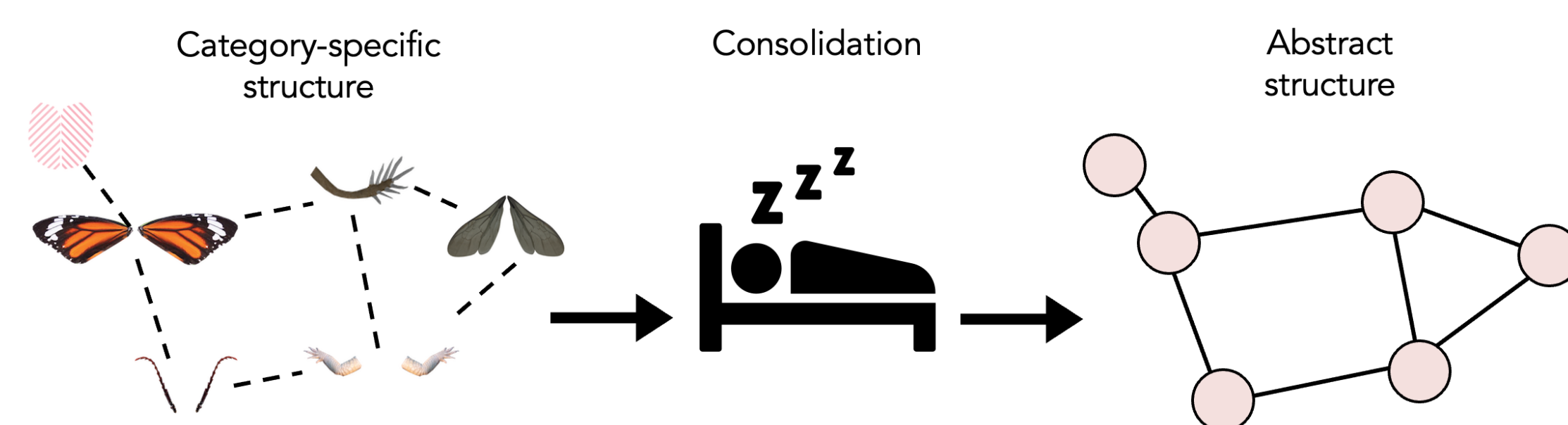


Memory reactivation during sleep facilitates abstraction of category structure

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Introduction

- Successful learning involves the generalization of details into an abstracted format that can be applied to new situations, and sleep has been hypothesized to play a role in this process.
- Previous work has found evidence of structure transfer learning in a non-semantic task after a 1-day delay¹.
- Does learning a novel category with a particular structure facilitate the learning of a second category defined by the same structure and non-overlapping features? If so, does this structure abstraction happen immediately, after a delay, or after reactivation of the first category during sleep?



