

MODELLING TEMPORALLY PRECISE SPIKE ARTEFACTS TO STUDY THEIR IMPACT ON SPIKE CORRELATION ANALYSES

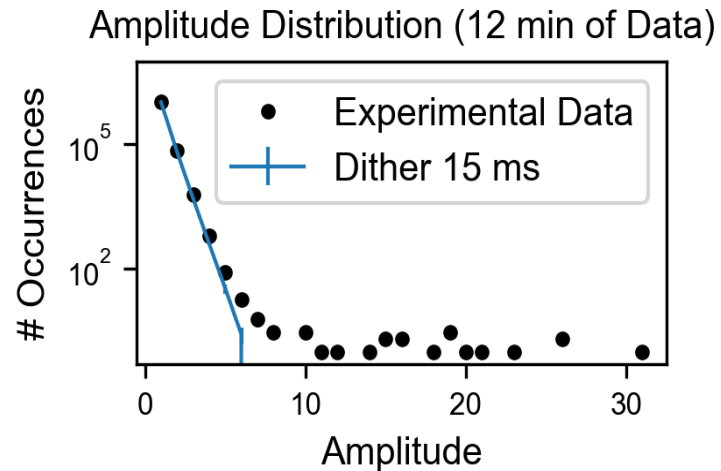
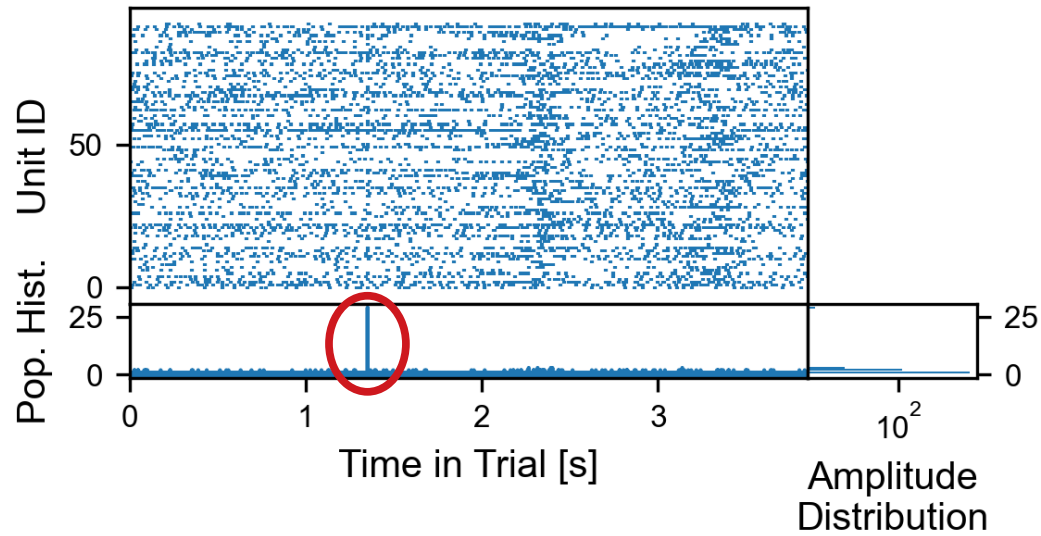
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SYNCHROFACTS

