

Introduction

Background:

- Previous studies of depth from motion parallax used orthographic rendering and random dots.
- Here we use stimuli more naturalistic both in terms of rendering and image characteristics.

Research questions:

- Is depth from motion parallax better with perspective than orthographic rendering?
- How is depth influenced by 3 additional cues in perspective rendering?
- Is depth better with more naturalistic (1/f) Gabor micropattern stimuli?

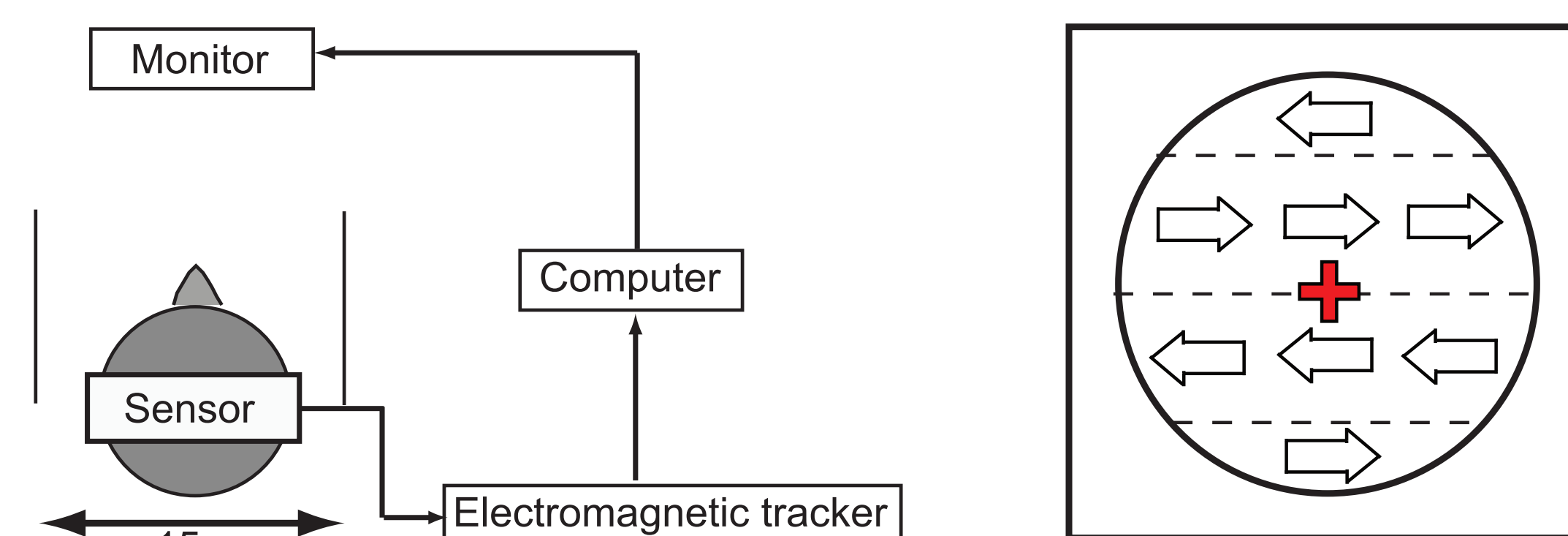
Methods

Hardware:

- Electromagnetic head tracking (100 Hz sampling) in 6 D.O.F.
- OpenGL enabled GPU, lag ~20 msec.

Display:

- Fixation point at centre of screen visible during stimulus presentation.
- Free head movements (no chin rest) with limited span (15 cm).
- 57 cm viewing distance, monocular viewing.



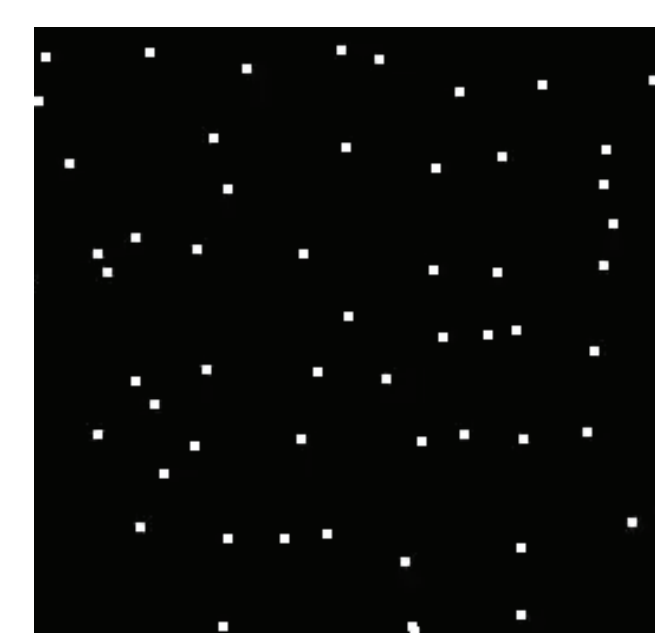
Syncing gain: Ratio between head movement and stimulus motion (proportional to rendered depth).

