Time Span Analysis

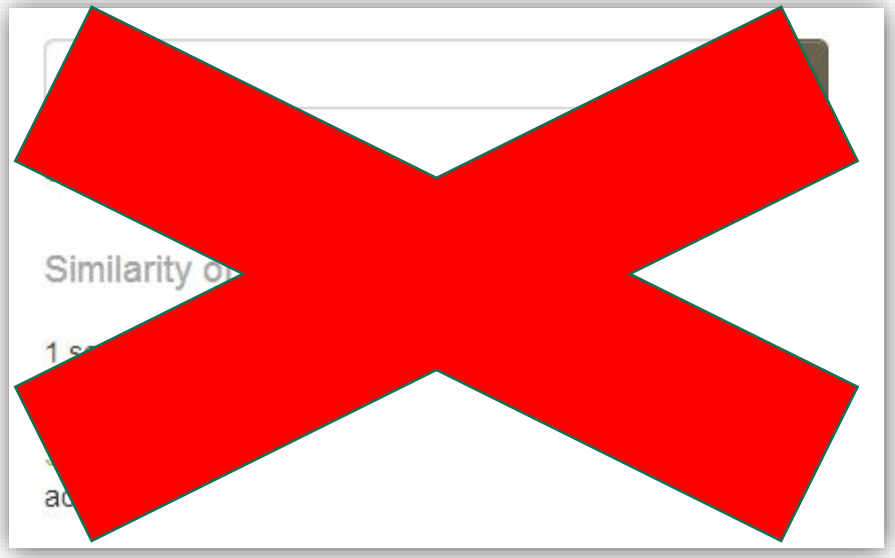
David Attaway

Time Span Analysis

Also known as Aoristic Analysis…

What is **Aoristic**?

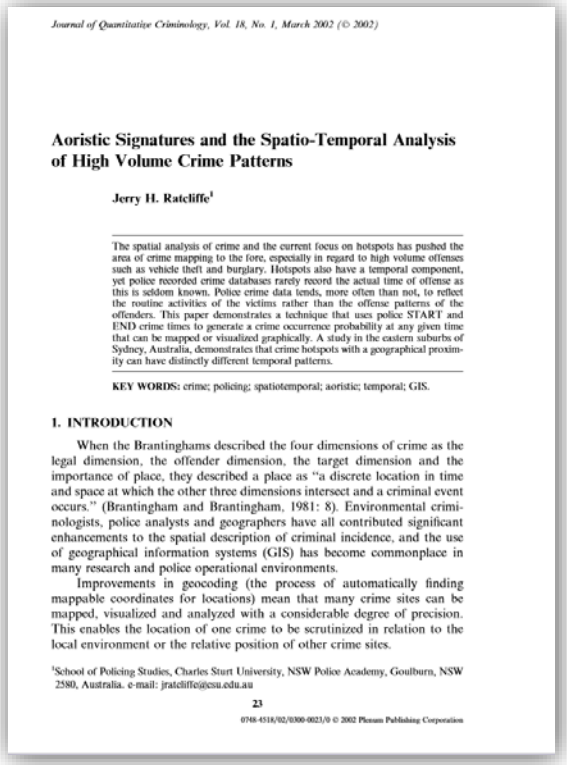
1840-50



Dr. Jerry Ratcliffe,
Temple University

indefinite → indeterminate

"without defined occurrence in time"



Journal of Quantitative Criminology, Vol. 18, No. 1, March 2002 (© 2002)

Aoristic Signatures and the Spatio-Temporal Analysis of High Volume Crime Patterns

Jerry H. Ratcliffe[1]

The spatial analysis of crime and the current focus on hotspots has pushed the area of crime mapping to the fore, especially in regard to high volume offenses such as vehicle theft and burglary. Hotspots also have a temporal component, yet police recorded crime databases rarely record the actual time of offense as this is seldom known. Police crime data tends, more often than not, to reflect the routine activities of the victims rather than the offense patterns of the offenders. This paper demonstrates a technique that uses police START and END crime times to generate a crime occurrence probability at any given time that can be mapped or visualized graphically. A study in the eastern suburbs of Sydney, Australia, demonstrates that crime hotspots with a geographical proximity can have distinctly different temporal patterns.

KEY WORDS: crime; policing; spatiotemporal; aoristic; temporal; GIS.

1. INTRODUCTION

When the Brantinghams described the four dimensions of crime as the legal dimension, the offender dimension, the target dimension and the importance of place, they described a place as "a discrete location in time and space at which the other three dimensions intersect and a criminal event occurs." (Brantingham and Brantingham, 1981: 8). Environmental criminologists, police analysts and geographers have all contributed significant enhancements to the spatial description of criminal incidence, and the use of geographical information systems (GIS) has become commonplace in many research and police operational environments.

Improvements in geocoding (the process of automatically finding mappable coordinates for locations) mean that many crime sites can be mapped, visualized and analyzed with a considerable degree of precision. This enables the location of one crime to be scrutinized in relation to the local environment or the relative position of other crime sites.

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Temporal Analysis!

Probability Analysis?

