

Social Foraging for Crime


A Simulation Study on Co- Offenders' Specialization

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Image credit: Amanda Lea

A herd of bison is grazing in a field of tall grass with red wildflowers. The bison are in the foreground and background, with one bison in the center-right foreground and another in the bottom-left foreground. The text is overlaid on the image.

Offending behavior can be seen as foraging

Johnson, 2014; Vandeviver *et al.*, 2021

Offenders are believed to be generalists with
occasional specialization*

Eker & Mus, 2016

**However, studies are missing the
concept of co-offending**

Image credit: Amanda Lea

Co-offending as a means of social exchange

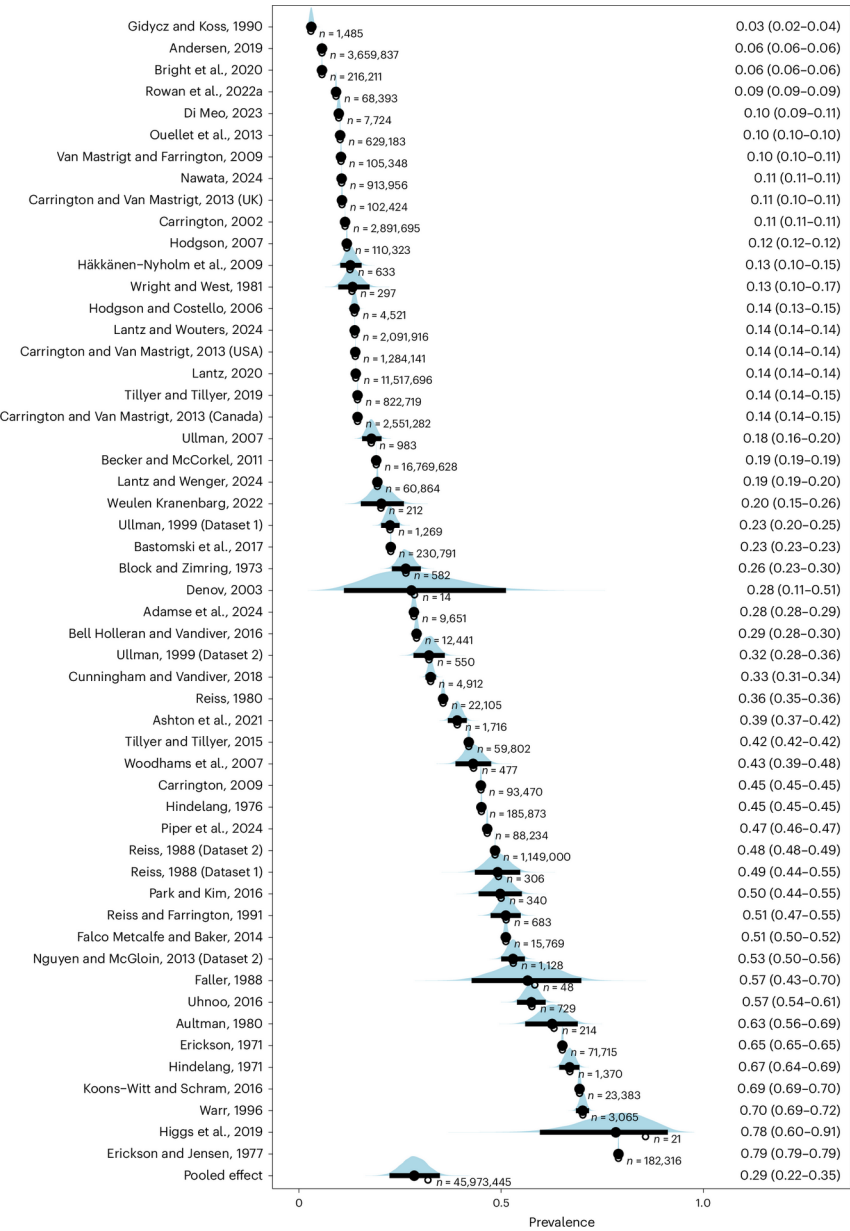
Weerman, 2003



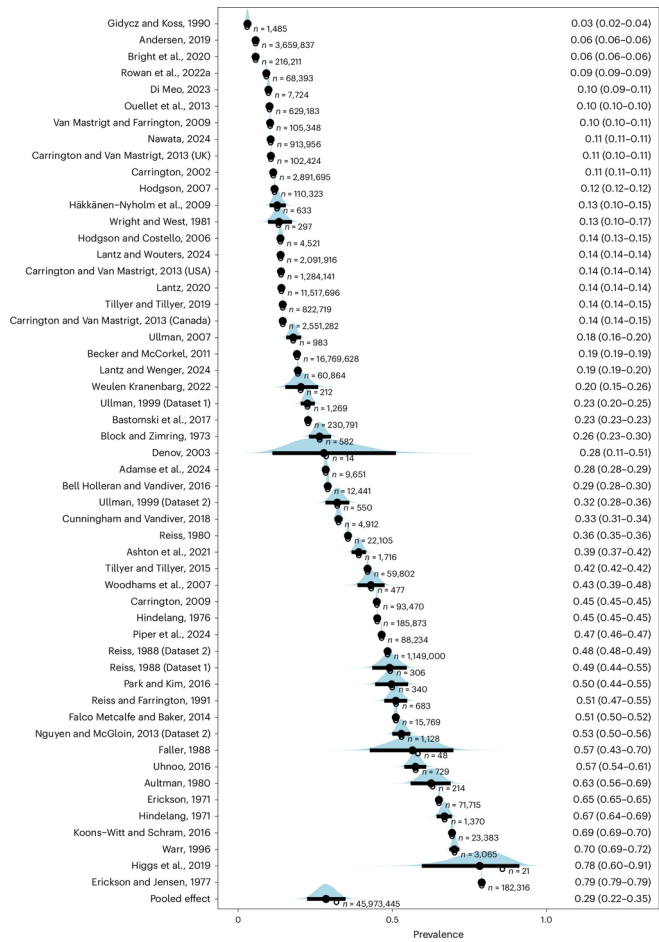


- Access to diverse parts of criminal network leads to a greater generalization (McGloin and Piquero, 2010; Klymentiev *et al.*, 2025)
- Co-offending allows the commitment of more sophisticated crime types (Felson, 2003; Tremblay, 2017)
- Co-offending groups involve offenders with different skills (Bright *et al.*, 2024)

Prevalence of co-offenses

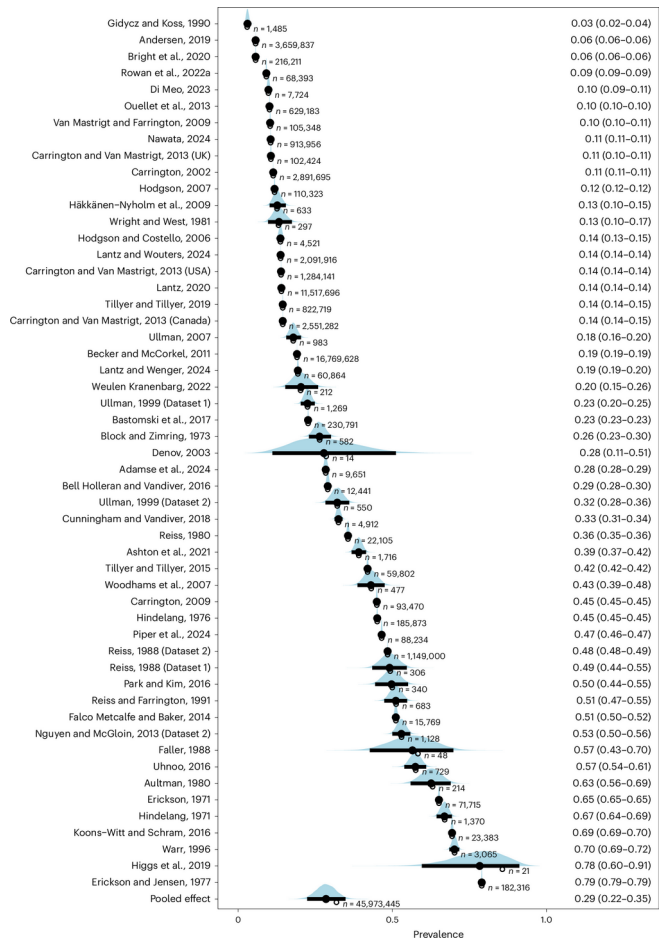


Prevalence of co-offenses



Why is co-offense prevalence less than 5% in some environments, while in others it's greater than 50%?

