

Human Computer Interaction

CE 382

Course Instructor: Vincent M. Nofong, Ph.D.

June 24, 2024

Introduction

Outline

- Who I am
- Course Information and Outline of CE 382
- Expected Learning Outcomes
- Rules
- Chapter One: Interaction Design

Introduction

About me

- Name: **Vincent M. Nofong, PhD**
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- Personal Website: <https://vincentnofong.com/>
- Uni website: <https://www.umat.edu.gh/staffinfo/staffDetailed.php?contactID=385>
- Office hours (Working days): **09:00 am - 16:00 pm GMT**
- Research interest: **data mining, trend prediction, classification, bioinformatics, artificial intelligence, machine learning**

Course Information (CE 382)

- Credit hours: **3**
- Attendance: **10%**
- Continuous Assessment: **30%**
 - Quizzes - two or three
 - Group assignment - one (application development)
- End of Semester: **60%**

Introduction

Course Outline (CE 382)

- 1 Interaction Design
 - 2 Establishing Requirements
 - 3 Prototyping
 - 4 Data Gathering and Analysis
 - 5 Cognitive Aspects of Design
 - 6 Social and Emotional Interactions
 - 7 User Interfaces
 - 8 Evaluations

Introduction

Expected Learning Outcomes (CE 382)

Students should understand and be able to:

- 1 Explain the characteristics of good and bad interaction design and use them to evaluate HCIs
- 2 Explain the characteristics of users that influence HCI and use them to inform user interface development
- 3 Explain, analyze and develop interaction evaluations
- 4 Explain and develop requirements for interaction design
- 5 Construct interactions using evaluation-based iterative process for directing the design of user interfaces.

Introduction

Reference Materials

- 1 Preece, J., Rogers, Y. and Sharp, H. (2023), Interaction Design: Beyond Human-Computer Interaction, John Wiley & Sons Ltd, Hoboken, U.S.A., 6th Edition, 716 pp. - **slides are based on this reference**
- 2 Lazar, J., Feng, J. H. and Hochheiser, H. (2017), Research Methods in Human-Computer Interaction, Morgan Kaufmann, Burlington, U.S.A., 2nd Edition, 560 pp.
- 3 Shneiderman B., Plaisant C., Cohen M. and Jacobs, S. (2016), Designing the User Interface, Pearson Publishers, 6th Edition, 616 pp.

Introduction

Rules

- 1 Feel free to ask questions in class, unless they are too “personal”.
- 2 Students should not be late for lectures or practicals.
- 3 Students should attend all lectures and practicals.
- 4 **In case you are unable to attend lectures or will be late, send me an email - at least 30 minutes before lectures.**
- 5 Students should do and submit all assignments before the given deadline.
- 6 Unless otherwise permitted, students should not use their mobile phones in class - note usage of Laptops/Desktops is permitted.

HCI CE 382

Chapter One: Interaction Design

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Interaction Design

What is Human Computer Interaction (HCI)?

- HCI is the study and the practice of usability.
 - It is about understanding and creating software and other technology that people will want to use, will be able to use, and will find effective when used.
- HCI is the study of how people use computer systems to perform certain tasks.
 - HCI tries to provide us with all understanding of the computer and the person using it, so as to make the interaction between them more effective and more enjoyable.

Interaction Design

Humans, Computer and Interactions

- The H:

- Humans are good at: sensing low level stimuli, pattern recognition, inductive reasoning, multiple strategies, adapting “Hard and fuzzy things”.

- The C:

- Computers are good at: counting and measuring, accurate storage and recall, rapid and consistent responses, data processing/calculation, repetitive actions, performance over time, “Simple and sharply defined things”.

- The I:

- Let humans do what humans do best and computers do what computers do best.

Interaction Design

Why Care? - Motivation

- HCI is the study of the ways that people use computers - aimed at making computers easier for people to use.
 - Is that possible to make computers easier for people to use?
Yes!
 - It happens when people who design computers and software keep in mind that they are designing for other people.

Interaction Design

Different Design Needs

The three broad categories of computer user:

- **Expert users** with detailed knowledge of that particular system.
- **Occasional users** who know well how to perform the tasks they need to perform frequently.
- **Novices** who have never used the system before.

