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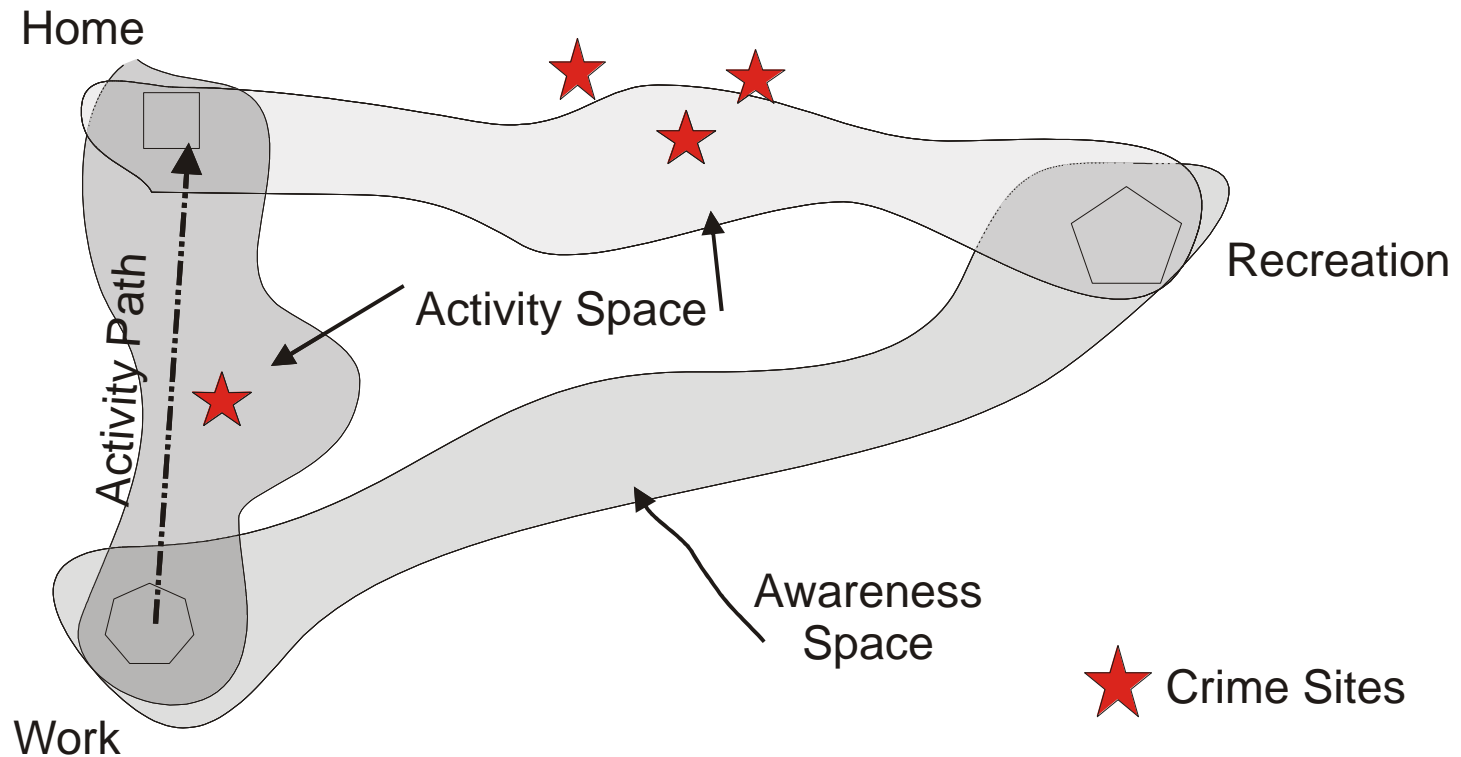
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How Many Ways Do Offenders Travel

Evaluating the Activity Paths of Offenders

INTRODUCTION

- The movement of offenders is not random





INTRODUCTION

- How many paths?
- 

INTRODUCTION

- How many paths?
- This question has significant meaning when profiling offenders
 - Help in using crime location to determine likely areas where the offender
 - Could have come from
 - Goes often

EXAMPLE

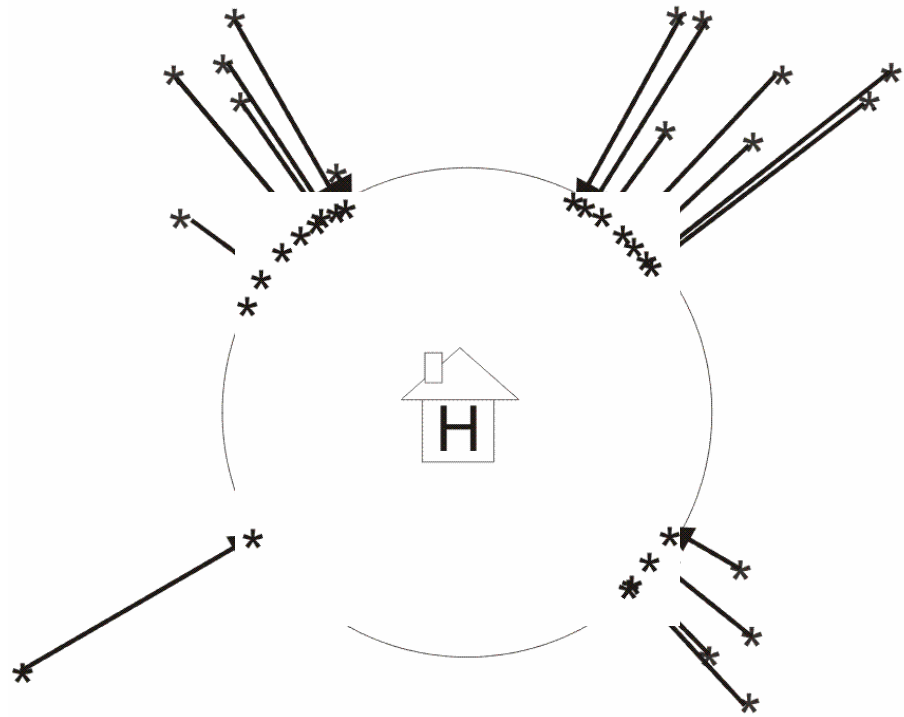


- NOT hot-spot analysis
- Find how many activity paths the offenders have



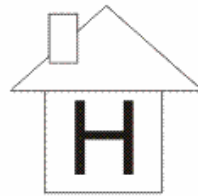
REMOVING DISTANCE

- The focus is solely on the directionality component of the offense, totally ignoring the distance component



METHOD

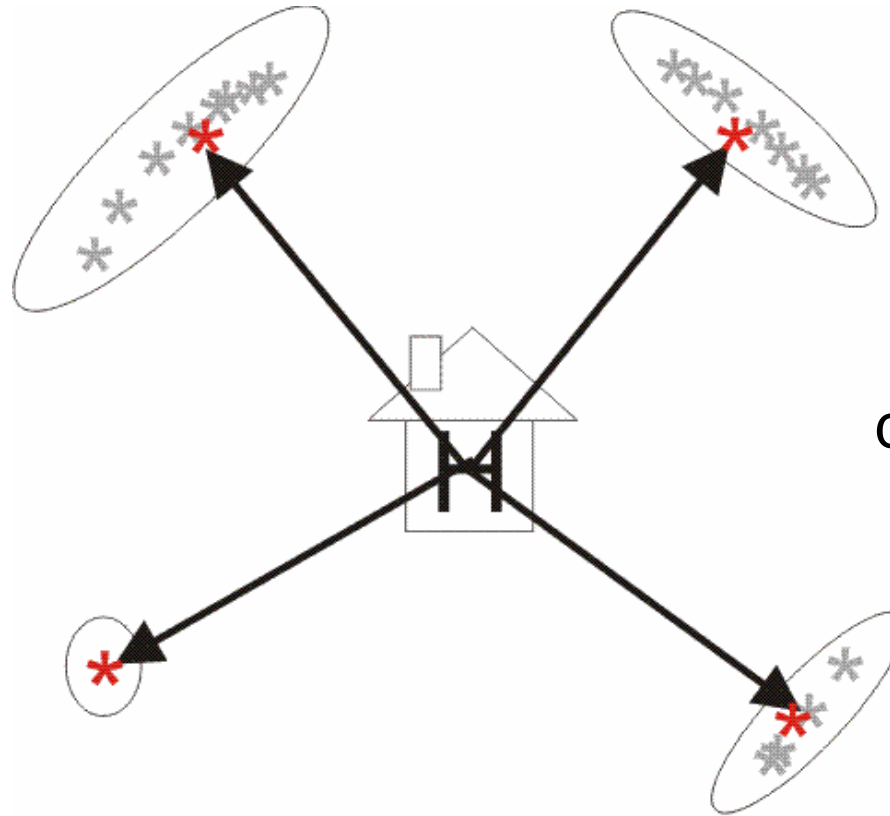
- No distance now
- How to get few major directions??



