Characteristics of Bistable Perception of Images with Monocular Depth Cues

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Introduction

- Visual system uses a number of monocular depth cues to perceive 3D space.
- In some cases these cues may provide an image with the characteristics of bistable perception, when a visual pattern becomes too ambiguous for the human visual system to recognize with one unique interpretation.
- These transitions from one percept to its alternative are called perceptual reversals.
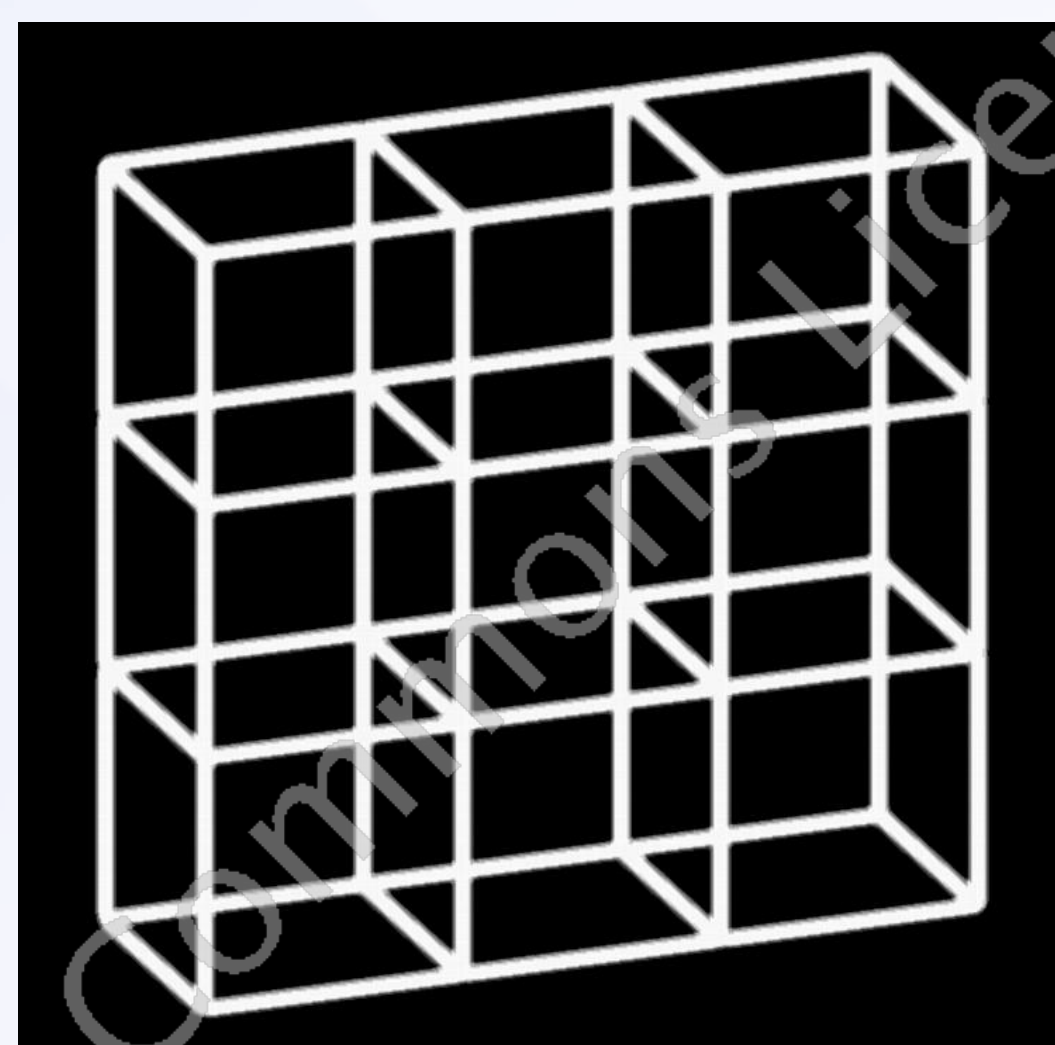
Objectives

