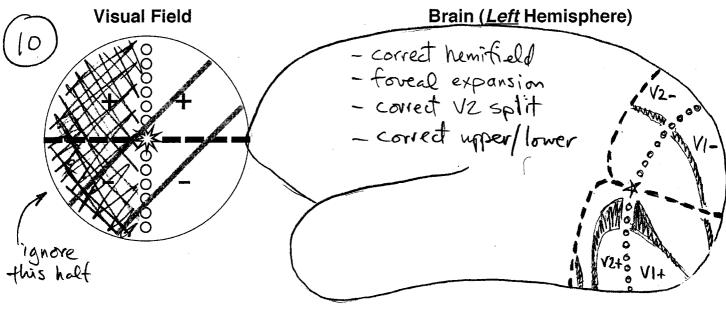
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C	ognitive Scie	ence 107B—W	inter 2007	Name (prin	<sub>ut/):</sub> Ke	24	
S	ystems Neui	obiology				<del></del>	
			equally weighted (			rimary visual cortex	z area V1
1.						rimary visual cortex l in the <i>cat dLGN</i> w	
						cell would respond	
	rate		-	longer de	dy vs.	-	
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2			transient	larger	Sustained 1	raige off transfe	?n
				V V3	· 2 - 1 ( )		
	t —	D O	light ÒN		light ÖFF	end	
	(b) Lagged	and non-lagged	d cells may help go	enerate direct	ion selectivity. I	Draw a simple block	diagram of how
			igged cell could be ion is preferred.	e used to mak	e a airection-se	lective unit, label th	veris, and
~			=	. + .	logged DX	non-lagged	. ) . —
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3. Area V1 and area V2 in primates each have a map of a portion of the visual field. The *entire* visual field is drawn at the left with *two gray lines* superimposed on it. In the space below, make a *careful* diagram of what activity the gray lines would generate in V1 and V2 in the *right* hemisphere. Use the *dashes/small-circles/star/plus/minus* convention used below. Remember the *fovea*!



4. We discussed the aperture problem for pattern translation, but also 'aperture problems' in general.

(a) Illustrate (in space to right) one pattern direction with a thick arrow, and then two different local directions with thin arrows that are consistent with that one pattern direction. Draw angles and lengths accurately!

- pattern direction is diameter of circle

- local directions any chard starting at base of pattern dir.

(b) Illustrate (in space to right) one local direction with a thin arrow,

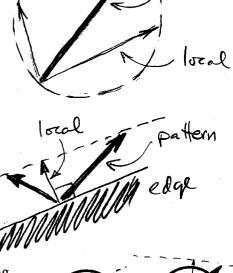
(b) Illustrate (in space to right) one local direction with a thin arrow, and then two different pattern directions with thick arrows that could possibly have generated that one local direction. Draw angles and lengths accurately!

- local direction is perpendicular to contour

- pattern directions extend from base of loral to edge-parallel dashed line (c) Here are two apertures viewing different parts of a scene containing

(c) Here are two apertures viewing different parts of a scene containing one moving object. The local direction detected inside each one is shown with thin arrows. Illustrate the direction the object is moving.

- shared pattern direction to right of 2 local dirs.



Pattern

(d) MSTd neurons response to rotations, spiraling movement, expansions, and contractions. Give an example of a visual stimulus situation that would result in a *contracting pattern* of movement in the visual field.

2) - walking backwards, watching an object more away, falling down a well looking up (ans. from 2001), etc., etc.

<ul> <li>5. We described the different types of receptors and input pathways in the somatosensory system.</li> <li>(a) Normally, alpha motoneurons (synapsing on main muscle) and gamma motoneurons (synapsing on muscle-spindle muscle) are co-activated. If the gamma motoneurons were accidentally over-activated, would this increase or decrease the firing of a muscle spindle? Very briefly, why?</li> </ul>
3 - increase, since muscle-spindle-nuscle (intrafusal) fibers will stretch the stretch receptor
(c) One somatosensory pathway predominantly carries information about touch to the thalamus. What three nuclei in this pathway make synapses on thalamic neurons?
- gracile nucleus - cureote nucleus - principal sensory nucleus of the trigeminal (N.I)
(d) What is the distinction between rapidly-adapting and slowly-adapting receptors (touch, stretch, pain) analogous to in the visual system?  Trapidly-adapting > Y-like, magno, transient [any Slowly-adapting > X-like, parvo, sustained OK]
6. We discussed 'recepto-topic' maps in the visual, somatosensory, and auditory systems.  (a) The sharply-peaked distribution of photoreceptor density in one retina is mapped onto two dLGN's by spreading out the retinal ganglion cell axons to achieve a uniform density in the dLGN, which strongly distorts the retinal image. What aspect of the input image is preserved by this transformation?  - local shape (local angles and local dimensions)  - the overall size can vary e.g.
(b) Cortical somatosensory maps contain many "discontinuities". Give an example of what is meant by this.  - a small movement along  a cortical representation  results in a large movement  to a non-overlapping receptive  field on the Skin Surface  (c) Why were the somatosensory cortex rearrangements observed in the Silver Spring monkeys (long-term sensory denervation of an arm) thought to involve sprouting of new axons?
4) - the complete invasion of the former [dont need of any 3b arm and hand representation by  the face required sprouting because the successive divergence of axons terminals is not large enough to explain 1-2 cm remap hand face

