



# BiophysTO Lunchtime Seminar Series

Date

Thursday, Jan 27<sup>th</sup>, 2022  
12:00 – 1:00 pm

## Prof. Nir Gov

Department of Chemical and Biological Physics  
Weizmann Institute of Science

### The geometry of decision-making in individuals and collectives

Choosing among spatially distributed options is a central challenge for animals, from deciding among alternative potential food sources or refuges to choosing with whom to associate. We present a spin-based model that describes the decision-making process while the animal group, or the individual, is moving through space and assessing the different options. Using an integrated theoretical and experimental approach (employing immersive virtual reality), we test the predicted interplay between movement and vectorial integration during decision-making regarding two, or more, options in space. The theoretical model reveals the occurrence of spontaneous and abrupt “critical” transitions (associated with specific geometrical relationships) whereby organisms spontaneously switch from averaging vectorial information among, to suddenly excluding one among, the remaining options. This bifurcation process repeats until only one option—the one ultimately selected—remains. Thus, we predict that the brain repeatedly breaks multi-choice decisions into a series of binary decisions in space–time. Experiments with fruit flies, desert locusts, and larval zebrafish reveal that they exhibit these same bifurcations, demonstrating that across taxa and ecological contexts, there exist fundamental geometric principles that are essential to explain how, and why, animals move the way they do.

**Host: Anton Zilman**

**Zoom Link:**

<https://us02web.zoom.us/j/89407663380?pwd=OFBMc2lhWVZKbUswQzk3VXNkLzhGdz09>



**Seminar  
Sponsors**

**UTSG**

Biochemistry

Physics

Chemistry