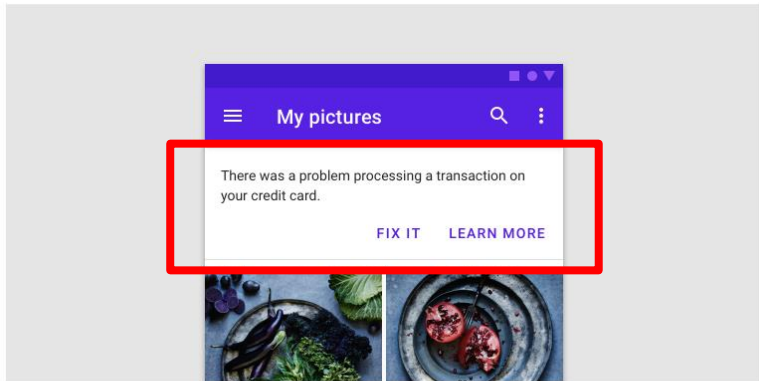
Guidelines fall into several groups, including these:

- 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.



CONTENTS

Usage

Anatomy

Placement

Behavior

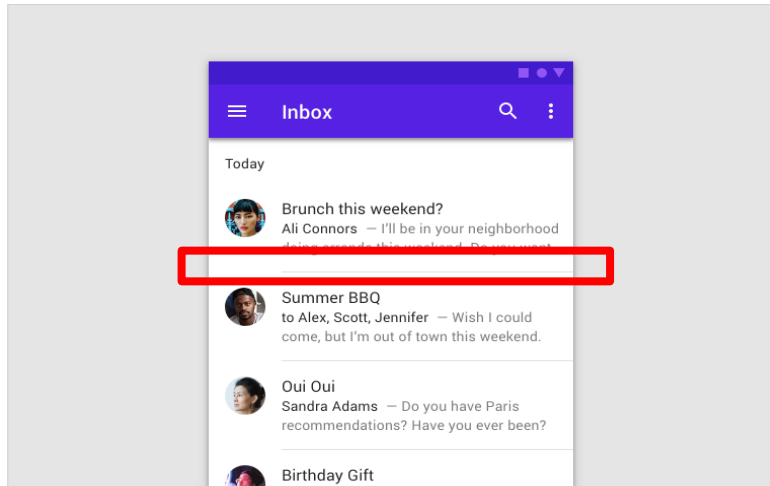
Theming

Specs

Implementation

Dividers

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



CONTENTS

Usage

Types

Theming

Specs

Implementation

Guidelines: Examples (US Government) - Navigation

Document Type: Guideline

Topic:

Navigation



Guideline:

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

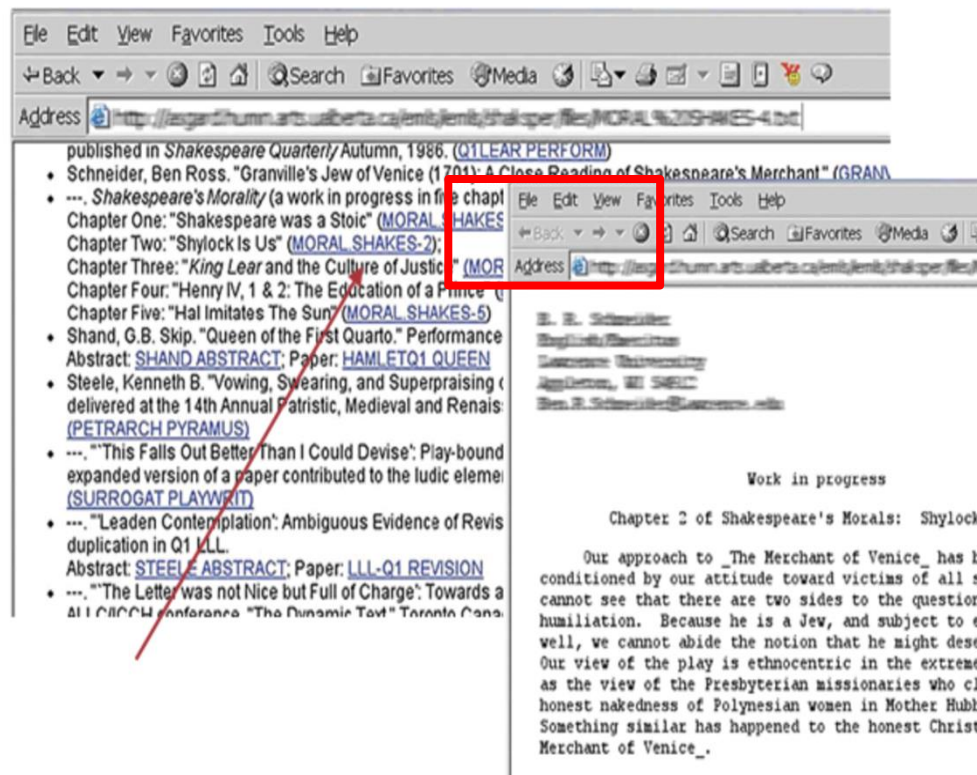
Comments:

