

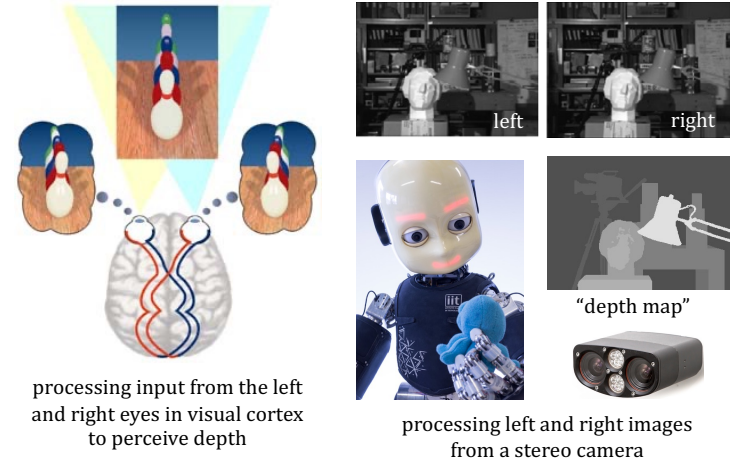
Who has stereo vision?



Nityananda, V. & Read, J. C. A. (2017) *Stereopsis in animals: evolution, function and mechanisms*, J. Exp. Biol. 220(14), 2502-2512

1

Binocular stereo vision



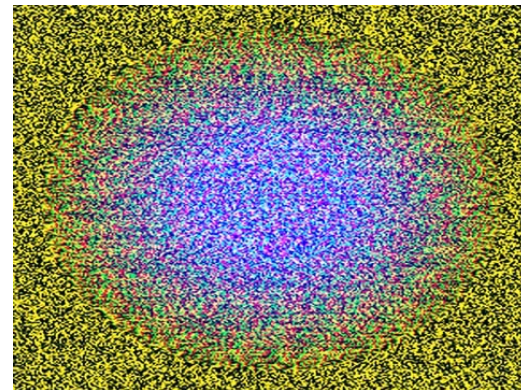
2

Stereograms and stereoscopes



First stereoscope invented by Sir Charles Wheatstone, 1838

3



4

Stereo disparity



left

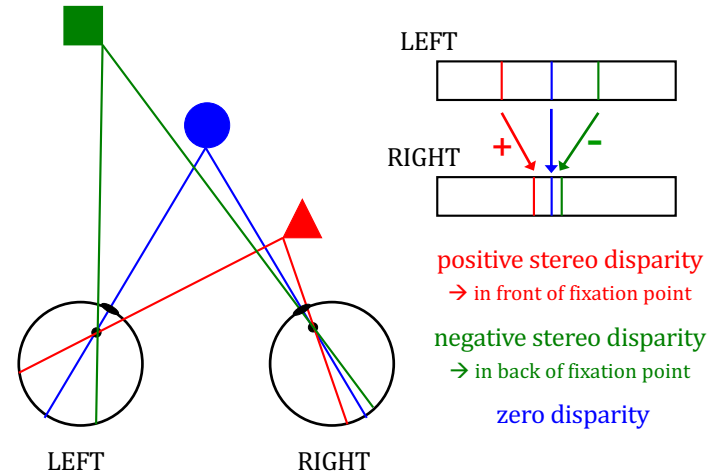
right



magic-eye
"autostereograms"

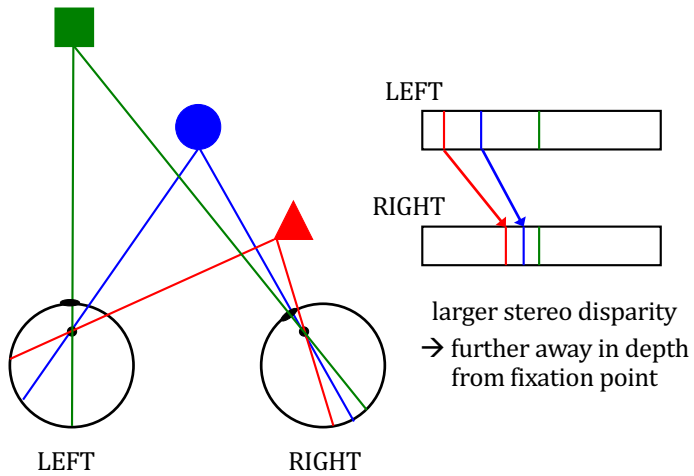
5

Stereo viewing geometry



6

Stereo viewing geometry



7

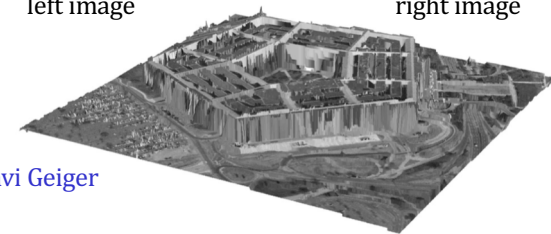
Results of stereo processing



left image



right image



Davi Geiger

8

Steps of the stereo process



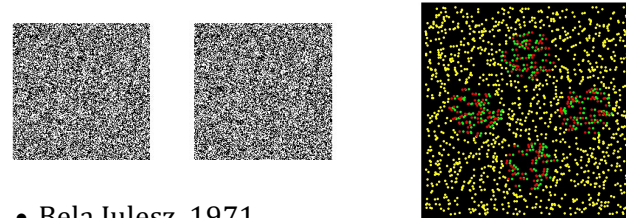
left

right

- extract features from the left and right images, whose stereo disparity will be measured
- match the left and right image features and measure their disparity in position
 - “stereo correspondence problem”
- use stereo disparity to compute depth

9

Random-dot stereograms



- Bela Julesz, 1971
- stereo system can function independently
- we can match “simple” features
- highlight the *ambiguity* of the matching process

10

Constraints on stereo correspondence

- Uniqueness
 - each feature in the left image matches with only one feature in the right (and vice versa...)
- Similarity
 - matching features appear “similar” in the two images
- Continuity
 - nearby image features have similar disparities
- Epipolar constraint
 - simple version: matching features have similar vertical positions, but... (stay tuned...)

11