Crime Mobility Polygrams and the Geometry of Co-Offending

Marcus Felson,[?]   Martin Andresen,[S]
and Richard Frank[S]

? , In transition next semester
S , Simon Fraser University

Mobility triangle invented by

Ernest W. Burgess 1925

"Can neighborhood work have a scientific basis?" In R.E. Park, E.W. Burgess, and R.D. McKenzie (Eds.), *The City: Suggestions for Investigation of Human Behaviors in the Urban Environment* (pp. 142 – 155). Chicago, IL: University of Chicago Press.

Burgess only applied mobility triangles to areas, which can understate proximity
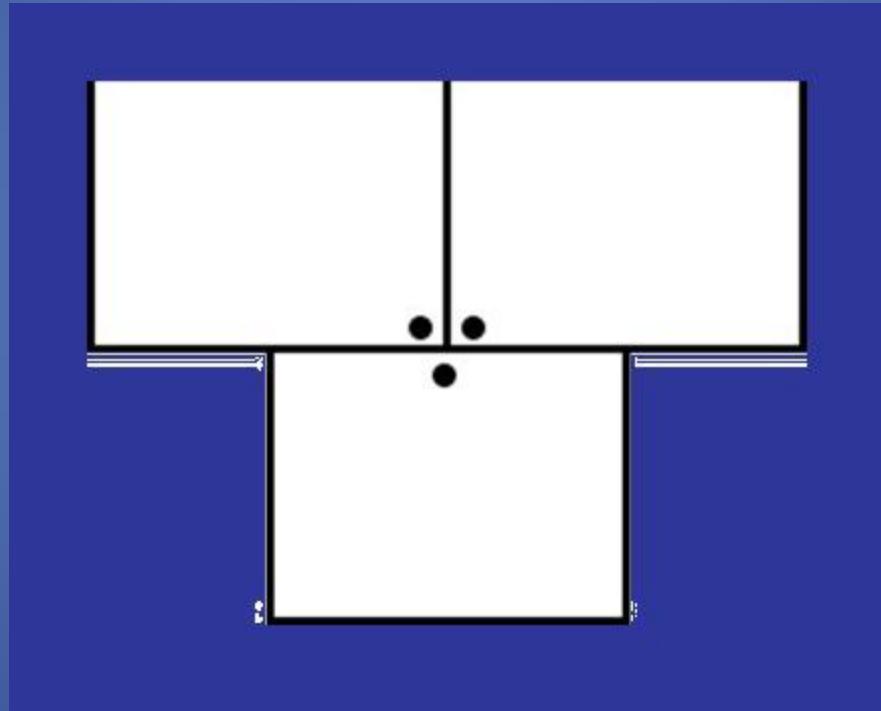
Mobility triangle perfected by

Liz Groff and Tom McEwen in a series of reports and papers, e.g.,

Groff, E.R. and T. McEwen (2007) Integrating distance into mobility triangle typologies. *Social Science Computer Review* 25: 210 – 238.