Prevalence of co-offenses



Why is co-offense prevalence less than 5% in some environments, while in others it's greater than 50%?

Perhaps in some environments it is:

- Hard to find a partner for co-offending (due to availability, not enough trustworthy or skillful partners)
- Crimes are relatively easy to execute alone
- Offenders do not even want to co-offend

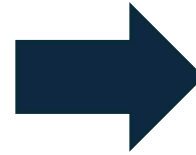
Weerman (2003)

OUTCOME

- Offenders are "foragers"
- Co-offending leads to generalization
- Co-offending allows the commitment of more sophisticated crime types (Felson, 2003; Tremblay, 2017)
- Varying prevalence of co-offending (mean = 30%) (Klymentiev *et al.*, 2025)

MECHANISM

?



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MECHANISM

What set of behavioral rules is more likely to lead to observed outcomes?

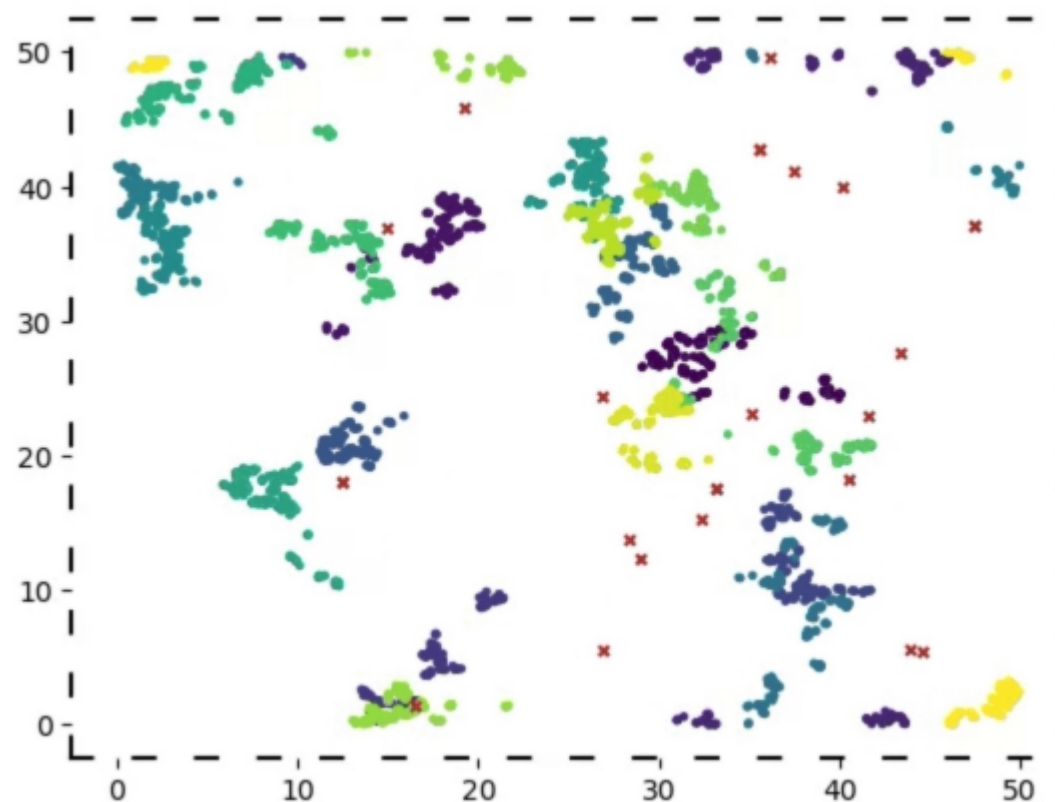


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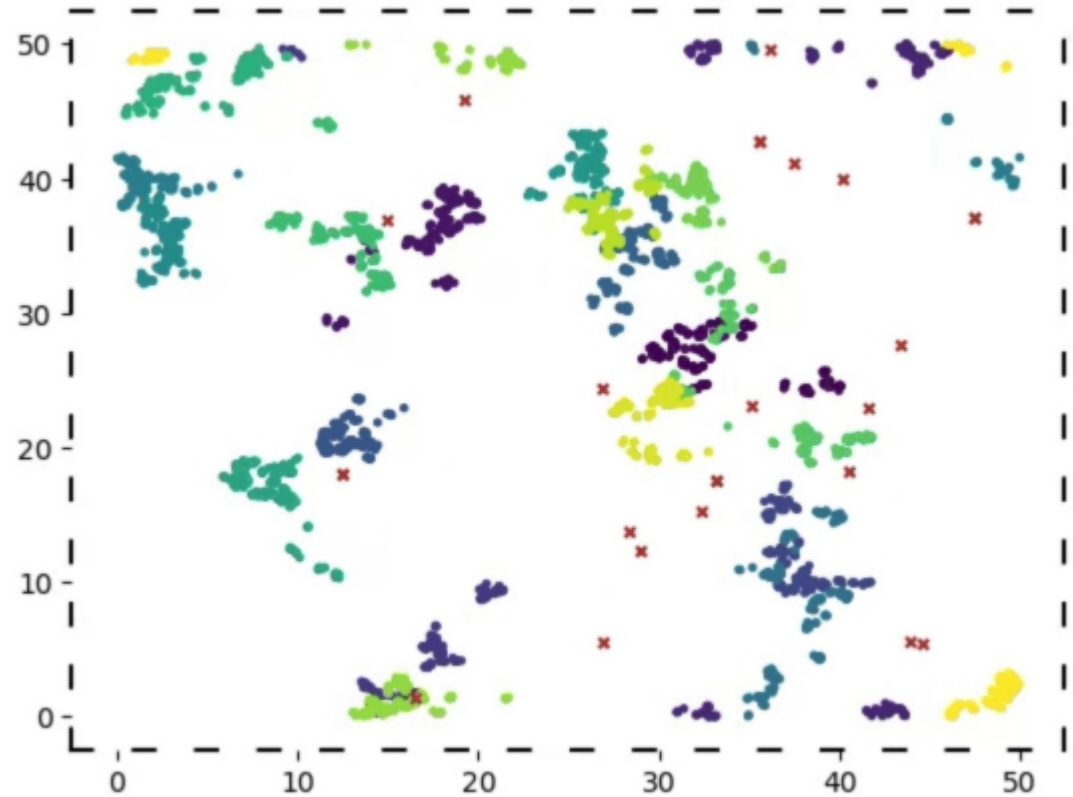
The agent-based model

- Move around (Levy walk)
- Crime opportunity within a search radius?
 - Potential partner(s) within a partner search radius?
 - Make a decision based on trust and skill preference
 - Solo offense
 - Co-offense
- Repeat until no crime opportunities left



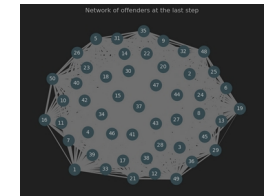
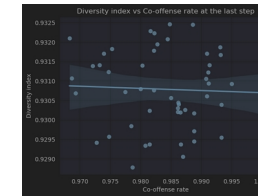
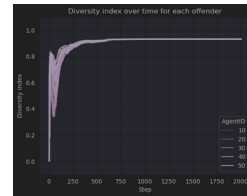
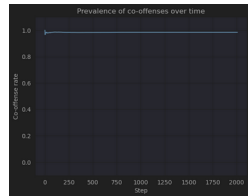
The agent-based model

- Parameters to explore:
 - Partner search radius
 - Skill preference
 - Trust preference
 - Crime complexity



