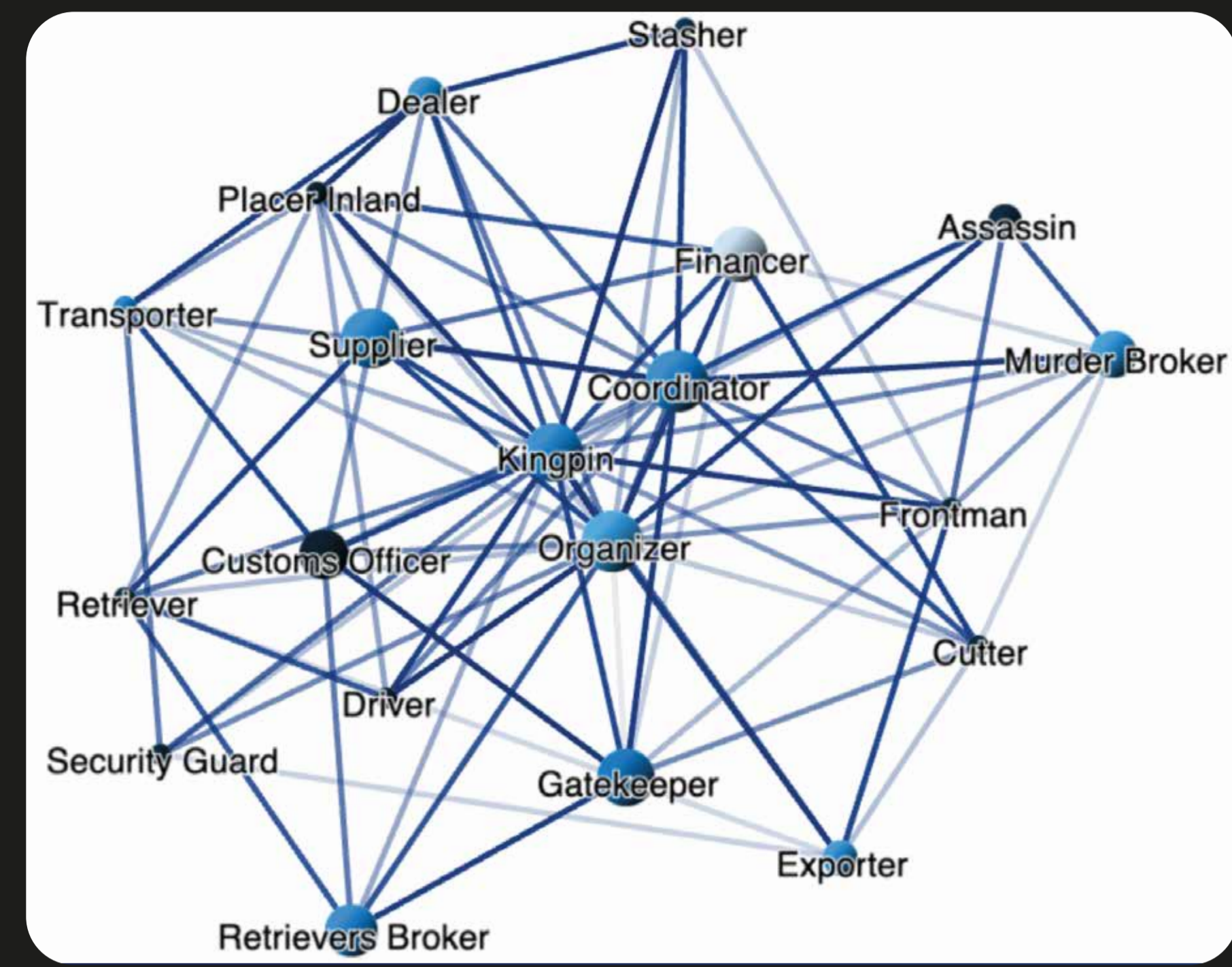