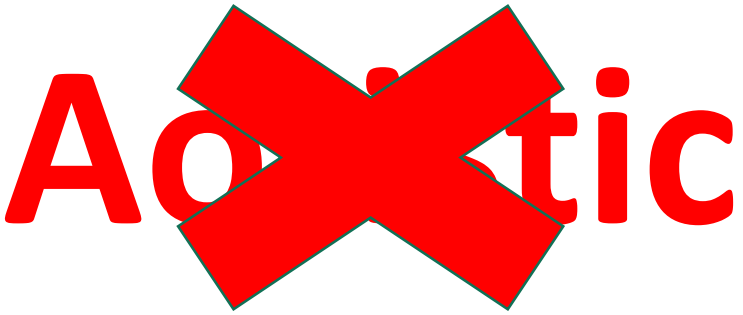
Spatial Temporal Analysis?

Space Time Analysis!

Aoristic?

Weighted Analysis?

To help with the confusion:



Phewww

Time Span Analysis

Yeaaa!

Thank God!

Formulas….

Hour End:

=IF(MINUTE(F2)<10,HOUR(F2)

F2)+1)

Data Ent

rmatting:

ddd

Day's P

Day's Between Fi

=(B2-A2)-(ROUNDDOWN(A2+

Day of week start:

=TEXT(L2,"ddd")

ity:

A2)

Da

=((M4)-(

O2)

Weight per hour:

K2>=$J2,IF(AND(Q$1>=$J2,Q$1<=$K2),$P2,0),IF(OR(Q$

Q$1>=$J2),$P2,0))

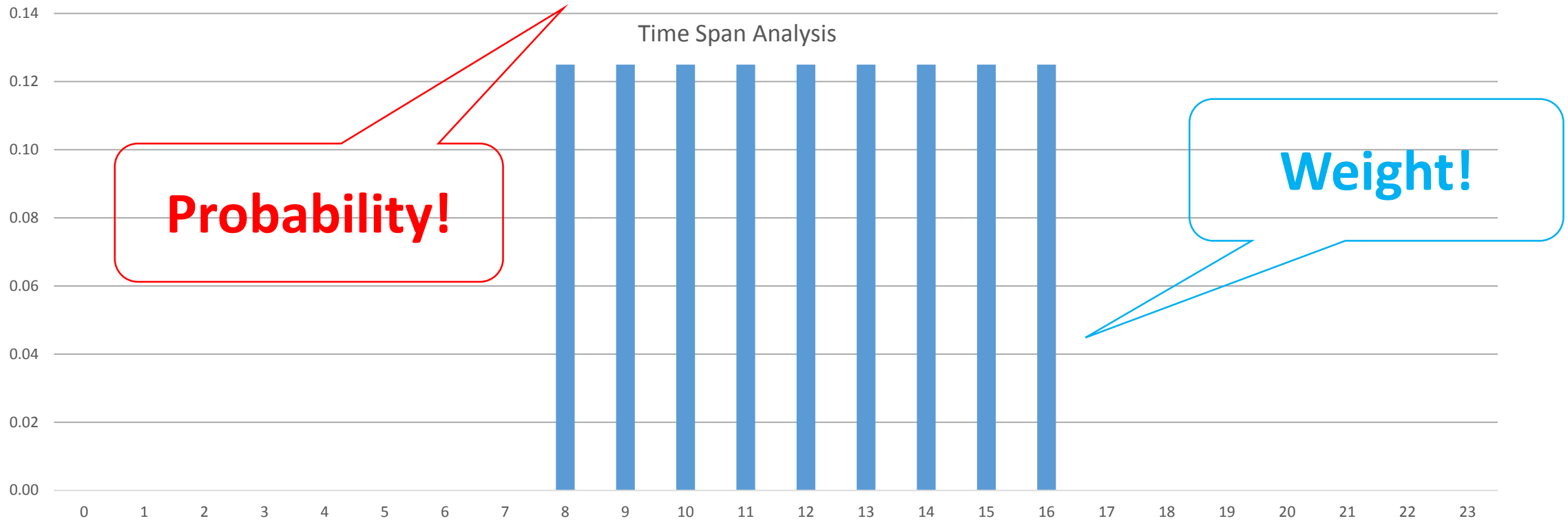
Simplified the Process
(Now in a Template)

Park my car:
April 12th, 2014
8:00 am

Total of 8 Hours unattended…

Notice my car is stolen
April 12th, 2014
4:00 pm

datetimestart	datetimeend	days	hours	weight
8/12/2014 8:00 AM	8/12/2014 4:00 PM	0.33	8	0.13



Calculates the probability that an incident occurred at a location:

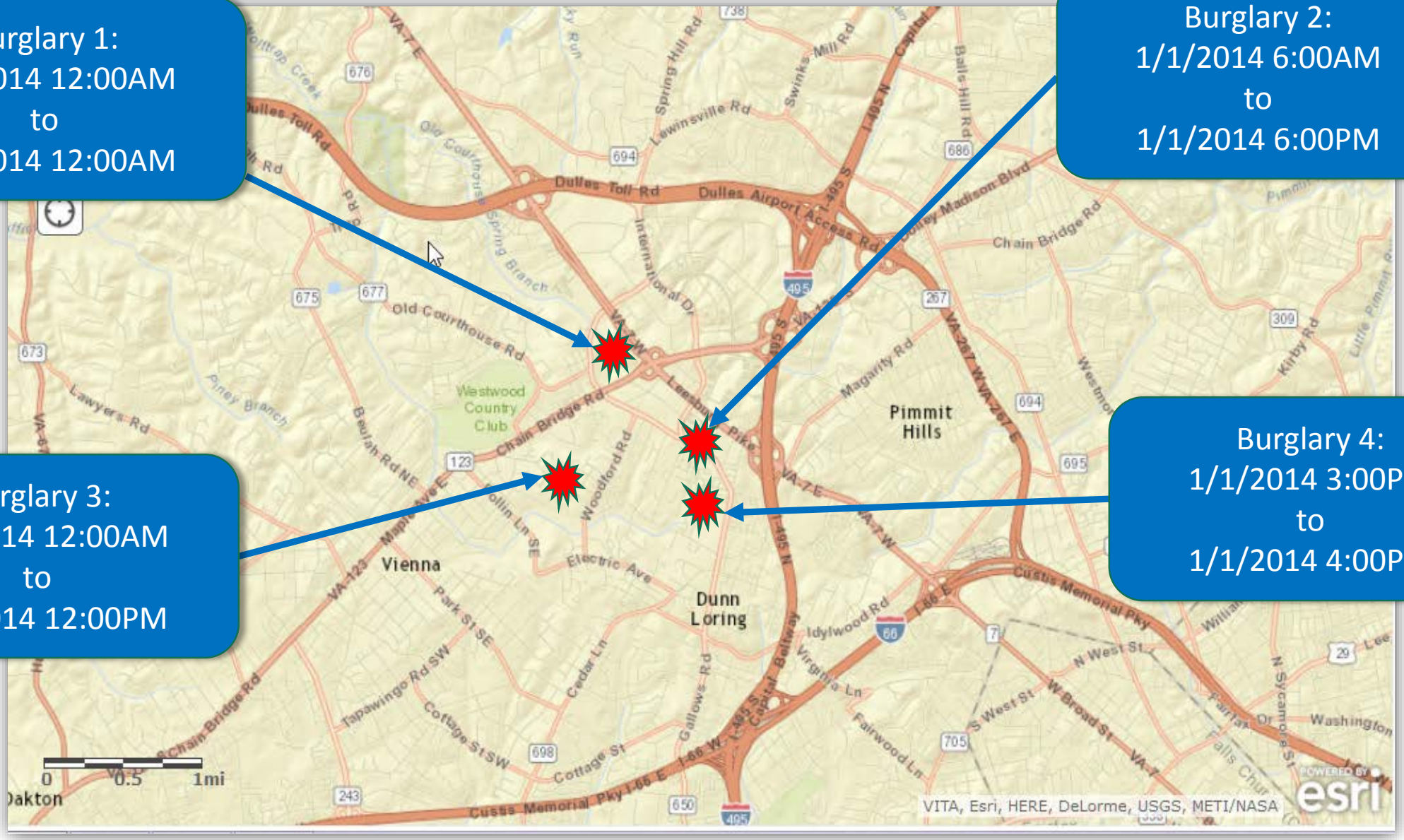
INCIDENT

Burglary 1:
1/1/2014 12:00AM
to
1/2/2014 12:00AM

Burglary 2:
1/1/2014 6:00AM
to
1/1/2014 6:00PM

Burglary 3:
1/1/2014 12:00AM
to
1/1/2014 12:00PM

Burglary 4:
1/1/2014 3:00PM
to
1/1/2014 4:00PM

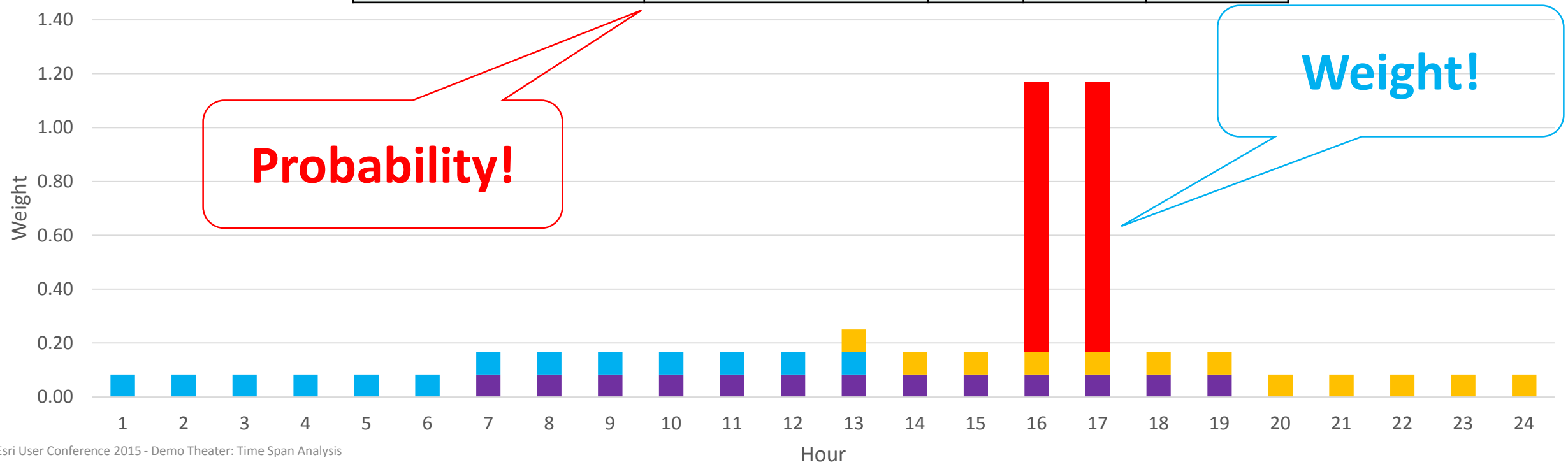


Burglary 1:
1/1/2014 12:00AM
to
1/2/2014 12:00AM

Total of 1 Hour unattended…

Analysis POWER comes w/ many points for analysis!!!

datetimestart	datetimeend	days	hours	weight
1/1/2014 12:00AM	1/1/2014 12:00PM	**0.5**	**12**	**0.08**
1/1/2014 6:00AM	1/1/2014 6:00PM	**0.5**	**12**	**0.08**
1/1/2014 12:00PM	1/2/2014 12:00AM	**0.5**	**12**	**0.08**
1/1/2014 3:00PM	1/1/2014 4:00PM	**0.04**	**1**	**1.0**



Gives you….

Search Blocks of Equal Duration

	12:00 AM	6:00 AM	12:00 PM	6:00 PM	12:00AM
	1	2	3	4	
Burglary 1	.25	.25	.25	.25	
Burglary 2		.50	.50		
Burglary 3	.50	.50			
Burglary 4			1.0		
Aoristic Sum	.75	1.25	1.75	.25	
Probability	18%	31%	43%	6%	