Task:

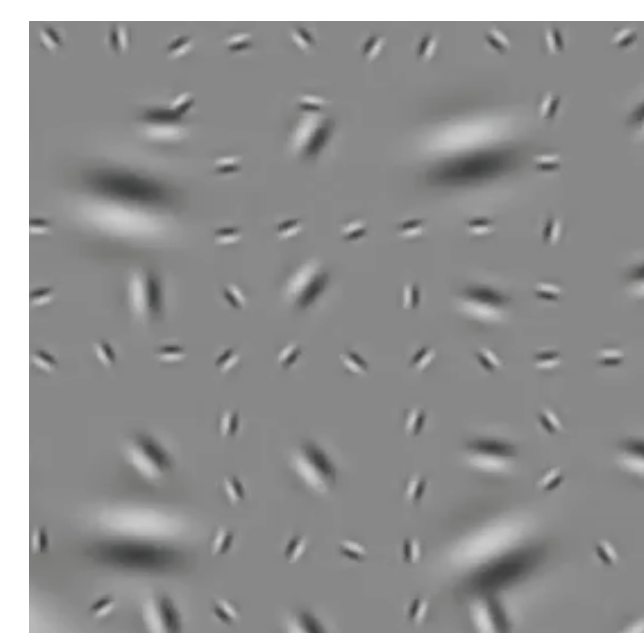
- Depth ordering (% correct), 2 AFC, 5 sec

Stimulus textures:

- Random white dots, black background.
- 1/f Gabor micropatterns (random orientations), grey background.



