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Locating Spatial Analyses of Crime:
The Crime Analysis Framework

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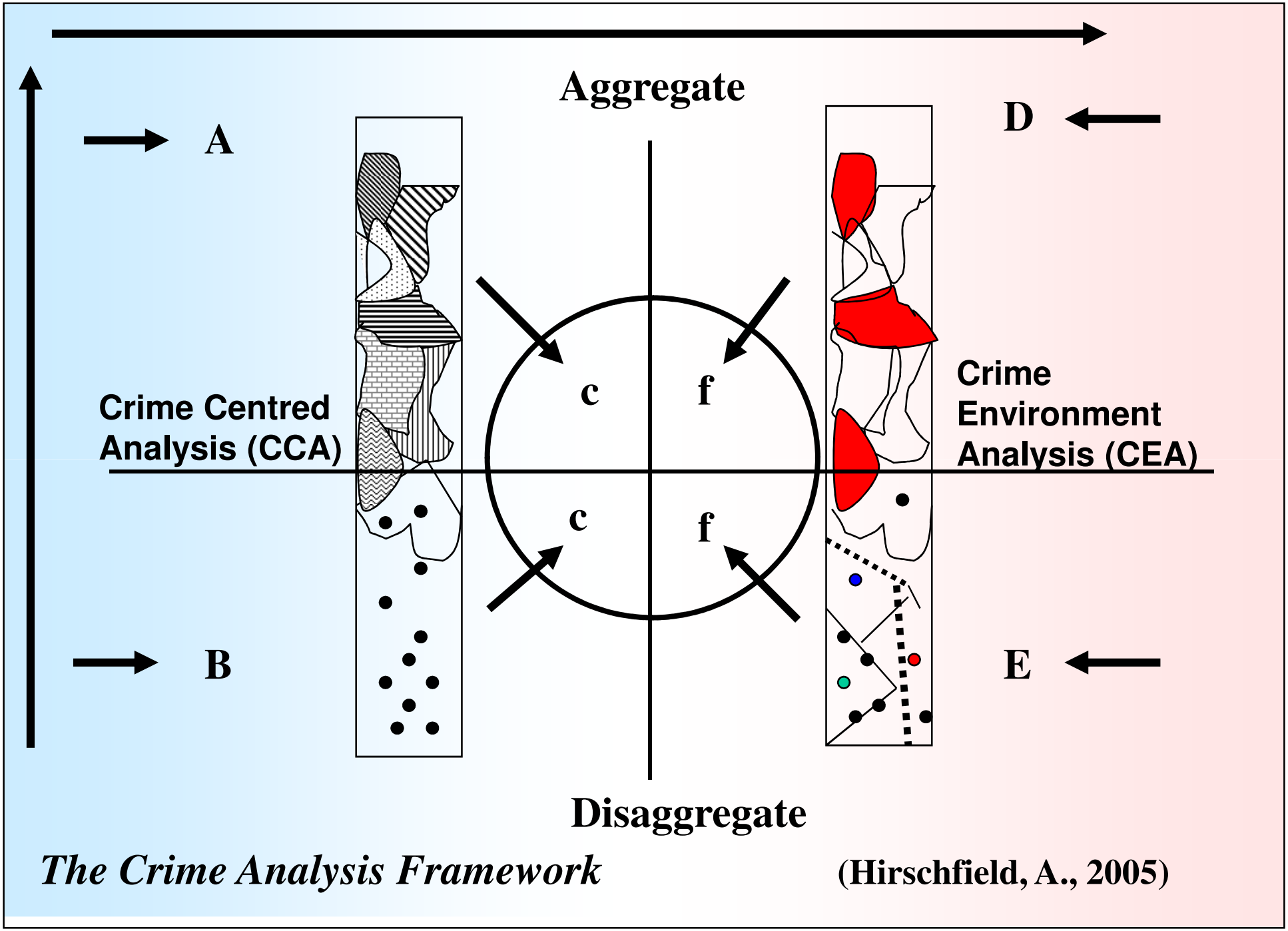
Why Map & Analyse Crime Data ?

- to identify the scale and distribution of crime and disorder
- to explore relationships between crime and the environment (physical & social)
- to target resources for crime prevention
- to evaluate the impact of crime prevention

- to inform police operations
- to apprehend offenders
- to profile the spatial behaviour of offenders.
- to predict the spatial and temporal distribution of offences
- to develop Early Warning Systems of emerging problems

➢ to communicate with and to engage communities

➢ to support bids for extra resources from government



The Crime Analysis Framework (Hirschfield, A., 2005)

Crime Centred Analysis I

Where do crimes occur ?

When do crimes occur ?

When crimes occur, *where* do they occur ?

Where crimes occur, *when* do they occur ?

How do crimes occur (MO analysis)

Do areas with one crime problem have other crime problems?

Where are these areas ?

Which and **how many** crimes do they have ?

How much of the population is affected (prevalence) ?

How concentrated is crime (socially,temporally, over space) ?

Crime Centred Analysis II

To what extent are there repeat crimes?

What is the time interval between repeats?

Where are repeat crimes concentrated?

Who are the victims? Who are the offenders?

Do offenders live in the areas with the highest crime rates?

Do offence locations relate to those of previous offences?

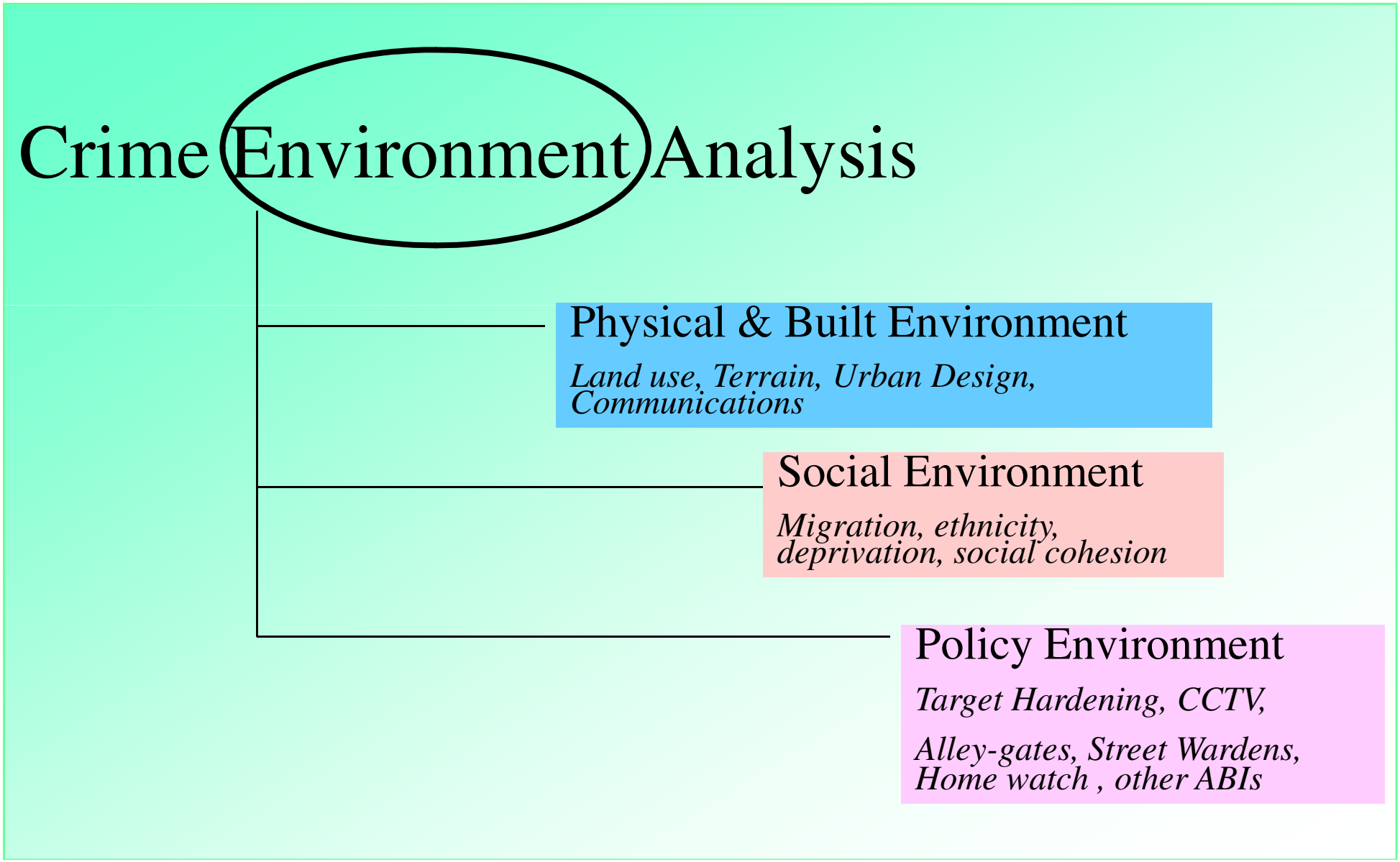
Is the volume of crime decreasing or increasing?

