In everyday life we feel a direct and undeniable connection between attending to something and our clear awareness of it. Despite this there exist a variety of laboratory situations in which attention and awareness appear to diverge. One approach to clarifying our understanding of attention and awareness is to build models of their neural mechanisms. We designed a task that allows us to separate the effect of feature-based cueing from perceptual discriminability, which we consider proxies for attention and awareness respectively. Our model predicts the perceptual discriminability of patches of dots on two dimensions, contrast and coherence, based on the magnitude of the BOLD response in V1 and MT. We predict that cueing (a proxy for attention) is best modeled as a form of sensory enhancement, altering the response properties of voxels. We predict that perceptual discriminability (our proxy for awareness) is best modeled as a threshold function of the difference in response magnitudes, which we predict is an invariant process relative to sensory enhancement. Our modeling approach not only finds neural correlates of behavior but ensures that the variability and error in the behavior matches the magnitude of variance and error in the voxel responses. This approach can help us to elucidate the underlying neural mechanisms which drive these high-level cognitive processes.