Random dots

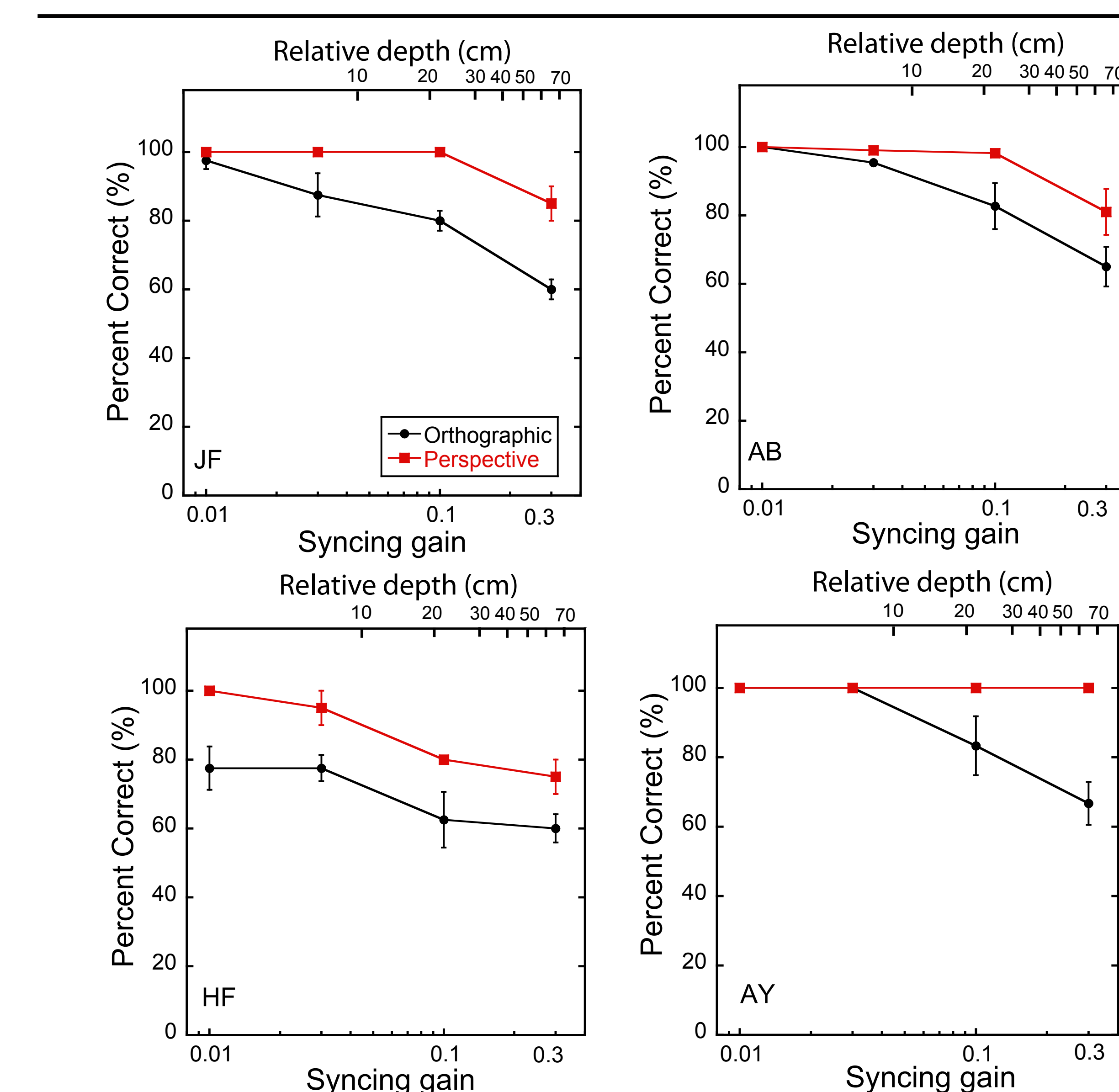
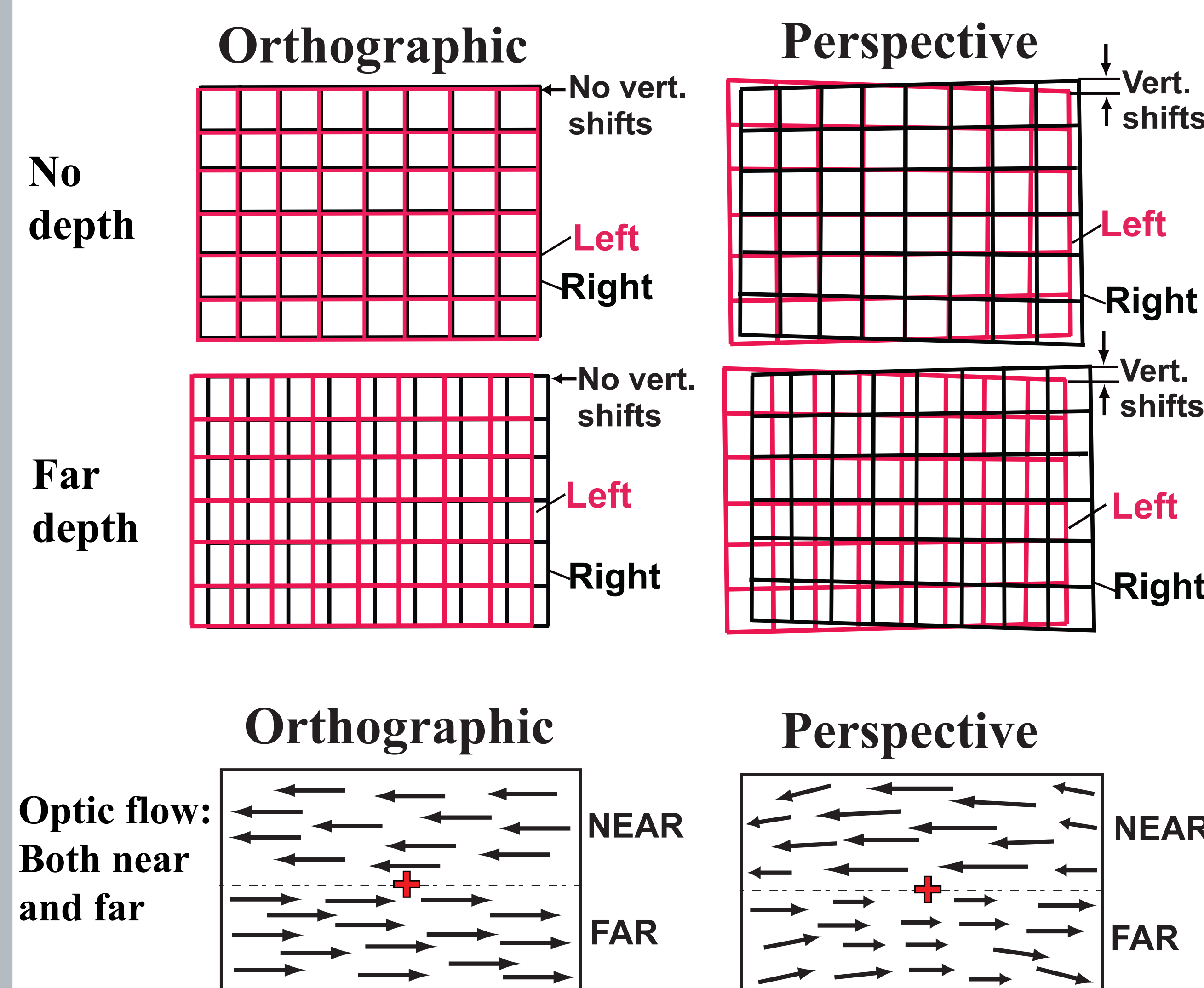


