ADVANCED DESIGN OF INTERACTIVE SYSTEMS

22 JANUARY 2026

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LECTURES & TOPICS

1

Introduction

Introduction of Goals and Topic

Exercise: DOIS Quiz & Choose groups

Homework: Story Interviews

2

Understanding Humans

Understand underlying cognitive effects:

Alignment, Theory of Mind, Mental Models

Exercise: Concept Development

Homework: Initial Design

3

Agency in HAI

Explainability, Ironies of Automation

How to design for Error, Feedback and Control?

Exercise: Build Prototype

Homework: Storyboard

4

Iterating on Design

Socio-Technical Systems

Exercise: Prototype + Generative Walkthrough

Homework: Revise Concept

5

Evaluating interactive systems

Overview of evaluation methods

Exercise: Revise Prototype

Homework: Evaluation protocol

6

Reflection on HAI

Social, legal, sustainability impact of AI

Discuss the role of designers for HAI interaction

Exercise: Poster, Presentation

RECAP HOMEWORK

INITIAL DESIGN CONCEPTS ___

Discuss (and agree):

- Choose one object of interests
- Note down the precise, specific interaction problem
- Summarise ideas in a design concept
- Describe
  - functions the user applies to the object
  - How a system could understand them
  - What are current limitations of AI systems in this regard?

EXERCISE

DESIGN CONCEPTS ___

For each of your ideas write down a one-sentence description:

- Who is your system for?
- What should it do?
- Summary of your tool

REFLECT

What user problem(s) does it solve?
Is the interaction clear?
What technology does it use?
How does it help users?

UNDERSTANDING AGENCY

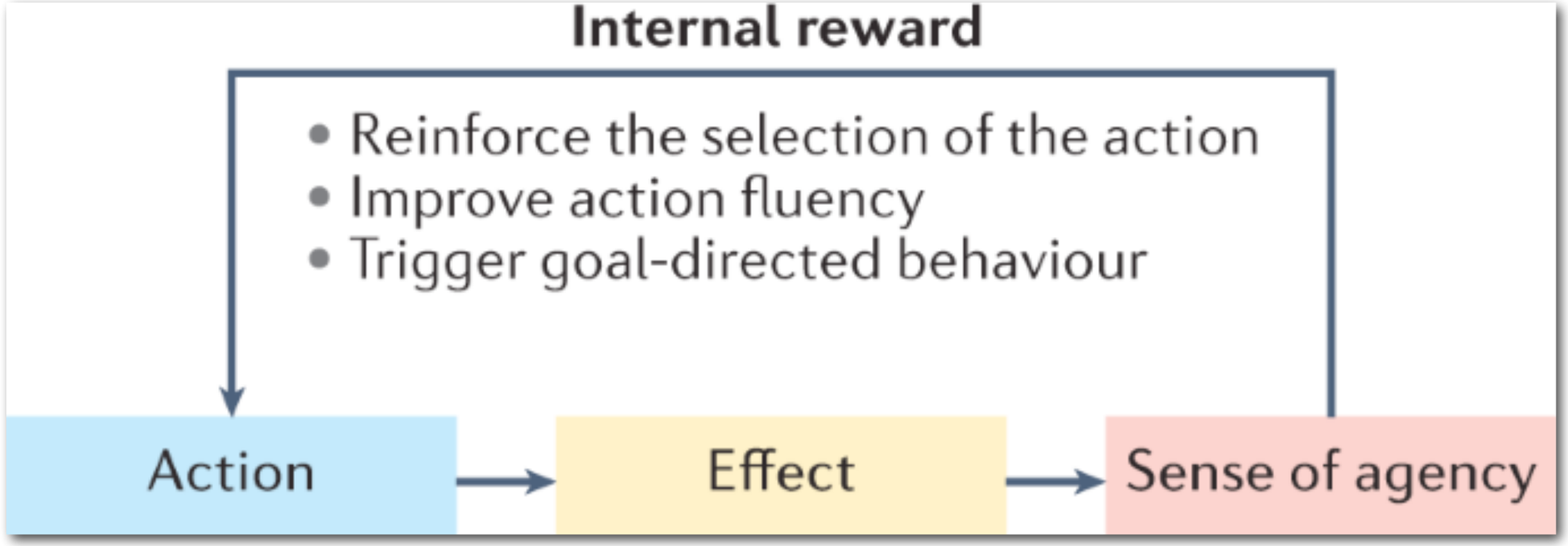
What is Agency?

