Heuristics on non planar graphs

Problem

Minimax using a good heuristic results in a good player for grid based games. There has been some work on general game playing agents (**[1]** and **[2]**) trying to find good heuristics automatically. Are these techniques generalizable to non planar graphs?
A non planar graph is a graph that cannot be drawn without the edges intersecting. Non planar graphs occur in social networks, dependencies of systems, and networks. Are these heuristics useful for these kind of graphs? What (possibly real-world) games can be played on these graphs? Are there any heuristics that are good independent of the graph?
A possible game is a marketing game, where each player can convince one vertex of an idea, and a vertex with more than half its vertices also becomes convinced. After 50 moves, the player with the most convinced vertices wins.

Related work

[1] and **[2]** has implemented automatic heuristic discovery from a description of a game. However, they only evaluated grid-based games or games based on planar grids. **[3]** proves that for a game of cops and robbers on a planar graph, 3 cops always win. Arbitrary many cops are needed to win in a non-planar graph. This suggests that the same rules do not apply for nonplanar graphs. **[4]** solved tic-tac-toe on some hypercubes, using similar techniques for solving as the 3D and 2D version did.

Implementation / Evaluation

We will generate random graphs (possibly with random rules) that the players get to play on. We will do empirical trials with the heuristics discovered using **[1]** or **[2]** and compare those to random, or simpler heuristics. We will do the same for planar graphs and compare the results, since we are interested in how the different graph classes compare.

References

[1] Clune, JJ 2007, 'Heuristic Evaluation Functions for General Game Playing', *Proceedings Of The National Conference On Artificial Intelligence*, 2, pp. 1134-1139
[2] Kuhlmann, G, & Stone, P 2006, 'Automatic Heuristic Construction in a Complete General Game Player', *Proceedings Of The National Conference On Artificial Intelligence*, 2, pp. 1457-1462
[3] Aigner, M, & Fromme, M 1984 'A game of cops and robbers', *Discrete Applied Mathematics*, 8, pp. 1-12
[4] Berlekamp, E, Guy, R, & Conway, J 1982, *Winning Ways, For Your Mathematical Plays / Elwyn R. Berlekamp, John H. Conway, Richard K. Guy*, n.p.: London ; New York : Academic Press, 1982