Are crimes affecting the same areas or new areas?

Are crimes diffusing or concentrating?

Is there evidence of displacement or crime switch?

Crime Environment Analysis I



Crime Environment Analysis II

What types of area have high crime?

Are they student areas or deprived estates?

Do they have particular types of housing /built environment?

Are they Policy Priority Areas?

What types of transport and communications do they have?

Are they accessible to offenders physically/ socially ?

Do they have poor natural surveillance?

Do they have a large number of potential crime attractors?

Do they have crime prevention measures already?

Are they deployed in the right places at the right times ?

How does the crime prevention relate to crime change ?

Crime Centred Analysis(CCA)

Techniques for Aggregate CCAs

- **Tabulation of crime counts and derivation of crime rates**
- **Identification of areas with significantly high and significantly low crime**
- **Calculation of the concentration of crime at area level**
- **Identification of crime mix and its variation across areas**

Distinguishing High and Low Crime Rates

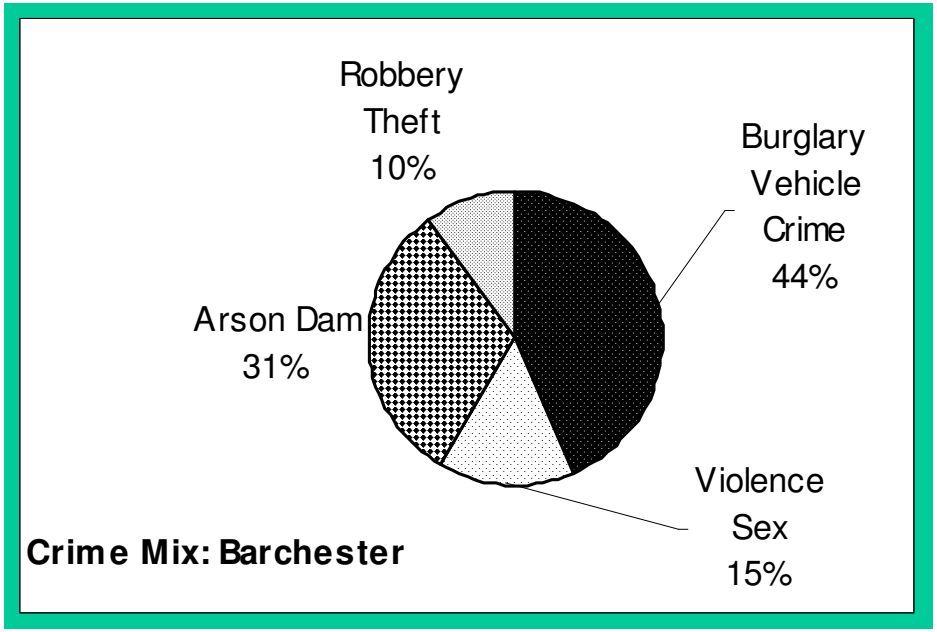
Ward	***Households***	***Burglary***	***Theft of Vehicle***	***Theft From Vehicle***
1	2,752	35.6	10.9	37.0
2	1,459	21.2	12.3	30.1
2	2,366	29,5	15.2	44.8
4	2,394	12.9	**6.2**	30.4
5	2,284	**52.1**	10.5	30.6
6	2,149	14.4	19.5	101.4
7	2,839	24.6	13.7	31.7
8	2,509	25.1	19.5	56.6
9	2,876	**47.2**	19.8	70.3
Mean		*25.1*	*12.0*	*40.4*
SD		*12.2*	*5.2*	*20.0*

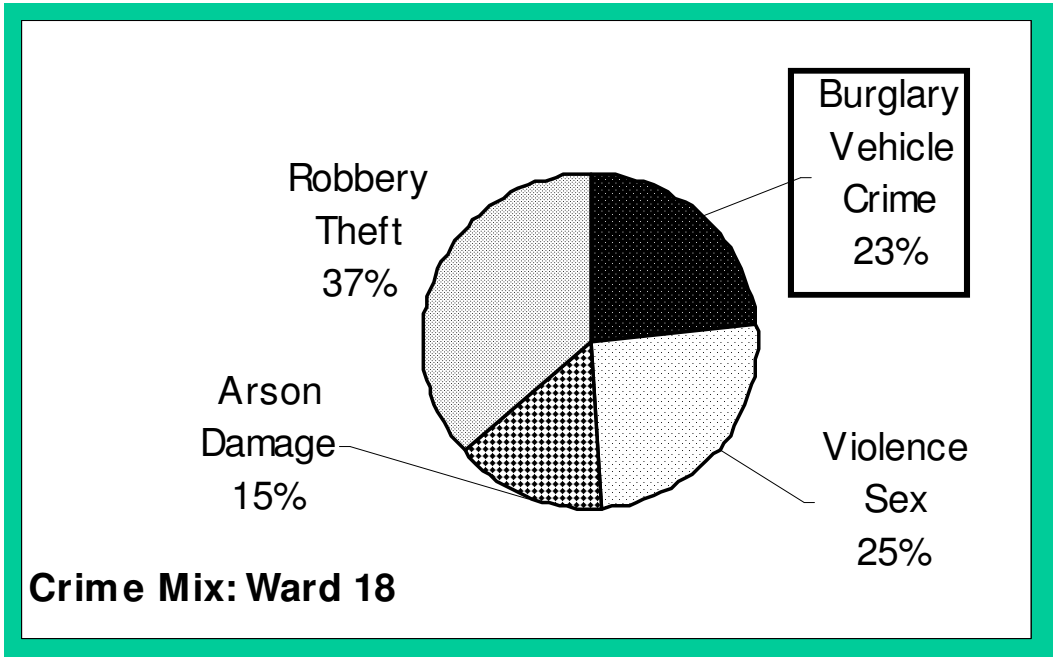
Malicious Ignition Dwelling Fires 1998/99
Resource Targeting Table (RRT)

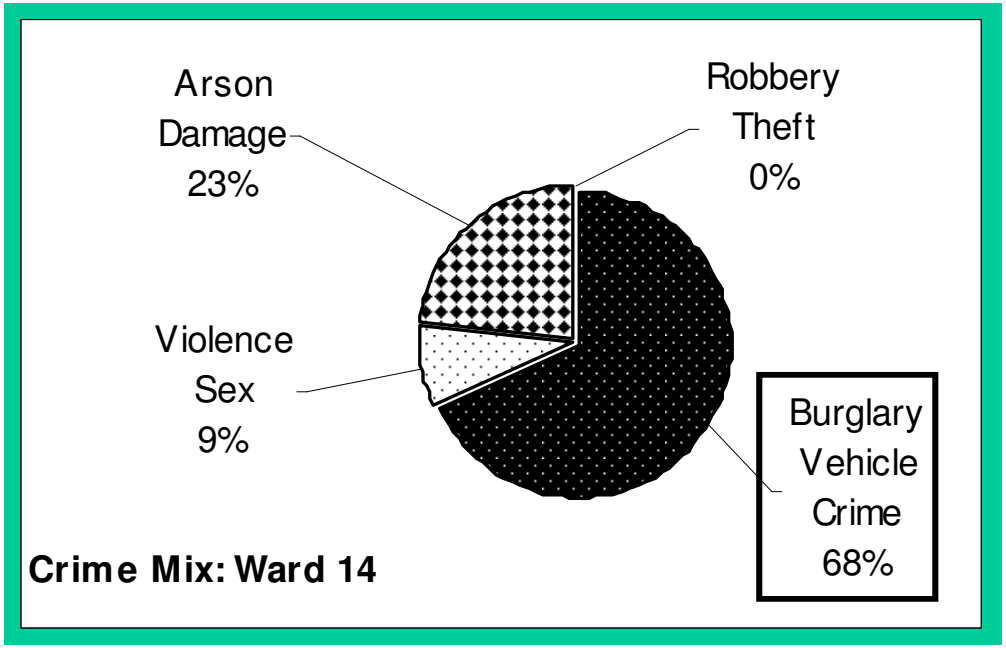
	Ward Code & Name	Cum % Pop	Cum % Hhlds	No. of Incidents98/99	Cum % Incidents98/99	
1	BNFG Bradford	0.46	0.49	47	4.00	
2	BNFE Beswick and Clayton	0.94	0.98	39	7.33	
3	BNFD Benchill	1.45	1.46	37	10.48	
4	BNFM Cheetham	2.01	2.00	37	13.63	
5	BNFY Lightbowne	2.54	2.55	36	16.70	
6	BNFZ Longsight	3.14	3.11	34	19.59	
7	BRFJ Langworthy	3.55	3.57	32	22.32	
8	BRFC Broughton	3.96	4.00	31	24.96	← 25% of Incidents
9	BNFK Central	4.32	4.43	30	27.51	
10	BNFF Blackley	4.80	4.94	25	29.64	
11	BNFU Harpurhey	5.27	5.45	25	31.77	
12	BPFW Werneth	5.73	5.86	23	33.73	
13	BRFK Little Hulton	6.19	6.34	23	35.69	
14	BNFB Baguley	6.68	6.84	20	37.39	
15	BQFD Central and Falinge	7.11	7.28	20	39.10	
16	BRFL Ordsall	7.39	7.60	20	40.80	
17	BPFR St.Marys	7.88	8.05	18	42.33	
18	BQFP Middleton West	8.16	8.33	18	43.87	
19	BNGA Moss Side	8.68	8.88	17	45.32	
20	BPFJ Hollinwood	9.08	9.28	17	46.76	
21	BNFA Ardwick	9.47	9.69	15	48.04	
22	BNGC Newton Heath	10.00	10.23	15	49.32	← 50% of Incidents