Error and Feedback

Control

AGENCY

Sense of Agency (SoA) is the subjective experience that oneself initiates and controls its own actions and, through



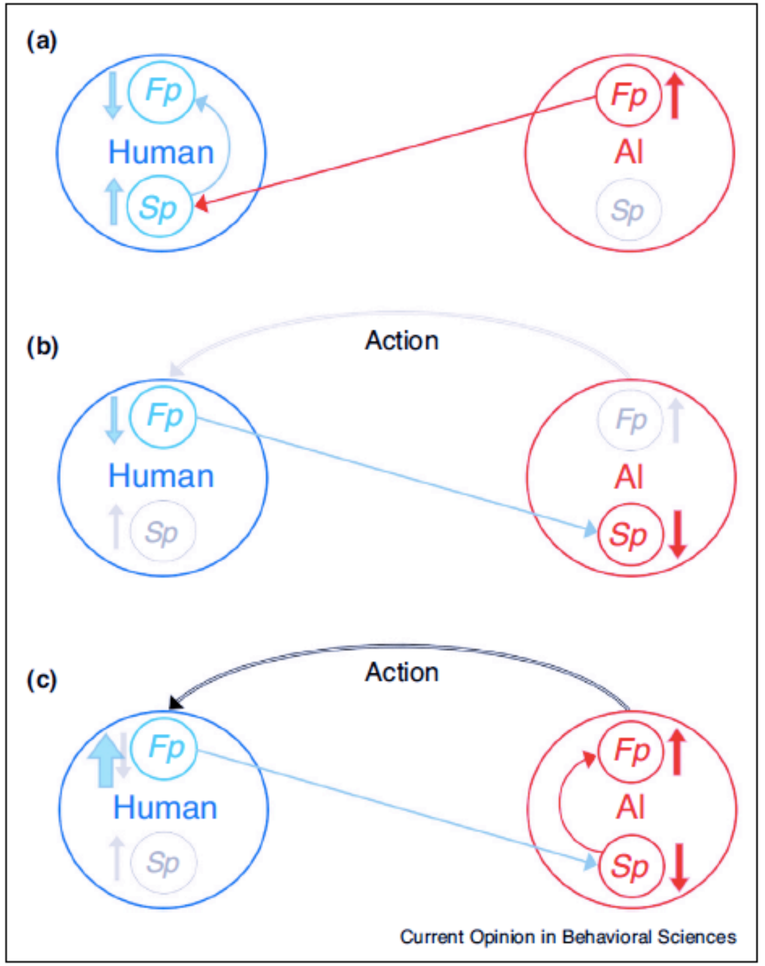
Legaspi and Toyoizumi (2019); Synthetic agency: Sense of Agency in Artificial Intelligence. Opinion in Behavioral Sciences

AGENCY

a Problem: AI simply demonstrating high SoA may reduce human SoA because the human perceives the AI to be controlling him/her.

b AI perceives decreased human SoA, must carefully choose its next actions, or perhaps perform no action at all, to increase human SoA.

c AI understanding of both human and its own SoA can then better respond to improve or manipulate human SoA.



Dynamics of the first-person and second-person (Fp and Sp) perspectives of SoA in human–AI interaction.

Legaspi and Toyoizumi (2019); Synthetic agency: Sense of Agency in Artificial Intelligence. Opinion in Behavioral Sciences

Different algorithms
with the **same interaction**
may produce **same user result**

The s**ame algorithm** with
different interaction may
cause **different user results**

REFLECT

AGENCY

Go through your design concept and look:

- When does the user drive the interaction?
- When does the system take over agency?
- How are you planning to communicate this take over?
- How can the user take over the lead again?

UNDERSTANDING AGENCY

What is Agency?

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DESIGNING FOR
ERROR AND FEEDBACK ___

Photo by Sahand Babali on Unsplash

Guidelines applicable to the design of most interactive systems. These become crucial the most agency is taken by the system.

3 Principles for good UI Design:

1. Recognize User Diversity → User-centred Design
2. Follow the Eight Golden Rules
3. Prevent Errors

- Shneiderman et. al.. (2016). Designing the user interface: strategies for effective human-computer interaction. Pearson.
- https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bc202e6b1fbde29b65e9470beacbea5daf4ed26a (Albrecht Schmidt)

EIGHT GOLDEN RULES

EIGHT GOLDEN RULES

1. Strive for consistency
2. Seek universal usability
3. Offer informative feedback
4. Design dialogue to yield closure
5. Prevent Errors
6. Permit easy reversal of actions
7. Keep users in control
8. Reduce short-term memory load

