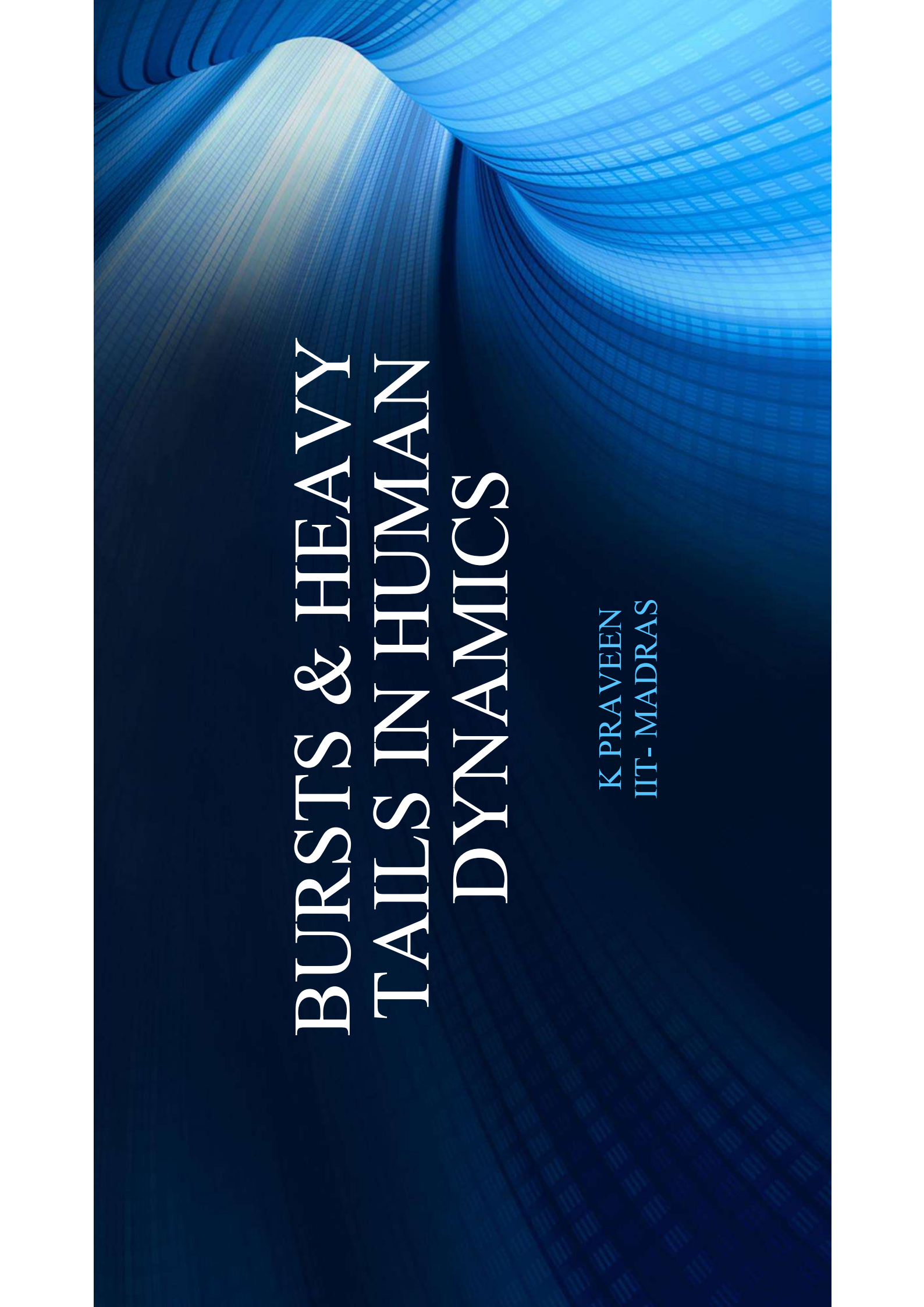




BURSTS & HEAVY TAILS IN HUMAN DYNAMICS

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The origin of bursts and heavy tails in human dynamics , A L Barabasi, Nature 2005.

situations, after training to a substance in 2007 it was accomplished over two days: two artificial odour cues were used in the procedure. From the start, observers at the feeder recorded the identification number of every marked bee that arrived there, and the hive was never opened unless an observer was at the feeder. Once foraging flights between hive and feeder were well established, observers in the tent watched the waggle dances. Whenever a numbered bee was seen to follow a dance and then move directly towards the exit, an observer outside the tent was alerted to catch the bee as it attempted to leave. If its identification number indicated that it had never previously visited the feeder, the bee was confirmed as a recruit, and a transponder attached. The bee was then either released directly from the hive exit, or taken in an opaque tube to one of three release points 200–250 m from the hive, and allowed to fly from there. Bees fitted with transponders could be detected while in flight within a 190° arc of radius 500 m, centred on the radar; their positions were shown once every 3 s on the screen of a desktop personal computer, and their coordinates recorded¹⁷.

