

Paradigms for Human-AI Interaction

Human-AI Interaction

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Summary

- Interaction(s) in HCI
- Interacting with AI
- Journey Map
 - You will work in groups:
<https://docs.google.com/spreadsheets/d/1JrluovlsTPnMV33Wp6joUOi6IUeBbw246-h8Qu4MDfA>

Interaction(s) in HCI

What is interaction (in HCI)?

- Interaction is...

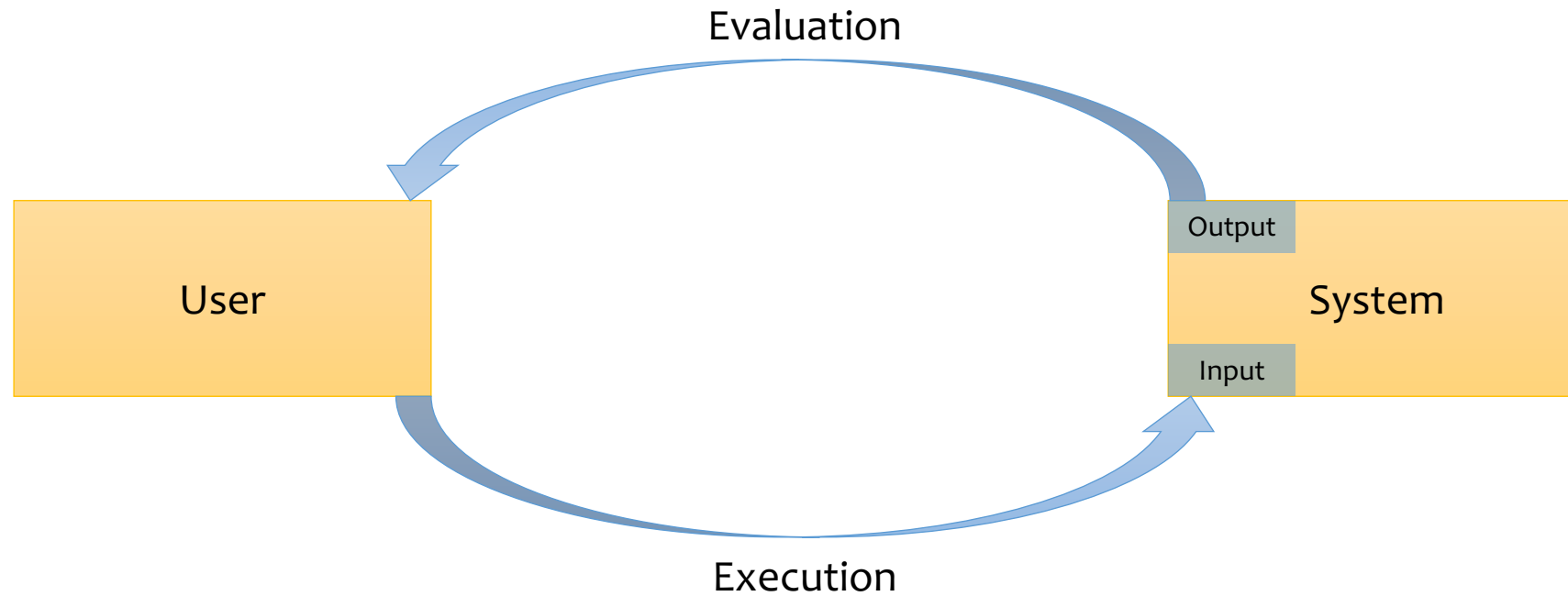
Concept	View of interaction	Key phenomena and constructs	Good interaction	Example support for evaluation and design
Dialogue	a cyclic process of communication acts and their interpretations	mappings between UI and intentions; feedback from the UI; turn taking	understandable; simple, natural; direct	methods/concepts for guessability, feedback, mapping; walkthroughs
Transmission	a sender sending a message over a noisy channel	messages (bits); sender and receiver; noisy channels	maximum throughput of information	metrics and models of user performance
Tool use	a human that uses tools to manipulate and act in the world	mediation by tools; directness of acting in the world; activity as a unit of analysis	useful and transparent tools; amplification of human capabilities	compatibility in instrumental interaction; break down analysis
Optimal behavior	adapting behavior to goals, task, UI, and capabilities	rationality; constraints; preferences; utility; strategies	improves or reaches maximum or satisfactory utility	models of choice, foraging, and adaptation
Embodiment	acting and being in situations of a material and social world	intentionality; context; coupling	provides resources for and supports fluent participation in the world	studies in the wild; thick description
Experience	an ongoing stream of expectations, feelings, memories	non-utilitarian quality; expectations; emotion	satisfies psychological needs; motivating	metrics of user experience; experience design methods
Control	interactive minimization of error against some reference	feedforward; feedback; reference; system; dynamics	rapid and stable convergence to target state	executable simulations of interactive control tasks

Taken from: Kasper Hornbæk & Antti Oulasvirta, What Is Interaction? In: *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*

