

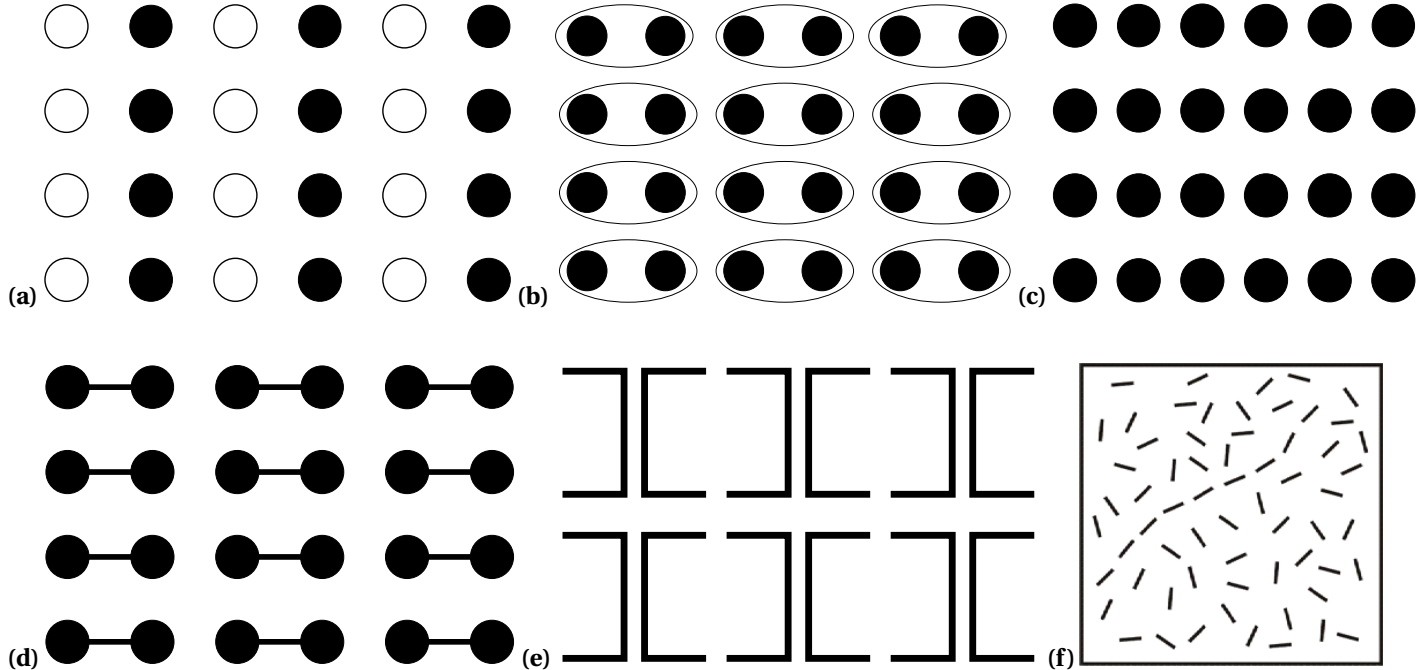
Mid-Level Vision: Segmentation (Biological)

1. Briefly describe the difference between bottom-up and top-down influences on grouping.

Top-down influences come from prior knowledge and experience. They cause image elements to be grouped because of prior expectations about what elements belong to the same object.

Bottom-up influences come from image properties. They cause image elements to be grouped because they have similar properties.

2. For each of the following images identify the “Gestalt Law” that gives rise to the observed grouping.



- (a) similarity
- (b) common region
- (c) proximity
- (d) connectivity
- (e) closure
- (f) continuity

3. Explain how lateral connections in V1 give rise to the Gestalt biases of similarity and continuity.

Lateral inhibitory connections cause mutual suppression of neurons representing similar image elements. At borders between dissimilar elements there is less inhibition, and hence the border is enhanced.

Lateral excitatory connections cause mutual enhancement of neurons representing co-linearly orientated image elements. Hence, the response of elements that form continuous contours is enhanced.

4. Explain what is meant by border ownership?

Border ownership refers to the fact that the boundary between two regions in an image is perceived as part of one region (the foreground) and not the other region (the background). This means that foreground objects have a defined shape (delineated by the border), whereas background objects appear shapeless.

5. Explain how lateral connections in V2 could give rise to border ownership.

Neurons encoding edges in V2 come in opponent pairs, representing borders owned by regions to each side of the edge. Excitatory connections link neurons encoding borders consistent with a probable object. Inhibitory connections link neurons encoding borders inconsistent with a probable object.

6. Give a definition of the Helmholtz Likelihood Principle

Image elements are organised into groups that reflect the most probable objects in the environment consistent with the sensory data and our prior experience.