Perform Clustering!
(K-Means)



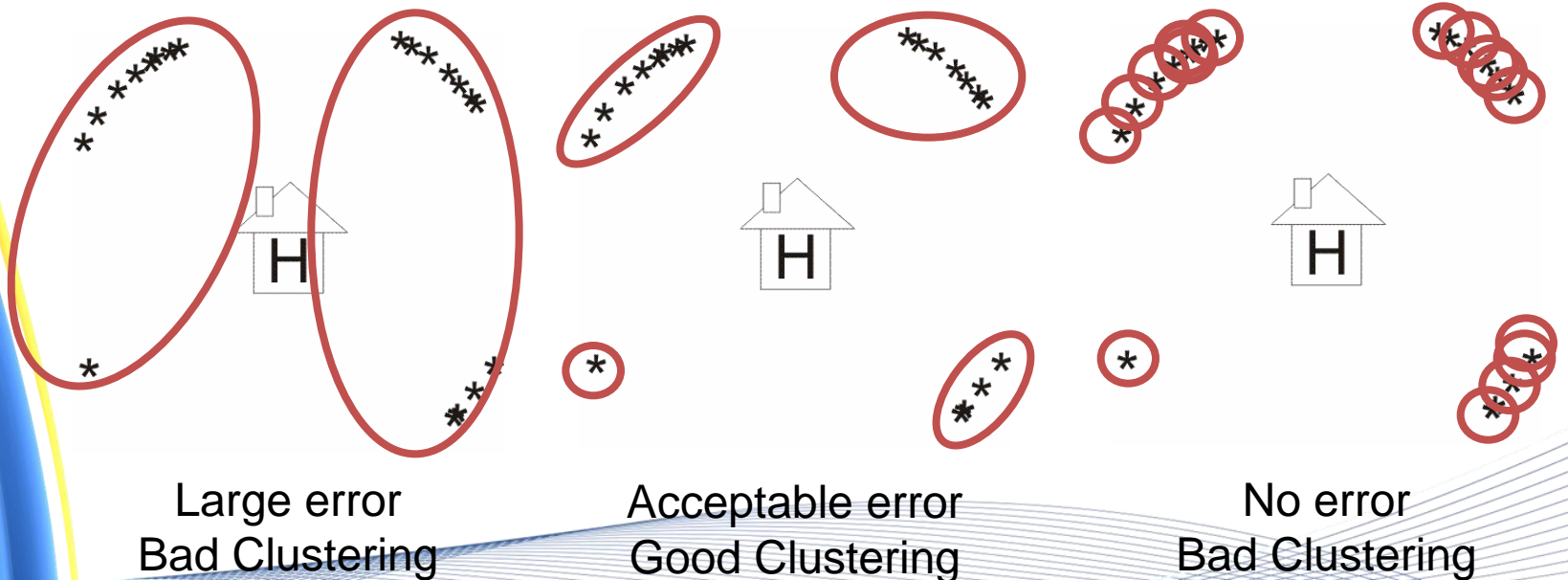
CLUSTERING OF DIRECTIONALITY



Each cluster center represents a cardinal direction, or the direction of an activity path.

CLUSTERING WITH K-MEANS

- Requires the number of clusters to be given
- Rather than taking a wild guess
 - Try 1, 2, 3... clusters
 - until the addition of a single cluster results in negligible benefits



DATA

➤ Crime Data-Warehouse

- a collection of databases
- at Institute of Canadian Urban Research Studies (ICURS) at Simon Fraser University (SFU)
- Five years of real-world crime data
 - For the Province of British Columbia (BC), Canada
 - From Canada's federal police, the Royal Canadian Mounted Police (RCMP)
- Calls-for-service data between August 1, 2001 and July 31, 2006
- Information about crime-events (~4.4million) and people (~9million)

DATA

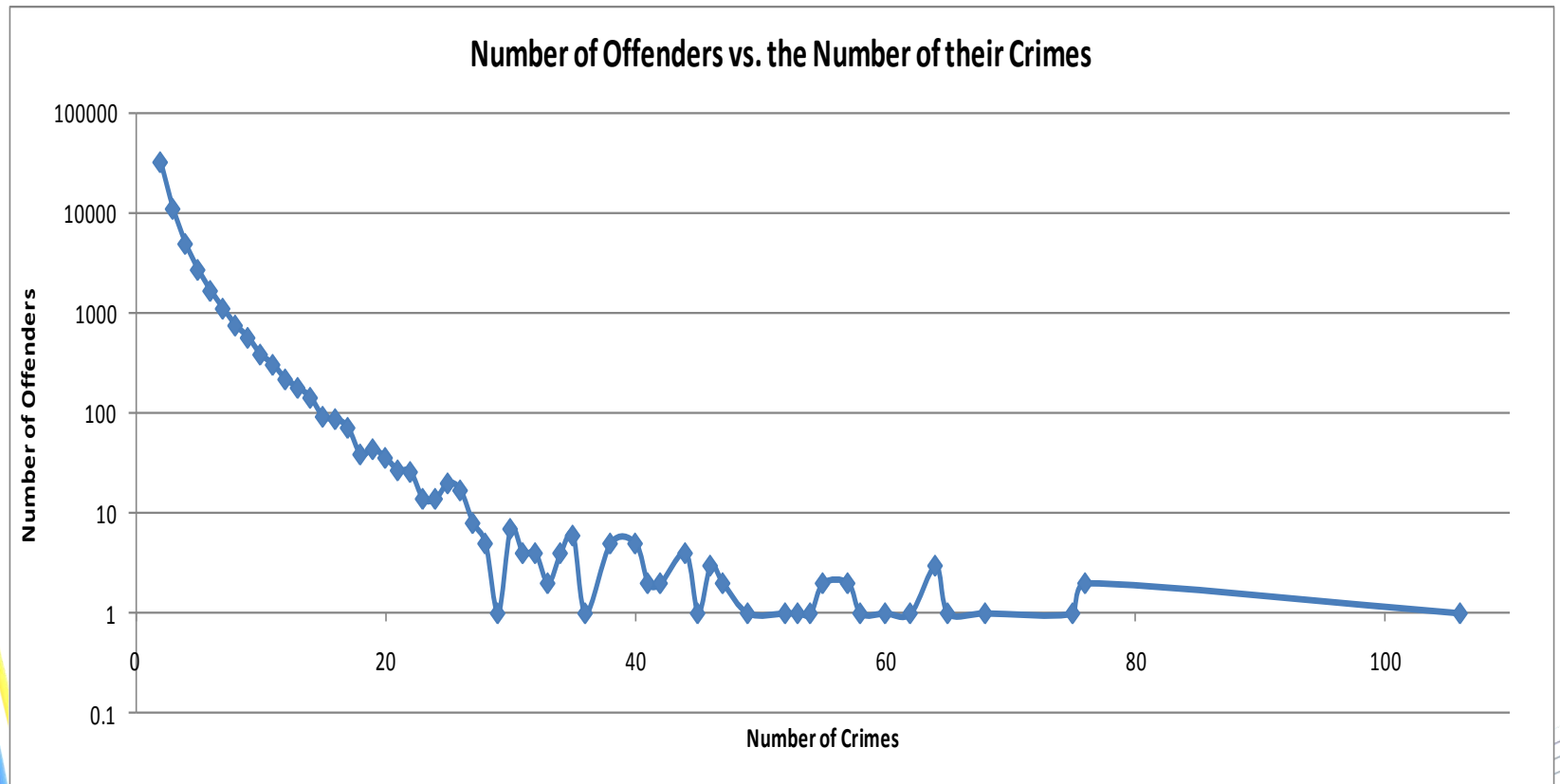
- For the people involved in each crime
 - Full name (first, last and middle)
 - Home address (geocoded to longitude/latitude)
 - Crime address (geocoded to longitude/latitude)
 - Type of involvement
- Repeat offenders were identified by having the same full name

RESULTS

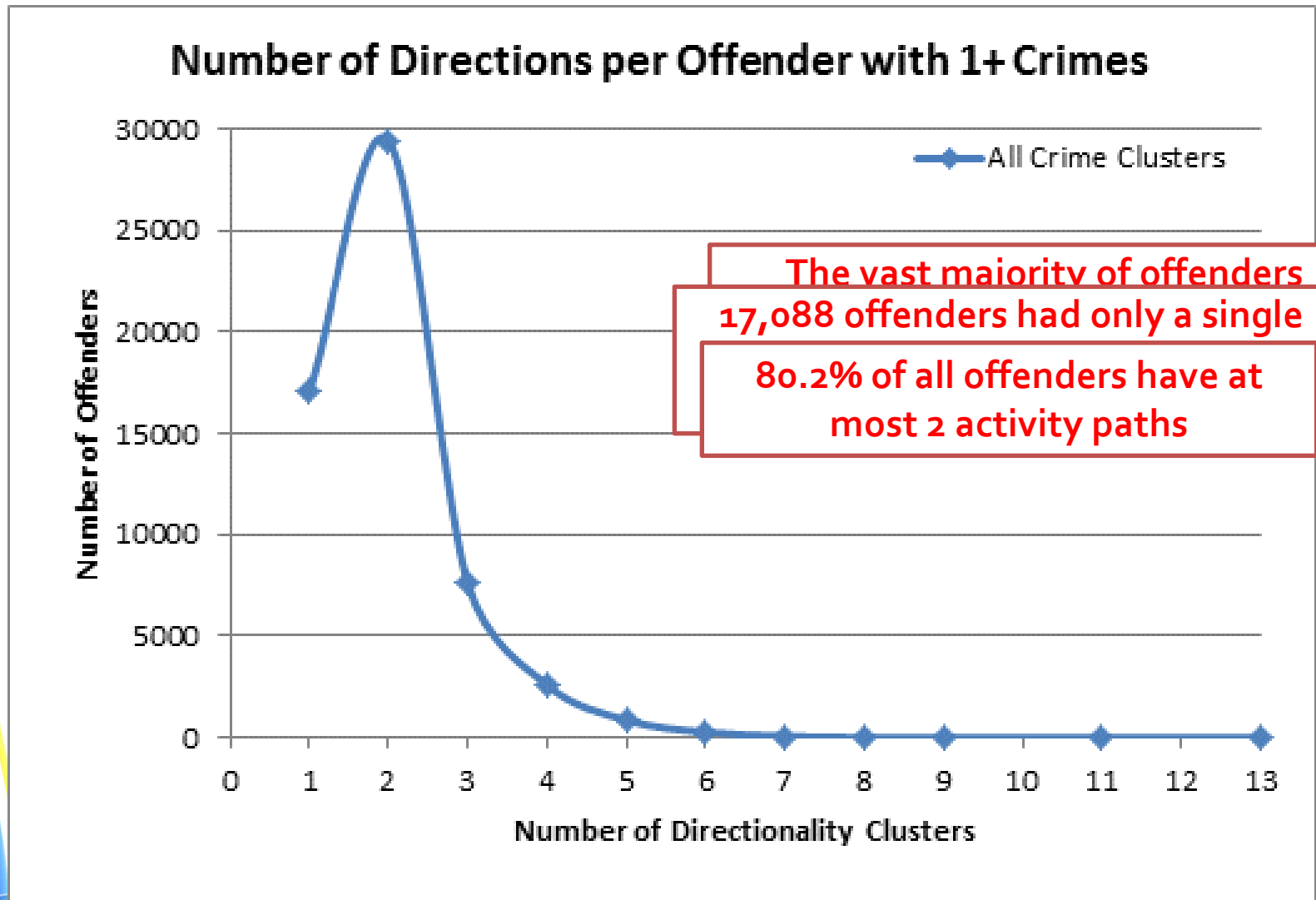
- All offenders who were *suspect, charged, chargeable, or charges were recommended against them* IN MORE THAN 1 CRIME
- Valid address both for their home location and their crime location