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EIGHT GOLDEN RULES

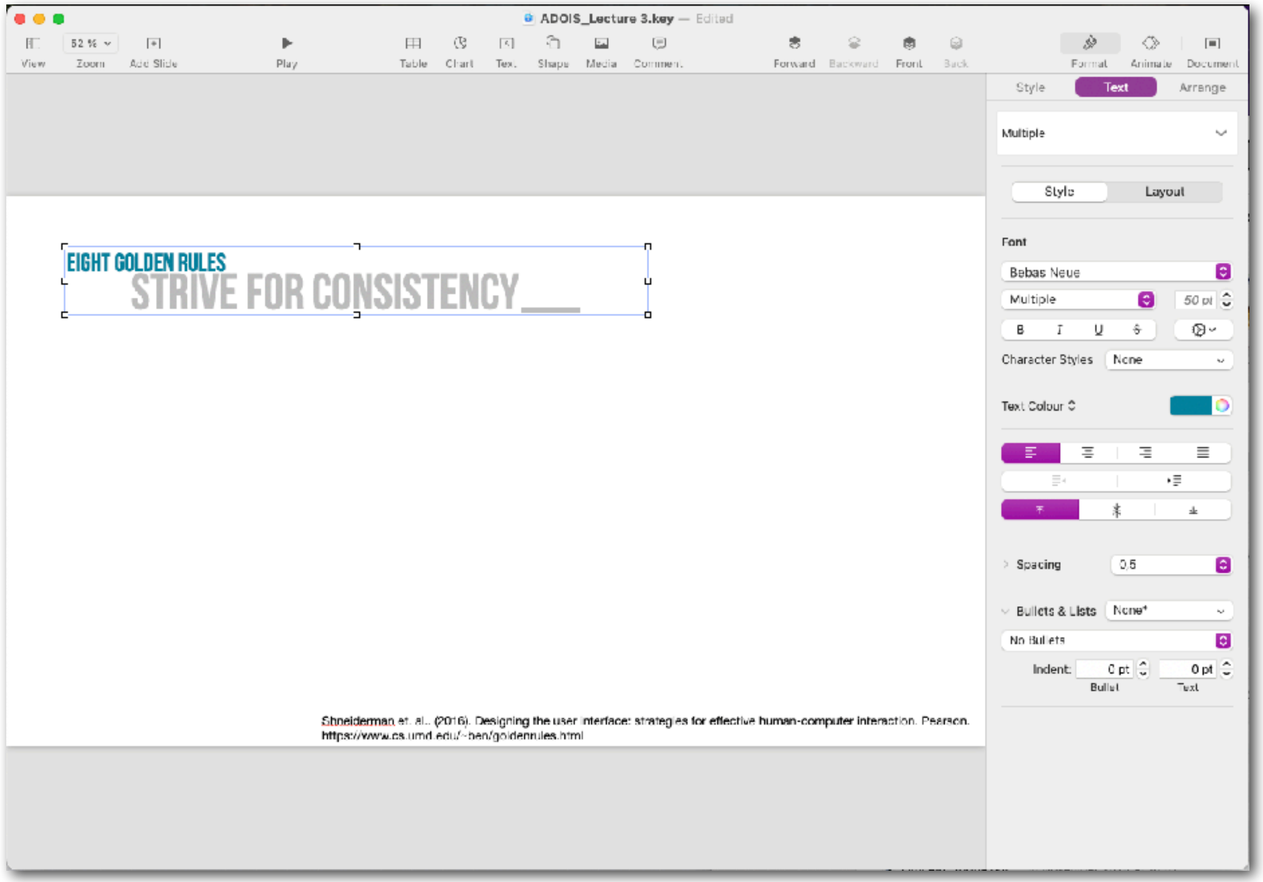
STRIVE FOR CONSISTENCY

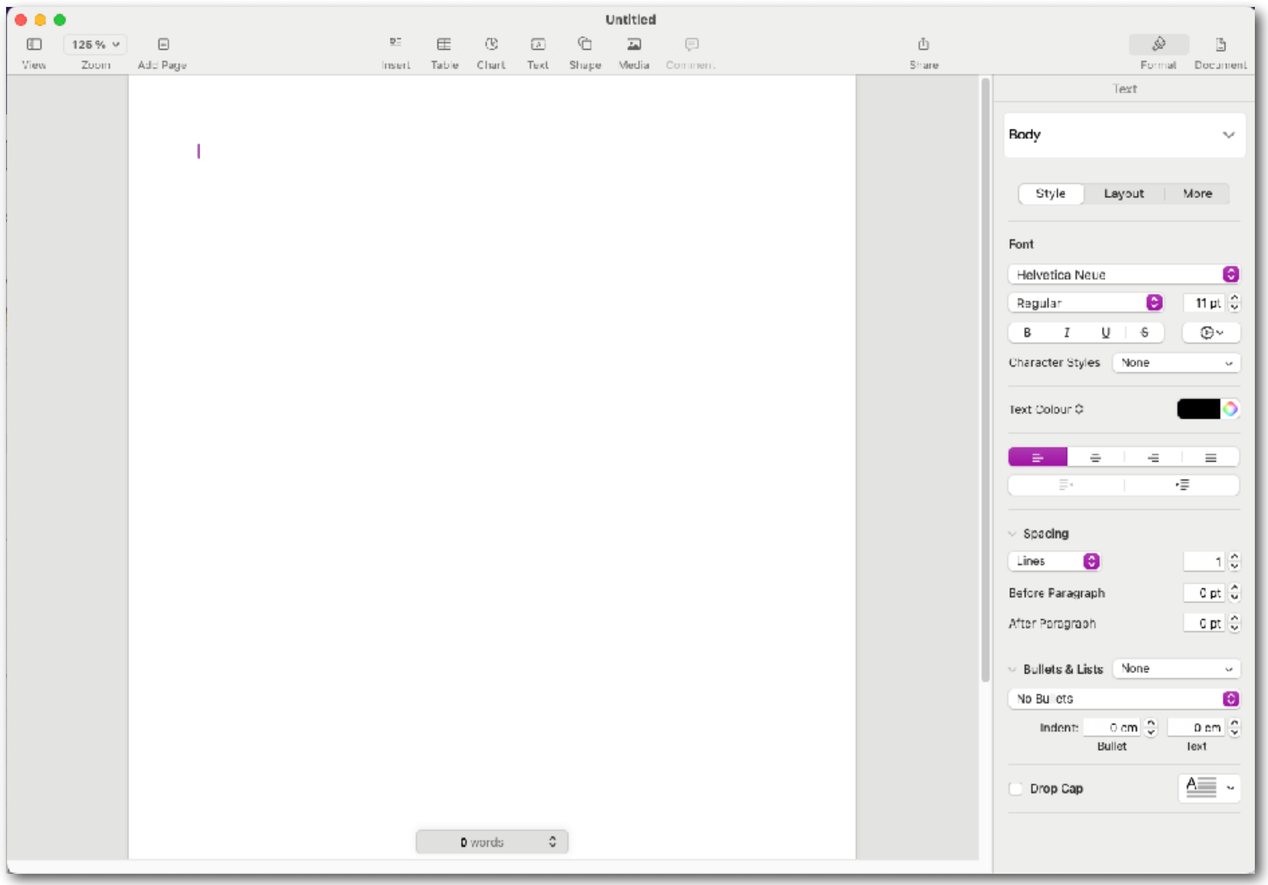
- Consistent sequences of actions should be required in similar situations;
- Consistent terminology should be used in prompts, menus, and help screens,..
- Consistent color, layout, capitalization, fonts, … should be employed throughout the UI
- Exceptions, e.g. required confirmation of the delete command or no echoing of passwords, should be comprehensible and limited

Shneiderman et. al.. (2016). Designing the user interface: strategies for effective human-computer interaction. Pearson.
https://www.cs.umd.edu/~ben/goldenrules.html

EIGHT GOLDEN RULES

STRIVE FOR CONSISTENCY___





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EIGHT GOLDEN RULES

STRIVE FOR CONSISTENCY- LIMITATIONS

Breaking consistency:

- To highlight
- TO WARN USERS
- To distinguish similar actions with different outcomes e.g. delete file vs delete disk

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https://www.cs.umd.edu/~ben/goldenrules.html

EIGHT GOLDEN RULES

SEEK UNIVERSAL USABILITY

- Recognize the needs of diverse users and design for plasticity, facilitating transformation of content.
  - **Novice to expert** differences,
  - **age** ranges, **disabilities**, **international** variations,
  - **technological** diversity