Note: Users may well be novices at one computer application but experts at another one, so users will belong to different categories for particular computer systems.

What is Interaction Design?

- “Designing interactive products to support the way people communicate and interact in their everyday and working lives”.
- Preece, Sharp and Rogers (2019)
- “The design of spaces for human communication and interaction”. - Winograd (1997)

Interaction Design

Goals of Interaction Design:

- Develop usable products - easy to learn, effective to use, and provide an enjoyable experience.
- Involve people and users in the design process.
- Consider what people are good and bad at.
- Consider what might help people with the way they currently do things.
- Think through what might provide quality experiences.
- Consider a person's privacy concerns if data is being collected about them.
- Use people-centered techniques during the design process.



Interaction Design

HCI and Interaction Design

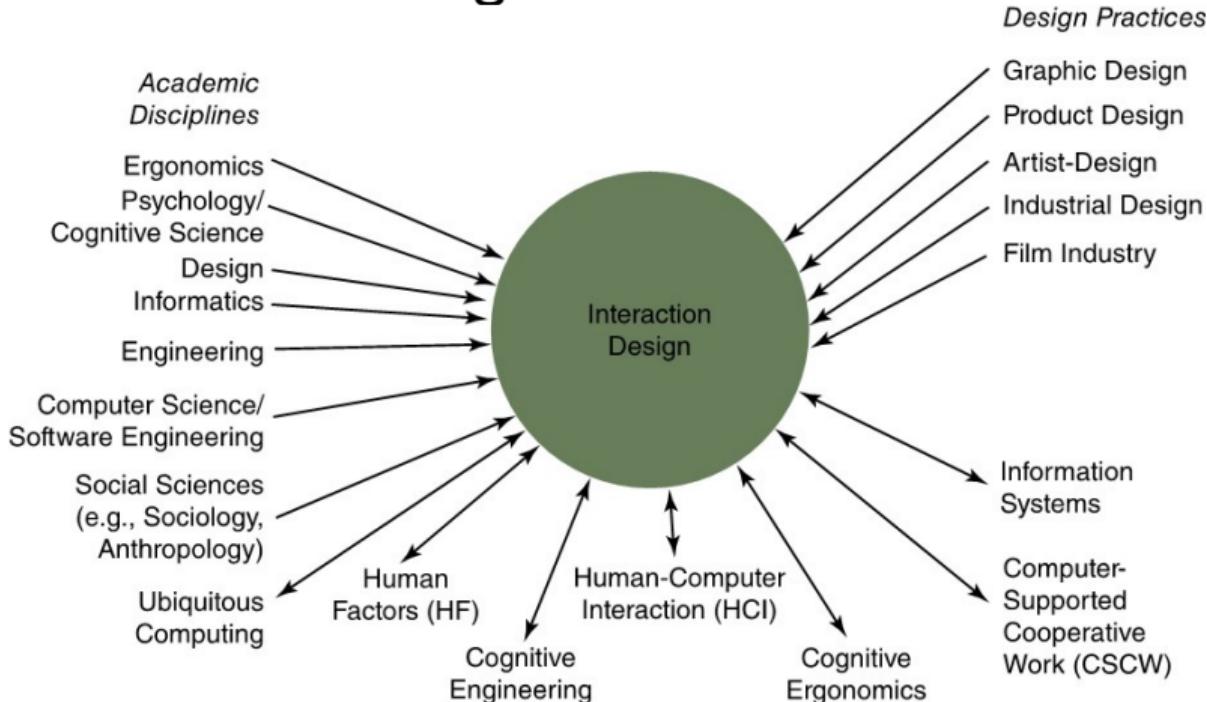


Figure 1: Interdisciplinary Fields in Interactive Design

Working in multidisciplinary teams

- Many people from different backgrounds involved
 - Different perspectives and ways of seeing and talking about things
 - **Benefit:** more ideas and designs are generated
 - **Disadvantage:** difficult to communicate and progress forward the designs being created

Interaction Design

Categories of Professionals in Interactive Design Business

- **Interaction Designers** - people involved in the design of all the interactive aspects of a product.
- **Usability Engineers** - people who focus on evaluating products, using usability methods and principles.
- **Web designers** - people who develop and create the visual design of websites, such as layouts
- **Information Architects** - people who come up with ideas of how to plan and structure interactive products.
- **User Experience Designers (UX)** - people who do all the above but who may also carry out field studies to inform the design of products