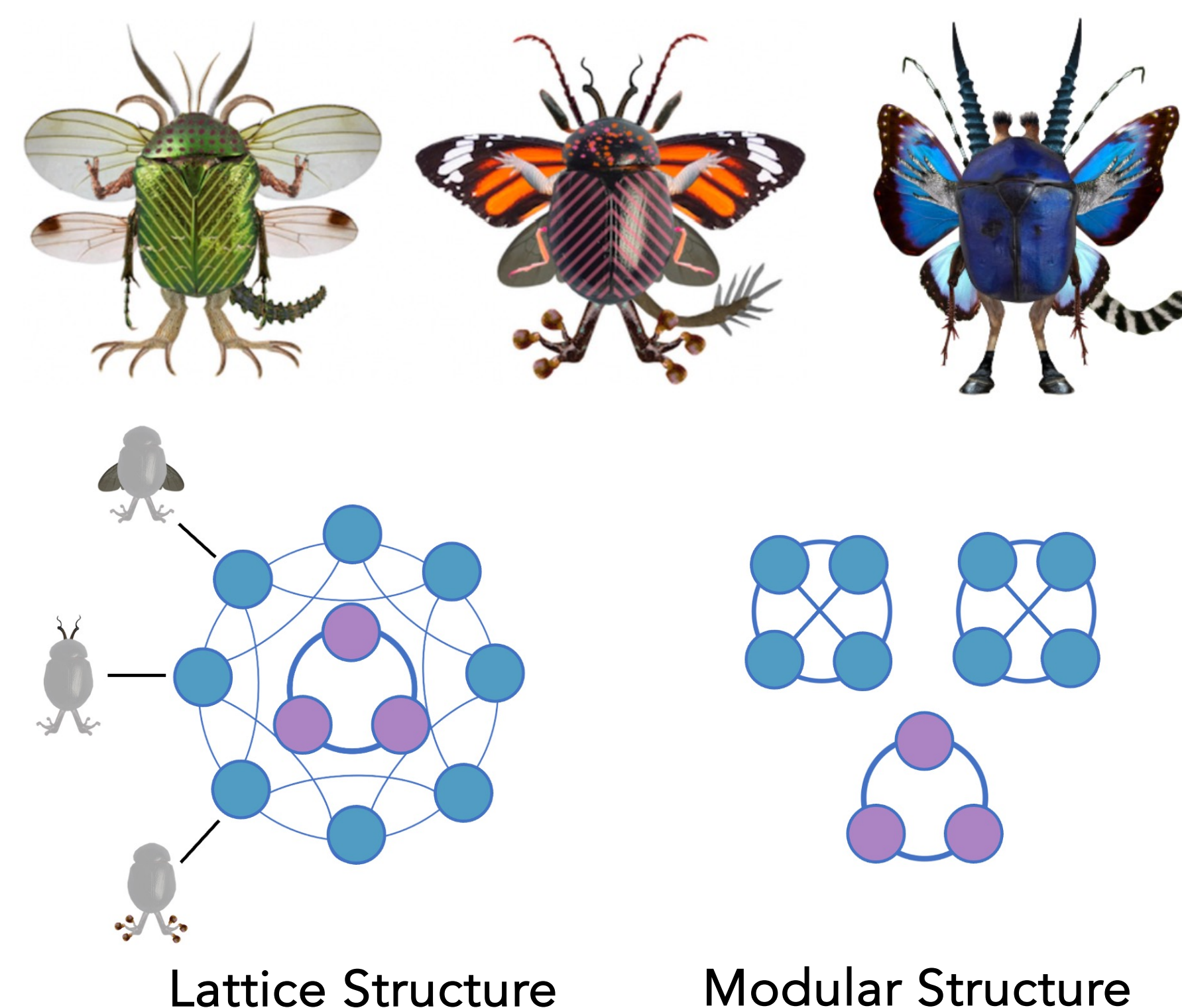
Category Design

Category features:

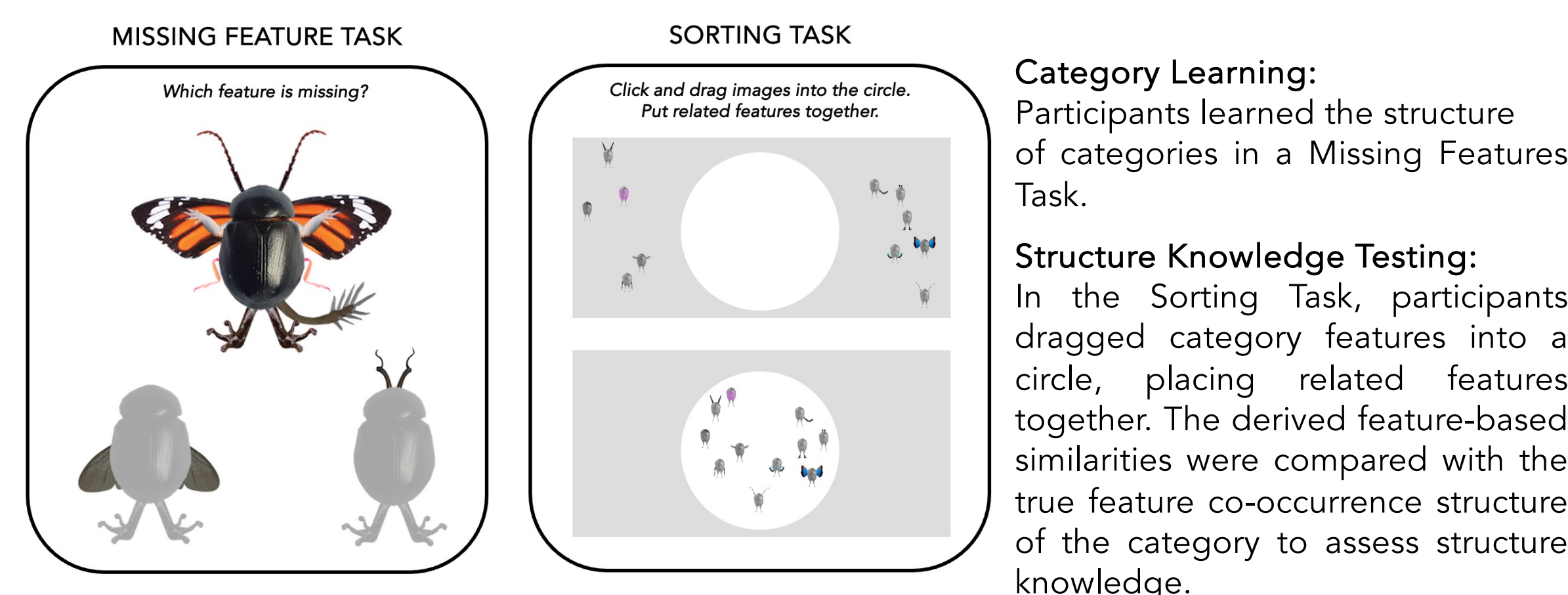
Three novel insect "species" were used, each containing 11 discrete features that could either be present or absent on specific exemplars (*top*).

Category structures:

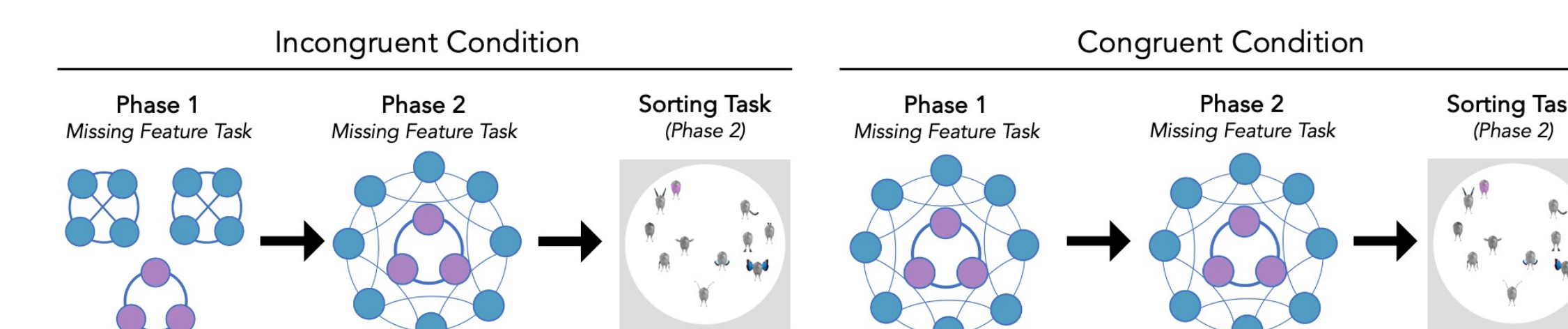
Each species was assigned to either a Modular or Lattice structure that determined the patterns of feature correlations within each resulting category. Assignment of species to structure, and features to structure nodes, was randomized for each participant (*bottom*).