- Study temporal characteristics of bistable perception of the images with two types of monocular depth cues - perspective and shadowing.
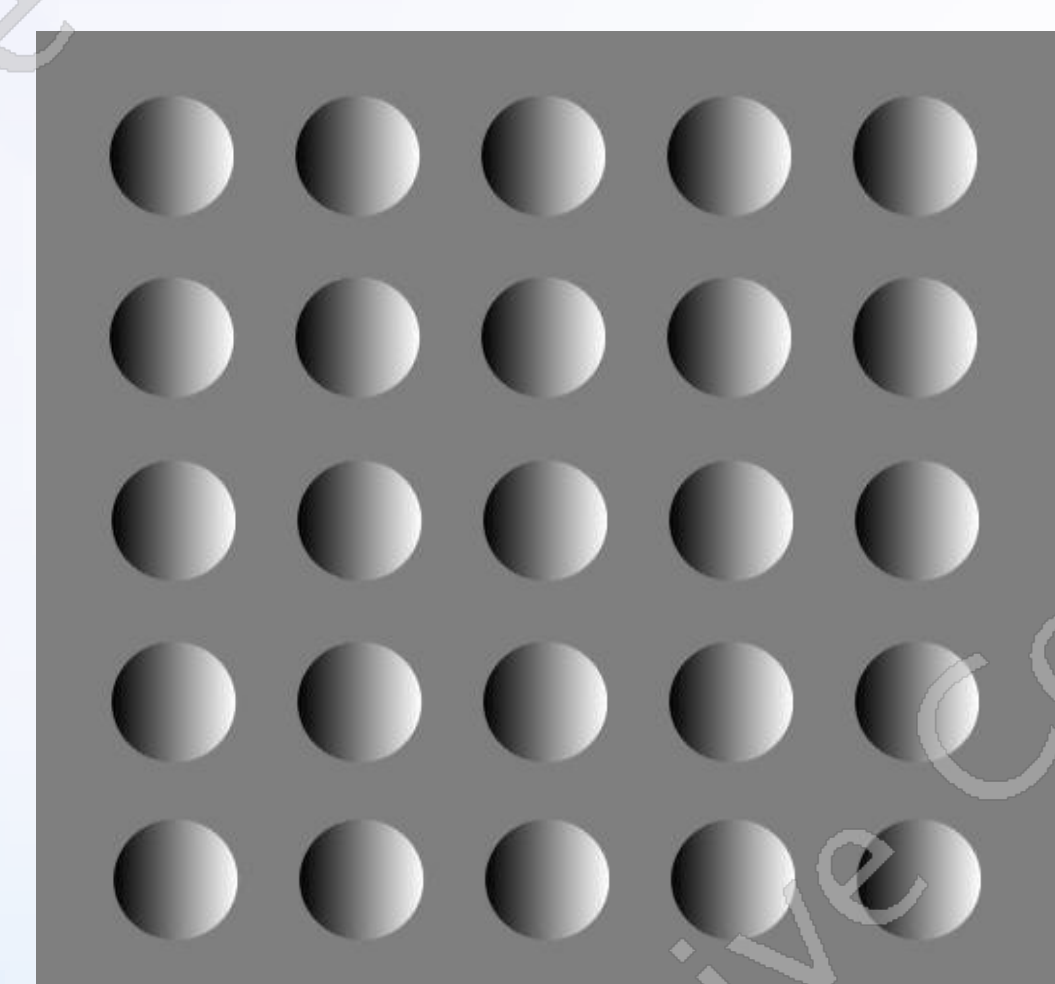- Look for neurophysiological correlates of the process of bistable perception.