Synchronous Artefact Spikes

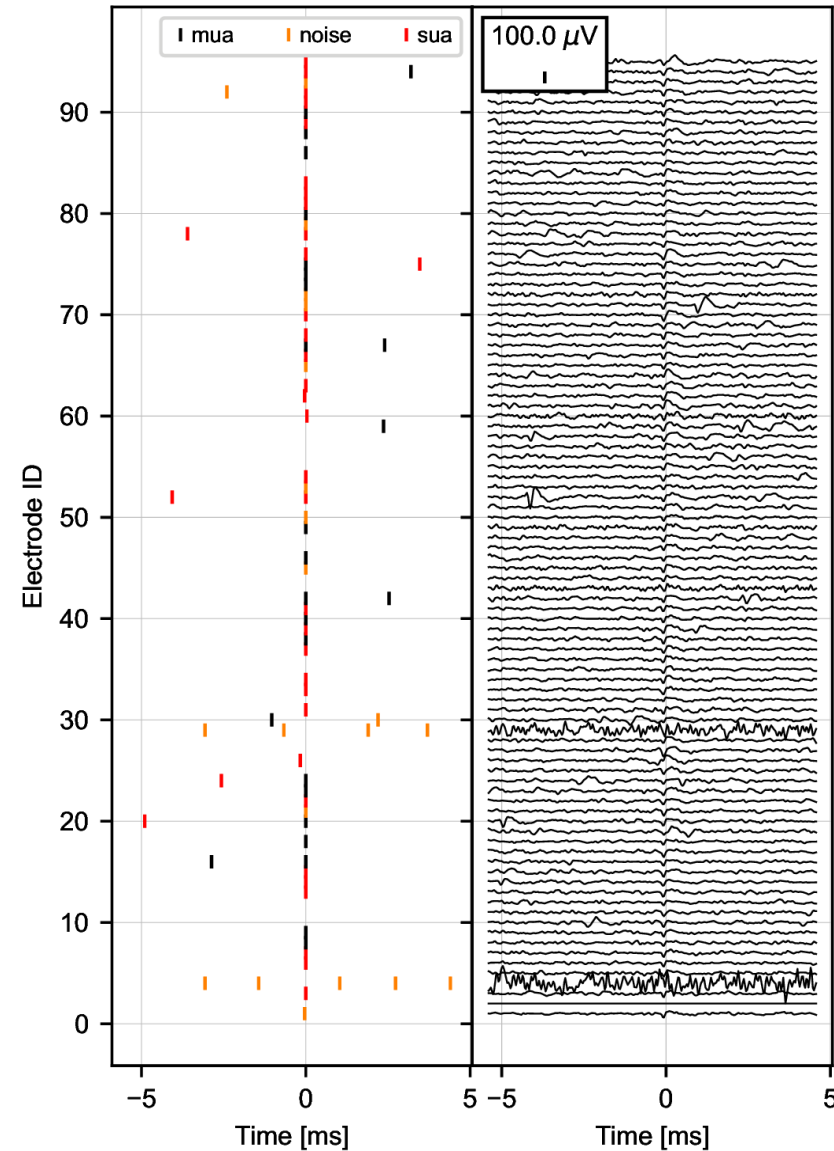
at Sampling Rate Precision (30 kHz)



Synchrofact triggered

Spike Times

Raw Signals,
Highpass at 250 Hz



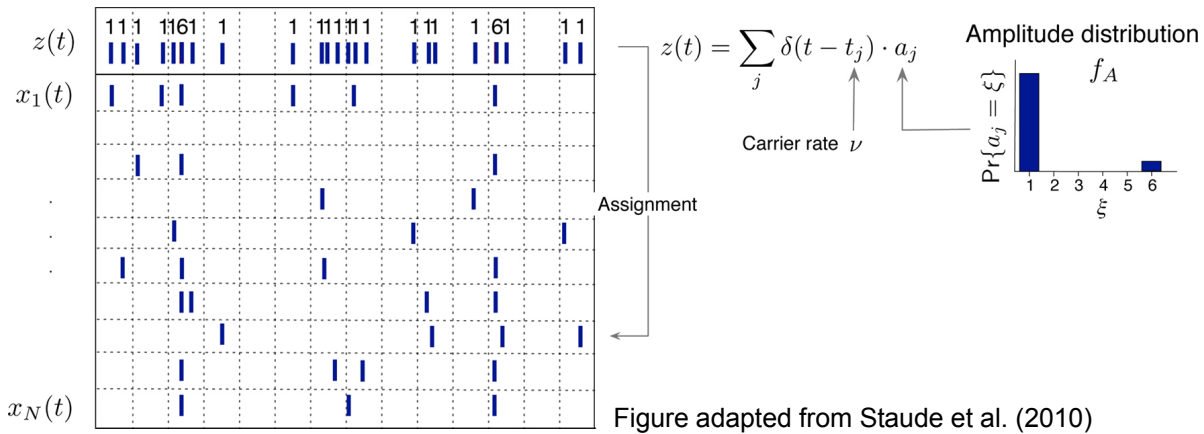
RESEARCH QUESTION:

HOW DO THESE ARTEFACTS IMPACT ANALYSES?

