Decoding a turn: The Latent Spaces Within Stereotypical Turns in Drosophila

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Turning is a complex locomotor maneuver requiring the asymmetric articulation of legs on both sides of the body. Characterizing the leg kinematic changes that compose a turn is a necessary pre-requisite to understanding the neural circuit mechanisms that underlie it. By analyzing leg kinematics in flies performing turns in response to optogenetic activation in surfaces with and with out friction, we aim to understand the role of mechanical coupling in coordinating these movements. Given the high dimensional leg kinematics space explored by the legs during turning, we employ dimensionality reduction to identify latent dimensions in this space. We are currently able to use these latent dimensions to decode kinematic parameters such as velocities based on joint angles. Advancing this line of investigation could help identify the degrees of freedom employed by the nervous system of the fly to execute turning in context appropriate ways.

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My Contributions:

Pipeline Creation: Helped create the pipeline for analyzing flies walking on a slippery surface by annotating images in DeepLabCut. Developed and wrote code for a model to calculate the step-cycles of flies walking on the slippery surface. Using Python I fitted a plane to each fly's legs, only using time points where all legs touched down on the slippery surface; I identified these time points by finding joint angle peaks. Used this plane to calculate when the fly was stepping, based on the distance from each leg to the plane.

Nonlinear Dimensionality Reduction: Employed CEBRA (Consistent Embedding for Behavioral Representation and Analysis) to analyze leg kinematics. Wrote code to train embedding models and ran iterations with different parameters, creating an embedding that can be used to help decode kinematics.

Presentation: Created poster with feedback from various lab members.