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)

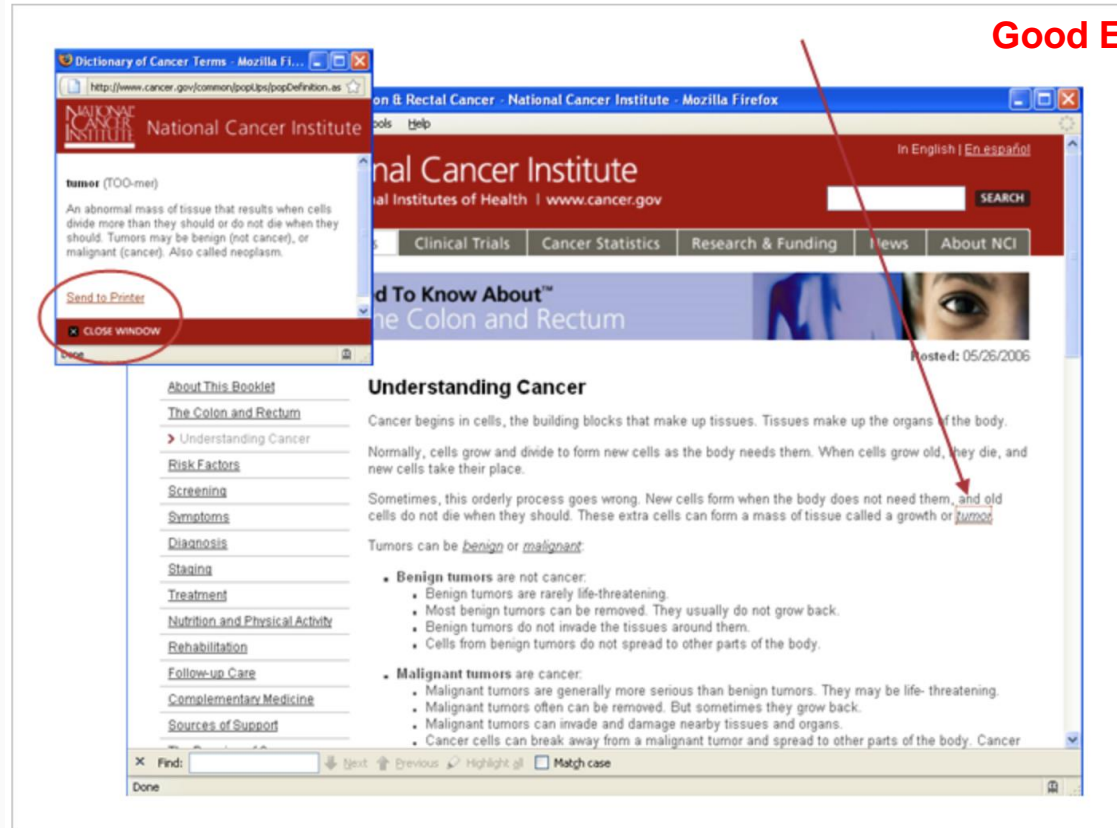
The link for this document opens a new browser window that presents the user with a disabled 'Back' button. This can confuse users.

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.



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.

Checkboxes | Multi-select

What do you want on your burger?

☒ Cheese



☐ Tomato

☐ Lettuce

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.

Radio buttons | Single select

What burger do you want?

☒ Hamburger 

☐ Chicken burger

☐ Veggie burger

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

The collage shows several government websites with the following features:

- Inland Revenue Department:** Features a search bar, site map, and a banner for the 'e-Stamping Service'.
- Labour Department:** Includes a 'What's New' section with a press release about the Revenue (Stamp Duty) Bill 2021.
- Auxiliary Medical Service:** Displays a 'Welcome Message' and 'What's New' section.
- Census and Statistics Department:** Shows a 'Browse by Subject' section with a line chart for Population (CQ00) and a table for Labour Unemployment Rate.