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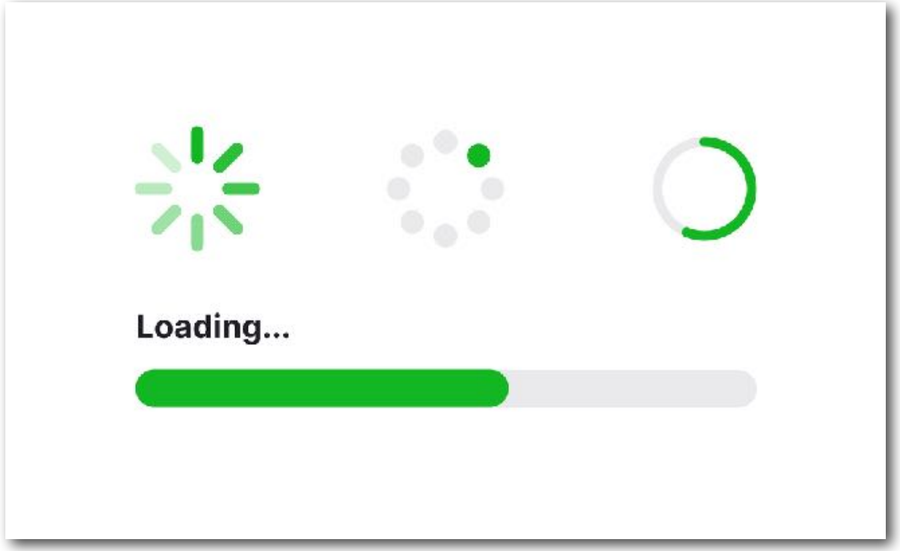
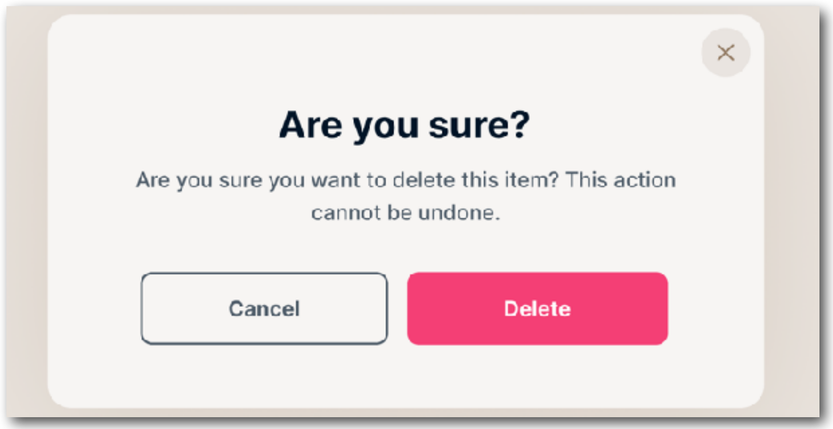
EIGHT GOLDEN RULES

OFFER INFORMATIVE FEEDBACK

- For every user action, there should be an interface feedback.
  - **frequent and minor actions**, the response can be **modest**
  - **infrequent and major actions**, the response should be more **substantial.**





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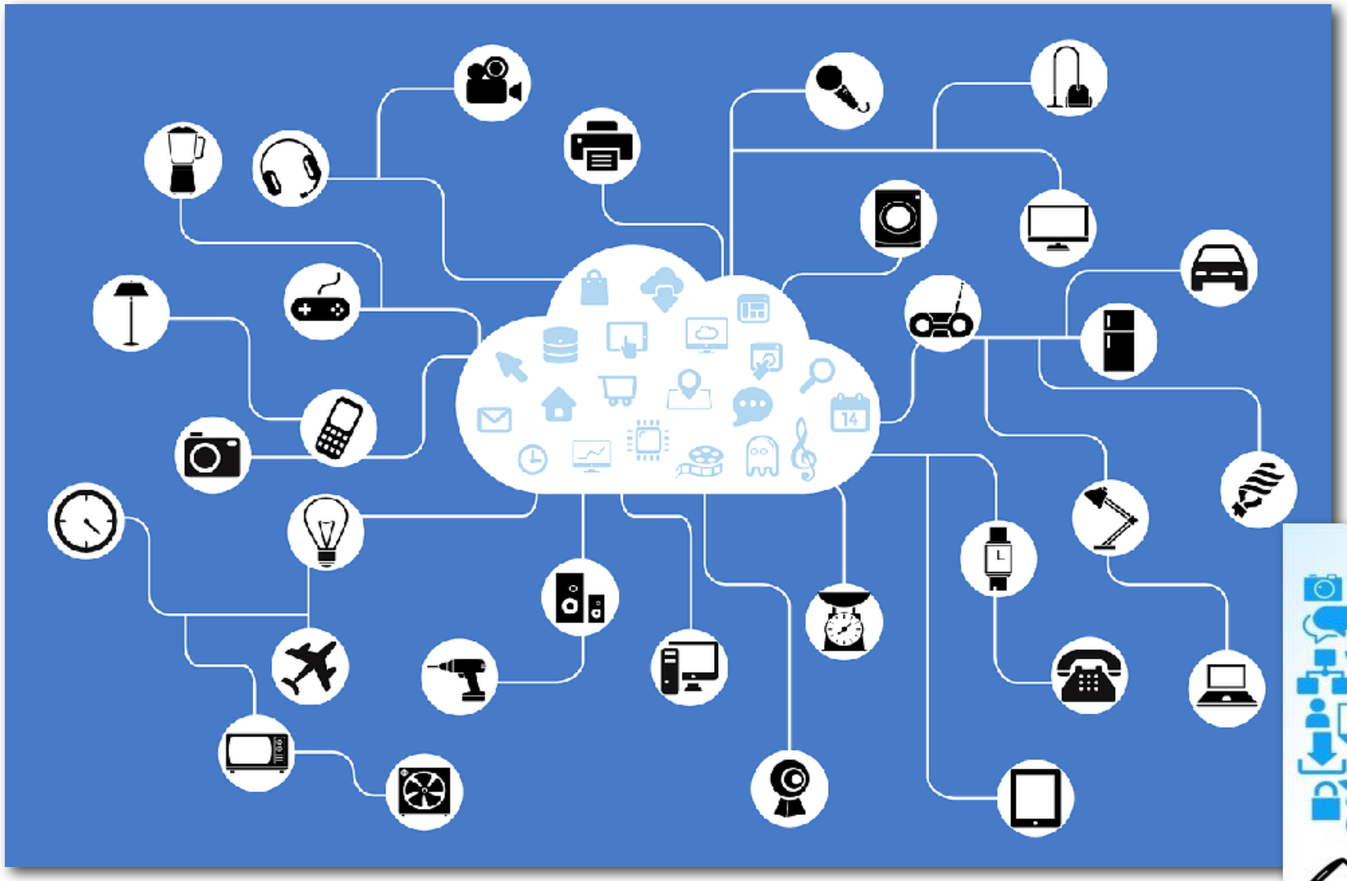
EIGHT GOLDEN RULES