Gabors

Orthographic and perspective rendering

Three additional cues in perspective rendering:

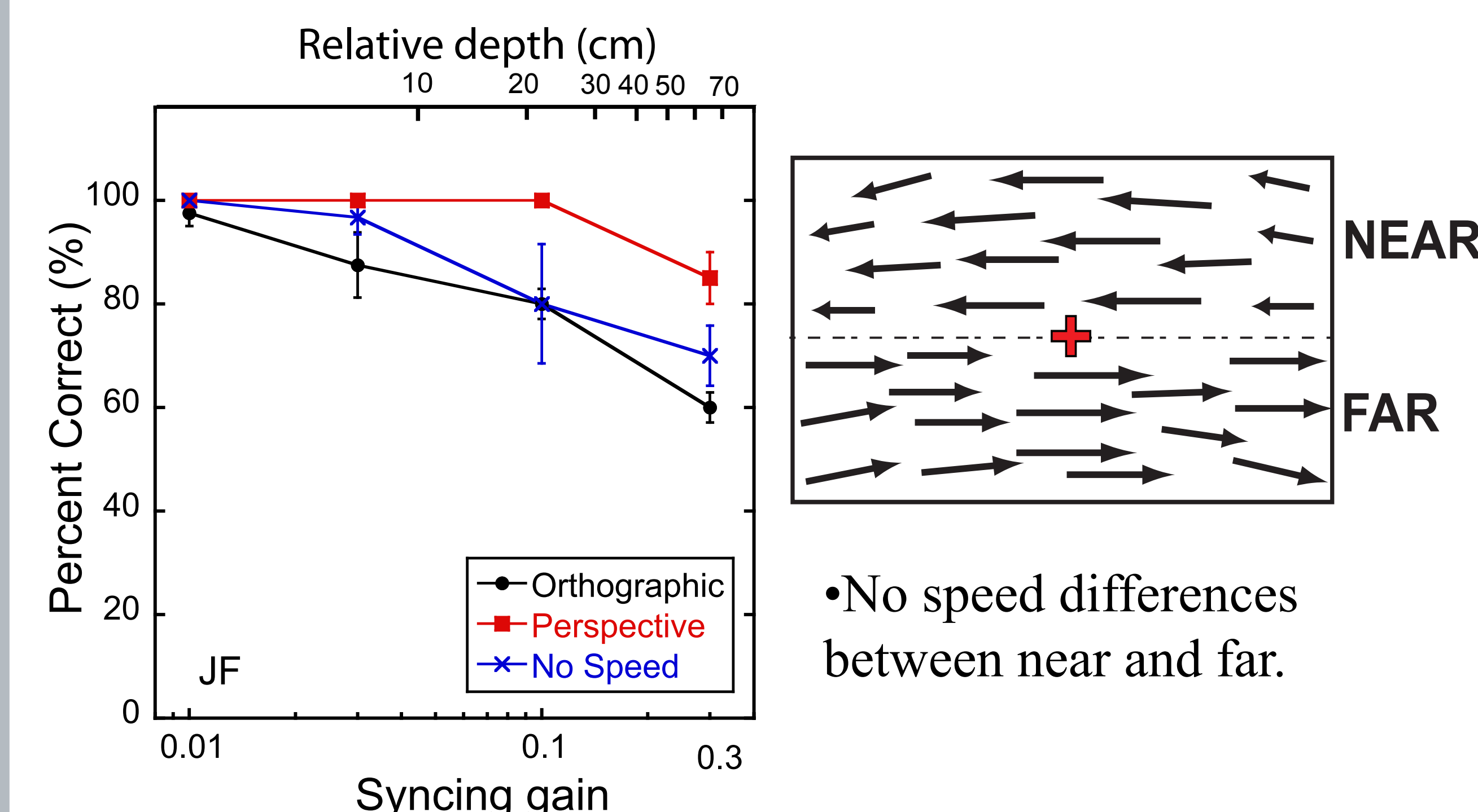
- Speed differences - Nearer surface moves faster than farther surface.
- Vertical shifts - Larger at outer corners of image.
- Lateral gradients in speed.



