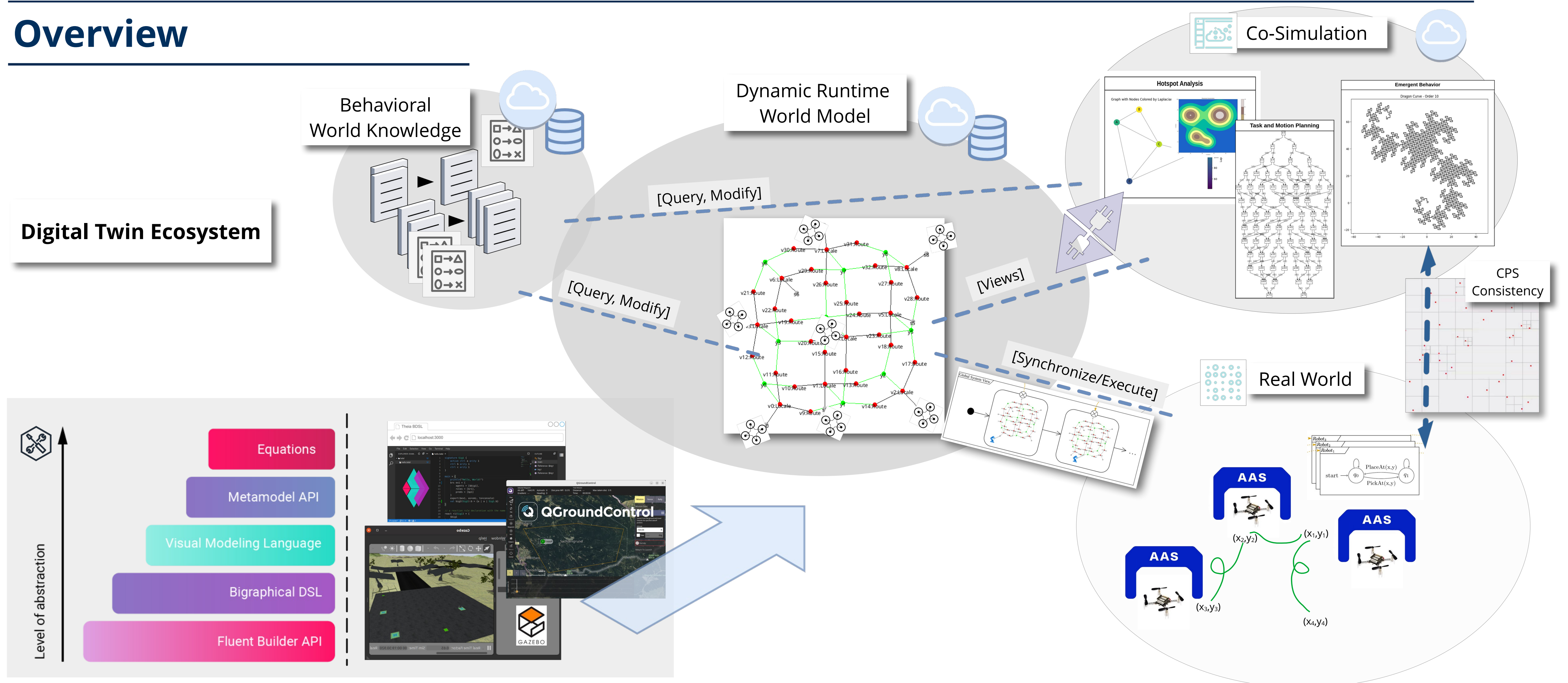


Programming Drone Collectives: Towards Safe Plug-and-Play Modularity

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Overview



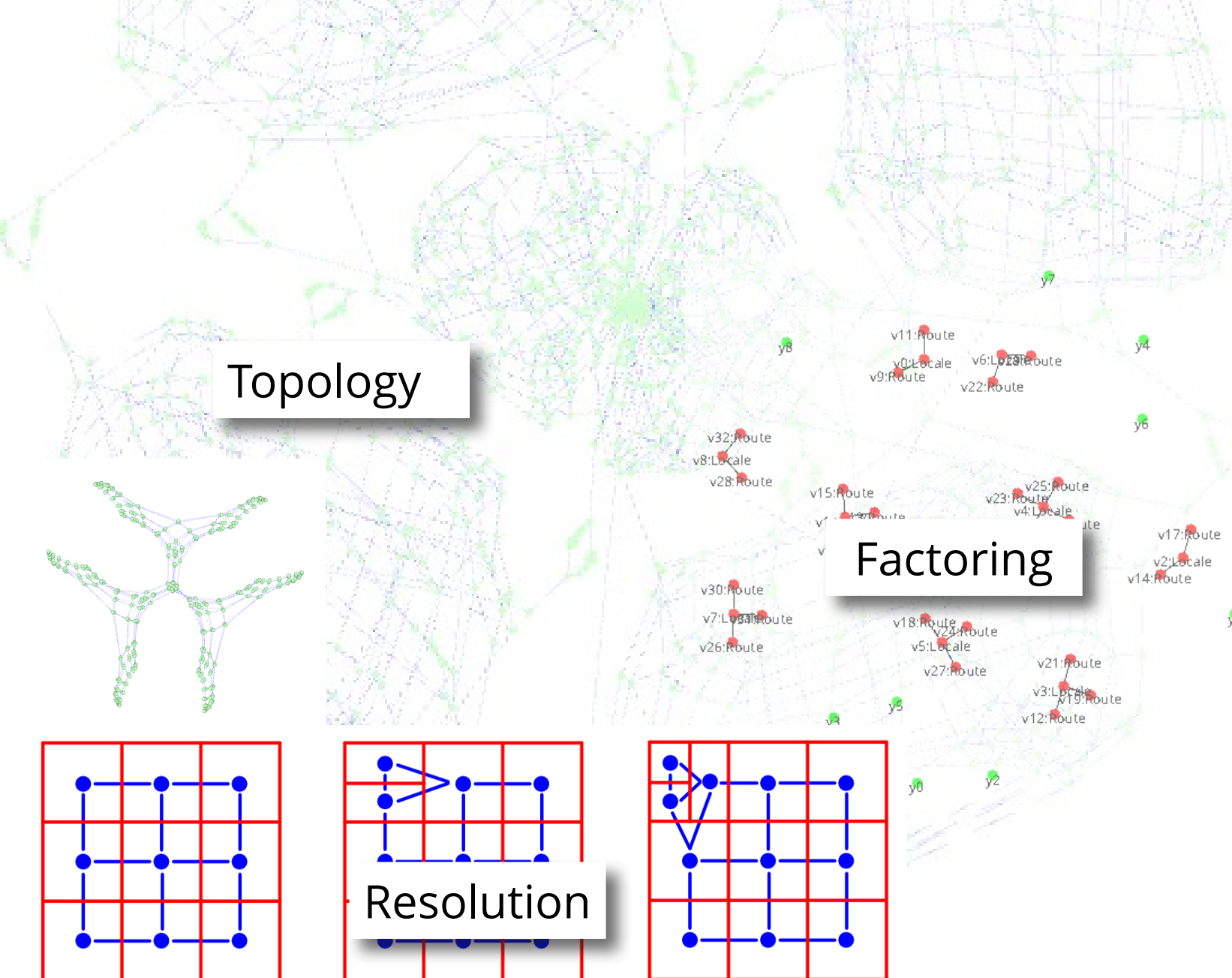
Spatio-Temporal Computing

A **Formal** yet **Practical** Model-first Approach (Graph-theoretical, Rule-based Language)

Movement, Interaction, Failure Handling and **Program Composition** are First-Class Citizens

Program Analysis and **Learning** at Design and Runtime

Designed for **Meta-Interoperability** and **Programmability**



Practical Digital Twins

Start Over Safely: Stepwise Prototyping w/ Validation, Co-Simulation, and Runtime Verification [6,2,3]

Reasonable Complexity: eXplainable Programs [5], Separation of Concerns, Multi-View Queries

Scales Horizontally and Vertically for Free: Collision-freeness, Auto-parallelization, Program Composition, Abstractions for Emergent Programming

