

Anomalous Human Travel: Experimental Results and Theoretical Challenges

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Abstract

In the light of increasing international trade, intensified human mobility and an imminent influenza A epidemic the knowledge of dynamical and statistical properties of human travel is of fundamental importance. Despite its crucial role, a quantitative assessment of these properties on geographical scales remains elusive and the assumption that humans disperse diffusively still prevails in models. In 1998 Hank Eskin invented the internet game *wheresgeorge.com*, an online bill tracking system. The idea behind the game is simple. Users can register at the website, mark individual dollar bills, report them to the website, reenter them into circulation and subsequently monitor their geographic dispersal as other users make reports to the website. We have analysed the *wheresgeorge.com* dataset and used the dispersal of nearly half a million dollar bills as a proxy for human travel. We were thus able to assess the statistical properties of human travel with a high spatio-temporal precision. We found that dispersal is anomalous in two ways. First, the distribution of travelling distances decays as a power law, indicating that trajectories of bank notes are reminiscent of scale free random walks known as Lvy flights. Secondly, the probability of remaining in a small, spatially confined region for a time T is dominated by algebraic tails which attenuate the superdiffusive spread. We were able to show that human travel can be described mathematically on many spatiotemporal scales by a two parameter continuous time random walk model to a surprising accuracy and conclude that human travel on geographical scales is an ambivalent effectively superdiffusive process.