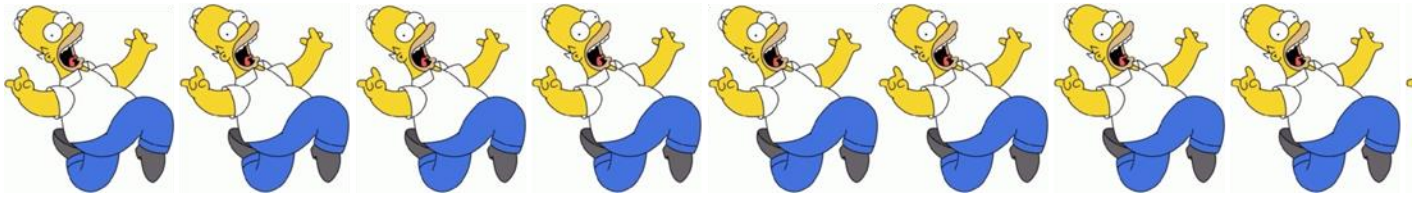
Simpson's Paradox: Fallacies when combining data

PROFESSIONAL & CONTINUING EDUCATION
UNIVERSITY of WASHINGTON

SIMPSON'S PARADOX

- A trend appears in different groups of data but disappears or reverses when these groups are combined.
- Simpson, E.H. (1951) The interpretation of interaction in contingency tables. Journal of the Royal Statistical Society, Ser B, 13, 238-241
- https://en.wikipedia.org/wiki/Simpson's_paradox
- https://www.scientificamerican.com/article/mathematical-games-1976-03/
- http://www.mortalityresearch.com/images/uploads/entry_image/Simpsons_paradox_in_MLB.pdf
- https://www.jstor.org/stable/2984065?seq=1#page_scan_tab_contents
- https://www.jstor.org/stable/2284382?seq=1#page_scan_tab_contents
- See: L10-SimpsonsParadox.py



SIMPSON'S PARADOX

Player	1995 Hits/ At Bat	1995 BA
Derek Jeter		
David Justice		

Player	Comb Hits/ At Bat	Comb BA
Derek Jeter		
David Justice		

SIMPSON'S PARADOX

Player	1995 Hits/ At Bat	1995 BA
Derek Jeter	12/48	0.25
David Justice	104/411	**0.253**

Higher Batting Average (BA)

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Derek Jeter		
David Justice		

SIMPSON'S PARADOX

Player	1995 Hits/ At Bat	1995 BA	1996 Hits/ At Bat	1996 BA
Derek Jeter	12/48	0.25	183/582	0.314
David Justice	104/411	**0.253**	45/140	**0.321**

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Higher Batting Average (BA)

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Player	Comb Hits/ At Bat	Comb BA
Derek Jeter	195/630	**0.310**
David Justice	159/551	0.289

Higher Batting Average (BA)

SIMPSON'S PARADOX

Player	1995 Hits/ At Bat	1995 BA	1996 Hits/ At Bat	1996 BA	1997 Hits/ At Bat	1997 BA
Derek Jeter	12/48	0.25	183/582	0.314	190/654	0.291
David Justice	104/411	**0.253**	45/140	**0.321**	163/495	**0.329**

Higher Batting Average (BA)

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Higher Batting Average (BA)

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Player	Comb Hits/ At Bat	Comb BA
Derek Jeter	385/1284	**0.300**
David Justice	312/1046	0.298

Higher Batting Average (BA)

SIMPSON'S PARADOX

Method	Small Stones	Ratio	Large Stones	Ratio
Old	81/87	**93%**	192/263	**73%**
New	234/270	87%	55/80	69%