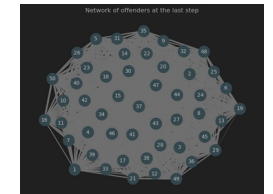
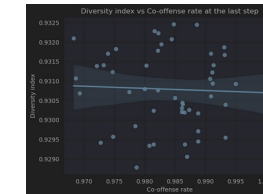
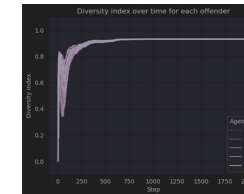
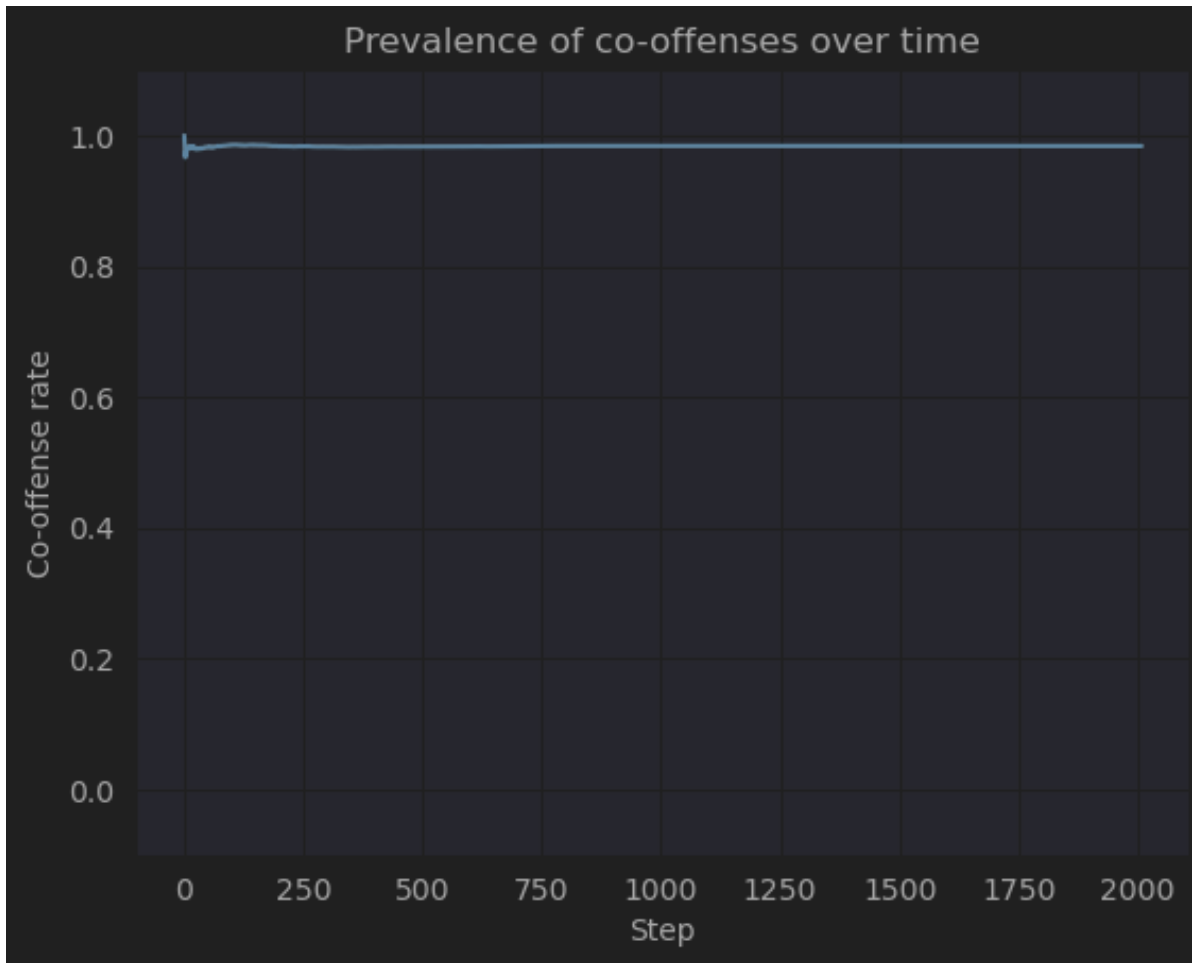
Preliminary results

Scenario 0: Random (everyone can access everyone with no skill or trust preference)



