NEURAL INFORMATION PROCESSING SYSTEMS

Early visual degradation scaffolds hierarchical representations

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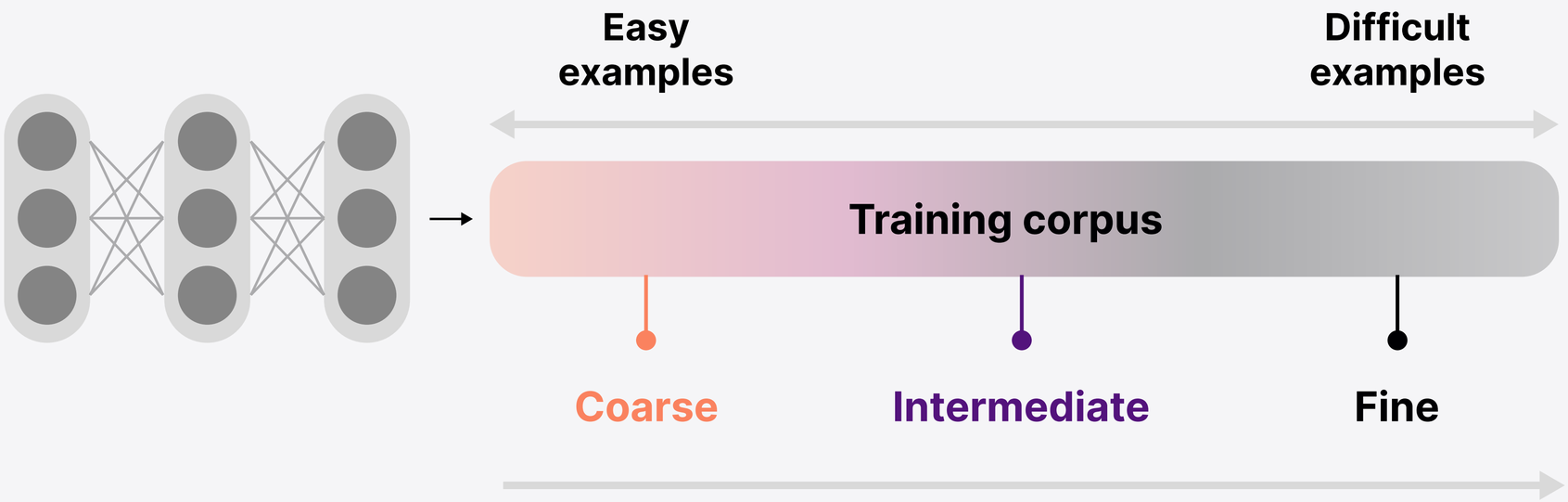
Jeonghwan Cheon[1], Marin Vogelsang[2], Lukas Vogelsang[2], Pawan Sinha[2]

[1] Independent Researcher,
[2] Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology

Curriculum learning

Curriculum learning trains models by presenting examples in a structured order, typically from easy to difficult.