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The origin of bursts and heavy tails in human dynamics

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The dynamics of many social, technological and economic phenomena are driven by individual human actions, turning the quantitative understanding of human behaviour into a central question of modern science. Current models of human dynamics, used from risk assessment to communications, assume that human actions are randomly distributed in time and thus

letters to nature

well approximated by Poisson processes^{1–3}. In contrast, there is increasing evidence that the timing of many human activities, ranging from communication to entertainment and work patterns, follow non-Poisson statistics, characterized by bursts of rapidly occurring events separated by long periods of inactivity^{4–8}. Here I show that the bursty nature of human behaviour is a consequence of a decision-based queuing process^{9,10}, when individuals execute tasks based on some perceived priority, the timing of the tasks will be heavy tailed, with most tasks being rapidly executed, whereas a few experience very

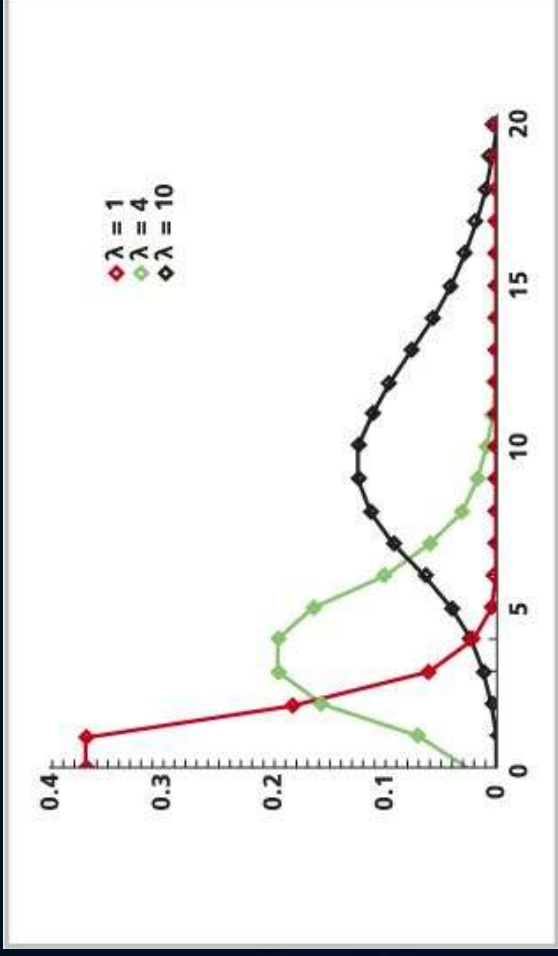
physical sciences, forecasting human and social patterns remains a difficult and often elusive goal.

Current models of human activity are based on Poisson processes, and assume that in a dt time interval an individual (agent) engages in a specific action with probability qdt, where q is the overall frequency of the monitored activity. This model predicts that the time interval between two consecutive actions by the same individual, called the waiting or inter-event time, follows an exponential distribution (Fig. 1a–c)¹. Poisson processes are widely used to quantify the consequences of human actions, such as