Navigation and Search Elements:

- Language options: 繁體版 (Traditional Chinese), 简体版 (Simplified Chinese).
- Search bars with placeholder text like 'Enter search keyword(s)' or 'Enter Your Keyword(s)'.
- Site maps and email notification services.
- Left-hand navigation menus with categories like 'Home', 'What's New', 'Publications', and 'Press Releases'.

Data Display Examples:

- Population (CQ00) Line Chart:** Shows data from End-2017 to End-2020. The Y-axis ranges from 7,100 to 7,700. The data points are approximately: End-2017 (7,400), Mid-2019 (7,450), and End-2020 (7,474.2).
- Labour Unemployment Rate Table:**

Subject	Period	Figure
Unemployment Rate (seasonally adjusted) (%)	11/2020-1/2021 #	7.0

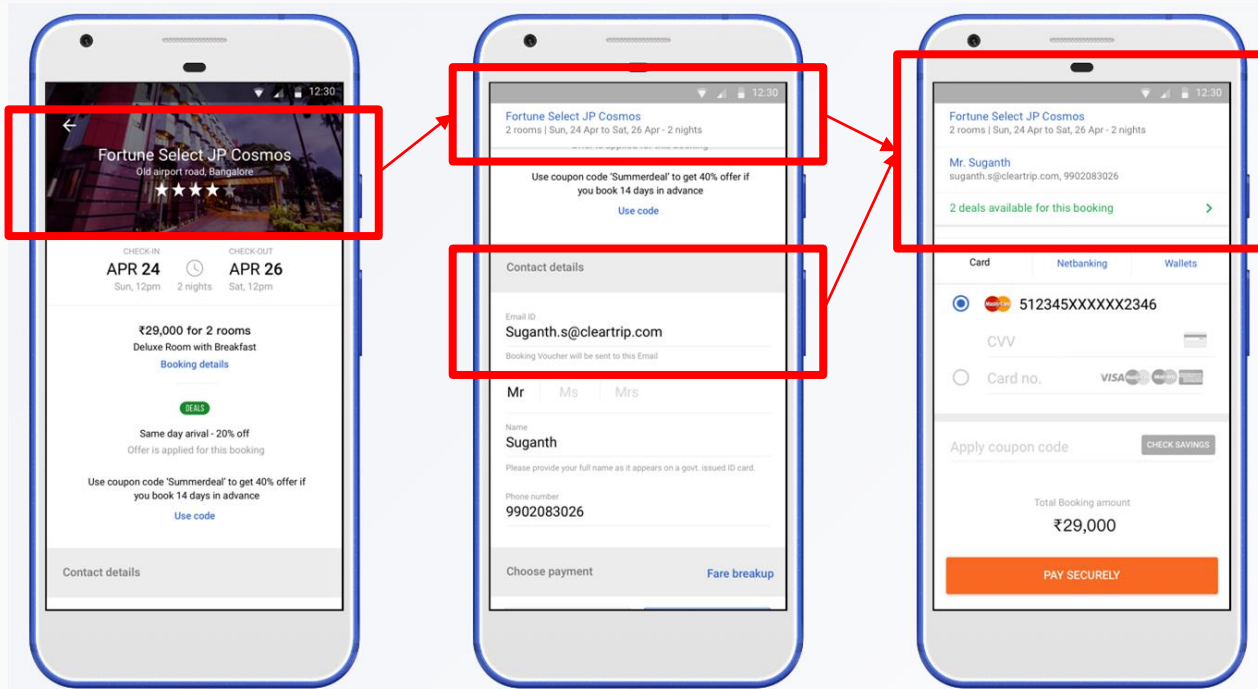
1. Consistency of data display. During the design process, the terminology, abbreviations, formats, colors, capitalization, and so on should all be standardized and controlled by use of a dictionary of these items.

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

SIGN INCabelasVIEW CART

1. BILL TO
Enter your billing information.

2. SHIP TO
Where do you want your items shipped?

3. SHIPPING METHOD
How do you want to ship your items?

4. PAYMENT
Apply payment and discounts.

5. REVIEW ORDER
Apply discounts, review and submit your order.

CONFIRM BILLING NAME AND ADDRESS

ⓘ We were unable to verify the address you provided.

Ed Scott
4678 Chestnut Street
San Francisco, CA 94126
USA

USE ENTERED ADDRESS

You may also edit the address below and try again.
[Help with Address](#)

☐ This is a company

ENTER BILLING NAME

First Name
ED

Last Name
SCOTT

ENTER BILLING ADDRESS

Country
UNITED STATES

Address
4678 CHESTNUT STREET

Add another address field

City
SAN FRANCISCO

State
CALIFORNIA

Zip Code
94126

Phone Number
4157819824

In case we need to call about the order

Email Address
ED.SCOTT@GMAIL.COM

☒ I would like to receive emails of Cabela's best sales and specials. You can unsubscribe at any time. If you currently receive emails, you will no longer receive them if you uncheck this box.