Specific locations on the map for offender, victim, crime location

Crime mobility triangle 21ˢᵗ Century – Modern data files make this work
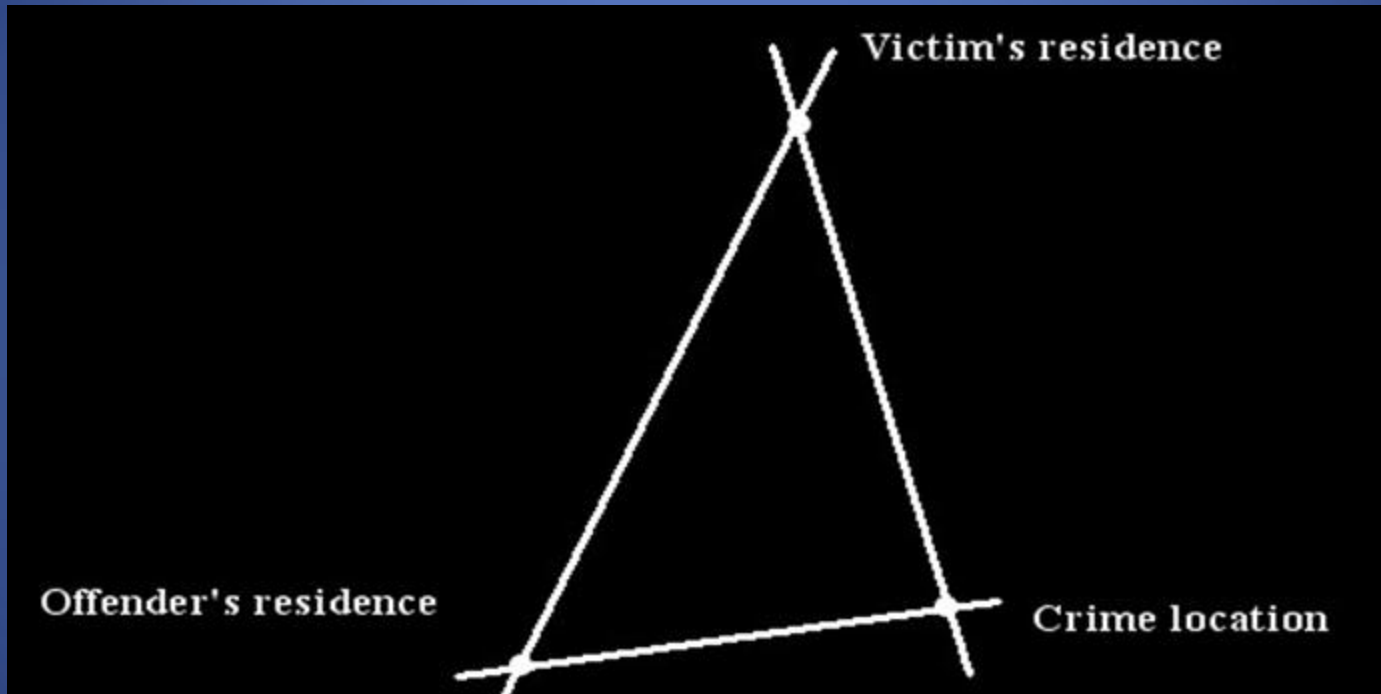
Why important?

- Mobility triangles can summarize a lot of information, taking into account address of offender, of victim, and of the crime itself.

- The **area covered** tells us how geographically dispersed the crime's components are.

- Antidote to geo - tecchies – those who spew out ever more spatial detail, more trees, less forest

Minimum mobility triangle area

- Zero - woman hits man within shared apartment
- (Technically, could be a few feet travelled)

Maximum mobility triangle area

Offender from Greenland comes to Australia
and victimizes a tourist from Chile

- Greenland to Australia 14,769 km
- Chile to Australia 13,291 km
- Chile to Greenland 7,198 km

Mobility triangle area 47,764,430 sq km. NEGLECTING the curvature of the earth.

60 or older - Do this the hard way

Under 60 – Go to a triangle area calculator, e.g.:
http://mste.illinois.edu/dildine/tcd_files/program17.htm

More interesting than a single mobility triangle

- Sum up a group of mobility triangle areas

- Use measures of centrality and dispersal

- Thus compare nations, cities, crime types, offender types, or whatever you like

- Crime in space is very complex, so it's nice to extract some summary indicators

The long distance issue

- Many crime participants are visitors or tourists
- Extreme travel distances can dominate
- To reduce extreme values, use **medians,** not means
- Median are of crime mobility triangle *summarizes* the spatial expanse of a sample of crime incidents

Enter co-offenders

- Suppose two offenders live in different locations, commit their criminal act in a third place on a victim living in a fourth place
- You need a crime mobility *polygon*
- More than three points, too, when considering
  - multiple victims not living together
  - Bystanders
  - two crime scenes