Create artificial data with and without artefacts and run analyses on it

- Generate artificial data consisting of:
 - independent Poisson background
 - injected synchrofacts
 - injected features to be extracted by analyses
- Goal: Test impact on
 - rate-based analyses
 - correlation analyses
 - synchrony analyses
 - spatio-temporal spike patterns

DATA GENERATION MODEL



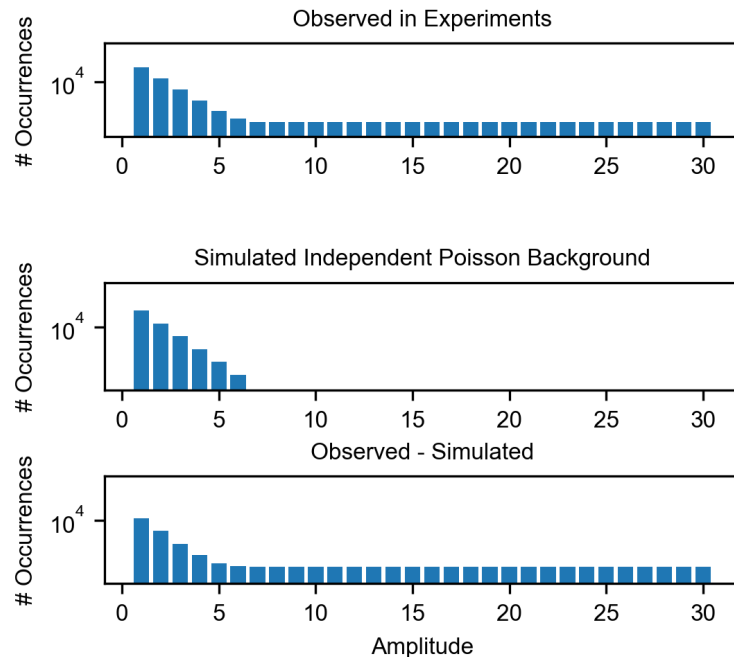
Mother process (Poisson) $z(t)$

For spike j in z : Draw amplitude a_j from amplitude distribution f_A

Assign spike to a_j neurons resulting in an event with amplitude a_j

These neurons are chosen randomly in the original model (uniform assignment)

Repeat for each spike in z

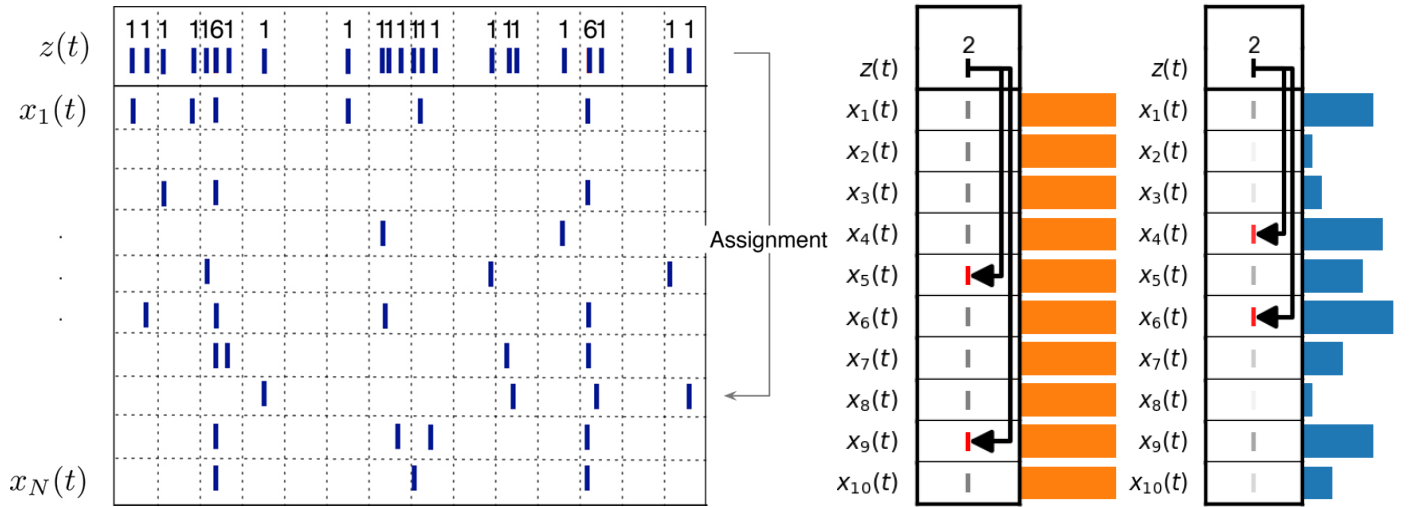


Staude, B. et al. (2010). Higher-order correlations in non-stationary parallel spike trains: statistical modeling and inference. *Frontiers in Computational Neuroscience*, 4, <https://doi.org/10.3389/fncom.2010.00016>.

