Self-Directed Learning in Online Laboratory

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Background

Self-directed online learning has become increasingly prevalent in recent years.

Autonomy
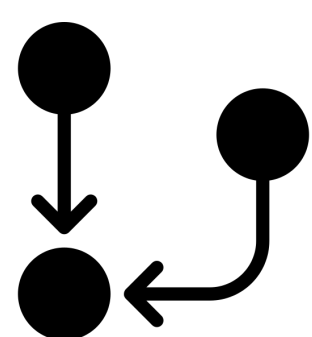Learning without any instructor, syllabus, or mandate

Learner-Centered
Informal learning by asking, answering, and learning at the discretion of the learners outside classroom settings

VERA, Online Laboratory

VERA supports self-directed online learning through ecological modeling.

Enables learners to construct conceptual models of ecological systems and run interactive model simulations, which Allows learners to explore ecological systems and perform what-if experiments
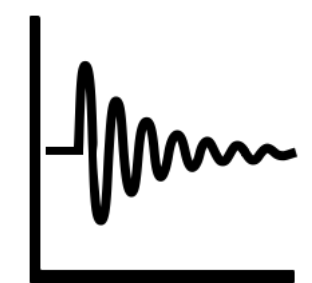
Retrieves species information from EOL (Smithsonian's Encyclopedia of Life) to populate the conceptual models. EOL provides direct access to VERA through its website.
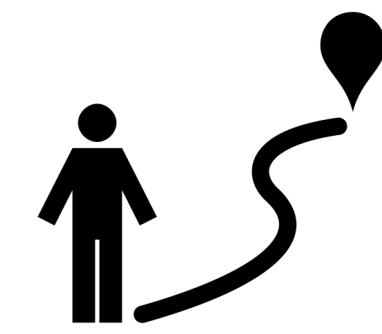
Learning Analytics in VERA

VERA has been publicly available since 2018 and has attracted many self-directed learners around the world.