Basic mobility polygon for two offenders
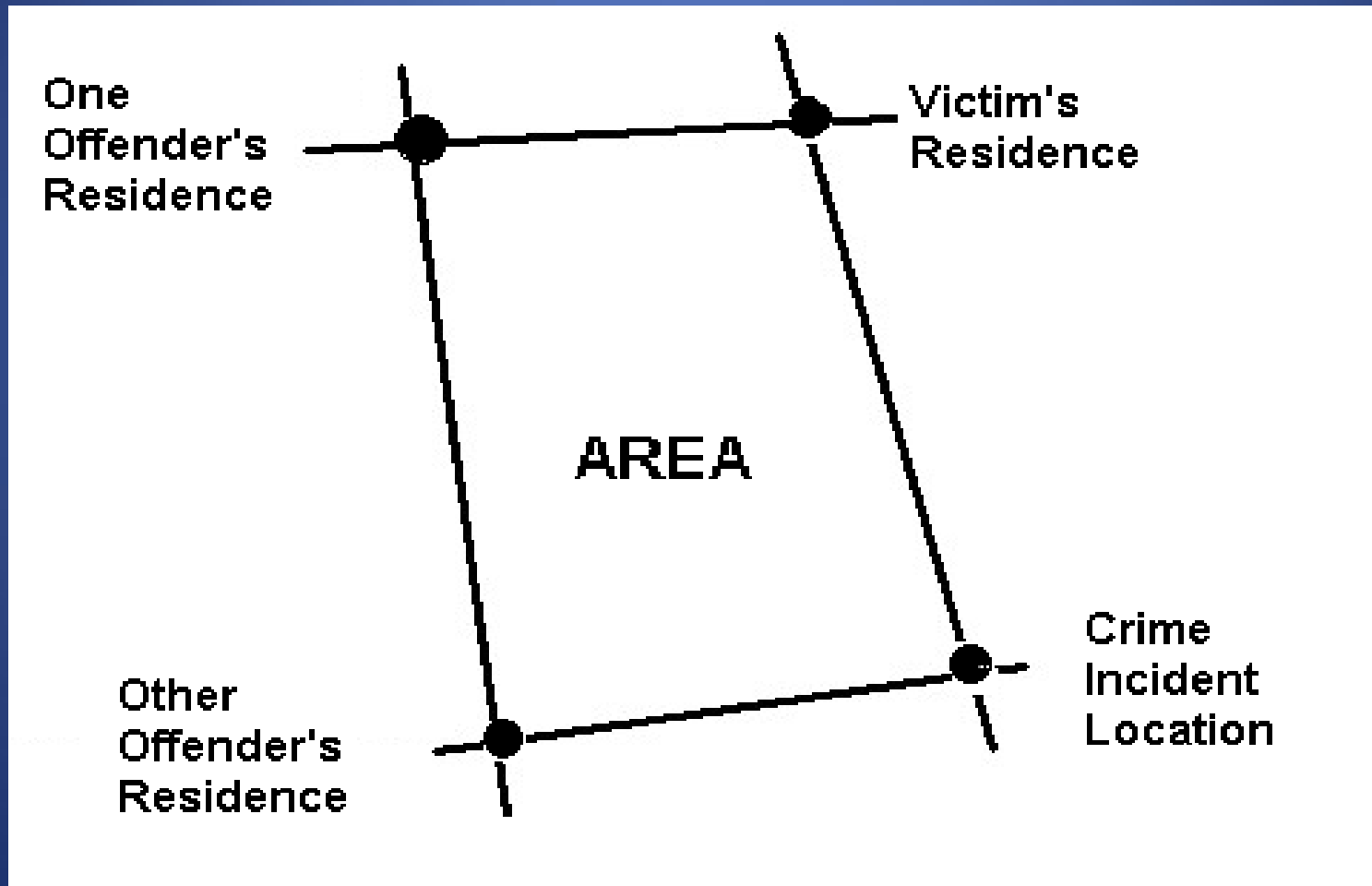
Crime pentangle (subtype of crime polygon for 3 offenders)