OFFER INFORMATIVE FEEDBACK - LIMITATIONS



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EIGHT GOLDEN RULES

DESIGN DIALOGUE TO YIELD CLOSURE___

- Sequences of actions should be organized into groups with a **beginning, middle, and end**.
- Informative feedback at the completion of a group of actions gives users the satisfaction of accomplishment, a sense of relief [...]
- Important for actions that are not immediate and span over a longer time or multiple steps

Shneiderman et. al.. (2016). Designing the user interface: strategies for effective human-computer interaction. Pearson.
https://business.amazon.in/en/discover-more/blog/order-management-process

EIGHT GOLDEN RULES

PREVENT ERRORS

- As much as possible, design the interface so that users cannot make serious errors
- If users make an error, the interface should offer simple, constructive, and specific instructions for recovery“

That means as a Designer you should:

- Detect errors
- Different options how to handle it:
  - Involve the user with dialogs (current practice)
  - Prevent the error or consequences on system level (e.g. create backups/versions)

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EIGHT GOLDEN RULES

PERMIT EASY REVERSAL OF ACTIONS

- As much as possible, actions should be reversible.
- Relieves anxiety, since users know that errors can be undone, and encourages exploration [...]
- The units of reversibility : **single action, a data-entry task,** or a **complete group of actions**

  Always provide UNDO functions

  - Possibly with infinite depth
  - Over sessions
- Not trivial (conceptually as well as technically)
  - Example: write a text, copy it into the clipboard, undo the writing, is the text is still in the clipboard?

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EIGHT GOLDEN RULES

PERMIT EASY REVERSAL OF ACTIONS - LIMITATIONS

As a basic rule – all actions should be reversible

- When is this not possible?
  - Communication applications (e.g. email)
  - Smart environments
  - Machines
  - Cars
- In certain settings processes and basic physical laws prevent reversal of actions
  — possible interaction layer (buffering user interaction) possible – but not always (e.g. breaks, emergency stop)

Shneiderman et. al.. (2016). Designing the user interface: strategies for effective human-computer interaction. Pearson.

EIGHT GOLDEN RULES

KEEP USERS IN CONTROL

- “Experienced users strongly desire the sense that they are in charge of the interface and that the interface responds to their actions.
- They don’t want surprises or changes in familiar behavior”

- The system should be predictable
- Current developments (AI, Ubicomp) are in contrast:
  - Intelligent agents
  - Smart environments

Topic of this course

Shneiderman et. al.. (2016). Designing the user interface: strategies for effective human-computer interaction. Pearson.

EIGHT GOLDEN RULES

REDUCE SHORT-TERM MEMORY LOAD

- “Humans’ limited capacity for information processing in short-term memory
- designers should UIs where users must remember information from one display to [..] another display.”

“rule of thumb is that people can remember ‘seven plus or minus two chunks’ of information”

- The system should remember, not the user
  - Make information that is required visible
  - Recognition is easier than recall, use memory aids (visual or audio)

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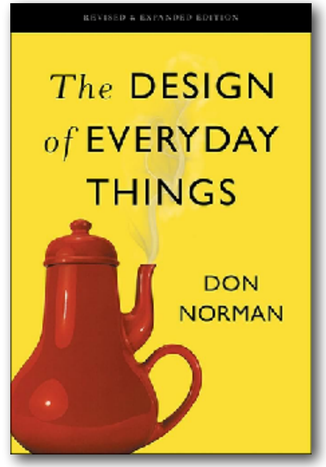
UNDERSTANDING ERRORS



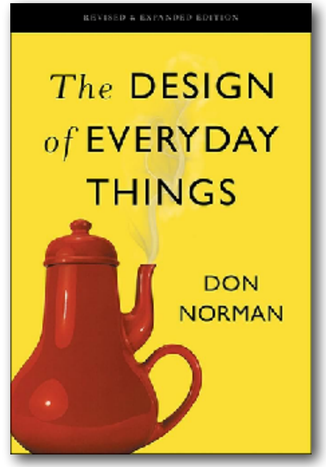
"If an error is possible, someone will make it" (Norman)

- Human Error may also be a starting point to look for design problems.

