

Simple Algorithmic Principles of Discovery, Subjective Beauty, Selective Attention, Curiosity and Creativity*

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I postulate that human or other intelligent agents function or should function as follows. They store all sensory observations as they come—the data is ‘holy.’ At any time, given some agent’s current coding capabilities, part of the data is compressible by a short and hopefully fast program / description / explanation / world model. In the agent’s subjective eyes, such data is more regular and more *beautiful* than other data [2,3]. It is well-known that knowledge of regularity and repeatability may improve the agent’s ability to plan actions leading to external rewards. In absence of such rewards, however, *known* beauty is boring. Then *interestingness* becomes the *first derivative* of subjective beauty: as the learning agent improves its compression algorithm, formerly apparently random data parts become subjectively more regular and beautiful. Such progress in data compression is measured and maximized by the *curiosity* drive [1,4,5]: create action sequences that extend the observation history and yield previously unknown / unpredictable but quickly learnable algorithmic regularity. We discuss how all of the above can be naturally implemented on computers, through an extension of passive unsupervised learning to the case of active data selection: we reward a general reinforcement learner (with access to the adaptive compressor) for actions that improve the subjective compressibility of the growing data. An unusually large data compression breakthrough deserves the name *discovery*. The *creativity* of artists, dancers, musicians, pure mathematicians can be viewed as a by-product of this principle. Good observer-dependent art deepens the observer’s insights about this world or possible worlds, unveiling previously unknown regularities in compressible data, connecting previously disconnected patterns in an initially surprising way that makes the combination of these patterns subjectively more compressible, and eventually becomes known and less interesting. Several qualitative examples support this hypothesis.

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