

Cognitive (Neuro) Psychology

V. Perceiving and recognizing objects

Marianne Maertens

Technische Universität Berlin

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What do you see?



What do you see?



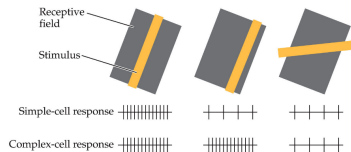
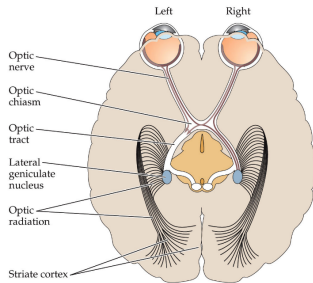
What do you see?



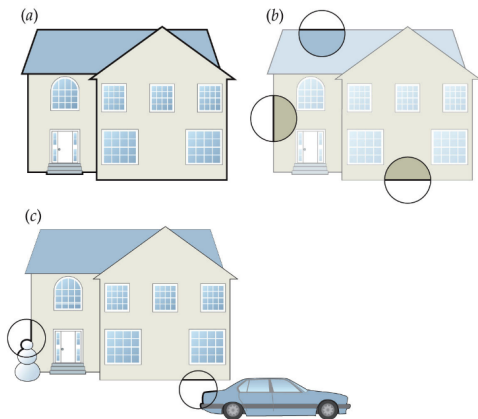
The problem of object recognition

- The pictures were just a bunch of pixels on a screen, but in each case you perceived a house
- How did you recognize all three images as depicting a house?
- How did you recognize the first and third images as depicting the same house, but from different viewpoints?
- How does your visual system move from points of light, like pixels, to whole entities in the world, like houses?

So far ...



Edge detection



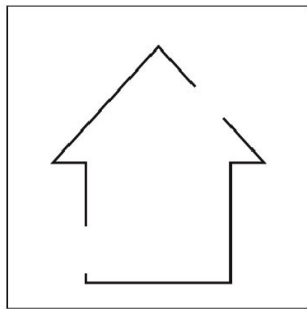
- cells in primary visual cortex have small receptive fields and respond to edges of varying orientations
- How do you know which edges go together and which ones don't?

Mid-level vision

- A loosely defined stage of visual processing that comes after basic features have been extracted from the image and before object recognition and scene understanding
- Involves the perception of edges and surfaces
- Determines which regions of an image should be grouped together into objects

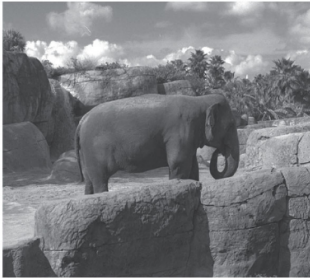
Finding edges: computers are not as good as humans

- Sometimes computers don't find enough edges

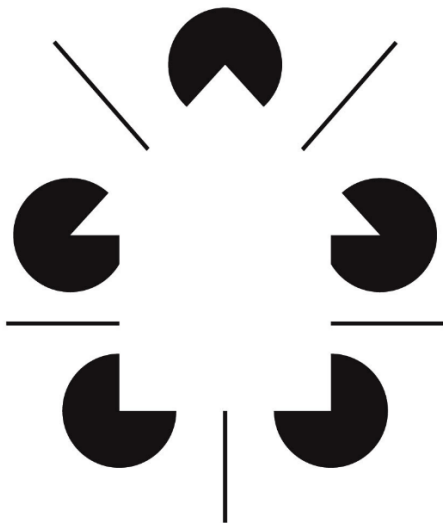


Finding edges: computers are not as good as humans

- Sometimes computers find too many edges

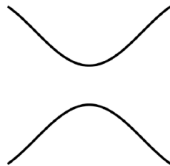


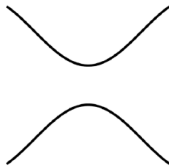
Human contour perception is inferential







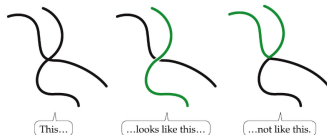




What kind of regularities in the stimulus are taken as evidence for a contour in the world?