- 57,962 unique offenders with a total of 189,682 crimes
- Each offender
 - Had between 2 and 106 (!!) crimes
 - An average of 3.27 crimes per offender
 - A median of 2 crimes

NUMBER OF OFFENDERS AND THEIR CRIMES

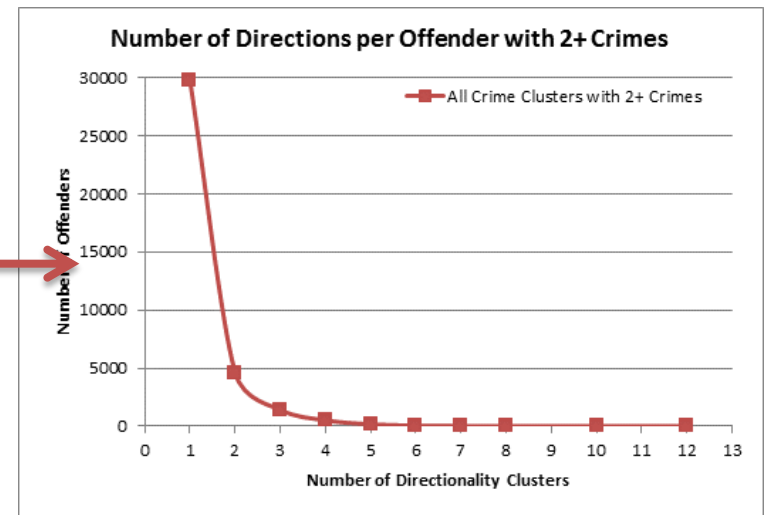
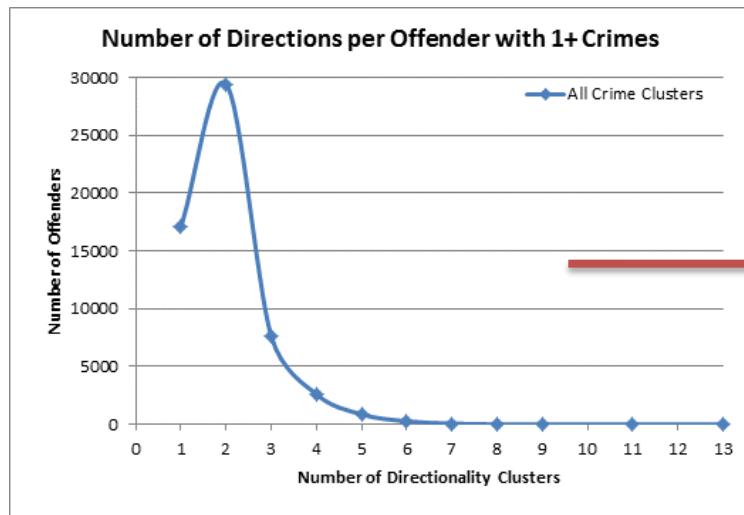


DISTRIBUTION OF CRIMES VS # OF PATHS



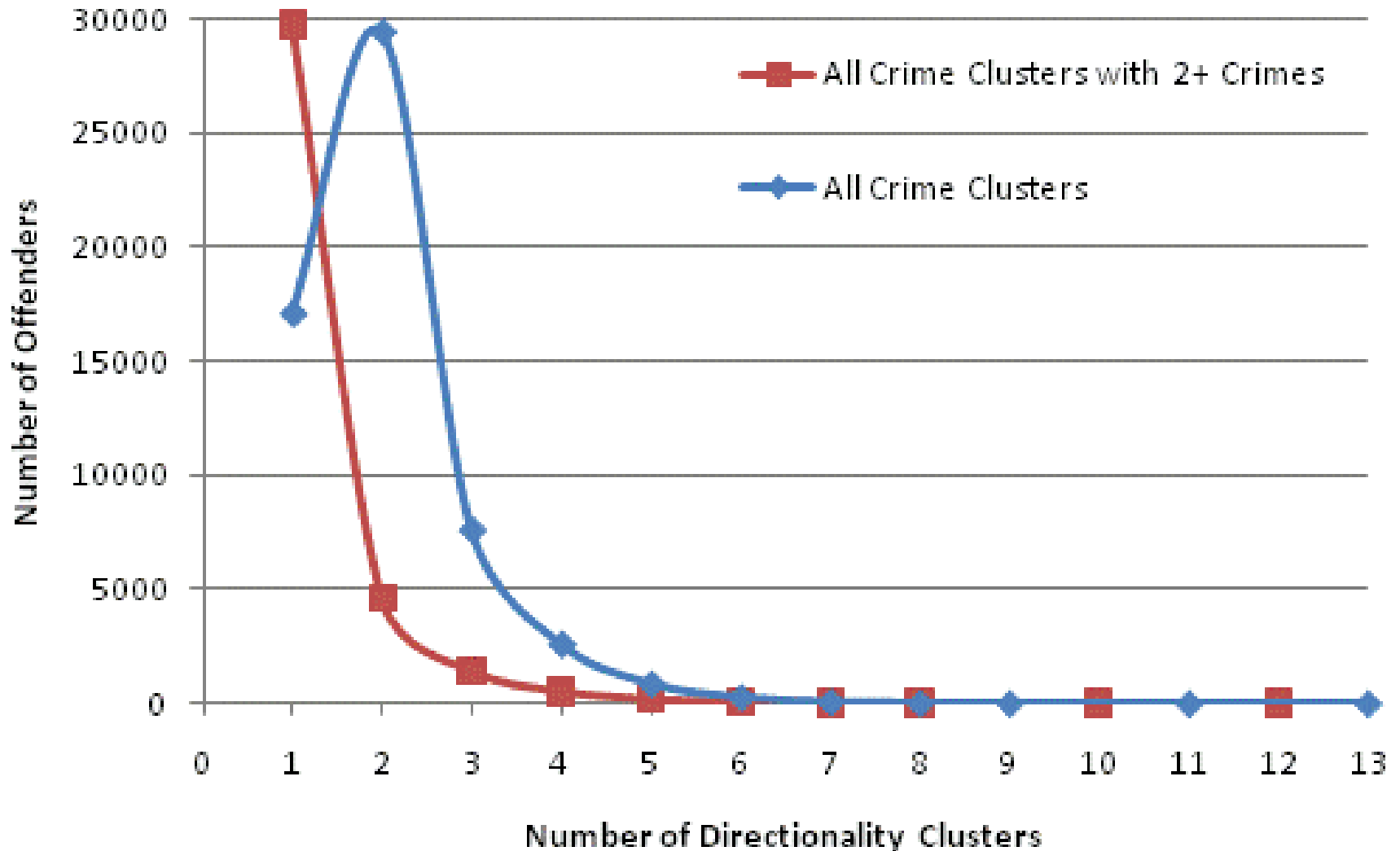
ALL CRIMES

- single crime location does not necessarily indicate that the offender actually prefers that direction
- singleton clusters removed