- Perspective was better than orthographic rendering.
- Depth systematically declined as rendered depth increased.
- Greater differences between two types of rendering as rendered depth increased.

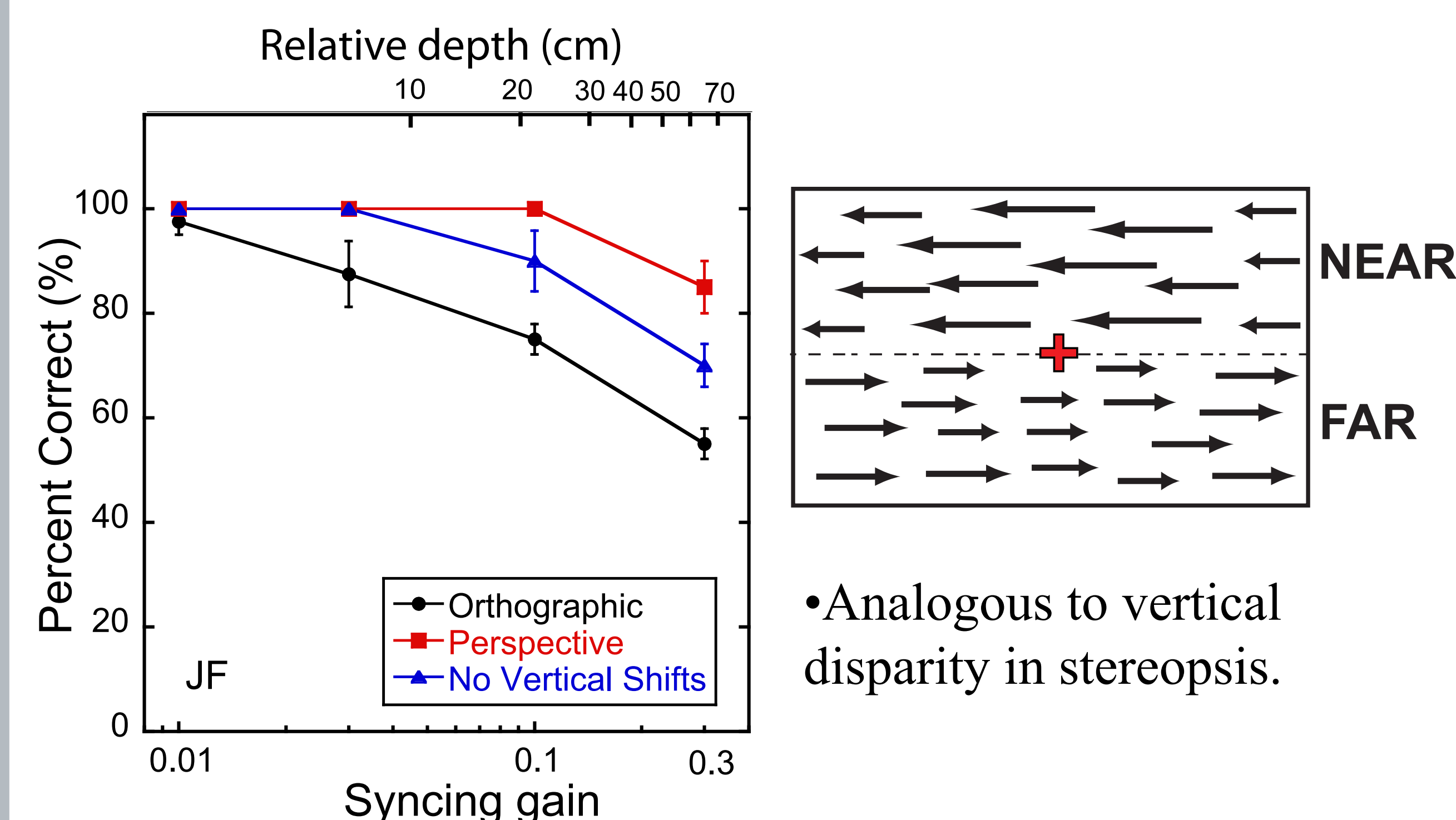
Results: Removal of three perspective cues