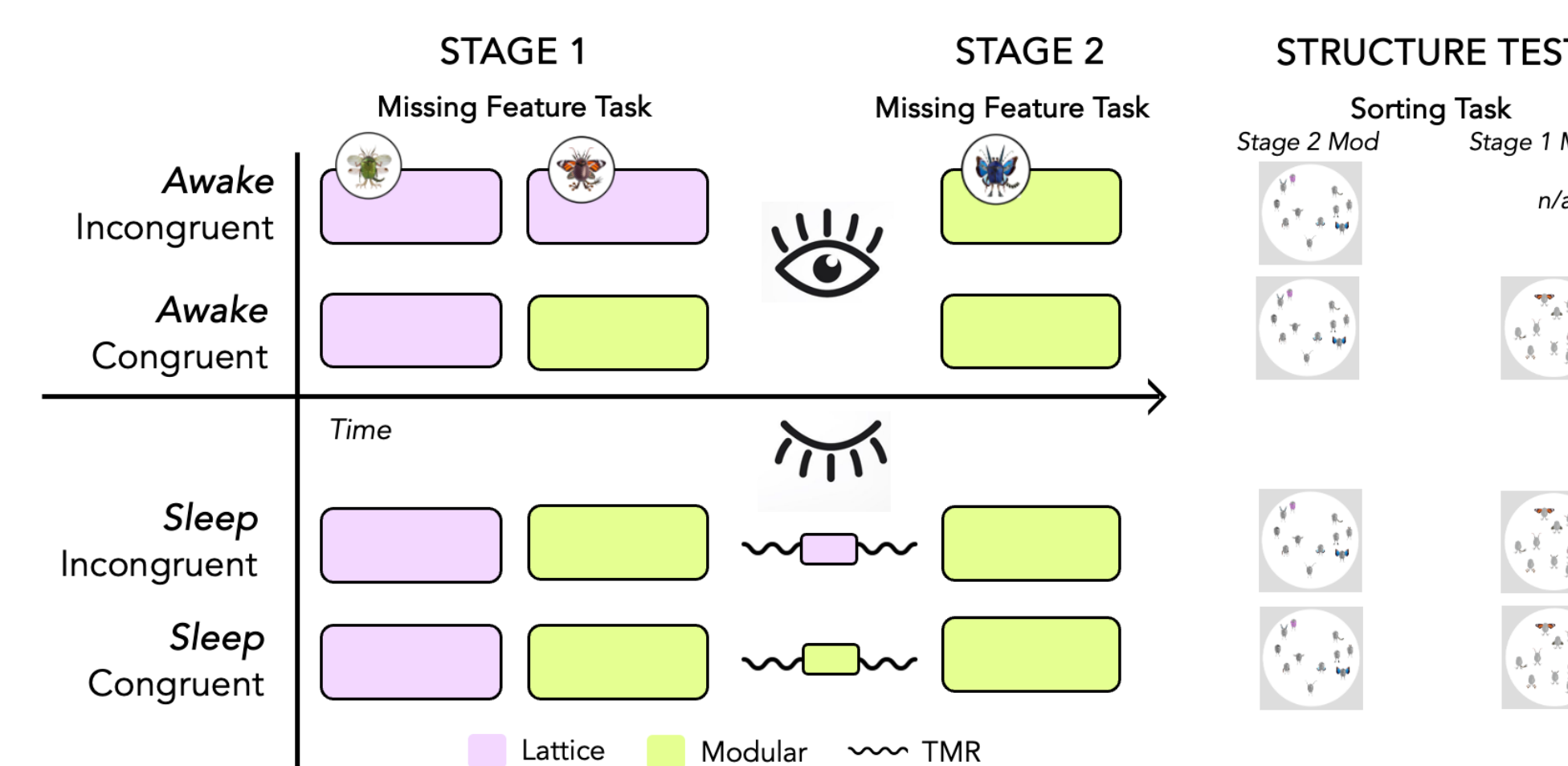
Tasks and Experimental Design



Exp 1: Testing immediate transfer

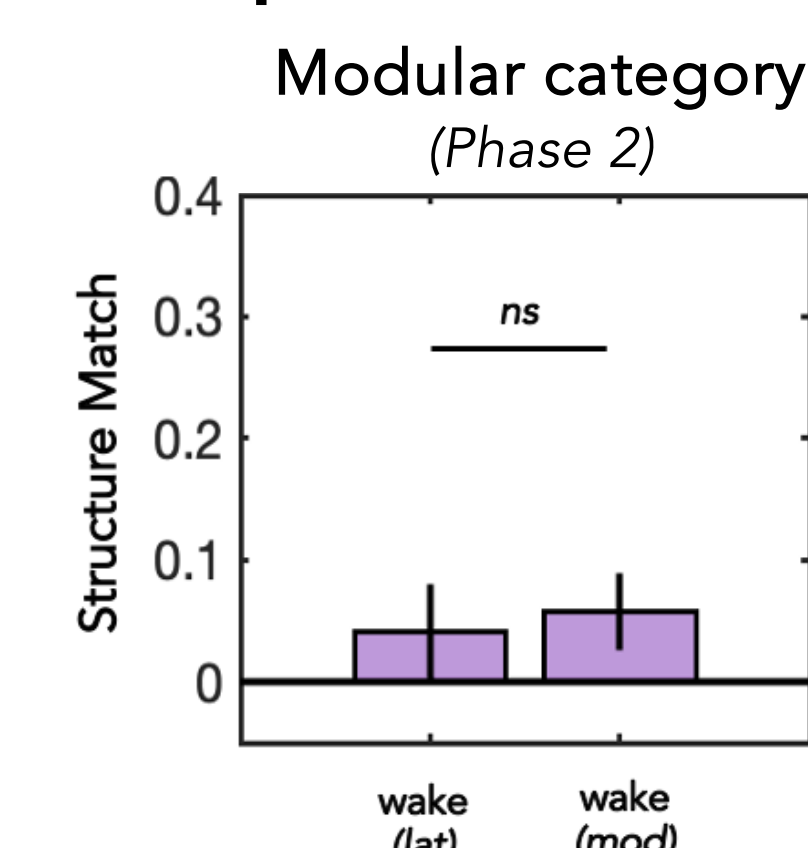


Exp 2: Testing transfer after sleep and TMR



Participants in the sleep condition were given a 2-hour nap opportunity while EEG data were collected. TMR was used to encourage reactivation of either the Lattice (incongruent) or Modular (congruent) category during sleep: we replayed insect-related sounds that were paired with the categories in the Missing Feature Task in Stage 1.