Interaction Design

What to design - things to consider

- Need to take into account:
 - Who the users are
 - What activities are being carried out
 - Where the interaction is taking place
- Need to optimize the interactions users have with a product:
 - So that they match the users' activities and needs
 - Bad design example: <http://bolden.nl/>
 - Is this a clever design? Yes, definitely.
 - But is this bad design? Absolutely!
 - This is a great example of designing for the designer, rather than the user:

Interaction Design

The User Experience

The user experience refers to:

- How a product behaves and is used by people in the real world.
- The way people feel about it the product
- Their pleasure and satisfaction when using the product, looking at it, holding it, and opening or closing it.

Note: You cannot design a user experience, you can only design for a user experience.

Interaction Design

The User Experience: iPod User Experience Success

Why was the iPod a success?



- Designers ensured quality user experience from the start.
- Designers ensured it is simple, elegant, distinct brand, pleasurable, must have fashion item, catchy name, cool, etc.

Core characteristics of interaction design

- Users should be involved through the development of the project
- Specific usability and user experience goals need to be identified, clearly documented and agreed at the beginning of the project
- Iteration is needed through the core activities

Interaction Design

Core characteristics of interaction design: Why?

To help designers:

- understand how to design interactive products that fit with what people want, need and may desire
- appreciate that one size does not fit all e.g., teenagers are very different to grown-ups
- identify any incorrect assumptions they may have about particular user groups e.g., not all old people want or need big fonts
- be aware of both people's sensitivities and their capabilities

Interaction Design

Accessibility and Inclusiveness

- **Accessibility:** the extent to which an interactive product is accessible by as many people as possible
 - Focus is on people with disabilities; for instance, those using android OS or apple voice-over.
- **Inclusiveness:** making products and services that accommodate the widest possible number of people .
 - For example, smartphones designed for all and made available to everyone regardless of their disability, education, age, or income

Interaction Design

Disabilities

- Whether someone is disabled changes over time with age, or recovery from an accident
 - The severity and impact of an impairment can vary over the course of a day or in different environmental conditions
 - Disabilities can result because technologies are designed to necessitate a certain type of interaction that is impossible for someone with an impairment

Understanding disability (1/2)

Disabilities can be classified as:

- Sensory impairment (such as loss of vision or hearing)
- Physical impairment (having loss of functions to one or more parts of the body after a stroke or spinal cord injury)
- Cognitive (including learning impairment or loss of memory/cognitive function due to old age)

Interaction Design

Understanding disability (2/2)

Each disability type can be further defined in terms of capability:

- For example, someone might have only peripheral vision, be color blind, or have no light perception

Impairment can be categorized:

- Permanent (for instance, long-term wheelchair user)
- Temporary (that is, after an accident or illness)
- Situational (for example, a noisy environment means that a person can't hear)

Interaction Design

Usability Goals

- Effective to use (doing the right thing)
 - How good a product is at doing what it is supposed to do
- Efficient to use (doing things right)
 - Product supports users carrying out their tasks efficiently.
- Safety: Product is safe to use
- Have good utility
 - Product provides a right kind of a functionality so users can do what they need or want to do
- Learnability: Product is easy to learn
- Memorability
 - Easy to remember how to use product
- Product is enjoyable to use

Interaction Design

User experience goals (1/2)

Desirable aspects

- satisfying
- enjoyable
- engaging
- pleasurable
- exciting
- entertaining
- helpful
- motivating
- challenging
- enhancing sociability
- supporting creativity
- cognitively stimulating
- fun
- provocative
- surprising
- rewarding
- emotionally fulfilling

User experience goals (2/2)

Undesirable aspects

- boring
- frustrating
- annoying
- childish
- intrusive
- unpleasant
- patronizing
- cutesy
- gimmicky
- creepy
- deceptive
- making one feel stupid
- making one feel guilty

Interaction Design

Design principles

- Generalizable abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense
- Main principles: **Visibility, Feedback, Constraints, Consistency, Affordance**

Interaction Design

Visibility Principle - Poor Interface



- How does it work?
- Push a button for the floor you want?
- Nothing happens. Push any other button?
Still nothing. What do you need to do?
- It is not visible as to what to do!