Bengio 2009



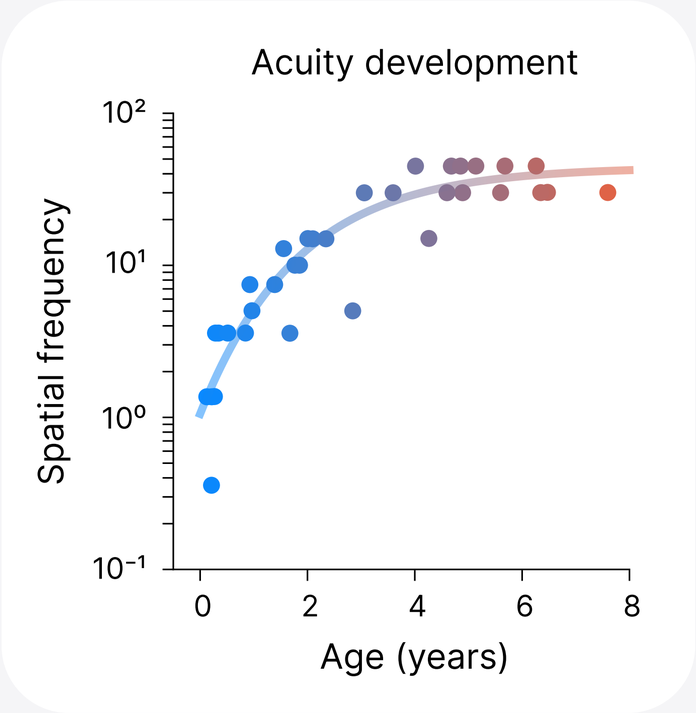
Ren 2018, Stretcu 2020

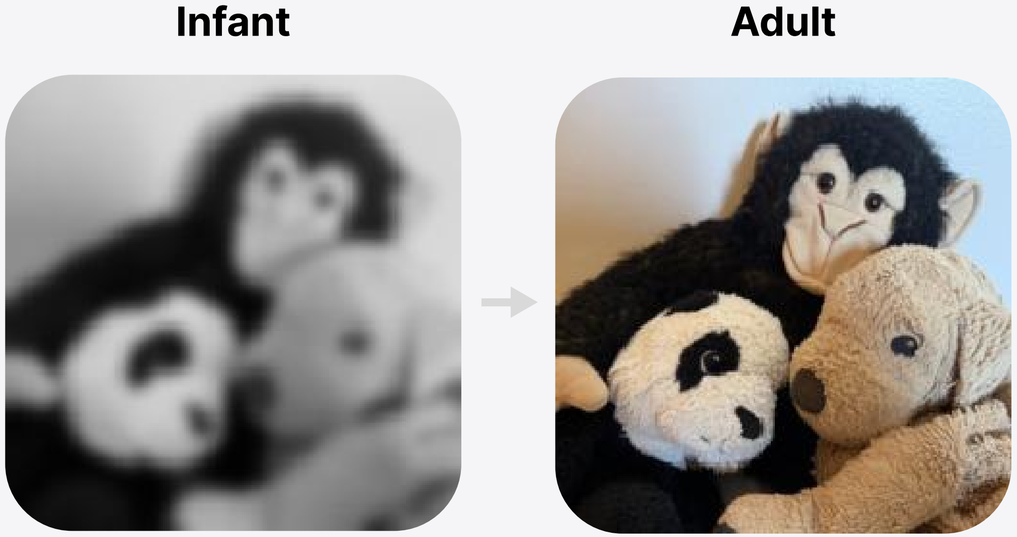
Hypothesis

Perceptual development

02

Developmental visual constraints can induce an implicit curriculum without externally prescribing the order in which categories are learned.