BACK

CONTINUE

Apply Promo Code

Promotion Code

Apply

Help With Promotion Codes

ⓘ Redeem Cabela's Bucks

Gift Cards and CLUB Points can be used in the payment section during checkout

SUBTOTAL \$47.94

TAX \$--

TOTAL \$47.94

Add \$2.00 to qualify for **FREE** shipping! [Details](#)

HAVE A QUESTION?

800.237.4444

☐ Live Chat ☐ Email

Tax Information

What is your return policy?

Is your checkout secure?

☒ Have an issue with checkout?

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.

User details

Edit

First Name
Rolf

Last Name
Smeds

Title
Vaadin Developer

Street address
Ruukinkatu 2-4

Postal code
20540

City
Turku

Country
Finland

Save changes

Revert

User details

Edit

First Name
Rolf

Last Name
Smeds

Title
Vaadin Developer

Street address
Ruukinkatu 2-4

Postal code
20540

City
Turku

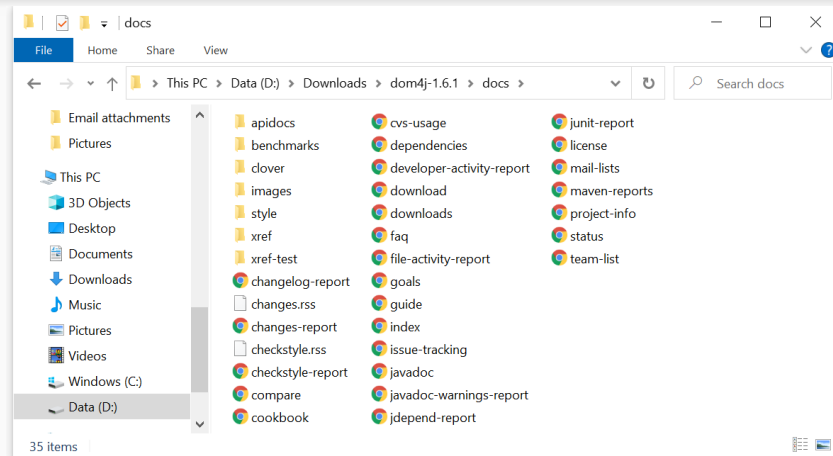
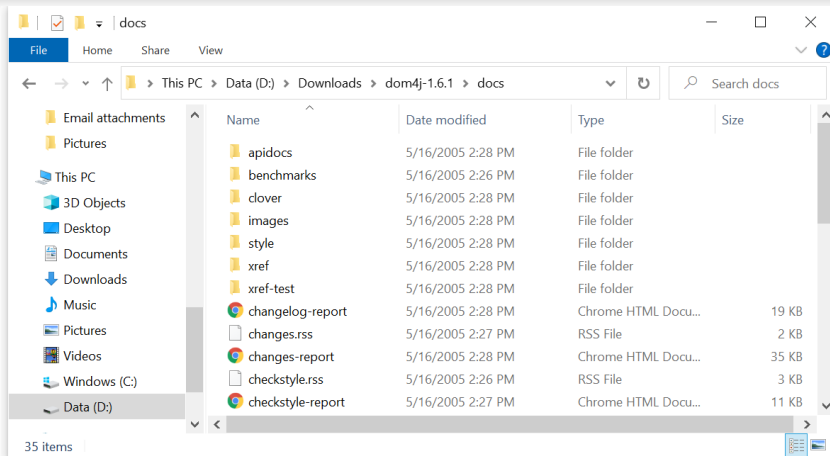
Country
Finland