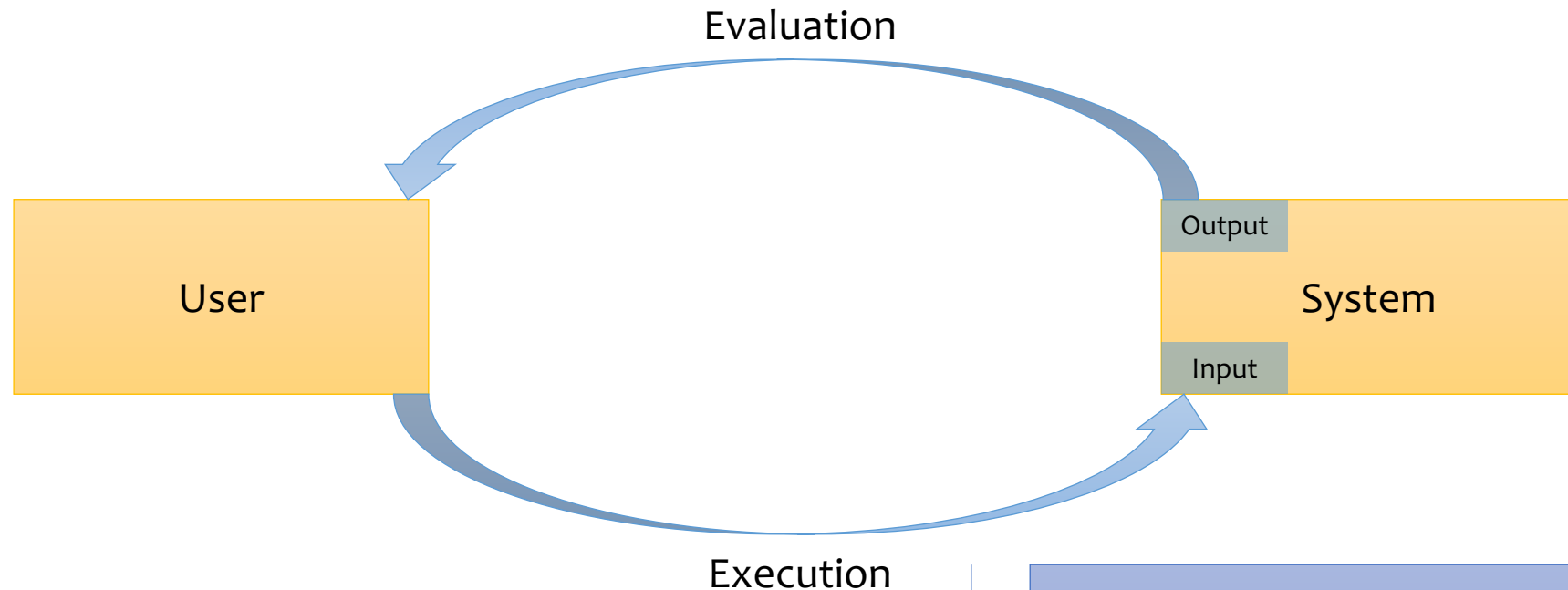
What is interaction (in HCI)?

- Interaction...
 - **is not** the idea promoted and repeated in folk notions that a computer and a human are engaged
 - it concerns two entities, e.g., humans and computers, that determine each other's behavior over time:
 - Their mutual determination can be of many types, including statistical, mechanical, and structural.
 - In HCI (but also HAI) **users**, with their **goals** and **pursuits**, are the ultimate metric of interaction.

