Effect of the 2D spectral distribution on visual aesthetic preference

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Introduction
Human observers aesthetically prefer images with amplitude spectral slope similar to that of natural scenes.
- The amplitude spectrum of natural images has a 1/f characteristics.
- Human observers have a peak aesthetic preference for images with intermediate amplitude spectrum slope value (near -1 to -1.5), and prefer images with either larger or smaller slopes less.

The spectrum slope of the images varies with orientation and the 2D spectral distribution is quite different for different categories of scenes (Torralba & Oliva, 2003).

Naturalness is an important image property to classify images (Baddeley, 1997; Oliva and Torralba 2001) and is related to aesthetic preference (Ho et al. 2014).

We investigated the relationship between (1) spectral distribution and aesthetic preference, (2) spectral distribution and naturalness, and (3) naturalness and aesthetics preference judgments.

Method
Examples of stimuli and their spectra

![Examples of stimuli and their spectra](image)

Test stimuli were scrambled grayscale images (8x8) with a predetermined 1/f amplitude spectrum.
- The predetermined shape of the amplitude spectral distribution was determined by a function of spatial frequency f and orientation θ,
\[
A(f, θ) = \frac{a + b \cos(2θ + \phi)}{1 + c \cos(2θ + \phi)}
\]

- Slope (α) at vertical/horizontal orientation: -2.5 to -0.5
- Slope difference (β) between oblique and vertical/horizontal orientation: -0.3 to 0.3

The observers pressed a key to indicate either the aesthetics value or the naturalness of the test stimuli on a 6-point Likert scale in separate rating sessions.
- There were 20 blocks in each rating session.
- Each block contained 26 types of images without repetition and were presented in random order.

Discussion
Human aesthetic preference not only depends on the amplitude spectral slope but also on the overall shape of the 2D spectral distribution.

The naturalness rating of the images also depends on both the averaged spectral slope and the shape spectral distribution, correlating with the preference judgment.

At the group level, the naturalness of the test images can be considered as a good indicator for visual aesthetic preference.

However, the individual difference indicates that other factors than naturalness might also involved.