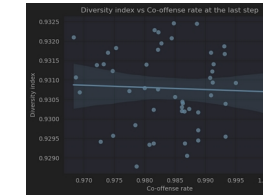
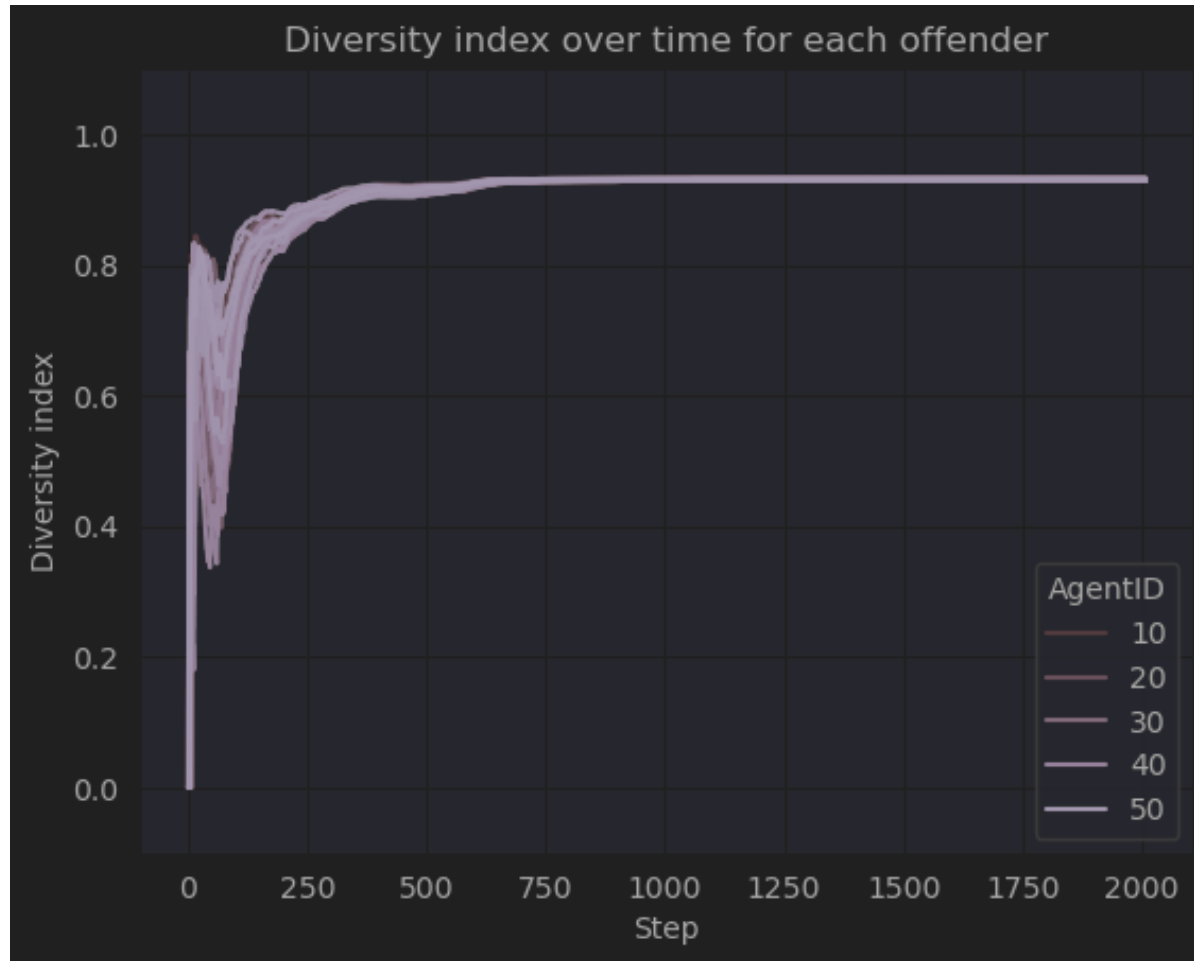
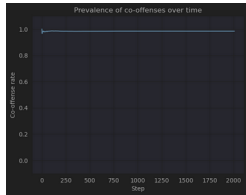
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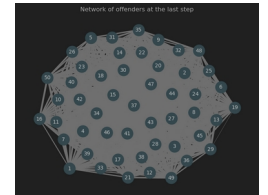
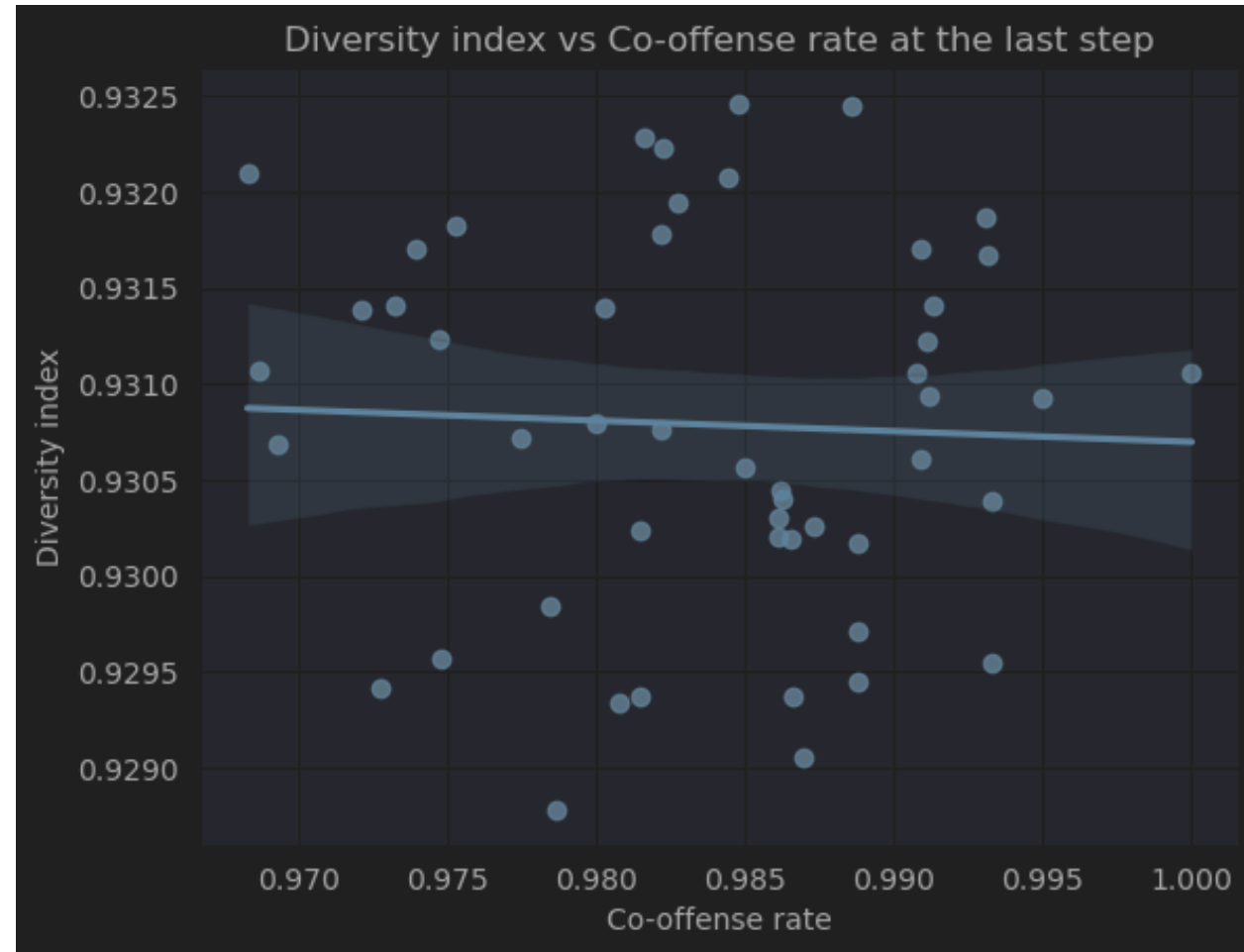
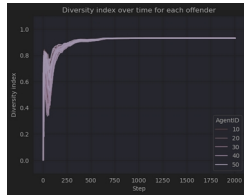
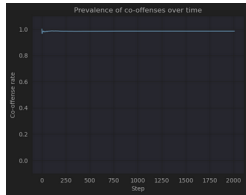
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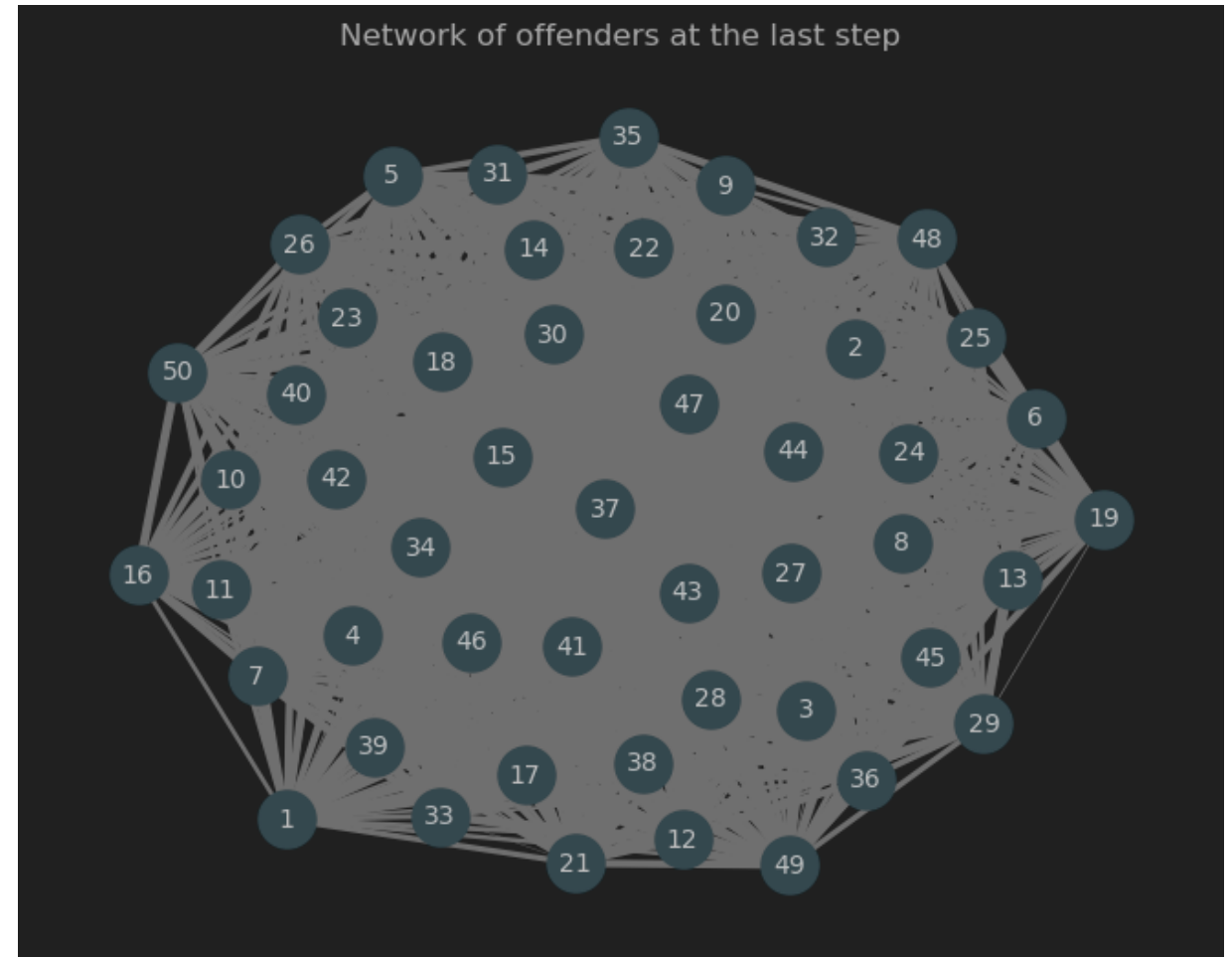
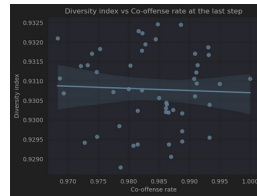
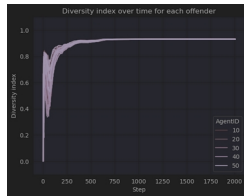
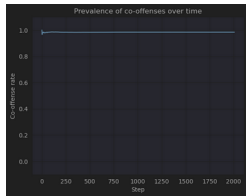
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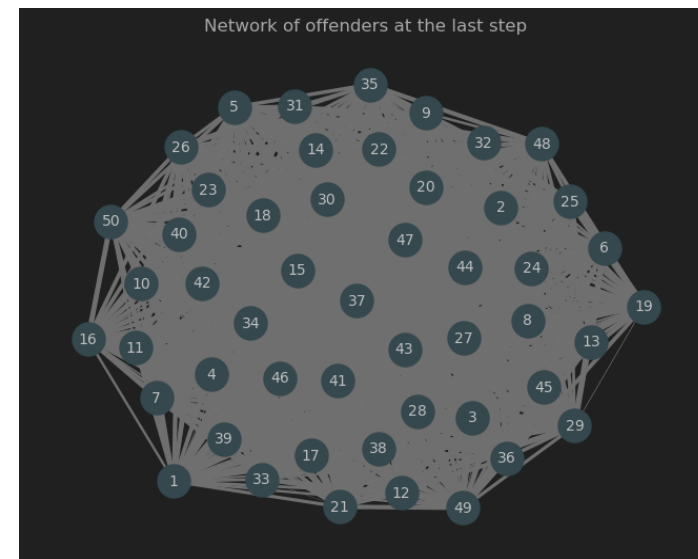
