Processing of environmental geometry in miniature brains: Spatial memory in the house cricket (*Acheta domesticus*)

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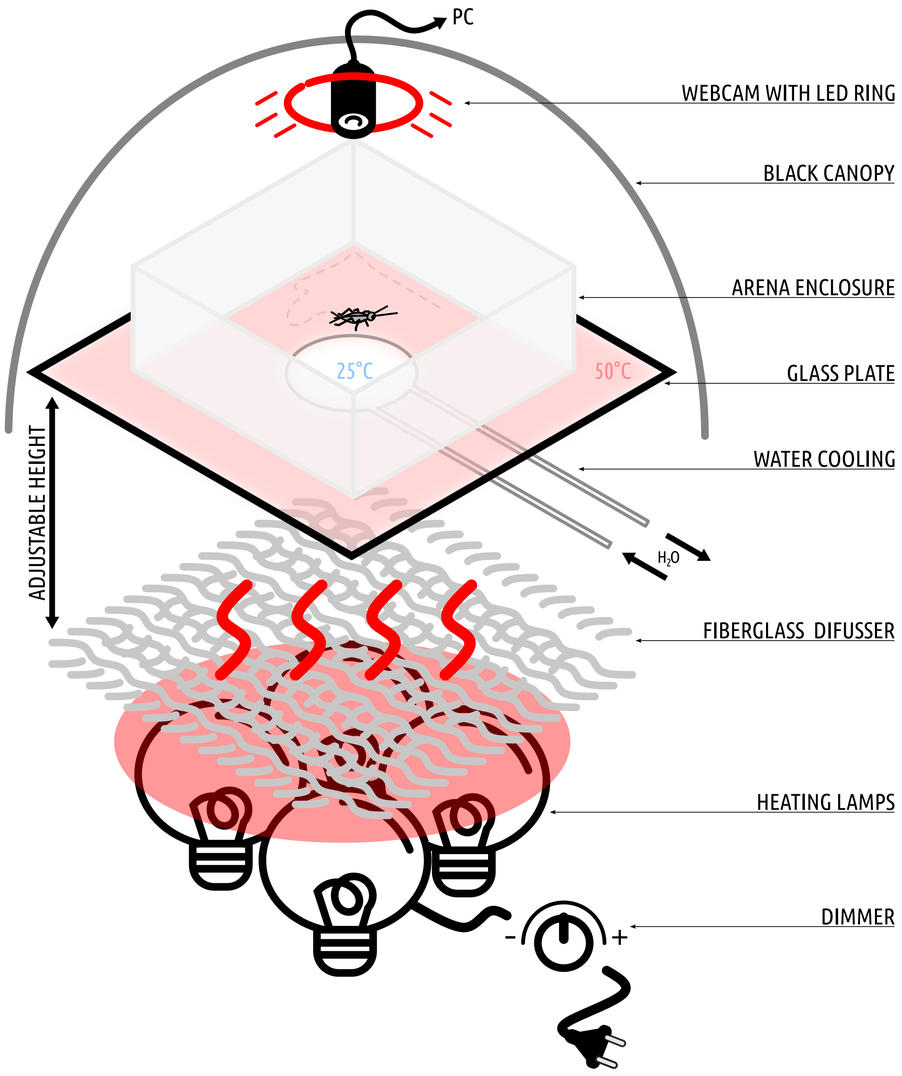
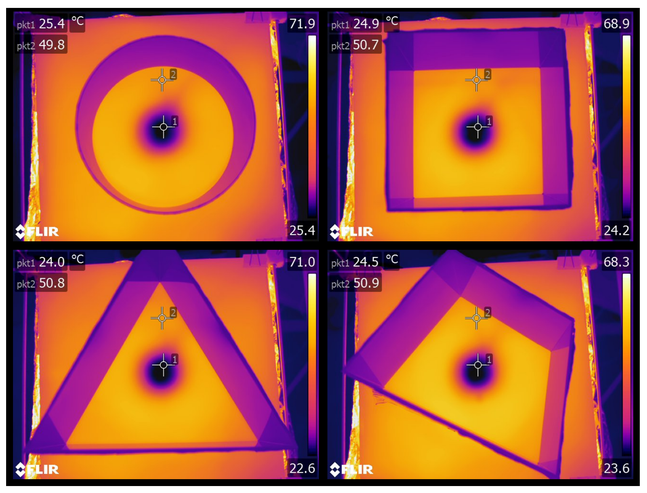
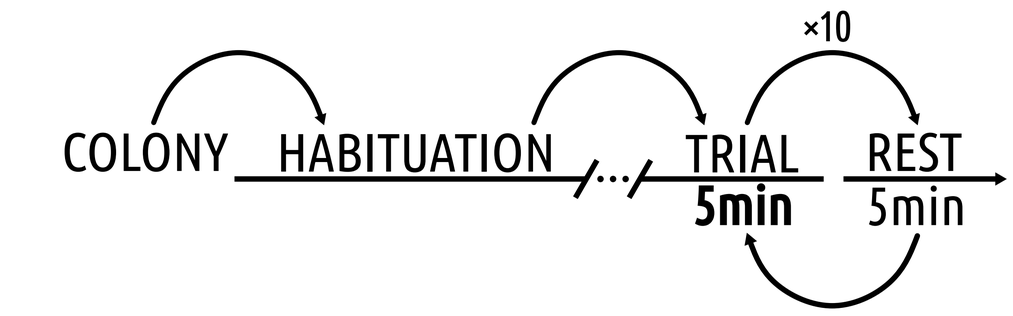
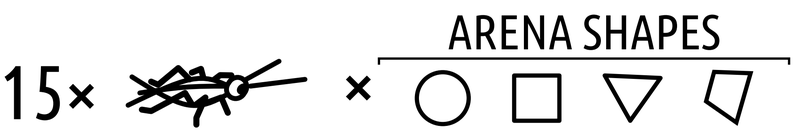
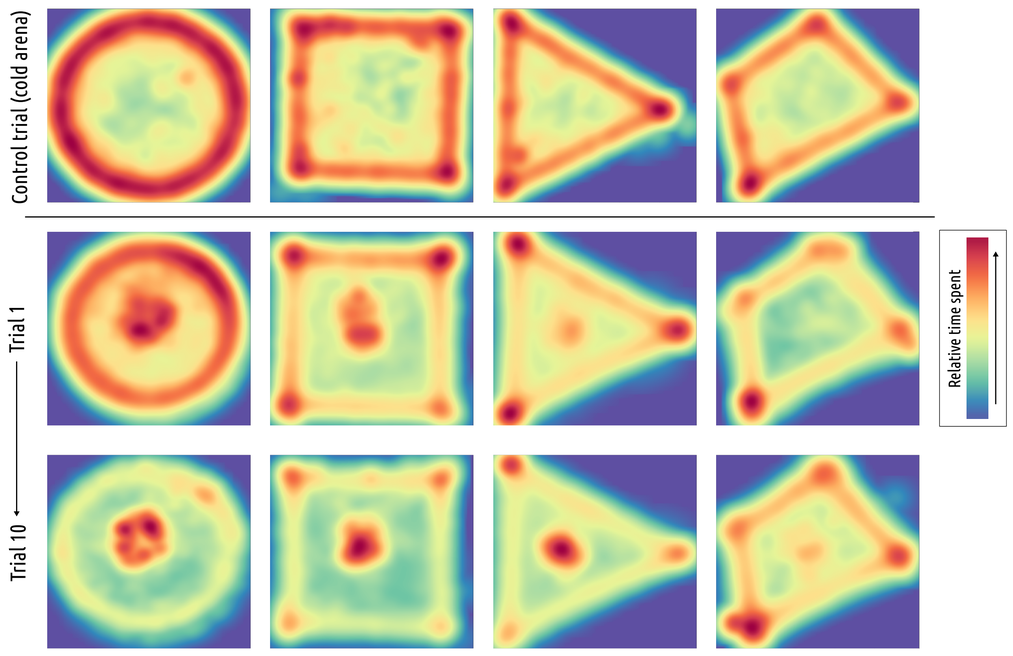