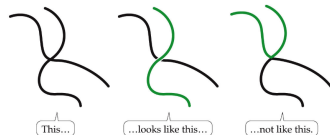
Gestalt grouping rules

- Good continuation



Gestalt grouping rules

- Good continuation

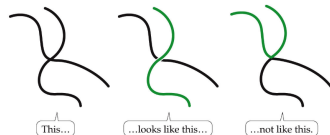


- Similarity



Gestalt grouping rules

- Good continuation



- Similarity

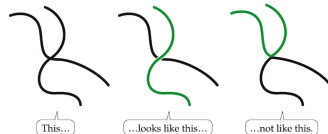


- Proximity

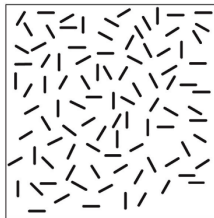
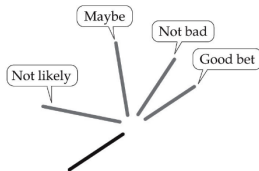


Gestalt grouping rules

- Good continuation

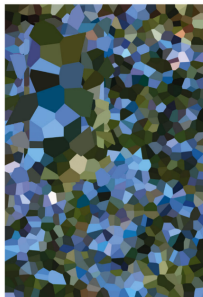
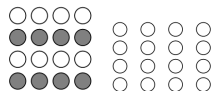


Which gray line is a likely continuation of the black line?



Gestalt grouping rules

- Proximity and similarity serve texture segmentation



Gestalt rules at work

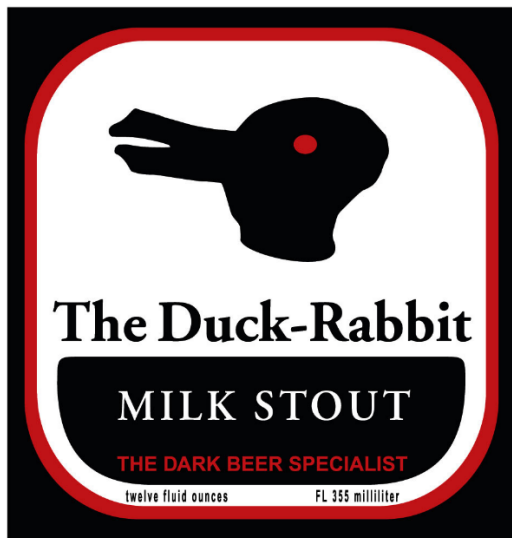


Gestalt rules at work

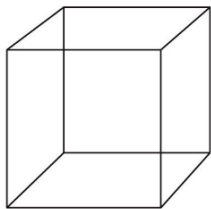


Camouflage

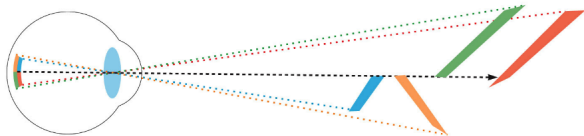
Ambiguous figures



Ambiguous figures



Ambiguous figures



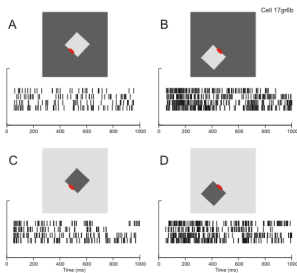
- **accidental viewpoints:** to see the arbitrary shapes just like the four squares would be quite a coincidence
- chances for this are so slim that the visual system might refuse this possibility

What is figure and what is ground?



What is figure and what is ground?

- figure-ground assignment is a critical step on the path from image to object recognition
- happens as early as in the first extrastriate cortical area V2



Summary

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References

- Wolfe, J.M., Kluender, K.R. & Levi, D.M. (2012). *Sensation & Perception*. Sinauer Associates: Sunderland, MA.
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