Exercise (solutions in class)

Q1) The left lateral geniculate nucleus (LGN) hosts a representation:
1. Of the entire left visual hemifield
2. Of the entire right visual hemifield
3. Only the binocular region of the right visual hemifield
4. Only the monocular region of the left visual hemifield
5. Of the entire visual field

Q2) An ordered representation of the visual field in the brain visual regions is defined:
1. somatotopic map
2. proprioceptive map
3. salience map
4. retinotopic map
5. tonotopic map

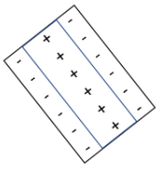
Q3) The presentation of a visual stimulus activates
1. Simultaneously the ventral and the dorsal visual pathway
2. First the dorsal visual pathway and then the ventral visual pathway
3. First the ventral visual pathway and then the dorsal visual pathway
4. Only the ventrai visual pathway
5. Only the dorsal visual pathway

Q4) According to Hubel and Wiesel, which cells of the visual system selectively respond to stimulus orientation:
1. Retinal ganglion cells
2. Retinal bipolar cells
3. Parvocellular cells of the LGN
4. Magnocellular cells of the LGN
5. Simple cells of V1

Q5) Which information is processed by neurons of the blob regions of V1?
1. Orientation of outlines
2. Color contrast
3. Disparity
4. Direction of movement
5. Spatial frequency

Q6) Which is the main computational problem that the ventral visual pathway has to solve:
1. Sensory-motor integration
2. Perception of movement
3. Perceptual invariance
4. Multimodal integration
5. Cognitive conflict

Q7) Among the 5 illustrated, which is the most effective stimulus for activating the simple cell of V1 whose receptive field is schematized below (+ = activated by light; - = inhibited by light)?



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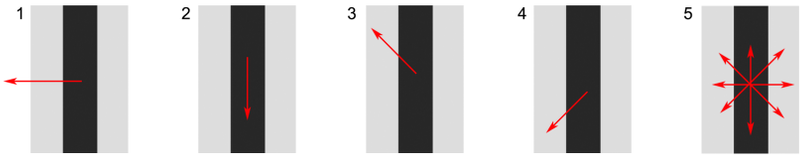
Q8) Due to the aperture problem, V1 neurons are only able to detect

1. Visual motion perpendicular to contour orientation
2. Visual motion parallel to contour orientation
3. Visual motion oblique and up relative to contour orientation
4. Visual motion oblique and down, relative to contour orientation
5. Visual motion in any direction



Q9) In the early visual areas (for instance V1) the amount of cortical area devoted to each degree of the visual field

1. Varies inversely to stimulus eccentricity (distance from the fovea)
2. Varies directly to stimulus eccentricity
3. It does not depend on stimulus eccentricity
4. It is higher for stimuli shown in the upper quadrant of the visual field
5. It is higher for stimuli shown in the lower quadrant of the visual field

Q10) For which cell in early visual regions (e.g., retina, LGN and primary visual cortex), the position of the stimulus within the receptive field is not critical to activate the neuron:

1. Retinal photoreceptor (e.g., cones)
2. ON-Center retinal ganglion cell
3. OFF-Center retinal ganglion cell
4. Simple cell in V1
5. Complex cell in V1

Q11) Why does visual perception need visual selective attention?

1. To learn skilled visuo-motor behavior
2. To overcome intrinsic limitation of visual processing
3. To encode visual object invariance
4. To derive the depth of visual stimuli
5. To keep the visual system sensitive to visual input over a wide range of illumination

Q12) At which level of visual processing does visual selective attention operate?