CCA:

Crime Mix







Ward	*Burglary Prevalence*	*Burglary Concentration*	*Burglary Prominence*
17	**52.1 (1)**	**8.8 (2)**	**20.3 (1)**
21	**47.2 (2)**	**10.0 (1)**	11.6 (14)
1	**42.2 (3)**	7.3 (4)	12.0 (12)
8	35.6 (4)	6.5 (7)	13.6 (8)
13	35.6 (5)	7.2 (5)	14.4 (7)
9	34.1 (6)	**8.5 (3)**	18.9 (3)
7	33.1 (7)	6.6 (6)	12.2 (11)
15	26.5 (8)	5.2 (9)	10.7 (17)
2	25.9 (9)	4.2 (11)	16.3 (5)
20	25.1 (10)	4.6 (10)	7.6 (20)
19	24.6 (11)	5.2 (9)	11.3 (16)
14	21.2 (12)	2.3 (16)	**19.0 (2)**

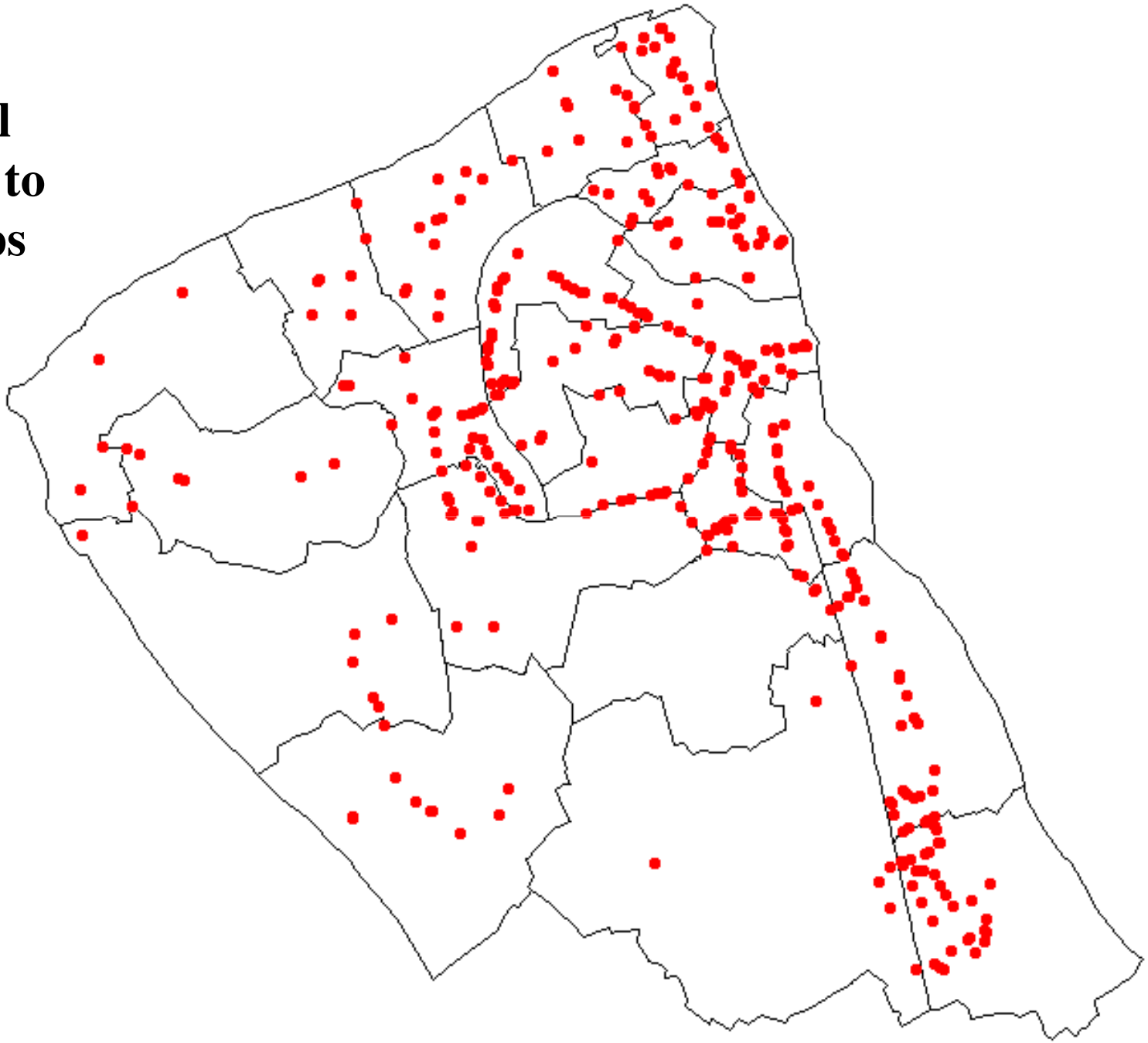
CCA Mapping Techniques

Disaggregate Data Analyses

- **Mapping the distribution of individual incidents (offence, victim, offender locations);**
- **Mapping the distribution of repeat incidents (multiple incidents, repeat victims, prolific offenders)**
- **Identifying clusters /'hot spots' from points**
- **Exploring space-time clustering**

Criminal Damage to Bus Stops Wirral

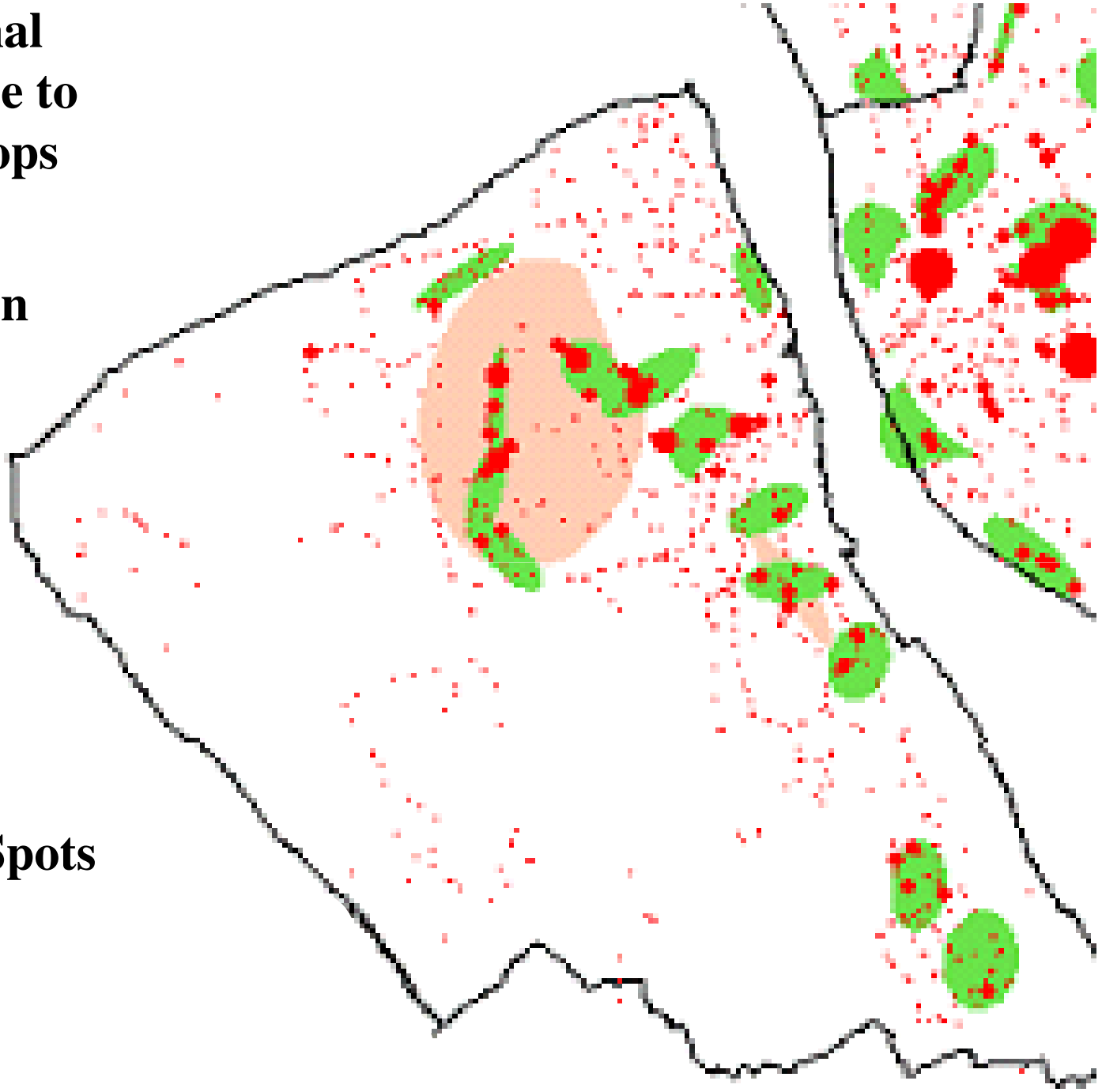
(Newton 2004)