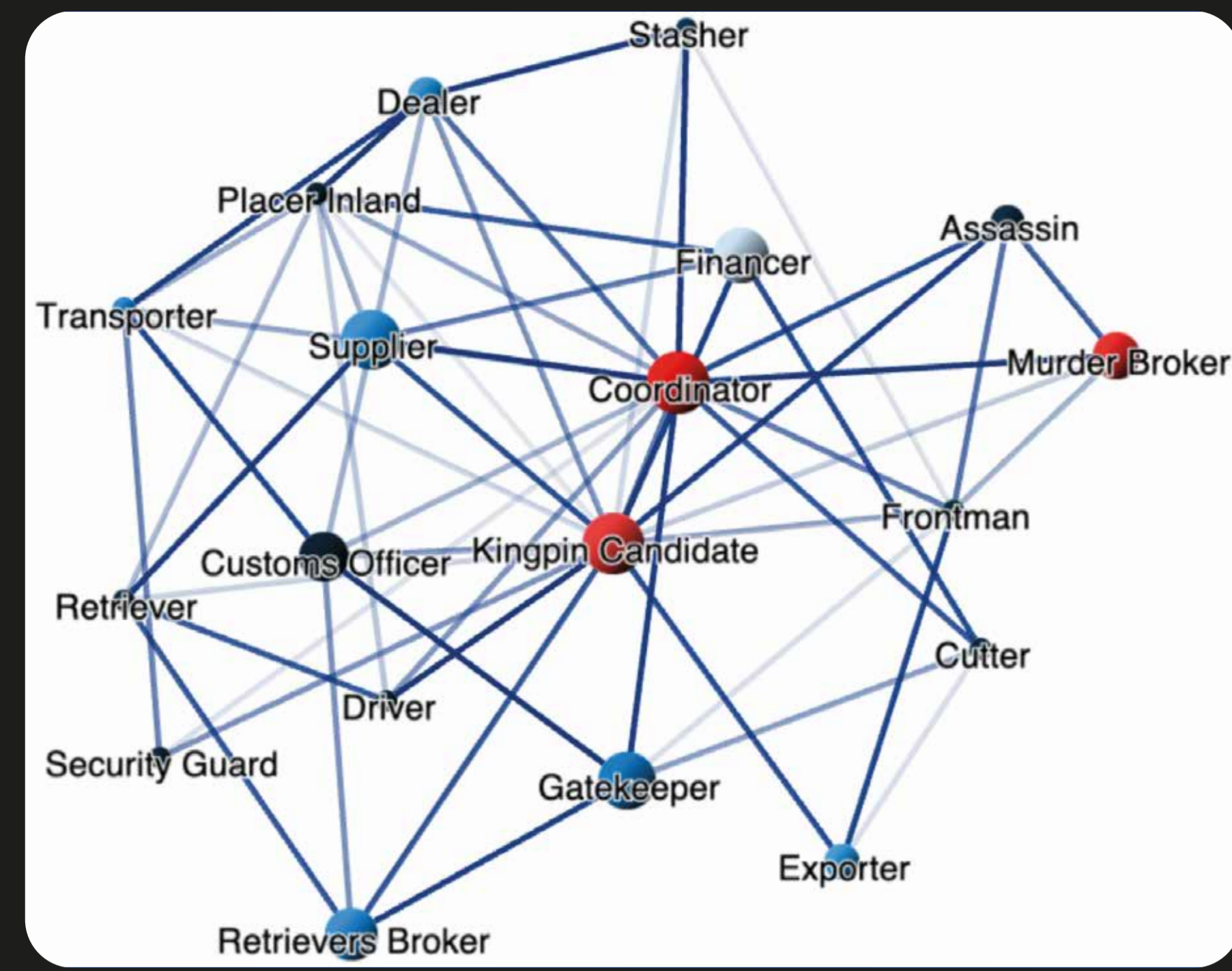