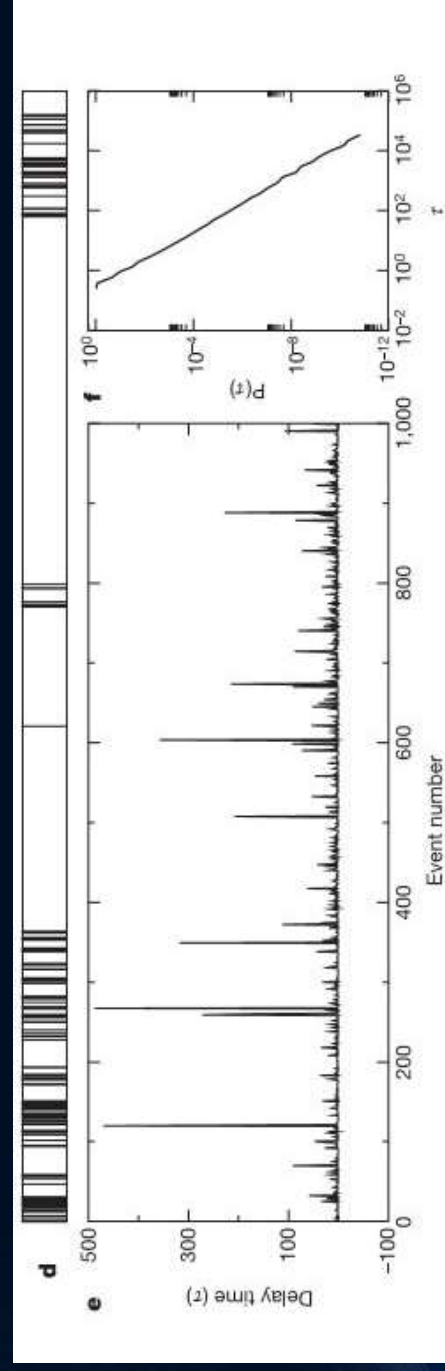
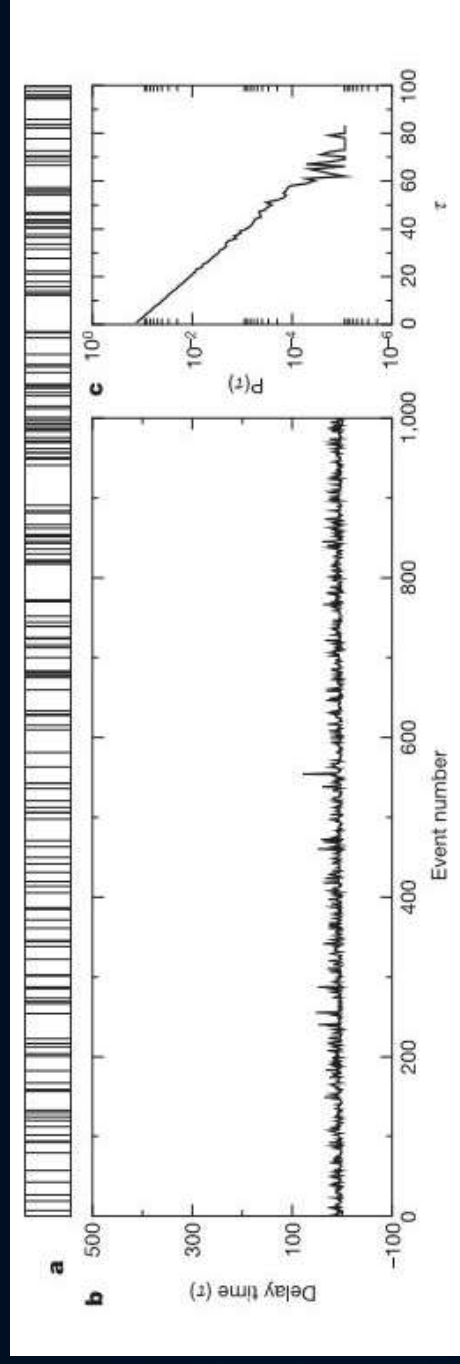
Poisson distribution

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

- Events occur independently of each other.
- Probability that a given event occurs in a given period of time doesn't change with time.



Poisson distribution



BURSTS

A burst is a sudden escalation in our activity pattern, characterized by an excessive focus on a certain type of task at the exclusion of all other responsibilities.