Modern: Open-Source, Ready for IDTA AAS, Fully Interoperable, Fast

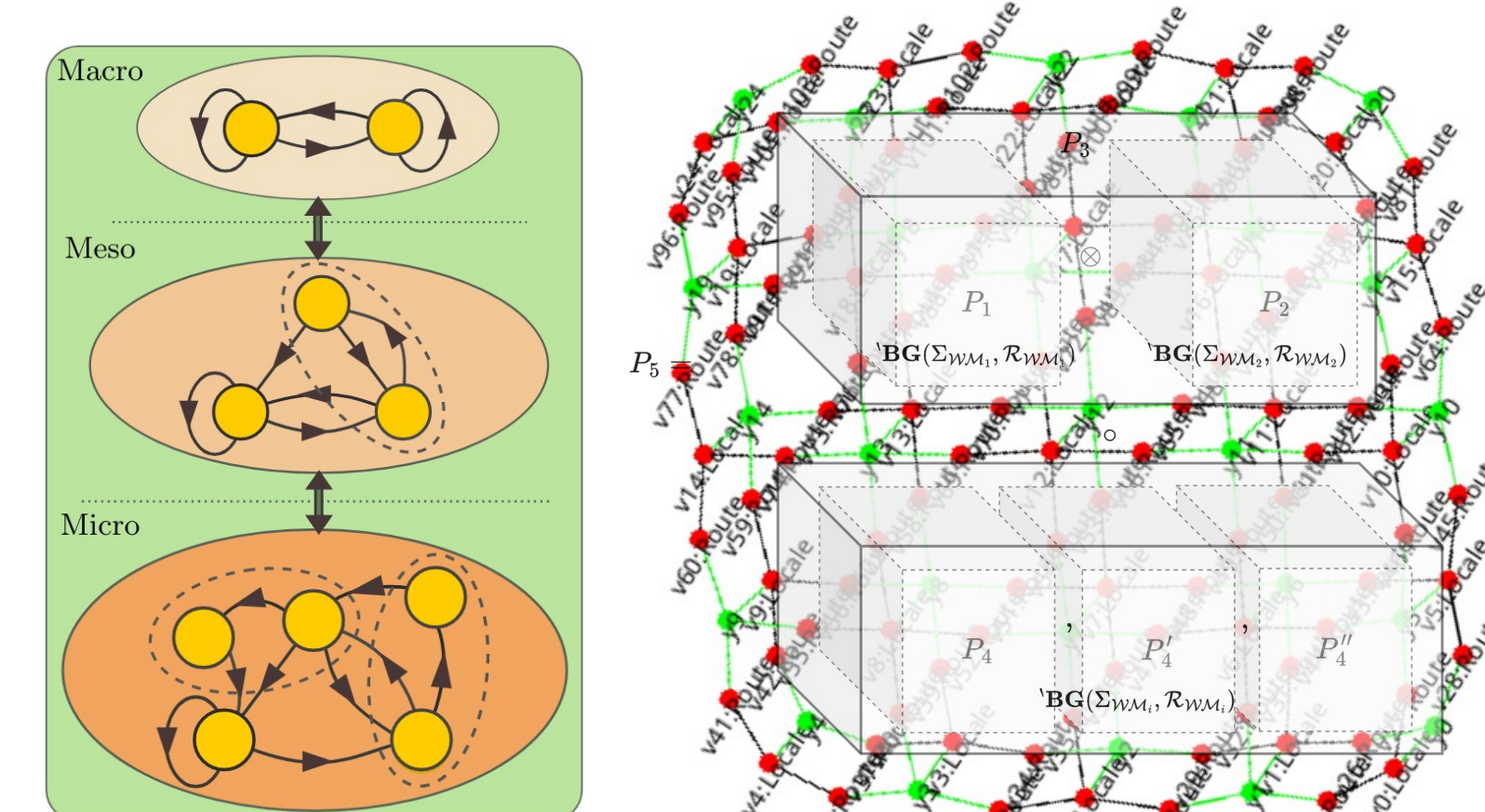


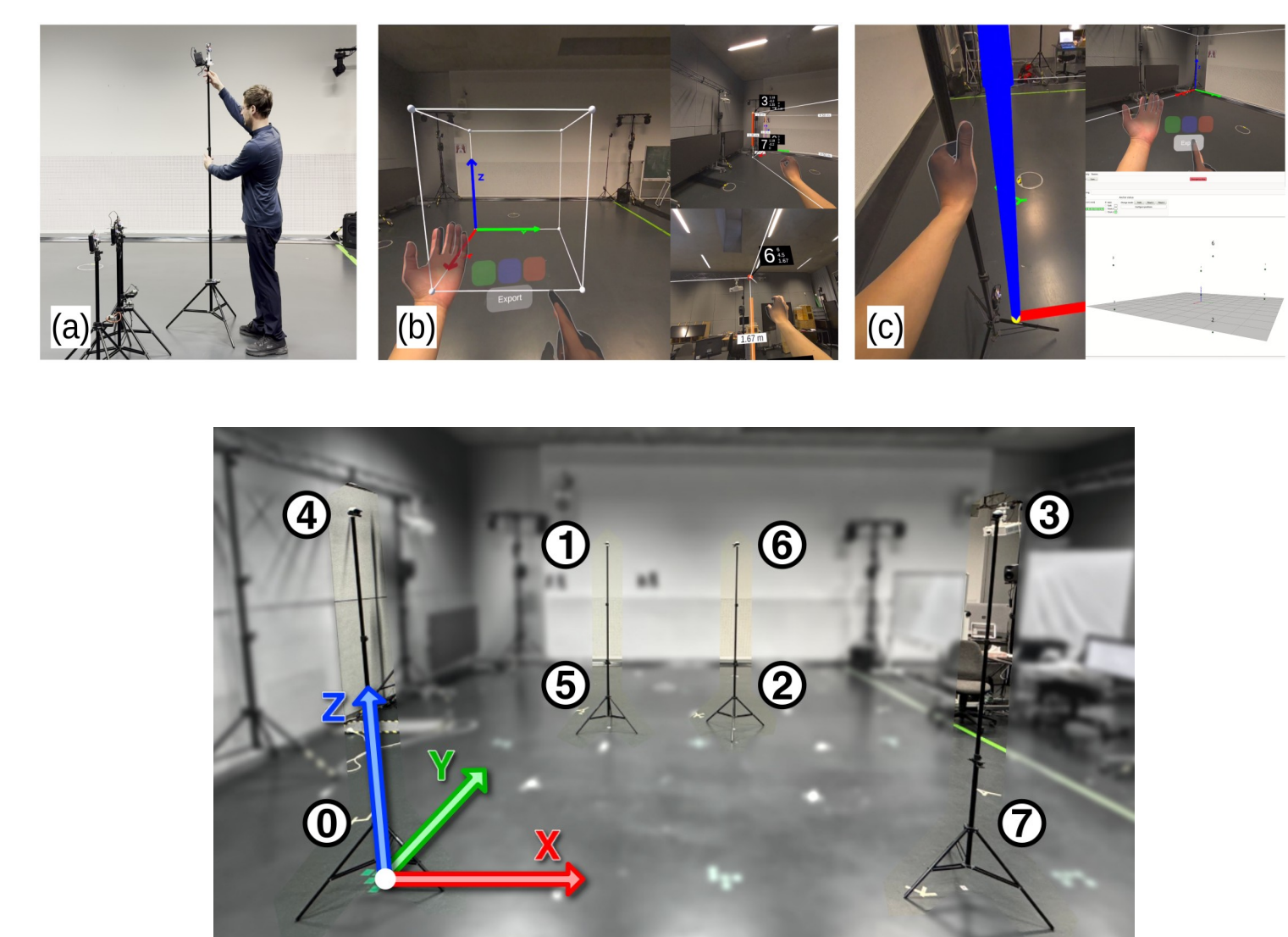
Fig. 1: Multilevel analysis / Emergent Behavior

Case Studies

Cyber-physical Spaces: Configuration and Deployment [7]

Drone Collectives: Adaptive formations using bigraph-based motion planning [1]

Modular and Interoperable Toolchains [4]



Figures:

Fig. 1: Spatio-Temporal Program Coordination Problem. Mixture of own work and "FIG. 5. Multilevel analysis via ϵ -machines." from F. E. Rosas et al., "Software in the natural world: A computational approach to hierarchical emergence." arXiv, Jun. 05, 2024. doi: 10.48550/arXiv.2402.09090.

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