Old Method is more effective

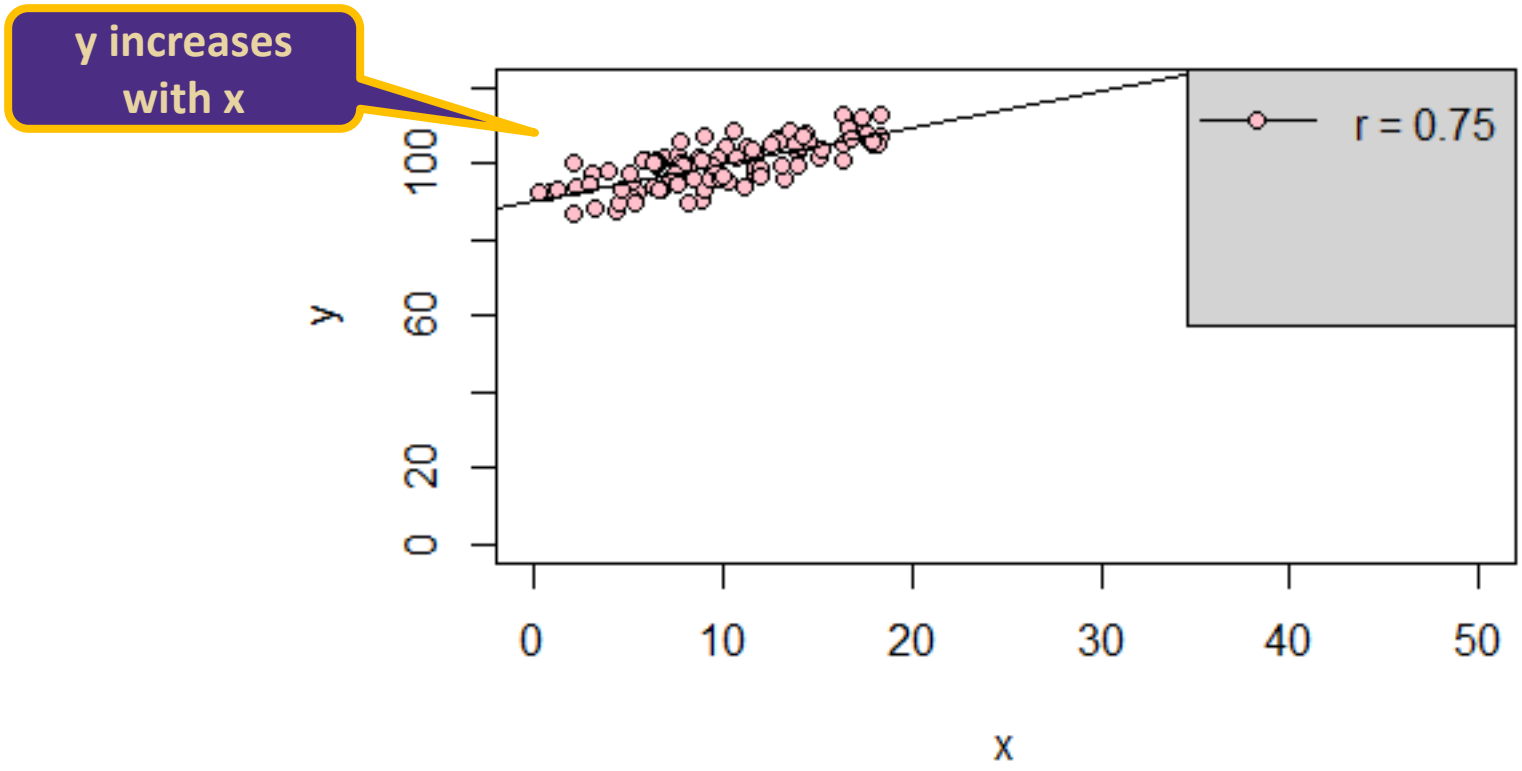
Successes/Treatments

Old Method is more effective

Method	All Stones	Ratio
Old	273/350	78%
New	289/350	**83%**

New Method is more effective

SIMPSON'S PARADOX



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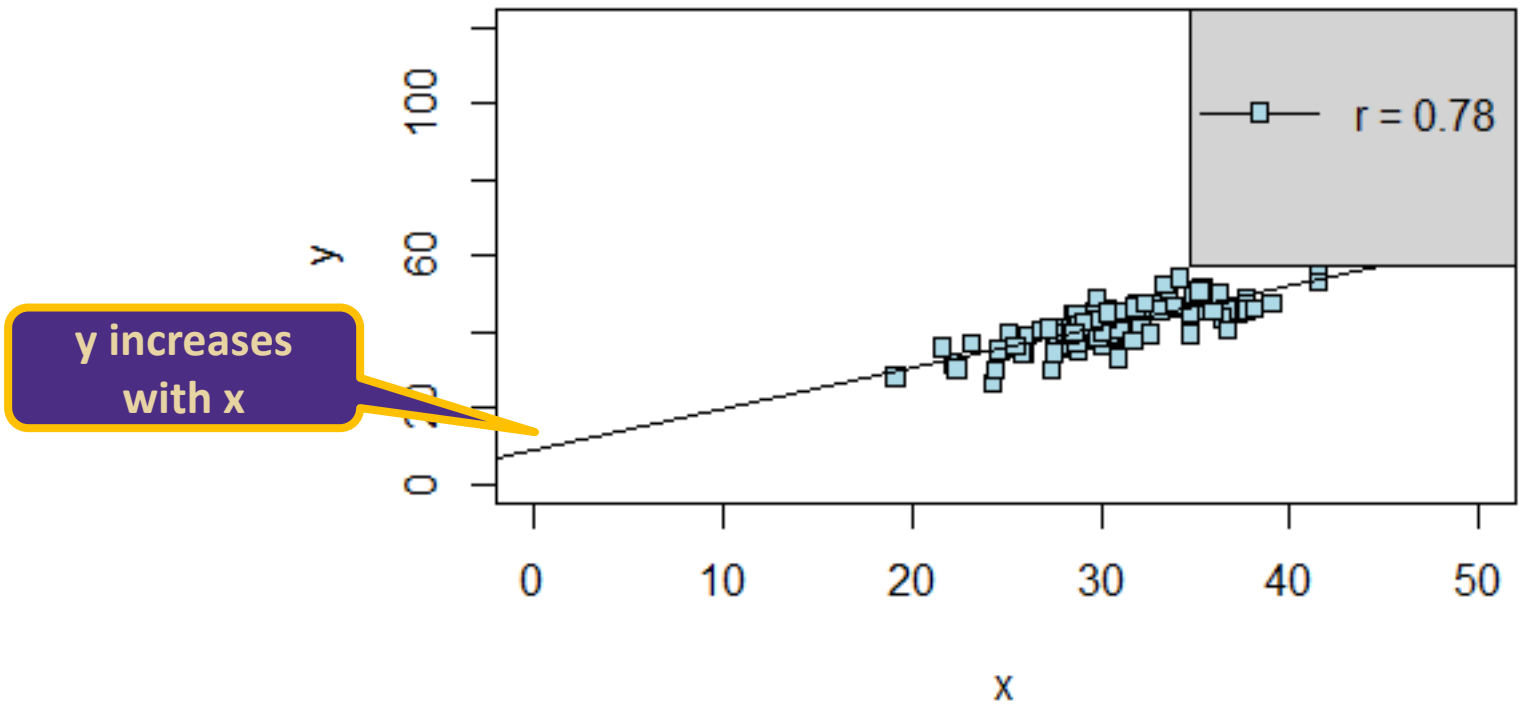

