Constructing Depth Information in Briefly Presented Scenes

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Question: How does pictorial depth information unfold within the glance?

Purpose: Explore the trends of perceived depth in more natural visual settings, rather than examining the contributions of single or interacting depth cues.

1. How does depth information “fill in” as the viewing time increases?
2. Which factor influences two-point depth discrimination ability more: local pixel-distances or global depth structures?
3. Is there an obligatory contribution of global image structures in depth comparisons?

Experiment 1: How do depth planes “fill in”?

Task: Respond which dot is closer to you on the image by pressing the corresponding button on the keyboard.

Design: Participants were seated such that, across all three conditions, the distance from the eye to near and far image were approximately the same.

Results:
- Performance is not at ceiling by the end of the glance
- Accurate depth comparisons emerge in a coarse-to-fine manner

Experiment 2: Is performance driven by pixel-distance or depth disparity?

Task: Respond whether the two points presented are similar or different in depth.

Design: Participants were asked to judge the depth similarity of the embedded object in the original condition.

Comparisons:
- Foreground and Background Comparisons
- Matched global structure vs mismatched global structure

Results:
- Depth judgments of different depth planes improve over time, independent of the pixel distance between the points.
- Depth judgments of similar depth planes are easier when the points are near on the image. When the points are far apart on the image, performance remains poor, even with more viewing time.

Experiment 3: Is global image structure obligatory in depth judgements?

Task: Respond whether the two points presented are similar or different in depth.

Design: Participants were asked to judge the depth similarity of the original condition.

Comparisons:
- Original vs baseline
- Embedded vs baseline

Results:
- The global image information obligatorily influences a comparative depth judgment.
- *Global image structure which is incompatible with the embedded point comparison impairs performance.

Conclusions:
- *Local two-point comparisons of depth in a natural image are necessarily influenced by the global structure of the image.
- *Depth comparison accuracy generally emerges in a coarse-to-fine, foreground to background manner. Proximity of the comparison points in the two-dimensional image only benefits performance when the two points are similar in depth.