What Visual Discrimination of Fractal Textures Can Tell Us About Discrimination Of Camouflaged Targets

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Most natural images have $1/f^{\beta}$ Fourier image statistics, a signature which is mimicked by fractals and which forms the basis for recent applications of fractals to camouflage. To distinguish a fractal camouflaged target (with $1/f^{\beta*}$ statistics) from a $1/f^{\beta}$ natural background (or another target), the exponents of target and background (or other target) must differ by a critical amount ($d\beta=\beta-\beta^*$), which varies depending on experimental circumstances. The same constraint applies for discriminating between friendly and enemy camouflaged targets. Here, we present data for discrimination of both static and dynamic fractal images, and data on how discrimination varies as a function of experimental methods and circumstances. The discrimination function has a minimum near $\beta=1.6$, which typifies images with less high spatial frequency content than the vast majority of natural images (β near 1.1). This implies that discrimination between fractal camouflaged objects is somewhat more difficult when the camouflaged objects are sufficiently similar in statistics to the statistics of natural images (as any sensible camouflage scheme should be), compared to the less natural β value of 1.6. This applies regardless of the β value of the background, which has implications for fratricide; friendlies and hostiles will be somewhat harder to tell apart for naturalistically camouflaged images, even when friendlies and hostiles are both visible against their backgrounds. The situation is even more perverse for "active camouflage". Because of perceptual system nonlinearities (stochastic resonance), addition of dynamic noise to targets can actually enhance target detection and identification under some conditions.