Priority blind execution



Poisson distribution

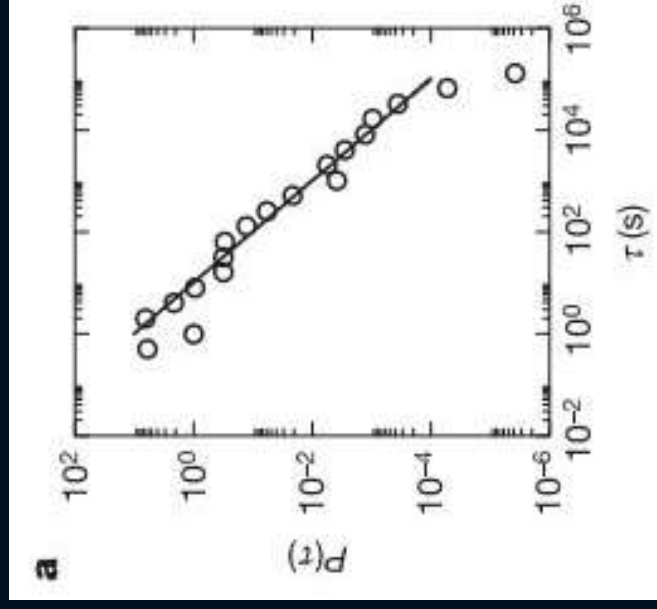
Priority based execution



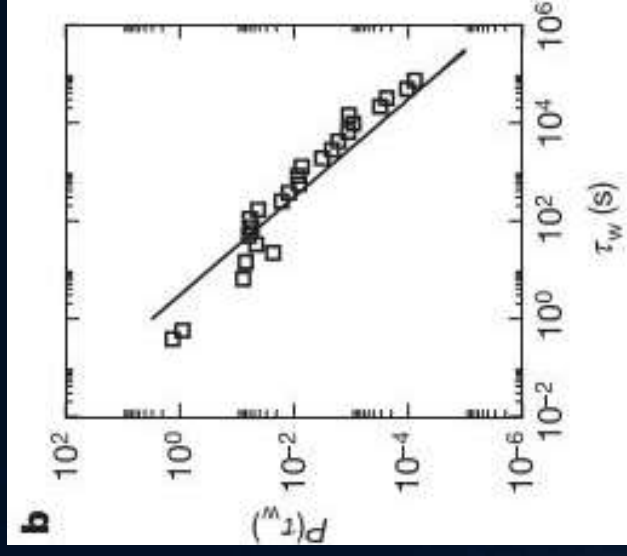
Power law



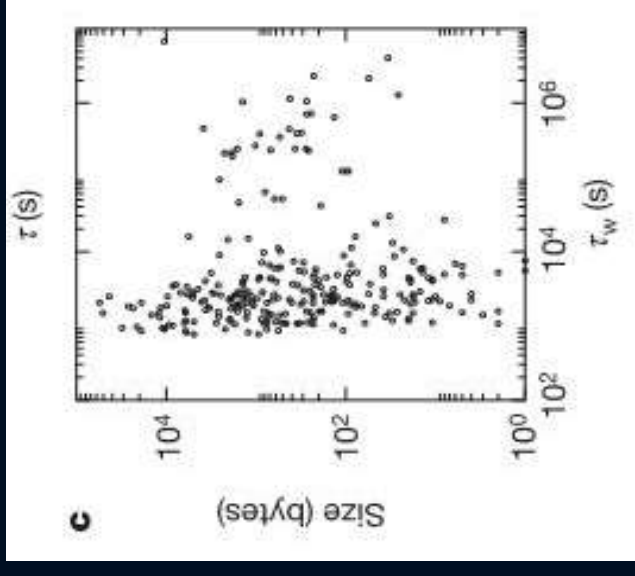
E-MAIL COMMUNICATION



Time interval between consecutive e-mails. Exponent $\alpha = 1$.



Distribution of time taken by user to reply to an e-mail



E-mail size v/s waiting time

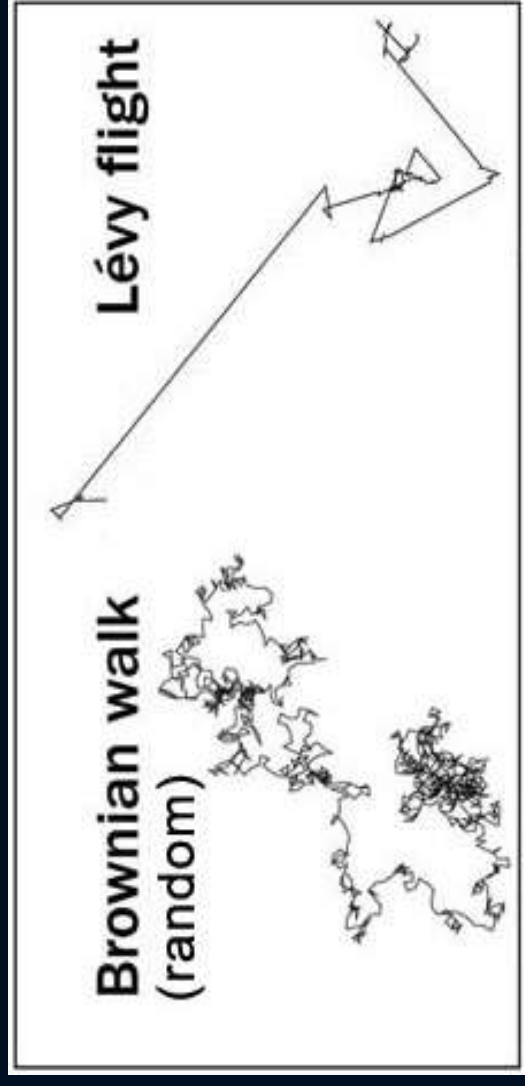
HUMAN MOVEMENT

Dirk Brockmann was interested in studying the spread of diseases.



Is bursts just confined to humans ?

- Albatross fishing pattern
- Animals hunting for prey
- Evolution



Bursts are also in

- Web site
- Printer jobs
- Library use
- Wikipedia edits
- Trades made by currency brokers
- Letter correspondence
- Hand movements

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- **Bursts:** the hidden patterns behind everything we do, from your e-mail to bloody crusades , A L Barabasi , Penguin 2010.
- Modeling bursts and heavy tails in human dynamics, Vazquez et al.

THANKS FOR LISTENING !!!!!!!