CitadelPolice: An Interactive Visualization Environment for Scenario Testing on Criminal Networks

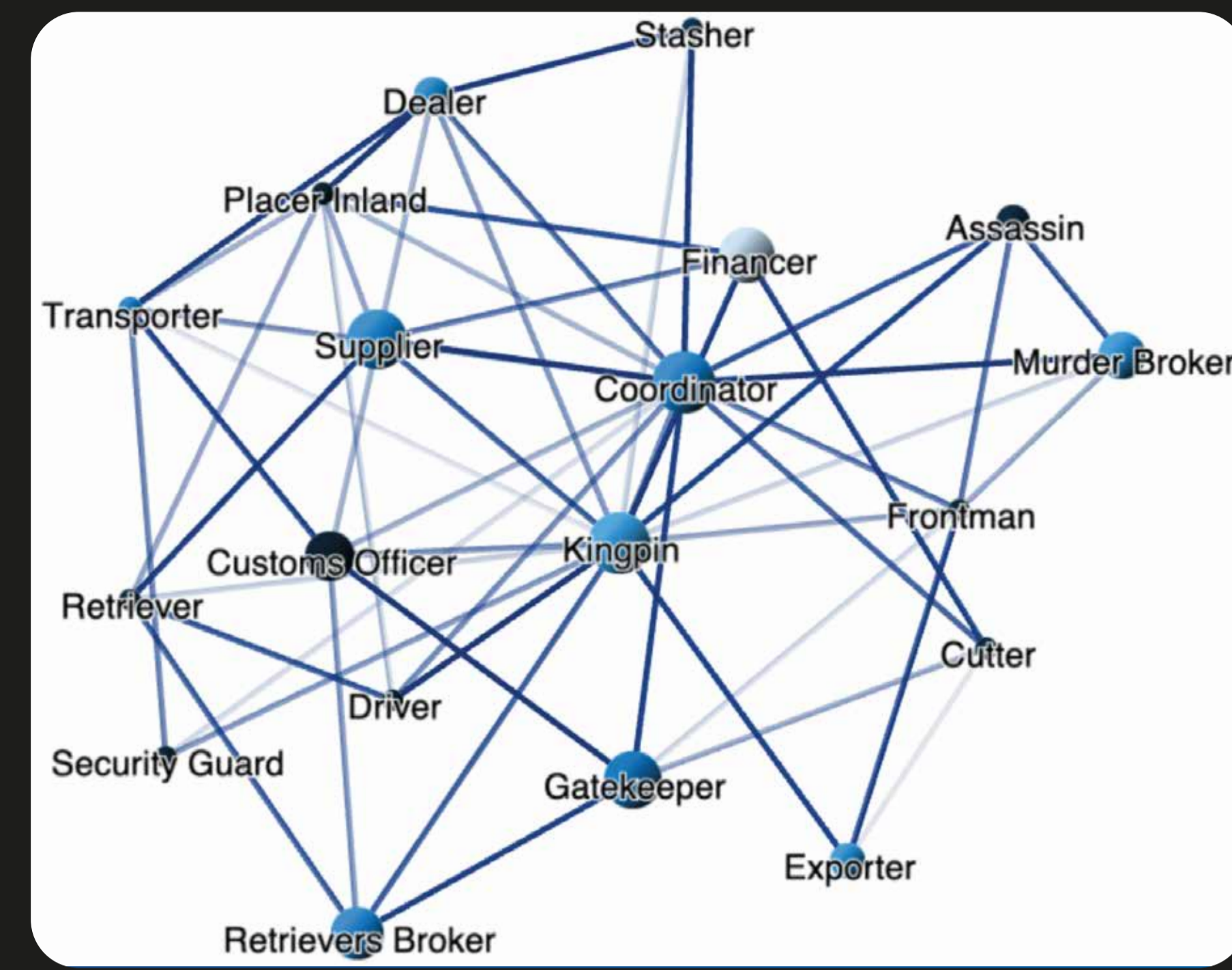
Liza A. S. Roelofsen Robert G. Belleman
 Frederike Oetker Rick Quax
 Miles van der Lely



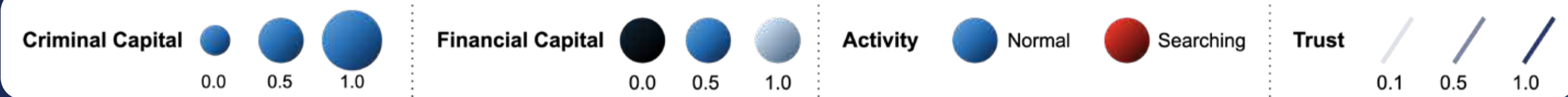
Day 1: Undisturbed Criminal Cocaine Network



Day 10: A Conclave has occurred



Day 35: The Criminal Network has Recovered



Research Aim

To bridge the gap between law enforcement and recent research through the creation of an interactive graph visualization dashboard on which law enforcement officers can independently investigate different intervention scenarios and their outcomes.

Introduction

The current state of the Dutch Criminal Cocaine Network is critical. The network operates with high efficiency, large amounts of cocaine are being shipped to the port of Rotterdam, retrieved and sold throughout the country or transported across the border to other European countries. Associated with this profit-based organized crime are (threats of) violence, endangering the safety of people that come in contact with the criminal network (Roks, 2022). And although there is plenty of police intervention, the networks recover through temporarily prioritizing security over efficiency and finding replacements for the removed criminals (Berlusconi, 2021). This prompted both researchers and law enforcement to reconsider the prevailing intervention methodology. Currently, further research remains necessary and an approach suited well within this time is the use of computational models to gain more insight into these criminal networks and find better disruption techniques. However, the missing link until now was the bridge between the researchers creating these models and law enforcement agencies having access to real data and scenarios in which intervention needs to be executed.

Methods

The main component of this research was the implementation of the Criminal Cocaine Replacement Model (CCRM) as a use-case into an online graph visualization and manipulation tool called Citadel.

Criminal Cocaine Replacement Model An Agent-Based Model on a network which simulates the recovery of a hypothetical, but realistic, sub-segment of the Dutch Criminal Cocaine Network after the removal of a central node, e.g. a kingpin or a specialist.