Norman's model of interaction

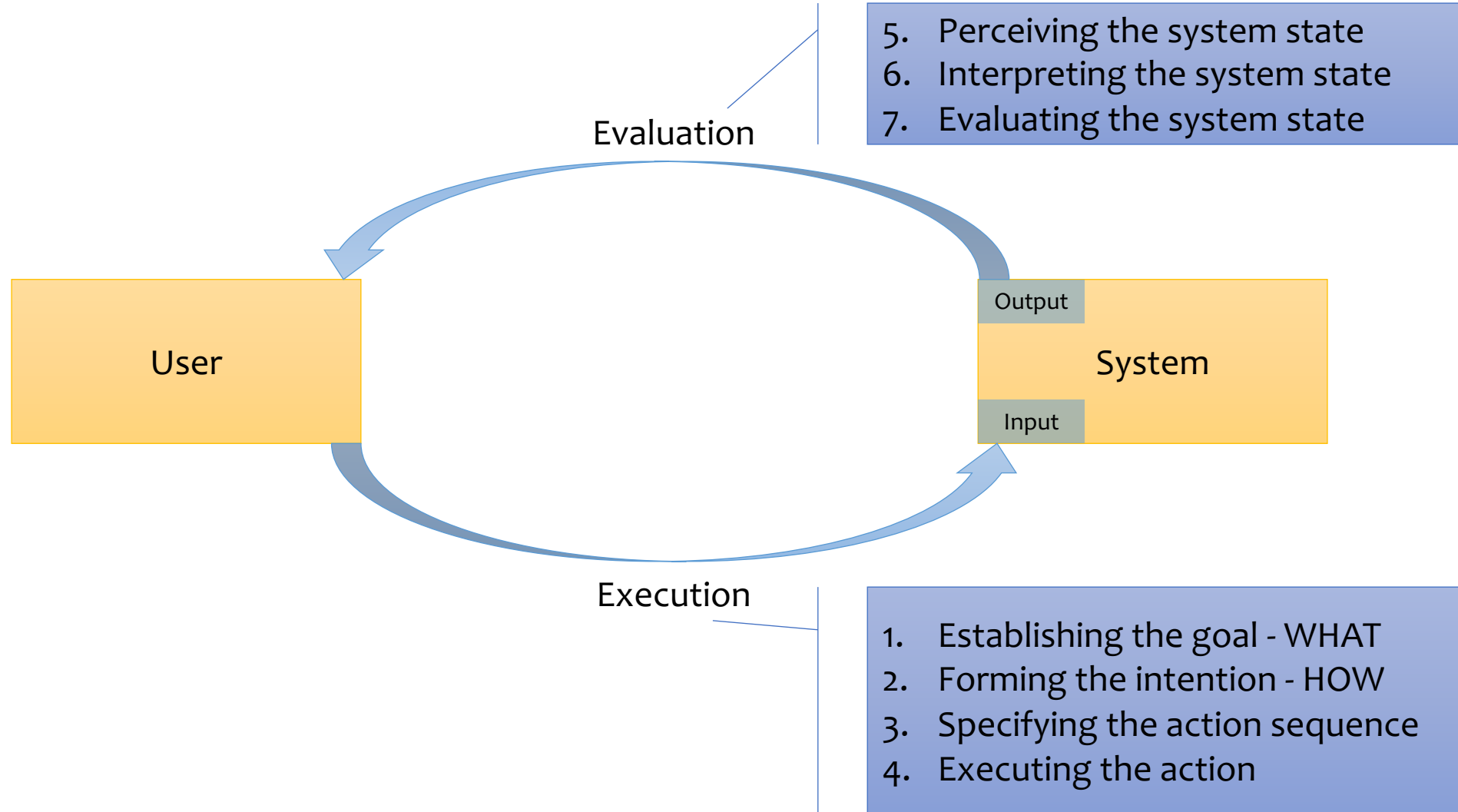


Norman's model of interaction

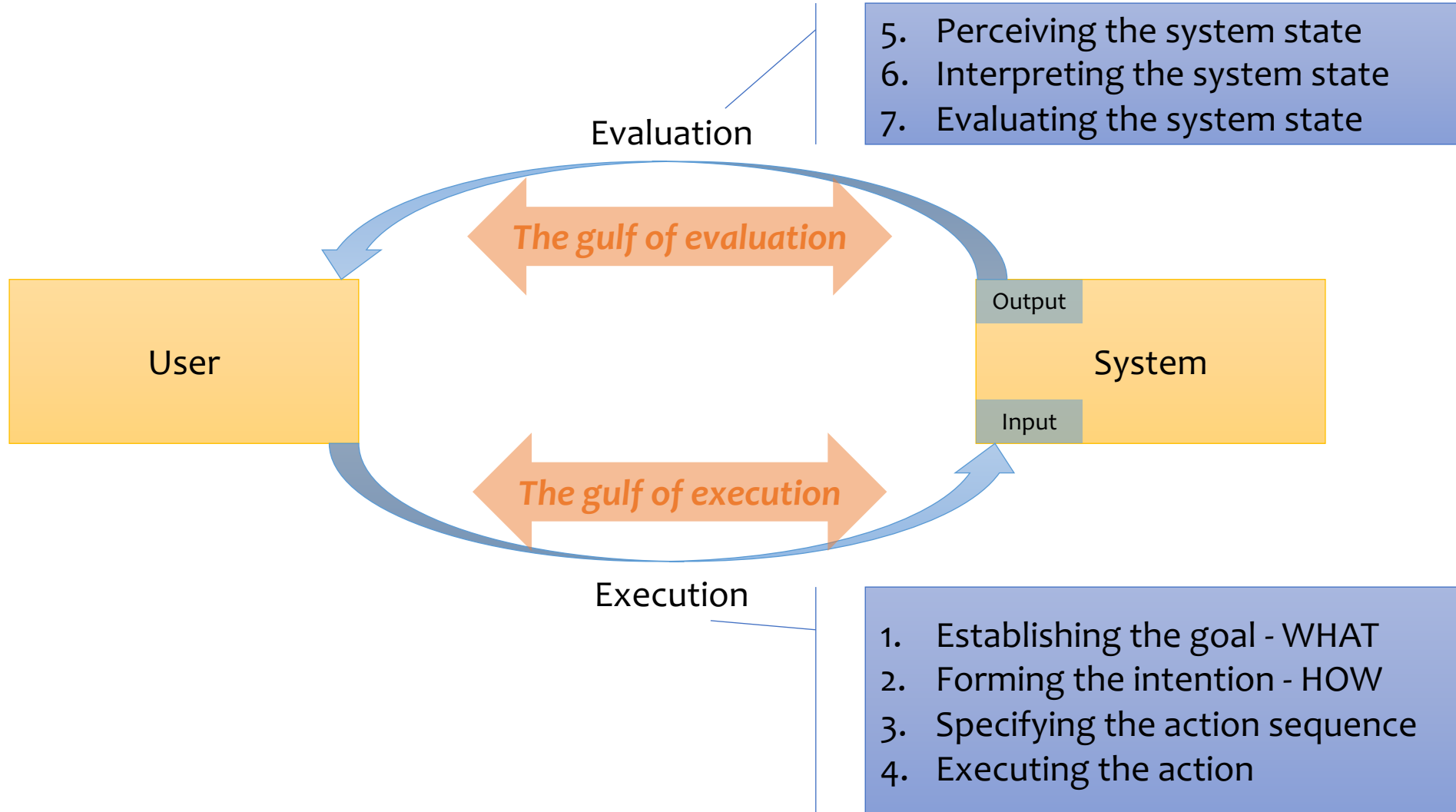


1. Establishing the goal - WHAT