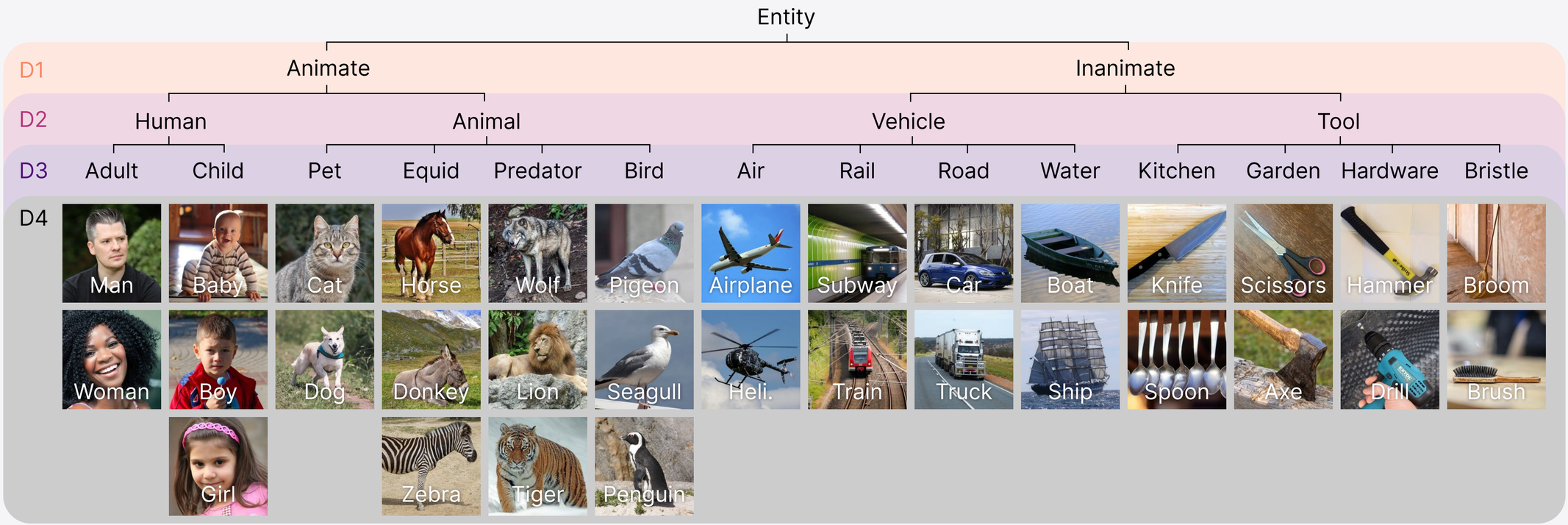
Atkinson 1977, Braddick 2011

Setup

Semantic taxonomy

03

We measure abstraction with a four-level (D1–D4) probing taxonomy,
ranging from the coarse animate–inanimate distinction to individual object concepts.

