Multimodal Perception and Cognition 2013

Re-exam model answers

Each part of each question is worth 5 marks. The grades were assigned according to the following scheme:

0-24	-3
25-49	00
50-59	02
60-69	4
70-79	7
80-89	10
90-110	12

To get 5 for a question, a student must get nearly all of the points made in the model answer, unless it is a numerical calculation question, in which case the student must get it completely correct to get 5.

1

Question 1 refers to Lecture 1: Approaches to Human Cognition: Experimental Cognitive Psychology and Cognitive Neuroscience

a. See slide 7. Should have mentioned at least 2 or 3 of concept formation (Bruner *et al*, 1956), generative linguistics (Chomsky, 1957), memory (Miller, 1956) or problem-solving (Newell *et al*., 1958).

b. See slide 50. Should briefly describe experiment and results of Bartels and Zeki (2000).

2.

Question refers to Lecture 2: Approaches to Human Cognition: Cognitive Neuropsychology and Computational Cognitive Science

a. See slides 12-14. Dissociation is where patient performs normally on task X and is impaired on task Y. Doesn't necessarily imply different modules for X and Y - Y might use additional modules or just be more difficult. Double dissociation is where one patient performs normally on A but is impaired on B and another patient performs normally on B but is impaired on A. Provides evidence for separate modules for A and B.

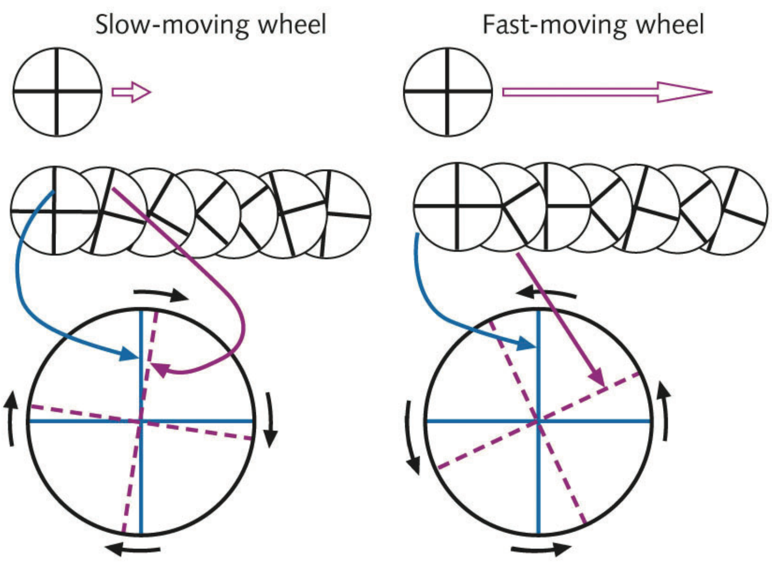
b. See slides 29-34, particularly 34. Network initialized with randomly weighted links. Output pattern generated by a network for an input pattern compared with known correct outputs. Weights back-propagated through the network to adjust link weights so that output becomes closer to desired output.

3.

Refers to Lecture 3: The Perception of Motion

a. See slides 15-16. It is called the motion after-effect. It happens because the motion-detecting neurons adapt to the downward motion of the waterfall and become fatigued. When gaze moved away from downward-moving scene, stationary objects seem to move upward because the downward-sensitive motion detecting neurons fire less than normal, i.e., less than the upward-sensitive detectors, which corresponds to an upward-moving percept.

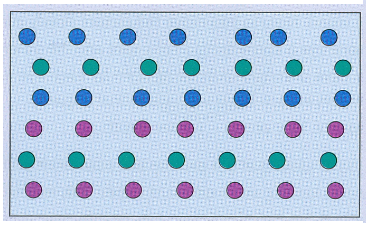
b. See slide 26. Also known as the “waggon-wheel” effect. If one has fast circular motion on a movie, then the frame rate can be too slow to represent it properly. Apparent motion causes us to see each spoke move to the nearest spoke on the next frame. This might not be the same spoke - it could be the previous spoke (see diagram). Some claim that this is only possible in a frame-based situation such as a movie or in stroboscopic lighting. However, the phenomenon has also been perceived under continuous illumination, but the explanation is more contraversial.



4.

Questions refers to Lecture 4: 3-D Vision

a. See slide 17.



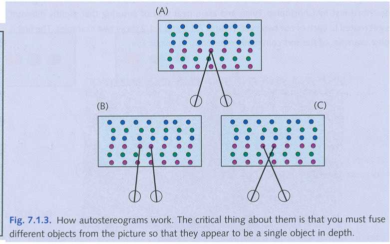
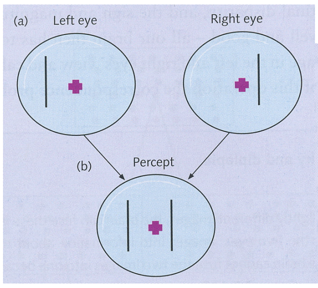
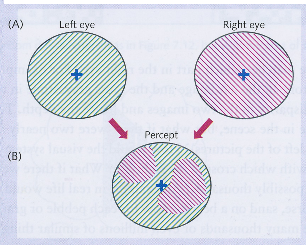


Fig. 7.1.3. How autostereograms work. The critical thing about them is that you must fuse different objects from the picture so that they appear to be a single object in depth.

