

Human Factors and Human-Machine Interaction

Fundamental Principles of Interaction

FACULTY

OF COMPUTER SCIENCE



FUNDAMENTAL PRINCIPLES OF INTERACTION

Discoverability & **Understanding** results from appropriate application of **six** fundamental psychological concepts:

- Affordances
- Signifiers
- Constraints
- Mappings
- Feedback
- Conceptual Models



AFFORDANCES

- **Obviously existing** possible **interactions** between persons and the environment
- Jeff Raskin: „*Each function and the method of operating it would be apparent by merely looking at it.*“
- Make the function and the method of its implementation **transparent**
- Affordance = *Function* + **Perceptibility**



AFFORDANCES

- Affordances are not universal/obvious at all times
→ result of **interaction experience**
- **Not limited to physical items**
- **Digital interaction experience** as a basis of affordances



SIGNIFIER

- Don Norman: „*I call any physically perceivable cue a signifier, whether it is incidental or deliberate.*“
- Signifiers are – incidental or deliberate – **signals**
- **Affordance**: *what* action is possible (focus on relationship)
- **Signifier**: *where* the action should take place

→ Signifiers must be perceivable

→ Signal how actions are done



SIGNIFIER

- Social Signifier →



- Also present in digital environment →



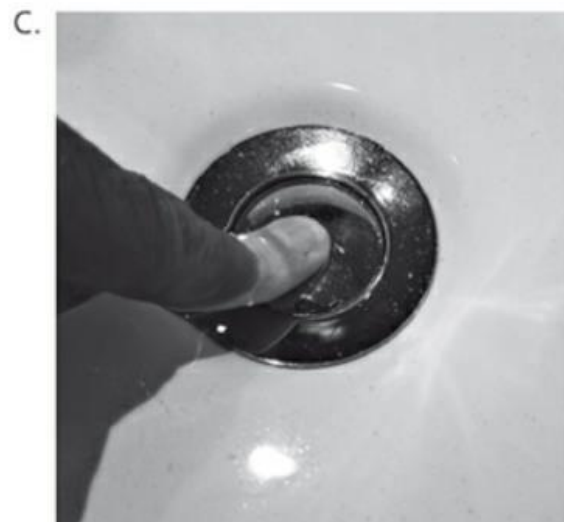
- „Users complete the design“ →



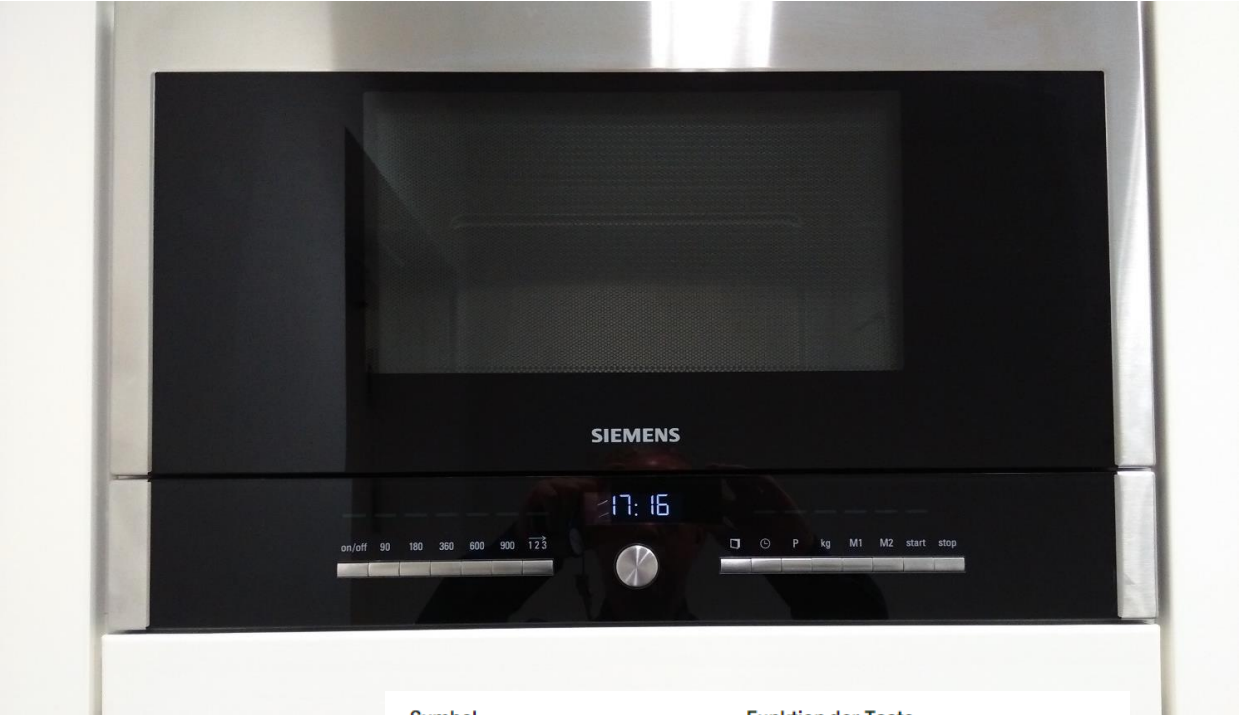
- Affordances & Signifier support **discoverability**



