Surveying early warning signals of transitions using a large-scale collaborative experiment

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A model system enables new insights into collective behavior

Humans form collaborative groups to achieve collective goals, and conflict arises between groups with differing goals. Conflicts between groups can arise as transitions, or regime shifts, where control of a resource or territory passes from one group to another.

Determining the mechanisms that drive transitions in a simple, “painful” online experiment can help us begin to understand collective behavior in real-world social systems.

Finding early warning signals of transitions in a large, comprehensive dataset could enable us to deduce generic knowledge of early warnings applicable to various socio-ecological systems.

Transitions can be identified using many variables

We characterize transitions using the fraction of pixels ($f_{\text{trans}}$) that differ from a 3-hr sliding reference image. A transition is identified when $f_{\text{trans}} \geq 0.4$ close after a 2-hr stable ($f_{\text{trans}} < 0.15$) period.

Finding early warning signals of transitions with machine learning

At each timestep, we aim at predicting the time of the next transition, which we call a transition. We use machine learning to capture the power of early warning signals with variables.

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We manage to detect half of transitions arriving within 20 minutes with only 1% of false positives.

Future work

Understanding global trends through statistical mechanics

Can we model the dynamics of the whole canvas thanks to thermodynamic analogies (temperature/density) vs. correlation length?

Can it help to understand emergent patterns and larger-scale transitions?

The effect of organizational structure on composition dynamics

How does the emergent social structure (bottom-up, top-down, or a more complex hierarchy) impact the formation and stability of compositions?

Is external communication and vertical organization (in Reddit subreddits) necessary for effective collaboration?