Methods

a) Psychophysical experiments
- **Stimuli**

A matrix of nine Necker cubes
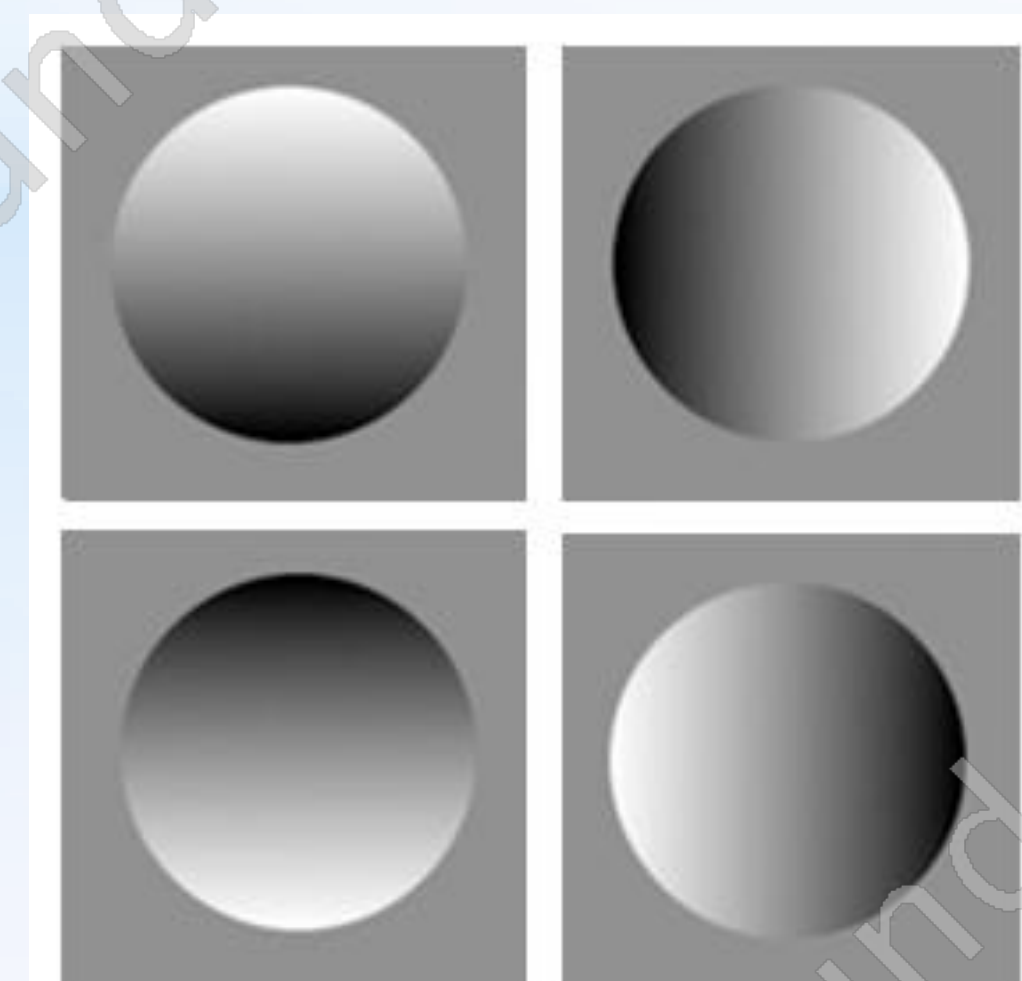
Five lines of shadowed circles

- Observers (26 young men and women) were marking perceptual reversals by pressing a button.