- Errors are routinely made
  - Communication and language is used between people to clarify – more often than one imagines
  - Common understanding of goals and intentions between people helps to overcome errors

https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bc202e6b1fbde29b65e9470beacbea5daf4ed26a
(Albrecht Schmidt)

UNDERSTANDING ERROR TYPES



- Two fundamental categories
  - Mistakes
    - overgeneralization
    - wrong conclusions
    - wrong goal
  - Slips
    - Result of “automatic” behaviour
    - Appropriate goal but performance/action is wrong

https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bc202e6b1fbde29b65e9470beacbea5daf4ed26a
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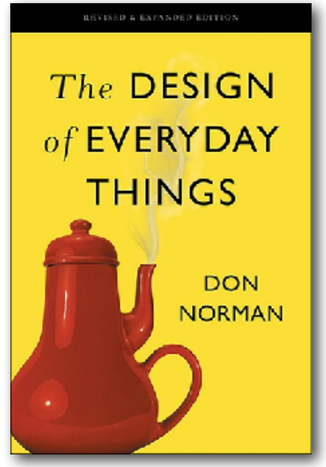
UNDERSTANDING ERRORS



Design implications

- Assume all possible errors will be made
- Minimize the chance to make errors (constraints)
- Minimize the effect that errors have (is difficult!)
- Include mechanism to detect errors
- Attempt to make actions reversible

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(Albrecht Schmidt)

DESIGNING FOR

THE AUTOMATION IRONY

AUTOMATION DOES NOT CURE HUMAN ERROR

- Automation shifts some errors from operator errors to design errors
  - harder to detect/tolerate/fix design errors
- Automation addresses the easy tasks, leaving the complex, unfamiliar tasks for the human
  - humans are ill-suited to these tasks, especially under stress
- Automation hinders understanding and mental modeling
  - decreases system visibility and increases complexity
  - operators don’t get hands-on control experience
  - prevents building mental rules and models for troubleshooting

Photo by charlesdeluvio on Unsplash

EXERCISE

DESIGN ALTERNATIVES

Choose one or two aspects of your main concept

Consider 3-5 alternatives:

- Focus on alternative forms of interaction, not different functionality
- Address at least one golden rule.
- Look for error potential and how the user could recover.

REFLECT

Reflect on trade-offs between them:
- What is better?/ What is worse?
Choose one or recombine features for a new concept

UNDERSTANDING AGENCY

What is Agency?

Error and Feedback

Control

DESIGNING FOR USER CONTROL ___

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Expanding these 8 Golden rules of UI design to automated systems resulted in the following 6 design principles:

1. Expectability and predictability
2. Communicate options for interventions
3. Exploration of interventions
4. Easy reversal of automated and intervention actions
5. Minimize required attention
6. Communicate how control is shared

Schmidt, A., & Herrmann, T. (2017). Intervention user interfaces: a new interaction paradigm for automated systems. interactions, 24(5), 40-45.

DESIGNING FOR USER CONTROL ___

Photo by charlesdeluvio on Unsplash

Expanding these 8 Golden rules of UI design to automated systems resulted in the following 6 design principles:

1 Expectability and predictability

Ensure that users are not surprised by automated behavior and that they understand how it develops.

Schmidt, A., & Herrmann, T. (2017). Intervention user interfaces: a new interaction paradigm for automated systems. interactions, 24(5), 40-45.

DESIGNING FOR USER CONTROL ___

Photo by charlesdeluvio on Unsplash

Expanding these 8 Golden rules of UI design to automated systems resulted in the following 6 design principles:

1. Expectability and predictability
2. Communicate options for interventions

   Make options for interventions that may be context-aware visible and understandable for users in an unobtrusive way.

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DESIGNING FOR USER CONTROL

Expanding these 8 Golden rules of UI design to automated systems resulted in the following 6 design principles:

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3. Exploration of interventions

Allow the safe and enjoyable exploration of interventions and their potential impacts, e.g., by simulation or previews on future system statuses.

Photo by charlesdeluvio on Unsplash

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DESIGNING FOR USER CONTROL

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Offer a simple means to reverse the impact of the system's automated behavior or of the results of interventions.

Photo by charlesdeluvio on Unsplash

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DESIGNING FOR USER CONTROL ___

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4. Easy reversal of automated and intervention actions
5. Minimize required attention

Minimize the user attention required to operate the system by implicitly controlled feedback.

