



Vietnam National University of HCMC
International University
School of Computer Science and Engineering



UI/UX Design & Evaluation

★ Design Theory, Principles and Guidelines ★

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<https://vichithanh.github.io>



SCAN ME

Course Overview

1. Introduction to HCI
2. Needfinding
3. Defining needs and tasks
4. Prototyping
- 5. Design guidelines, principles, and heuristics**
6. Human abilities and theoretical models
7. Visual design and design patterns
8. Heuristic evaluation
9. Usability testing
10. Advanced interactions

Hall of Fame or Shame?

Did we make you smile?

Based on your shopping experience,
how likely are you to recommend us on
a scale of 0 - 10?

Extremely unlikely



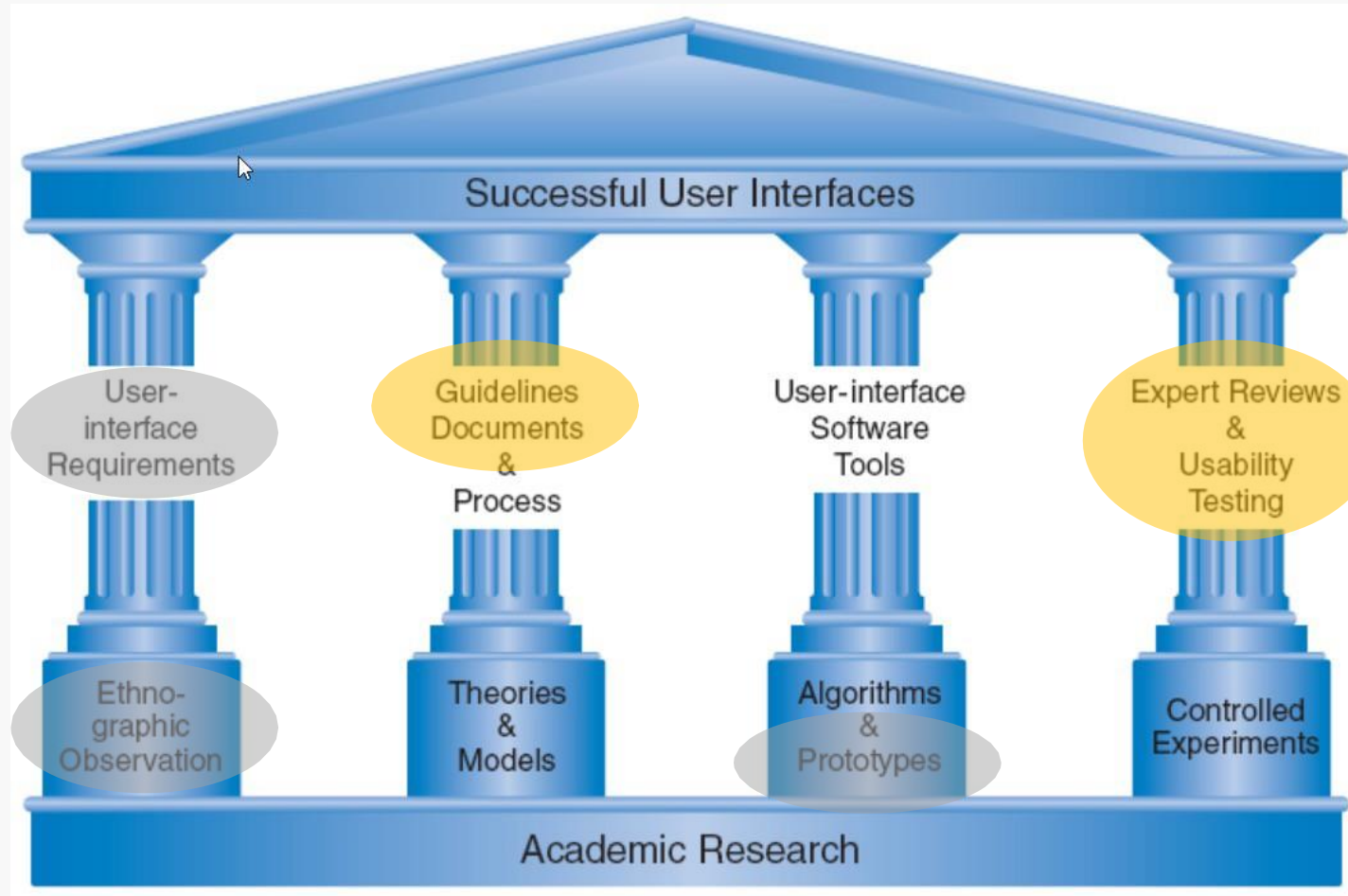
0 1 2 3 4



5 6 7 8 9 10

Extremely likely

The Four Pillars of Design



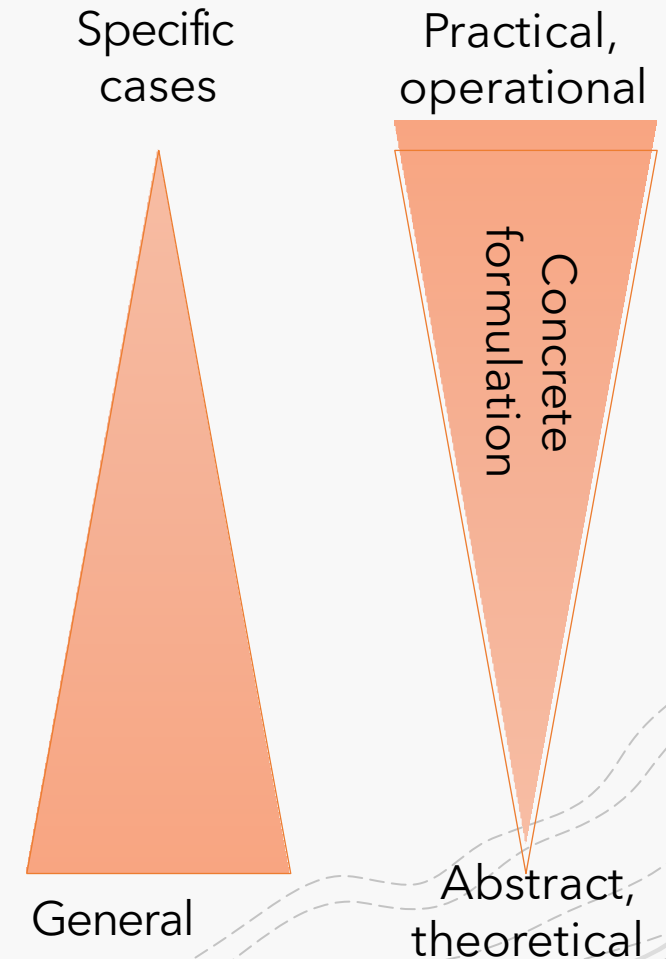
Ben Shneiderman & Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction

Goals

- Generating design solutions
 - Guidelines
 - Principles
 - Theories
- Evaluating generated designs
 - Expert reviews and heuristics
 - Usability testing
 - Controlled experiments

Generating Design Solutions

- Guidelines: Low-level focused advice about good practices and cautions against dangers.
- Principles: Mid-level strategies or rules to analyze and compare design alternatives.
- Theories: High-level widely applicable frameworks to draw on during design and evaluation, as well as to support communication and teaching.