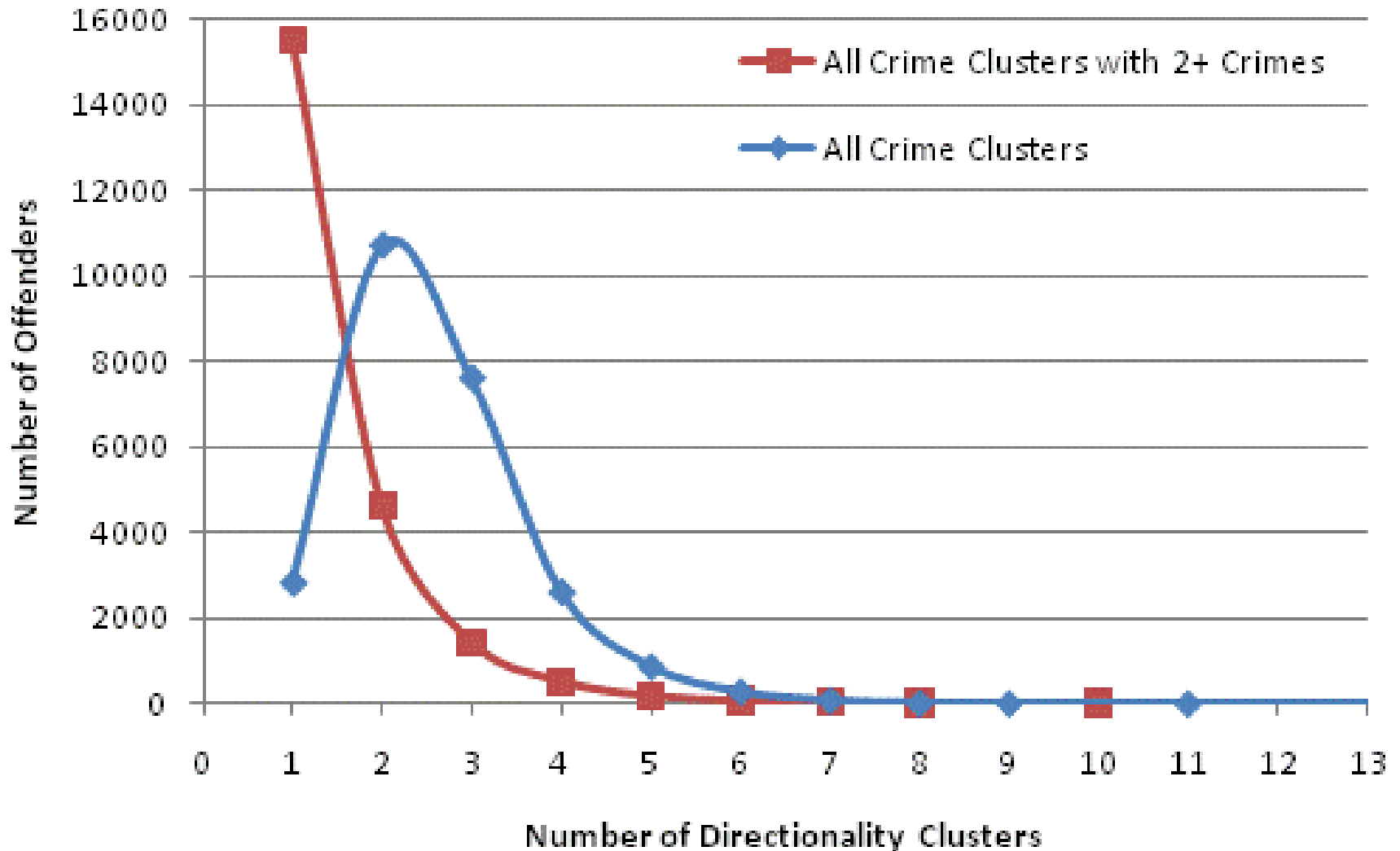


- instead of 80% having two directionality clusters, over 81% of the offenders have a *single* activity path along which they offend
- Over 99.2% of the offenders have at most 4 activity paths

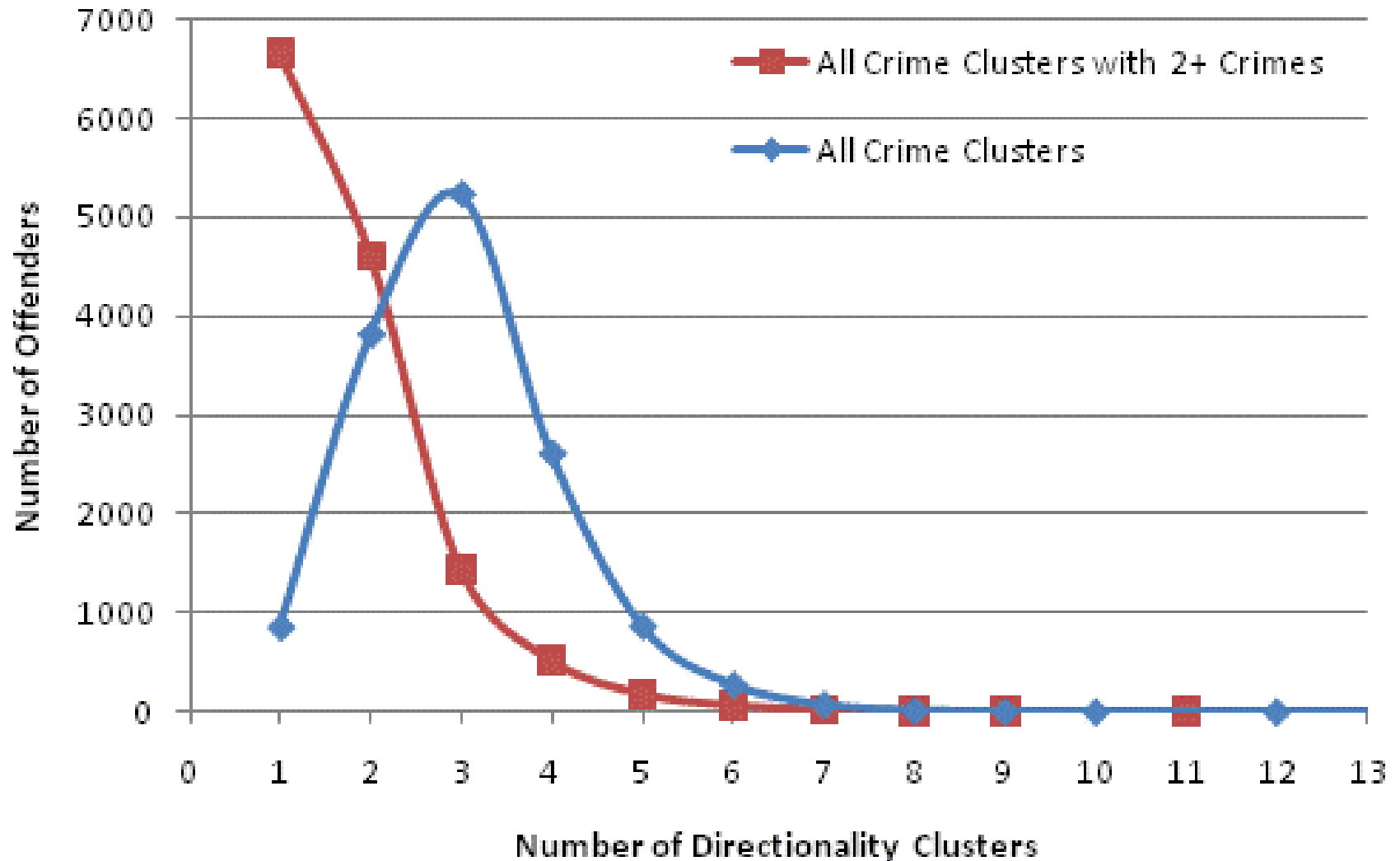
Number of Directions per Offender with 1+ Crimes



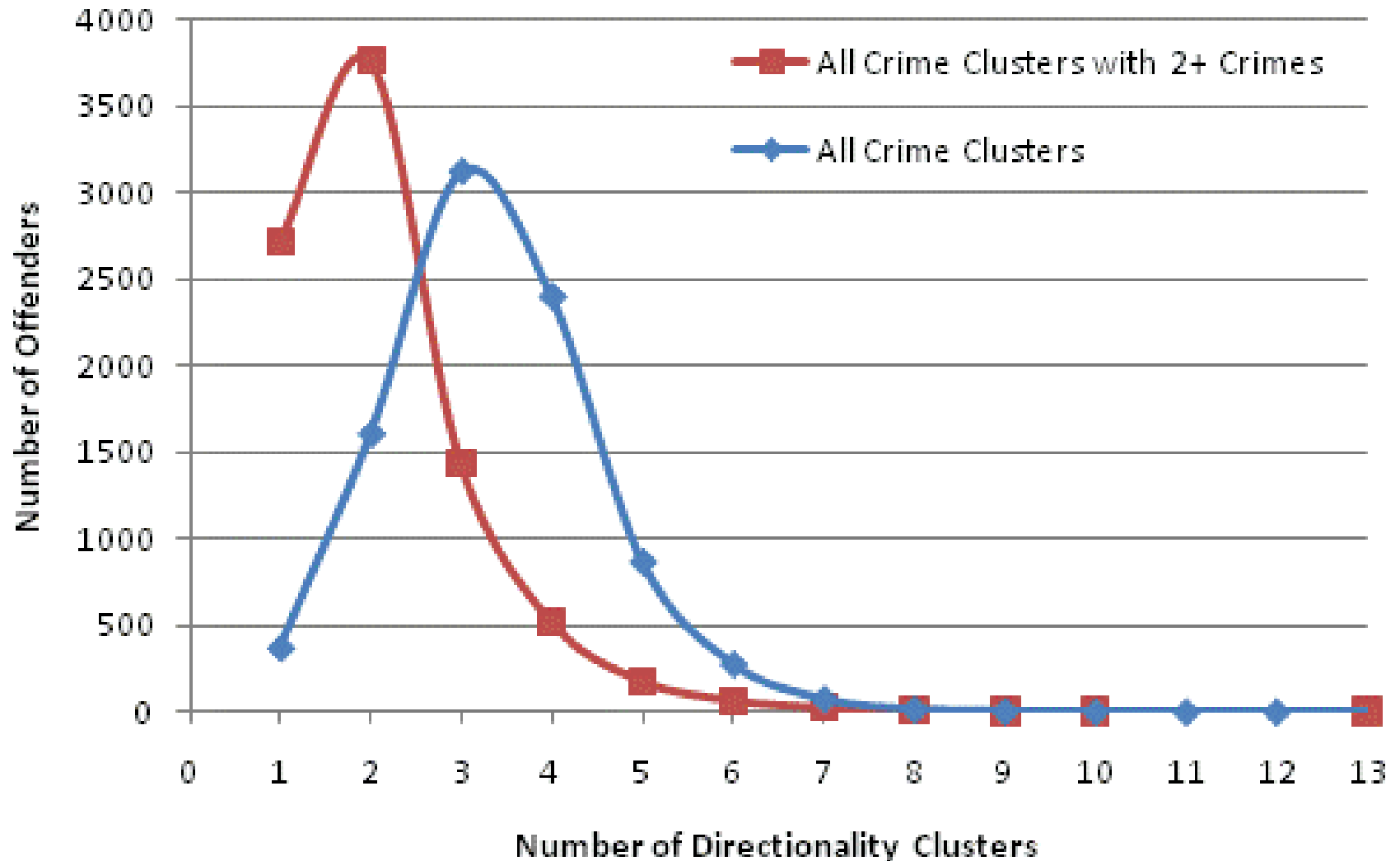
Number of Directions per Offender with 2+ Crimes