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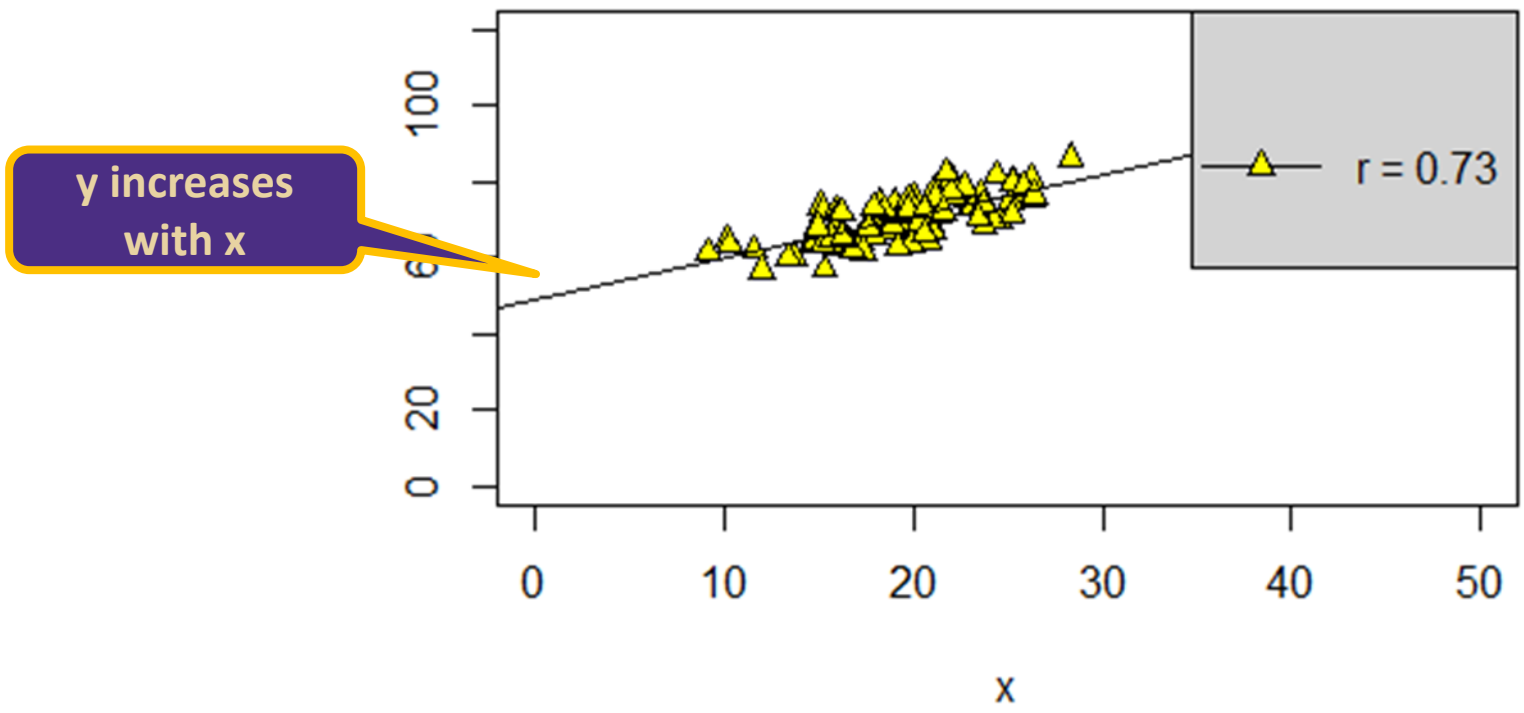