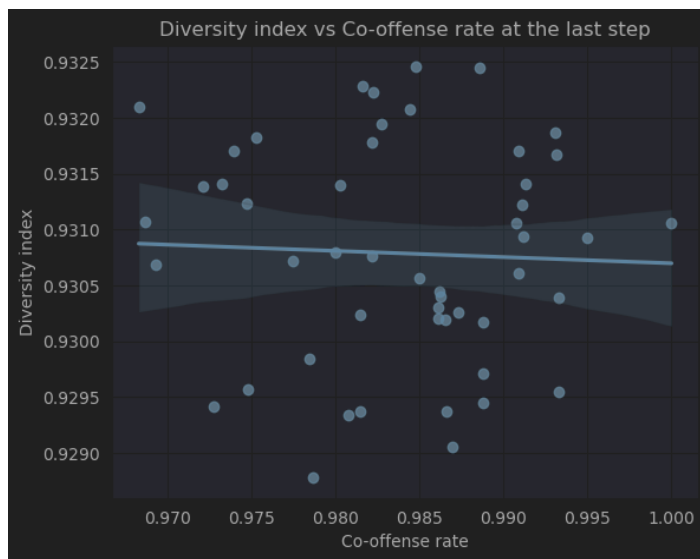
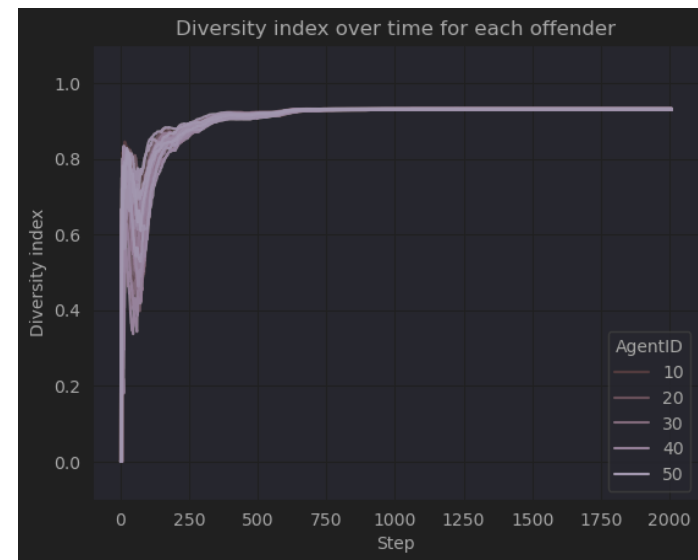
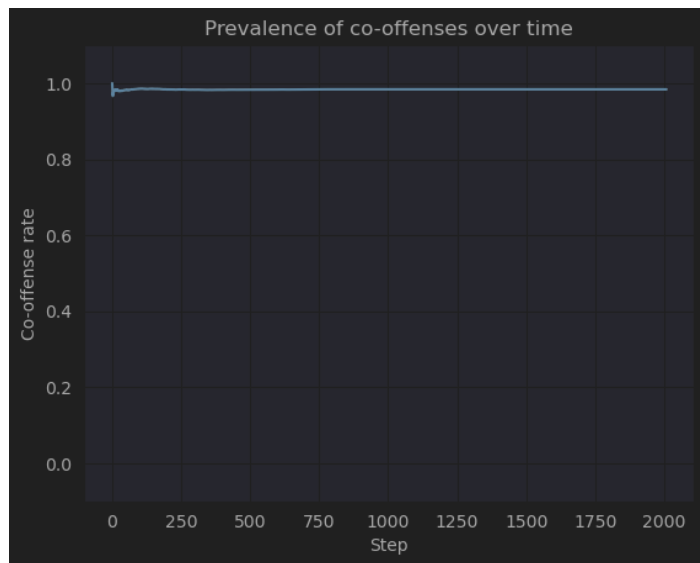
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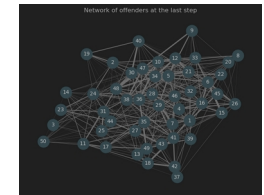
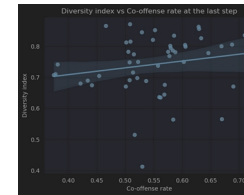
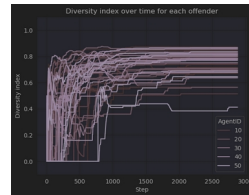
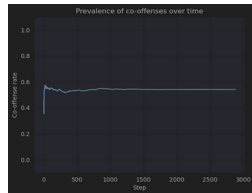
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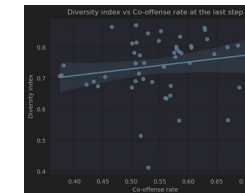
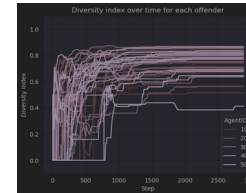
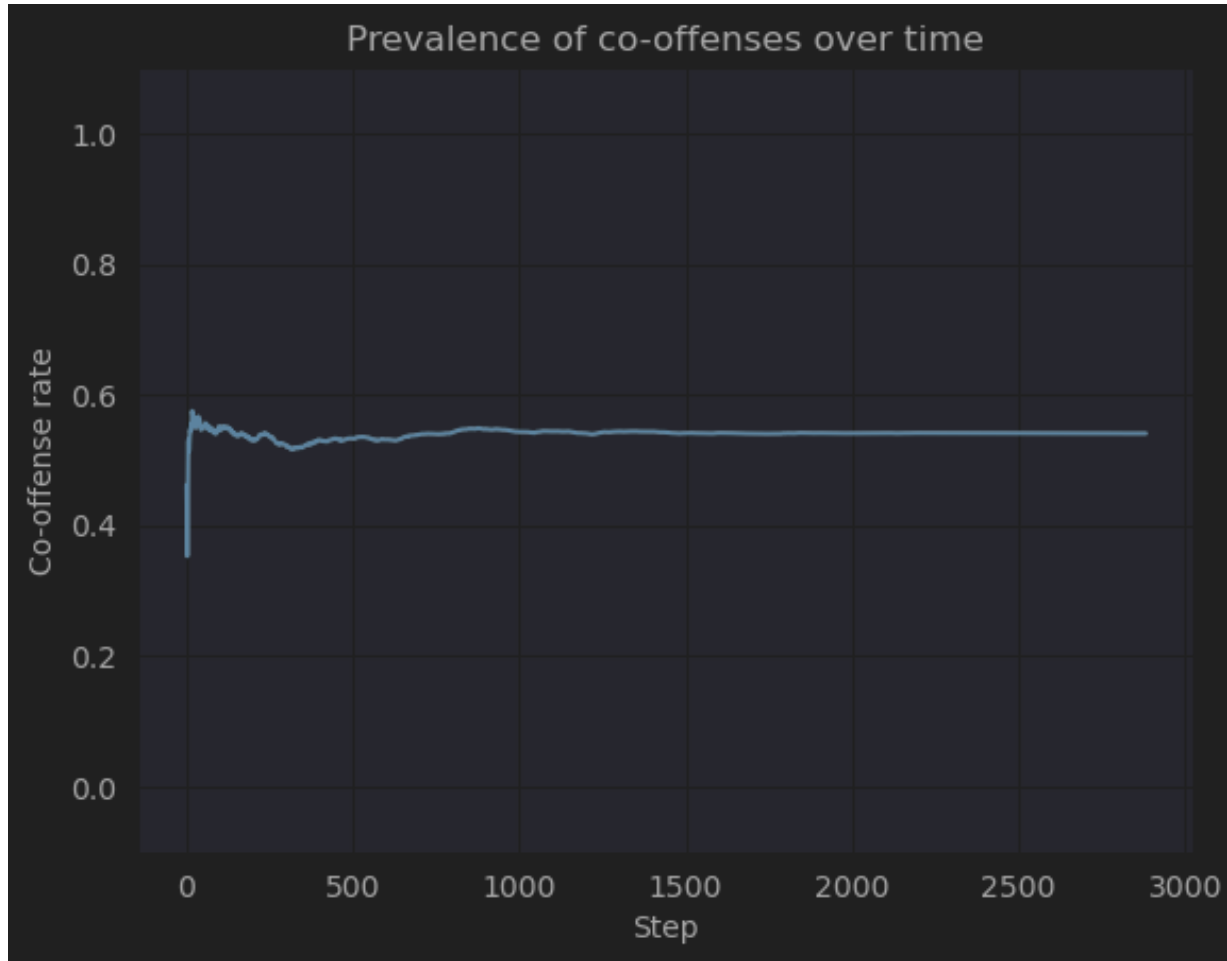
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Scenario 1: Limited access to partners, moderate skill and trust preference