Pattern repeats imperfectly in a series of stripes. Usually image on fovea is the same leading to no disparity and no depth. Need to get one stripe on one fovea and the adjacent stripe on the other fovea. Can do this by crossing eyes or focusing “behind” the plane of the image.

b. See slide 21.





Diplopia is double vision - seeing two images at the same time, a different one in each eye. If images on both eyes are almost the same, then typically fused into one. If images are too different, then cannot do this - binocular rivalry: see some parts of one image and some parts of the other one, changing over time. If one image has many contours or moving contours, then it may dominate the other one. If one eye is very dominant, then the image in that eye may suppress the other one. Finally you may simply see both images, in which case this is diplopia.

5.

Lecture 5: Sound waves and the peripheral auditory system.

a. See “Sound waves”, slide 8. Intensity is proportional to the square of the amplitude. So if intA/intB = 9, then ampA/ampB = 3.

b. See “Sound waves”, slide 8 and 15. ampA/ampB = 10 implies intA/intB = 100. Intensity ratio of 100 corresponds to 10 log_10(100) dB = 20dB: A is 20dB more intense than B.

6.

Refers to Lecture 6: Auditory streaming

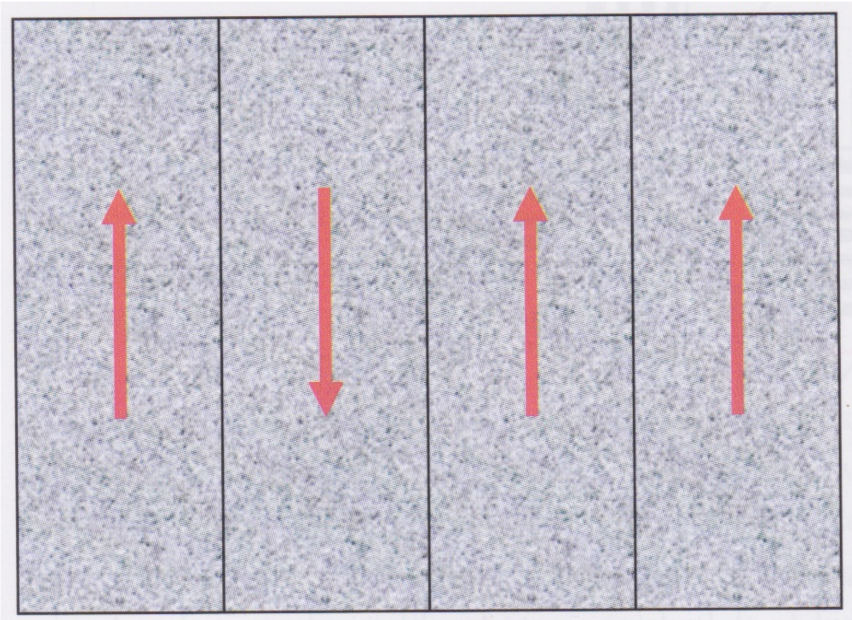
a. See slide 6. Perception of segregation becomes stronger with more repetition. If the stimulus is split into multiple streams too easily, we would be too sensitive to changes and have an unstable perception of the auditory scene. We therefore have a damped or “lazy” response. We start out by assuming only one source and only add sources (streams) if there is enough evidence (e.g., lots of tones clustered into two different frequency regions).

b. See slides 11. Stream segregation can also be induced by using tones with different timbres instead of different pitches. We assume tones with different timbres come from different sources, so tend to segregate them into separate streams.

7.

Refers to Lecture 7: The development of vision

a. Slides 20-21.



Used VEP or preferential looking to explore motion perception. Dots in 3 of the 4 sections in figure above are moving in one direction, the other one moves in the opposite direction. If baby interested in odd-man-out section then indicates it can see the motion. Experiments show that babies can first spot medium motion at about 12 weeks, slow and fast motion sensitivity follow later. Also experimented with “looming” stimuli: experimenter appears to swing large slab at baby, measure amount of alarm induced - infants able to distinguish between slabs that would hit them and ones that wouldn’t.