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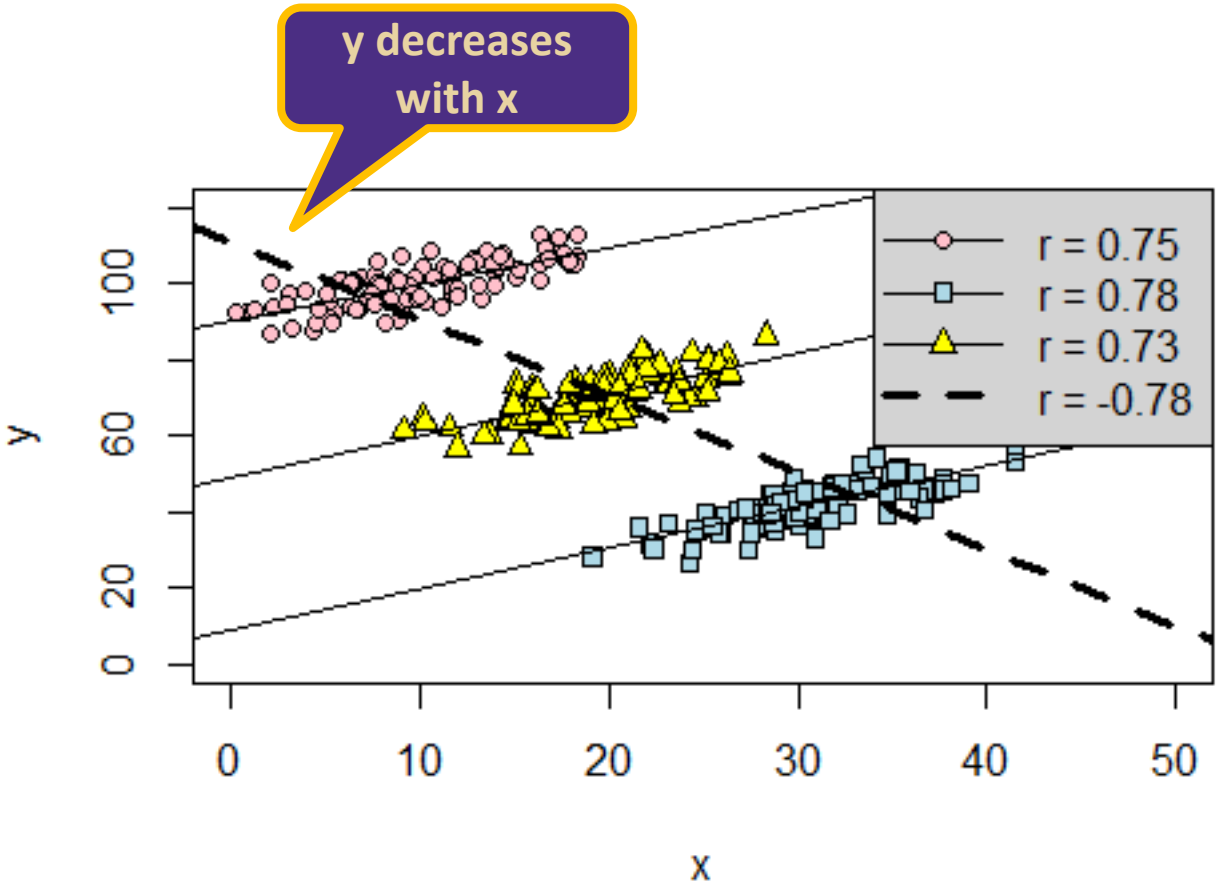