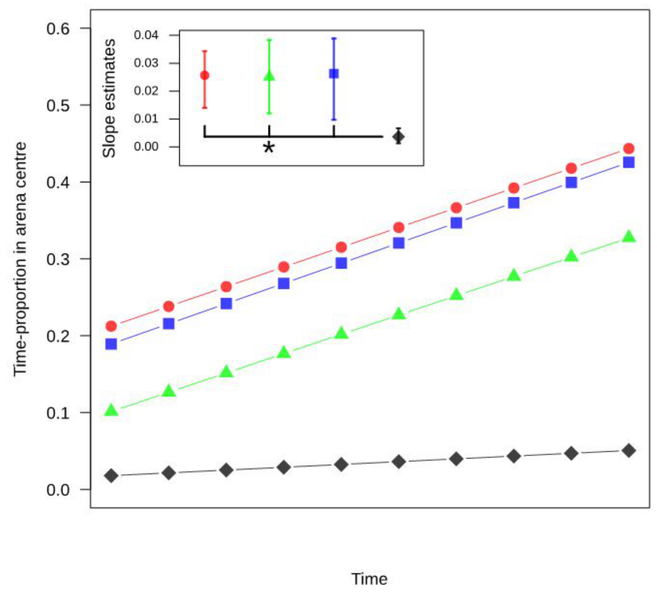
Sensitivity to geometry plays a considerable role in spatial navigation in various vertebrate species. This capacity has usually been explained in reference to the hypothesis of the high-level geometric module (Cheng, 1980) and the core system of layout geometry (Spelke, Lee, Izard, 2010). Recently, it has been suggested that insects navigate in space using fairly simple view-matching mechanism (Wystrach & Beugnon 2009). Still, it is possible that insects' miniature brains can directly encode environmental geometry and use it for navigation, as the core cognition account predicts. In our study, we tested the capacity of the house cricket (Acheta domesticus) to learn layout geometry in different shape areas (including symmetrical and nonsymmetrical) preventing the use of view-matching. We employed the searching for the center paradigm in combination with non-visual condition modeled on the Tennessee Williams setup ("dry" analog of Morris' water maze).











Results

In all symmetrical arenas (compared to the non-symmetrical) insects tended to spend more time on the centrally localized cold spot (median of time spent in the center is 10±5% in the first trial vs. 40 ±5% in the tenth trail). Learning curves depended on the shape of symmetrical arena.

Conclusion

The results suggest that insects can rely on geometric information in the absence of visual cues. Therefore, although further in-depth studies are required to explain the actual mechanism of insect navigational behavior, the view-matching model should not be perceived as the ultimate explanation.