Figure 2: Elevator Control Panel

Interaction Design

Visibility Principle - Improving on a poor Interface



Figure 3: Elevator Control Panel

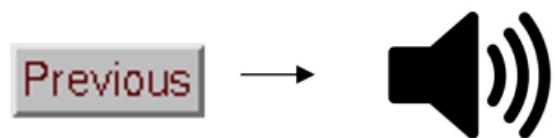
With this elevator, you need to insert your room card in the slot by the buttons to get the elevator to work!

- How would you make this action more visible?
 - Make the card reader more obvious
 - Provide an auditory message that says what to do (which language?)
 - Provide a big label next to the card reader that flashes when someone enters
 - Make relevant parts visible
 - Make what has to be done obvious

Interaction Design

Feedback Principle

- Sending information back to the user about what has been done
- Includes sound, highlighting, animation, and a combinations of these.
- For example, when screen button is clicked, it provides sound or red highlight feedback:



Constraints Principle

- Restricting the possible actions that can be performed
- Helps prevent user from selecting incorrect options
- Physical objects can be designed to constrain things
- E.g. only one way you can insert a key into a lock

Consistency Principle

- Design interfaces to have similar operations and use similar elements for similar tasks.
- For example, always use Ctrl key plus first initial of the command for an operation: Ctrl+c, Ctrl+s, Ctrl+o
- The main benefit is that consistent interfaces are easier to learn and use

Interaction Design

Consistency Principle -When consistency breaks down

- What happens if there is more than one command starting with the same letter?
 - For example, save, spelling, select, style
- You have to find other initials or combinations of keys, thereby breaking the consistency rule
 - For example, Ctrl+s, Ctrl+Sp, Ctrl+shift+l
- Increases learning burden on user, making them more prone to errors

Consistency Principle -Internal and External Consistency

Internal Consistency

- Refers to designing operations to behave the same within an application
- Difficult to achieve with complex interfaces

External Consistency

- Refers to designing operations, interfaces, and so on to be the same across applications and devices
- Very rarely the case, based on different designer's preference

Interaction Design

Consistency Principle -A Case of External Consistency Keypad numbers layout



Affordance Principle

- An invitation to action
- Refers to an attribute of an object that allows people to know how to use it
- E.g. a mouse button invites pushing, a door handle affords pulling.

Interaction Design

Affordance Principle - Virtual Affordances - Examples



Switch suggests toggling

knob suggests turning

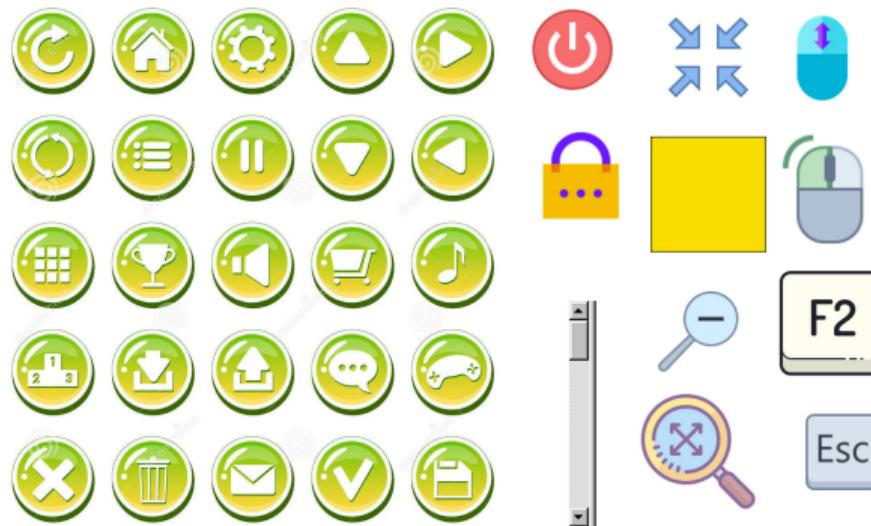
button suggests pressing

slot suggests inserting, handle suggests turning

Interaction Design

Affordance Principle - Virtual Affordances

- How do the following screen objects afford?
- What if you were a novice user? Would you know what to do with them?