Save changes

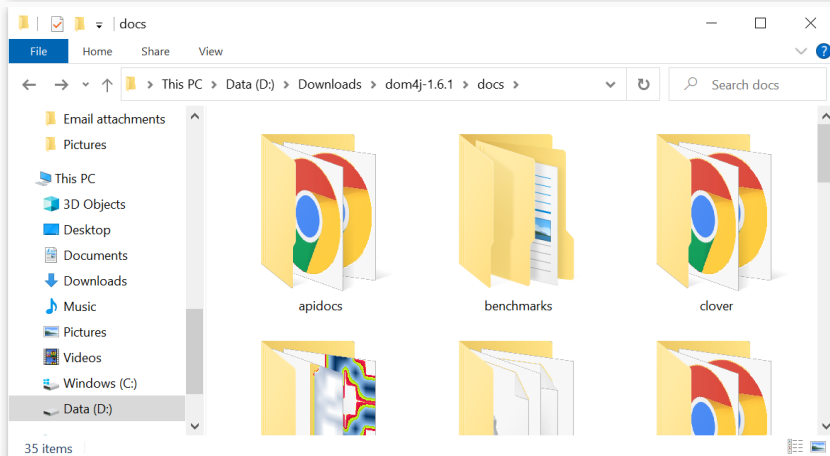
Cancel

16

Example: Organizing the Display Guideline




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.
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: **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



Nerdy Nina

"The book is way better than the movie!"

#booklover
#bookaddict
#booknerdproblems

DEMOGRAPHICS

Age: 25
Location: Sao Paulo, Brazil
Education: Software Engineer
Job: QA at Indie Game Company
Family: Lives with her boyfriend

TECH

Internet
Social Networks
Messaging
Games
Online Shopping



GOALS

- Discovering new books / authors to read
- Finding unique stories
- Cataloging book collection

FRUSTRATIONS

- Keeping track of different series
- Forgetting a book launch date
- Finding space for more books

READING HABITS

- Fast pace reader
- Never lends books
- Likes hardcovers and boxed collections
- Pre-order books to get them first
- Reads eBooks, but prefer physical copies
- Always finishes a book
- Loves binge reading and re-reading

FAVORITE BOOKS



ABOUT

John is a graduate student at UCLA who cares deeply about animal rights. He spares his own time to volunteer at the local animal shelter and to promote pet adoption. He wishes to order some design artifacts to raise awareness at his school.

AGE 28
OCCUPATION Ph.D Student
INCOME Less than \$50k
STATUS Single
LOCATION Los Angeles, CA

NEEDS

- Create designs that promote animal adoption
- Order design artifacts such as posters, badges and buttons to distribute them to students
- Help with the crowdfunding

FRUSTRATIONS

- Some vendors charge way too much for the designs
- Connecting with the local vendors require extra time on his end
- If he ends up not getting the funds, he has to put in his own money

SOCIAL MEDIA ACTIVITY



CURRENT FEELINGS

Stressed Concerned Busy

PERSONALITY

PASSIONATE MOTIVATIONAL
GIVING LOVING OPTIMISTIC

JOAN THE SINGLE MOM

SINGLE FEMALE, 44 YEARS OLD
Chicago, IL



"I'm a single mom, so if I'm not working, I'm taking care of my kids. On my clock, every minute counts and it's easy to get behind."

Joan is a single mom who works as an HR manager in a mid-sized company. Her job is stressful. She tries not to bring work home, but occasionally she has to. On those nights, she isn't able to touch it until she is finished cooking dinner and helping her kids with their homework. Often times, this means she can't get to the work before 9pm.

Joan has 2 kids: one 9 year old boy and one 7 year old girl. They require a lot of attention, and now that they are getting older, she spends even more time driving them around town to everything from soccer practice to birthday parties. She spends a lot of her free time in the car and making small talk with other parents.

Joan only owns one vehicle, and although it's not that old, her attention is elsewhere. She already admits that she is not able to keep up with maintenance schedules or track records.



NAME

Leia Organa
Princess

"Darth Vader destroyed Alderaan (my home planet), and is taking over The Galaxy. I will not sit still for this! I need to defeat him. But how?!"

If only there was a way to destroy the Death Star and defeat the Empire once and for all..."

QUOTE

#KEYWORD
Bold

Leader

Courageous

AGE

21

TECH-SAVVY
* because she's from the future

5

/ 5

FRUSTRATION(S)

The Empire destroyed her home planet
She doesn't know how to destroy the Death Star

GOAL(S)

