

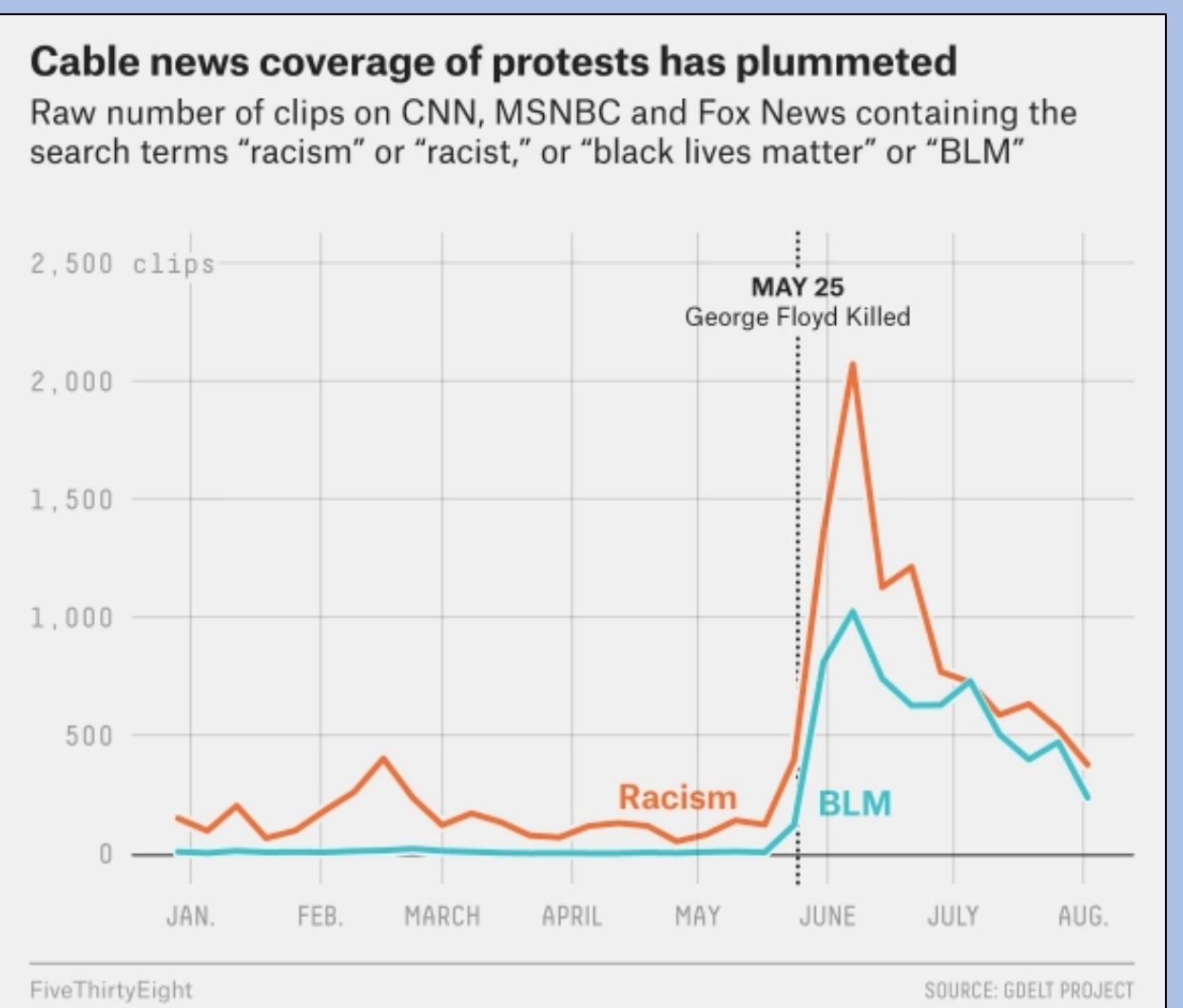


Misjudgment of Time Series Graphs Due to Serial Dependence