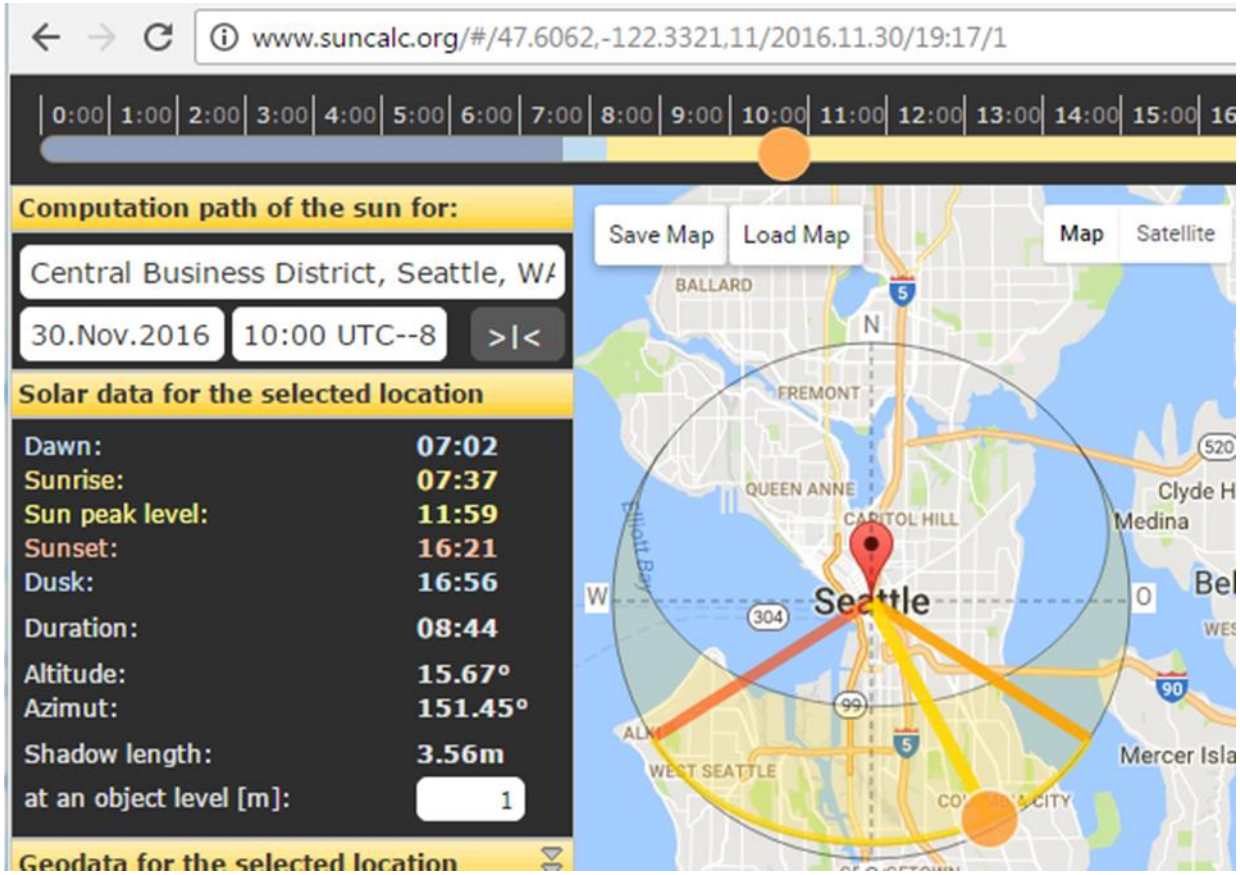
SIMPSON'S PARADOX

Example: Sun rise in Seattle (See: Sunrise.R)

- Given measurements between 7 AM and 1 PM, does the sun rise over time in Seattle?
- Height of sun is measured in degrees.
- We should get results from various times of year (i.e., summer solstice, fall equinox, winter solstice) and combine those data.

SIMPSON'S PARADOX

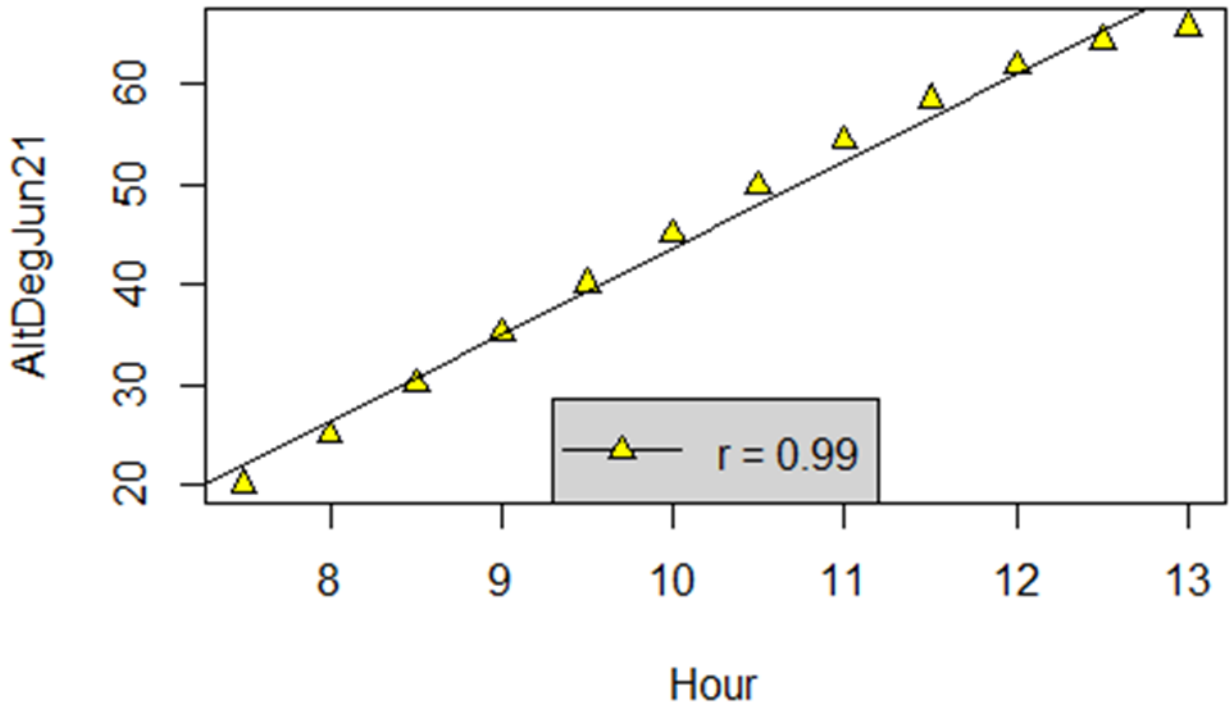
Example: Sunrise in Seattle (See: Sunrise.R)



SIMPSON'S PARADOX

Example: Sunrise in Seattle (See: Sunrise.R)

