Wallpaper groups are a class of 17 distinct textures that resemble beautiful Victorian wallpapers and feature heavily in Islamic art. In each wallpaper group, unique combinations of symmetries tile the image plane, unlike the individual symmetries typically used in vision research. We show that the symmetry content of each texture is reflected in both brain activity and symmetry detection performance, indicating that the human brain encodes symmetries with a high level of precision. This opens new avenues for research on how symmetries in textures contribute to natural vision and may help explain the prevalence of symmetries in human artistic expression.

**Tweets**

1. New paper with @AlasdairClarke in Proceedings of the Royal Society B: Biological Sciences: “The human visual system preserves the hierarchy of 2-dimensional pattern regularity” (paper link) (1/8).
2. Symmetry is widely recognized as important for visual perception and is typically studied using patterns with reflection at a single image location. Wallpaper groups are a class of 17 distinct textures in which combinations of different symmetry types tile the image plane (2/8).
3. Wallpaper groups (<https://en.wikipedia.org/wiki/Wallpaper_group>) resemble beautiful Victorian wallpapers and feature heavily in Islamic art. They represent the complete set of possible symmetries in two-dimensional images (3/8).
4. Hierarchical relationships exist between group pairs based on the unique symmetry content of each group. We test the predictions that groups lower in the hierarchy should produce weaker brain activity and be more difficult to detect (4/8).
5. We show that the hierarchy is reflected both in brain activity measured using EEG and performance on a symmetry detection task, indicating that the human brain encodes symmetries in textures with a high level of precision and detail (5/8).
6. This is consistent with functional MRI data showing that rotation and reflection symmetries in a subset of the wallpaper groups are represented parametrically in several areas of human (<https://www.jneurosci.org/content/36/3/714.short>) and macaque (<https://www.biorxiv.org/content/10.1101/2021.03.13.435181v1>) visual cortex. (6/8).
7. Our results open the door for new avenues for further research on how symmetries in regular textures contribute to natural vision and may help explain the prevalence of symmetries in artistic expression throughout human history. (7/8).
8. We have more work underway using the wallpaper group stimuli, so stay tuned if you find them as interesting as we do! We would like to acknowledge our support, financial and otherwise, from @vistayorku, @CFREF\_APOGEE, @NSERC\_CRSNG, @NSF, @YorkUHealth and @CentreforVisio1 (8/8).