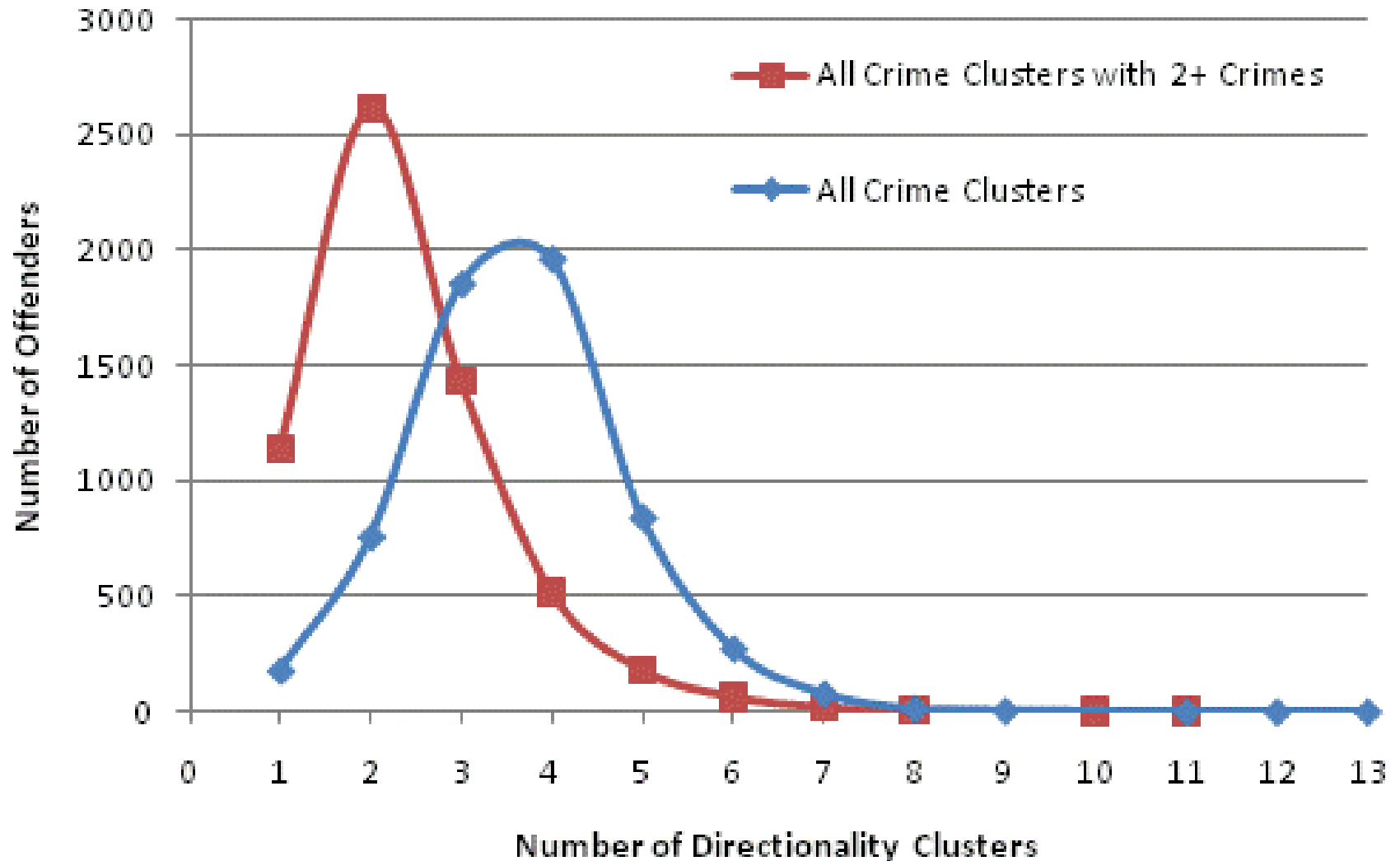
Number of Directions per Offender with 3+ Crimes



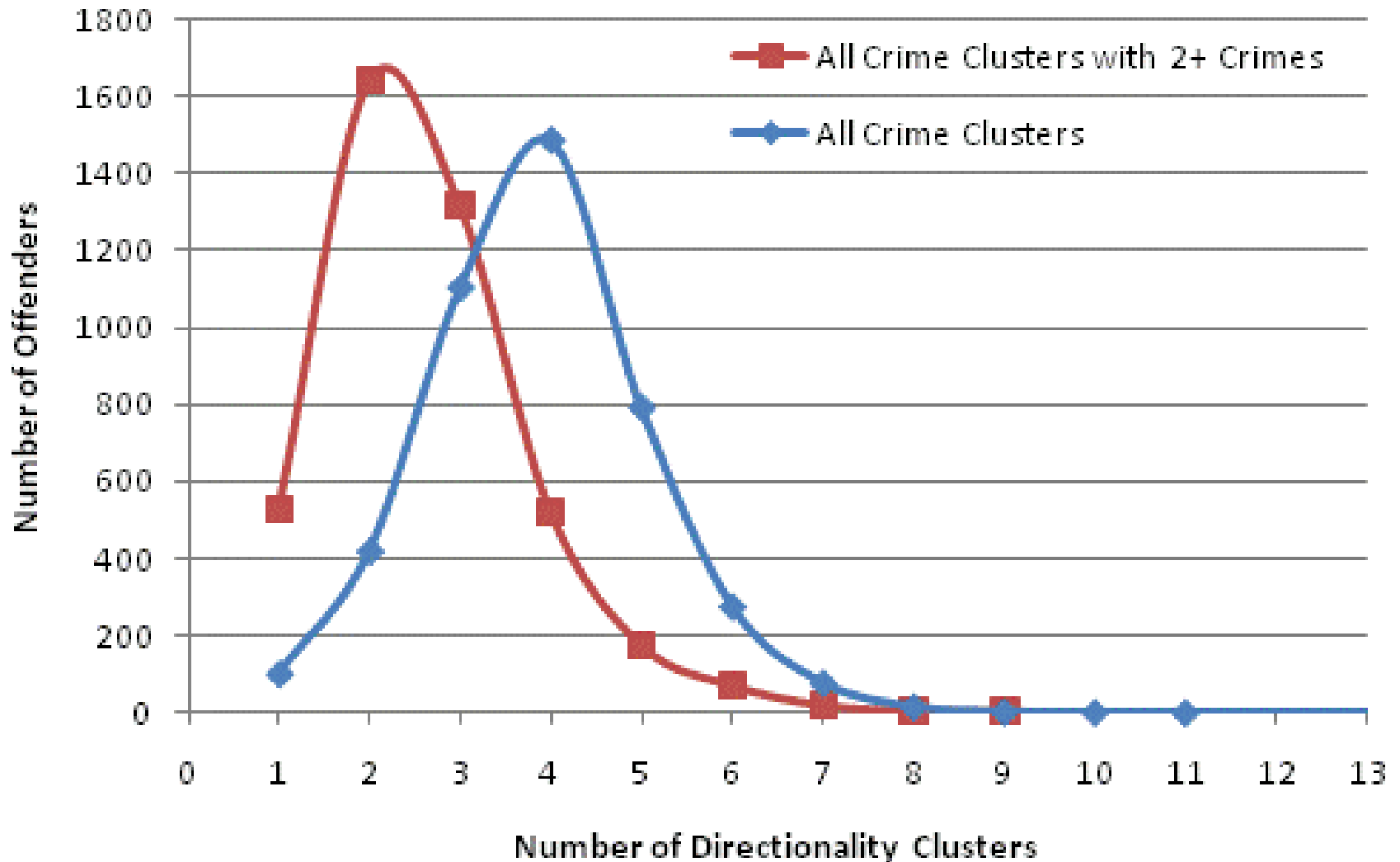
Number of Directions per Offender with 4+ Crimes



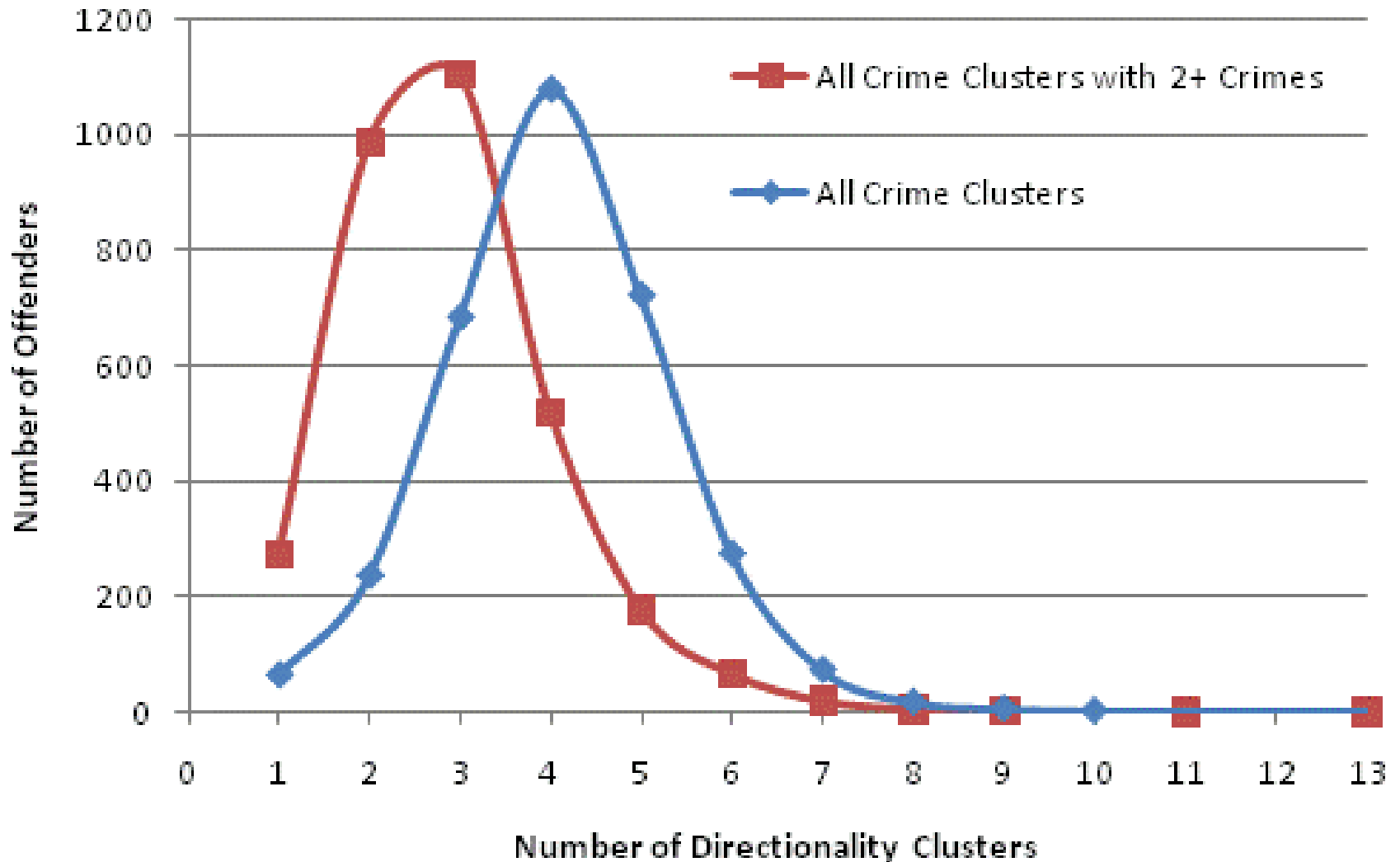
Number of Directions per Offender with 5+ Crimes