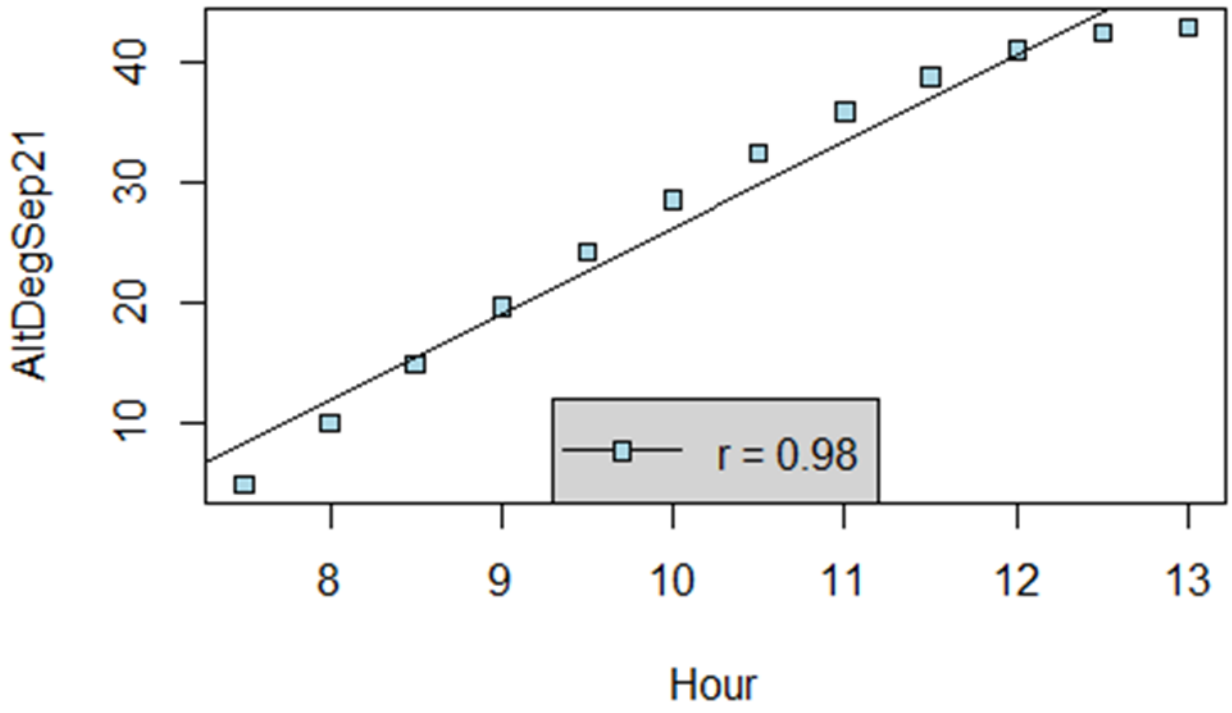
Jun 21st



SIMPSON'S PARADOX

Example: Sunrise in Seattle (See: Sunrise.R)

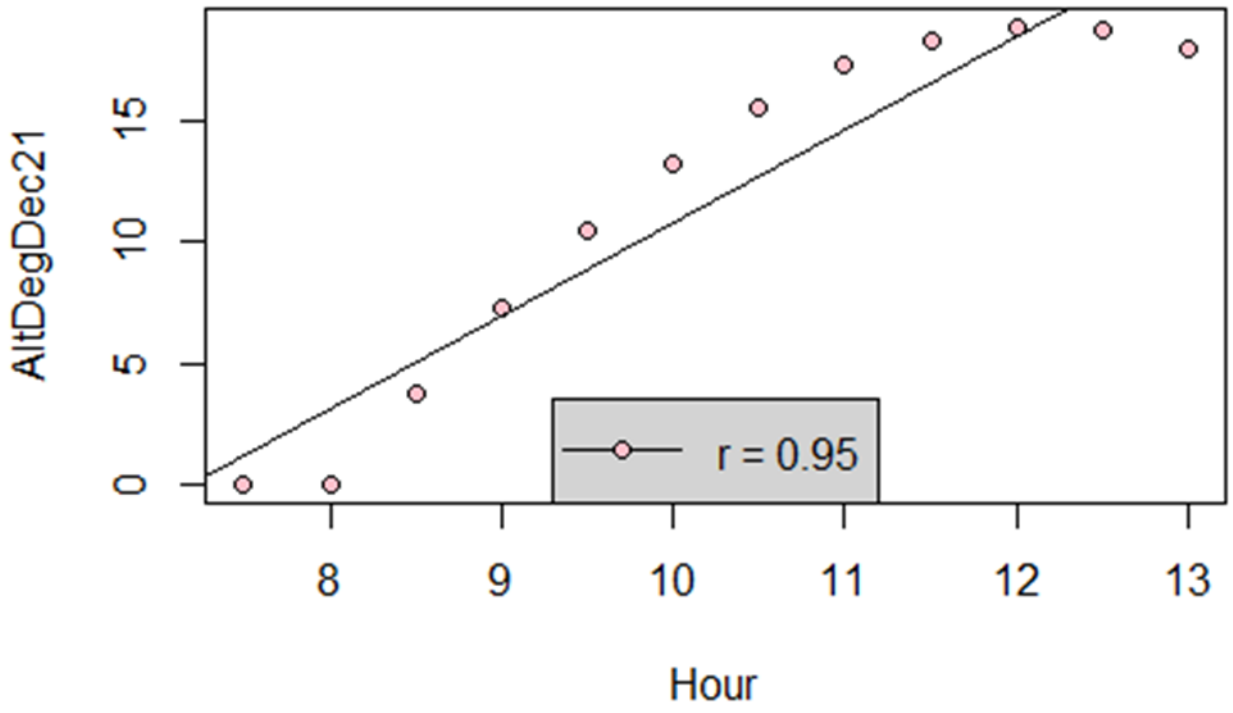
Sep 21st



SIMPSON'S PARADOX

Example: Sunrise in Seattle (See: Sunrise.R)

