

Announcements

- Homework 2 is out
- Due date: **Thursday Oct 12**

Project Related Deadlines

- Team-up by the end of class, **Thursday Oct 5**
- “Preliminary” project ideas presentations:
Tuesday Oct 10 and **Thursday October 12**
- Project Proposal is due **October 26**

Northeast Robotics Colloquium

- Held at Northeastern University on Saturday October 21st
- <https://nerc2017.ccis.northeastern.edu/>
- Deadline for registration: October 15
- \$50 dollars for graduate students, \$10 for undergrads

Overview of Robotics Journals

Affordances



James J. Gibson (1904 - 1979)



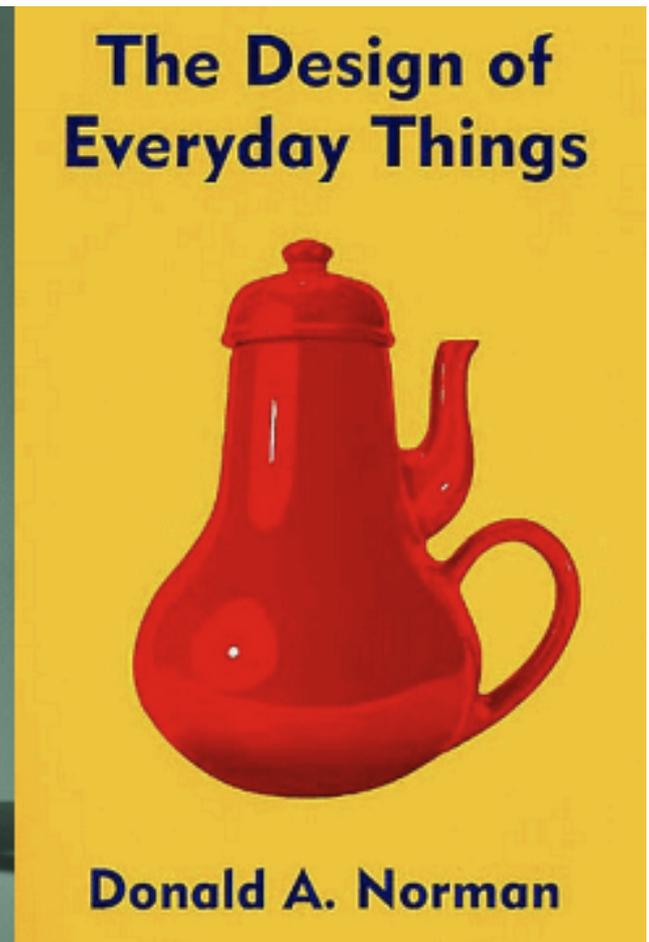
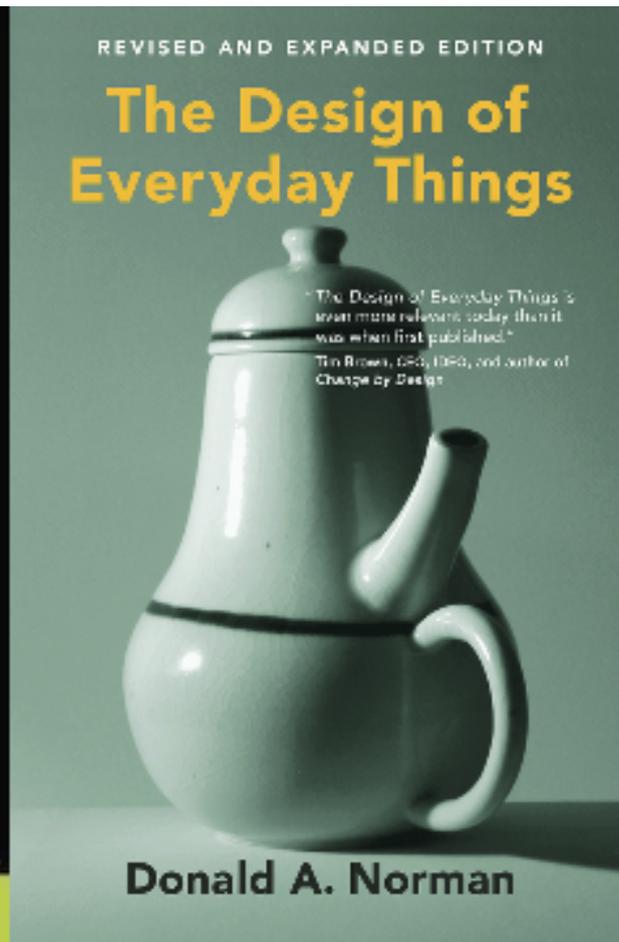
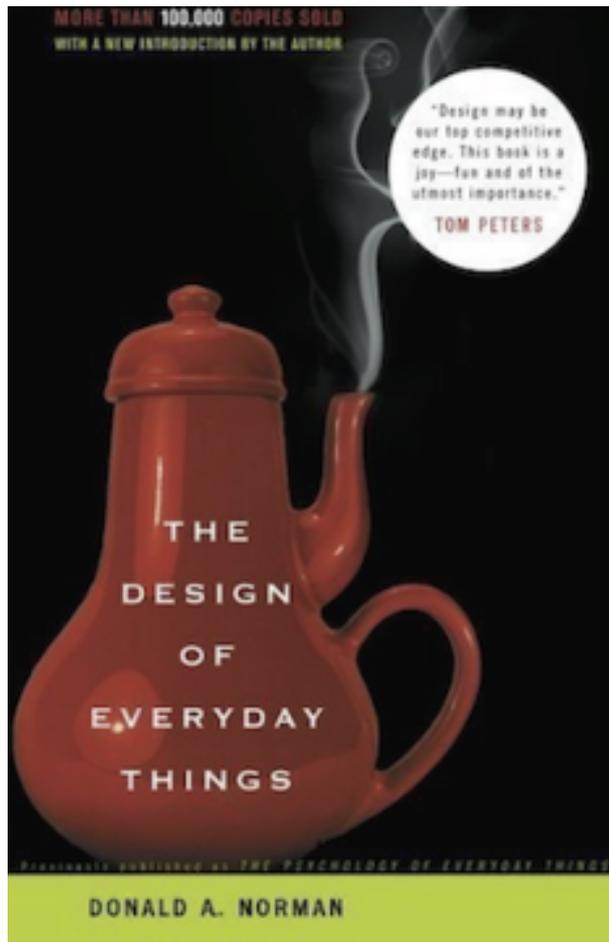
Eleanor J. Gibson (1910 - 2002)