Design Principles - Software User Interfaces

- 1 The Structure Principle
- 2 The Simplicity Principle
- 3 The Feedback Principle
- 4 The Visibility Principle
- 5 The Tolerance Principle
- 6 The Reuse Principle

Design Principles - Software User Interfaces

The Structure Principle (1/2)

- The user interface design should have an organized and well-built structure.
- The design and model should be apparent and recognizable.
- The design should be user-friendly, ensuring ease of use.
- Information should be simplified and separated as much as possible to enhance the user experience.

Design Principles - Software User Interfaces

The Structure Principle (2/2)

Techniques of UI Design that support the principle:

- Navigation between major interface screens should be simple for seamless interaction.
- Grouping objects effectively helps in organizing and presenting information logically.
- The design should be intuitive, allowing users to easily understand and navigate the interface.

Design Principles - Software User Interfaces

The Simplicity Principle (1/2)

- Common and repetitive tasks should be a great experience within the user interface design.
- The design should communicate easily with the user and provide shortcuts or hotkeys for related and/or longer procedures.

Interaction Design

Design Principles - Software User Interfaces

The Simplicity Principle (2/2)

Techniques of UI Design that support the principle:

- Consistency in design elements and interactions helps users navigate and interact seamlessly.
- Navigation within the screen should be simple to ensure easy access to different functionalities.
- Effective alignment of fields and elements enhances visual clarity and improves usability.

Design Principles - Software User Interfaces

The Feedback Principle (1/2)

- The user interface design should provide clear and informative feedback to users regarding actions, interpretations, state changes, conditions, errors, or exceptions.
- Language used should be familiar, concise, and unambiguous.

Design Principles - Software User Interfaces

The Feedback Principle (2/2)

Techniques of UI Design that support the principle:

- Explanation of rules helps users understand how the interface functions.
- Anticipating user mistakes and providing guidance or corrective measures.
- Design should be intuitive, allowing users to easily grasp and navigate the interface.

Design Principles - Software User Interfaces

The Visibility Principle (1/2)

- Users should be able to easily locate desired information or options.
- Providing fewer choices helps users make decisions effectively, as too many options can lead to confusion, prolonged decision-making, or incorrect choices.
- UI designers should avoid including irrelevant, unnecessary, or useless information.

Interaction Design

Design Principles - Software User Interfaces

The Visibility Principle (2/2)

Techniques of UI Design that support the principle:

- Avoid creating cluttered or busy interfaces that overwhelm users.
 - Effectively group objects to enhance visual organization and clarity.
 - When reviewing other applications, consider their design choices critically and selectively apply relevant elements.

Design Principles - Software User Interfaces

The Tolerance Principle (1/2)

- UI design should be forgiving and tolerant of user mistakes.
- Design should allow users to easily undo and redo actions to recover from errors.
- Providing helpful recommendations can guide users towards making the right choices.
- A good UI design should accommodate varied input methods and tolerate spelling variations.

Interaction Design

Design Principles - Software User Interfaces

The Tolerance Principle (2/2)

Techniques of UI Design that support the principle:

- Anticipate and expect users to make mistakes, and provide mechanisms for easy error correction.
- Design should be intuitive, allowing users to easily understand and navigate the interface.
- Navigation between major interface screens should be simple, facilitating user interactions and tasks.

Design Principles - Software User Interfaces

The Reuse Principle (1/2)

- Consistency in UI design reduces cognitive load and enhances user experience.
- Applying the same elements, layout, actions, and behavior across the user interface or a series of designs promotes familiarity and reduces the need for users to rethink or remember.

Interaction Design

Design Principles - Software User Interfaces

The Reuse Principle (2/2)

Techniques of UI Design that support the principle:

- Maintain consistency throughout the UI design, ensuring that elements and interactions follow established patterns.
- Set project standards to establish guidelines and ensure consistency across different UI designs.
- Clearly explain the rules and guidelines to users, helping them understand and navigate the interface consistently.