2. Forming the intention - HOW
3. Specifying the action sequence
4. Executing the action

Norman's model of interaction

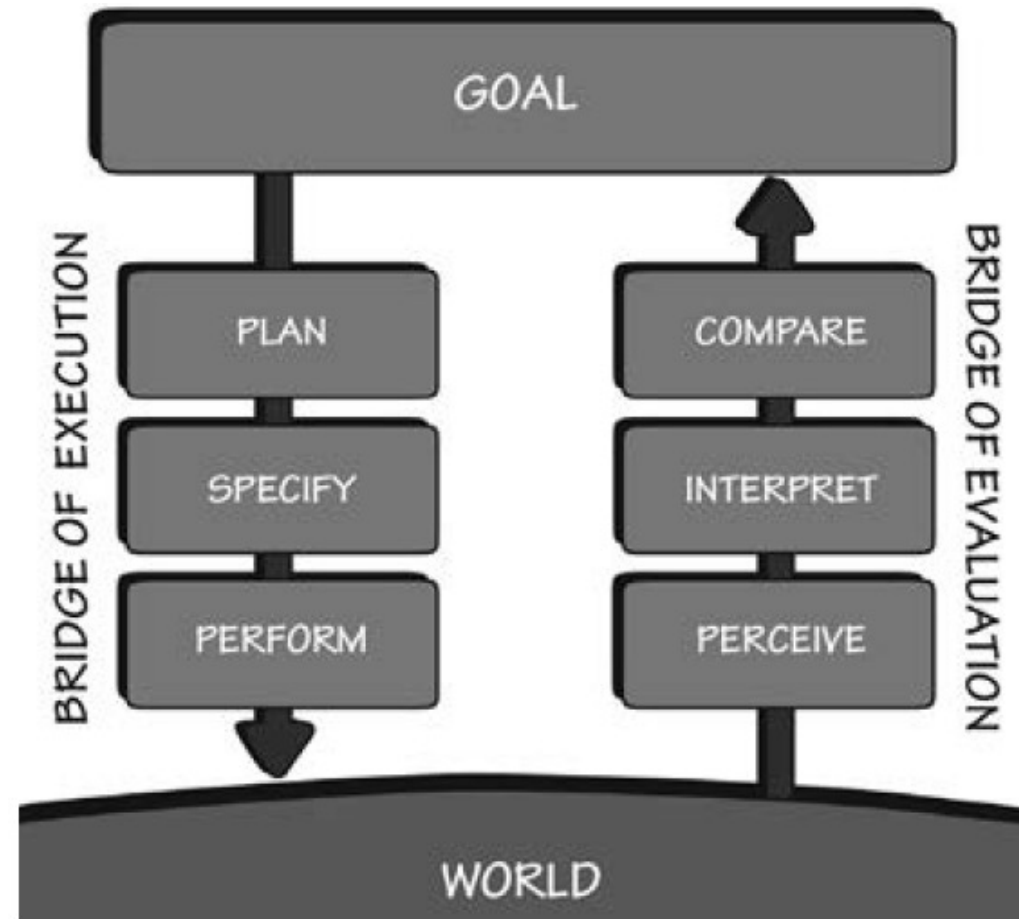
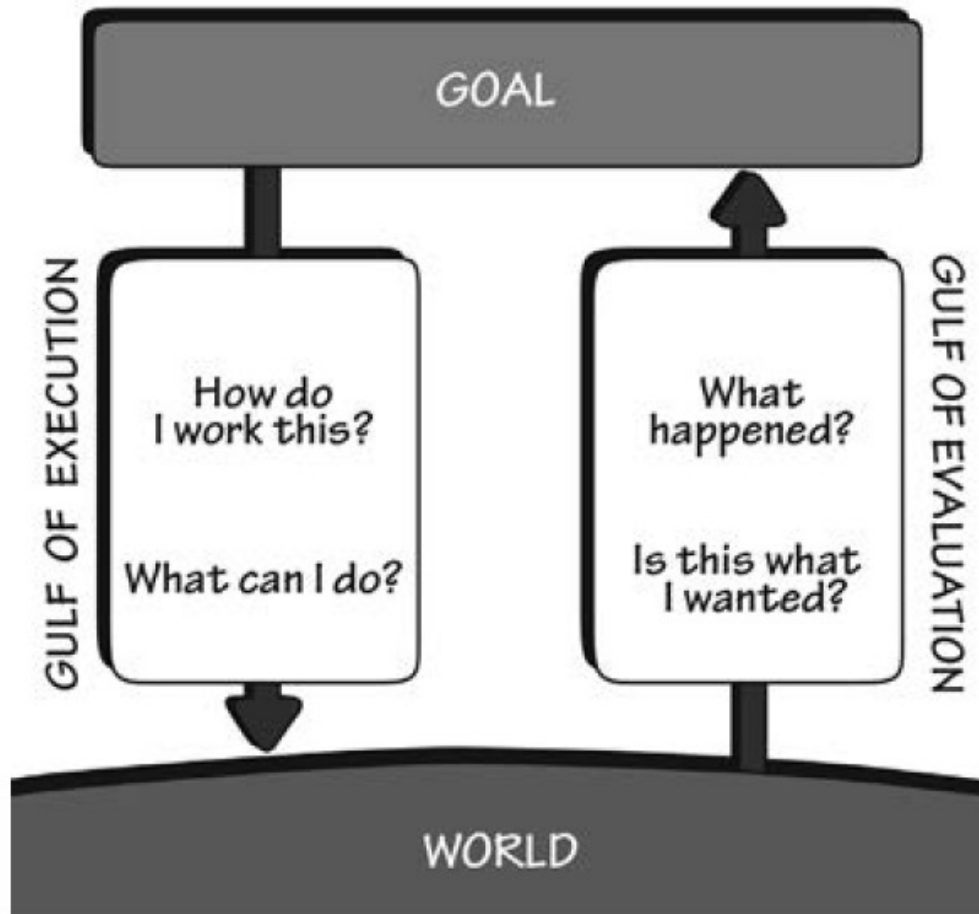