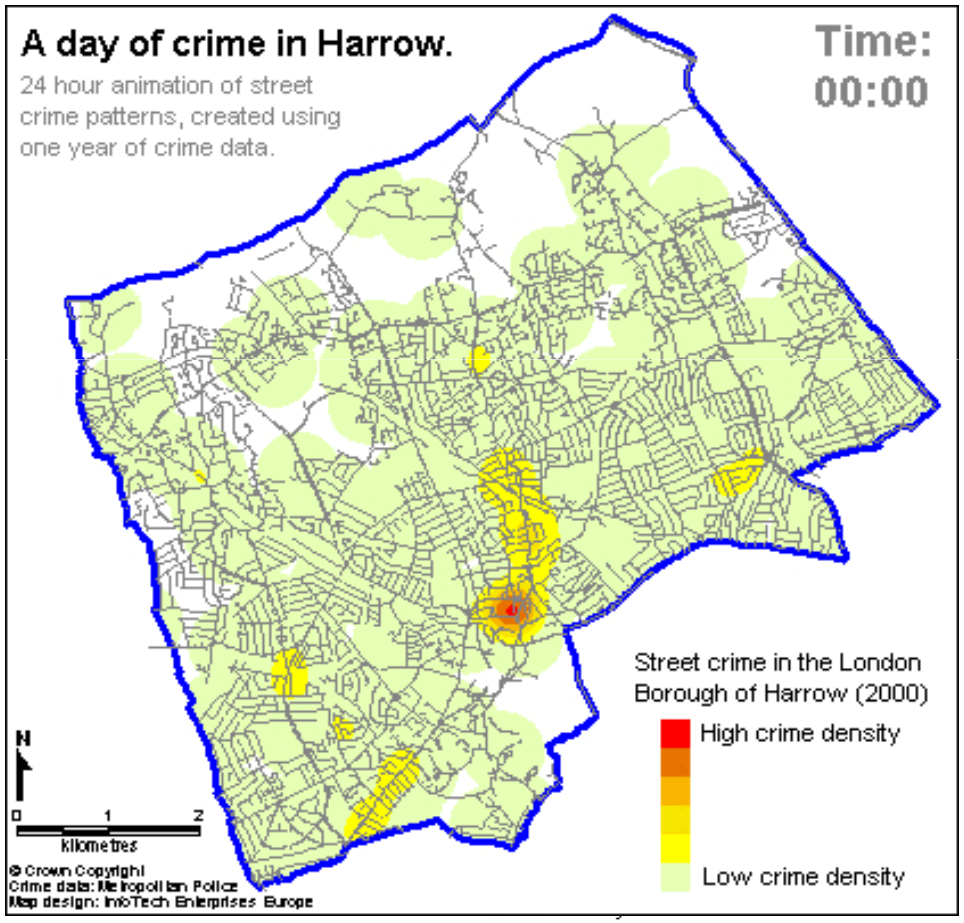
Points

Criminal Damage to Bus Stops Wirral

(Newton 2004)



Hot Spots



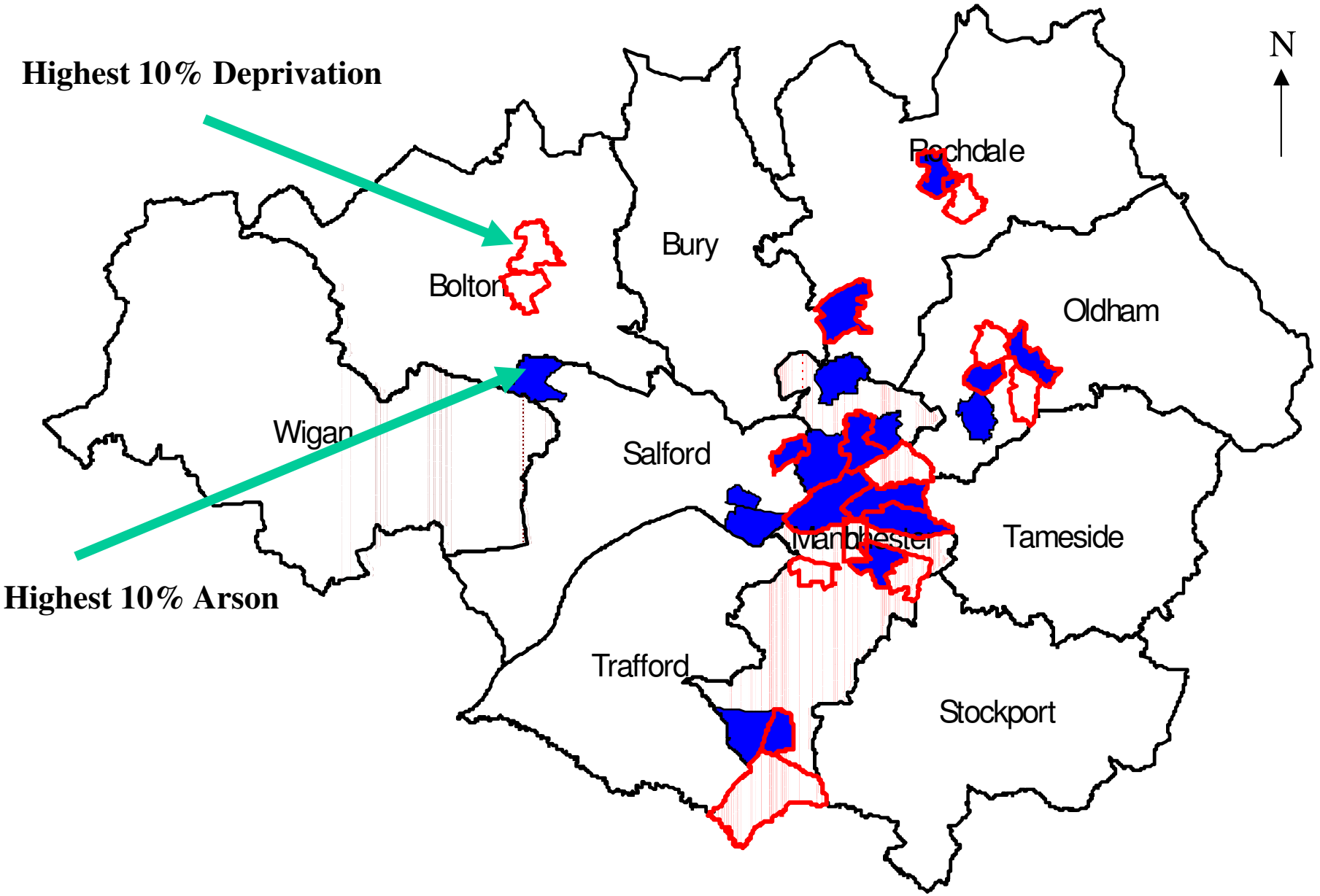
(Chainey, 2001)

Crime Environment Analysis(CEA)