What is an affordance anyway?





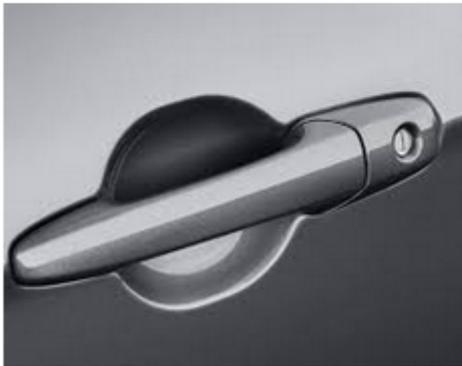
Don Norman



Example: Door Handles



Car Door Handles



Using Door Handles



Chairs



Leisure Chairs



Weird Chairs



Are these chairs?



High Chairs



Ned Matura



Gibson on Affordances

“An affordance is an invariant combination of variables, and one might guess that it is easier to perceive such an invariant unit than to perceive all the variables separately. It is never necessary to distinguish all the features of an object and, in fact, it would be impossible to do so. Perception is economical.” (p. 134-135, Gibson 1979)

Gibson on Affordances

“I now suggest that we perceive when we look at objects are their affordances not their qualities. [...] what an object affords us is what we normally pay attention to.”

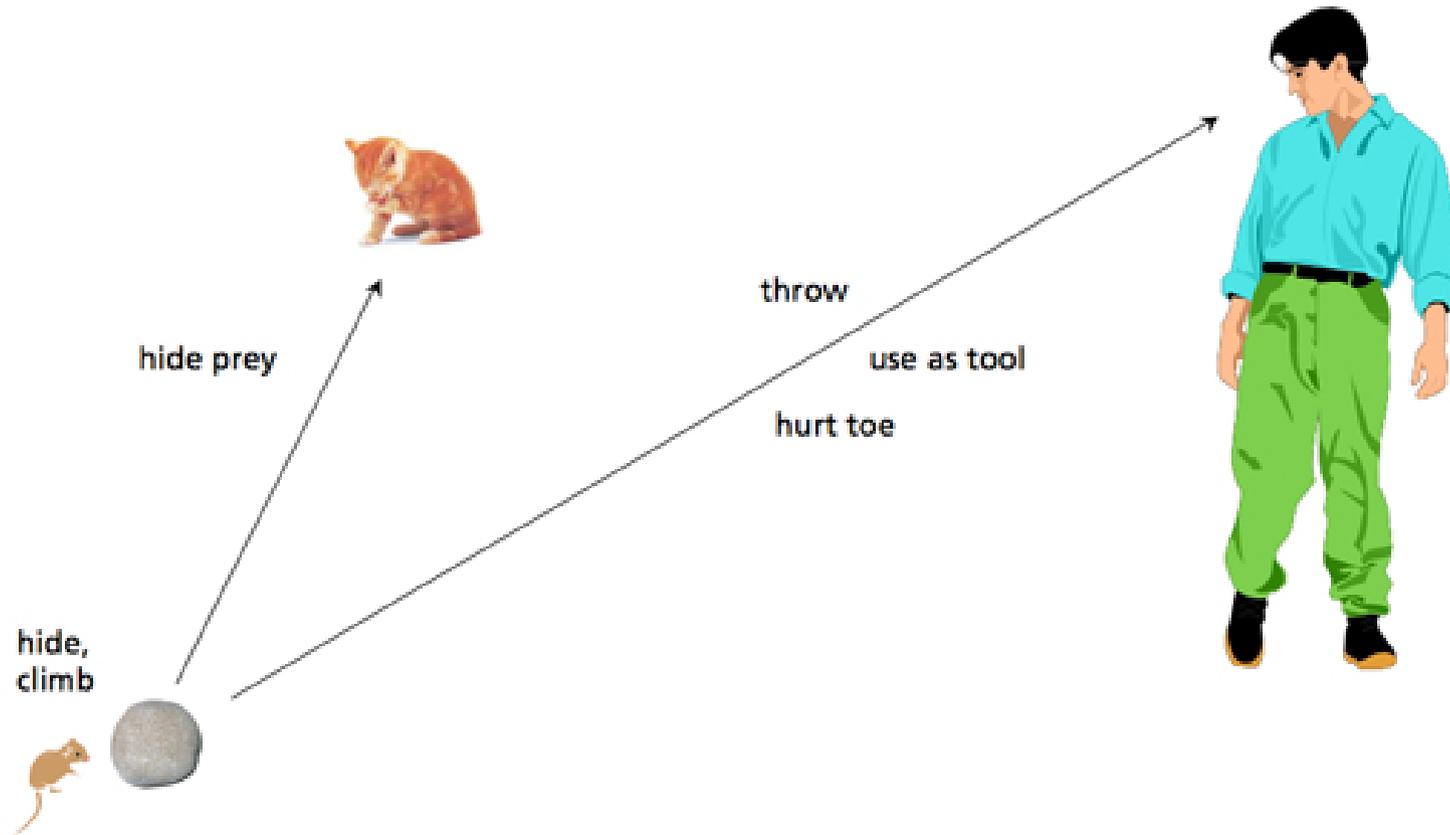
Gibson on Affordances

“For example, an object affords throwing if it can be grasped and moved away from one's body with a swift action of the hand before letting it go. The perceptual invariant in this case is the shrinking of the visual angle of the object as it is being thrown. This highly interesting "zoom" effect will draw the attention of the child.” -(p. 235, Gibson 1979).

How Children Learn Affordances

- "If the object is hand size it is graspable, if it is too large or too small, it is not" - (p. 234, Gibson 1979)
- Children learn their scale of sizes as commensurate with their bodies, not with a measuring stick

Affordances are relative to the body

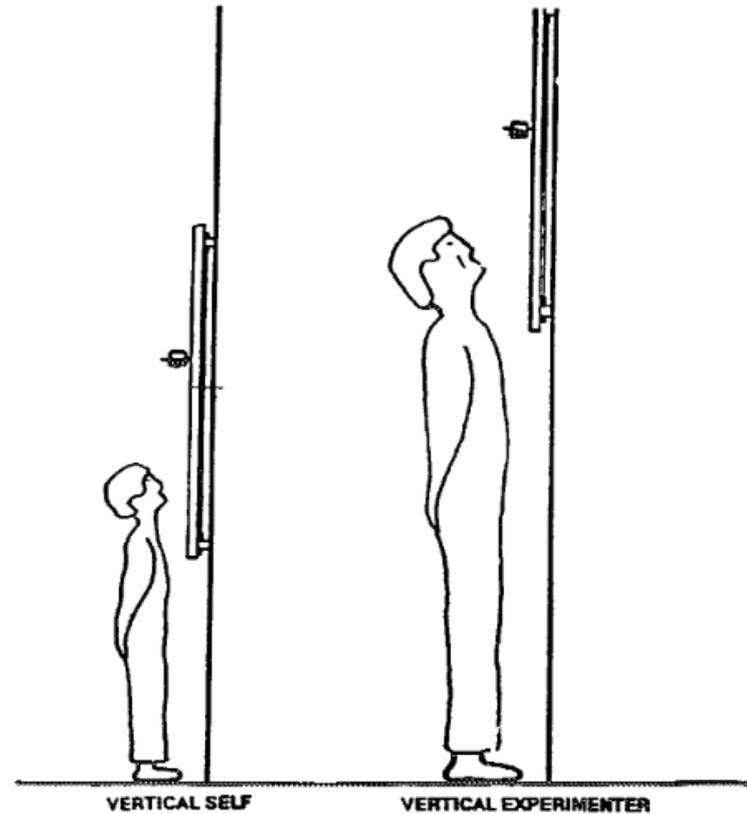
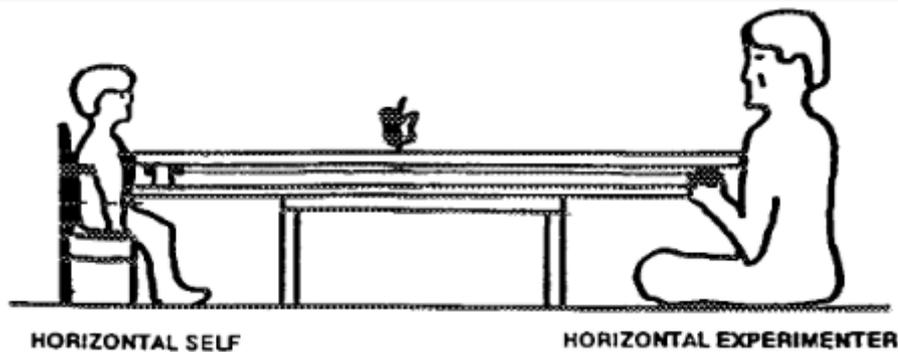