Design Theories

Theoretical frameworks enabling foundational research

The “Why”

Design Theories

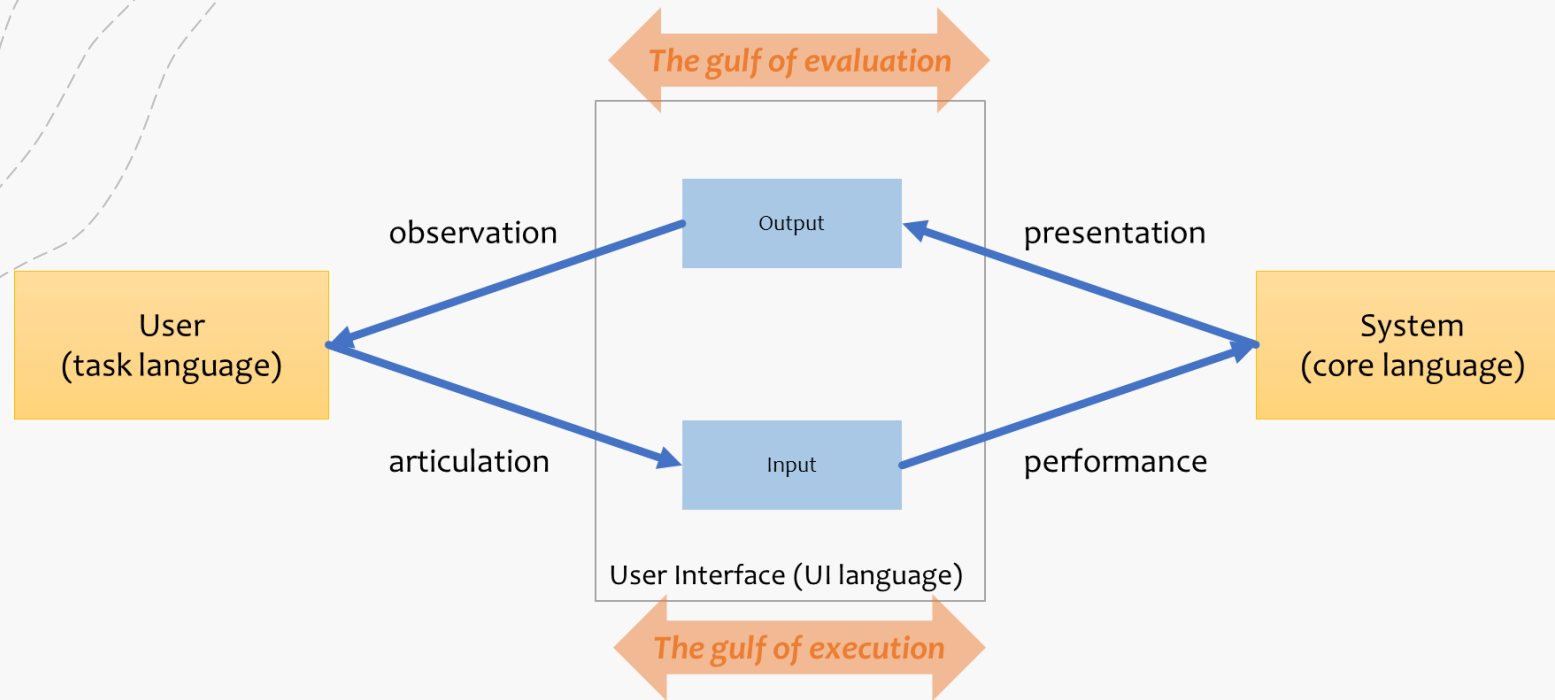
Types of theories

- Descriptive
 - UI elements, terminology, semantics
- Explanatory
 - Sequences of events with causal relationships
- Prescriptive
 - Guidelines for designers to make decisions
- Predictive
 - Comparison of design alternatives based on performance figures

Human capacity

- Motor task
 - Skill in pointing, clicking, ... movements
- Perceptual
 - Sensory inputs
- Cognitive
 - Problem-solving, short-/long-term memory

Norman's Action Models (Explanatory)



1. **Goal** (form the goal)
2. **Plan** (the action)
3. **Specify** (an action sequence)
4. **Perform** (the action sequence)
5. **Perceive** (the state of the world)
6. **Interpret** (the perception)
7. **Compare** (the outcome with the goal)

Foley and van Dam Four-level Approach (Descriptive)

- Conceptual level
 - User's mental model of the interactive system
- Semantic level
 - Describes the meanings conveyed by the user's command input and by the computer's output display
- Syntactic level
 - Defines how the units (words) that convey semantics are assembled into a complete sentence that instructs the computer to perform a certain task
- Lexical level
 - Deals with device dependencies and with the precise mechanisms by which a user specifies the syntax

Consistency Theories (Prescriptive)

- **Consistency** of nouns (objects) and verbs (actions)
 - Reduces learning time and errors
- Consistency of
 - Color
 - Layout
 - Icons
 - Fonts and Font sizes
 - Button sizes
 - ...
- Inconsistencies might be used (sparingly!) for drawing attention

Design Principles

The important aspects that we need to consider when creating a design.

The “What”

Design Principles

- More practical than Theories
- More fundamental, widely applicable, and enduring than Guidelines
- Fundamental principles (→ from Needfinding)
 - Determine user's skill levels
 - Identify the tasks
- 5 primary interaction styles
- 8 golden rules of interface design
- Prevent errors
- Automation and human control

Interaction Styles

- Direct manipulation
- Menu selection
- Form fill-in
- Command language
- Natural language

Advantages

Direct manipulation

Visually presents task concepts
Allows easy learning

Allows easy retention
Allows errors to be avoided
Encourages exploration
Affords high subjective satisfaction

Menu selection

Shortens learning
Reduces keystrokes
Structures decision making
Permits use of dialog-management tools
Allows easy support of error handling

Form fill-in

Simplifies data entry
Requires modest training
Gives convenient assistance
Permits use of form-management tools

Command language

Flexible
Appeals to "power" users

Supports user initiative
Allows convenient creation of user-defined macros

Natural language

Relieves burden of learning syntax

Disadvantages

May be hard to program
May require graphics display and pointing devices

Presents danger of many menus
May slow frequent users
Consumes screen space
Requires rapid display rate

Consumes screen space

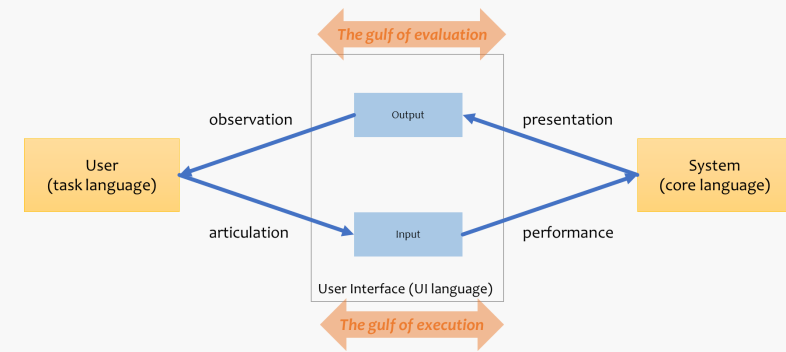
Poor error handling
Requires substantial training and memorization

Requires clarification dialog
May not show context
May require more keystrokes
Unpredictable

Norman's Principles from Action Models

Principles of good design

- State and the action alternatives should be visible
- Should be a good conceptual model with a consistent system image
- Interface should include good mappings that reveal the relationships between stages
- User should receive continuous feedback



User failures can occur

- Users can form an inadequate goal
- Might not find the correct interface object because of an incomprehensible label or icon
- May not know how to specify or execute a desired action
- May receive inappropriate or misleading feedback

The 8 Golden Rules of Interface Design

- Strive for consistency
- Cater to universal usability
- Offer informative feedback
- Design dialogs to yield closure
- Prevent errors
- Permit easy reversal of actions
- Keep users in control
- Reduce short-term memory load

The 8 Golden Rules of Interface Design

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- Similar situations should lead to similar sequences of actions
- Same terminology in prompts, menus, help
- Color, layout, capitalization, fonts,
- ...
- Exceptions should be comprehensive and limited
- E.g., delete, password echo

Consistency with mental models



Consistency of Interpretation

Order Timing:

Later

Now

- Which one is the selected one?
 - Color codes are ambiguous
 - No further internal clues
 - No external clues
- Does it represent the current status?
- Does it represent the status that we want to achieve?

Inconsistency for Drawing Attention

- The border color and button text color in the “danger zone” are deliberately different than the rest of the page

Merge button

When merging pull requests, you can allow any combination of merge commits, squashing, or rebasing. At least one option must be enabled.

- ☒ **Allow merge commits**
Add all commits from the head branch to the base branch with a merge commit.
- ☒ **Allow squash merging**
Combine all commits from the head branch into a single commit in the base branch.
- ☒ **Allow rebase merging**
Add all commits from the head branch onto the base branch individually.