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DESIGNING FOR USER CONTROL ___

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6. Communicate how control is shared

Clearly communicate the distribution of responsibilities, as well as the actual control between the human and the machine.

Schmidt, A., & Herrmann, T. (2017). Intervention user interfaces: a new interaction paradigm for automated systems. interactions, 24(5), 40-45.

RECAP

TELLING STORIES___

Choose your method to refine your Design Alternatives:

- Current scenario
- Future scenario
- Interaction Snippets
- Storyboard
- Video prototype

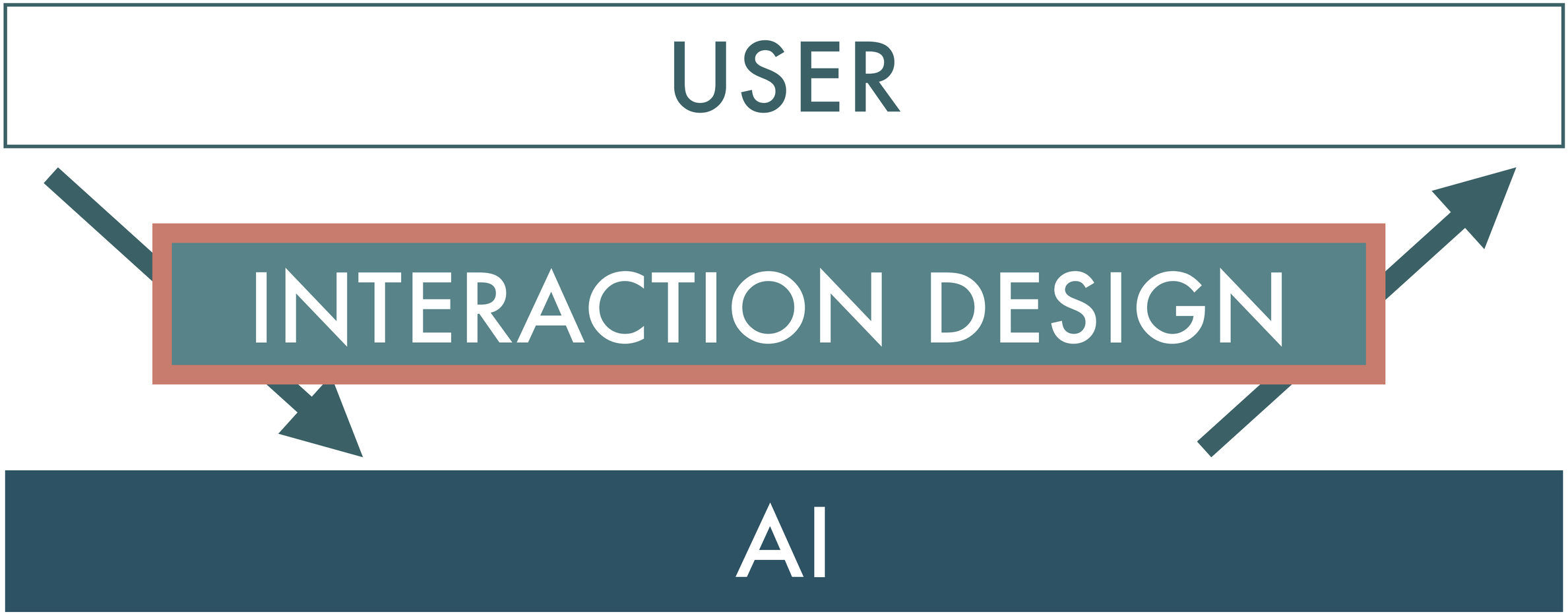
Current scenario
Draws from current real-world observations of how people use technology today

Future scenario
Builds upon current scenarios to imagine how future users will interact with the new technology in this setting and context

Update the scenario
if it helps you explore alternatives
as long as it remains true to real users

RECAP

FOCUS___



EXERCISE

CONSTRUCT SCENARIOS

- Summarise your alternatives in (up to 3) Scenarios (see future scenarios)
  - Compare it to what you have learned from your users
  - How does it address your target group?

REFLECT

How the user can express and control this expression with the system?
How can the system provide feedback ?
What happens when errors appear?

EXERCISE

PROTOTYPING

REFLECT

How the user can express and control this expression with the system?
How the system can provide useful feedback ?
What happens when errors appear?

- Translate your scenarios into paper prototypes
- Act how a user would interact with it (keep track of what works and what doesn't)
  - Do it quick
  - Look at it
  - Elaborate if necessary

HOMEWORK

STORYBOARD ___

Discuss (and agree):

- Choose a final scenario
- Note down the interactions in the scenario
- Outline a storyboard for the first video prototype

ADVANCED DESIGN OF INTERACTIVE SYSTEMS

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