Social Mobilization in Context

Alex Rutherford[1], Sohan d'Souza[1], Manuel Cebrian[2], Esteban Moro[3], and Iyad Rahwan[1]

[1]*Masdar Institute of Science and Technology, Abu Dhabi, United Arab Emirates*
[2]*University of California San Diego, La Jolla, CA, USA*
[3]*Universidad Carlos Rey III de Madrid, Madrid, Spain*

Milgram's small-world experiment [1], and its subsequent reincarnations [2], showed that social networks are very efficient at searching for targets. The efficiency of this search relies on people's ability to use some measure of distance (physical [3] or social [4]) to exploit the network structure as they approach the target. The DARPA Red Balloon Challenge [5] differed fundamentally in that the 10 target balloons were placed at random, unknown locations, with no navigational tips given. Thus, the success of the winning team was determined by the the number and geographical distribution of the people recruited to conduct the search [6]. While the challenge was hailed as a great success, with all balloons found within 9 hours, it is difficult to draw broad conclusions from a single run. Yet, it is impractical to conduct a sufficient number of these searches in the real world to obtain significant results. We present the results of large-scale numerical simulations of the search process, tracking the geographical spread through the search space. We use high-resolution census data to construct an artificial social network based on a geographic model of friendship [7] and simulate the recruitment process based on empirical distributions of waiting times for information propagation.
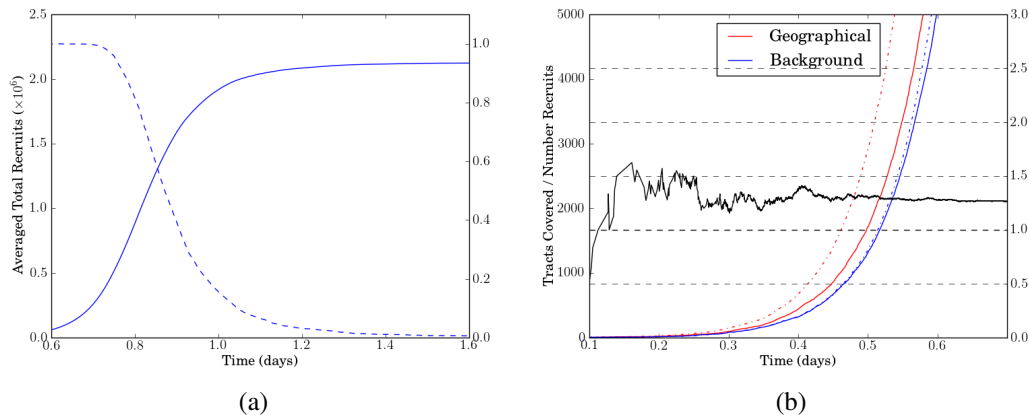

Figure 1: (a) Average number of recruits over 3000 distinct searches (solid line) and proportion of searches persisting (dashed line) over time. (b) Search efficiency of long and short-range recruits (dashed lines) and their ratio (black line) compared to rate of recruitment (solid lines) for a single run

Figure 1(b) shows that long-range friends have comparable search efficiency to short-range friends, despite there being approximately twice as many of the former than the latter. In general we find that success relies crucially on the presence of long-range ties, as regions of high population density can otherwise trap the spread. We also explore whether success was influenced by DARPA's choice of balloon location and finally compare our results to an analytical model for the rate of spread of search.

References

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