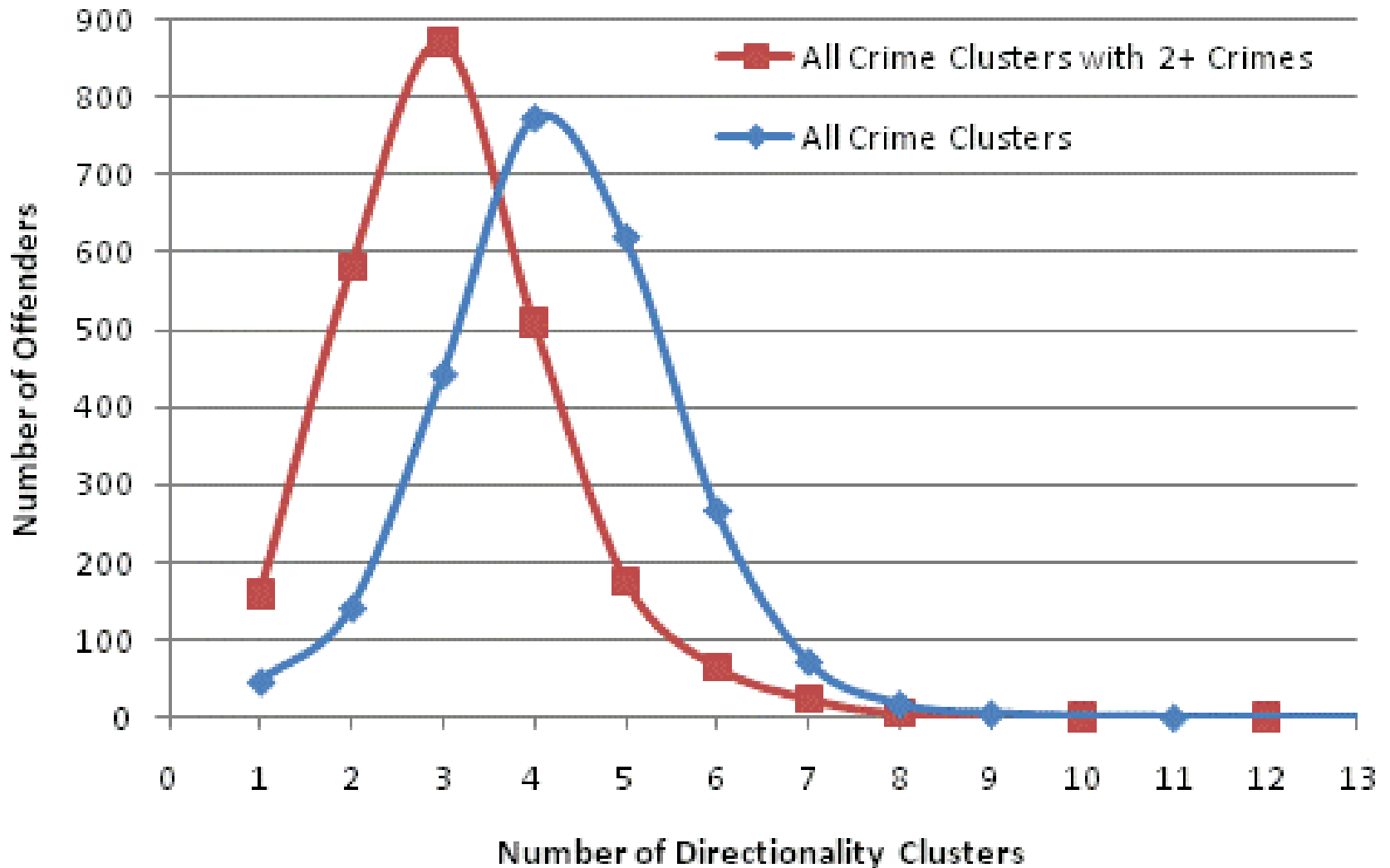
Number of Directions per Offender with 6+ Crimes



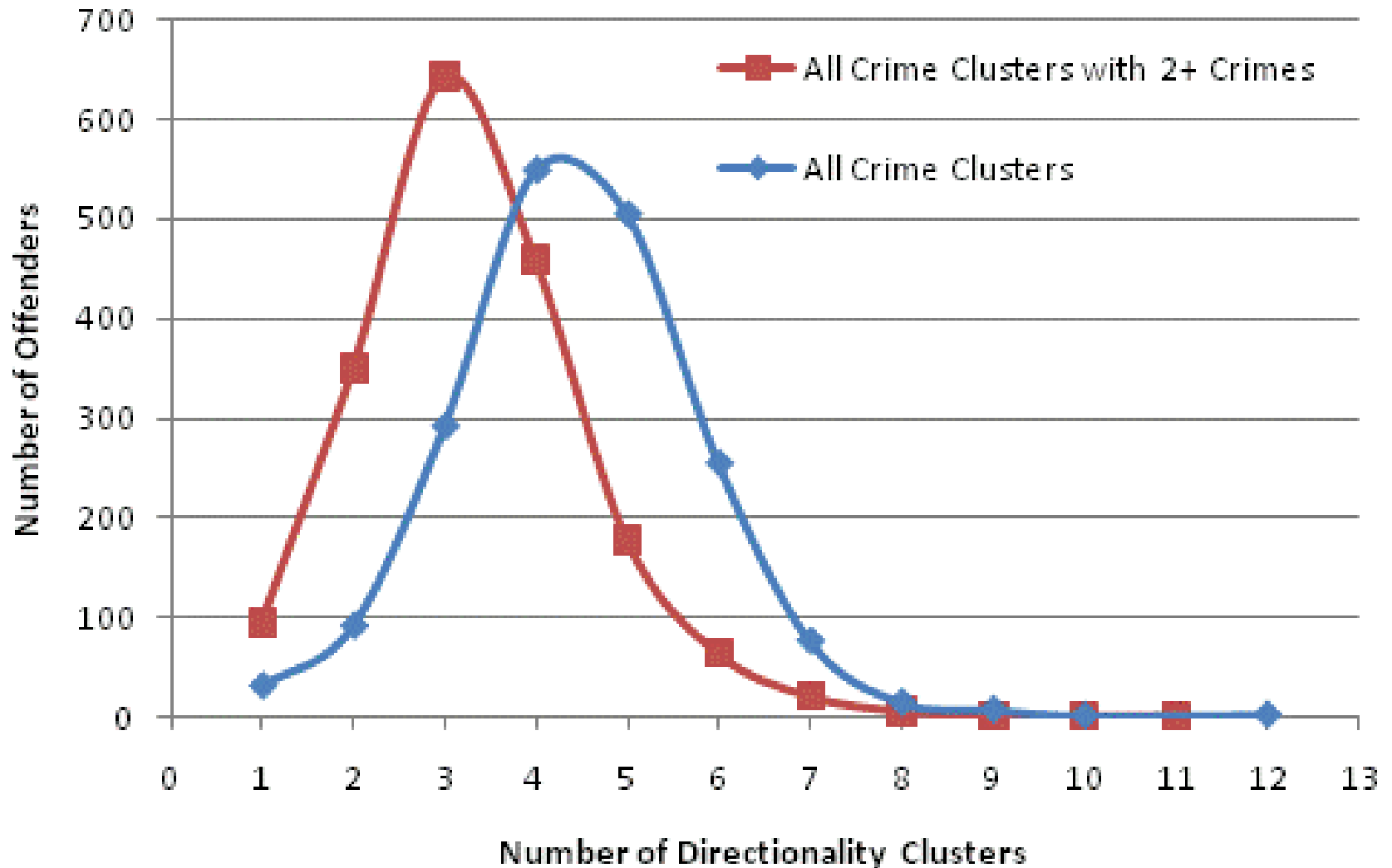
Number of Directions per Offender with 7+ Crimes