After pull requests are merged, you can have head branches deleted automatically.

- ☐ **Automatically delete head branches**
Deleted branches will still be able to be restored.

GitHub Pages

GitHub Pages is designed to host your personal, organization, or project pages from a GitHub repository.

- Source**
GitHub Pages is currently disabled. Select a source below to enable GitHub Pages for this repository. [Learn more.](#)
- None** ▾
- Theme Chooser**
Select a theme to publish your site with a Jekyll theme using the master branch. [Learn more.](#)
- Choose a theme**

Danger Zone

- Make this repository private**
Please [upgrade TdP-prove-finali](#)
- Transfer ownership**
Transfer this repository to another user or to an organization where you have the ability to create repositories. **Transfer**
- Archive this repository**
Mark this repository as archived and read-only. **Archive this repository**
- Delete this repository**
Once you delete a repository, there is no going back. Please be certain. **Delete this repository**

The 8 Golden Rules of Interface Design

- Strive for consistency
- **Cater to universal usability**
 - Offer informative feedback
 - Design dialogs to yield closure
 - Prevent errors
 - Permit easy reversal of actions
 - Keep users in control
 - Reduce short-term memory load
- Users with different needs: let the interface *adapt*, let content be *transformed*
- Novices vs. experts. Young vs elderly. Web vs. mobile. Users with disabilities (→Accessibility)
- **Responsive** design
- International (and cultural) variations

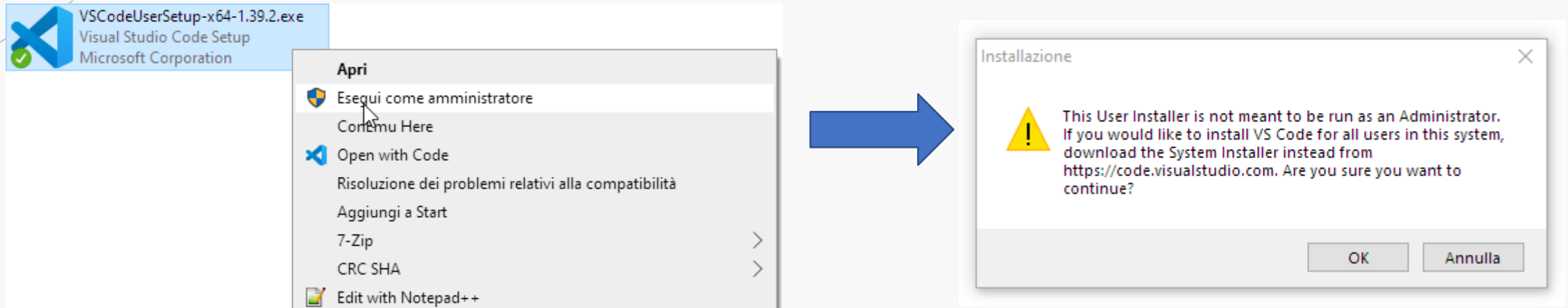
The 8 Golden Rules of Interface Design

- Strive for consistency
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- Prevent errors
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- Keep users in control
- Reduce short-term memory load
- For ***every*** human action, there should be an interface feedback
- Frequent and minor actions: light feedback
- Infrequent and major actions: stronger feedback
- Visual presentation of objects helps showing the changes (e.g., dim, highlight, grey out, ...)

Example



Example



Try to install VS Code for all users on a computer (install to Program Files rather than user's folders)

The 8 Golden Rules of Interface Design

- Strive for consistency
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- **Design dialogs to yield closure**
- Prevent errors
- Permit easy reversal of actions
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- Every sequence of actions should have
 - Beginning
 - Development
 - End
- Provide clear feedback at end
 - Satisfy users
 - 'Delete' current task from their working memory, prepare for the next

Clear Dialog Sequence



The 8 Golden Rules of Interface Design

- Strive for consistency
- Cater to universal usability
- Offer informative feedback
- Design dialogs to yield closure
- **Prevent errors**
- Permit easy reversal of actions
- Keep users in control
- Reduce short-term memory load

- Avoid the possibility of making errors
- Disable menu items, buttons, links, ... that are not applicable
- Prevent entering illegal characters
- Offer simple, constructive and specific instructions for recovery
- Repair only the faulty part
- Errors should not alter application state (or make it easy to restore)

Error Prevention

ACCEDI ALL'AREA RISERVATA


Attenzione: se la username è un codice fiscale inserirlo con le lettere MAIUSCOLE

Username

Password

Hai dimenticato la password? Clicca [QUI](#)

Sei un professionista della salute? [Registrati](#)



The 8 Golden Rules of Interface Design

- Strive for consistency
- Cater to universal usability
- Offer informative feedback
- Design dialogs to yield closure
- Prevent errors
- **Permit easy reversal of actions**
- Keep users in control
- Reduce short-term memory load
- Actions should be reversible (at the cost of extra development effort)
 - Relieves anxiety
 - Encourages exploration
- Different levels of reversibility
 - A single action
 - A data-entry task
 - A complete group of actions

The 8 Golden Rules of Interface Design

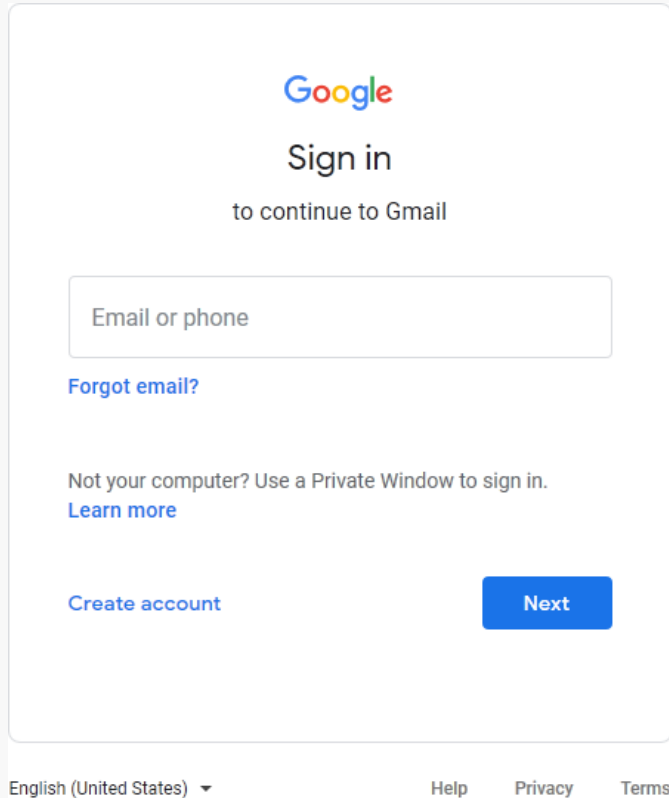
- Strive for consistency
 - Cater to universal usability
 - Offer informative feedback
 - Design dialogs to yield closure
 - Prevent errors
 - Permit easy reversal of actions
 - **Keep users in control**
 - Reduce short-term memory load
- The interface should *always* respond to user actions
 - Minimize the tedious and lengthy tasks
 - Avoid surprises or changes in familiar behavior
 - Provide undo/redo, cancel/confirm

The 8 Golden Rules of Interface Design

- Strive for consistency
- Cater to universal usability
- Offer informative feedback
- Design dialogs to yield closure
- Prevent errors
- Permit easy reversal of actions
- Keep users in control
- **Reduce short-term memory load**

- Rule of thumb:
 - People can remember 7 ± 2 chunks of information
- Information on a screen should not be needed (remembered) in the next screen
- No entry of phone numbers (collect from addressbook), show website location, fit long forms in a single page, ...

Discussion – An Exception?