Victim's Residence / Other Co-Offender's Residence / One Co-Offender's Residence / Crime Incident Location / AREA
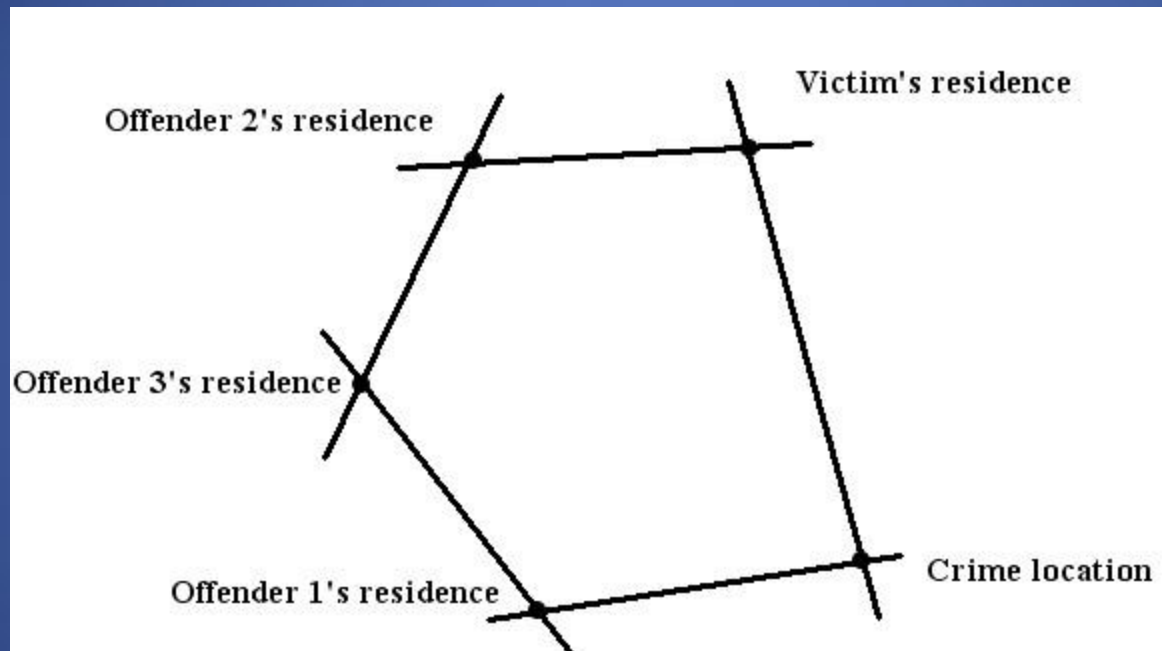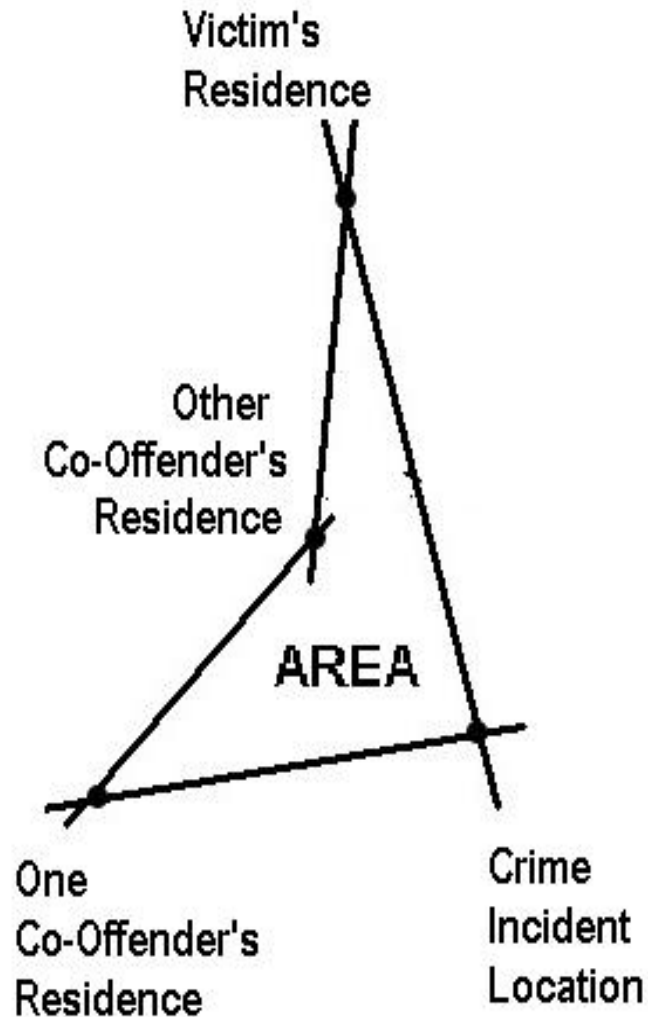
Oh my. It can also be concave