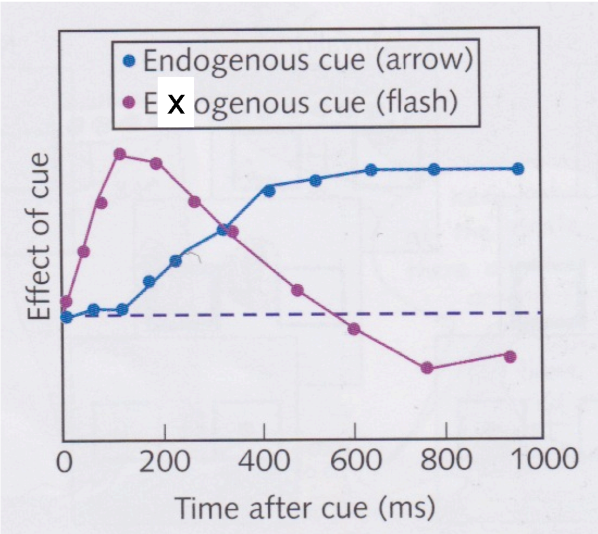
b. Slides 25-27. Babies are better than adults at distinguishing between monkey faces. By the time they reach 10 months, babies also start to find it hard to distinguish between monkey faces and are better at distinguishing between human faces. Can explore this with habituation and preferential looking: show one monkey until baby gets bored, then show two monkeys - if baby prefers new monkey, then indicates it can tell the difference. Example of perceptual narrowing.

8.

Refers to lecture 8: Attention and neglect

a. Slides 8-10. Covert attention is when you're attending to something in your peripheral vision - it is not foveated. Overt attention is when you are attending to the image falling on the fovea.

b. Slides 12-13. Endogenous cue: Attention consciously directed towards cued location; top-down, relatively slow, sustained, requires conscious effort. Exogenous cue: Attention grabbed by an unexpected and interesting event; bottom-up, fast, transient and automatic.



Exogenous cue grabs attention quickly but effect falls off quickly and can even hinder performance after about 600ms (inhibition of return). Endogenous cue is slower to take effect but lasts longer.

9.

Refers to Lecture 9: Consciousness

a. Slide 7. Epiphenomenalism is the idea that mental states are created by physical processes but cannot have any causal effect on physical events. Seems to deny possibility of free will. Often attributed to de la Mettrie(1748). Actually seems to be supported by experiments on timing of decision making by Libet (1985), which suggest that our decisions to act are made before we become aware of having decided to act.

b. Slide 11 and 18-23. The "hard problem" is experience: what it is *like to be* an organism. "How can physical processes in the brain give rise to subjective experience?" Researchers have responded to the hard problem in basically 4 ways

- it's insoluble - "new mysterians" (Nagel, McGinn, Pinker)
- "Let's try to solve it - possibly with some new kind of science" (Gray, Clarke, Chalmers, Libet, Penrose)
- "Let's solve the 'easy' problems first" (Crick and Koch)
- There is no hard problem (Churchland, Dennett)

10.

Refers to lecture 10: The Perception of Faces

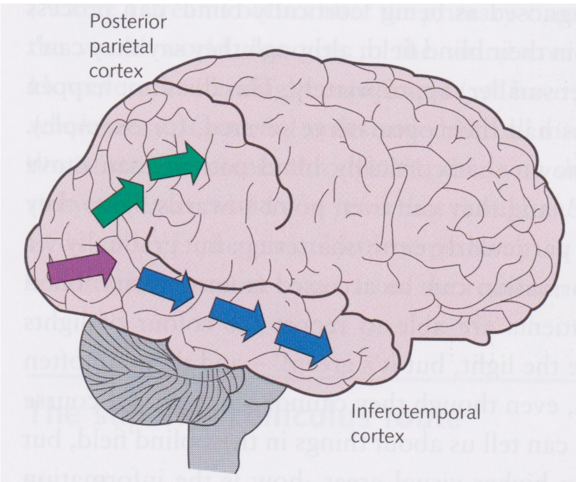
a. Slide 48-50. Inability to recognize people by their faces. Able to otherwise see normally. Recognize people from non-facial cues (e.g., shoes, gait, clothes). Can describe people's faces, but not recognize them from their faces. Some prosopagnosics can recognize facial expressions but not facial identity; others have the opposite problem. Some prosopagnosics can tell (unconsciously) whether a face is familiar or unfamiliar (Tranel and Damasio, 1985). Prosopagnosia is often associated with lesions in the ventral pathway between V1 and the amygdala.

b. Slide 51. Capgras syndrome is a delusional mis-identification syndrome. It is the "mirror image" of prosopagnosia: can identify who the person is, but the face seems *unfamiliar* - as though an impostor has taken over the body of someone you know. Capgras is often associated with lesions in the dorsal pathway between V1 and the STS (superior temporal sulcus).

11.

Refers to lecture 11: Vision and action

a. Slides 5-6. After being processed by V1, visual information is sent on to the "extrastriate cortex", which is a large collection of different brain areas. Some of these areas can be understood as being in a "what" stream and others in a "where" stream.



The "what" stream (blue) travels ventrally from V1 to the inferotemporal cortex and is involved in object recognition and discrimination. The "where" stream (green) travels dorsally from V1 to the posterior parietal cortex and is involved in locating objects in the world and allowing one to interact with them.

b. Slides 19-20. Optic ataxia (or Bálint-Holmes syndrome) is associated with damage to the posterior parietal cortex and results in impairment when attempting to reach out and grasp objects. People with optic ataxia can see and recognize objects normally (ventral “what” stream) but are not good at picking things up and manipulate them (dorsal “where” stream)