AFFORDANCES & SIGNIFIER



AFFORDANCES & SIGNIFIER



Symbol	Funktion der Taste
on/off	Gerät ein- und ausschalten
90	Mikrowellen-Leistung 90 Watt wählen
180	Mikrowellen-Leistung 180 Watt wählen
360	Mikrowellen-Leistung 360 Watt wählen
600	Mikrowellen-Leistung 600 Watt wählen
900	Mikrowellen-Leistung 900 Watt wählen
123	Folgebetrieb anwählen
	Gerätetür öffnen



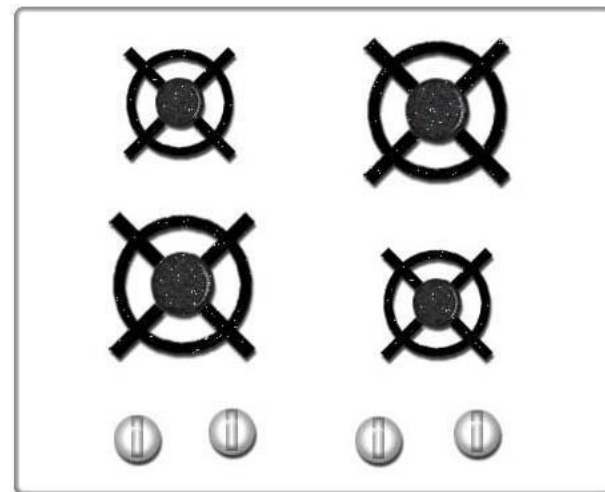
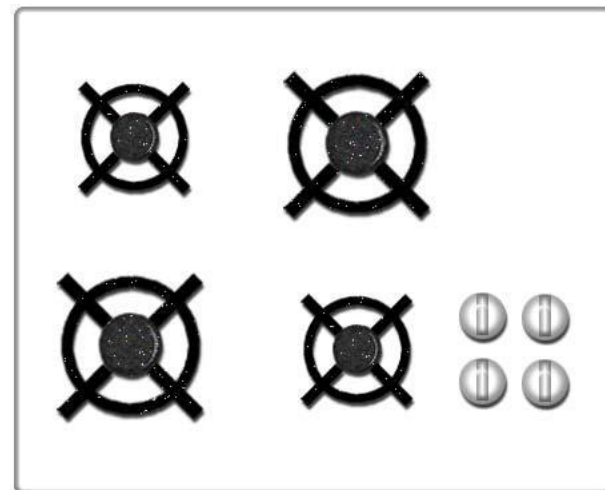
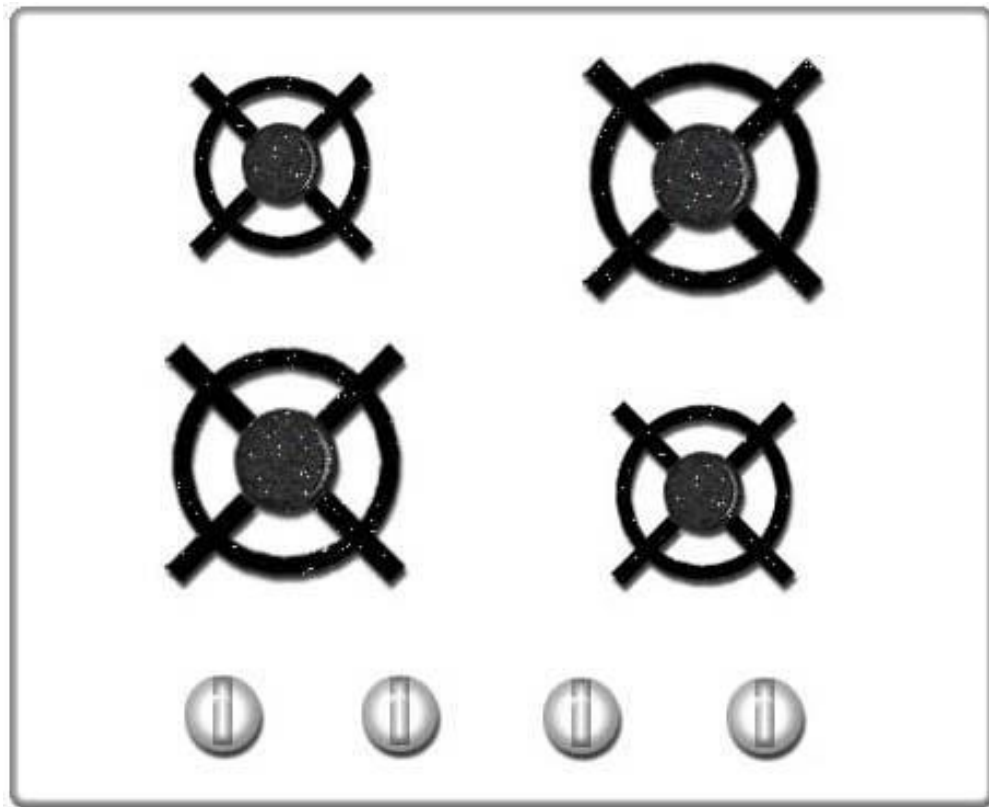
How do you open the microwave?