So an extra offender *might reduce* the area of a mobility polygon

Sometimes you may want to overrule the concavity
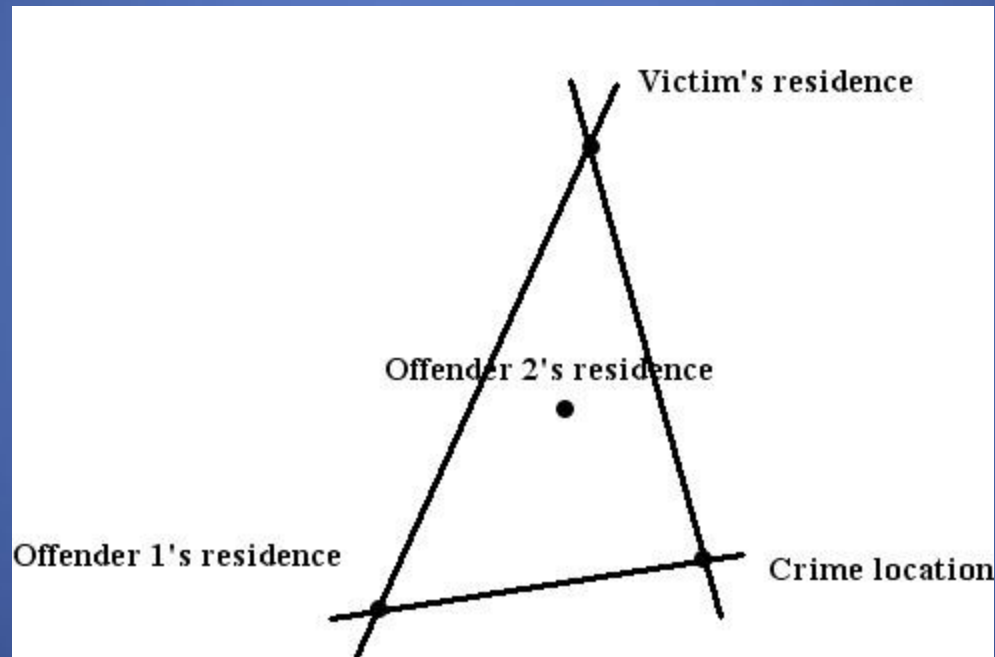
Some empirical work

- British Columbia

- Test case: Coquitlam, Surrey, in BC, metropolitan populations

Mobility polygon median area by number of victims and number of offenders

Number of Offenders in incident	Number of Victims in Incident		
	1	2	3
1	2.8	6.6	10.3
2	3.4	11.1	11.0
3	5.3	↘ 23.5	↘ 2.0
4	1.9	28.5	47.4

↘ **Based on fewer than ten cases.**

Conclusions so far

- Number of victims spreads out the mobility polygon the most
- Number of offenders has an impact, too
- Not automatic. When offenders number four, decreasing area.
- Coutner tendencies!
  - Co-offending draws on a larger area, BUT
  - propinquity can set up an offending group

Variations in Mobility Quadrangle area among several types of crime

Crime	Median	StdDev
Commercial Burglary ⬂	21.87	13.74
Theft From Motor Vehicle	12.31	45.20
Nonresidential) Burglary	9.14	61.29
Robbery	7.06	52.70
Theft of Motor Vehicle	6.57	53.78
Sexual Assault	4.85	512.69
Armed Robbery	4.63	55.53
Homicide ⬂	4.10	11.33
Assault	2.97	316.09
Aggravated Assault	2.32	6.94
Residential Burglary	2.14	10.35
Theft	1.60	169.43

Two offenders one victim – Surrey

⬂ **Based on fewer than ten cases**

Note that

- Violent and property crimes intermingle for lesser and greater areas covered

- Theft from and of motor vehicles differ

- Standard deviations sensitivity to extreme values.