Norman's model of interaction

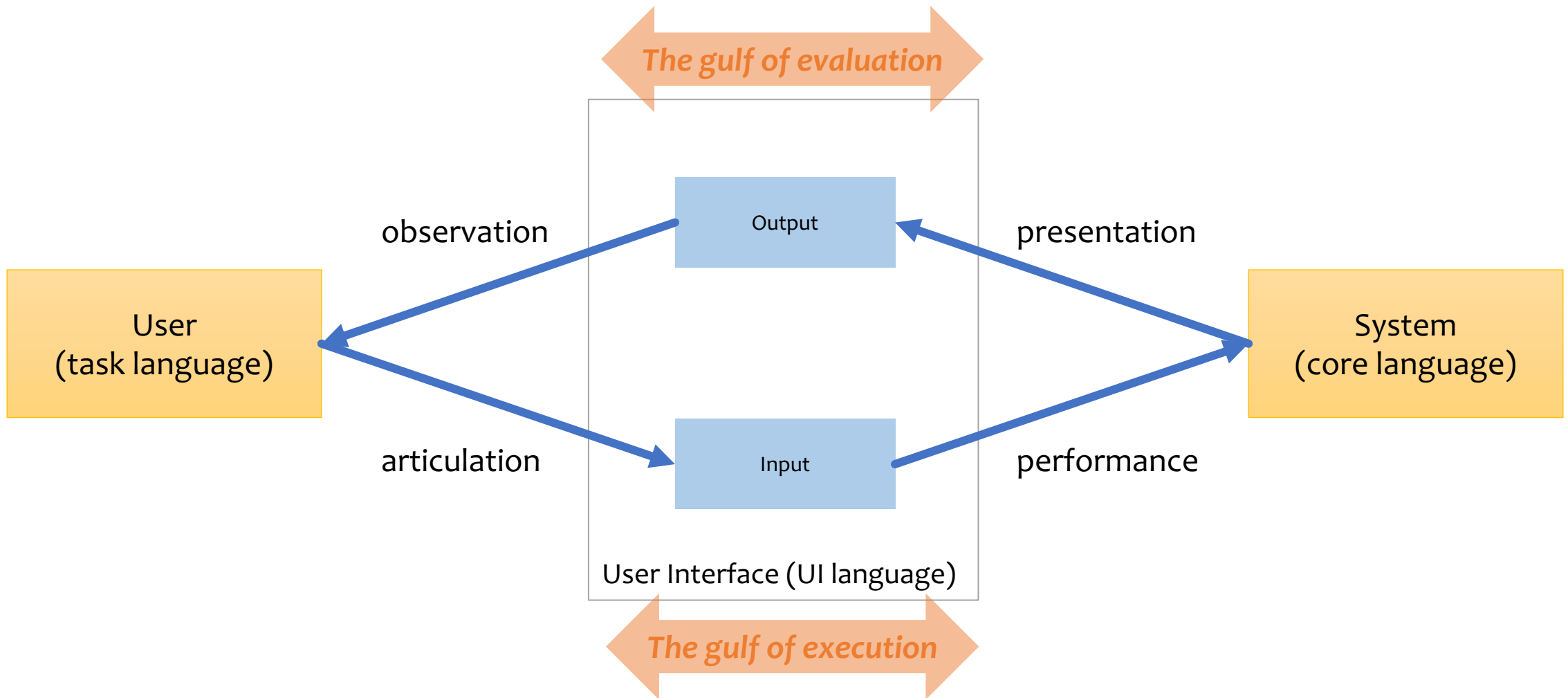


Norman's diagrams

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)



Abowd and Beale model, with explicit UI




Human errors*

in the gulf of execution

Slip

- You have formulated the right action, but fail to execute that action correctly
 - E.g., click the wrong icon, or double-click too slow, ...
- May be corrected by a better interface (spacing, layout, highlights, ...)