Dec 21st



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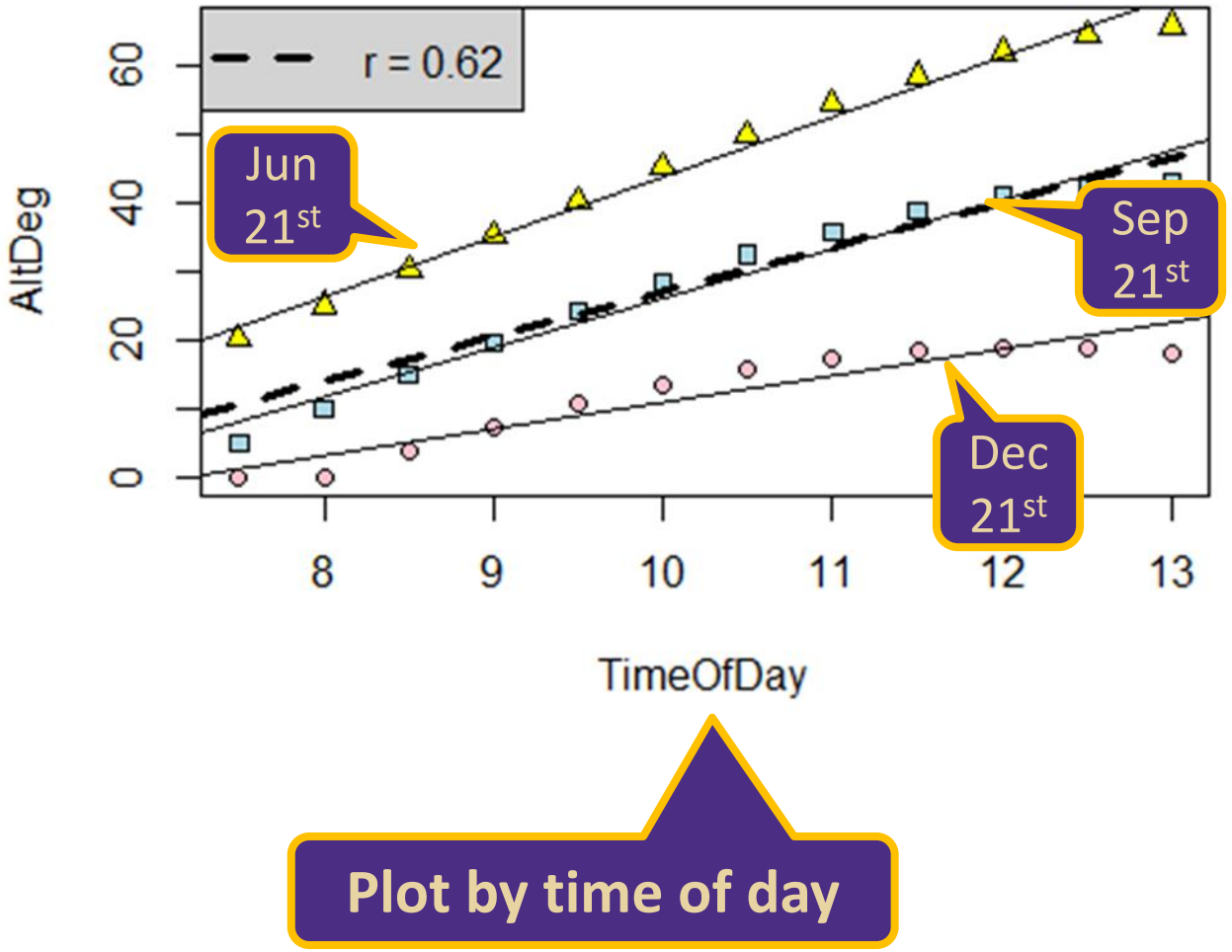