Google

Sign in
to continue to Gmail

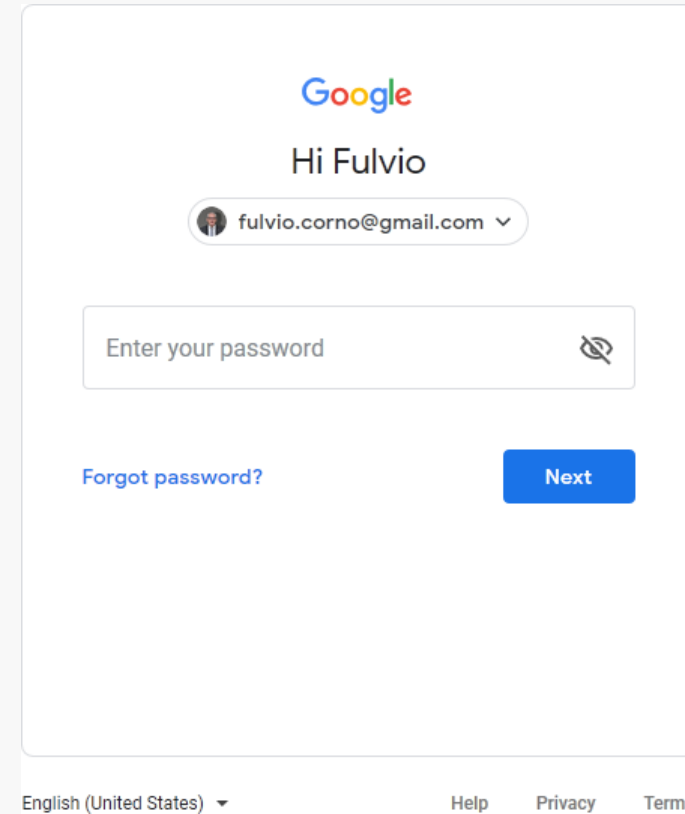
Email or phone

[Forgot email?](#)

Not your computer? Use a Private Window to sign in.
[Learn more](#)


[Create account](#) [Next](#)


English (United States) ▼ Help Privacy Terms



Google

Hi Fulvio

 fulvio.corno@gmail.com ▼

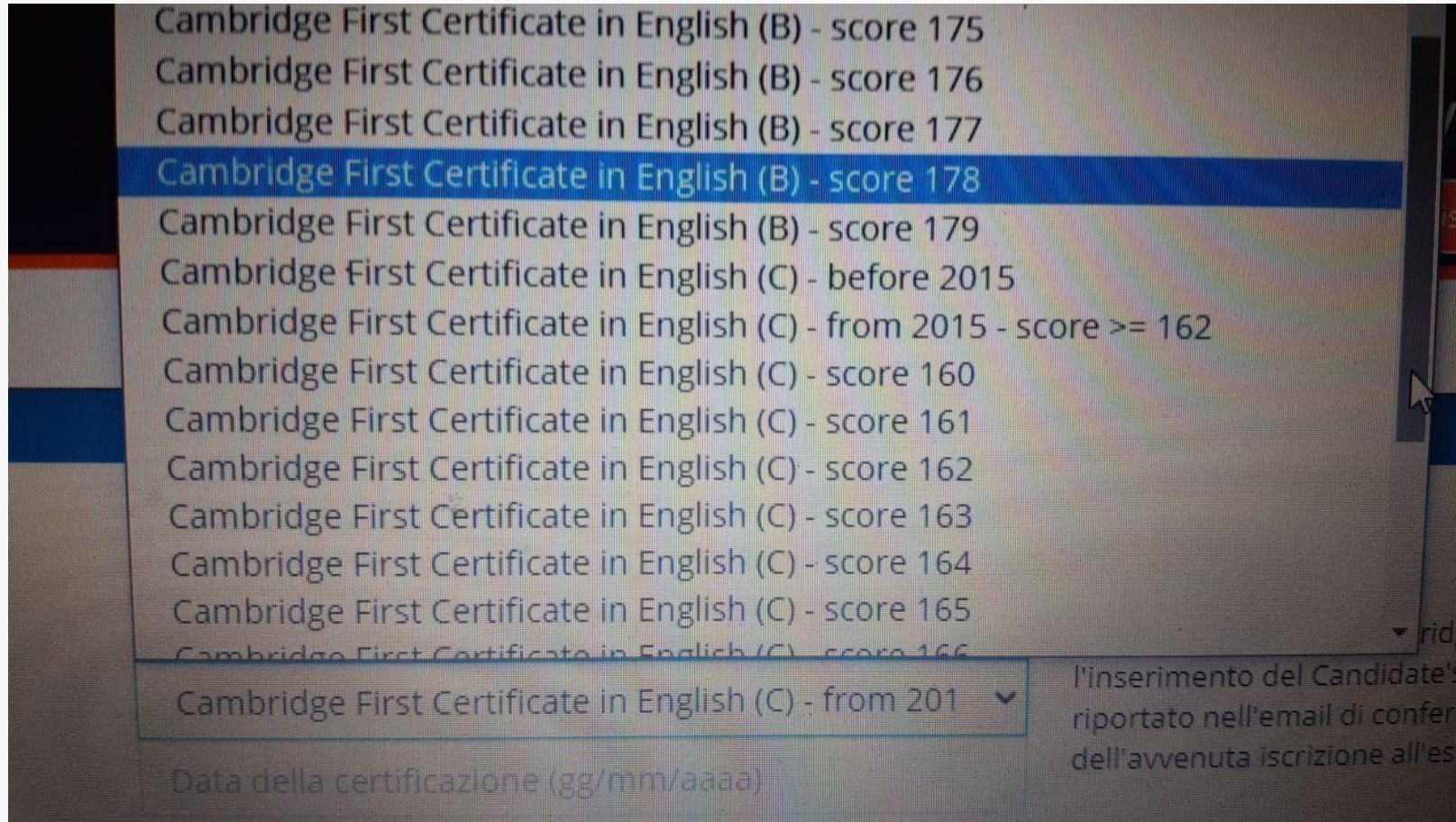
Enter your password 

[Forgot password?](#) [Next](#)

English (United States) ▼ Help Privacy Terms

Exceptions...

sometimes entering is better than selecting



Design Principles by Benyon (I)

(adapted from Norman, Nielsen and others)

Learnability – helping people access, learn and remember the system

- *Visibility* – ensure that things are visible, so users can see what functions are available and what the system is currently doing
- *Consistency* (→above)
- *Familiarity* – use language and symbols that the intended audience will be familiar with
- *Affordance* – design things so it is clear what they are for (e.g., buttons should be pushed). Maps the (perceived) properties of the objects with how they can be used

Design Principles by Benyon (II)

(adapted from Norman, Nielsen and others)

Effectiveness – giving users the sense of being in control, knowing what to do and how to do it

- *Navigation* – support people in moving around the different sections: maps, directional signs, information signs
- *Control* – who is in control for the next interaction? Clear and logical mapping between controls and their effect. Relationships with the “side effects” in the real world
- *Feedback* (→feedback above)

Design Principles by Benyon (III)

(adapted from Norman, Nielsen and others)

- **Safety and Security**

- *Recovery* (→error recovery)
- *Constraints* (→prevent errors)

- **Accommodation** – offer an interaction way that suits the users

- *Flexibility* (→universal usability)
- *Style* – stylish, attractive, nice-looking
- *Conviviality* – polite, friendly, pleasant. No abrupt interruptions