1. At all levels of the visual system, including low, intermediate, and high level
2. At all levels of the visual system, except in the retina
3. At all levels of the visual system, except in the retina, LGN and V1
4. At cortical level, starting in V2
5. In the ventral visual pathway but not in the dorsal visual pathway

Q13) In the cueing paradigm of selective visual attention, the cue (usually an oriented arrow) briefly presented at the center of the screen immediately before target appearance:

1. It serves to distract the participant in the experiment
2. It is informative about the possible location of the target
3. It triggers object-based attention
4. It is not informative about the possible location of the target
5. It is bears no relationship with the target

Q14) A sudden change of illumination from one region of the visual scene triggers:

1. Top-down visual selective attention
2. Bottom-up visual selective attention
3. Object-based visual selective attention
4. Covert selective attention
5. Eye movements with affecting visual attention

Q15) In visual search tasks, a vertical red target appears concurrently with a variable number of horizontal blue stimuli. The participant's task is to decide whether the vertical red target is present or not on the screen, as accurately and quickly as possible. The participant response (reaction time in msec)

1. Is affected by the number of blue stimuli
2. Is not affected by the number of blue stimuli
3. Is faster if the target appears on the left of the screen
4. Is faster if the target appears on the right of the screen
5. Is inversely related to the number of blue stimuli

Q16) What properties of a visual stimulus (e.g., location, shape, color) can be used by visual attention to select a stimulus:

1. spatial location, shape and color
2. spatial position, but not shape and color
3. shape, but not color and spatial position
4. color, but not shape and spatial position
5. shape and color, but not spatial position

Q17) You've been instructed to pay attention to red stimuli presented tin the visual scene.
This is an example of:

1. Top-down, object-based attention
2. Bottom-up, object-based attention
3. Top-down, space-based attention
4. Bottom-up, space-based attention
5. Covert attention

Q18) Relative to the unattended condition, selective attention affects the orientation tuning of neurons in cortical area V4 by producing:

1. Inhibition of response to all orientation
2. enhancement of response only to preferred orientation
3. enhancement of response to preferred orientation, and inhibition of response to other orientation
4. enhancement of response to all orientation (multiplicative scaling)
5. no effect of attention on neuronal response in area V4

Q19) The effect of top-down visual attention on neuronal responses tends to be larger in:

1. Retina
2. LGN
3. Area V1
4. Area V2
5. Area V4

Q20) Placing two visual stimuli (one effective and one ineffective to elicit the neuron response) inside the receptive field of a neuron of area V2, and directing animal's attention toward the ineffective stimulus results in:

1. Poor response, as when the ineffective stimulus is presented alone
2. Strong response, as when the effective stimulus is presented alone
3. Average of the strong and poor response
4. Additive response (strong + poor response)
5. No effect of attention

Q21) According to the model of exogenous (bottom-up) visual attention, the salience map is used particularly for:

1. Long-term memory of the stimulus
2. Cognitive control
3. Attribute emotional meaning to the stimulus
4. Eye movement guidance
5. No function

Q22) The main characteristic of "Popout targets" is that they

1. Are composed of features identical to the surrounding (distracting) stimuli
2. Are composed of features that differ from the surrounding stimuli
3. Are composed of a unique of features that are present in the surrounding stimuli
4. Are preceded by informative cues
5. Require top-down attention to be correctly detected

Q23) Relative to conjuction targets, popout target stimuli evoke

1. Reduced neuronal response
2. Identical neuronal response
3. Larger neuronal response
4. No response
5. More variable neuronal response

Q24) The subthreshold electrical microstimulation of the FEF (frontal eye field) in the monkey evokes enhancement of visual responses of neurons recorded simultaneously in area V4:

1. only if the motor field of the stimulated neurons in the FEF and the visual receptive field of the V4 neuron are aligned (in spatial register);

2. always;
3. only if the motor field of the stimulated neurons in the FEF and the visual receptive field of the V4 neuron are misaligned (not in spatial register);
4. only if the electrical stimulation of the FEF evokes an eye movement;
5. only if the motor field of the stimulated neurons of the FEF and the visual receptive field of the V4 neuron occupy opposite hemifields of the visual scene;

Q25) Visual selective attention and gaze (eye movements):

1. Are controlled by largely overlapping neural mechanisms
2. Are always aligned in the exploration of the visual scene
3. Are controlled by completely independent functional mechanisms
4. Activate completely separate neural circuits
5. Depend exclusively on the ventral visual pathway