Probability

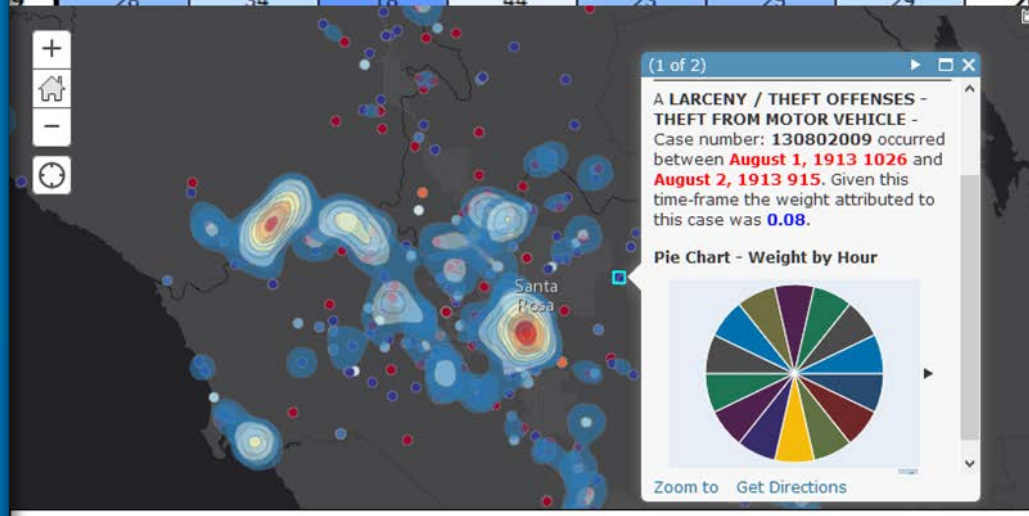
and

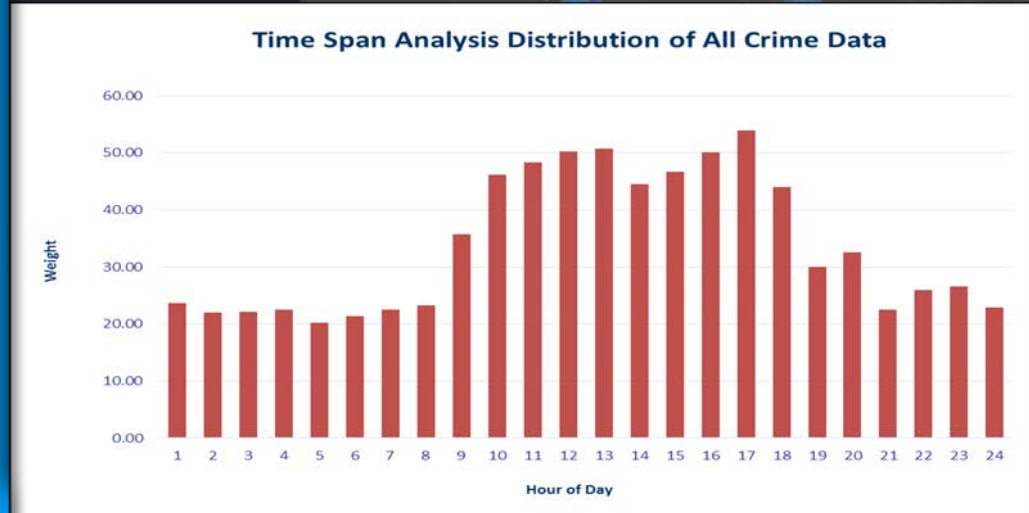
Weight

Demo

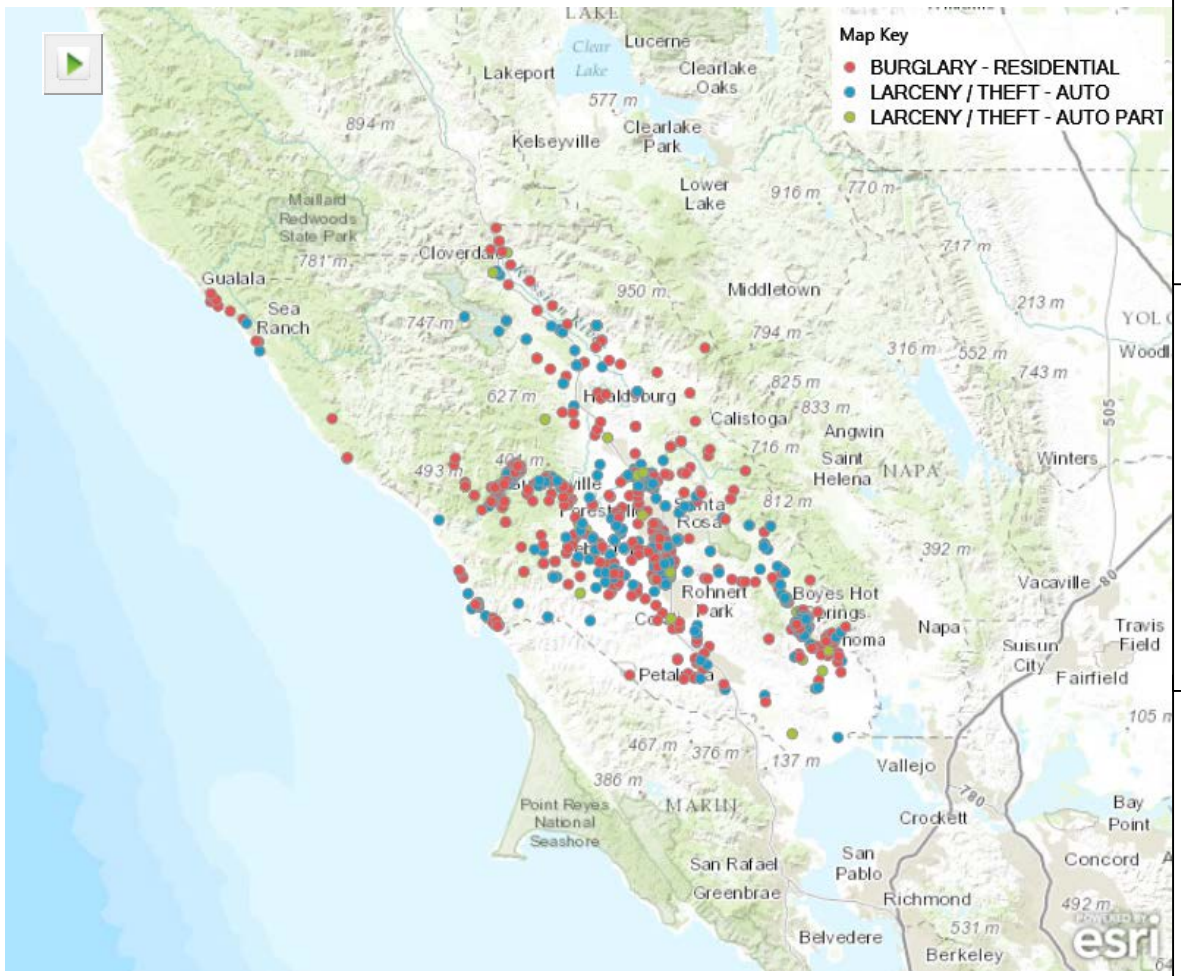
David Attaway

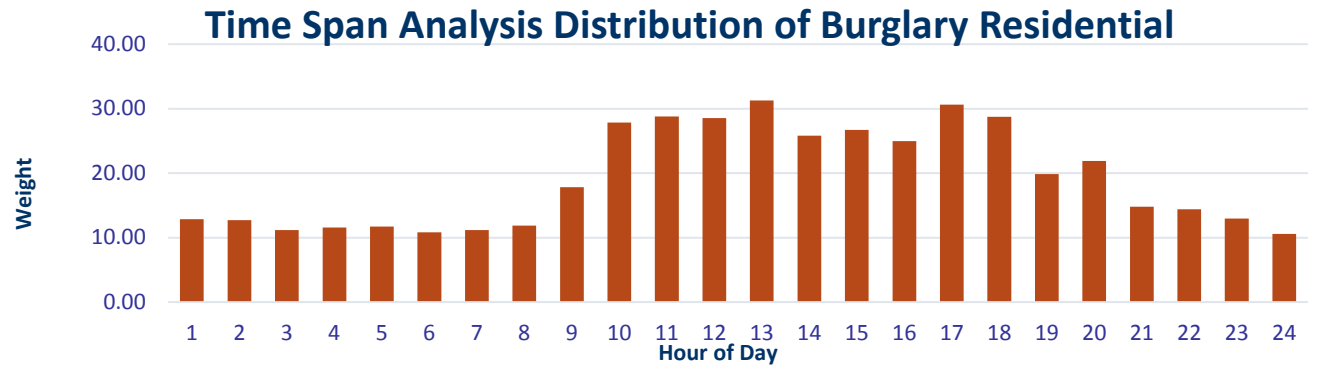
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Tot