Citadel

Implementation Considerations

- A transformation of the graph format and simulation paradigm
- Addition of interactivity into the model using "triggers"
- Preservation of the Mental Map throughout the simulation runs

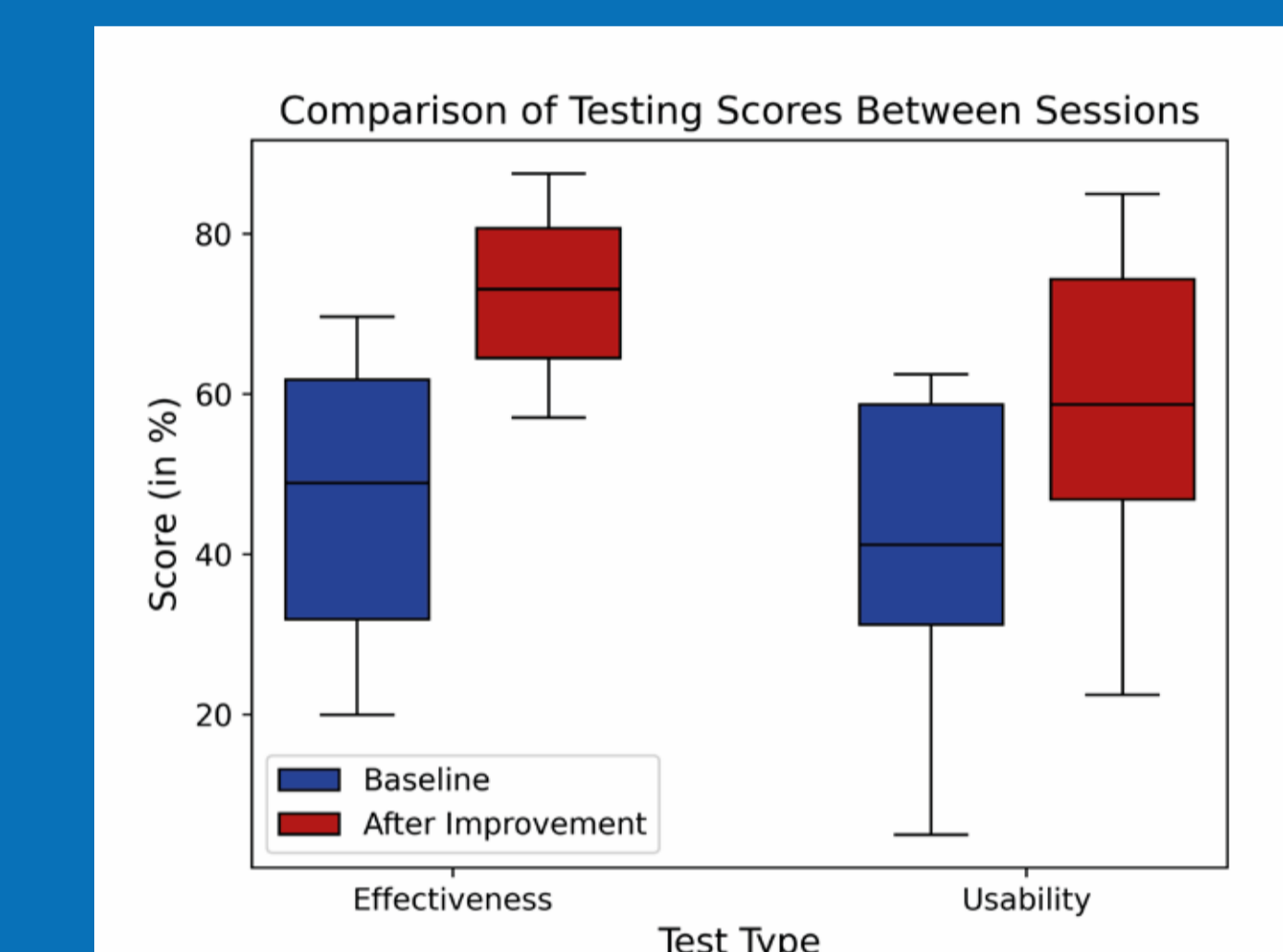
Evaluation

Sequential Testing Sessions:

- Aim: assess how understandable and usable CitadelPolice is for brand-new users.
- Participants: highly educated general users with varying ages and educational backgrounds as participants.

Performance measured through:

- **Usability:** System Usability Scale (SUS)
- **Effectiveness:** % correctly answered network and simulation questions



Mann-Whitney U test

Test Type	Statistic (U)	P-value
Effectiveness	10	0.003**
Usability	26	0.075

Conclusion

CitadelPolice should provide law enforcement with a novel tool to disrupt the criminal cocaine network in the Netherlands. We created the possibility for law enforcement to cultivate specialized interventions by independently simulating disruption methods and comparing the outcomes. In effect, we hope this leads to more effective disruptions, more efficient use of resources and making our country safer. For now, we are continuing development and improvement of CitadelPolice.

Acknowledgements

We want to thank the members of the Hyperion project within the Dutch Police, Paul Duijn and Thijs Vis.