(1) No speed differences



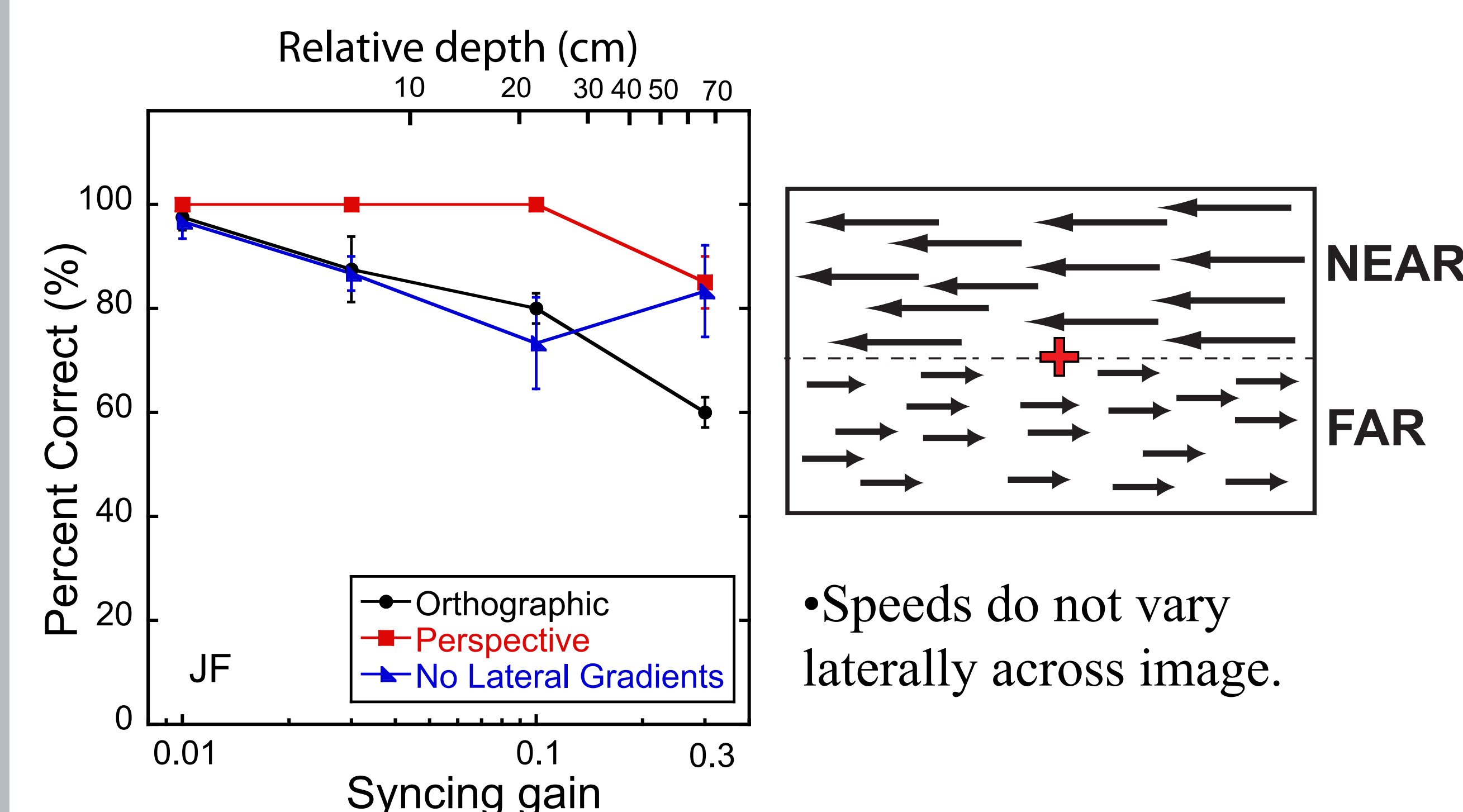
- No speed differences between near and far.