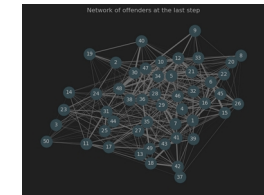
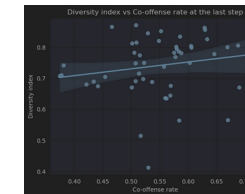
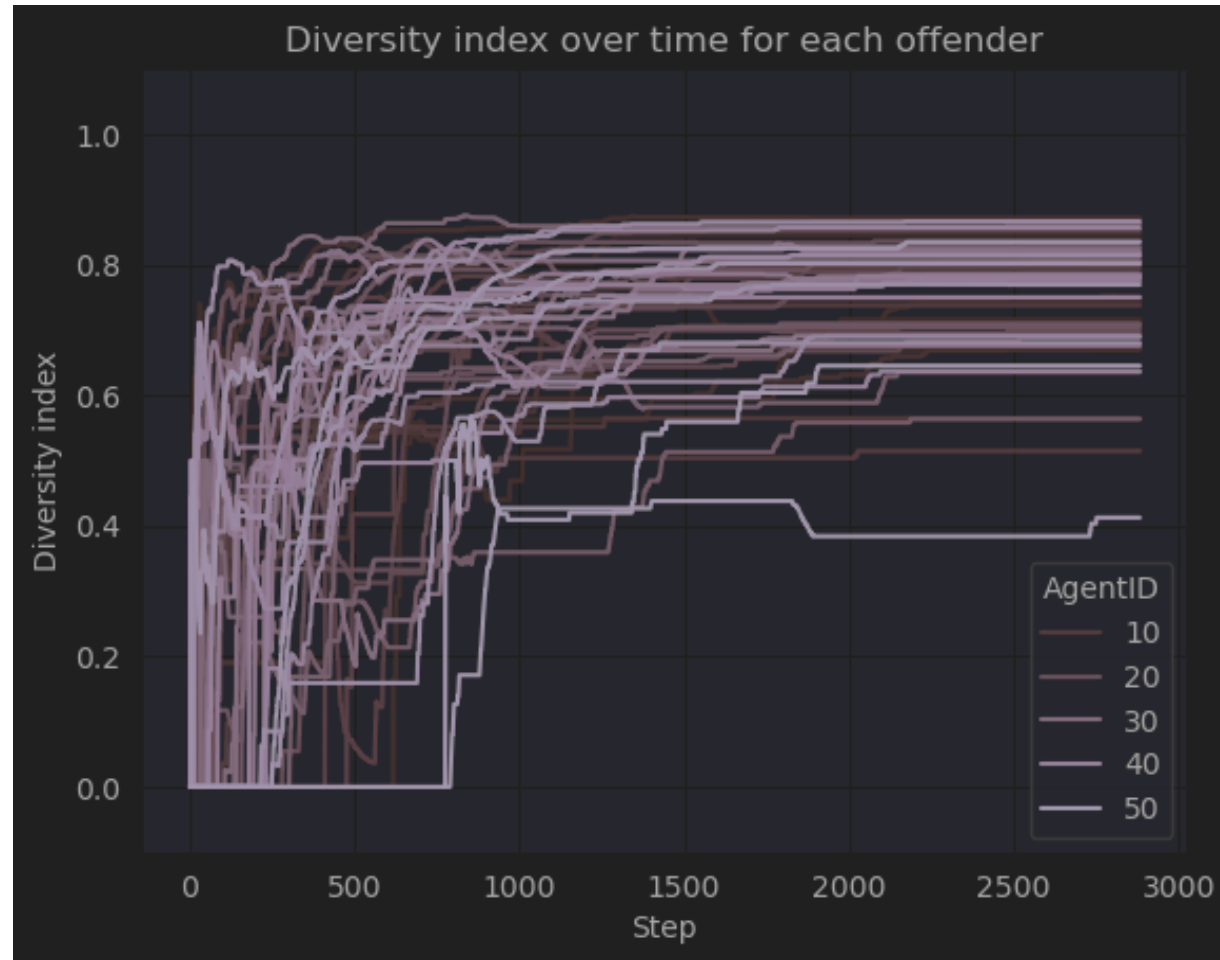
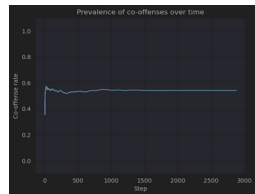
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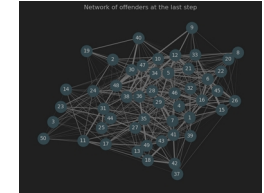
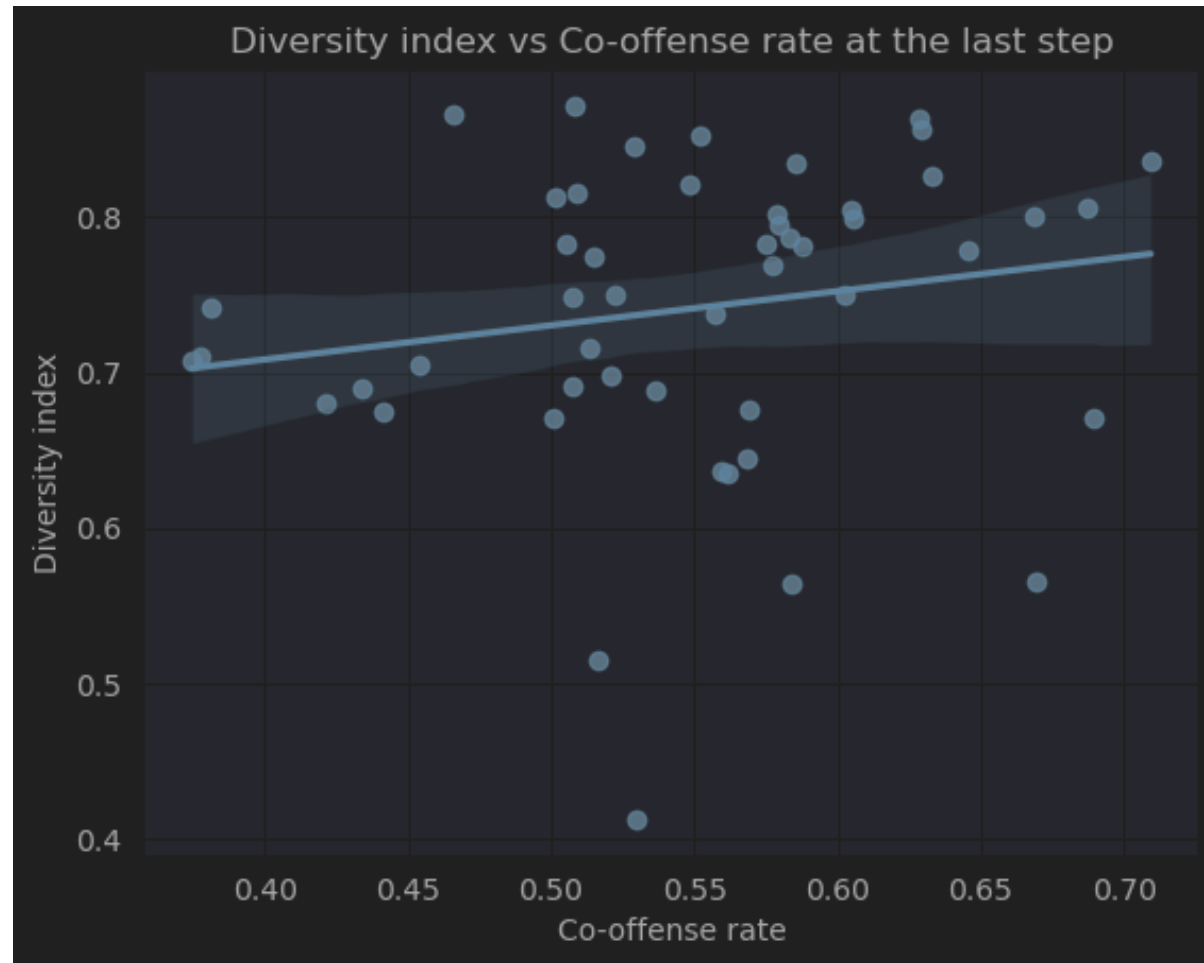
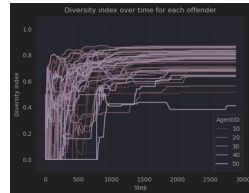
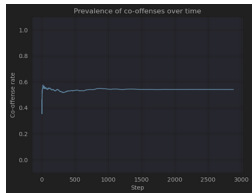
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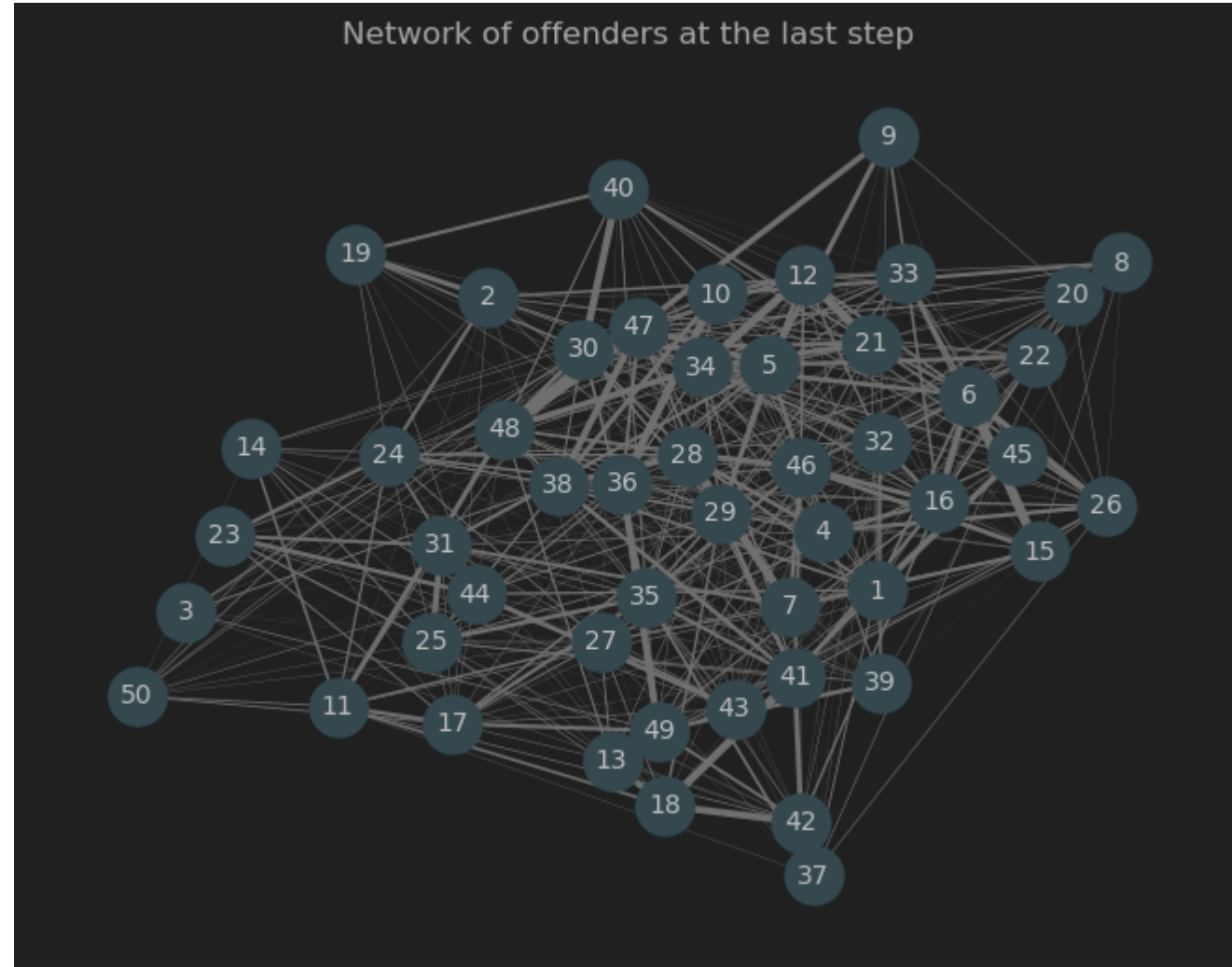