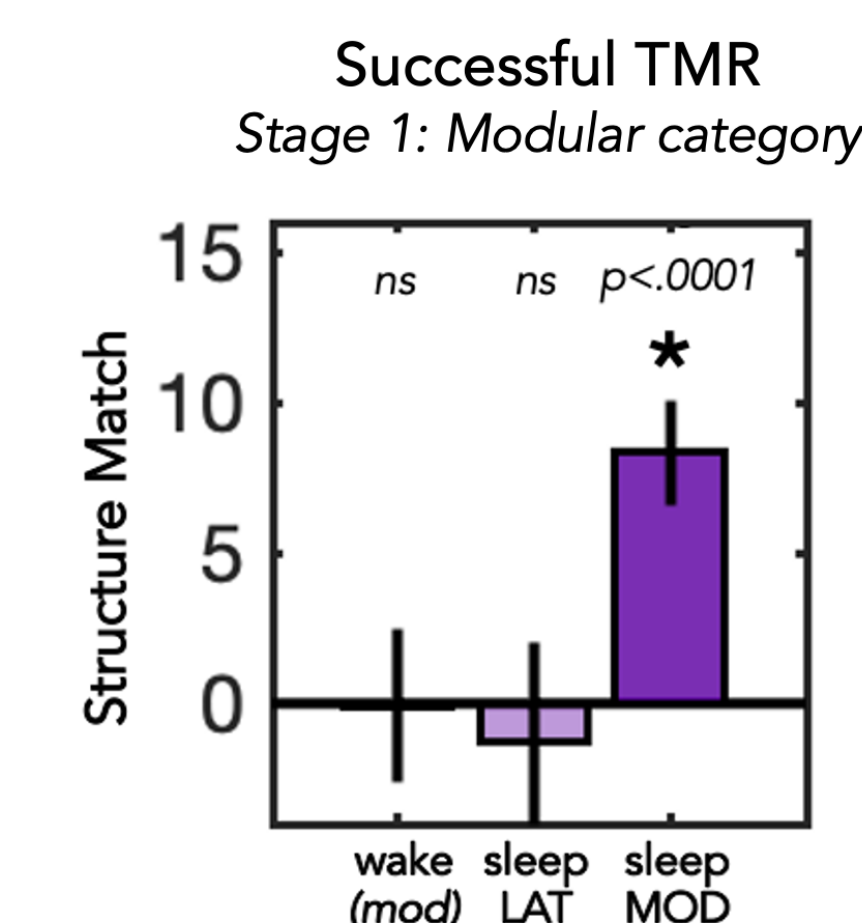
Exp 1: behavioral study results



Immediate transfer of category structure was not observed in Experiment 1. Learning a Modular category in Phase 