Design Principles - Software User Interfaces The Reuse Principle

- Adobe Products (Photoshop and Lightroom)
- Microsoft Products (Word, Excel, PowerPoint)

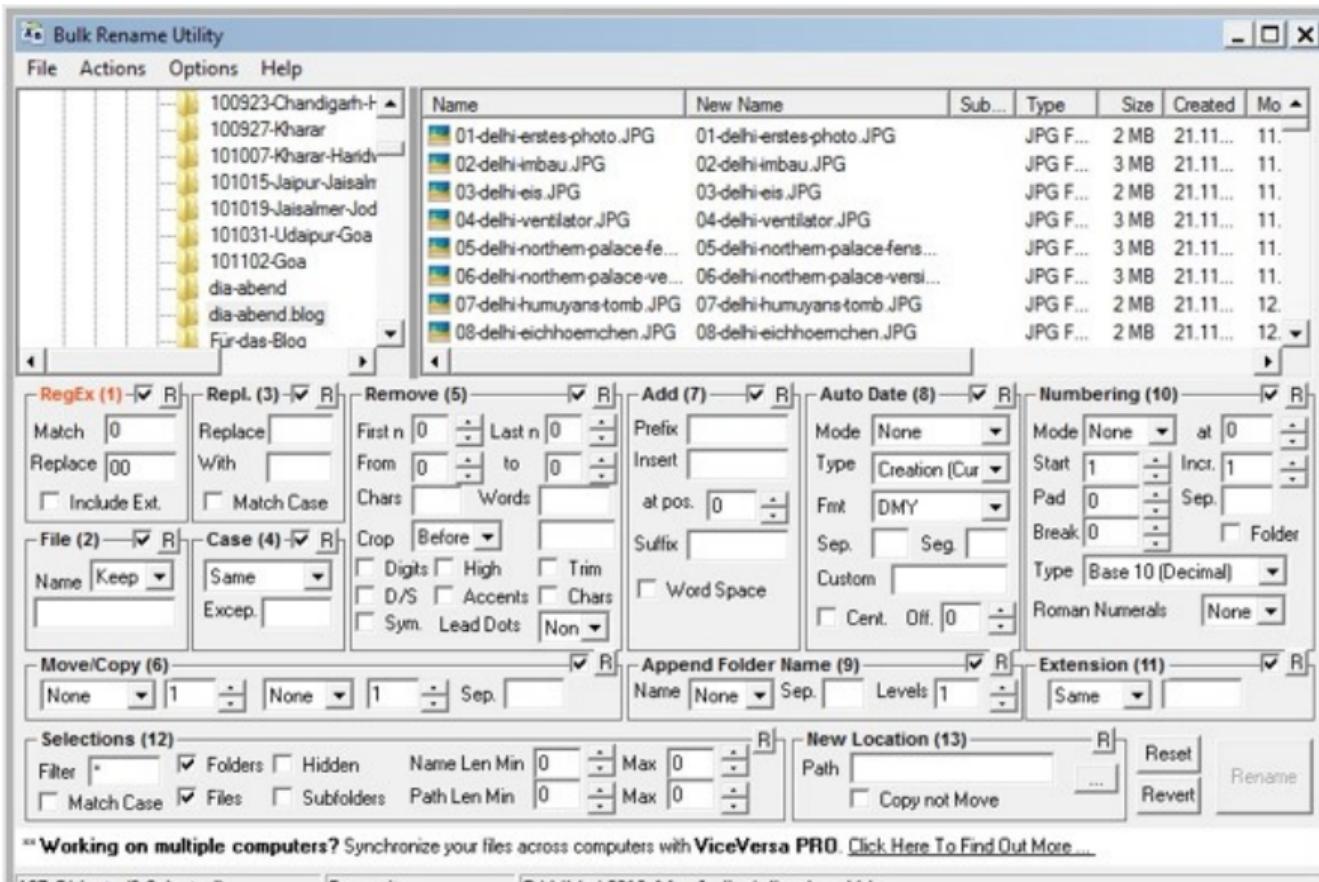
Interaction Design

Design Principles - Software User Interfaces: Activity

Which will you recommend? Why?



Which Design Principles are not followed? - Be better than this



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Good vs Bad UI



Form A

First Name*

John

Last Name*

Doe

Phone*

0123456789

Email*

admin@abc...