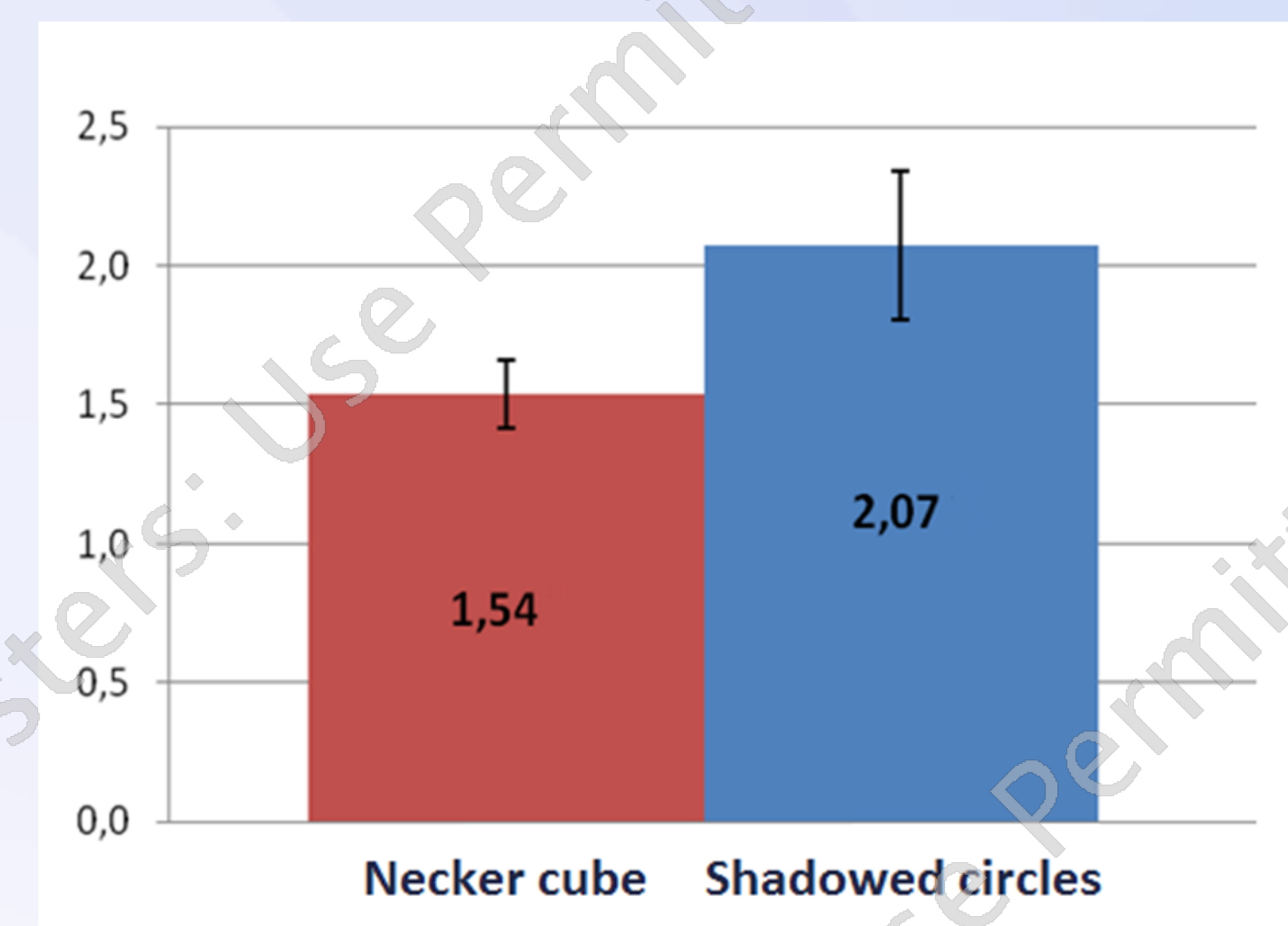*b) Neurophysiological experiments*
- **Stimuli**

A shadowed circle at different orientation

- Microelectrode registration of cat LGN neuron activity was performed (for the details please see *Podvigin et al., 2001*).

Results

- Both stimuli proved to have the characteristics of bistable images with a preferred percept (the one observed for a longer period).

A ratio between preferred and non-preferred percept observation time

- For both images this ratio values don't differ significantly (p>0,05). This similarity of temporal characteristics of perception of ambiguous images of the two types implies top-down influences upon bistable perception process.

- Cat LGN neurons that proved to be sensitive to brightness gradient orientation (*Podvigin et al., 2001*) appeared to be sensitive rather to the horizontal orientation of the brightness gradient within the test image than to vertical one.