1 did not facilitate learning of another Modular category in Phase 2.

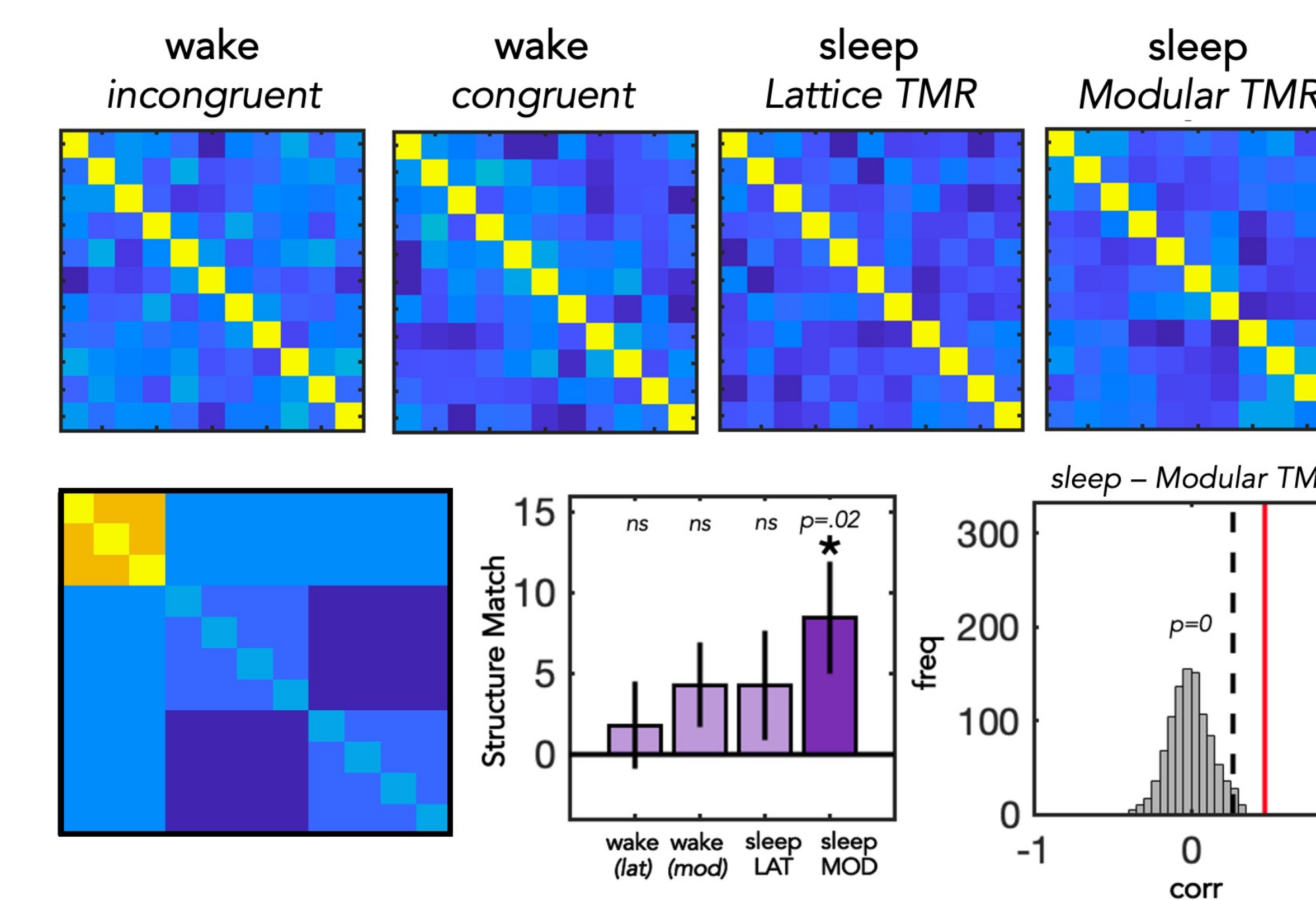
Does abstraction of category structure rely on a period of rest or sleep?