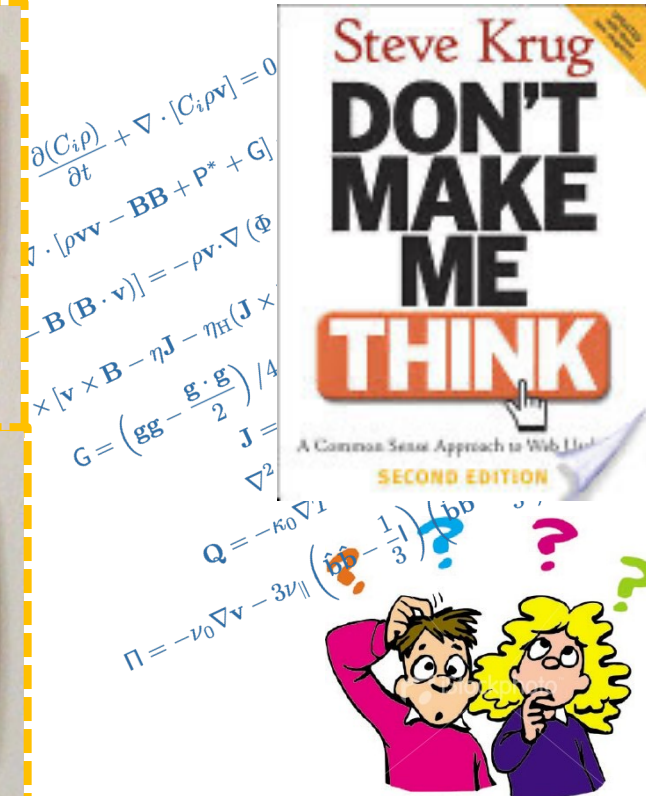
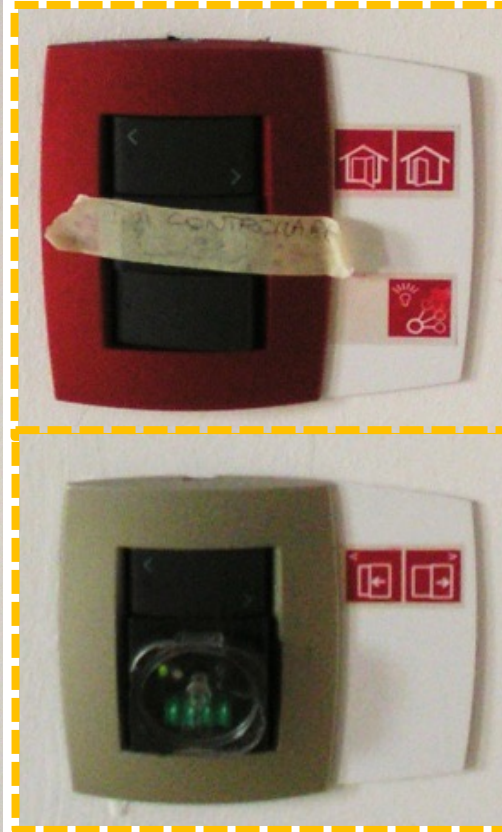
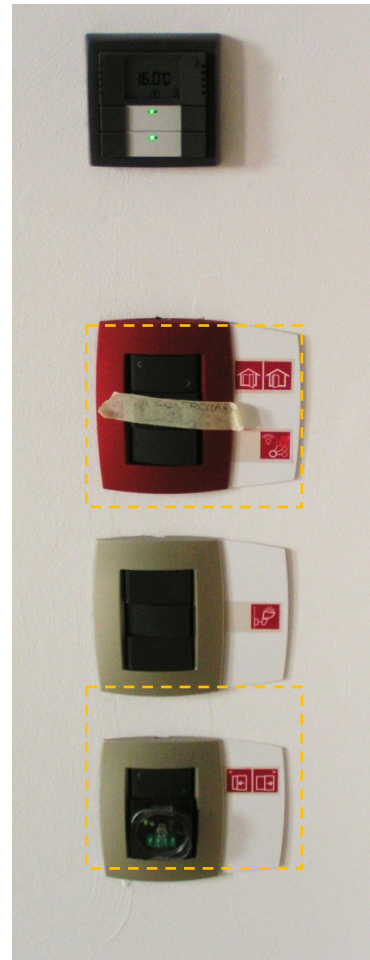
Mistake

- You don't know the system well and you may not formulate the right goal
 - E.g., click  for Zoom, but it means Search
- The user's mental model of the system's state is not correct
- Requires more radical redesign, or additional training