Research Question

How can we understand how people learn in a self-directed manner using their log data in VERA ?
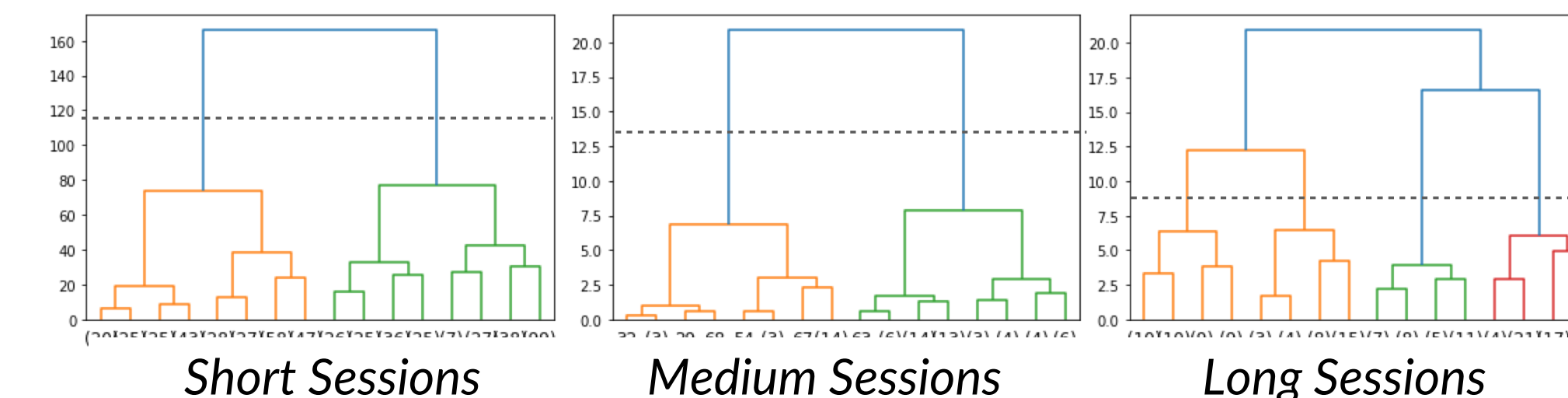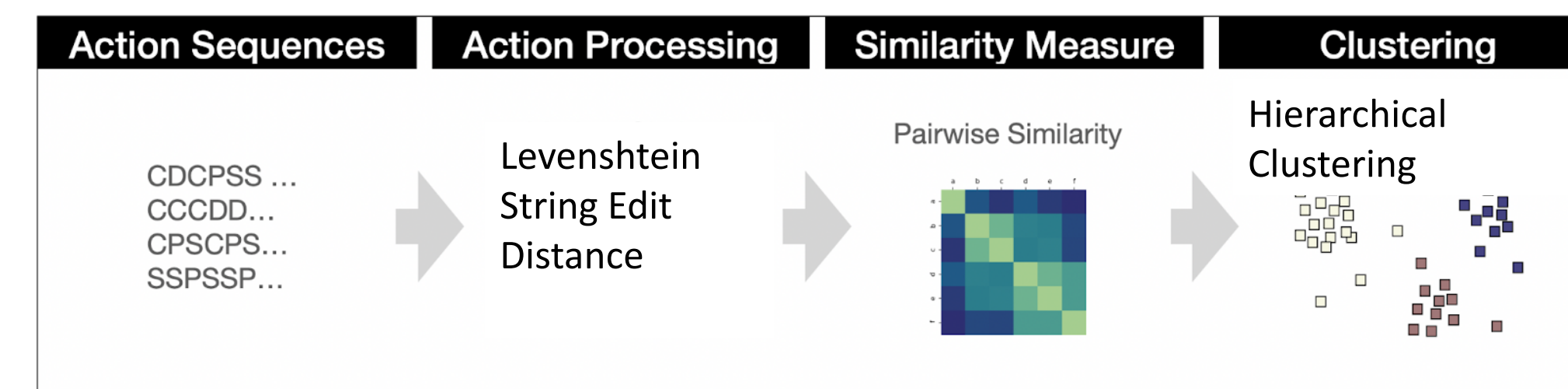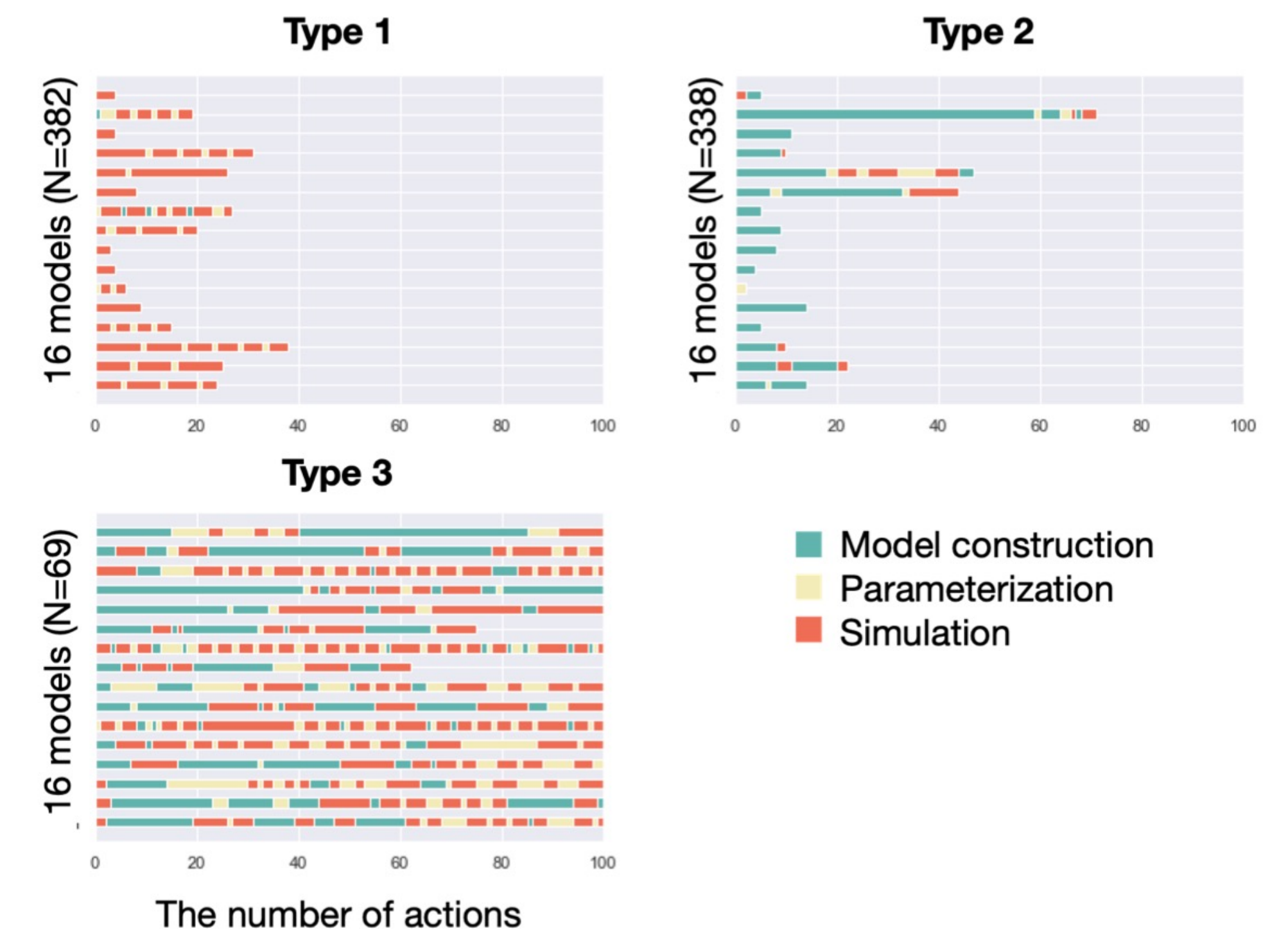
Data