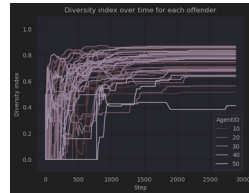
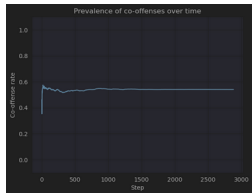
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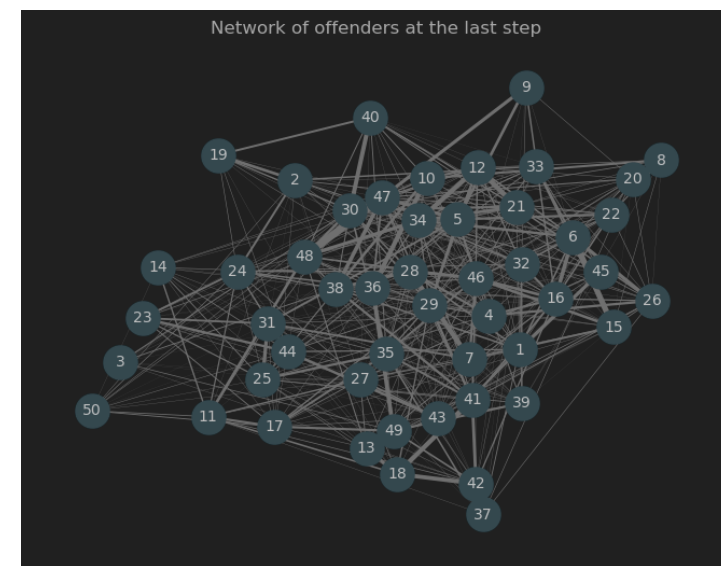
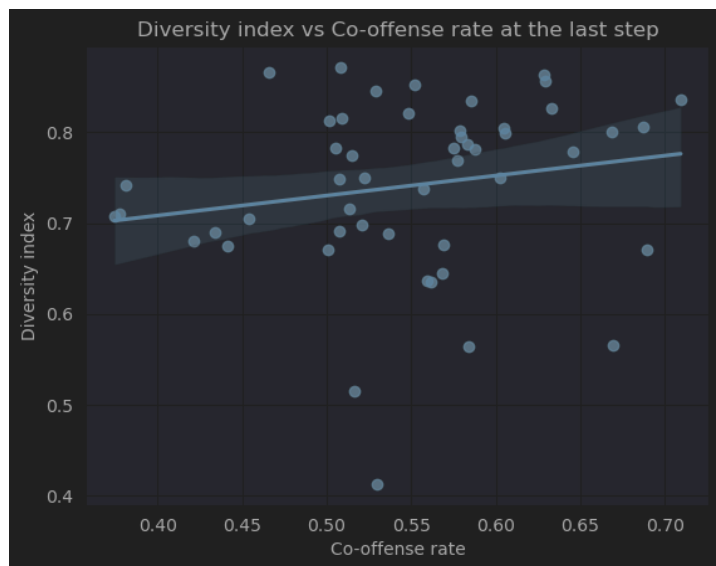
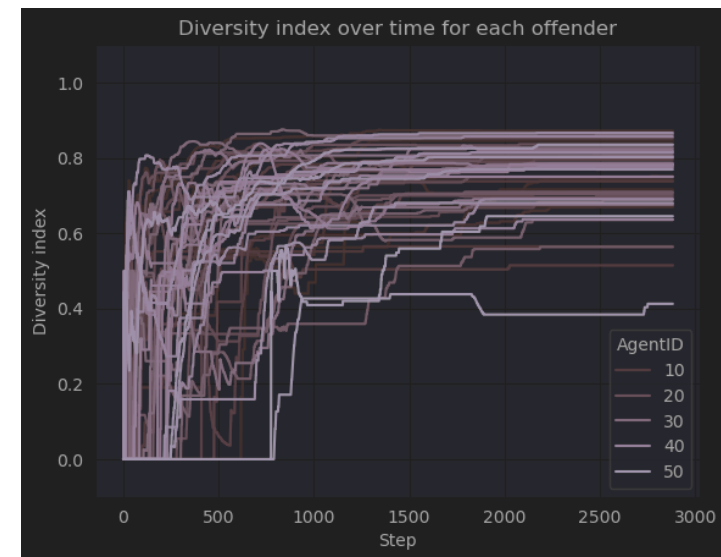
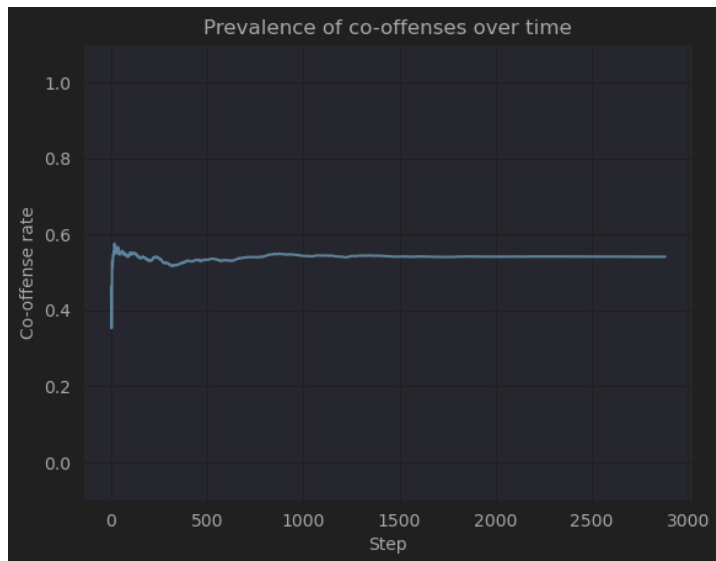
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Scenario 1: Limited access to partners, moderate skill and trust preference