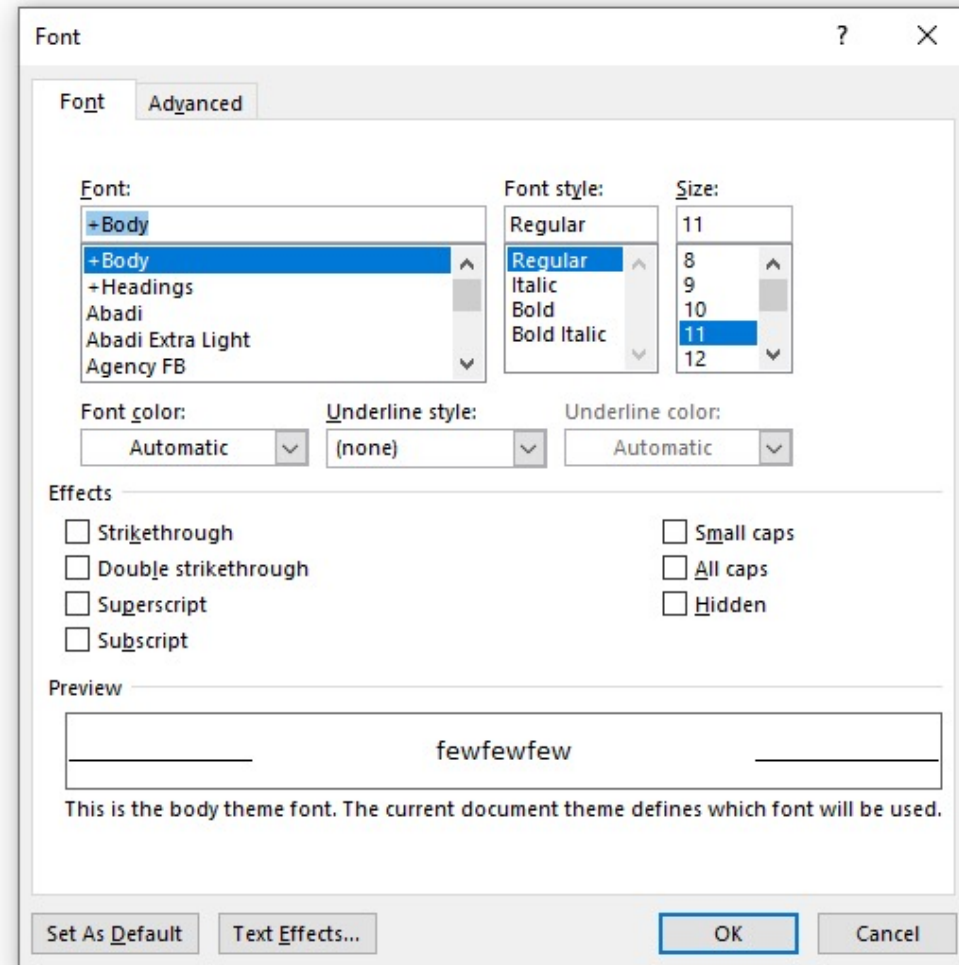
* About Human errors

- Human errors should **never** be considered as faults of the user
- Rather, «they are usually a result of bad design» (Norman)
- Humans tend to be imprecise, distracted, not-omniscient
 - System design should anticipate this human behavior
 - Minimize the chance of inappropriate actions (evaluation)
 - Maximize the possibility of discovering and repairing an inappropriate action (execution)
 - Enable users to understand the state of the system and build an appropriate model

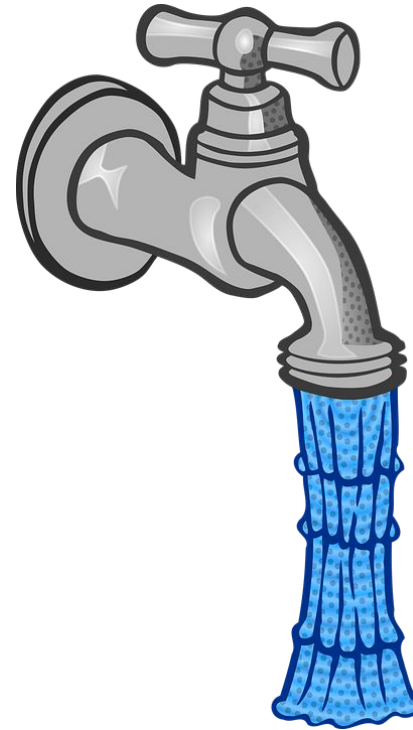
Example (articulation): find the right switch



Example (presentation): what are the allowed combinations?



Example (presentation): what is the correct mental model?



Willett Kempton, Two Theories of Home Heat Control, In: *Cognitive Science*

Interacting with AI

What is an AI-based System?

- Artificial intelligence (AI) refers to systems that display intelligent behaviour **by analysing their environment** and **taking actions** – with some degree of **autonomy** – to achieve specific goals.
- AI-based systems can be purely software-based, acting in the virtual world (voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (advanced robots, autonomous cars, drones or Internet of Things applications).

AI for Europe, COM/2018/237 <https://www.europeansources.info/record/communication-artificial-intelligence-for-europe/>

Amazon Alexa

- Vocal commands in natural language
- Vocal responses and actions



<https://www.youtube.com/watch?v=Ymewnb3gJJQ>

Amazon Alexa

- *Sorry, I'm having problems in understanding you right now...*





<https://www.youtube.com/watch?v=XQCHoKAq9xA>

Gmail spam filter

- No input needed
- User can override decisions already taken by the system

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 **Abu Dhabi Investment Authority <sheikhamed10@gmail.com>** Wed, Feb 3, 11:55 AM (3 day)
to bcc: me ▾

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Intelligent smartphone camera

- Simple selection of familiar parameters
- The system automatically recognizes faces and decide exposure and other parameters



<https://www.youtube.com/watch?v=-Cb222zDCTU>

Google Nest thermostat

- Initial set up
- Automatic learning
(very sensitive in the first two weeks, much less after)
- Continuous adjustments in time



<https://www.youtube.com/watch?v=20367DapHlc>

Google Nest thermostat

- Automatic learning
(very sensitive in the first two weeks, much less after)
- Continuous adjustments in time

Pattern of temperature changes	How it changes your thermostat's schedule
Two weekdays in a row (Monday and Tuesday)	All weekdays (Monday to Friday)
Same day two weeks in a row (two Mondays in a row)	That day of the week (every Monday)
Two weekend days in row (Saturday and Sunday)	All weekend days (Saturday and Sunday)
Two days in a row including a weekday and a weekend (Friday and Saturday)	All seven days of the week (Monday to Sunday)

Amazon's warehouse

- Automatic movement of the shelves
- Automatically position objects in the shelves



<https://www.youtube.com/watch?v=TUx-ljgB-5Q>

Amazon's warehouse

- The Amazon worker wears a special vest that allows the robots to detect his location and stop before they get too close



<https://www.nytimes.com/2019/07/03/business/economy/amazon-warehouse-labor-robots.html>

Jibo

- Emotional attachment object
- Emphatic communication



<https://www.youtube.com/watch?v=FB53BlrTFdw>

Jibo

- Emotional attachment object
- Emphatic communication





<https://www.youtube.com/watch?v=XSoAlc7cZ2Q>

AI-based systems as smart tools



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AI-based systems as smart tools



- Digital technologies are Cognitive Artifacts: physical objects designed to display or operate about information for enhancing human cognition (Norman, 1991; Hutchins, 2002)
- *Cognitive Artifacts + Artificial Intelligence = smart tools*
 - look like standard GUIs
 - aim to alleviate some tasks by acting autonomously
 - users are meant to be in control through the interface
 - might be confusing in terms of autonomy vs control because of probabilistic model