Norman's Seven Principles for Transforming Difficult Tasks into Simple Ones

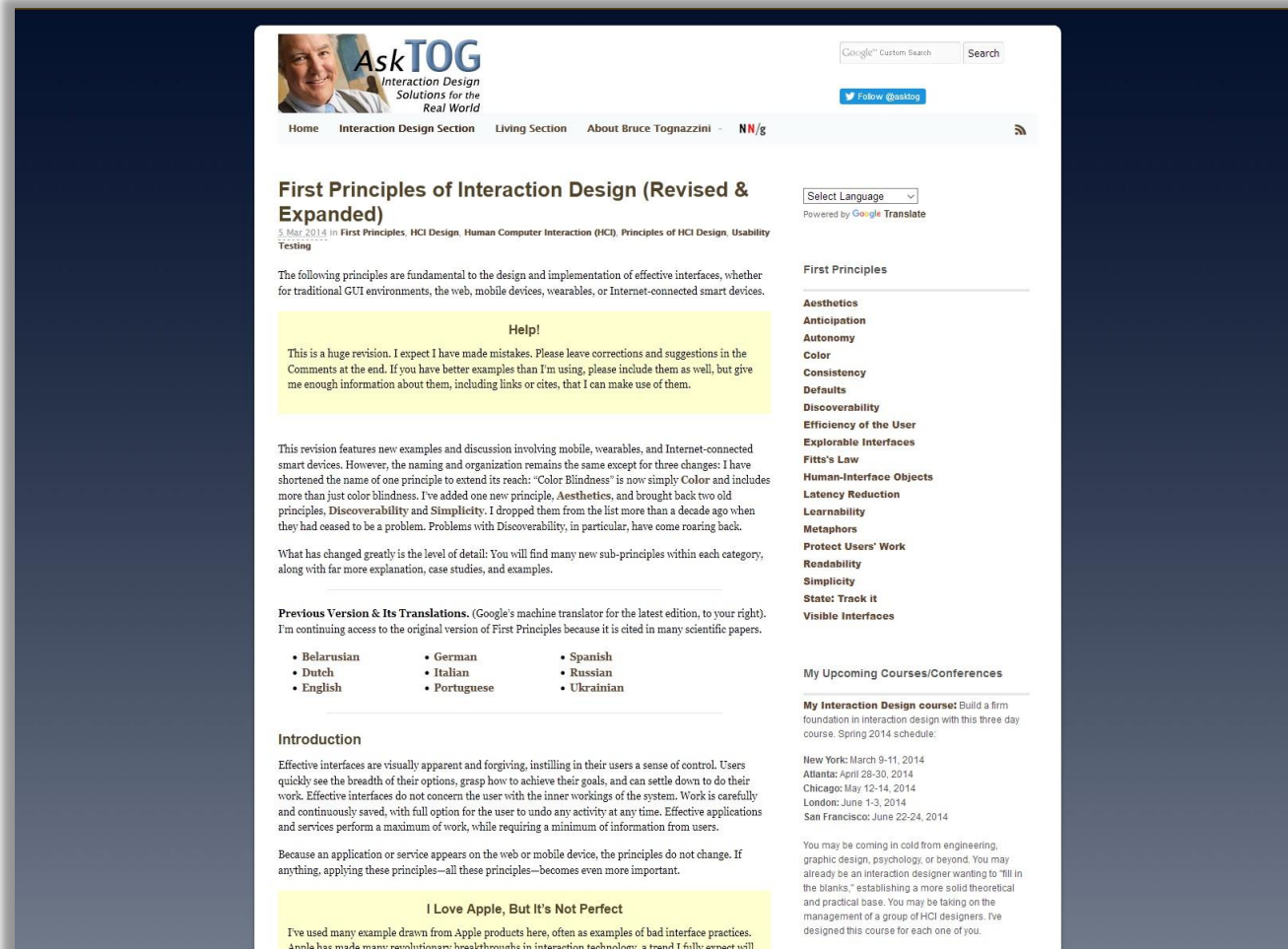
- Use both knowledge in the world and knowledge in the head
- Simplify the structure of tasks
- Make things visible
- Get the mappings right
- Exploit the power of constraints, both natural and artificial
- Design for error
- When all else fails, standardize

D. Norman, The Design of Everyday Things

First Principles of Interaction Design (Bruce Tognazzini, 2014)



<https://asktog.com/atc/principles-of-interaction-design/>



[Aesthetics](#)
[Anticipation](#)
[Autonomy](#) [Color](#)
[Consistency](#)
[Defaults](#)
[Discoverability](#)
[Efficiency of the User](#)
[Explorable Interfaces](#)
[Fitts's Law](#)
[Human-Interface Objects](#)
[Latency Reduction](#)
[Learnability](#)
[Metaphors](#)
[Protect Users' Work](#)
[Readability](#)
[Simplicity](#) [State:](#)
[Track it](#)
[Visible Interfaces](#)

Design Guidelines

Shared language to promote consistency among multiple designers in terminology usage, appearance, and action sequences

The “How”

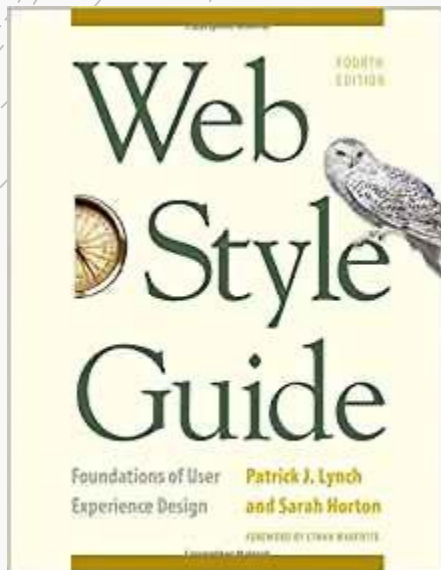
Design Guidelines

- Concrete suggestions about “How” the Principles may be satisfied
- Often rule-based
- Based on best practices
- Encapsulate experience of expert designers
- Sometimes blessed as «standards»
- But:
 - May be too specific and hard to apply to your situation
 - Difficult to develop a general-purpose guideline

Web Style Guide



Web Style Guide, 4th Edition: Foundations of User Experience Design (2016)
<https://webstyleguide.com/>



Web Style Guide by Patrick J. Lynch and Sarah Horton

Contents

- [Front Matter](#)
- [Chapter 1: Strategy](#)
- [Chapter 2: Research](#)
- [Chapter 3: Process](#)
- [Chapter 4: Information Architecture](#)
- [Chapter 5: Site Structure](#)
- [Chapter 6: Page Structure](#)
- [Chapter 7: Interface Design](#)
- [Chapter 8: Graphic Design](#)
- [Chapter 9: Typography](#)
- [Chapter 10: Editorial Style](#)
- [Chapter 11: Images](#)
- [Chapter 12: Video](#)
- [Back Matter](#)

About the authors

Patrick J. Lynch and Sarah Horton have been working together on award-winning interface and graphic design projects since 1991. They began collaborating on *Web Style Guide* in 1997, moving from a web-only version to print and web in 1999. The book is in its 4th edition and has been translated into more than eight languages.

- [Learn more about Pat and Sarah](#)
- [Web Style Guide, 4th Edition: Foundations of User Experience Design on Amazon](#)

Praise for the 4th Edition of Web Style

[Contents](#)

[Search](#)

[Front Matter](#)

Web Content Accessibility Guidelines (WCAG)



<https://www.w3.org/WAI/standards-guidelines/wcag/>

The screenshot shows the W3C Web Accessibility Initiative (WAI) website. The top navigation bar includes links for "Skip to Content", "Change Text Size or Colors", and language options: "This page in: English • Español • Français". There are also links for "All Translations" and "Hide Options". The main header features the W3C logo and the text "Web Accessibility Initiative WAI" with the tagline "Strategies, standards, resources to make the Web accessible to people with disabilities". A search bar is located on the right. Below the header is a secondary navigation bar with links: "Accessibility Fundamentals", "Planning & Policies", "Design & Develop", "Test & Evaluate", "Teach & Advocate", and "Standards/Guidelines". The main content area is titled "WCAG 2 Overview" and includes a "Summary" section. The summary text states: "This page introduces the Web Content Accessibility Guidelines (WCAG) international standard, including WCAG 2.0, WCAG 2.1, and WCAG 2.2. WCAG documents explain how to make web content more accessible to people with disabilities. A different page [introduces WCAG 3](#). WCAG is not an introduction to accessibility. For introductions, see [Accessibility Fundamentals Overview](#). Quick links to resources:

- [How to Meet WCAG 2 \(Quick Reference\)](#)
- [WCAG 2.2 Draft, What's New in WCAG 2.2 Draft with status and timeline](#)
- [WCAG 2.1 Standard](#)
- [WCAG 2.0 Standard](#)

 Page Contents


- [Introduction](#)
- [WCAG 2.0, 2.1, 2.2](#)
- [Who WCAG is for](#)
- [What is in WCAG 2](#)

"

U.S. Government Mobile User Experience Guidelines



U.S. General Service Administration
<https://digital.gov/resources/mobile-user-experience-guidelines/>



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Mobile User Experience Guidelines

Six user experience guidelines for creating a mobile product.