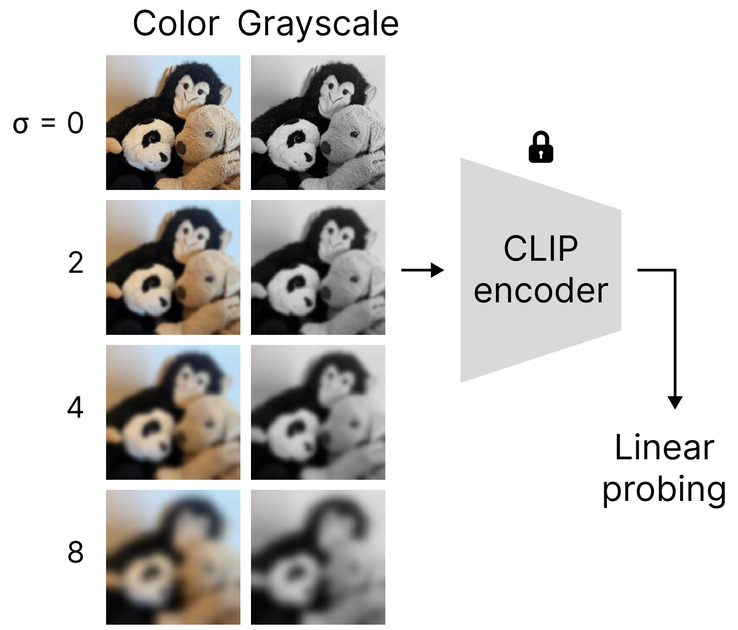


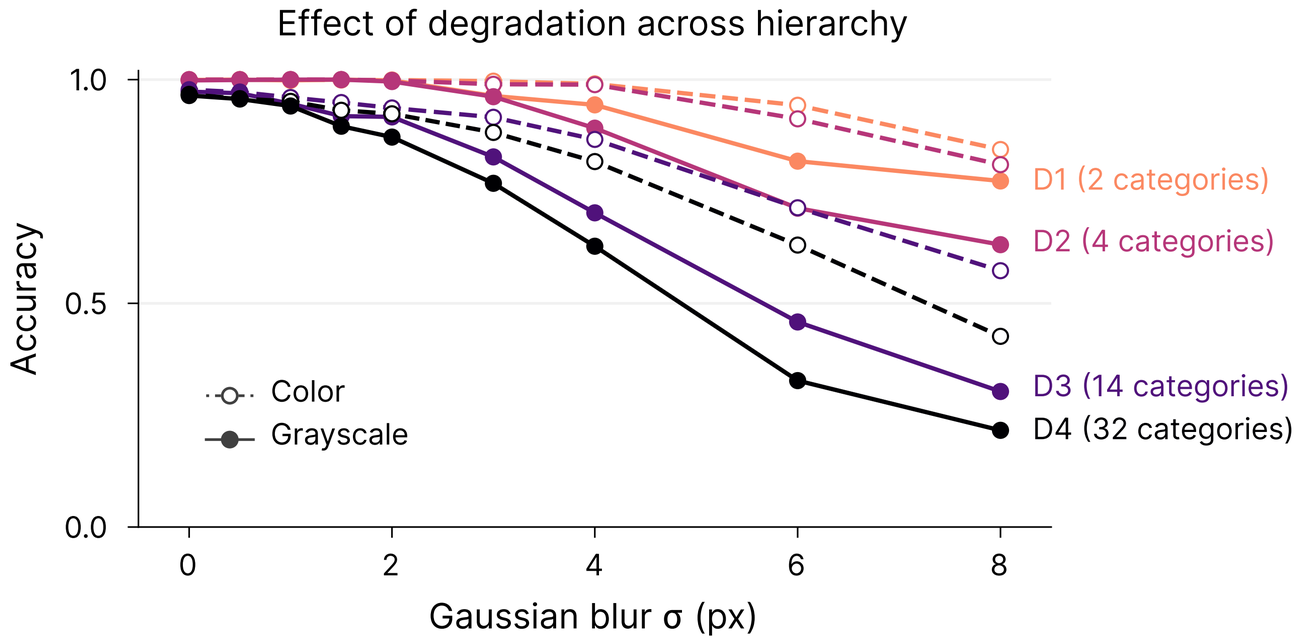
Results

Hierarchy-dependent effects of visual degradation

04

Visual degradation preferentially impairs discrimination of finer categories while largely preserving coarse ones.