Preliminary results

Scenario 1: Limited access to partners, moderate skill and trust preference



Future directions

- Assess the interaction between parameters
- Find the most appropriate set of parameters that is able to represent the real-life outcomes
- Quantify the expected outcomes

Team:

- Ruslan Klymentiev
- Paul Jeffrey Brantingham
- Rafael Prieto-Curiel
- Luis Enrique Correa Rocha
- Christophe Vandeviver



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- Skill level = number of previous successful crime events
- Trust level = number of previous successful collaborations
- Assign probability for each potential partner and the agent itself (for solo offending)

$$P(j) = \text{softmax}(\beta_{\text{trust}} \cdot T_{ij} + \beta_{\text{skill}} \cdot S_j)$$

- McGloin and Piquero (2010): redundancy of ego-centric network = more versatility
- Nieto et al. (2024): 54% (of 1,796 co-offending groups) were specialists, 46% were generalists
- Grund and Morselli (2017): 47% were entirely specialists, around 30% were entirely generalists, and the remainder showed mixed behavior

Theoretical model proposed by Weerman (2003)

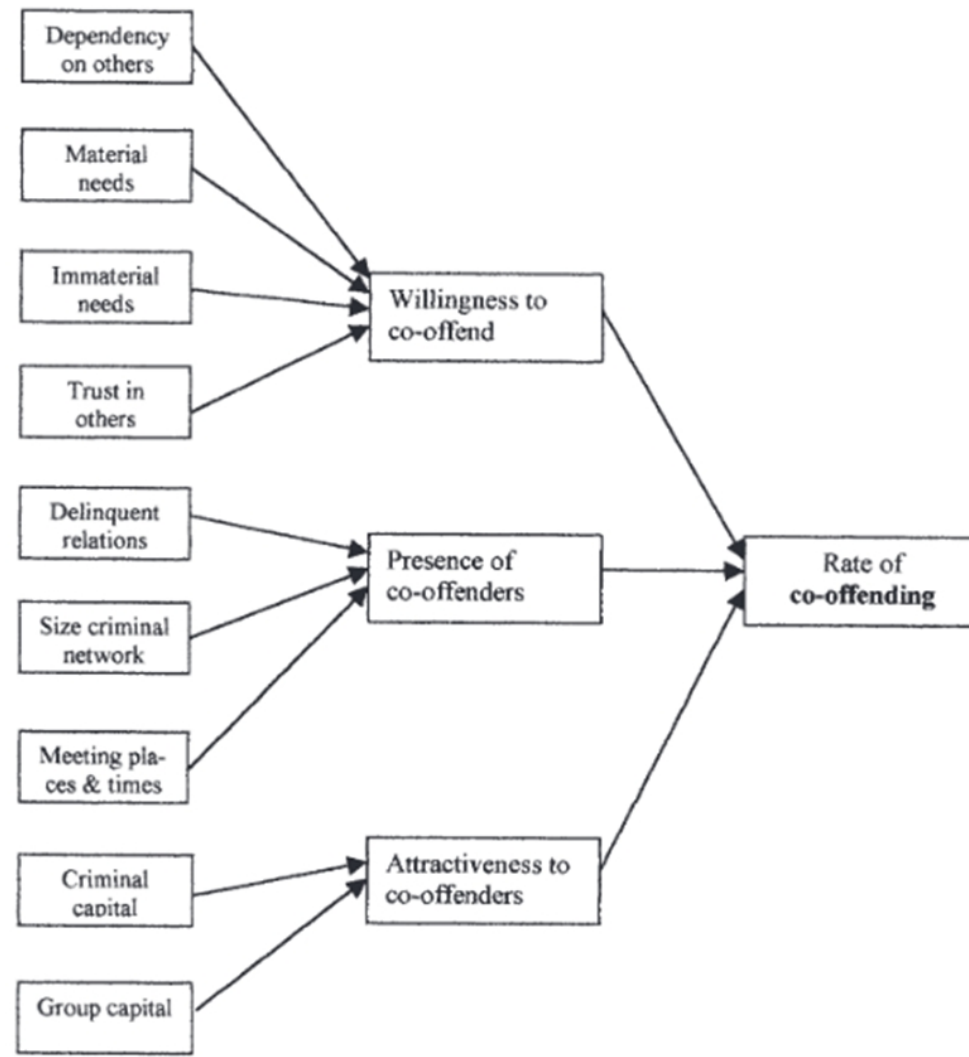


FIG. 2 Direct and indirect influences on individual co-offending rate