To defeat the Empire
To restore democracy within the Galactic senate

User Journey: Examples

ADAM ARTIST

Task

Adam registered and would like to sell his first product

Motivation

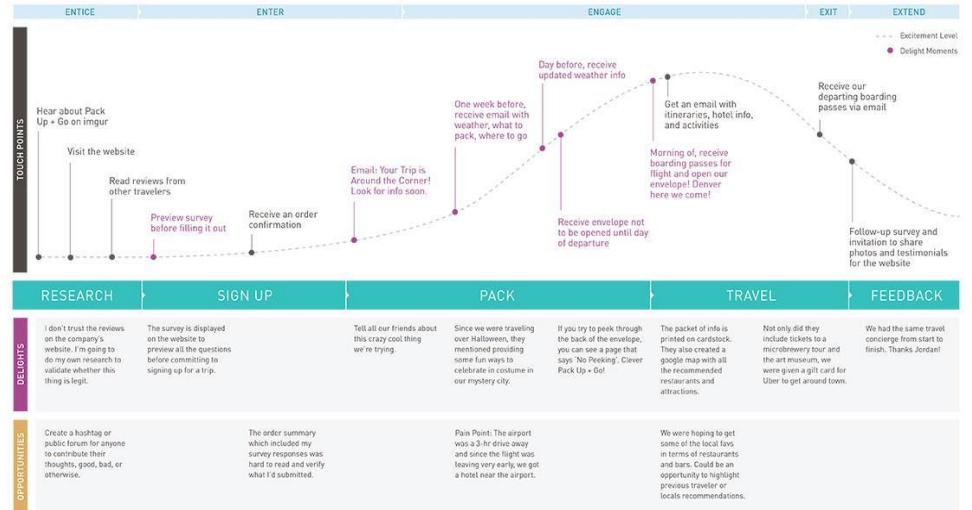
To earn money with his hobby
To popularize his art

Context

He is working on his computer in his studio



PACK UP + GO Customer Experience Journey Map



Created by Atomic Object

NOVEMBER 01, 2017

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 organize 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/>

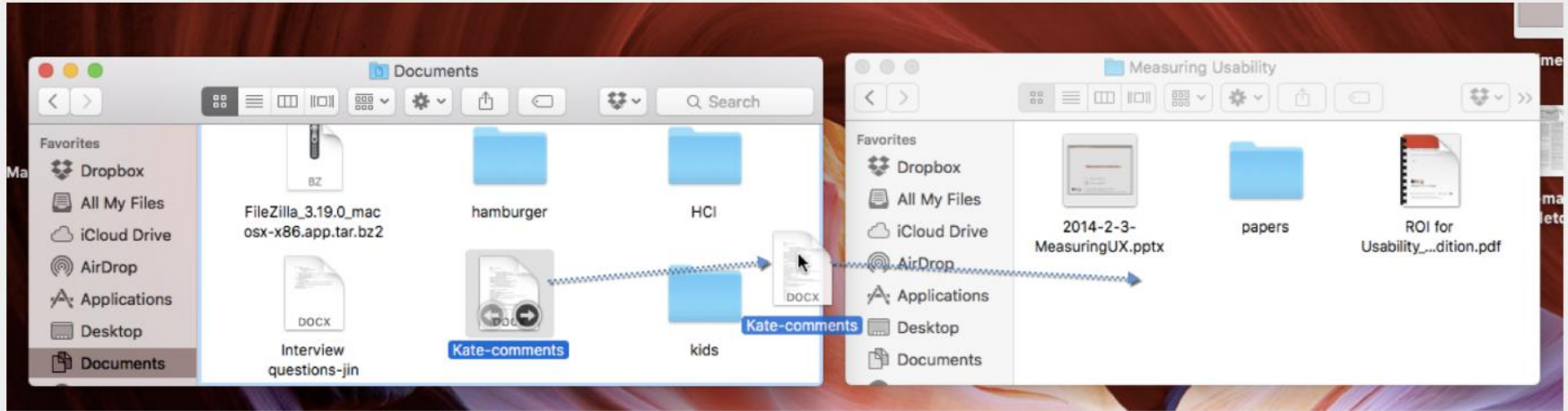
Interaction Style - Direct Manipulation Example

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.

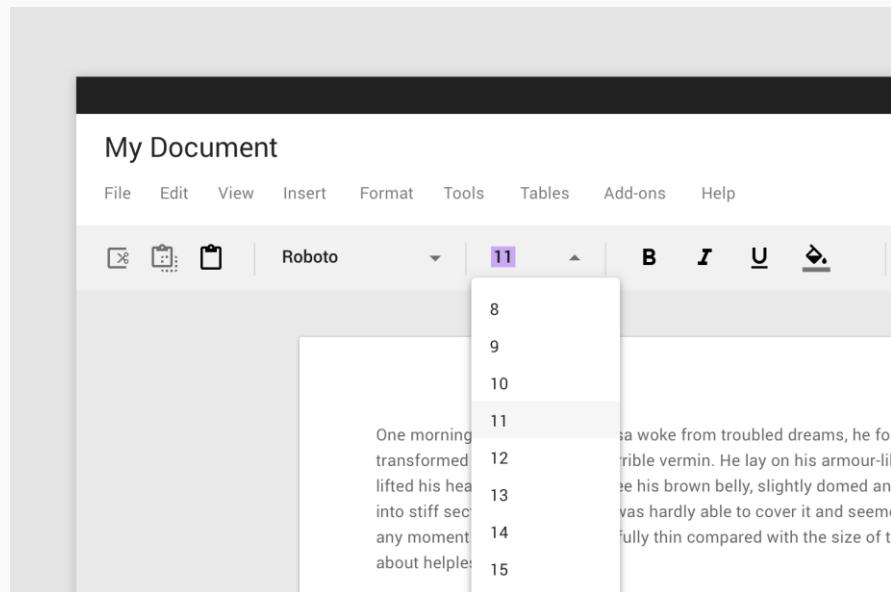
3. Some gestures can be more error-prone than typing.

