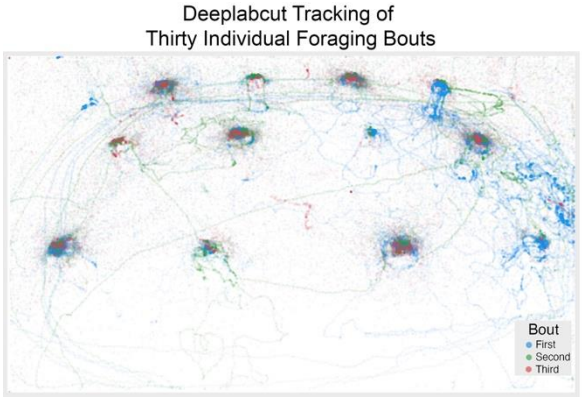
Summer 2022 Final Report
Reed Warburton Class of 2023

This summer I began research into how bumblebees are predisposed to **use** social cues and their preference for conspecific social cues as compared to heterospecific and non-social cues. I additionally spent time organizing two years of past work into a publishable paper on using machine learning to track bumblebee foraging behavior.

My experiment this summer focused on testing the strength of bee's learned associations while foraging. The first phase involved training bees to visit or avoid artificial flowers with specific stimuli on them. There were three stimuli conditions, conspecific stimuli (a pinned bumblebee), heterospecific stimuli (a pinned honeybee) and nonsocial stimuli (a white plastic cube). After the training phase, the bumblebees were then tested: they were allowed to forage on a new array of novel artificial flowers and were tested on their ability to use the learned associations. The purpose of this experiment was to better understand how bumblebees perceive the presence of heterospecific competitors on shared floral resources, and whether their documented ability to learn conspecific associations had a genetic bias towards positive association (cite). The complexity and time intensive nature of this novel procedure meant that more data collection is still necessary, but this summer was a promising start to the experiment and led to valuable insights on the strategies necessary to continue this new procedure.

While running the experiment I also spent time analyzing data and researching the literature with the ultimate goal of publishing a paper on my previous work in Dr. Jones' lab. This work culminated in the first draft of a manuscript that will be submitted to a scientific journal later this fall. The paper is on the use of a machine learning software, DeepLabCut, in tracking videos of bumblebees foraging. Developing my skills with the software and the necessary code to analyze its outputs has taken me three years, and it is gratifying to see the results of that work. As I outline in the paper, by using the software a researcher is able to analyze bee foraging behavior much faster and quantify behaviors that have previously been impossible to measure. The most impactful new behavior that this software gives us access too is visit duration, or the length of time a bee spends on a flower. Such a measurement is possible to do by hand, but is so arduous, time intensive, and open to error that it was functionally impossible for most labs. However, it is easy to do in DeepLabCut and we were able to show that visit duration is heavily influenced by a bee's experience with a flower, with large implications for studies of pollination and bee cognition The figure below is an example of a different kind of innovation. Using DeepLabCut, researchers can now visualize the paths of foraging bees in ways that were once impossible. While the paper is still being edited, I am confident that it represents an exciting new chapter in bumblebee research.



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