Number of cell sensitive to different stimulus orientations
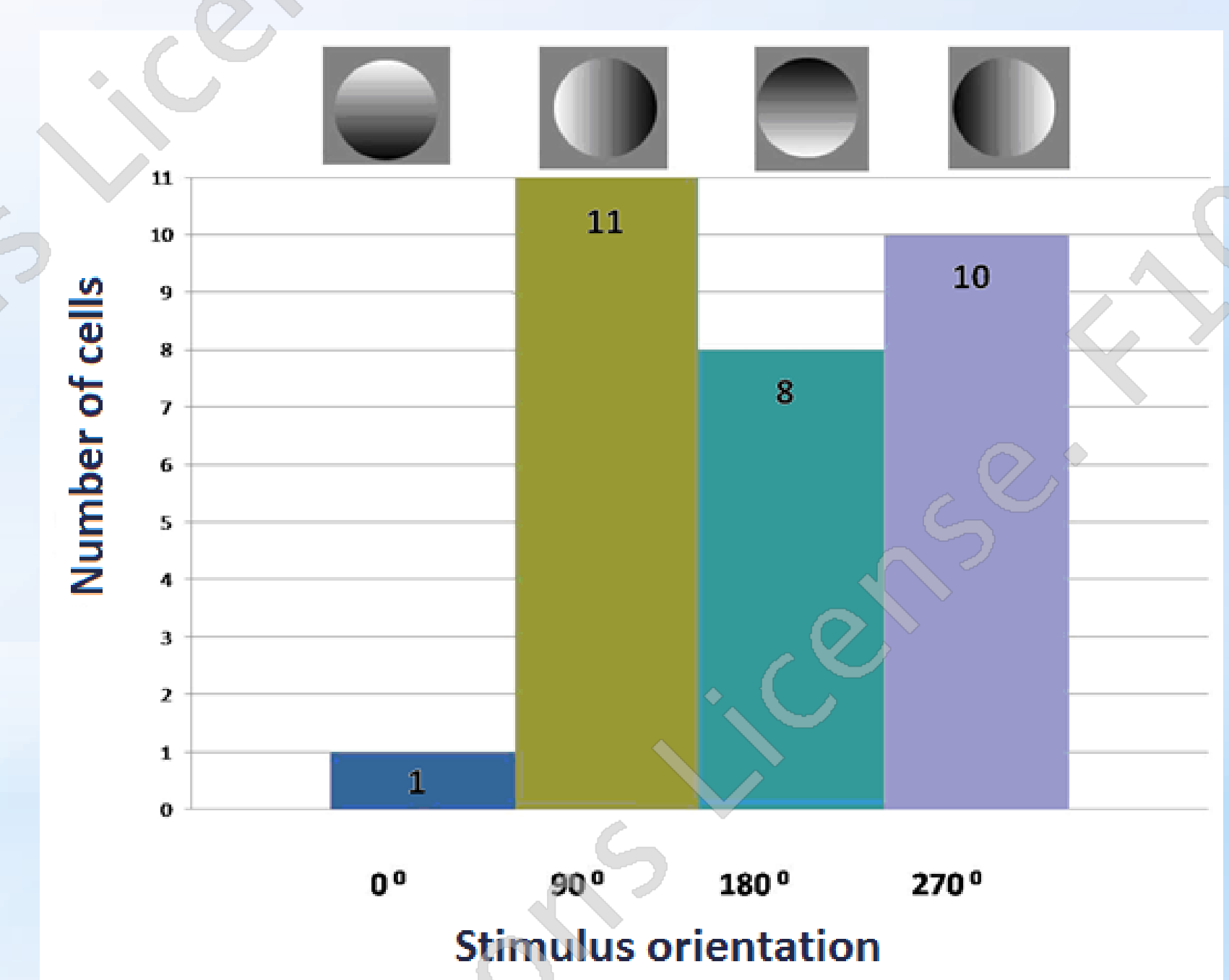
- One may suppose that the more ambiguous the image is the more units (LGN cells) have to be used by the system to recognize the image.

Conclusion

- The process of bistable perception of the images with monocular depth cues (such as shadowing) is likely to be based on the information from LGN neurons sensitive to brightness gradient orientation, though the final decision on what we see is apparently a result of top-down influences