Interaction Style: Navigation & Menu Selection

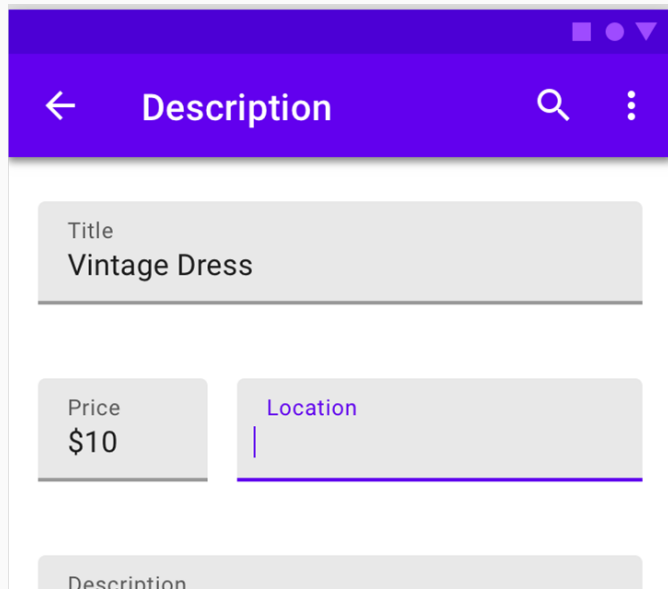
In navigation & menu selection, users **review choices, select the one most appropriate** to their task, and observe the effect.

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



A mobile application interface for listing a vintage dress. The top bar is purple with a back arrow, the title "Description", a search icon, and a menu icon. Below the bar, the form consists of several fields: a "Title" field containing "Vintage Dress", a "Price" field containing "\$10", a "Location" field with a purple cursor, and a "Description" field at the bottom.

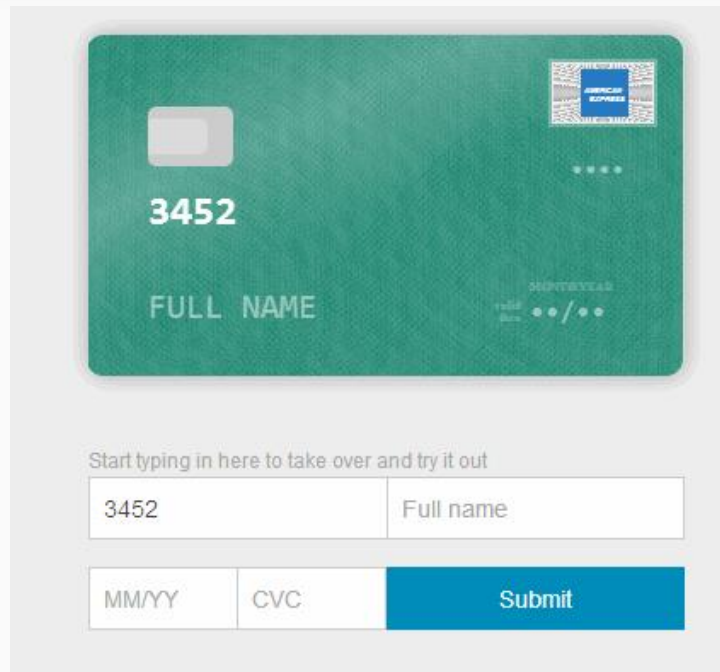
← Description 🔍 ⋮

Title
Vintage Dress

Price
\$10

Location

Description



A credit card payment form. At the top is a green credit card illustration with a chip, the number "3452", the text "FULL NAME", and an expiration date field. Below the card, a prompt says "Start typing in here to take over and try it out". The form includes input fields for the card number "3452", the "Full name", the expiration date "MM/YY", and the "CVC". A blue "Submit" button is at the bottom right.