(a) Draw two different pure-tone auditory stimuli of different amplitudes and the corresponding spike trains that you might expect from a cell in NA.  Soft Shim  (and Shim  (b) Assume that a left NM cell generates 2 spikes and a right NM cell generates 2 spikes, all in response to the same sound stimulus. Given that there is no certainty that a given sound wavefront will generate a spike in both left and right NM cells, what is the maximum number of different interaural time delays (ITD's) this data consistent with? Very briefly explain your answer.  (c) If a source emits a noise containing many frequencies, it will activate neuron at many different locations within the lateral part of the central nucleus of the inferior colliculus (ICc-laterat). How then can the true interaural delay be determined?  (d) Why is it difficult to detect the location (azimuth) of a pure tone source?  (a) Primates use eye movements to place the fovea, which has a greater concentration of receptors than the retinal periphery, over interesting targets. Bats, by analogy, are said to have an 'acoustic fovea'. What bat behavior inspired this sandogy?  (a) Primates use eye movements to place the fovea, which has a greater concentration of receptors than the retinal periphery, over interesting targets. Bats, by analogy, are said to have an 'acoustic fovea'. What bat behavior inspired this sandogy?  (a) Primates use eye movements to place the fovea, which has a greater concentration of receptors than the retinal periphery, over interesting targets. Bats, by analogy, are said to have an 'acoustic fovea'. What bat behavior inspired this sandogy?  (a) Primates use eye movements to place the fovea, which has a greater concentration of receptors than the retinal periphery, over interesting targets. Bats, by analogy, are said to have an 'acoustic fovea'. What bat behavior inspired this sandogy?  (a) Primates use eye movements to place the fovea, which has a greater concentration of receptors than the retinal periphery, over interesting propers. P	7. Cochlear ganglion cells project to both <i>nucleus angularis</i> (NA) and <i>nucleus magnocellularis</i> (NM) in the barn owl. Each <i>nucleus laminaris</i> (NL) then receives input from both the left and right nucleus magnocellularis.
soft shim  response  (b) Assume that a left NM cell generates 2 spikes and a right NM cell generates 2 spikes, all in response to the same sound stimulus. Given that there is no certainty that a given sound wavefront will generate a spike in both left and right NM cells, what is the maximum number of different interaural time delays (ITD's) this data consistent with? Very briefly explain your answer.  Coincidence: In most several case where diff. wavefronts responded to coincidence: In most several requences, it will activate neuron at many different locations within the lateral part of the central nucleus of the inferior colliculus (ICc-lateral). How then can the true interaural delay be determined?  The source emits a noise containing many frequences, it will activate neuron at many different locations within the lateral part of the central nucleus of the inferior colliculus (ICc-lateral). How then can the true interaural delay be determined?  The source emits a noise containing many frequences, it will activate neuron at many different locations within the lateral part of the central nucleus of the inferior colliculus (ICc-lateral). How then can the true interaural delay be determined?  The source emits a noise containing many frequences, it will activate neuron at many different locations within the lateral part of the central nucleus of the inferior colliculus (ICc-lateral). How then can the true interaural delay be determined?  The source emits a noise containing many frequences, it will activate neuron at many different locations within the lateral part of the central nucleus of the containing many frequency parts and the remaining many frequency and can be a pure to make a pure t	(a) Draw two different pure-tone auditory stimuli of different amplitudes and the corresponding spike trains
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8. An echolocating bat emits high frequency calls that are reflected off of objects in the environment and analyzed by its auditory system.  (a) Primates use eye movements to place the fovea, which has a greater concentration of receptors than the retinal periphery, over interesting targets. Bats, by analogy, are said to have an 'acoustic fovea'. What bat behavior inspired this analogy?  (b) At vary the frequency of the origining call so that the zrd harmonic of the echo always comes back around 60-62 kHz, where A-I has an expanded representation (b) A vowel spoken by one speaker sounds the same, regardless of the pitch (fundamental frequency) of their voice. Why?  The resonant frequences of the vocal bands of formals tract (set by tongue) pass same bands of formals frequency parts of bat echolocating calls and human vowels, despite their very different functions (detecting Doppler shift vs. identifying vowels across speakers). Explain why the signal processing problems solved are nevertheless similar.  (c) We drew a specific analogy between the processing problems solved are nevertheless similar.  (d) - in both cases, the freq difference between two bands of frequences must be defected independent one frequence for the alsolute frequences (numbered).	(d) Why is it difficult to detect the location (azimuth) of a pure tone source?
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