Scaling relative to one's own body



Do young children realize that affordances for others (e.g., adults) may be different?

Experimental Task



Rochat, P. (1995). Perceived reachability for self and for others by 3-to 5-year-old children and adults. *Journal of Experimental Child Psychology*, 59(2), 317-333.

Findings

- “From 3 years of age, children differentiate what an object affords for self and for others. [...] they accurately predict more reachability to an adult compared to themselves.”
- When the task is common, “young children are not rigidly confined to an ego centric perspective” but instead “express allocentrism and perspective taking””

Rochat, P. (1995). Perceived reachability for self and for others by 3-to 5-year-old children and adults. *Journal of Experimental Child Psychology*, 59(2), 317-333.

Affordances and Properties

“infants first notice the affordances of objects and only later do they begin to recognize their properties.”

Affordances of other people

- “... the richest and most elaborate affordances of the environment are provided by other animals and, for us, other people.” (p. 135, Gibson 1979)
- “Like detached objects they can be displaced by external forces.” (p. 135, Gibson 1979)
- “Unlike detached objects, however, they can move and change their appearance spontaneously under their own control.” (p. 135, Gibson 1979)
- “When touched they touch back, when struck they strike back; in short they interact with the observer and with one another.” (p. 135, Gibson 1977)

What was there before Gibson

Gestalt Psychology

- Gestalt means a unified or meaningful whole
- Gestalt psychology is based on the observation that we often experience things that are not a part of our simple sensations.
- Example:
 - we perceive motion where there is nothing more than a rapid sequence of individual sensory events (Christmas lights, motion pictures).