MAPPING

- **Mapping:**
 - Technical term borrowed from mathematics
 - Describes the **relationship** between the elements of two sets of things
- Spatial **correspondence** between **layout** of the controls and the **devices** being controlled
- **Natural mapping:** taking advantage of spatial analogies
- Good mapping **supports Understanding**





MAPPING



FEEDBACK

- ... is **communicating the results of an action** and/or the current system **state**
- ... must be **immediate**
- ... must be **informative**
- ... has to be **planned**
- ... must be **prioritized**
- **But:** Too much feedback is annoying



<u>System Interpretation</u>	<u>Response Time Definition</u>	<u>Time (Secs)</u>
Key Response	Key depression until positive response, e.g., "click"	0.1
Key Print	Key depression until appearance of character	0.2
Page Turn	End of request until first few lines are visible	1.0
Page Scan	End of request until text begins to scroll	0.5
XY Entry	From selection of field until visual verification	0.2
Function	From selection of command until response	2.0
Pointing	From input of point to display point	0.2
Sketching	From input of point to display of line	0.2
Local Update	Change to image using local data base, e.g., new menu list from display buffer	0.5
Host Update	Change where data is at host in readily accessible form, e.g., a scale change of existing image	2.0
File Update	Image update requires an access to a host file	10.0
Inquiry (Simple)	From command until display of a commonly used message	2.0
Inquiry (Complex)	Response message requires seldom used calculations in graphic form	10.0
Error Feedback	From entry of input until error message appears	2.0