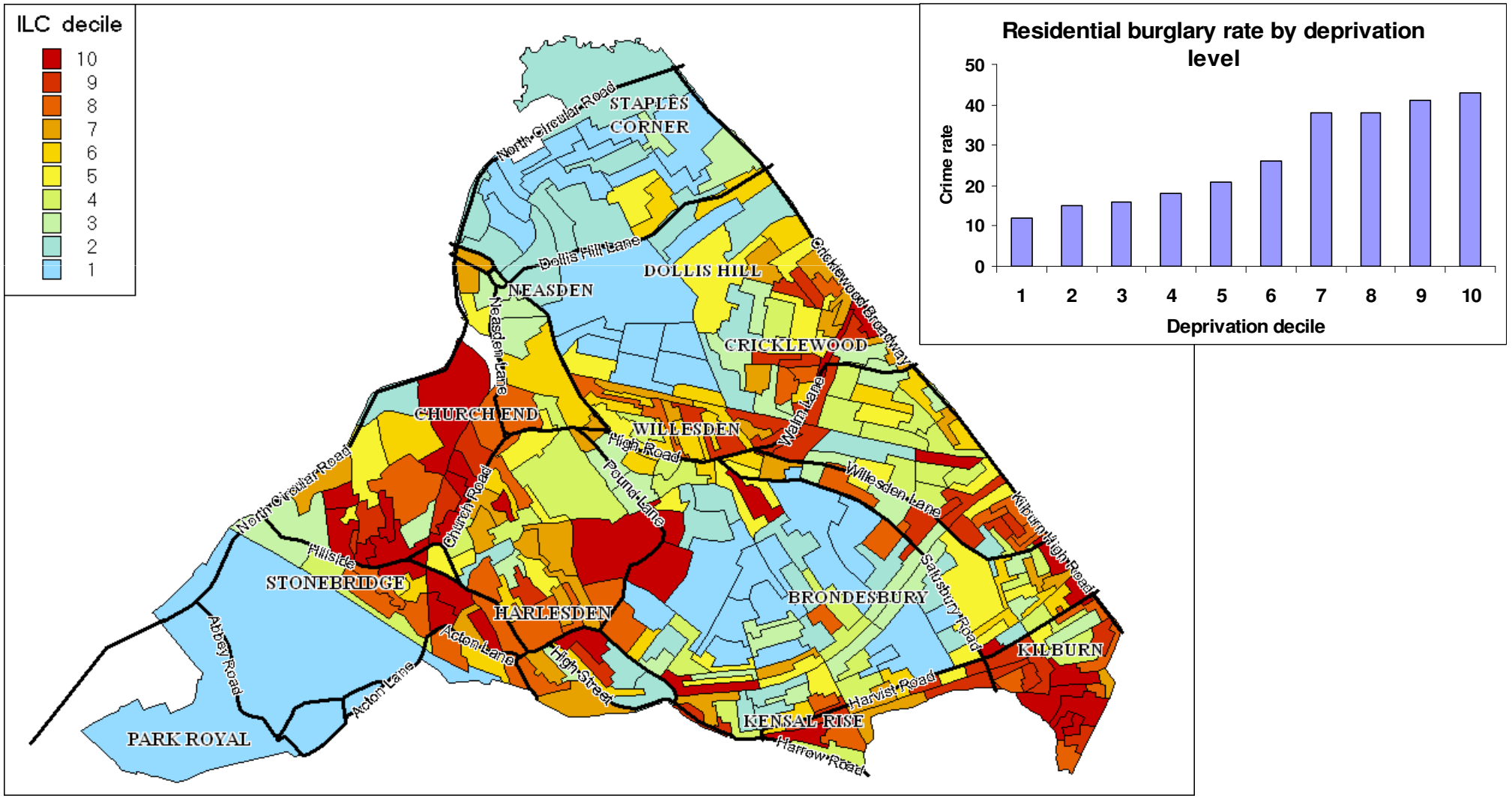
Techniques for Aggregate CEAs

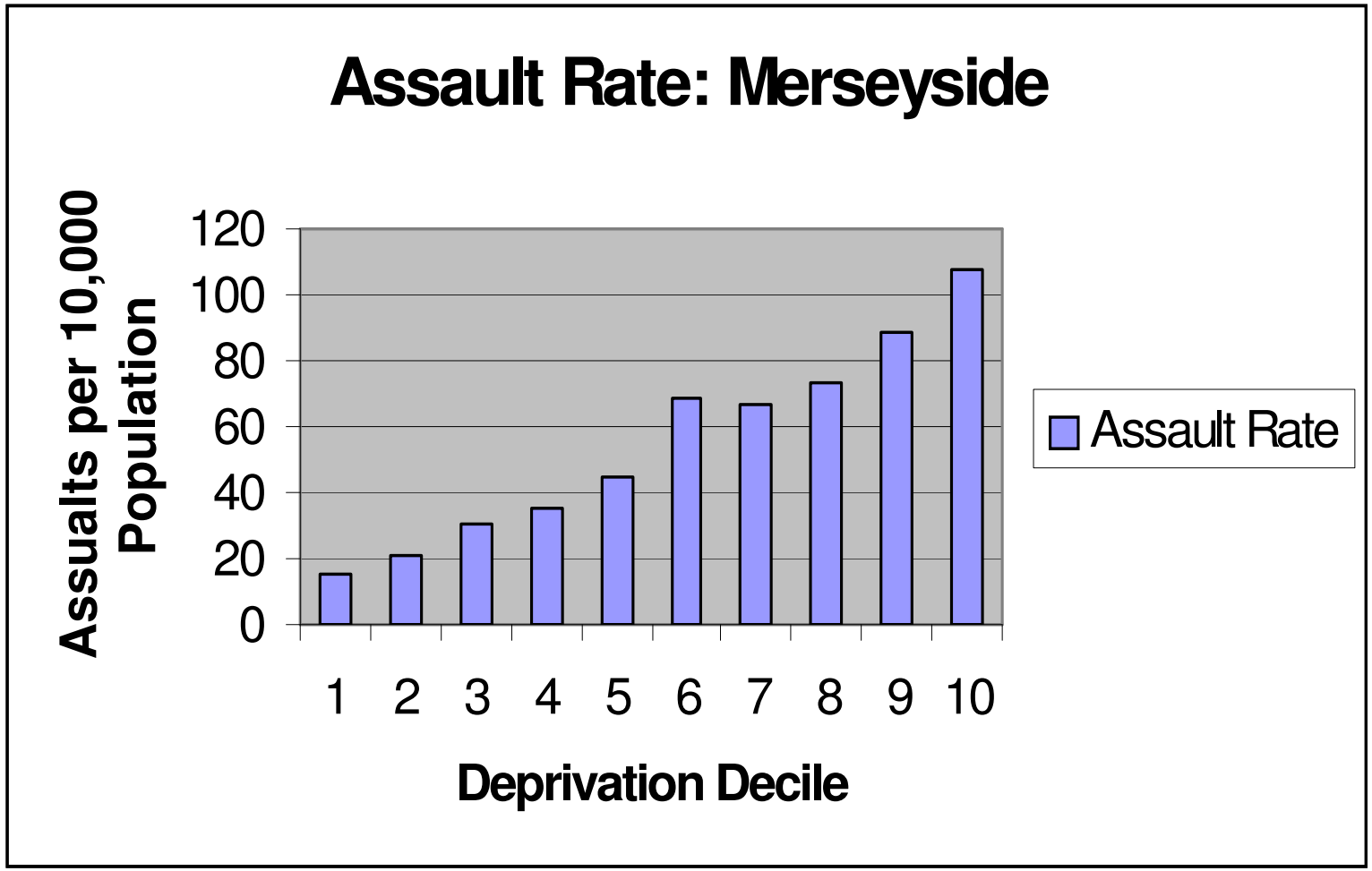
- **Derivation of crime rates for areas ranked by deprivation level**
- **Derivation of crime rates for different types of residential neighbourhood**
- **Identification of overlap between high crime and high values on other social indicators (e.g. unemployment)**
- **Calculation of the concentration of crime by area type, social indicator**