If your app doesn't have a good user experience, it goes to the [app graveyard](#).

The need for digital products to work better is not new in the federal government. Resources like the [Digital Playbook](#) and [Public Participation Playbook](#) have had impact helping agencies become user-friendly and both of these resources note the importance of developing usable products for mobile users.

As more agencies develop mobile apps and websites, they need quick guidance on mobile user experience Do's and Don'ts. To answer their call, we asked [MobileGov Community of Practice](#) members to choose their top Mobile UX Guidelines from the original group of 42 created in 2013 at community events in late 2014 and early 2015. From that feedback, we have distilled the following six mobile user experience guidelines:

Guideline 1: Make sure your content is structured and chunked appropriately for multiple devices

Guideline 2: Follow industry user interface guidelines and government regulations (like 508) in the development of your mobile product

In this page

Join a Community

Mobile

Web Analytics and Optimization

Web Managers

User Experience

U.S. Web Design System


MONDAY, 25 MARCH 2024

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U.K. Government Design System



<https://design-system.service.gov.uk>

 **GOV.UK** Design System


Search Design System

[Get started](#) [Styles](#) [Components](#) [Patterns](#) [Community](#)

Design your service using GOV.UK styles, components and patterns

Use this design system to make your service consistent with GOV.UK. Learn from the research and experience of other service teams and avoid repeating work that's already been done.

[Get started >](#)



What's new

17 October 2022: We've changed our 'Backlog' page into the new '[Upcoming components and patterns](#)' page and chosen 3 priorities that we plan to work on next.

[Sign up to get update emails about the Design System.](#)

Styles

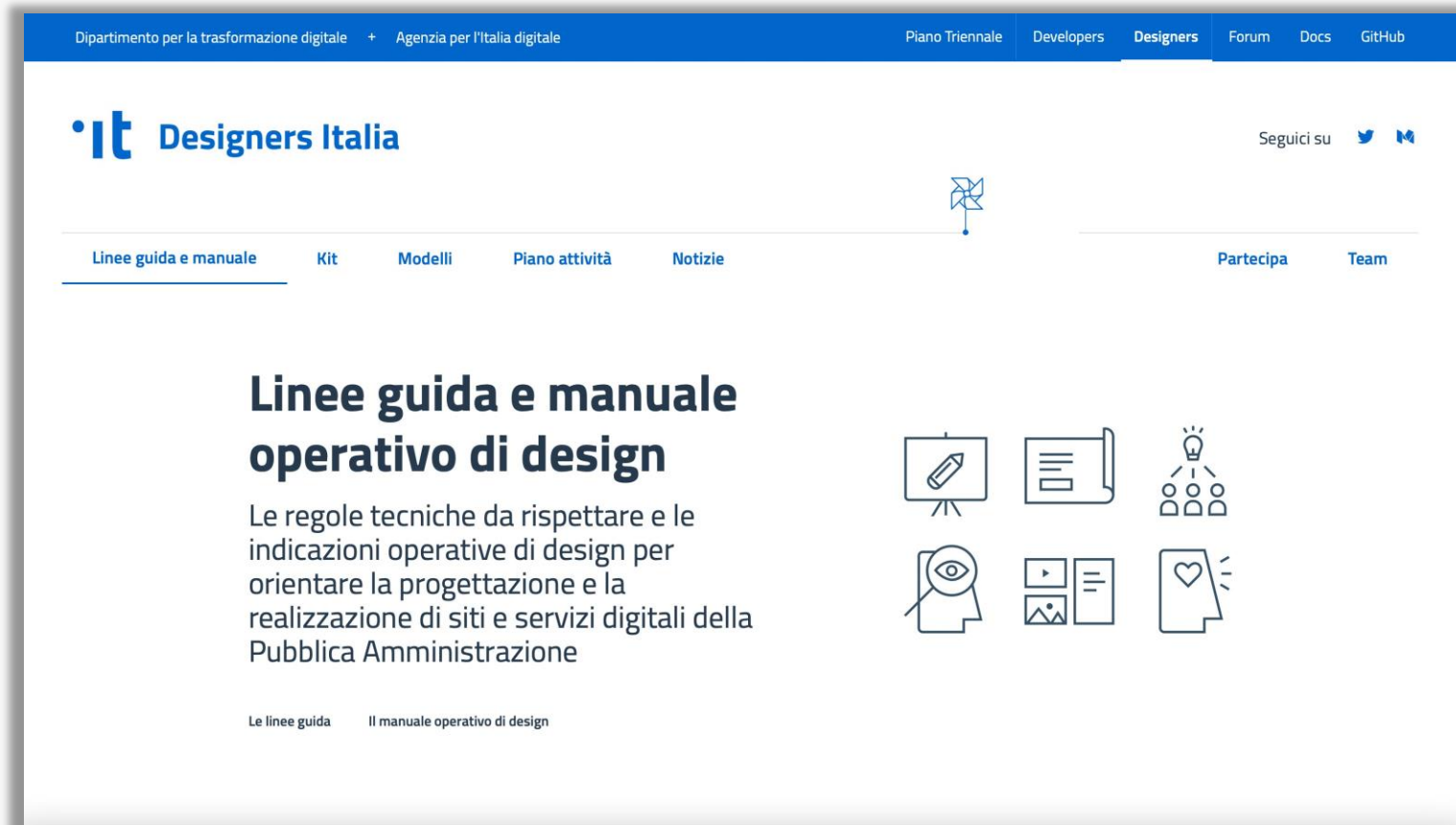
Components

Patterns

Italian Government Guidelines and Design System



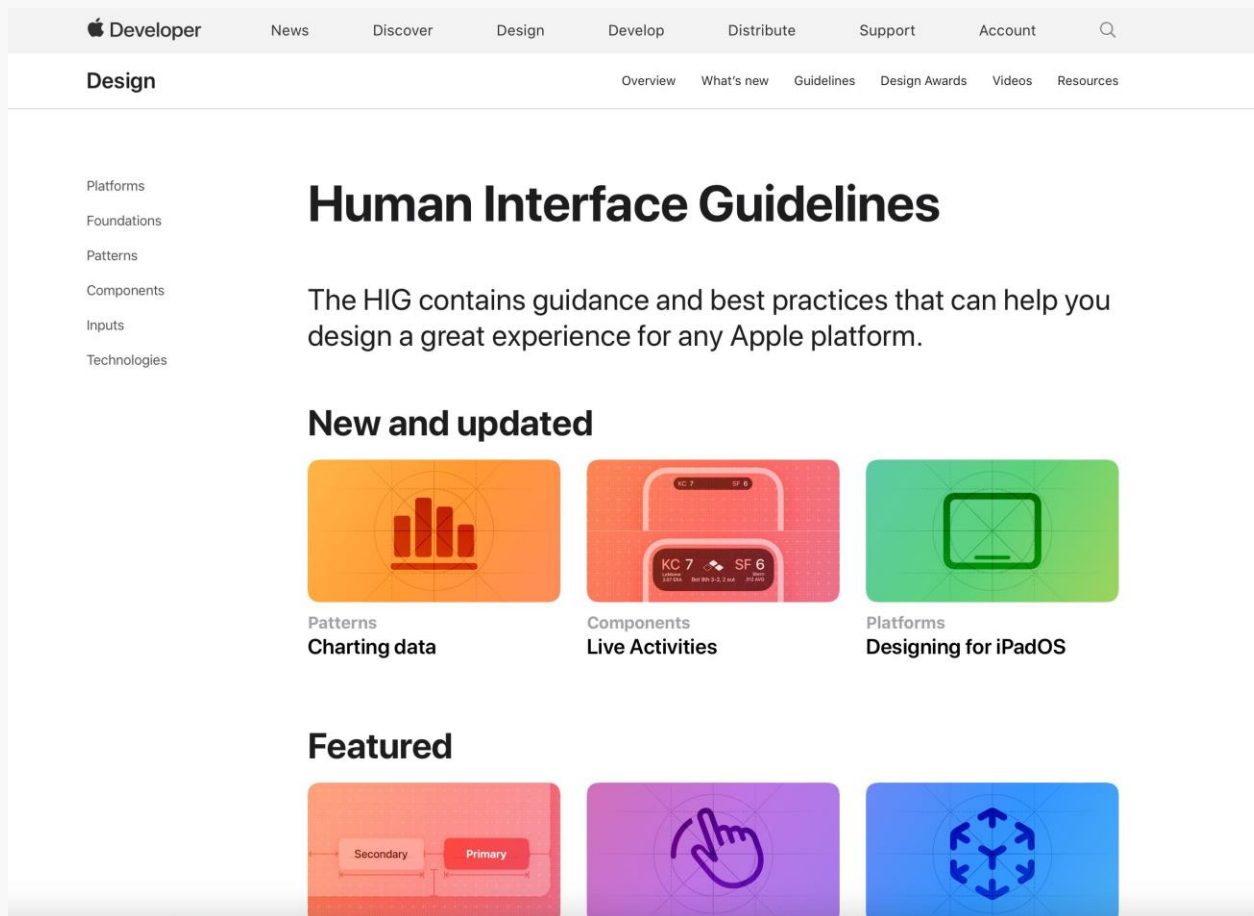
<https://designers.italia.it/linee-guida/>



