Viewpoint similarity of 3D objects predicted by image-plane position shifts

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Background

Based on their geometry, some object viewpoints seem more visually distinct from others when rotated by the same amount. Therefore, some viewpoints are more easy to discriminate from their neighbouring viewpoints than others. What are the computations that may underpin the human ability to discriminate object viewpoints?

Method

6 objects

-π -2.81 -2.48 -2.15 -0.17 0.17 1.82 2.15 2.48 2.81

Experimental design

Participants (n=39) had to rotate an on-screen object so that the "test pair" was perceived as being the same distance apart as a "standard pair". Test pairs that were adjusted to be a smaller distance apart than the standard were considered to be more discriminable; test pairs that were adjusted to be a greater distance apart were considered to be less discriminable.

Metric and results

A simple metric to predict viewpoint discriminability, based on ground-truth position shift vectors.

Human discrimination and metric performance varied across viewpoints, for both horizontal and vertical rotations.

Human performance closer to metric than bootstrapped shuffle predicts.

Conclusions

• Humans appear to visualise image plane position shifts in order to discriminate object viewpoints.
• This metric provides a potential computational correlate for existing, qualitative theories of object viewpoint discrimination.

References


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End-on views are most discriminable according to the metric.