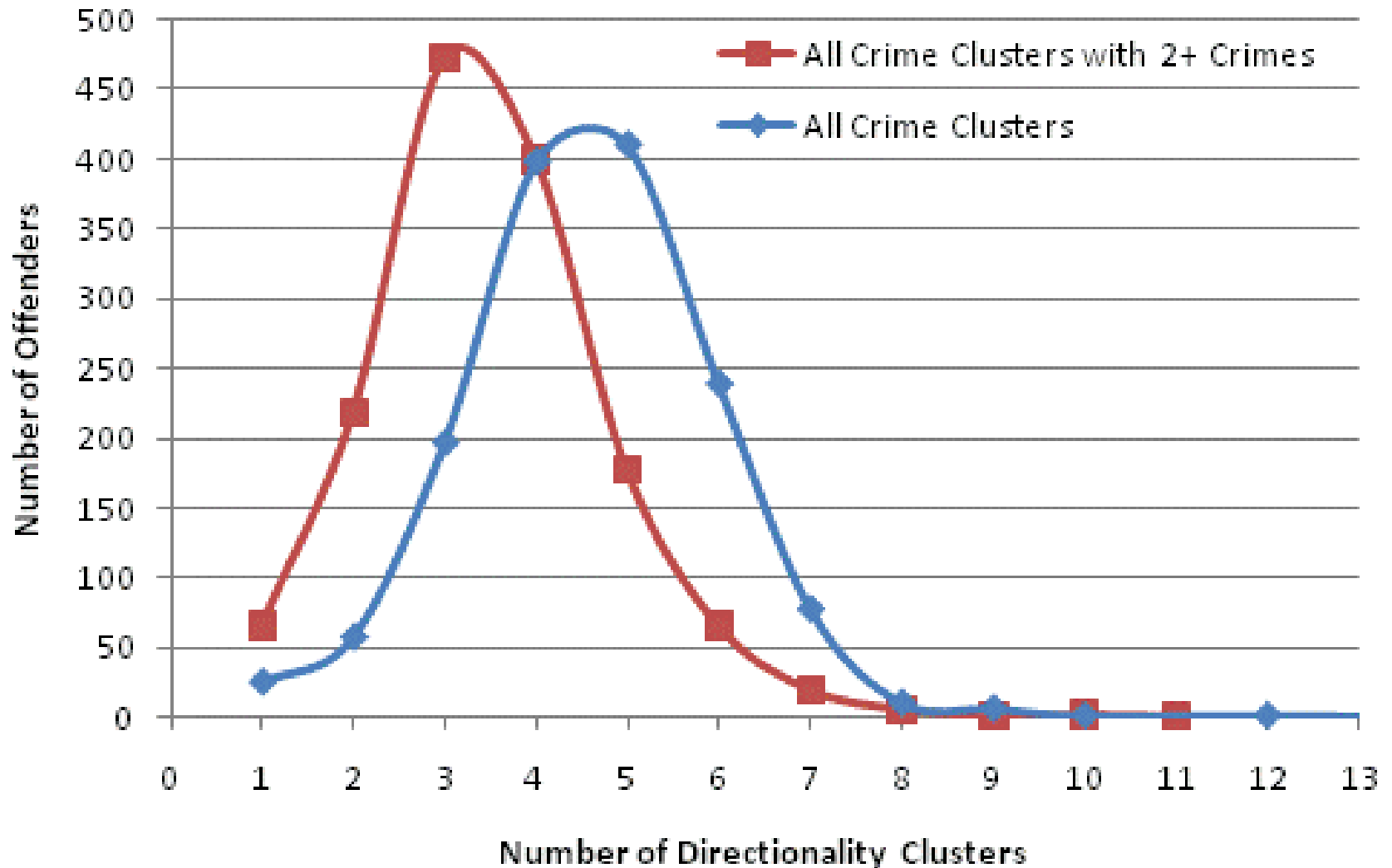
Number of Directions per Offender with 8+ Crimes



Number of Directions per Offender with 9+ Crimes



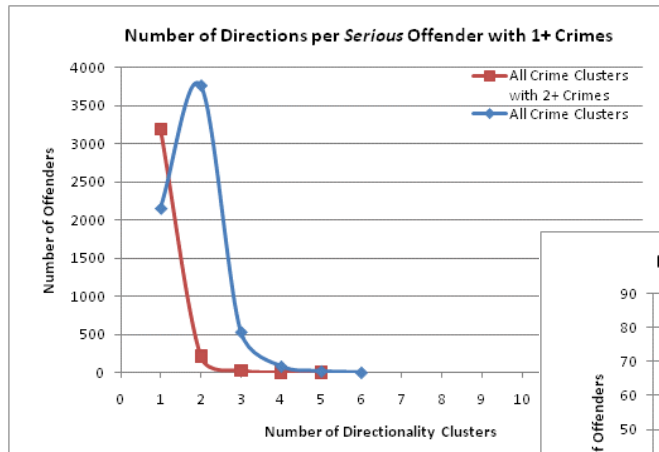
Number of Directions per Offender with 10+ Crimes



serious crimes: crimes against the person, such as (attempted) murder, assault, abduction