Preferred Slot*

2am-4pm ▼

Submit

Form B

Name

John Doe

Phone*

0123456789

Email*

admin@abc.com

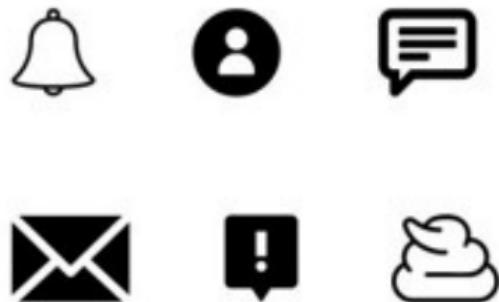
Preferred Slot*

2 AM - 4 PM ▼

Submit

Good vs Bad UI

✗ Inconsistent icons



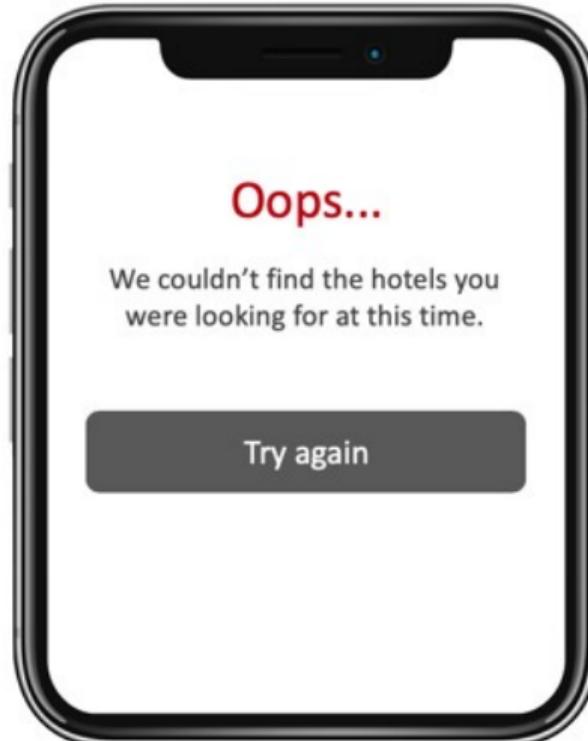
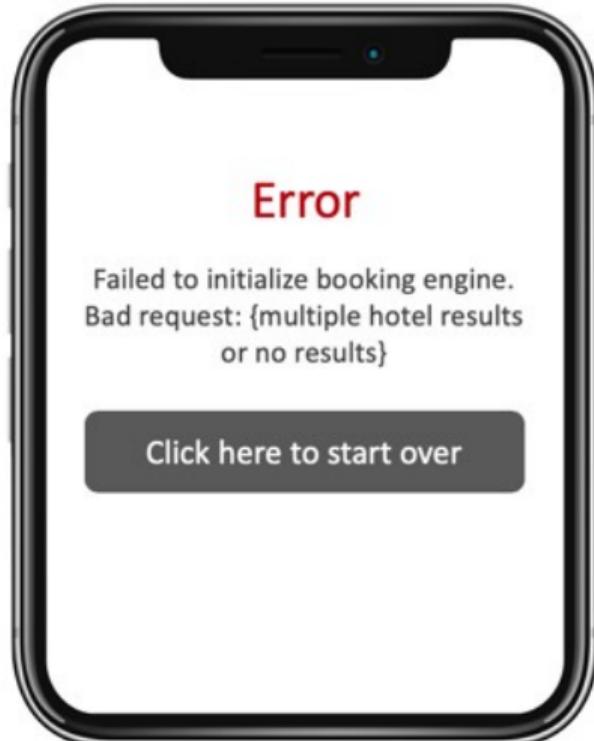
✓ Consistent icons



Good vs Bad UI



The Mobile Spoon



Interaction Design

Summary

- Interaction design is concerned with designing interactive products to support the way people communicate and interact in their everyday and working lives
- It is concerned with how to create quality user experiences
- It requires taking into account a number of interdependent factors, including context of use, type of activities, cultural differences, and user groups
- It is multidisciplinary, involving many inputs from wide-reaching disciplines and fields

Create designs with a user-centric approach, focusing on the needs of your audience rather than your own preferences.