3452
FULL NAME
MM/YY

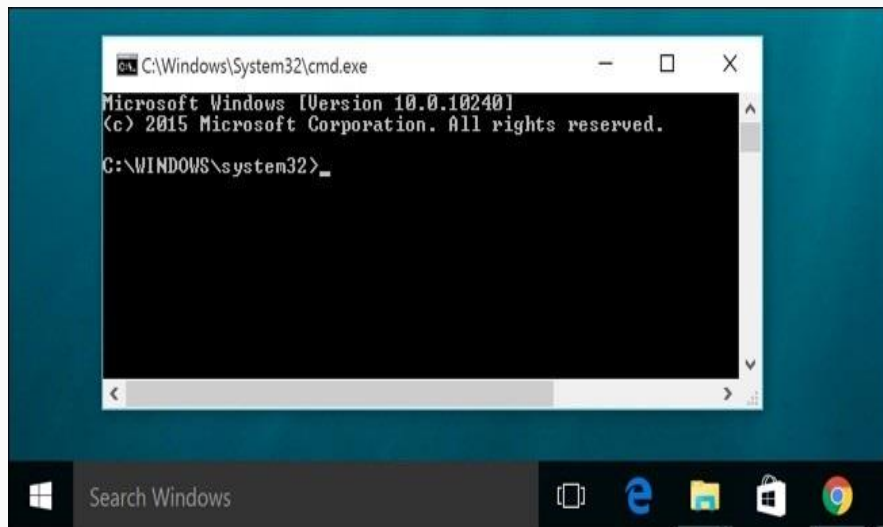
Start typing in here to take over and try it out

3452 Full name

MM/YY CVC Submit

Interaction Style: Command Language

```
raluca — -bash — 94x6
Last login: Thu Aug 18 16:29:22 on ttys002
Ralucas-MacBook-Air:~ raluca$ mv Documents/Kate-comments Documents/Measuring\ Usability/
```



<pre> +---+---+---+---+---+---+---+---+ 7 1 2 3 6 8 9 +---+---+---+---+---+---+---+---+ 8 9 4 6 2 3 7 +---+---+---+---+---+---+---+---+ 3 2 6 8 9 1 4 5 +---+---+---+---+---+---+---+---+ 1 3 6 4 7 +---+---+---+---+---+---+---+---+ 4 3 9 6 8 +---+---+---+---+---+---+---+---+ 9 6 4 7 1 3 +---+---+---+---+---+---+---+---+ 6 4 3 7 1 +---+---+---+---+---+---+---+---+ 5 8 4 +---+---+---+---+---+---+---+---+ 4 7 9 1 3 +---+---+---+---+---+---+---+---+ </pre>	<pre> nudoku 0.2.5 level: easy Commands Q - Quit r - Redraw h - Move left l - Move right j - Move down k - Move up x - Delete number c - Check solution N - New puzzle S - Solve puzzle H - Give a hint </pre>
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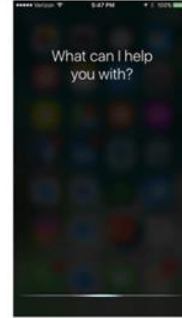
Interaction Style: Natural Language



AMAZON'S ALEXA



GOOGLE'S ASSISTANT



APPLE'S SIRI



MICROSOFT'S CORTANA

Advantages	Disadvantages
Direct manipulation <ul style="list-style-type: none"> • Visually presents task concepts • Allows easy learning • Allows easy retention • Allows errors to be avoided • Encourages exploration • Affords high subjective satisfaction 	<ul style="list-style-type: none"> • May be hard to program • Accessibility requires special attention
Navigation and menu selection <ul style="list-style-type: none"> • Shortens learning • Reduces keystrokes • Structures decision making • Permits use of dialog-management tools • Allows easy support of error handling 	<ul style="list-style-type: none"> • Presents danger of many menus • May slow frequent users • Consumes screen space • Requires rapid display rate
Form fill-in <ul style="list-style-type: none"> • Simplifies data entry • Enables convenient assistance • Permits use of form-management tools 	<ul style="list-style-type: none"> • Consumes screen space
Command language <ul style="list-style-type: none"> • Powerful • Allows easy scripting and history keeping 	<ul style="list-style-type: none"> • Requires learning and retention • Error-prone
Natural language <ul style="list-style-type: none"> • Relieves burden of learning syntax 	<ul style="list-style-type: none"> • Requires clarification dialog • May not show context • May require more keystrokes • Unpredictable