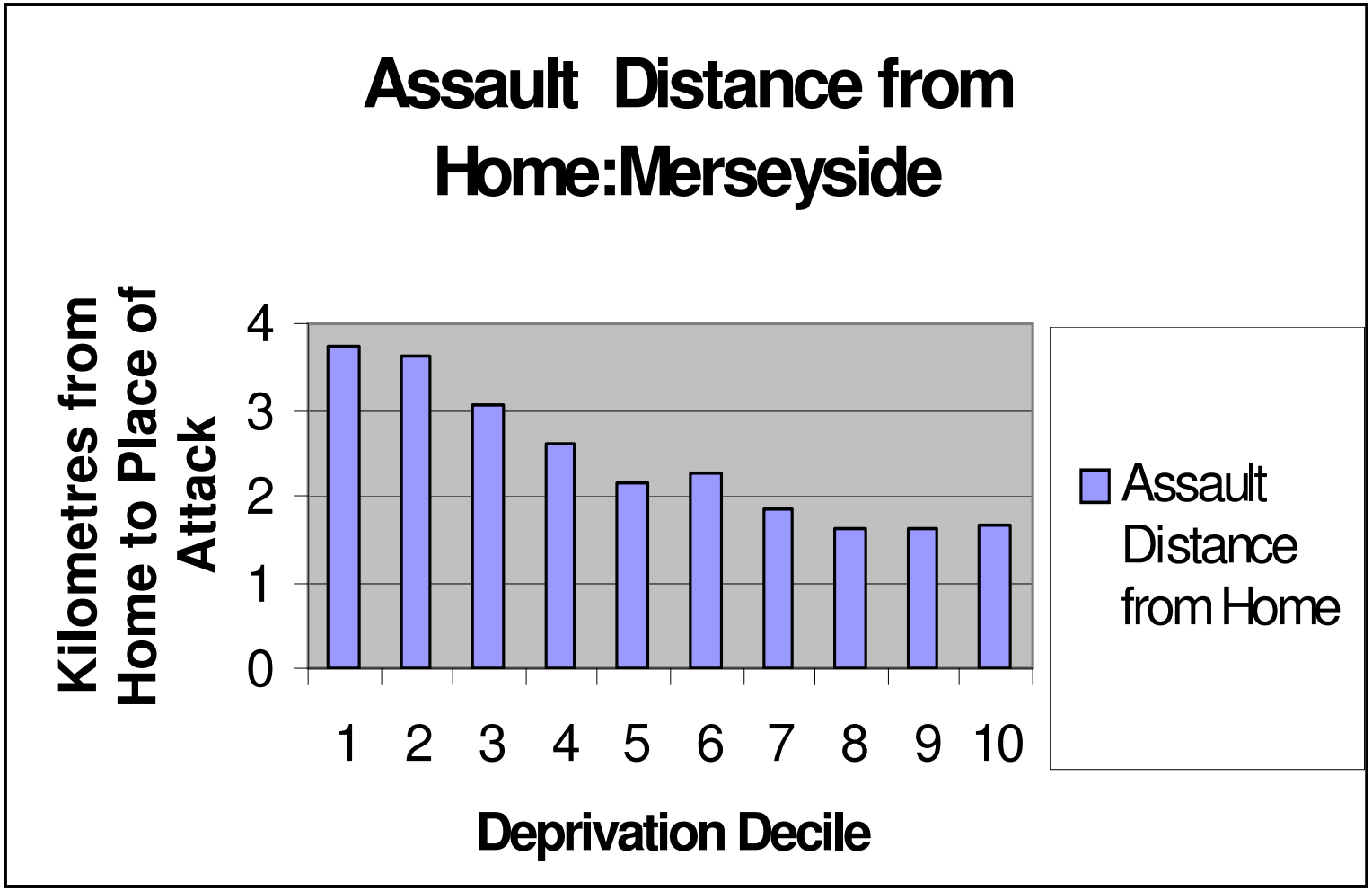
HIGHEST ARSON & HIGHEST DEPRIVATION



Mapping crime with deprivation




Assault Rate: Merseyside
Assaults per 10,000 Population
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Deprivation Decile
Assault Rate

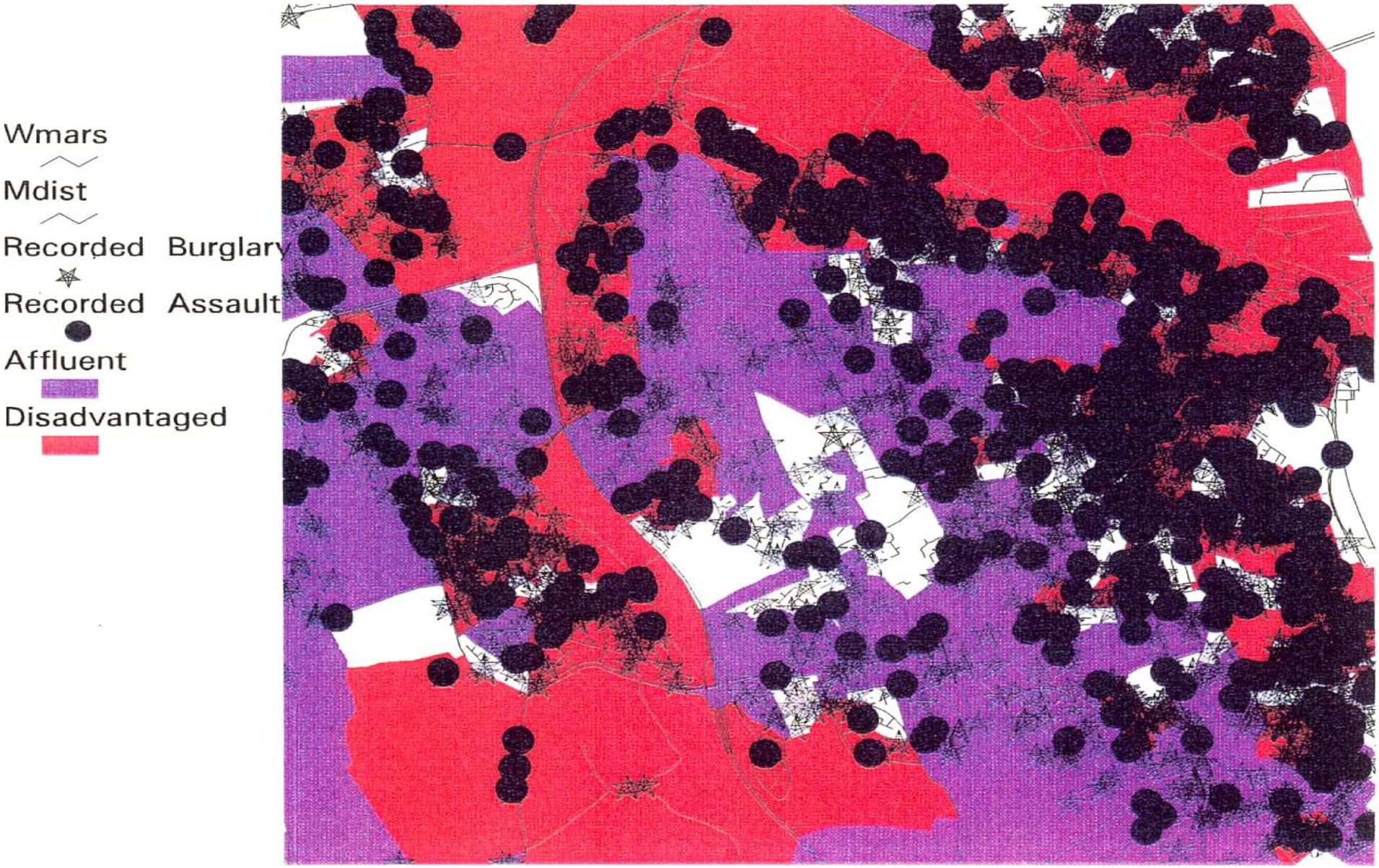

Assault Distance from Home:Merseyside
Kilometres from Home to Place of Attack
0
1
2
3
4
1 2 3 4 5 6 7 8 9 10
Deprivation Decile
Assault Distance from Home