- But also the variation confirms Ron's basic point is right – crime types must be disaggregated quite a bit

Imaginary findings, future ECCA talks - A

	Speaker	Topic	Imaginary finding
a	Croisdale-Brantinghams	Prolific offenders, victims	Less area
b	Wellsmith	Large facilities	More area
c	Homel and Murray	Bouncers, big bad places	More area
d	Cozens	Nighttime economy	More area
e	LeBeau	Hotels, motels	More area
f	Johnson, Summers	Rail connectivity	More area
g	Elffers	Pockets of local control	Less area
h	Park,Clare,Spicer,Clavert, Jensen, and Brantigham	Virtual environments	Use polygons in simulations
i	Kruger	Impact of walls	Effectiveness varies by travel

Imaginary findings . . . B

	Speaker	Topic	Imaginary finding
j	Wainer	Hot products	More area when hotter
k	Morgan, Clare, Kingsley	Assaults on police, repeat	Repeats more local ?
l	Ruiter	Longer crime trips	The farther co-burglars travel, the closer they live to one another!
m	Natarajan, Zella,Yu	Drug trafficking organization	More organized, more local the offenders, less local the victims
n	Wartell	Research into practice	A mobility polygon can be *shown*
o	Shella	Hotspots in Brazil	Local-drawing vs. wide area hotspots
p	Jessica	Juvenile theft prevention	Do 25 techniques vary in effectiveness by localism?
q	Verma	Police systems	Wider polygon, wider police organization?
r	Hirschfeld	Terrorists	Immediate trips vs. preparatory trips

Imaginary findings . . . C

	Speaker	Topic	Imaginary finding
s	Shukla, Bartgis	Meth manufacturing	Area polygons for different process stages
t	Rebocco	Hunting by rapists & molesters	Manipulative <opportunist < coercive
u	Hoke	Inmate behavior	Distances within prison!
v	Tompson	Scripts, waste dumping	Does far script differ from near script?
w	Pires, Clarke	Sequential foraging	Stage 1 wider area than stage 2 ?
x	Maxfield, Clarke	Theft in affluent society	Focus prevention on smaller-area?
y	Newton	High crime areas	*Local vs. wide high-crime areas*
z	Rossmo	Military applications	Osama bin Laden's mobility polygon
aa	Frank	Activity paths of offenders	Directionality related to polygon area?
bb	Wuschke, Huitson, Brantingham	Mental helalth data & calls for service	Impact of health care facilities on mobility polygons

Imaginary findings . . . D

	Speaker	Topic	Imaginary finding
cc	McCord	Motor vehicle theft	Soooooo many applications.
dd	Reynald	Taxonomy of guardianship	Type of guardianship affects polygon size
ee	Jones	Shaw -McKay & area traits	Link within-city area variations in polygons
ff	Bowers,Johnson,Guerett eSummers, Poynton	Displacement & diffusion	Does policing change polygons?
gg	Birks	Generative model simulations	Can you simulate these polygons?
hh	Ratcliffe	Attractors, generators	Good and bad bars & polygons
ii	Knutsson Madensen,Sousa,Eck	Crowd violence	How wide is crowd drawing area?
jj	Walker, Moak	Sexual predators, Internet	Do they look locally?

Evaluation

- Good news – We have passed the tipping point for becoming a science.

- Bad news – we have passed the tipping point for boring everybody to death.

Antidote

- Mobility polygons are useful for summarizing information

- When **the rest** of your study is complicated, insert something simple to help readers read and learn.

Thank you

felson@andromeda.rutgers.edu

I move to Texas State University
around January 1, 2011