

## Using Complex Agent Network Models to Understand Youth Violence

[Siew Ann Cheong](#),<sup>1,3</sup> Kaixuan Sun,<sup>1</sup> Jia Ning Leaw,<sup>1</sup> Rebecca P. Ang,<sup>2</sup> Vivien S. Huan,<sup>2</sup> Wei Teng Chan,<sup>2</sup> and Xiang Li<sup>2</sup>

<sup>1</sup>Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, 21 Nanyang Link, Singapore 637371

<sup>2</sup>Psychological Studies Academic Group, National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore 637616

<sup>3</sup>Complexity Institute, Nanyang Technological University, 61 Nanyang Drive, Singapore 637335

### Abstract

Youth violence is a growing concern in Singapore, and also elsewhere in the world. One of the most widely accepted and tested theory of youth delinquency, by Moffitt, suggests that at-risk youths can be divided into two groups, one that is adolescence-limited, and another that is life-course-persistent. Membership in these two groups appears to be predetermined at a young age, and social interactions between these two groups become important during the adolescent years. By building a simple agent-based model based on the microscopic interactions Moffitt described: (i) a maturity gap that dictates (ii) the cost and reward of antisocial behavior, and (iii) agents imitating the antisocial behaviors of others more successful than themselves, we that the two groups emerged naturally in our simulations, and also the important role the social network plays in shaping the life course outcomes [1]. Encouraged by this preliminary study, we then undertook a more comprehensive study, surveying the psychology, social science, and criminology literature to identify a total of 11 intrinsic (familial, individual, school) and 2 extrinsic (peer) factors linked to youth violence, and also their interdependencies. We then developed a complex agent network model where each complex agent is represented by a complex factor network of the 13 factors along with youth violence, coupled to each other through the extrinsic factors to form a complex social network. We simulated the model using as initial conditions the results from a large-scale school-based survey of the factors and random social ties, and let the factors evolve according to the same behavioral imitation dynamics between agents reported in Ref. [1]. We ran a sensitivity analysis on the model, to find the model most sensitive to the parameters linking (1) non-intact family, (2) delinquency in general, (3) school disengagement, (4) peer delinquency, and (5) friends in gang to gang involvement. We also ran a series of intervention scenario simulations, and our results show that it is critical to intervene early, and successful interventions work by tipping the balance between competing intrinsic and extrinsic factors [2].

### References

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[2] S. A. Cheong, K. Sun, J. N. Leaw, R. P. Ang, V. S. Huan, W. T. Chan, and X. Li, "Youth violence and interventions: insights from a complex agent network model", *Reports in Advances of Physical Sciences*, vol. 1, no. 1, 1740006, 10 February 2017.