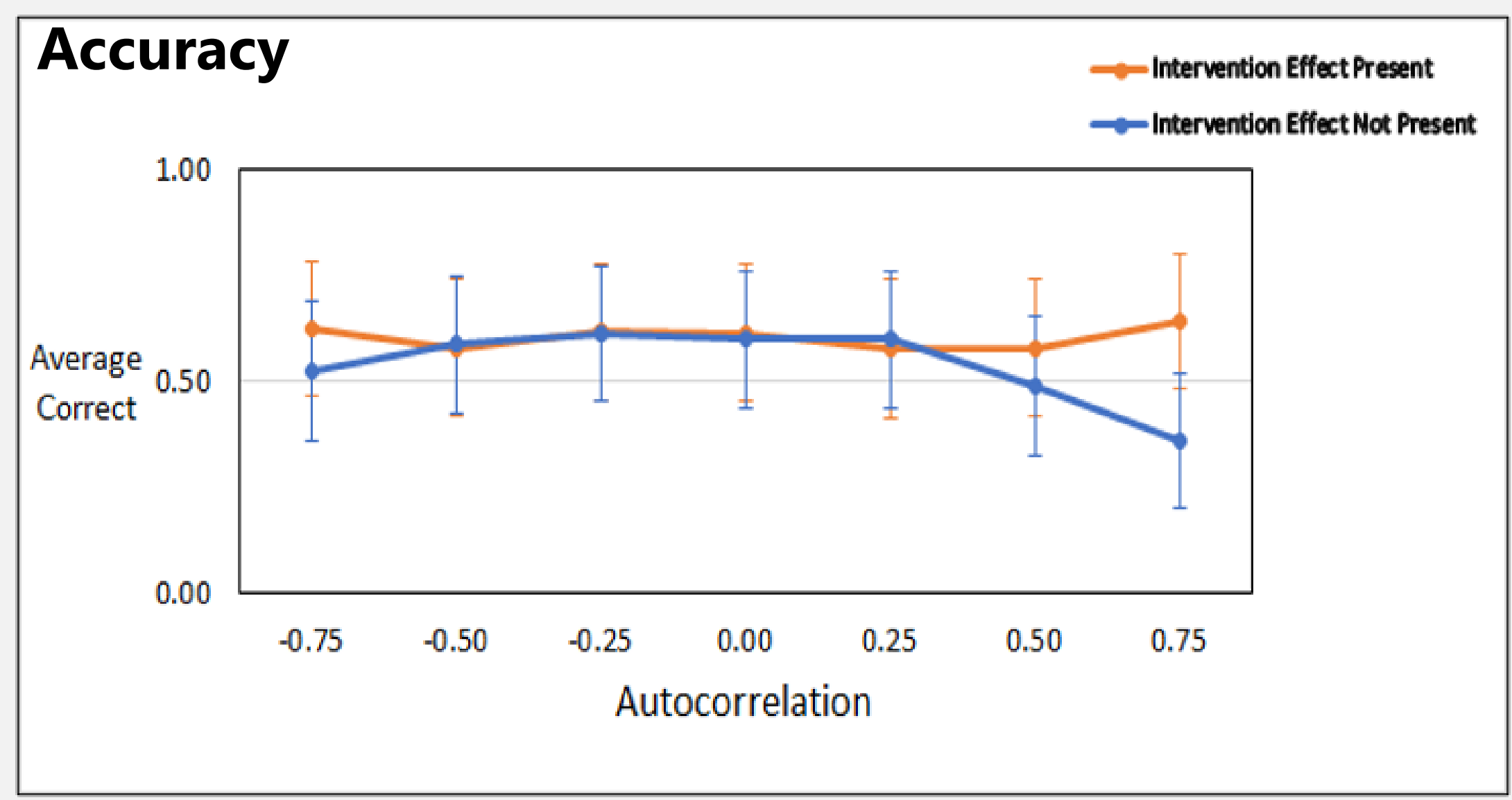
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INTRODUCTION