Behaviors and Outcomes
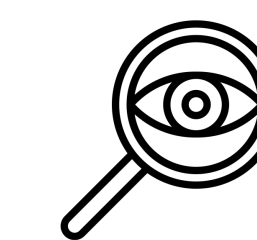
No Learning Goals, Demographics, nor Assessments

Method

We analyzed the modeling behaviors of 315 learners and 822 instances of learner-generated models.

Action Sequences	Action Processing	Similarity Measure	Clustering
CDCPSS ... CCCDD... CPSCPS... SSPSSP...	Levenshtein String Edit Distance	Pairwise Similarity	Hierarchical Clustering

Short Sessions   *Medium Sessions*   *Long Sessions*

Behavior Clustering

- Model construction
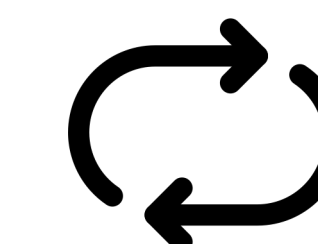- Parameterization
- Simulation

The number of actions

Findings

Large-scale domain knowledge helped learners build more complex ecological conceptual models (An et al., 2020 at AIED)
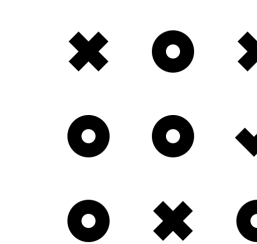
More successful students engaged in more productive behaviors (e.g., less repetition, systematic search) (An et al., 2021 at ITS)

More engaged learners display the full cycle of exploratory behavior consisting of model construction, parameterization, and simulation (An et al, 2022 at AIED)

Acknowledgements

Smithsonian · Encyclopedia of Life · dilab design intelligence laboratory · Georgia Tech · IBM · SOUTH BDHUB · NSF