The wallpaper groups are a class of 17 regular textures that resemble beautiful Victorian wallpapers, and together represent the complete set of possible symmetries in images. Each group has a unique combination of symmetries, and there are hierarchical relationships between groups based on the symmetries. We show that this hierarchy is reflected both in brain activity and symmetry detection performance. These findings expand our understanding of symmetry perception by showing that the human brain encodes symmetries with a high level of precision and detail. This opens new avenues for research on how representations of regular textures contribute to natural vision.