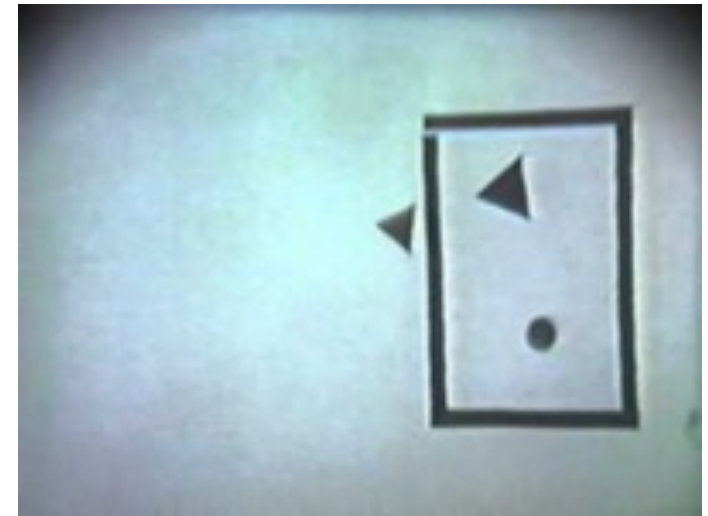
AI-based systems as artificial companions



AI-based systems as artificial companions



- Interaction with intelligent systems based on the metaphor of human-human interaction
- Human beings are coded to adopt an intentional stance
 - a tendency to anthropomorphize tools (e.g. Heider-Simmel illusion): yet, that does not imply that we actually believe that tools are intelligent (Reeves and Nass, 1996)
- There is evidence that anthropomorphic features increases UX
 - anthropomorphic features increase trust in an automated car (Waytz, Heafner, and Epley 2014)
 - expression of emotions improves efficacy in collaborative decision making tasks (de Melo, Gratch, and Carnevale 2015)



Heider-Simmel Illusion (1944)

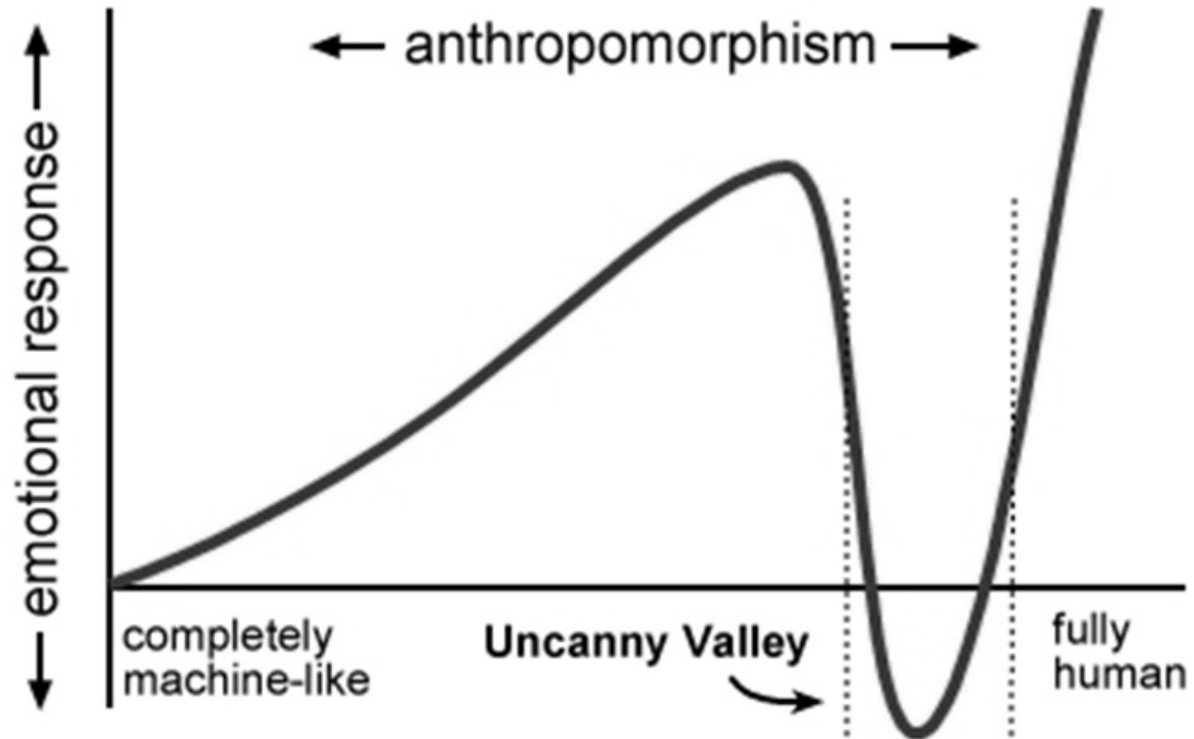
AI-based systems as artificial companions



- Yet, in the long term, UX can worsen
 - the presence of an anthropomorphized helper reduces enjoyment in games (Kim et al., 2016)
 - over-reliance and over-trust can in the long term bring to security and safety issues (Chung et al., 2017)
- Small aspects can induce larger and unwanted effects, e.g. people attribute negative stereotypes to female-presenting chatterbots more often than they do to male-presenting chatterbots (Brahnam & De Angeli, 2012)
- Keep attention to the **Uncanny Valley!**



AI-based systems as artificial companions



Summing up

Smart Tools

- Smarter but less predictable than objects
- Opaque mental model
- Principles of Interaction Design
- New principles to manage AI

Artificial Companions

- Almost but not like humans
- Encourage social attribution
- Uncanny valley
- Different principles

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