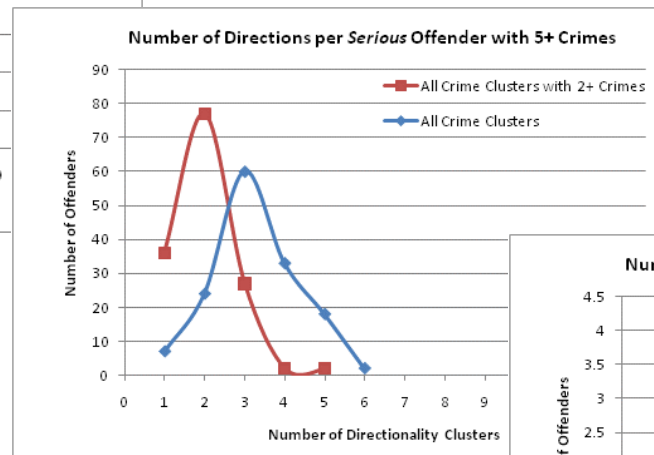
SERIOUS CRIMES

- number of activity paths for 6,562 offenders and only their serious crimes

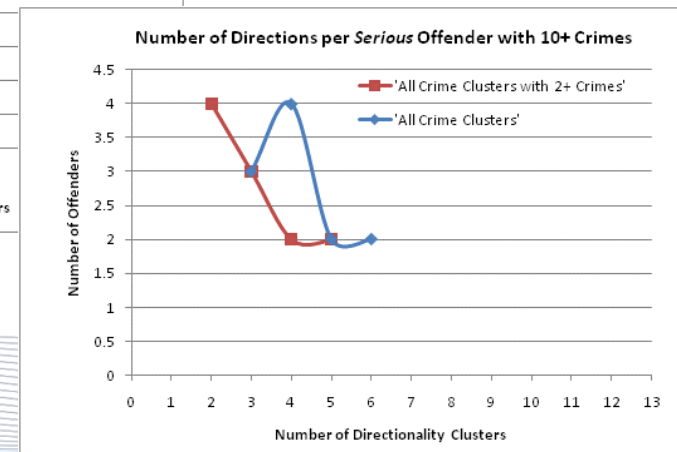


a) with 1+ Crimes

a) with 5+ Crimes



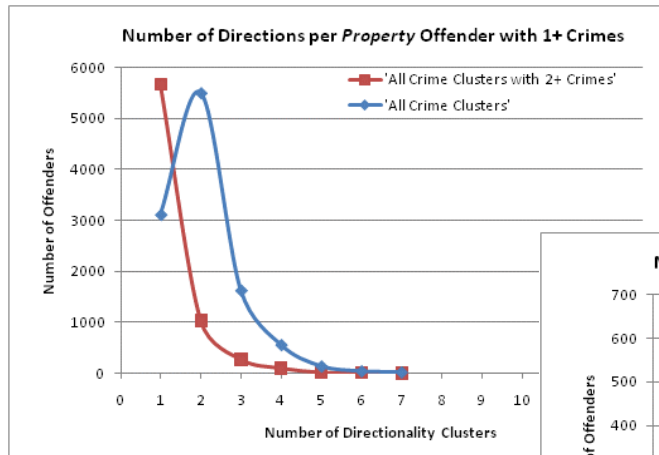
a) with 10+ Crimes



property crimes: crimes against property, such as breaking and entering or theft

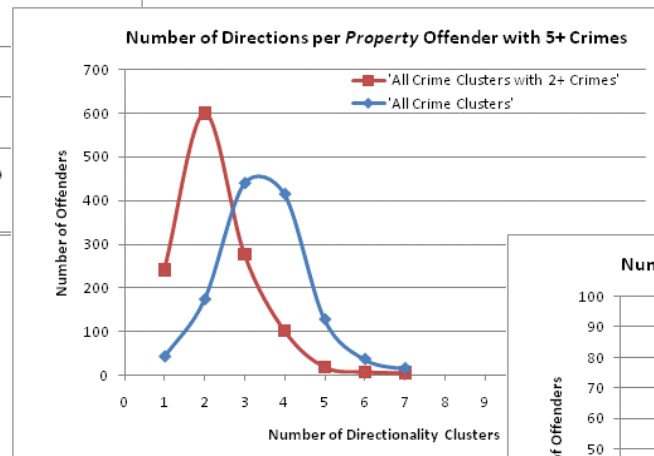
PROPERTY CRIMES

➤ number of activity paths for 10,983 offenders and only their serious crimes

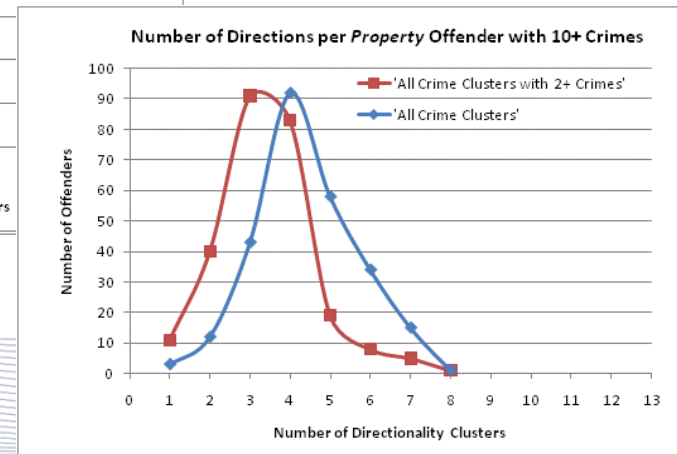


a) with 1+ Crimes

a) with 5+ Crimes



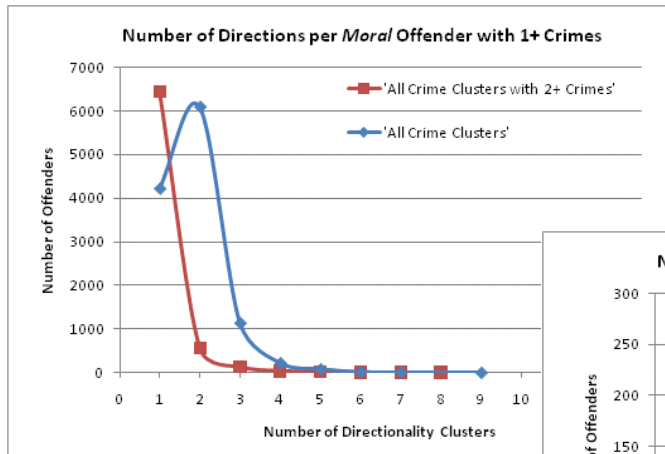
a) with 10+ Crimes



moral crimes: such as prostitution, arson, child porn, gaming, breach

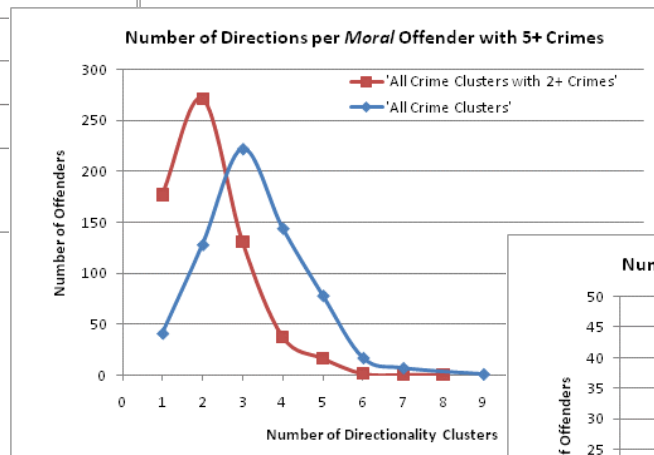
MORAL CRIMES

➤ number of activity paths for 11,784 offenders and only their serious crimes

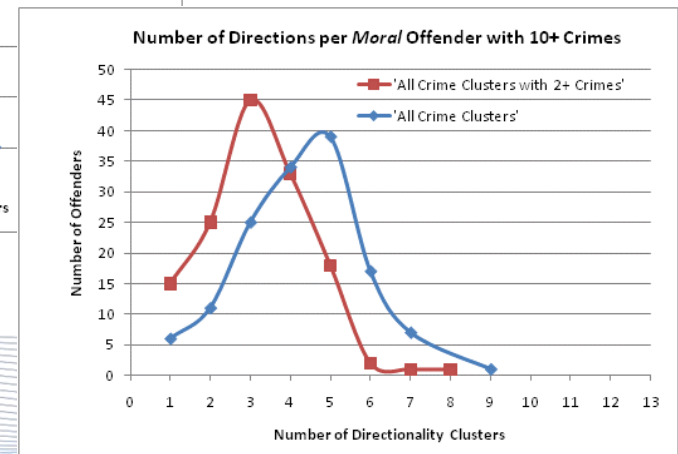


a) with 1+ Crimes

a) with 5+ Crimes



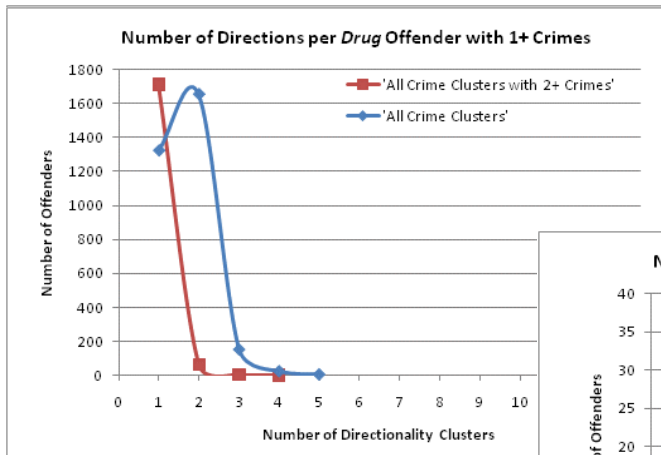
a) with 10+ Crimes



drug crimes: such as trafficking, possession, import/export

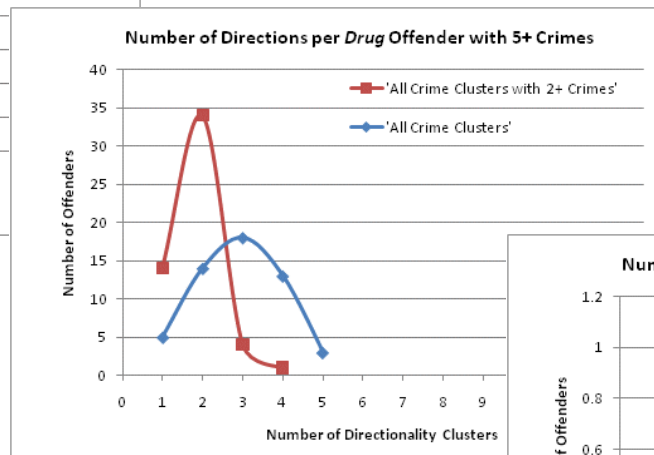
DRUG CRIMES

➤ number of activity paths for 3,148 offenders and only their serious crimes

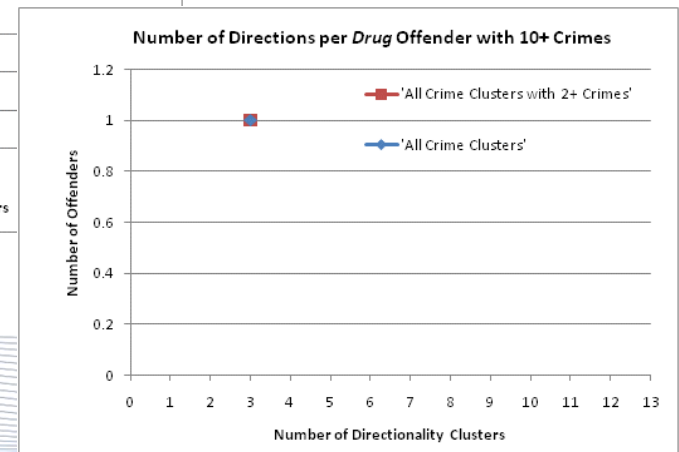


a) with 1+ Crimes

a) with 5+ Crimes



a) with 10+ Crimes



DISCUSSION & CONCLUSIONS

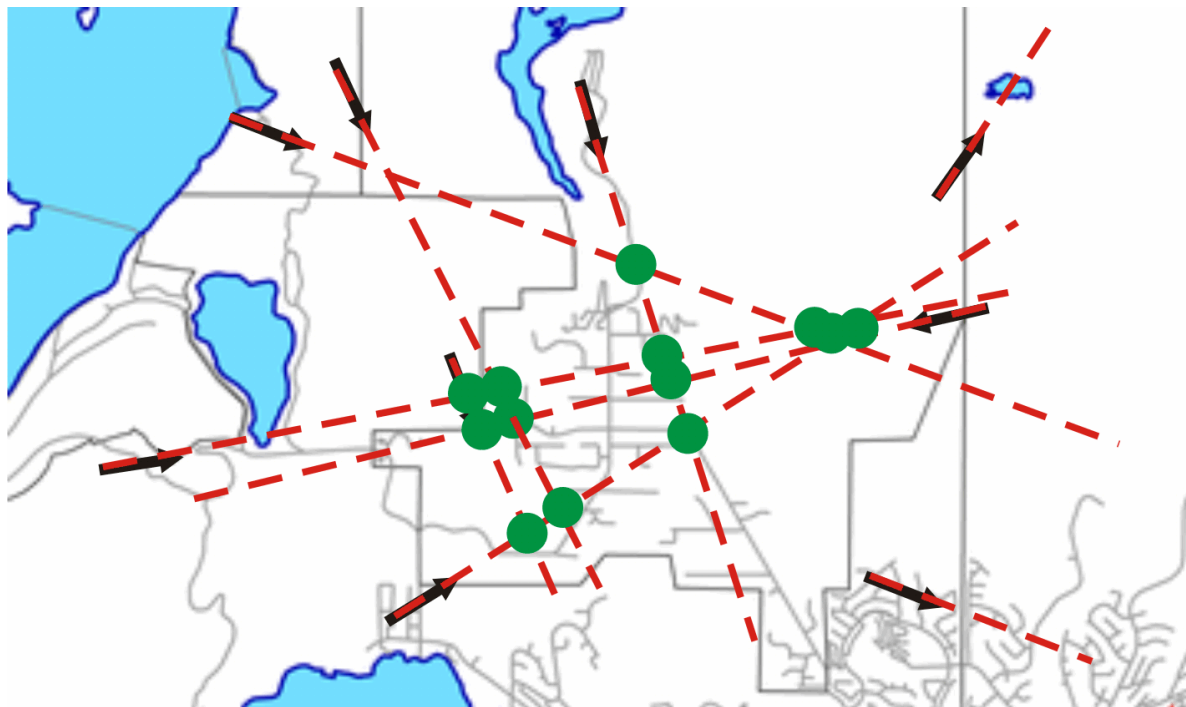
- The number of activity paths was investigated
- If 'paths' with single crime are removed
 - Number of activity paths drops to 1 in most cases
 - 2-4 for the much more frequent offenders
- This pattern is consistent when broken down for different crime-types
- The number of activity paths does not increase indefinitely, but seems to stabilize around 4 paths for the most frequent offenders
 - Indicates that there are at most 4 awareness nodes for each offender, in addition to their home location

DISCUSSION & CONCLUSIONS

- From a policing perspective
 - the fewer activity paths an offender has, the better.
- An offender with a lot of activity paths will have a very large activity space
 - Security measures which impact one of the activity paths would most likely displace the offenders crimes to another activity path

FUTURE DIRECTIONS

- Use these activity paths in order to predict the activity nodes
 - Which activity node were the offenders moving towards when they stopped to offend?



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Thank you!