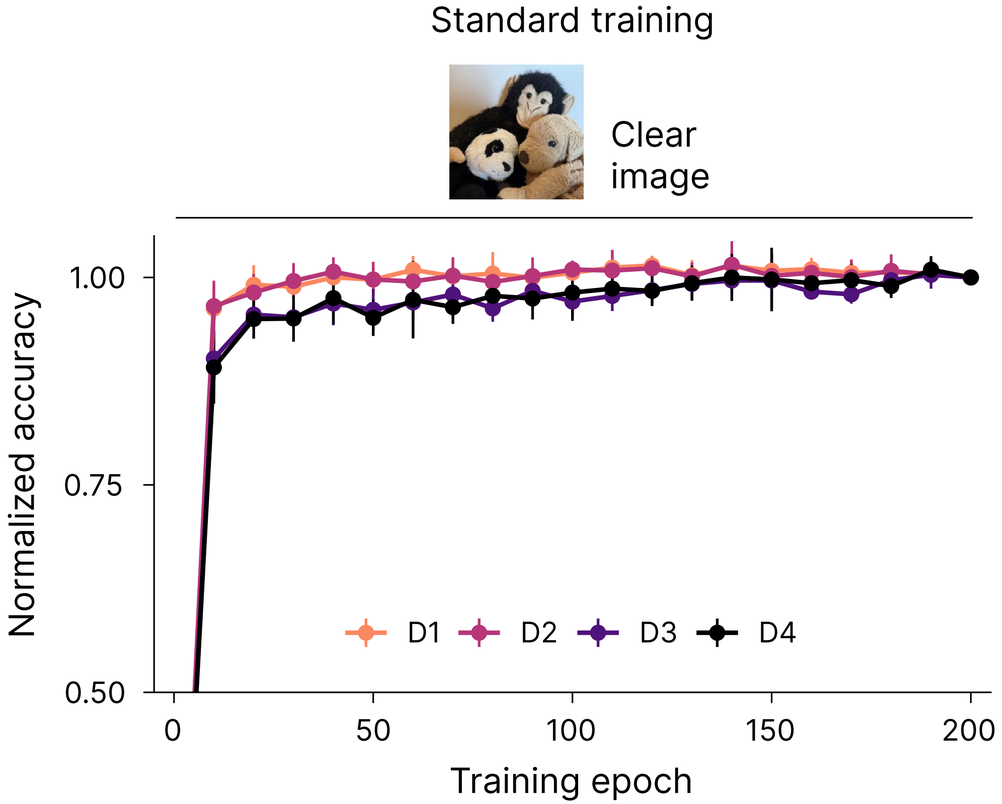


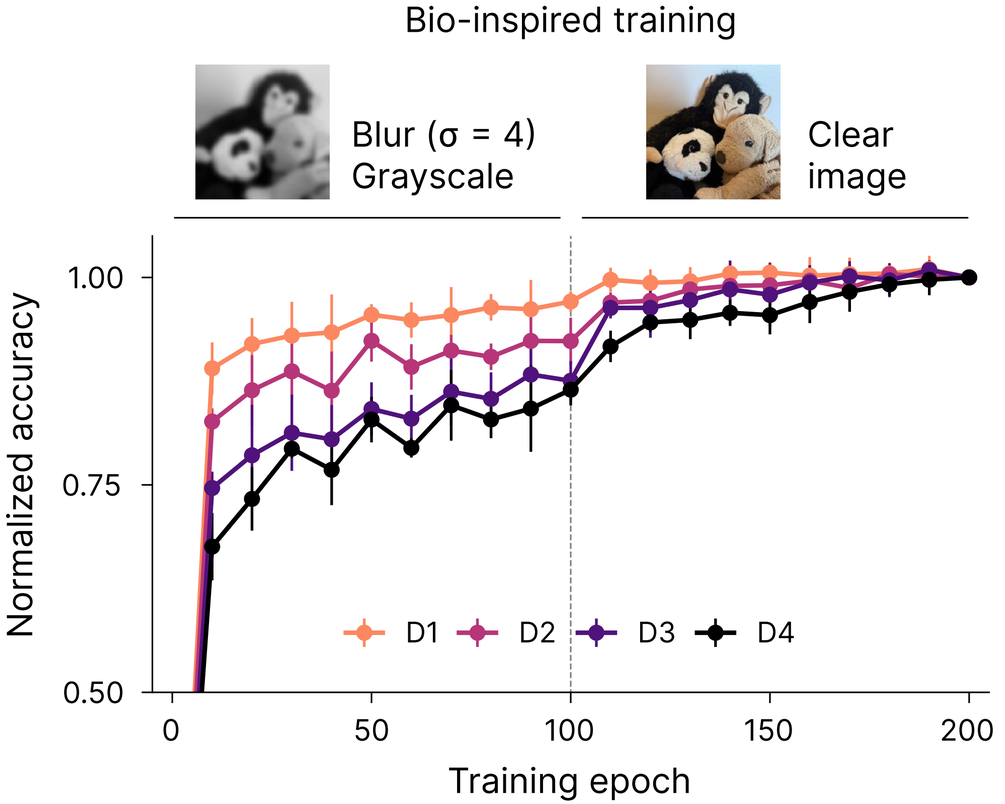
Results

Emergent coarse-to-fine curriculum

05

Transitioning from blurred grayscale images to clear color images induces an implicit coarse-to-fine learning trajectory.



