Contribution ID: **7** Type: **not specified**

# Perceptual Compression of Evidence in Intuitive Model Selection

In order to survive, animals constantly face decisions between competing interpretations for noisy and sparse sensory data. In statistics this problem, known as model selection (MS), is typically tackled by balancing a model's goodness-of-fit with a penalty for its complexity. A similar preference for simpler models—a concept known as simplicity bias—has been observed in humans (Gershman & Niv, 2013; Genewein & Braun, 2014). Moreover, human MS strategies have been quantitatively described as a linear combination of the models Maximum Log-Likelihood (L) and terms penalizing model complexity, such as its number of parameters or dimensionality (D) (Balasubramanian, 1997; Piasini et al., 2025). To investigate how the dependence of human behavior on L and D changes with the amount of available data (N), we designed an experiment where 100 naïve participants had to infer the number of hidden generative sources in noisy datasets of variable size. In most theoretical MS frameworks the log-likelihood L (the weight of goodness-of-fit to sensory evidence) grows linearly with N, eventually outweighing D. Our analyses show that the balance between L and D in human strategies changes as well, favoring L as more data becomes available. However, the weighting of the likelihood exhibits sublinear rather than linear growth in N, resembling a logarithm. This observed compressive scaling closely aligns with the well-established sublinear perception of numerosity (Krueger, 1984). The presence of this nonlinearity suggests that intuitive MS potentially leverages lower-level cognitive processes. The departure from ideal normative behavior might therefore arise not from a fundamentally different strategy, but from limitations due to the repurposing of elementary cognitive functions.

**Primary authors:** RINALDI, Francesco Guido (International School for Advanced Studies (SISSA), Trieste, Italy); PIASINI, Eugenio (International School for Advanced Studies (SISSA), Trieste, Italy)

**Presenter:** RINALDI, Francesco Guido (International School for Advanced Studies (SISSA), Trieste, Italy)

**Session Classification:** Contributed Talk