CEA Mapping Techniques

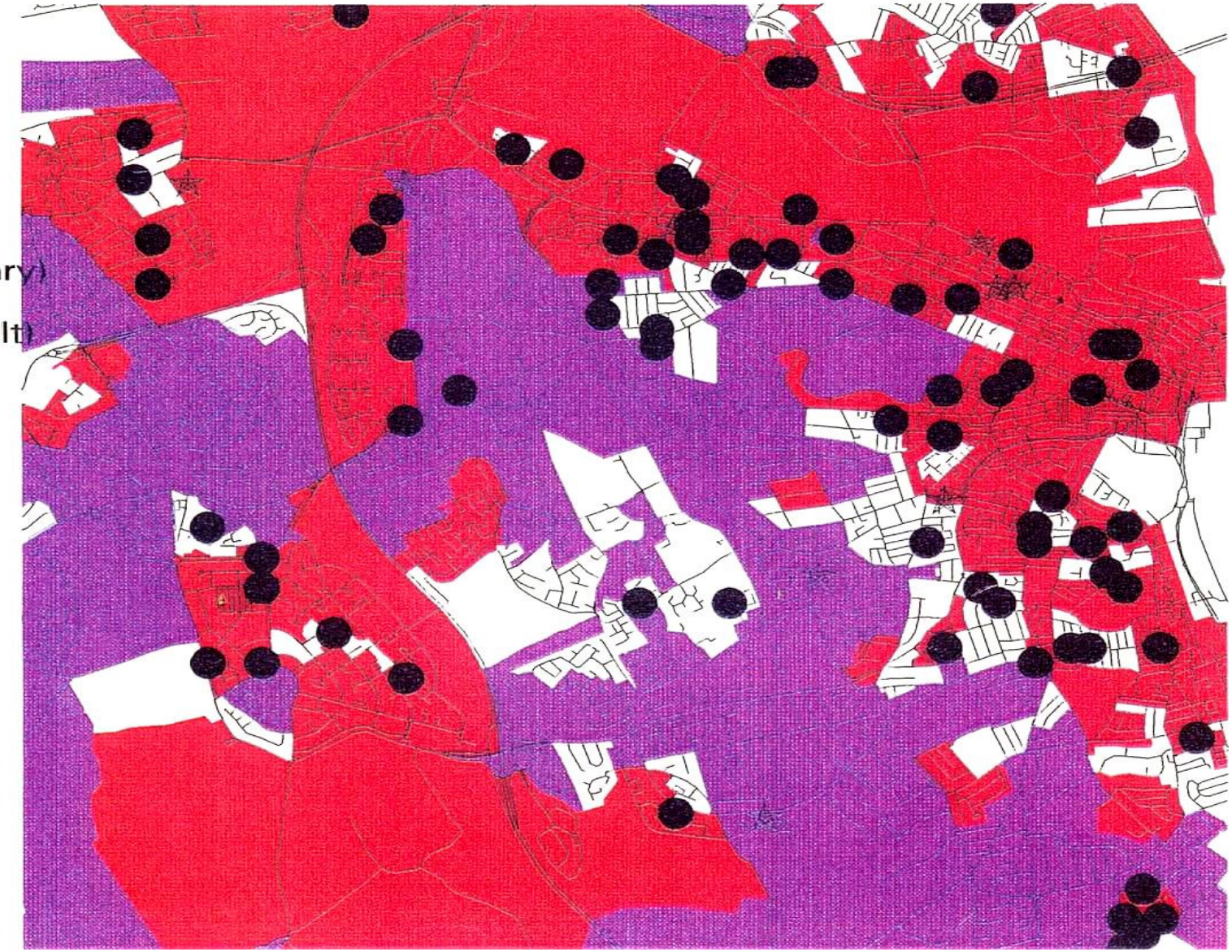
Disaggregate Data Analyses

- **Mapping incidents on contextual backcloths (Geodemographics, land use maps, digital aerial photos)**
- **Mapping hot spots and spatial-temporal clusters in relation to the environment**
- **Identifying 'hot spot' demographics & land use**
- **Conducting specific site and RADIAL analyses**