0	56	48	62	82	103	101	51	5
1	52	80	53	74	100	105	58	5
2	70	80	60	62	88	83	92	5
3	47	43	57	48	63	88	59	4
4	27	41	32	35	39	66	35	2
5	21	27	35	24	41	54	24	2
6	18	19	17	21	24	35	24	1
7	17	18	21	24	22	27	18	1
8	24	40	30	22	24	19	27	1
9	28	34	18	44	23	25	29	2

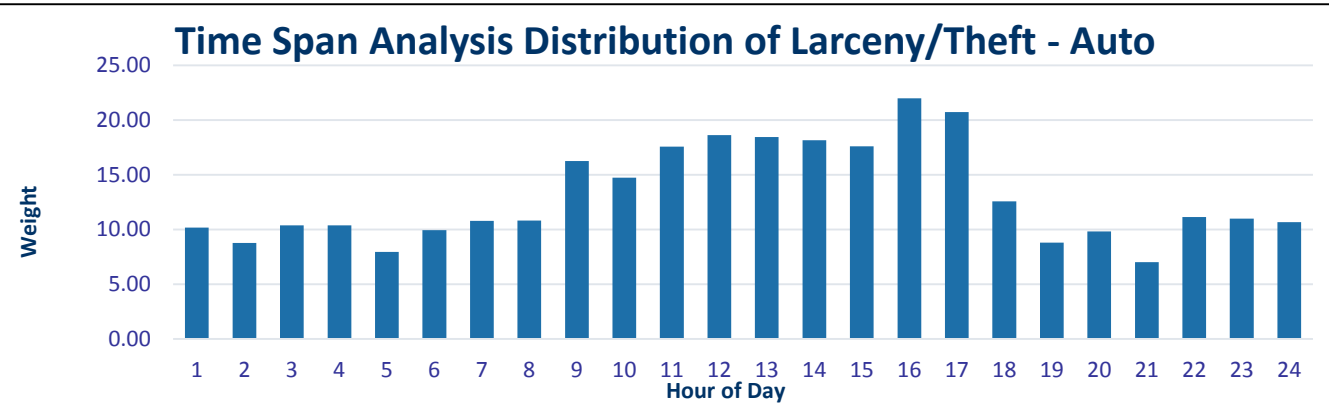


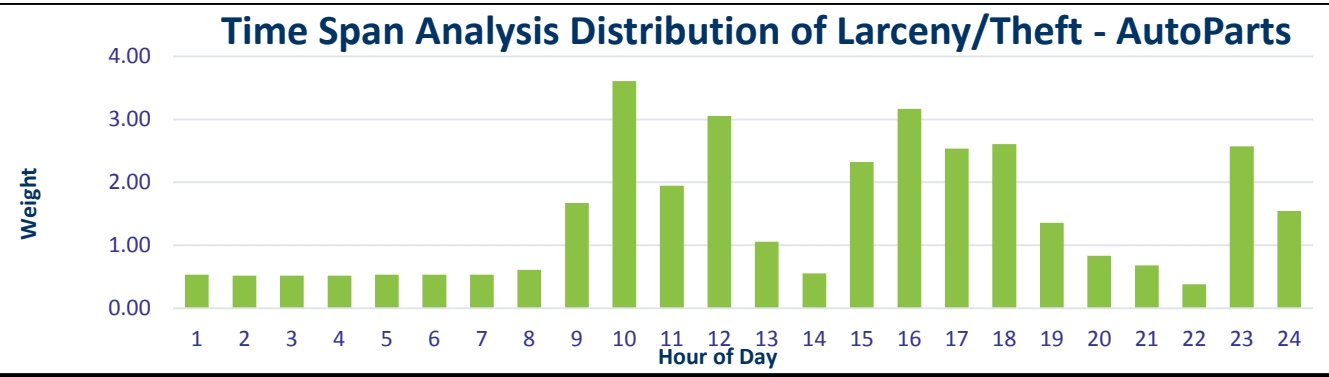


Crime Incidents – Southern California (All Types)









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Burglary Thefts Time Reported - Southern California

