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Exercise #7

Question 6.1
The remaining properties of edges that are encoded differently by different hidden units are spatial frequency, Phase, and Location within the reception field. In spatial frequency, some neurons respond better to gradual changes, while others have become more sensitive to sharp and narrow edges. Regarding Polarity, the change of shade is also recorded in the hidden units. Some neurons have become more responsive to the edges where the center is lighter than that of the surroundings. Some other neurons prefer the edges where the center is darker. Finally, in regards to the location within the receptive field, neurons can have preferences for edges which appear in parts of their receptive field. This allows the visual system to detect where the edge is located within the visual field, which ultimately contributes to the spatial awareness.

Question 6.2
This prove stimuli is supposed to represent edges by changing the patterns of activity throughout the LGNon and LGnoff layers. Here, an edge is represented in the transition area of the activation of the two layers. This creates a visual contrast which illustrates the light and dark transitions of edges in the natural visual environment.

Question 6.3
The V4's layer encoding of the line element combinations and the spatial invariance are key for interpreting and transforming the raw visual input into a form that supports object recognition. It is important to note that The form is flexible meaning it will support flexible and robust inputs. This allows the invariant and abstract representations in visual areas like the IT cortex to be observed.

Question 6.4
Selecting a V4 unit from the outer grid of Figure 3 that seems selective for the vertical line elements at the top and bottom, and then through the middle. This is a suggestion of the letter "H". Assuming that Object 5 resembles an H, this makes sense because the image receptive field captures the basic foundations of the letter H. This indicates that the unit plays a role in recognizing objects with distinct features that contribute to the network's ability to find and differentiate between objects based on the line elements.

Question 6.5
In my experience, after looking at the IT patterns it became evident that individual IT neurons do not code strictly for a single object. Rather, they code for parts of many different objects which allows the neuron to become active across multiple objects. This suggested that the units encode

many different complex combinations of features that are shared with many other objects, rather than remaining responsive to one object.

Question 6.7

For the neural cue, the network's settling time remains neutral. For the valid cue the settling time decreases in comparison to the neural cue which demonstrates the attention facilitated objects recognition by focusing efforts on the target's location. The settling time for the invalid cue increases compared to the other two. This is due to the fact that spatial attention gets misdirected which requires the network to overcome the bias and then reassess attention to the actual location of the target.

Trial Name	Cycle
Neural	55.2
Valid	43
Invalid	105.6

Question 6.8

Trial Name	Cycle
Neural	55
Valid	43
Invalid	139

Question 6.9

Invalid - Valid Lesioned: 139 - 43 = 96
Invalid - Valid Intact: 105.6 - 43 = 62.6

As expected, the lesioned network shows a greater difference which is indicative of the higher cost of redirecting the attention, This difference matches the disproportionate slowing that is seen in patients which supports the models validity through spatial neglect.