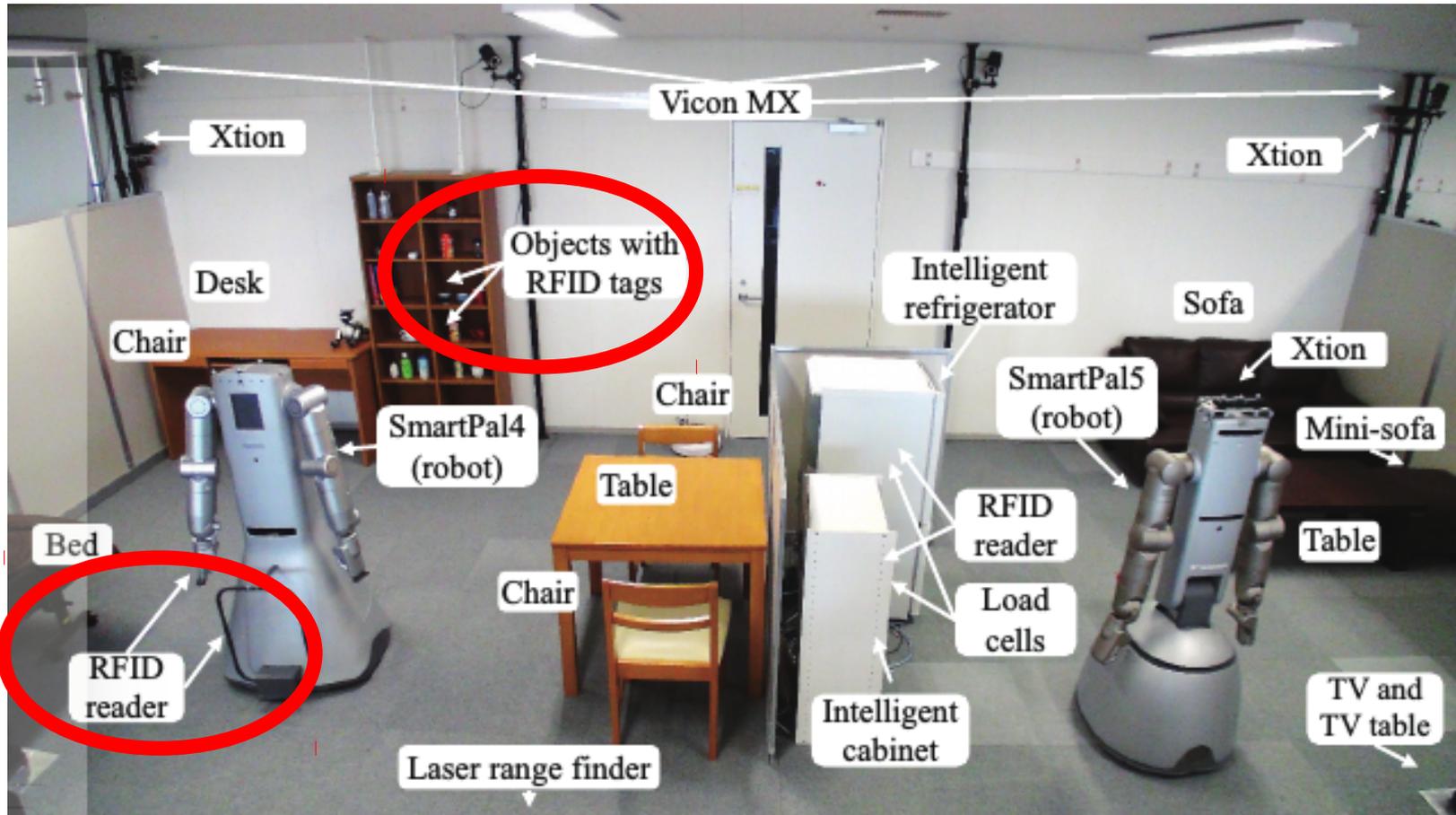


Koffka, K. (1935)

"Principles of gestalt psychology"

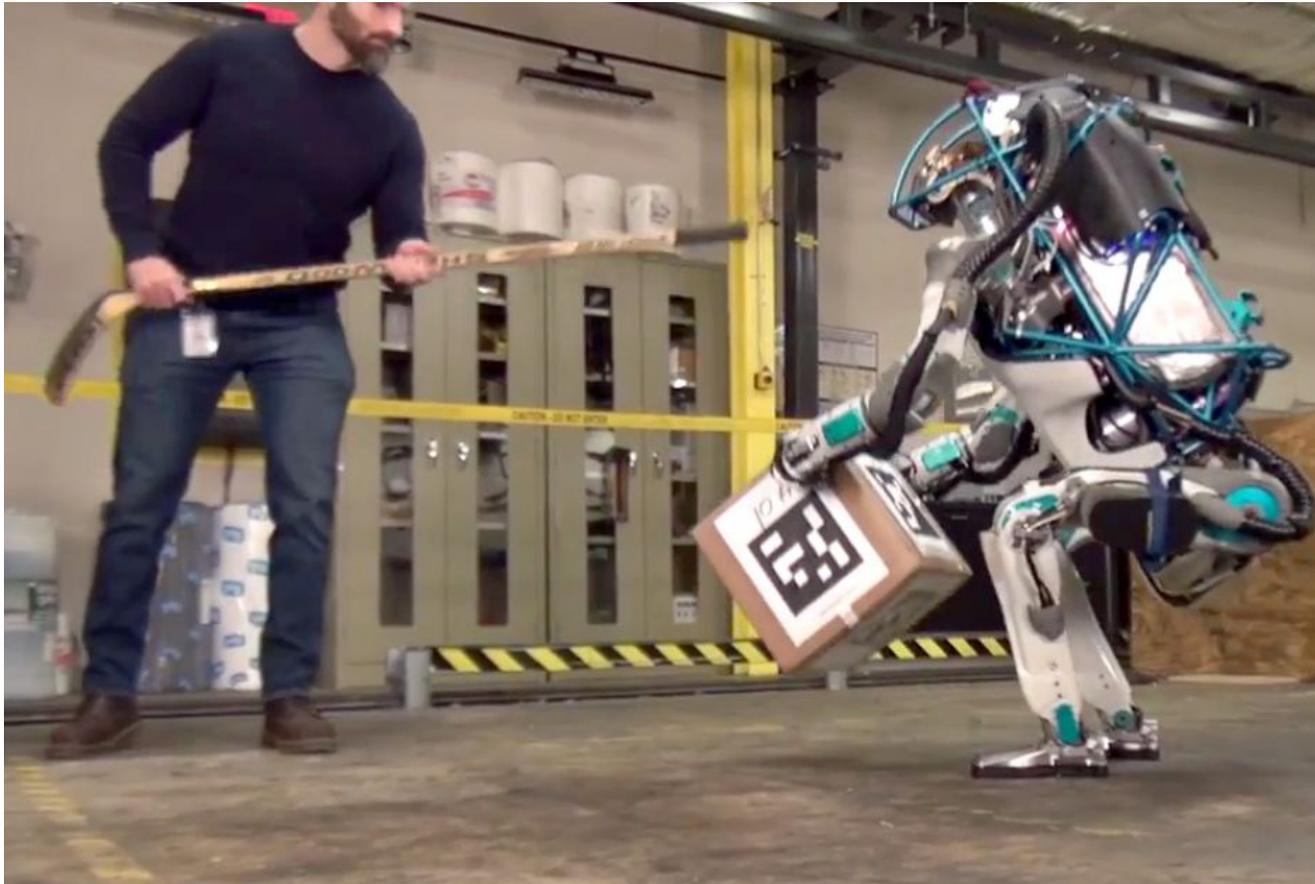
- "Each thing says what it is ... a fruit says "Eat me"; water says "Drink me"; thunder says "Fear me";" (p. 7, Koffka 1935)
- The postbox "invites the mailing of a letter", the handle "wants to be grasped", and things "tell us what to do with them." (p. 353, Koffka 1935)