Exp 2: sleep study results

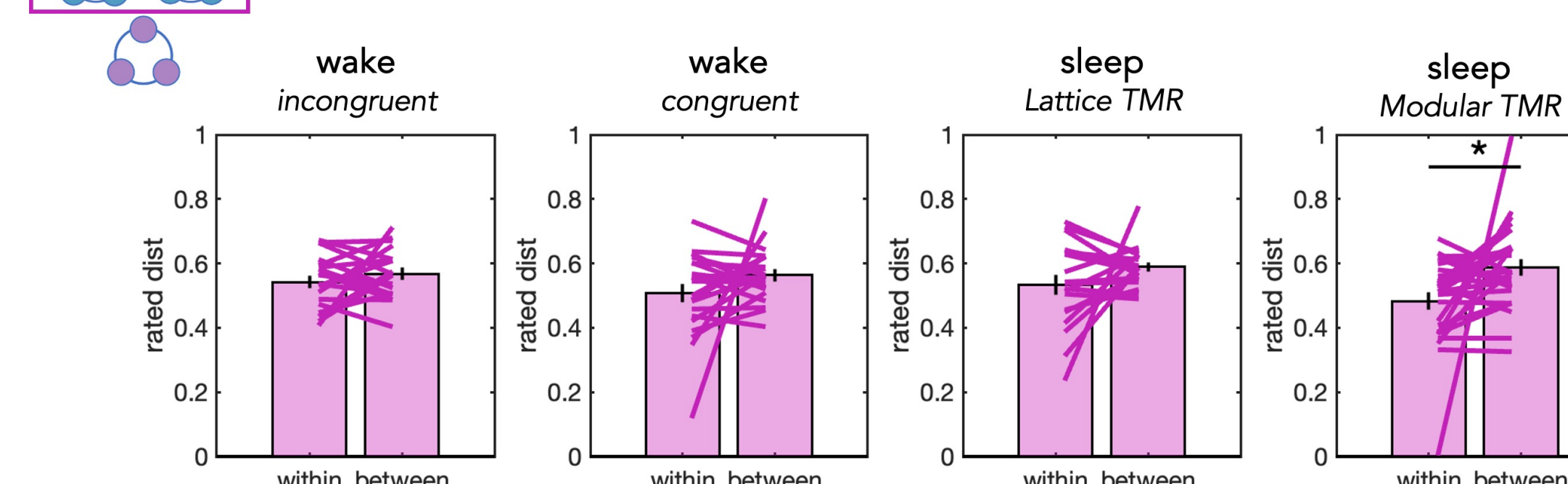


Left: TMR of the Stage 1 Modular category boosted memory for that category. **Middle:** TMR of the Stage 1 Modular category facilitated transfer learning of the Stage 2 Modular category. Successful structure learning was only observed in the Modular-TMR condition. **Bottom:** This structure transfer effect appears to be driven by the peripheral structure of the Modular categories.

Structure Transfer: Stage 2



Modular Structure Knowledge: Stage 2



Conclusions

Abstraction of category structure was not observed immediately after learning, nor after a period of rest. Abstraction of category structure only emerged after the category was reactivated during sleep using TMR, as evidenced by successful transfer learning. Next steps involve determining whether this structure abstraction is tied to a particular sleep stage (e.g., Stage 2, REM).