(2) No vertical shifts



- Analogous to vertical disparity in stereopsis.

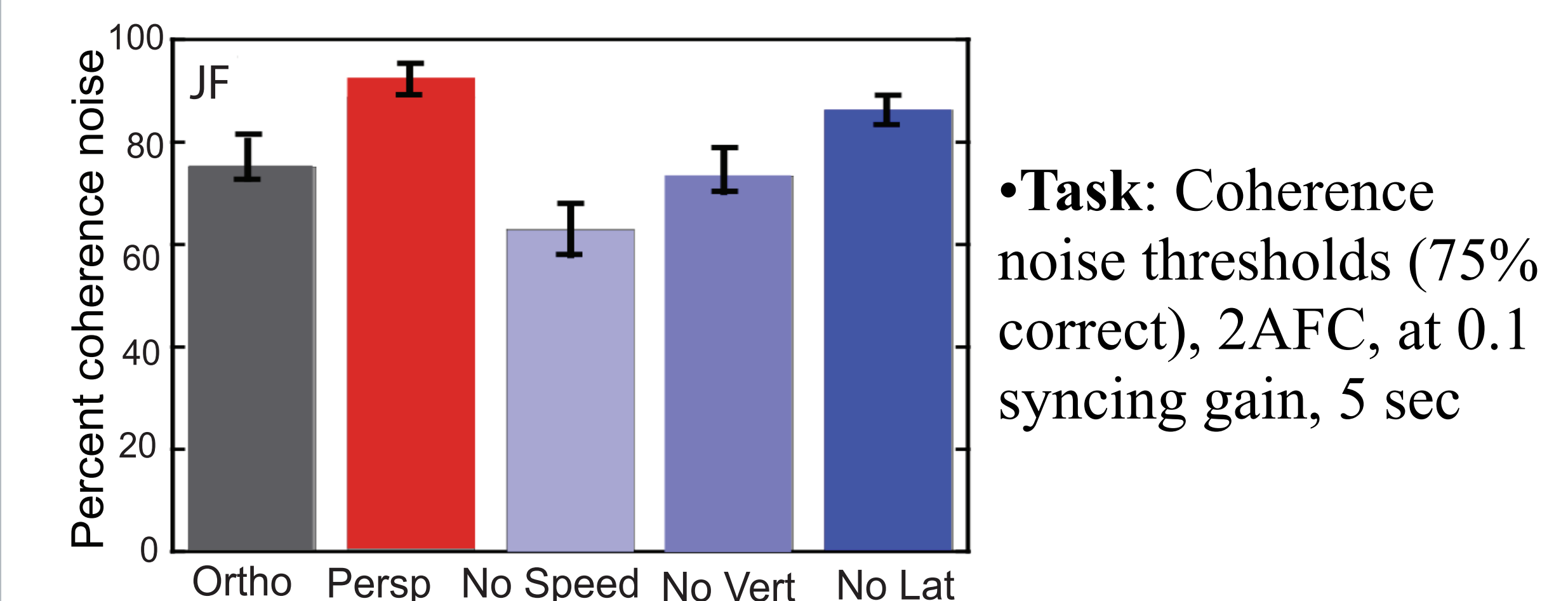
(3) No lateral gradients in speed



- Speeds do not vary laterally across image.

- Removal of any of 3 perspective cues (speed differences, vertical shifts or lateral gradients in speed) impairs depth.