Analogues in Robotics



Yoonseok Pyo, Kouhei Nakashima, Shunya Kuwahata, Ryo Kurazume, Tokuo Tsuji, Ken'ichi Morooka, Tsutomu Hasegawa, Service robot system with an informationally structured environment, *Robotics and Autonomous Systems*, Volume 74, Part A, December 2015, Pages 148-165, ISSN 0921-8890

Analogues in Robotics

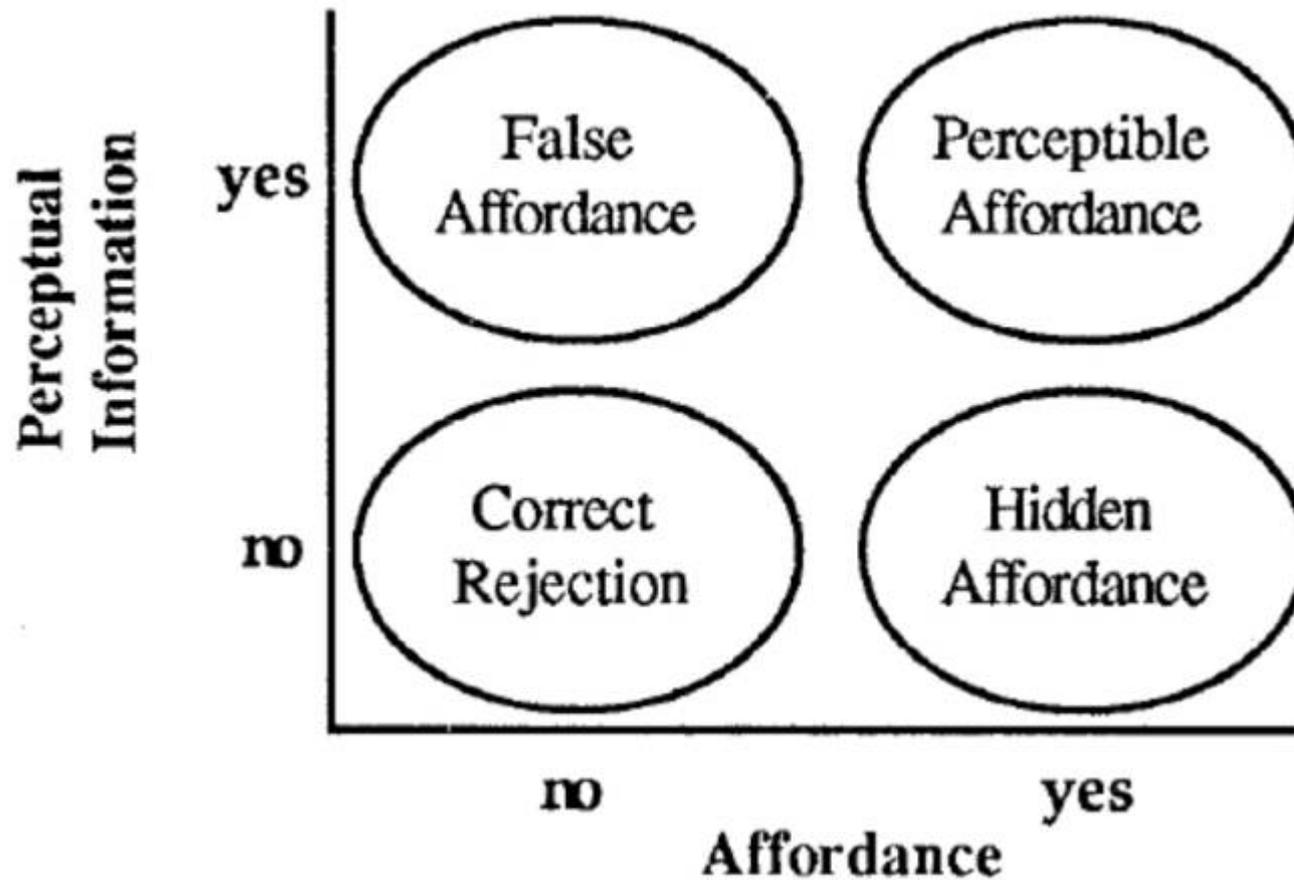


Gibson on Koffka

“When Koffka asserted that “each thing says what it is,” he failed to mention that it may lie. More exactly, a thing may not look like what it is.”

“the affordance of something DOES NOT CHANGE as the need of the observer changes.”

False and Unperceived Affordances







Kiera Grace Decorative Fruit Vase Fillers, 12 Red Apples

from [True Home Bliss](#)

Decorate your home with these realistic looking faux fruits. Great for your kitchen or living area, these faux fruits are made from high quality resin making them both durable ... [more »](#)

\$41.98

Free shipping. No tax
True Home Bliss

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So...what is an affordance anyway?

(discussion)

Glenberg, A. (1997). "What memory is for" Behavioral and Brain Sciences 20 (1): 1-55.

Two views of memory

- Memory is for ... memorization!
- Memory works in the service of perception and action

Two Environmental Properties

- Projectible properties
 - can be specified by information available in the light
- Nonprojectible properties
 - derived by other means or from memory

“Meshing”

These two mesh well



These two not so well



What about these two?



The embodied meaning of a cup

“As another example, consider the meaning of the cup on my desk. The embodied meaning is in terms of how far it is from me (what I have to do to reach it), the orientation of the handle and its shape (what I have to do to get my fingers into it), characteristics of its size and material (the force I must exert to lift it), and so forth. Furthermore, the meaning of the cup is fleshed out by memories of my previous interactions with it: pouring in coffee and drinking from it. Those memories make the cup mine.”

Memory Updates

“Memory is updated automatically (that is, without intention) whenever there is a change in conceptualization (mesh). The degree to which updating takes place is exactly correlated with the degree to which the conceptualization changes.”

In-class experiment

Which of these pairs do you like?

- DK v.s. DS
- CP v.s. CX
- AY v.s. AQ
- ZJ v.s. ZF
- VM v.s. VZ
- GP v.s. GB

Evidence for embodied conceptualization

- Embodiment and Affect (Van den Bergh et al. 1990)
- Presented a pairs of letters (e.g., WX and ZD) to two groups of people: typists and non-typists
- QWERTY & AZERTY keyboards used in Belgium
- Typists showed clear preference for pairs typed with different fingers
- Non-typists showed little on no preference

Another Example

Another Example

- Say your phone number

Another Example

- Say your phone number
- Now say it backwards

Another Example

- Say your phone number
- Now say it backwards
- Why was the second task more difficult?

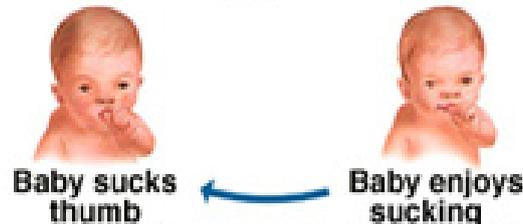
Learning Affordances

- Key question: how do humans learn to detect and utilize the affordances of objects in their environment?
- How can robots do the same?

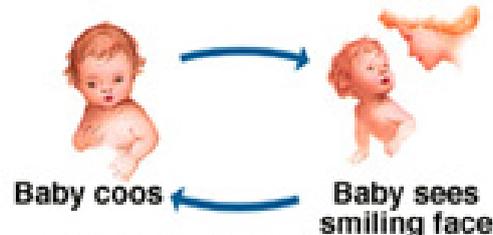
Piaget's Circular Reactions

Papalia, Human Development, 7e. Copyright © 1998. McGraw-Hill Companies, Inc. All Rights Reserved.