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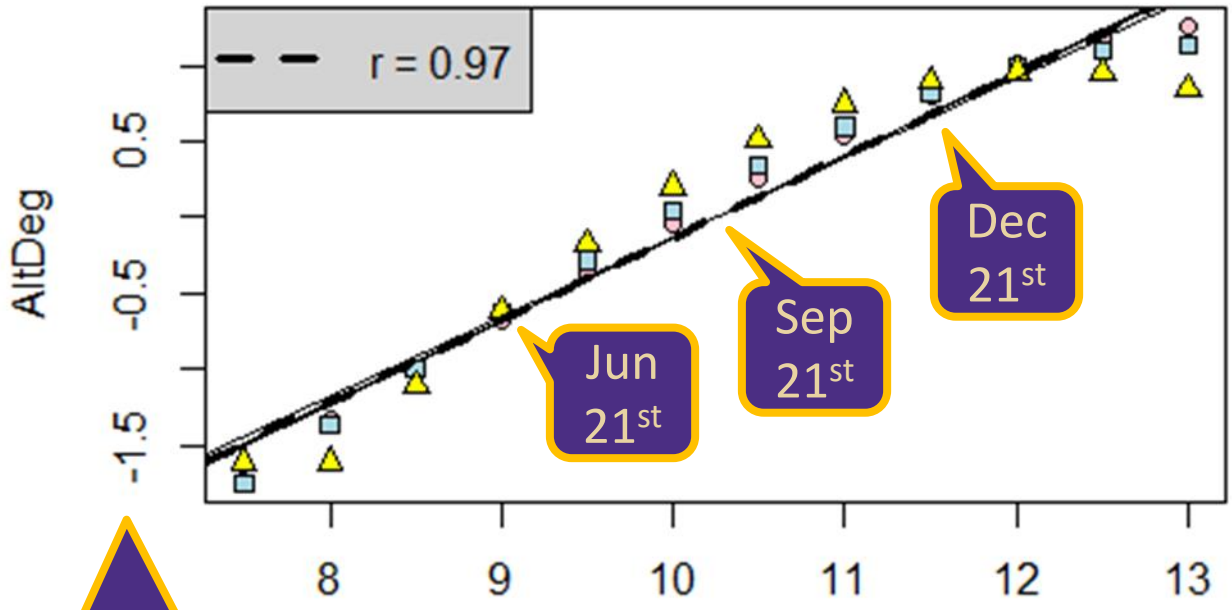

Normalize Altitude Degrees

Plot by time of day

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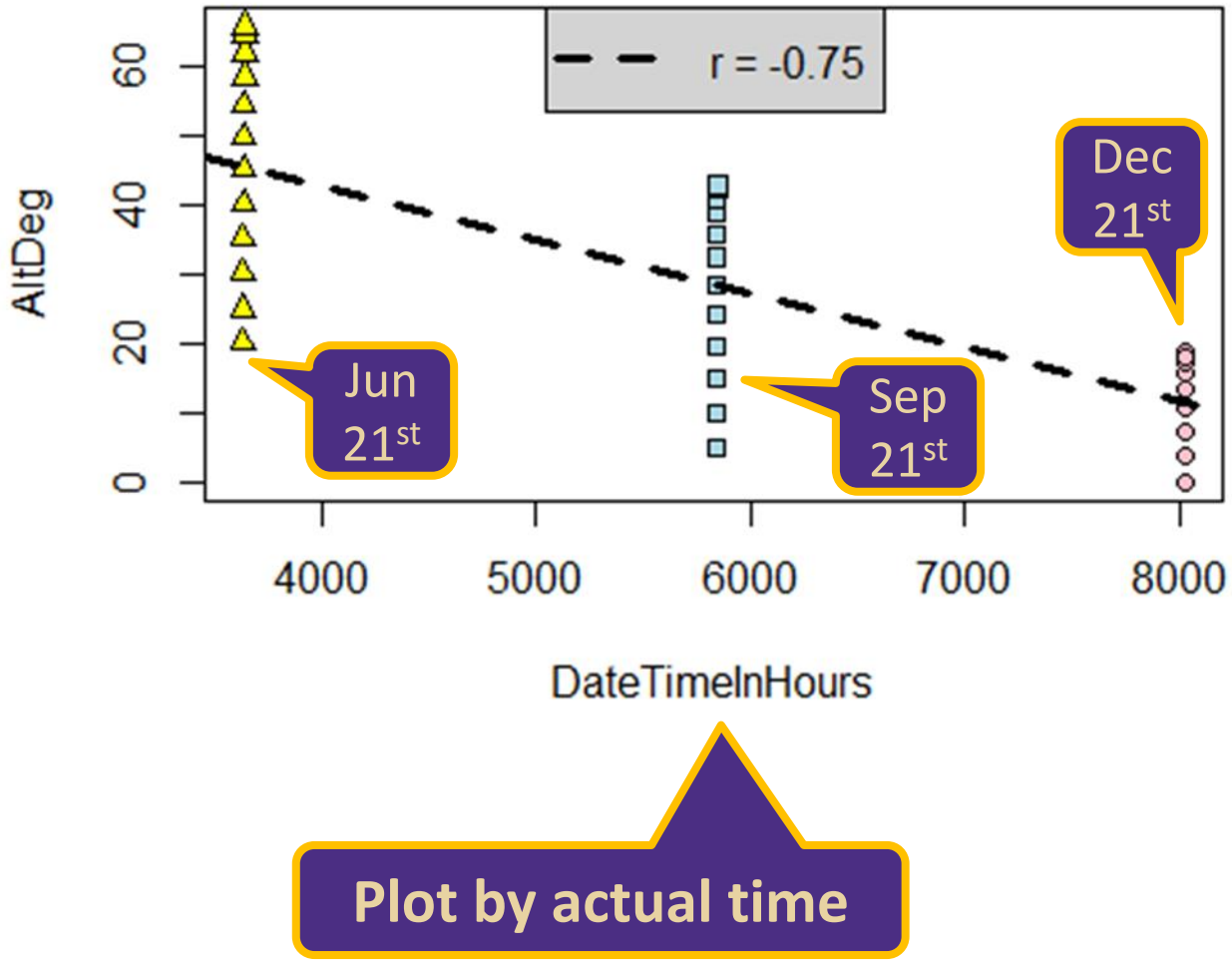

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