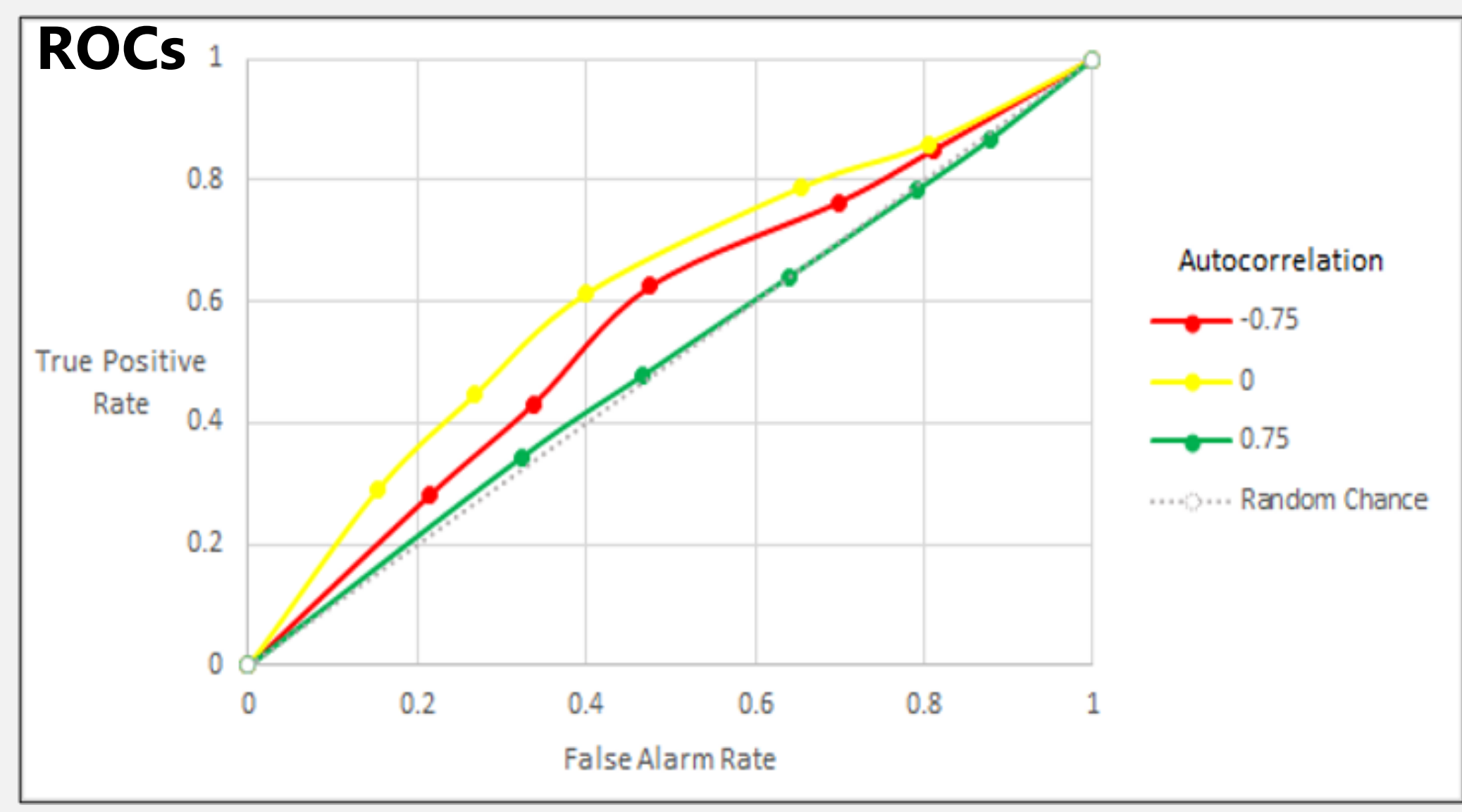
- Interrupted time-series graphs show data both before and after some intervention ("interruption"). Did the intervention have an effect? Consider this example: →
- Such judgments may be challenging due to serial dependence (non-zero autocorrelation) in time series data
- With positive autocorrelation, high scores tend to be followed by high, and low by low.
- In previous research, positive autocorrelation
 - Impaired discriminability
 - Biased toward belief that the intervention had an effect
- A simple account would be that viewers neglect autocorrelation, instead interpreting it as error size
 - Positive autocorrelation (often smooth) interpreted as low error
 - Negative autocorrelation (often jagged) interpreted as high error
 - Account predicts opposite biases for positive vs. negative autocorrelations



RESULTS



- Significant autocorrelation X intervention effect interaction, $p < .001$, $\eta^2_G = .14$
- Large absolute autocorrelation led to better judgment when an intervention effect was present, but worse when it was not



- Large positive and negative autocorrelation both:
 - significantly lowered discriminability
 - significantly increased bias to decide that the intervention had an effect

METHOD

- N=38 introductory psychology students
- 2 (intervention effect or not) X 7 (autocorrelation) repeated measures design
- Participants decided whether there was an intervention effect or not
- Some stimuli examples:

Population lag-1 autocorrelation

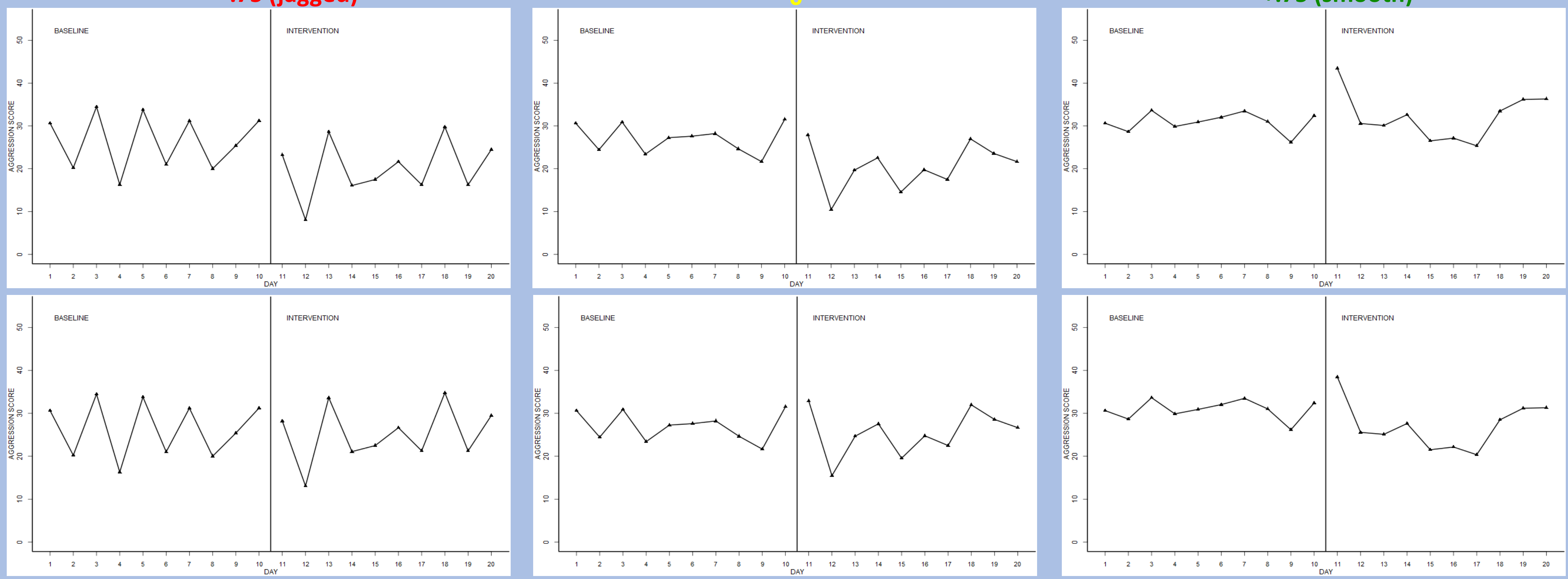
-.75 (jagged)

0

+.75 (smooth)

Intervention Effect Present

Intervention Effect NOT Present



DISCUSSION

- Replicated and extended previous work
 - Autocorrelation can impair and bias judgment of interrupted time-series graphs
- Novelty: Both positive and negative autocorrelation biased participants in the same direction
 - Autocorrelation neglect account cannot fully explain this pattern
- High absolute autocorrelation can lead people to believe that a salient event impacted time-series data even when it did not
- Informal graph judgment should be corroborated by formal statistical procedures (e.g., Borckardt et al., 2008)

REFERENCES

Borckardt, J. J., Nash, M. R., Murphy, M. D., Moore, M., Shaw, D., & O'Neil, P. (2008). Clinical practice as natural laboratory for psychotherapy research: A guide to case-based time-series analysis. *American Psychologist*, 63(2), 77-95. <http://dx.doi.org/10.1037/0003-066X.63.2.77>

Matyas, T. A., & Greenwood, K. M. (1990). Visual analysis of single-case time series: Effects of variability, serial dependence, and magnitude of intervention effects. *Journal of Applied Behavior Analysis*, 23(3), 341-351. <https://doi.org/10.1901/jaba.1990.23-341>