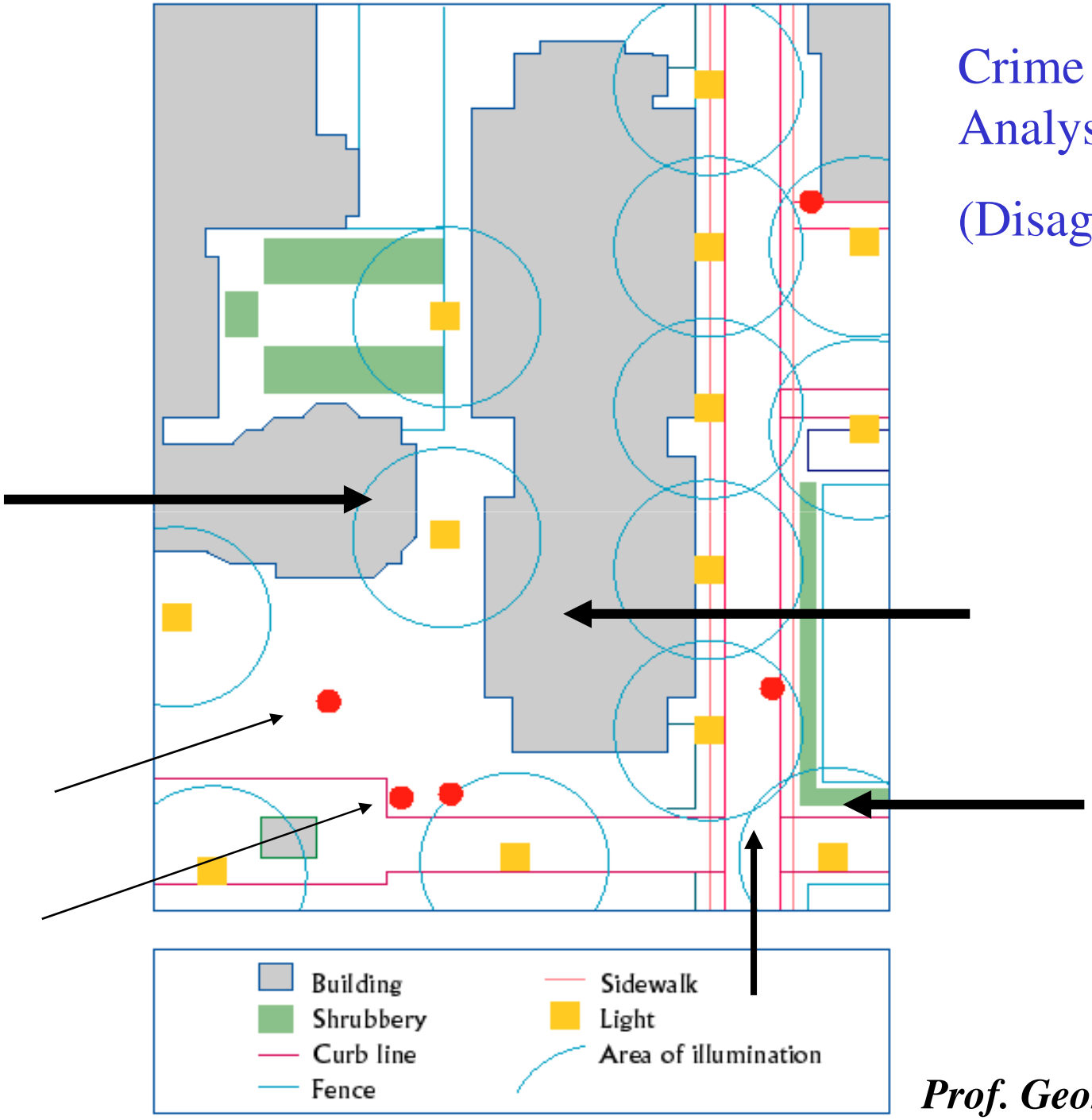
Offences in Oxton



Offenders in Oxton



High Definition GIS at Temple University

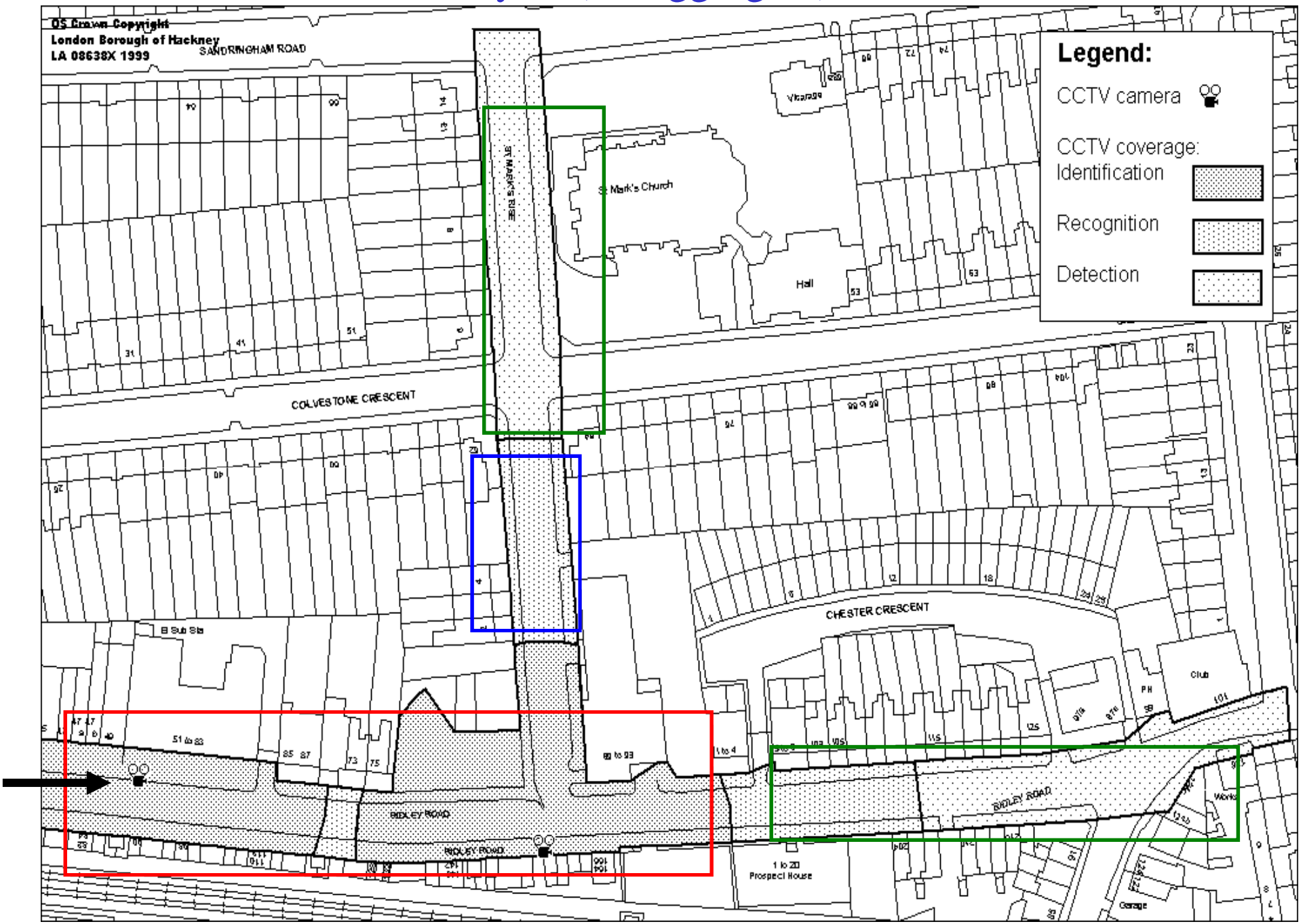


Crime Environment Analysis

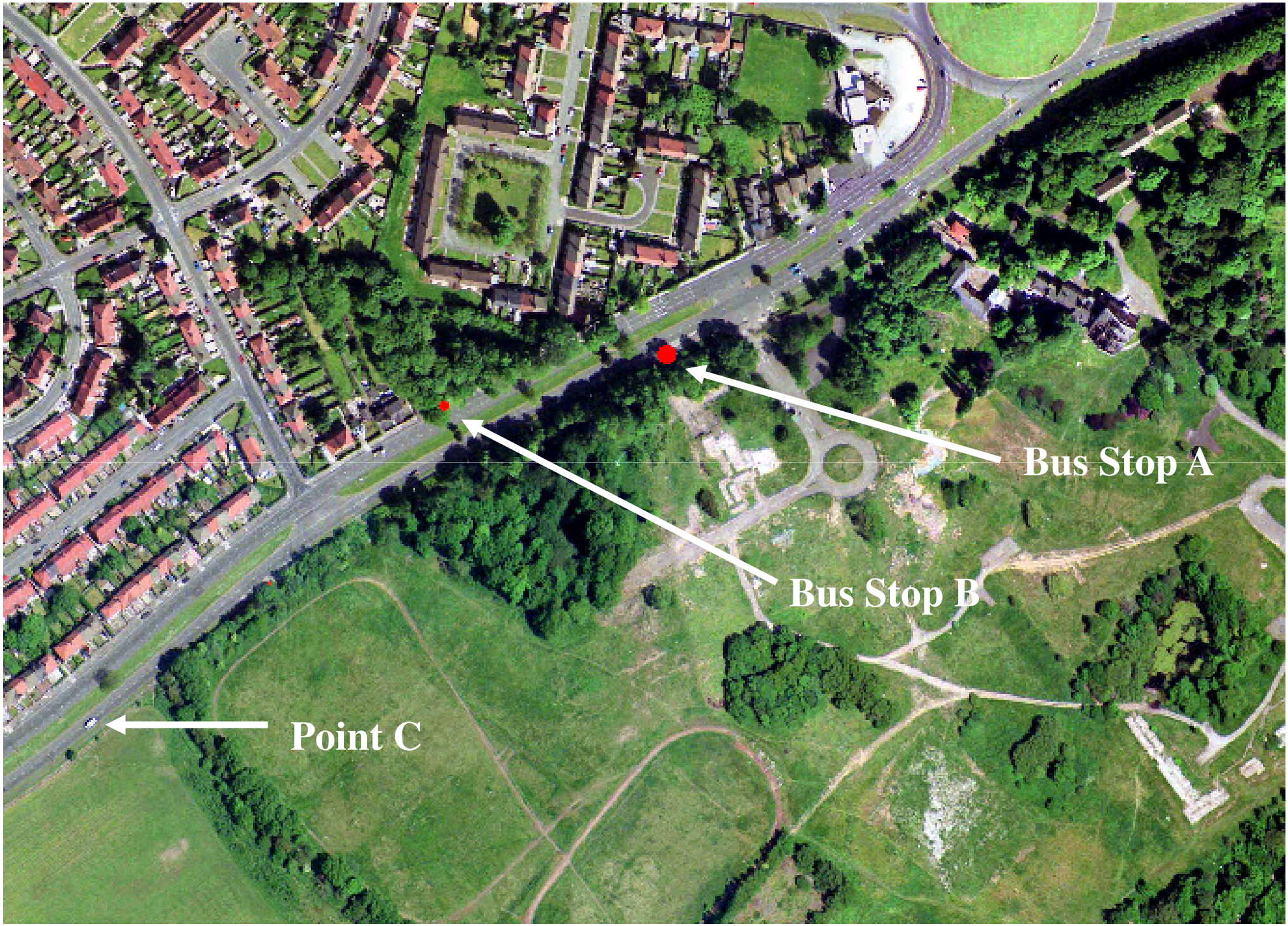
(Disaggregate)

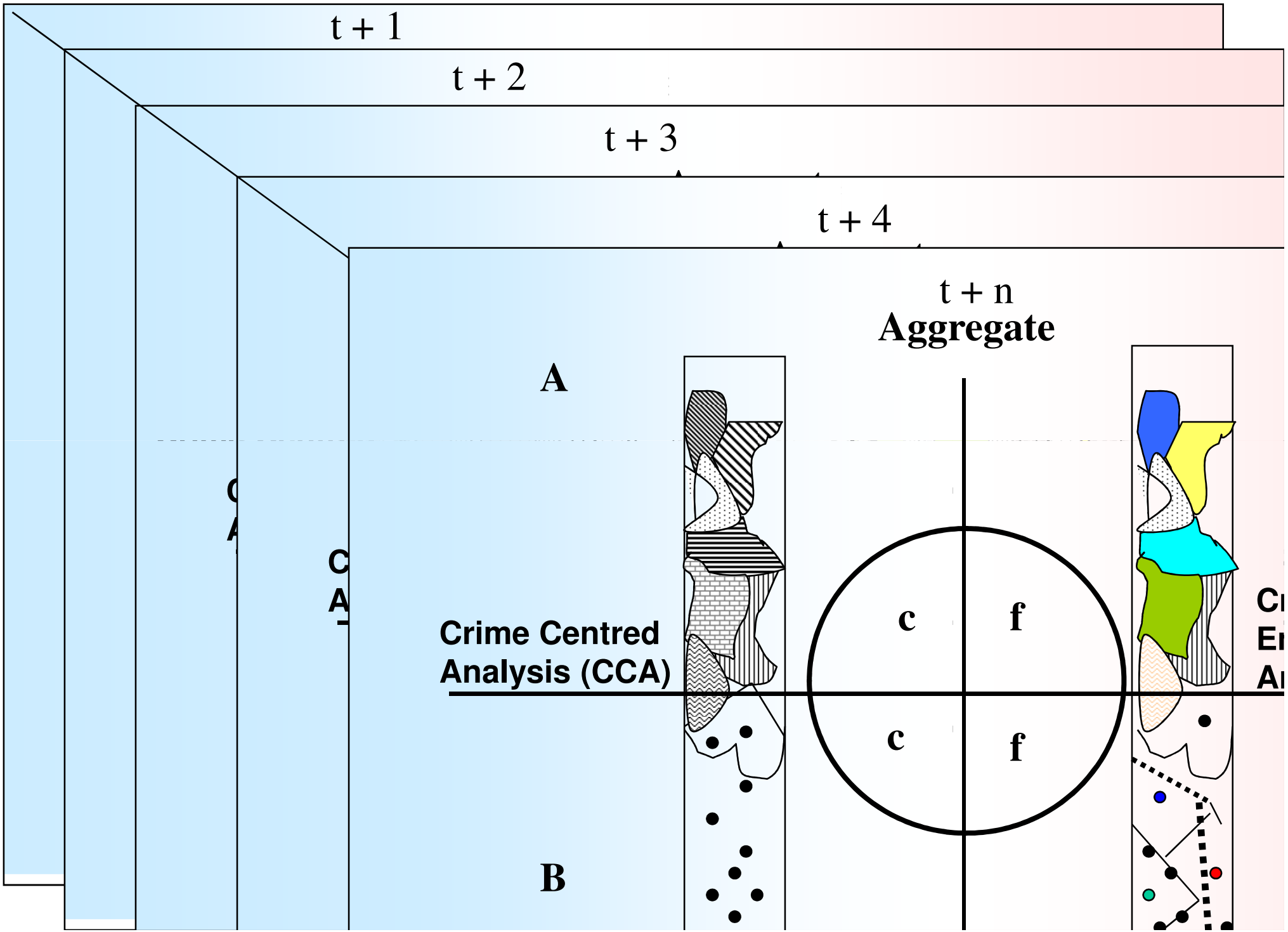
Prof. George Rengert (Temple)

Crime Environment Analysis (Disaggregate)



Spencer Chainey (Jill Dando Institute, UCL, London)


Bus Stop A
Bus Stop B
Point C


t + 1
t + 2
t + 3
t + 4
t + n
Aggregate
A
B
Crime Centred
Analysis (CCA)
c
f
c
f

Conclusion

- **Much** can be gained solely through CCAs
- **CEAs** add further insights by identifying factors that facilitate/inhibit crime (e.g. low/ high social cohesion, good/poor natural surveillance)

Both CCA and CEA require:

- **Awareness** of sources of data on crime, disorder, land use and socio-demographic conditions
- **Expertise** in data manipulation and processing
- **Basic skills** in data analysis
- **Competence** in the use of GIS
- **An ability** to interpret the results from analysis