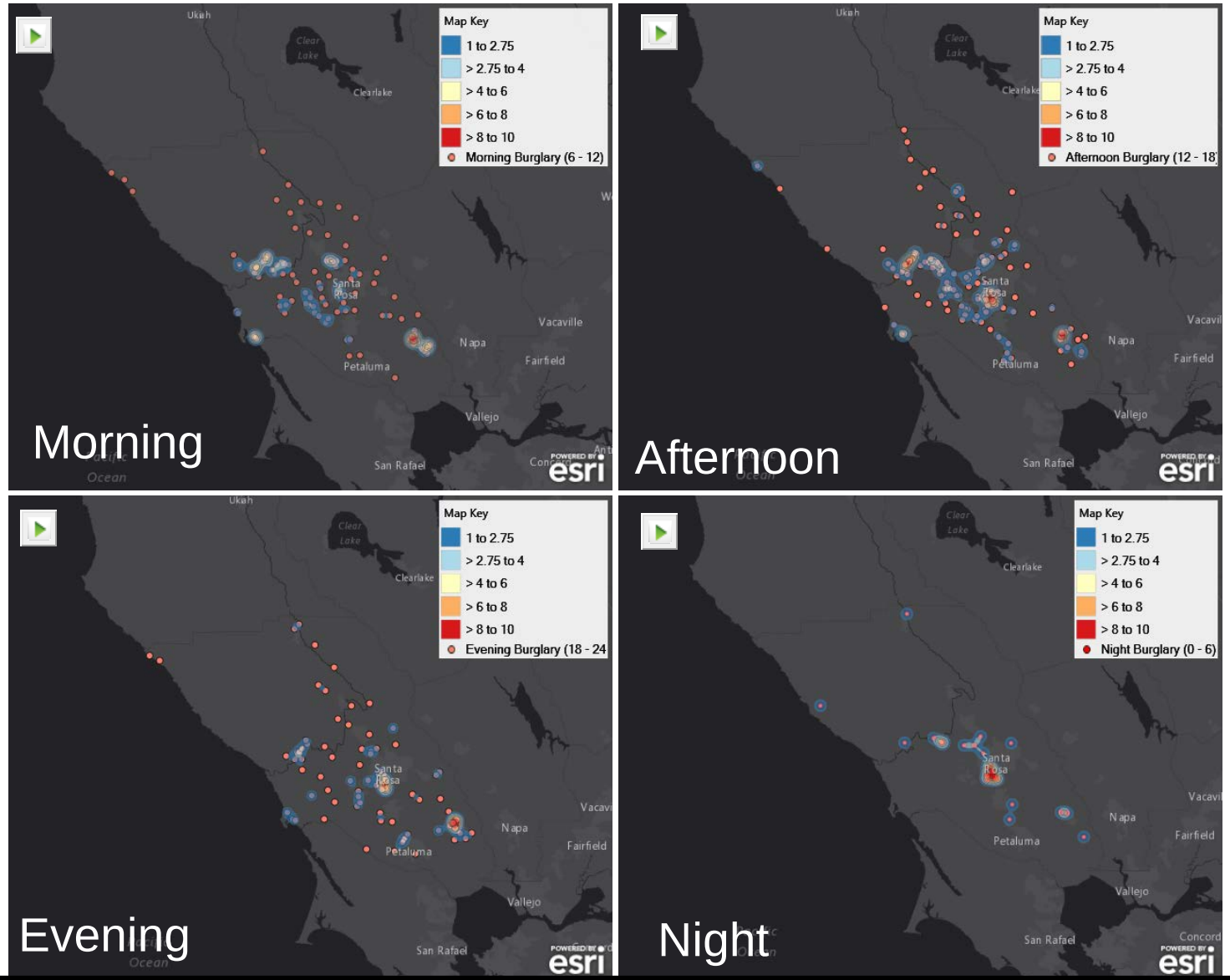
Distribution of Residential burglary

The times are divided into:

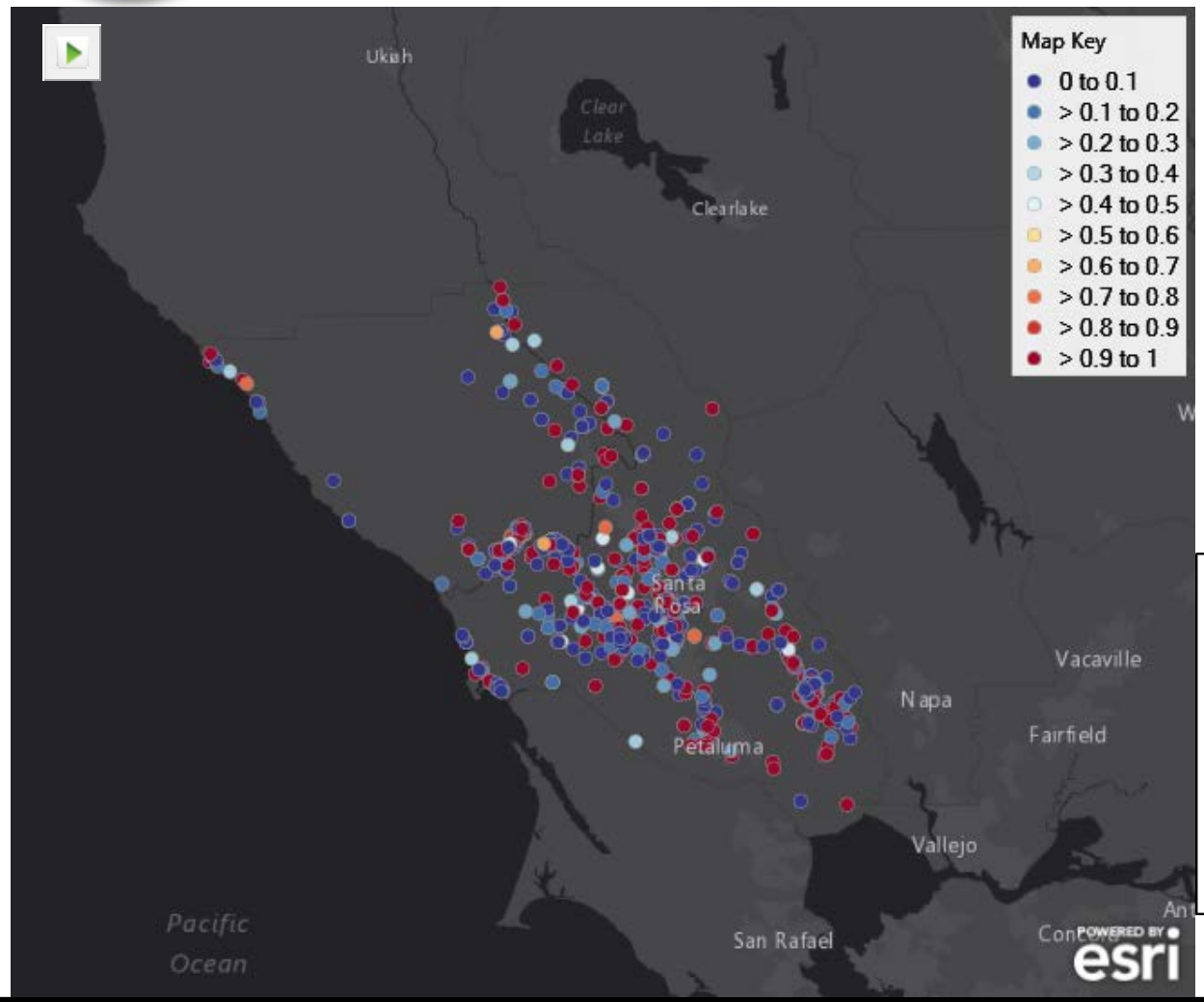
- Morning*,
- Afternoon*,
- Evening*,
- and Night* (four 6-hr intervals).

*(The times of day represent the time in which the vehicle theft was discovered)

Residential burglary reporting is highest in the Afternoon (1200-1800).

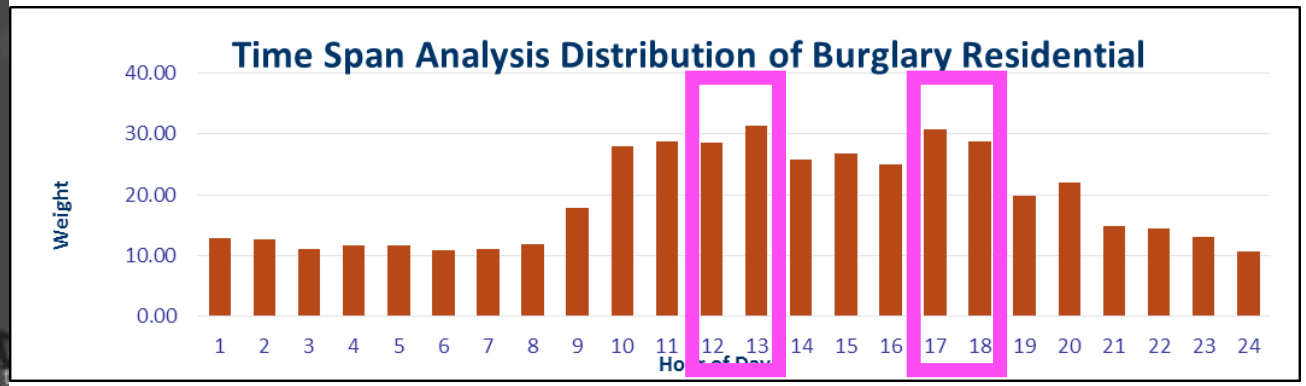


Time Span Analysis
Residential Burglary



The greatest probability of times when the residential burglaries:

- **Between 12 – 1pm (1200 – 1300)**
  and
- **5pm – 6pm (1700 – 1800).**



Want to learn more?

- **Documentation**
  - **Perform Time Span Analysis:**
    - **http://solutions.arcgis.com/intelligence/exploitation-analysis/**
    - **Link near the bottom of page – “Perform Time Span Analysis”**

- **Related Esri Training and Tutorials**
  - **Time Span Analysis Template**
  - **Additional Location to download:**
    - **TimeSpanAnalysis_1_0_0_for_ArcGIS10_2.zip**

Get more information on Time Span Analysis…

Understanding our world.