**Broader Impact Statement**

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*Social communication in a complex environment*

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Social communication is critical for animal survival. Humans and other animals communicate when searching for a partner, to achieve common goals (e.g., finding food sources) or to manage social conflicts (e.g., fighting or negotiating the access to limited sources). While the neural basis of social behavior has been studied for decades and in multiple model organisms, we still lack a basic understanding of how social communication signals are represented and controlled by the nervous system in the complex environment it was adapted to. Specifically, how social and non-social cues are dynamically integrated in the brain to drive moment by moment social decisions. A key challenge towards achieving this goal is the ability to monitor animal behavior in complex environments at a high spatiotemporal resolution. Being able to do so in a genetic model organism, will facilitate our understanding of the causal link between specific neural circuits and the control of social communication in complex environments.

Previous studies have indicated that flies form collective behaviors and have dynamic social networks. However, detailed quantification of social communication at the level of individual body parts of individual flies in the context of a complex social environment is missing. We will develop new computational approaches to keeping track of many socially interacting individuals (16 flies) over long periods of time (4 hours) while also capturing detailed kinematics that enable quantification of complex social behaviors. As vinegar flies feed, fight, mate and lay eggs on food patches, we will have a food patch in the middle of our behavioral arena. We will characterize social communication in a complex environment and will take advantage of the available genetic toolkit in *Drosophila* to determine how the activation of small subsets of neurons in the central brains of males and females modulate social interactions in the complex environment.

**The proposed work will narrow the gap in our understanding of how nervous systems control social behaviors in complex environments. By advancing the computational tools and sharing them with the community, we will set the stage for future experiments that aim to decipher the neural basis of social behaviors in more naturalistic conditions.**