PAINTERLY DEPICTIONS OF GLASSES DISPLAY A STYLIZED PATTERN OF HIGHLIGHTS

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For painterly depictions to be convincing, the distal world does not need to be captured perfectly. In other words, depictions that do not adhere to the statistical regularities found in the distal world can nevertheless be perceptually convincing. The perceptual features contained within a painterly depiction might therefor deviate from perceptual features found in photos. These deviations can be insightful for vision science. Here we present a demonstration of an annotational methodology that can be used to find such deviations.

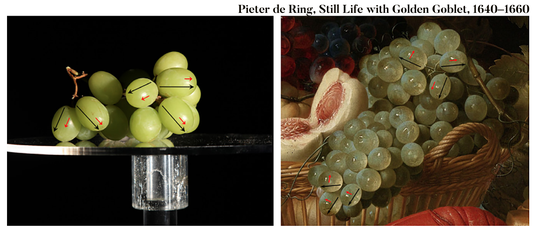
TWO EXAMPLES

Implement Blue by Margaret Preston, 1927; Art Gallery of New South Wales

"No optical distortion of the lemon in the water is shown here and yet the glass and the water appear convincingly transparent"
- Example from Cavanagh, 2005

Lesson learned:
Optical distortion is not always required for the perception of transparency

Pieter de Ring, Still Life with Golden Goblet, 1640–1660



Left: Grapes display a variety of orientations and each highlights is congruent to the grape's orientation.
Right: In paintings the grapes display similar variation in orientation, but highlights are not congruent. Nevertheless, this did not impact perceived glossiness
- Example from De Cicco, 2019

Lesson learned:
Congruent highlight orientation is not always required for the perception of glossiness

HYPOTHESIS

We hypothesize painters applied certain techniques of depictions that reliably captured certain perceptual features that in turn evoked convincing, robust perceptions. Identifying such painterly techniques and the related image features can help generate insights into cues that are, or are not, used by the visual system to evoke perceptions. We test this hypothesis by using a simple annotation paradigm to annotate highlights.

STIMULI

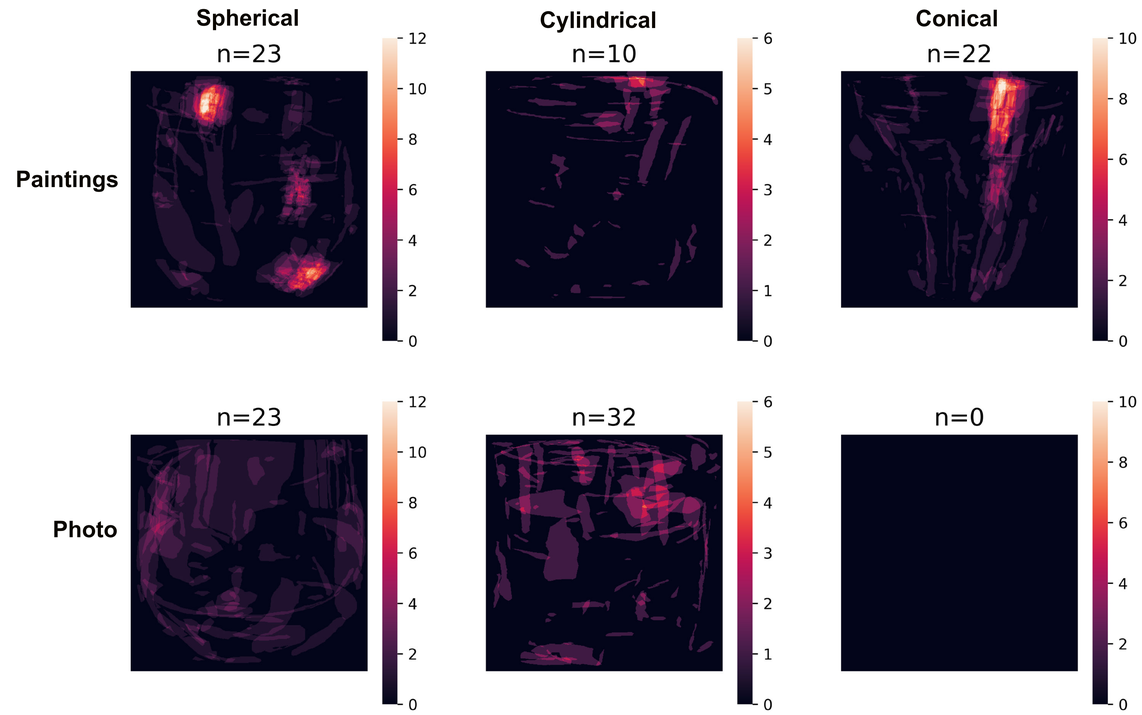
As stimuli we used 110 drinking glasses. Half the stimuli were painterly depictions of drinking glasses, taken from the Materials In Paintings dataset (van Zuijlen et al. 2020). The other half were photos of drinking glasses taken from the COCO dataset (Lin et al, 2014). For the analysis, we furthermore split up all drinking glasses into three shapes: spherical, cylindrical or conical. Each can respectively be seen in the figure below.

TASK

Participants (n=4) annotated highlights on drinking glasses using a simple annotation interface. The interface allowed users to draw shapes on top of the stimuli and users were instructed to mark the highlights in this way. For each presented stimuli, the target glass was indicated to participants by overlaying the glass geometry (see figure above) unto the interface. Once users started annotating the geometry would no longer be visible.

RESULTS

Spherical glasses (e.g., wineglasses) in paintings typically display a highlight on the rim in the top-left, and one caustic reflection in the bottom right. Conical glasses (e.g., martini glasses) typically display a stretched highlight from the top to the stem of the glass. For photographs we found that the highlights varied much in location and pattern.



CONCLUSIONS

Here we only investigated spatial distributions of highlights, but this method can easily be extended for the study of additional features of highlight such as shape, size, orientation, sharpness or contrast, or even for non-highlight features such as transparency or viscosity. Nevertheless, by only using this annotational paradigm we uncovered a clear spatial pattern of highlights in paintings that is not found for natural scenes. The current study is limited to a relatively small section of glossy objects and a single feature of highlights, but already demonstrates the benefits of annotating image features within paintings. This method is promising to be extended to a broader range of materials and image features depicted within paintings and can lead to a better understanding of higher level (pattern) cues for convincing material communication.

REFERENCES

- Cavanagh, P. (2005). The artist as neuroscientist. Nature, 434(7031), 301–307.
- Di Cicco, F., Wiersma, L., Wijntjes, M., & Pont, S. (2020). Material properties and image cues for convincing grapes: The know-how of the 17th-century pictorial recipe by Willem Beurs. Art & Perception, 8(3-4), 337-362.
- Van Zuijlen, M. J., Lin, H., Bala, K., Pont, S. C., & Wijntjes, M. W. (2020). Materials In Paintings (MIP): An interdisciplinary dataset for perception, art history, and computer vision. arXiv preprint arXiv:2012.02996.
- Lin, T. Y., Maire, M., Belongie, S., Hays, J., Perona, P., Ramanan, D., Piotr & Zitnick, C. L. (2014). Microsoft coco: Common objects in context. In European conference on computer vision (pp. 740-755). Springer, Cham.

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