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Detailed analysis of division of labor using long-term tracking

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Division of labor is a fundamental feature of insect societies and thought to play a major role in the ecological success of social insects. Despite the absence of centralized control, insect colonies must constantly adapt to environmental changes through dynamical transitions between the tasks performed by the workers. To decipher the mechanisms regulating division of labor we study the queenless clonal ant *Cerapachys biroi*, whose unusual biology allows us to set up large numbers of experimental replicate colonies of arbitrary size, genetic composition and demographic structure under controlled laboratory conditions. We built a custom video tracking setup, designed to be affordable and versatile. This setup allows us to track individual ants tagged with simple color marks for up to six weeks, and to measure individual behavior as well as interactions between workers. Dimensionality reduction schemes are then applied to the behavioral trajectories to extract the relevant tasks and to measure transitions between these tasks. This approach enables us to quantitatively describe how division of labor changes over time and to understand how interactions between individuals affect task allocation. The unique experimental control provided by the study system allows us to directly compare the social organization of replicate colonies and to obtain a statistical description of division of labor and its plasticity. The next step will be to perform manipulative experiments where division of labor is perturbed and its adaptation measured. For instance, how does a colony respond to the sudden replacement of foragers by nurses and vice-versa? And how does this dynamical adaptation depend on the demography and genetic composition of a colony?