Which properties determine the aesthetic preference for basic polygonal shapes?

Introduction
The Ancient Greeks were already interested in the aesthetic preference for simple polygon shapes. Famous examples are the Platonic solids. Motivated by his faith in the perfection of the world the philosopher Plato sought for the most perfect bodies of the cosmos. In his dialog Timaeus he considered the congruent regular polygonal faces triangle, square, and pentagon to be the basic units of which the five regular, convex polyhedra are constructed. These solids are highly symmetrical because of the congruent planes and edges with equal angles between them. These characteristics make them invariant against rotation and reflection and unique in their existence. Due to their symmetry, artists were fascinated by the solid’s aesthetic beauty for thousands of years.

Symmetry is one of the strongest predictors for aesthetical judgments in many fields and aspects of human vision. A large number of studies have shown that symmetrical visual stimuli are judged more positively than non-symmetrical stimuli.

Symmetry is also known as a fundamental aspect of the aesthetical principle of unity in variety. This principle states that beauty is conceived of as the equilibrium of the mutually counterbalanced factors unity (e.g. symmetry), and variety (e.g. complexity: Fechner, 1876). Later, this notion was transformed by Birkhoff (1932) and Eysenck (1941) into a mathematical formula to calculate an aesthetic measure.

Aim of the current study
– Investigation of the aesthetic preference for simple polygon shapes.
– Evaluation of objective aesthetic measures as predictors.
– Verification of symmetry in the context of aesthetic appreciation.
– Rotation of stimuli to test the stability of our findings.

Hypotheses
– Objective measures of aesthetics predict aesthetic preference for simple polygon shapes.
– A strong link between symmetry judgments and aesthetic judgments is expected.
– The objective measure of symmetry predicts subjective symmetry judgments.
– Rotation influences aesthetic and symmetry judgments significantly.

Stimuli
Based on the Platonic solids we used a black triangle, square, pentagon, and hexagon centred on a white background as stimuli (see Figure 1).

Methods

Objective measures
Birkhoff’s (1932) aesthetic value of polygons: Aesthetic value \( M_B \) is given by the ratio of order \( O \) and complexity \( C \) of an object:

\[
M_B = \frac{O}{C}
\]

Eysenck’s (1941) formula of aesthetic value: Eysenck modified Birkhoff’s formula as followed:

\[
M_E = O \times C
\]

Goodness of symmetry (Leeuwenberg, 1996): \( W \) reflects its detectability and can be quantified by a weight-of-evidence metric. \( n \) is the number of elements and \( E \) the number of non-redundant relationships between elements of a stimulus.

\[
W = \frac{E}{n}
\]

Procedure
– Pairwise comparison (online) of four fundamental polygons in upright (104 participants) or rotated (112 participants) orientation.
– Task: preference and symmetry judgments.

Data transformation
Preference judgments were scaled according to the Law of Comparative Judgment (Thurstone, 1927).

Results

– Aesthetic measure \( M_E \) can predict the right ordering of shapes but not the right intervals between these shapes (see Figure 2).
– \( M_B \) showed both wrong orderings and intervals between the shapes.
– Not strong connections between objective symmetry, subjective symmetry ratings, and preference ratings (see Figure 4 & 5).
– Goodness of symmetry cannot predict subjective symmetry ratings, both not for upright and slightly rotated single elements.
– Except for one reversal, rotation did not influence the ordering of aesthetic preference and symmetry ratings (see Figure 4 & 5).

References

Conclusion
Eysenck’s aesthetic measure predicts the order of aesthetic preferences for polygon shapes, but not the intervals between them. Consequently, other factors should be considered as well.

Although symmetry is important, it was no reliable predictor neither for aesthetic preference nor for symmetry judgments.

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