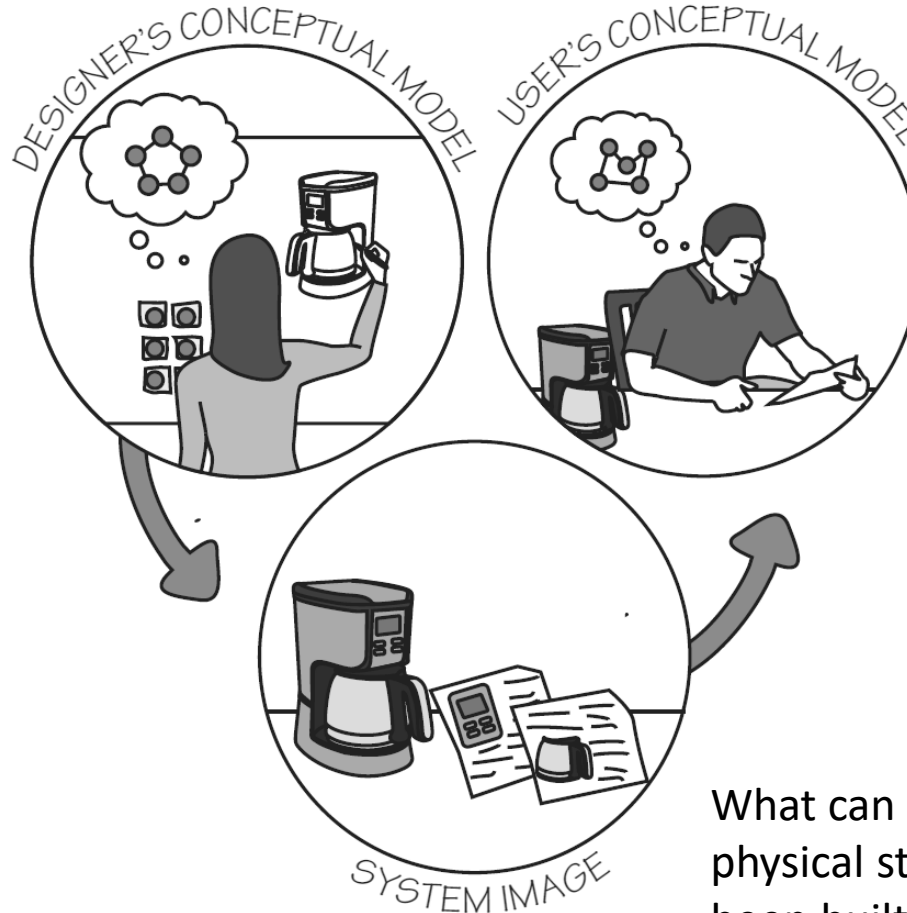
CONCEPTUAL MODELS

- „A conceptual model is an **explanation**, usually highly **simplified**, of **how something works**.“ (Norman, 2013)
- Can be found in manuals, on the computer (icons, folders, files)
- **Mental Model:** Conceptual model in people's mind that represent their understanding of how things work.
- Often inferred from the device itself, some are passed from person to person, some come from manuals
- Don Norman:
 - „A good model allows us to predict the effects of our actions“
 - “As long as things work properly, we can manage. When things go wrong, however, or when we come upon a novel situation, then we need a deeper understanding, a good model.”
- Major clues come from perceived structure, i.e., affordances, signifier, constraints, mappings



CONCEPTUAL MODELS

Designer's conception of look and feel

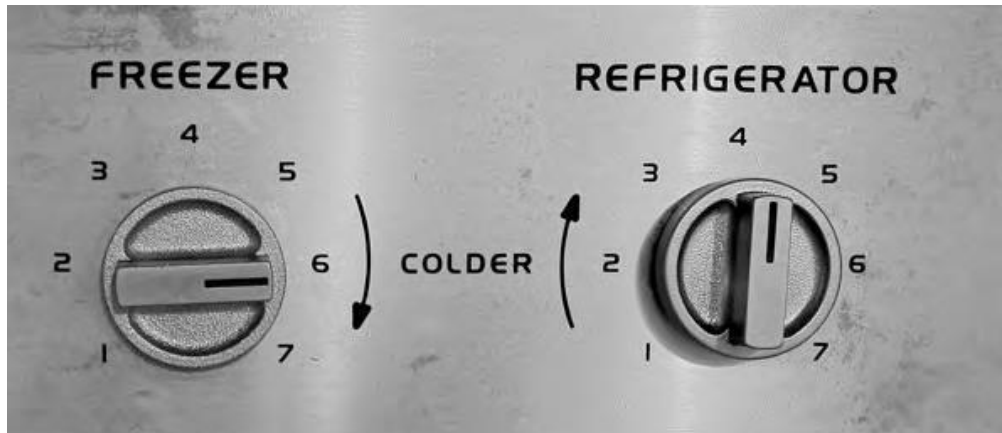


Developed through interaction with the product and system image

What can be derived from the physical structure that has been built (+ documentation)



