

# Visual Influence Networks in Walking Crowds

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## Abstract

Collective motion in human crowds is generated by local visual interactions between neighboring pedestrians. In this self-organizing behavior, some individuals play the role of “leaders” who strongly influence the crowd. Can “leadership” be attributed to personal qualities, or does it emerge from spatial relations within a crowd? To answer this question, we analyzed 15 min of motion-capture data from a human “swarm” experiment (N=10,16,20) in which participants were instructed to walk about the tracking area while staying together as a group. Last year we introduced a method of reconstructing spatially-embedded visual influence networks using Time-Dependent Delayed Correlation (TDDC) and reported a measure of net leadership; this year we present a new measure, accumulated influence, and compare the two, both representing the relative influence of each pedestrian. The rankings of pedestrians based on accumulated influence were consistent with the results of net leadership, and they revealed the same leadership gradient pattern from the front to the back. Overall, we find that leadership strongly depends on spatial position and weakly on personal qualities, with some individuals exhibiting stronger/weaker influence. In addition, we performed a series of analyses on time delays between changes in heading for all pairs of pedestrians. We are currently analyzing the speed of information propagation through a crowd, allowing us to test for a “chorus line effect” in which information spreads in a wave. Additionally, we introduce an experimental paradigm to alter the network topology in real crowds and study the effects of the manipulation on the macroscopic crowd movements. Based on the finding of behavioral cascades, we present the method of investigating if and how the information of heading change initiated by covert “leaders” with instructions spreads in a walking crowd.

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