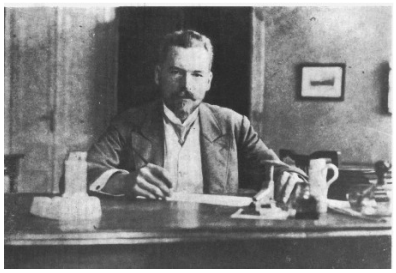

Contribution ID: **24** Type: **20 minute talk**

Random walks with asymmetric time delays

Friday, December 4, 2020 10:30 AM (20 minutes)

We study simple random-walk models with asymmetric time delays. Probability of a walker to move to the right or to the left depends on a difference between two state-dependent functions evaluated at states of the walker at two different times in the past. This might be seen as a model of a discrete replicator dynamics with strategy-dependent time delays. We assume hyperbolic-tangent fitness functions and to obtain analytical results we approximate them by step functions.

We observe a novel behavior. Namely, the mean position of the walker depends on time delays. This is a joint effect of stochasticity and time delays present in the system. In the deterministic version of a hyperbolic-tangent model, there appear symmetric cycles around a stationary point so the mean position of the walker stays the same. In stochastic versions without time delays, the expected value of the position of the walker is given by the stationary point.

If one interprets a position of the walker as a fraction of the population with a given strategy, then our results show that this fraction is a decreasing function of a delay, in fact a linear one for small delays. Moreover, bigger is the region with the (almost) unbiased random walk, smaller is the fraction of the population of the strategy with a bigger time delay.

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Session Classification: S4