Primary, Secondary, And Tertiary Circular Reactions



(a) Primary circular reaction: action and response both involve infant's own body (1 to 4 months)



(b) Secondary circular reaction: action gets a response from another person or object, leading to baby's repeating original action (4 to 8 months)



(c) Tertiary circular reaction: action gets one pleasing result, leading baby to perform similar actions to get similar results (12 to 18 months)

Exploratory Behaviors



Lateral Motion



Pressure



Contour Following



Enclosure



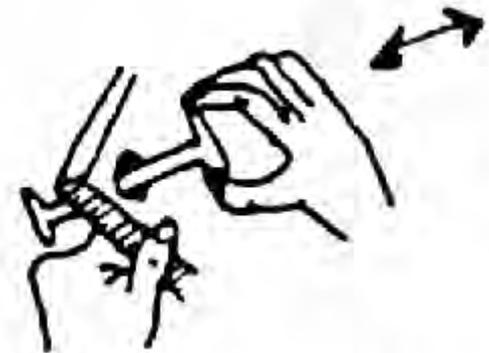
Static Contact



Insertion



Unsupported Holding



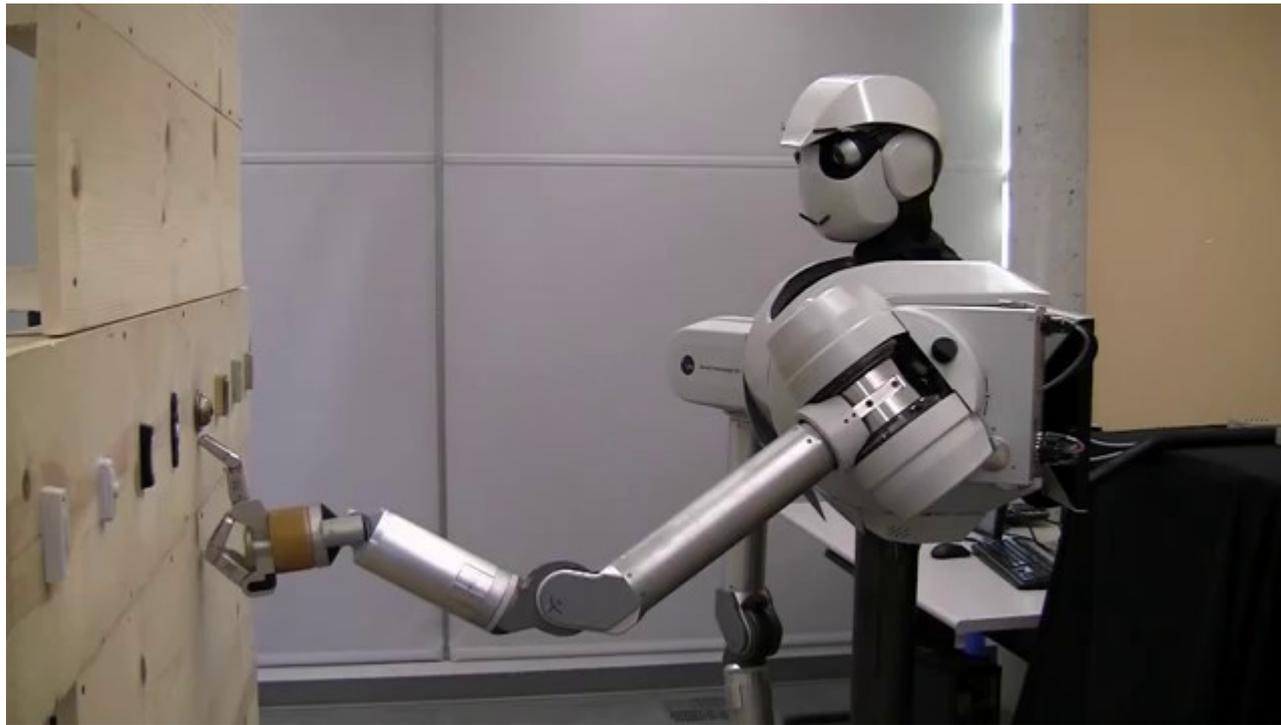
Part Motion Test

[Lederman and Klatzky, 1987]

Example Circular Reaction



Next time...how a robot can learn affordances using circular reactions



Sukhoy, V., et al. (2010). "Learning to press doorbell buttons." In the 9th IEEE International Conference on Development and Learning (ICDL), 2010.

Project Team-up

THE END