CONCEPTUAL MODEL

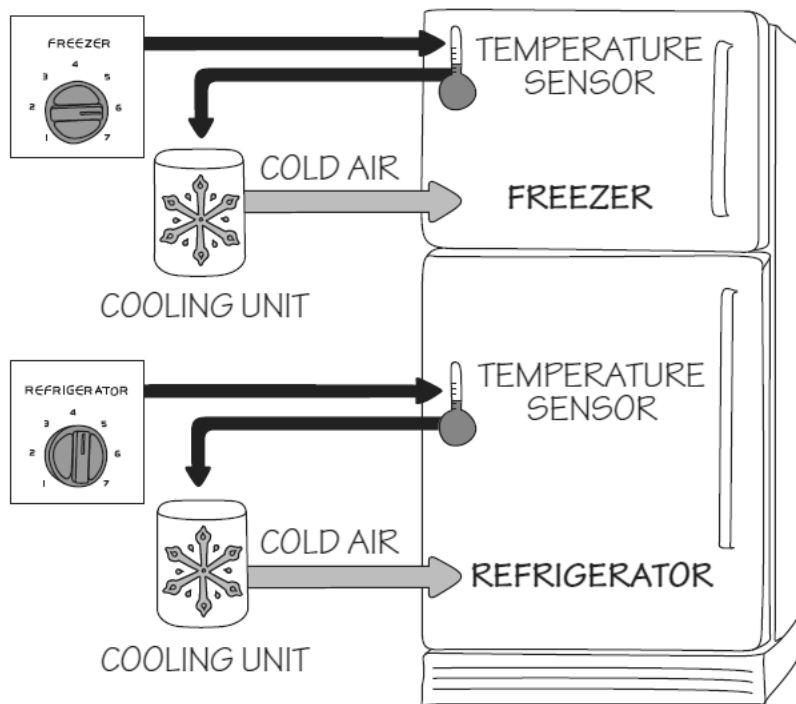


What conceptual model has been developed for this freezer-refrigerator combination?

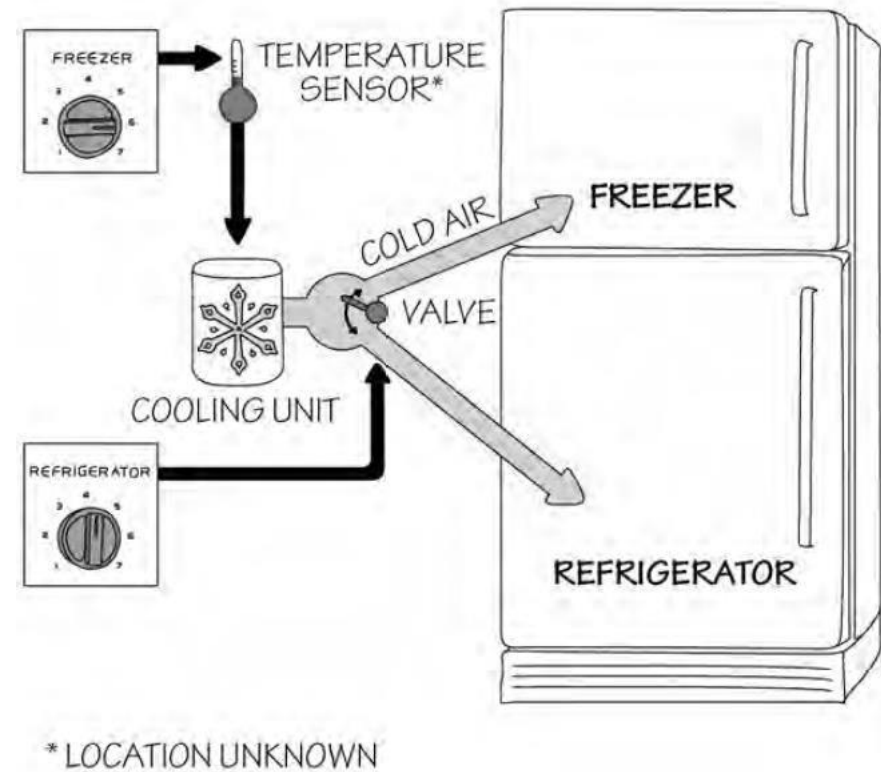


CONCEPTUAL MODEL

What we expect...



How it actually is...



EXERCISE

1. Take/find pictures of things with poor design.
2. Read up on the principles learned today (p. 10-30)
3. **Why is the design poor** and **how can it be improved**? Use the **fundamental principles** we've learned today to build your argument.
4. **Present** as posters/slides → explicitly relate to the terms/definitions from the slides/book