Apple HIG



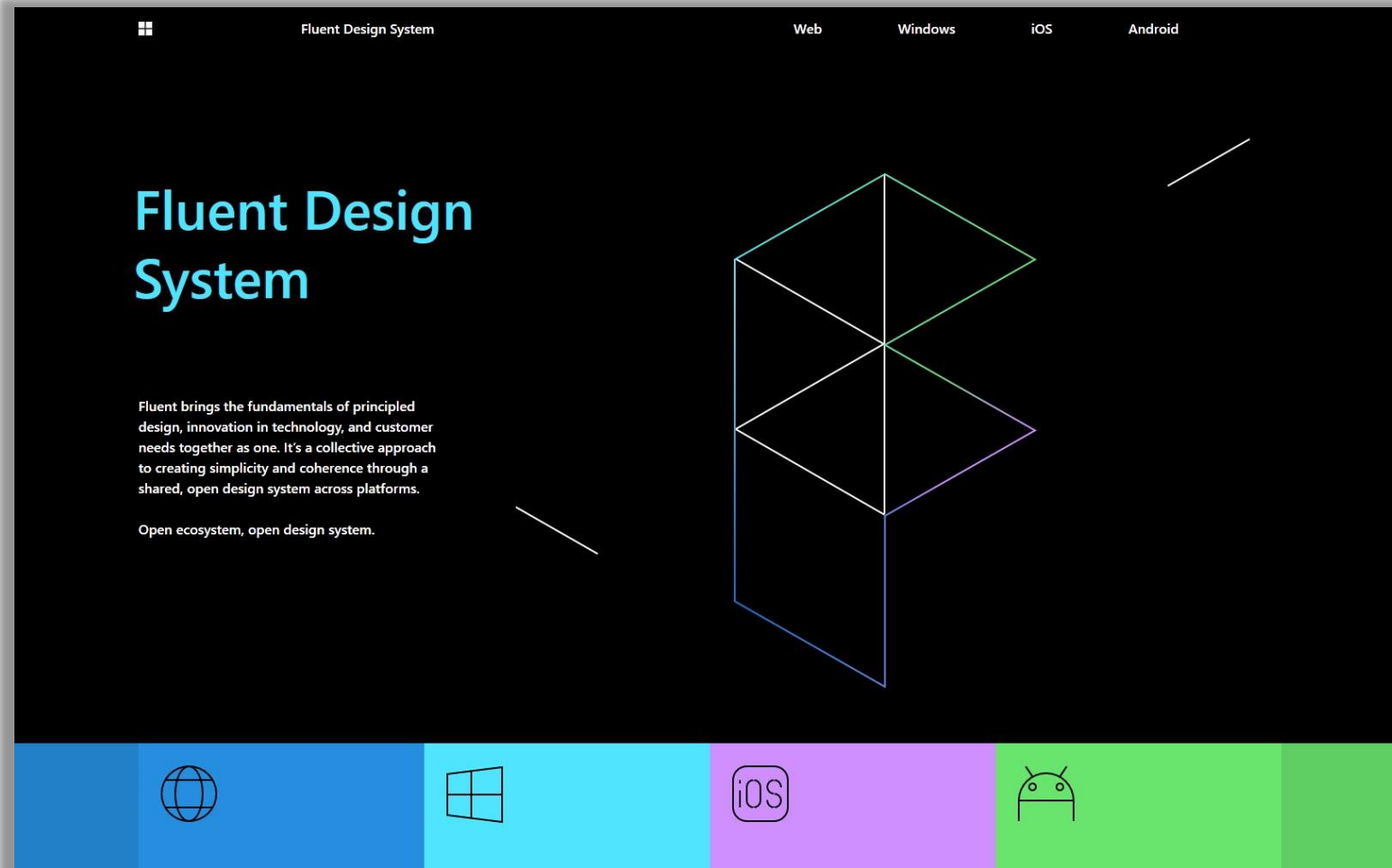
<https://developer.apple.com/design/human-interface-guidelines/>



Microsoft «Fluent» Design



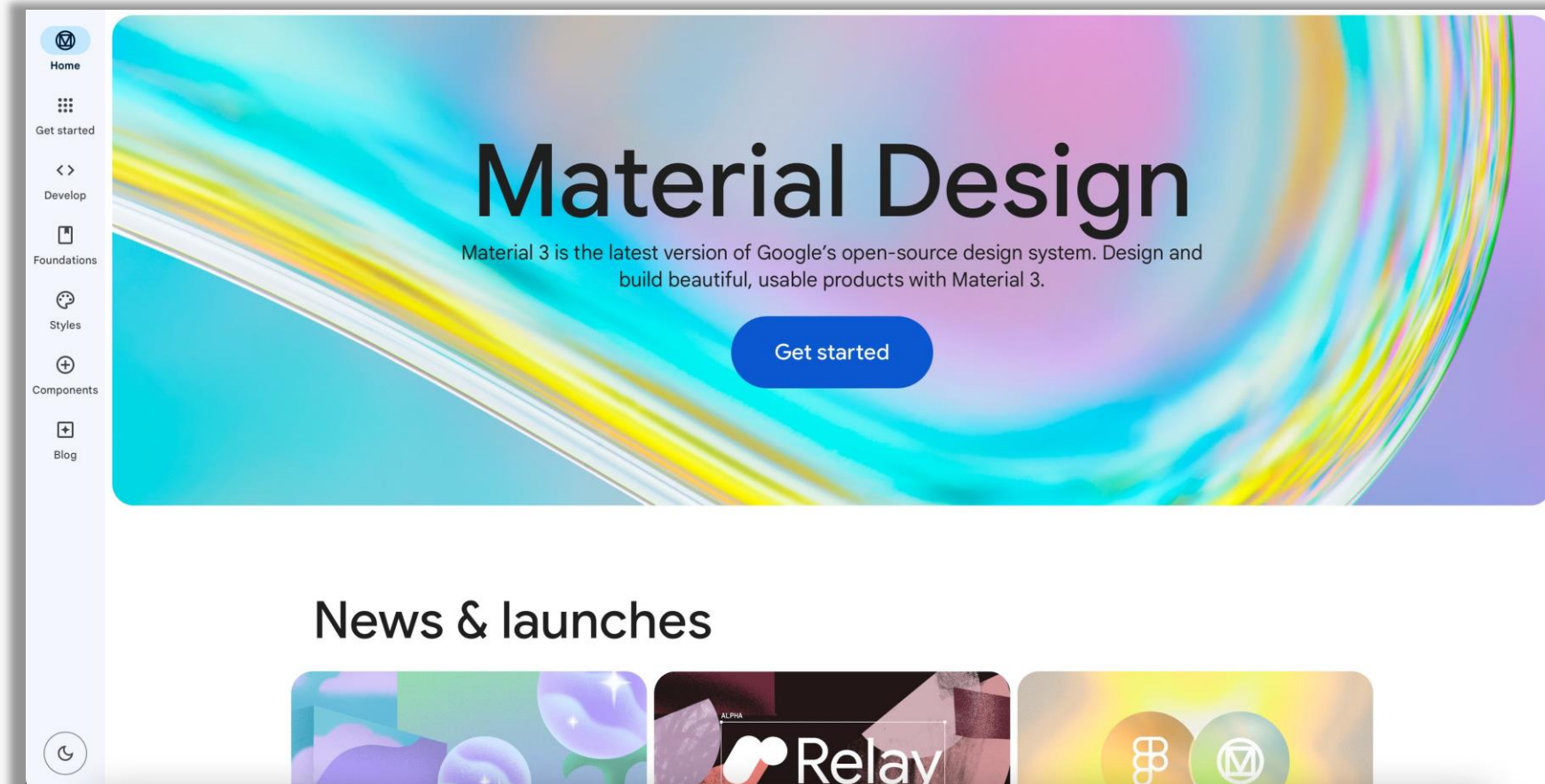
<https://www.microsoft.com/design/fluent/>