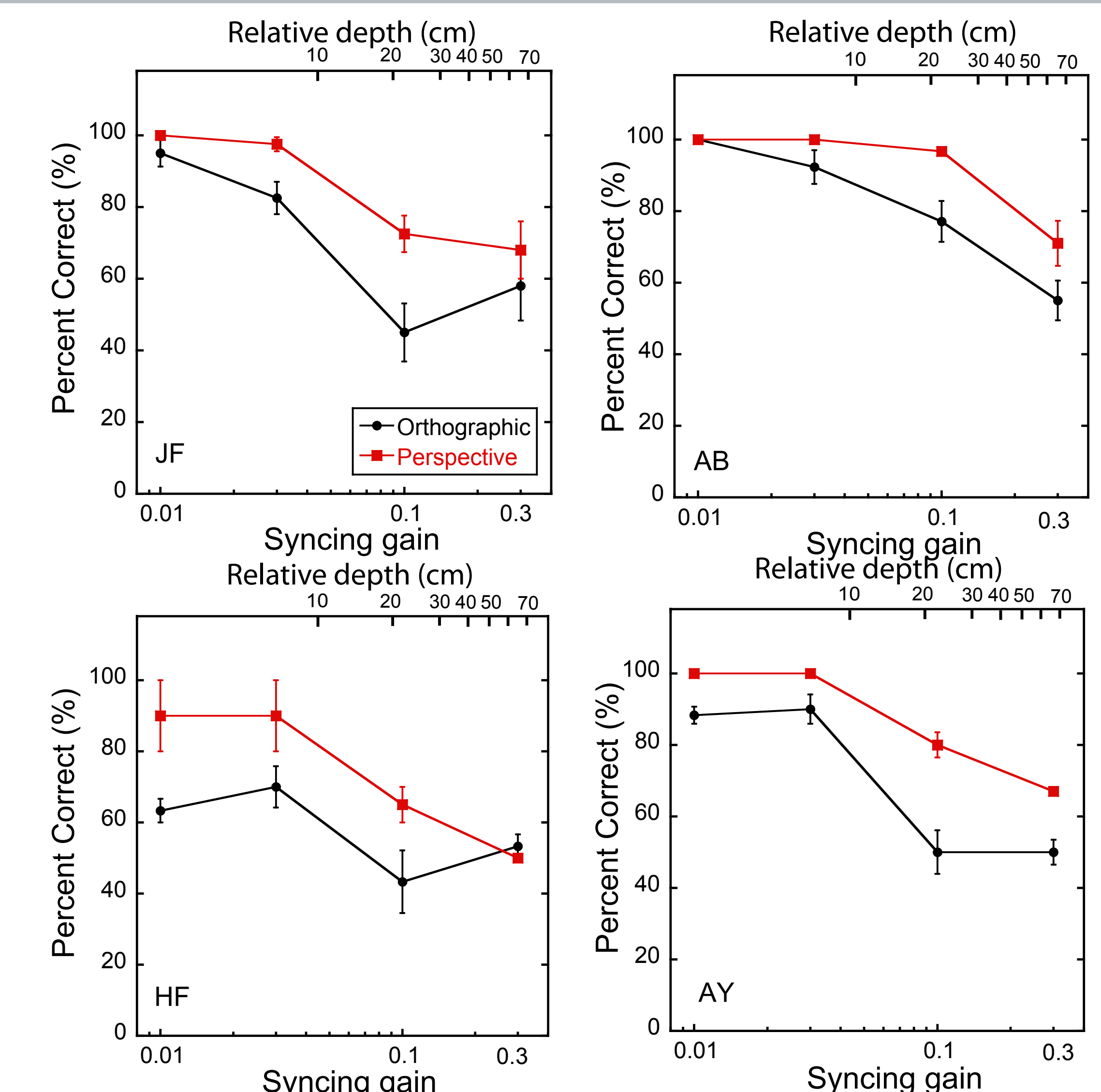
Results: Noise coherence thresholds



- **Task:** Coherence noise thresholds (75% correct), 2AFC, at 0.1 syncing gain, 5 sec

- Depth was better (possible with higher % noise) for perspective than orthographic rendering.
- Removal of perspective cues increased thresholds.

Results: Gabors



- Perspective was better than orthographic rendering with 1/f Gabor micropatterns.
- Depth was somewhat less than with random dots.

Conclusions

- Depth is better for perspective than orthographic rendering.
- Depth is enhanced by all three dynamic perspective cues.
- Depth, surprisingly, is better with random dot patterns than 1/f Gabor micropattern textures.

References:

Read, J.C.A. and Cumming, B.G (2006). Journal of Vision, 6(12), 1323-1355.
Rogers, S. and Rogers, B.J. (1992). Perception and Psychophysics, 52(4), 446-452.

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