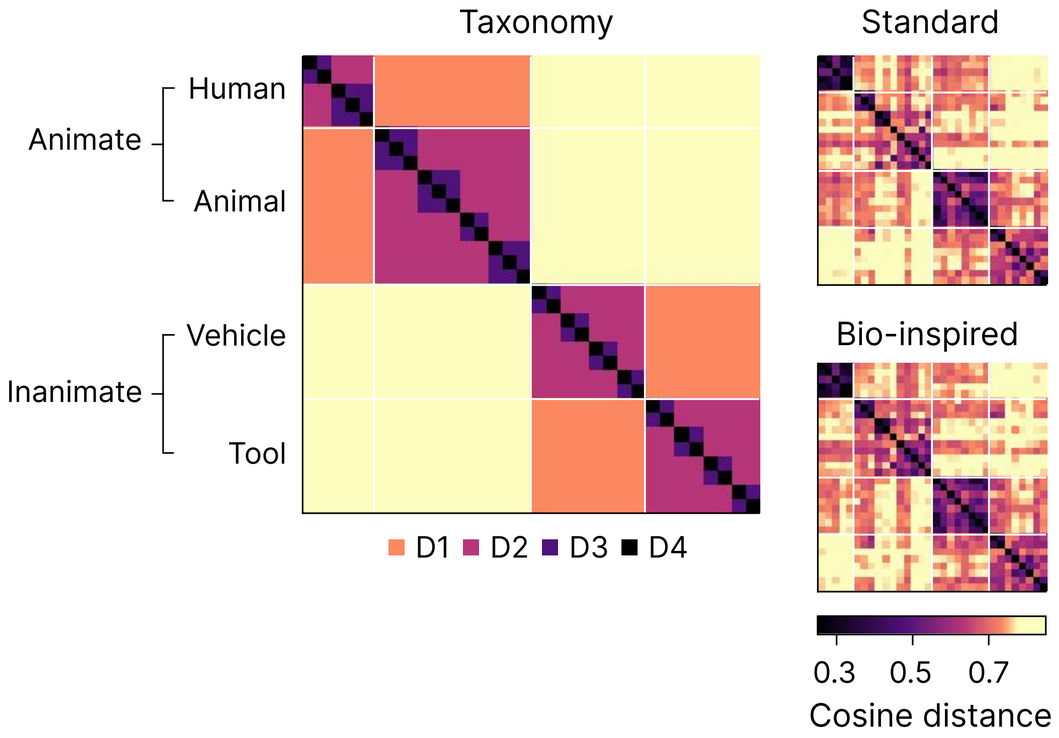


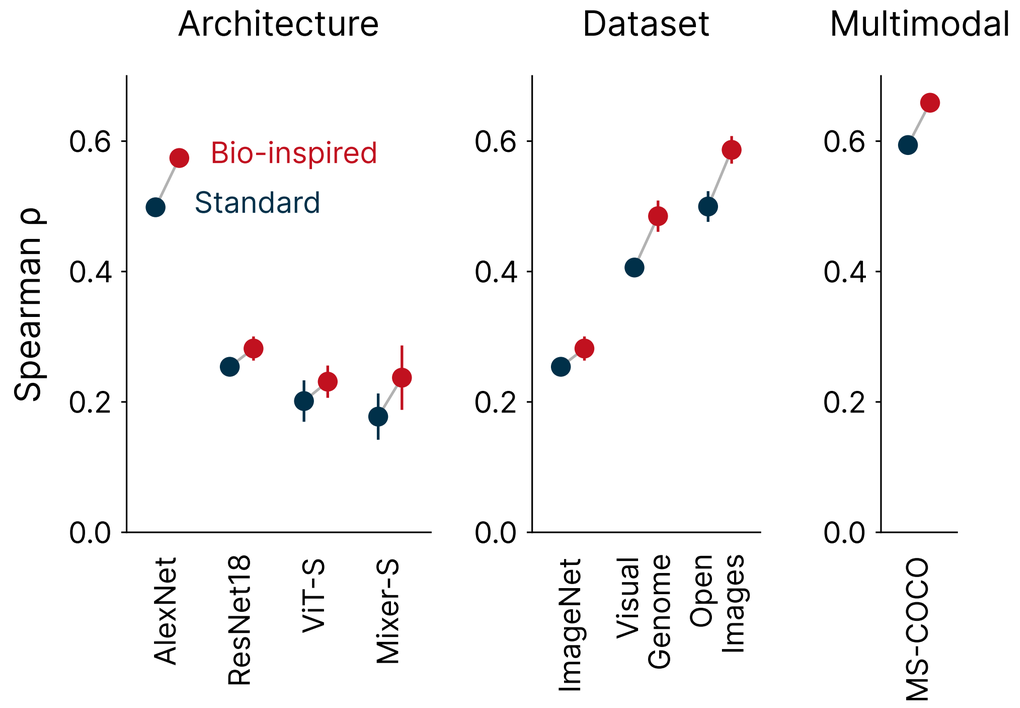
Results

Bio-inspired training enhances hierarchical alignment

06

Bio-inspired training produces visual representations that better reflect semantic taxonomic structure.





Takeaway

Developmental visual constraints guide
implicit coarse-to-fine category learning
and foster hierarchically organized representations.