Google Material Design

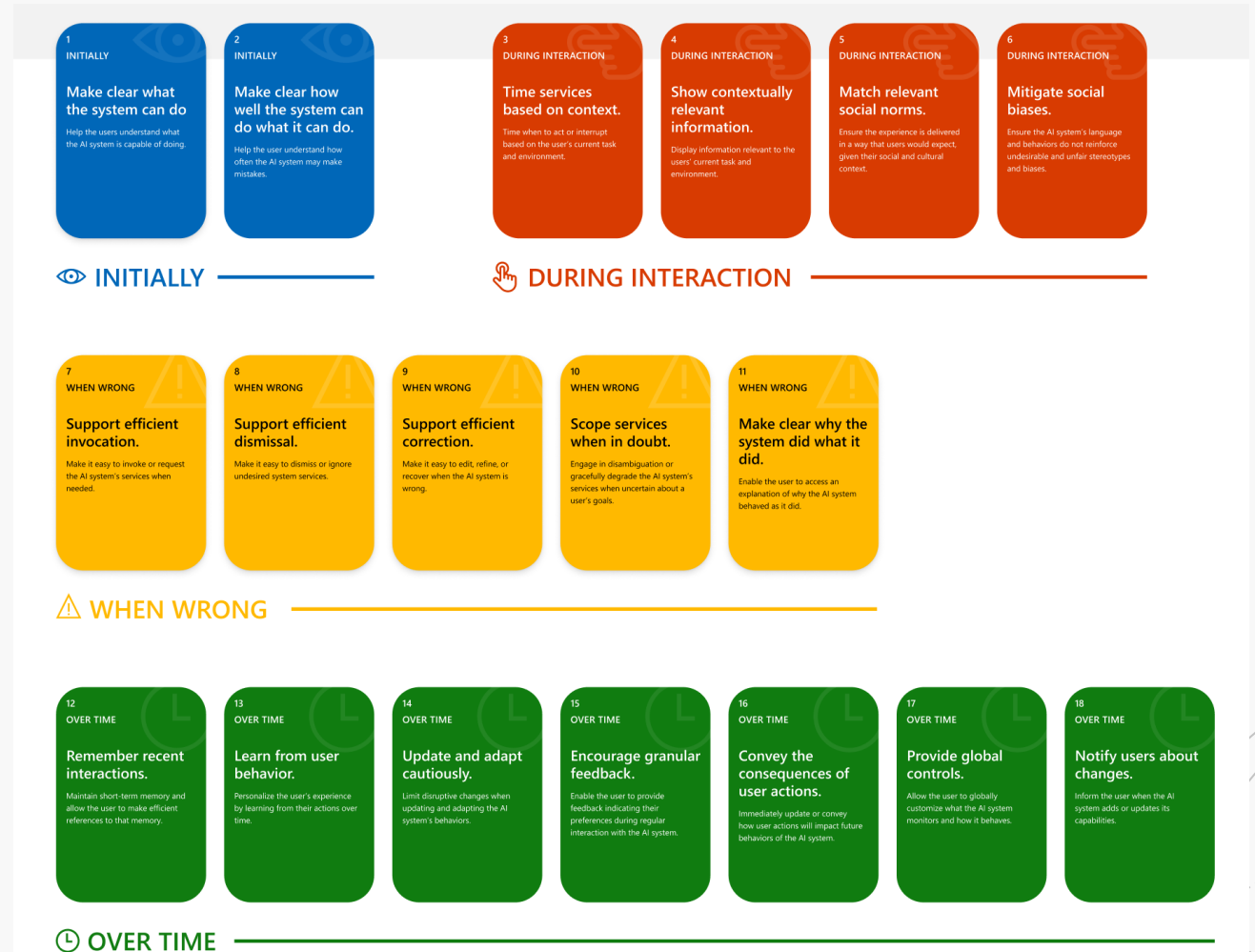


<https://material.io/>



Guidelines for Human-AI Interaction

- By Microsoft Research:
 - <https://www.microsoft.com/en-us/research/project/guidelines-for-human-ai-interaction/>
 - <https://www.Microsoft.com/en-us/haxtoolkit/ai-guidelines/>



Guidelines for Human-AI Interaction: Examples

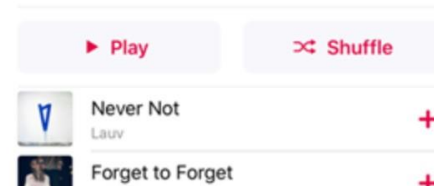
2
INITIALLY

Make clear how well the system can do what it can do.

Help the user understand how often the AI system may make mistakes.

EXAMPLE IN PRACTICE

Discover new music from artists we think you'll like.
Refreshed every Friday.



The recommender in **Apple Music** uses language such as "we think you'll like" to communicate uncertainty.

Make clear how well the system can do what it can do.

2

9
WHEN WRONG

Support efficient correction.

Make it easy to edit, refine, or recover when the AI system is wrong.

EXAMPLE IN PRACTICE



When **Bing** automatically corrects spelling errors in search queries, it provides the option to revert to the query as originally typed with one click.

Support efficient correction.

9

Guidelines for Augmented Reality

- By Apple Design:
<https://developer.apple.com/design/human-interface-guidelines/technologies/augmented-reality/>

Creating an engaging, comfortable experience

Let people use the entire display. Devote as much of the screen as possible to displaying the physical world and your app's virtual objects. Avoid cluttering the screen with controls and information that diminish the immersive experience.

Strive for convincing illusions when placing realistic objects. Design detailed 3D assets with lifelike textures to create objects that appear to inhabit the physical environment in which you place them. Using information from ARKit, you can scale objects properly and position them on detected real-world surfaces, reflect environmental lighting conditions and simulate camera grain, cast top-down diffuse object shadows on real-world surfaces, and update visuals as the camera's position changes. To help avoid breaking the illusion you create, make sure your app updates scenes 60 times per second so objects don't appear to jump or flicker.

Consider how virtual objects with reflective surfaces show the environment. Reflections in ARKit are approximations based on the environment captured by the camera. To help maintain the illusion that an AR experience is real, prefer small or coarse reflective surfaces that downplay the effect of these approximations.

Use audio and haptics to enhance the immersive experience. A sound effect or bump sensation is a great way to confirm that a virtual object has made contact with a physical surface or other virtual object. Background music can also help envelop people in the virtual world. For guidance, see [Playing audio](#) and [Playing haptics](#).

Minimize text in the environment. Display only the information that people need for your app experience.

References and Acknowledgments

- Ben Shneiderman, Catherine Plaisant, Maxine S. Cohen, Steven M. Jacobs, and Niklas Elmqvist, Designing the User Interface: Strategies for Effective Human-Computer Interaction
- Chapter 3: Guidelines, Principles, and Theories
- David Benyon: Designing Interactive Systems, Pearson, 2014
- Section 4.5: Design Principles
- COGS120/CSE170: Human-Computer Interaction Design, videos by Scott Klemmer,
https://www.youtube.com/playlist?list=PLLssT5z_DsK_nusHL_Mjt87THSTlgrsyJ

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International University
School of Computer Science and Engineering



THANK YOU

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<https://vichithanh.github.io>



SCAN ME