

Abstract Submitted
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The evolution of lossy compression SARAH MARZEN, University of California, Berkeley, SIMON DEDEO, Indiana University, Bloomington — In complex environments, there are costs to both ignorance and perception. An organism needs to track fitness-relevant information about its world, but the more information it tracks, the more resources it must devote to memory and processing. As a first step towards an understanding of this tradeoff, we use rate-distortion theory to study large, unstructured environments with fixed, randomly-drawn penalties for stimuli confusion (“distortions”). We find that two different environments will have nearly identical rate-distortion functions (but very different codebooks) when distortions are drawn from the same distribution, suggesting an interesting weak universality. We further identify two distinct regimes for organisms in these structured environments: a high-fidelity regime where perceptual costs grow linearly with environmental complexity, and a low-fidelity regime where perceptual costs are, remarkably, independent of the number of environmental states. This last result suggests that evolution will drive organisms to the threshold between the high- and low-fidelity regimes. In dynamic environments of rapidly-increasing complexity, well-adapted organisms will find themselves able to make, just barely, the most subtle distinctions in their environment.

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