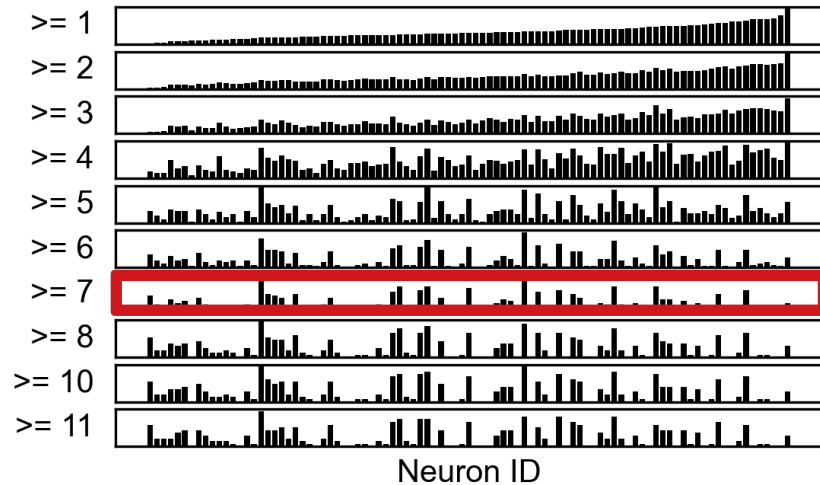
Used as amplitude distribution

THE ASSIGNMENT DISTRIBUTION

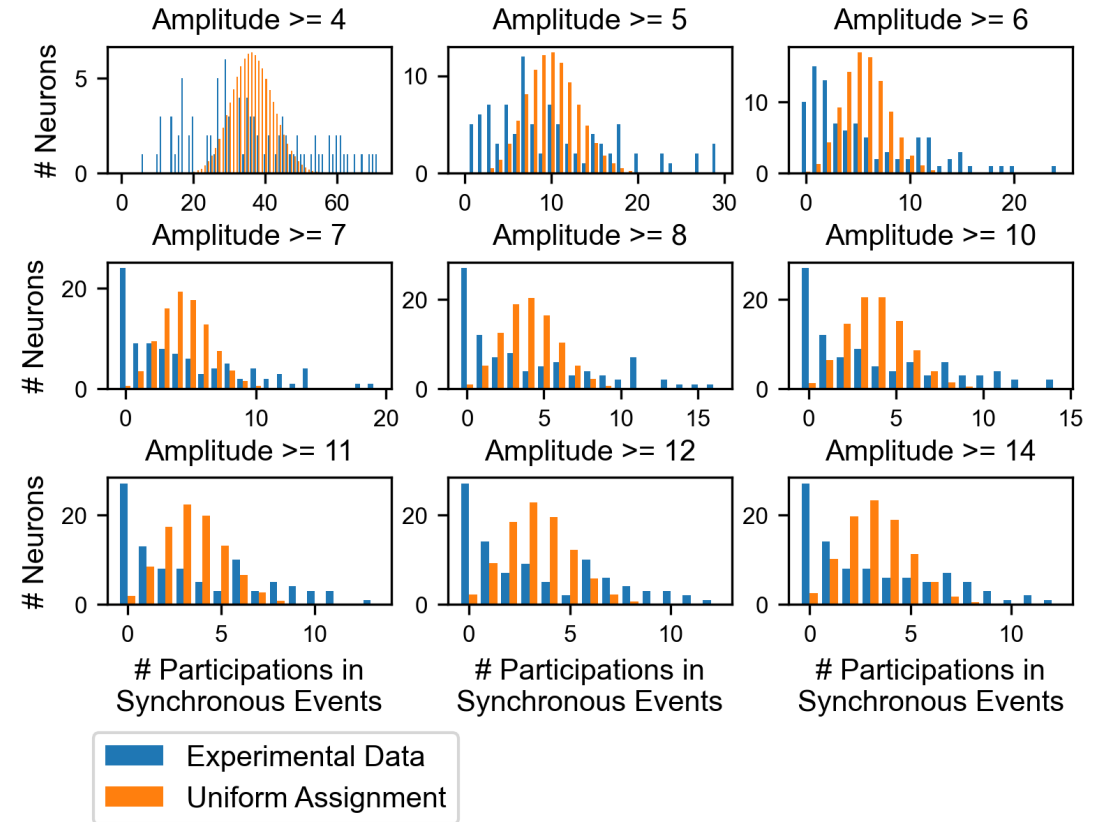
Figure adapted from Staude et al. (2010)



Cumulative Contribution to Amplitude



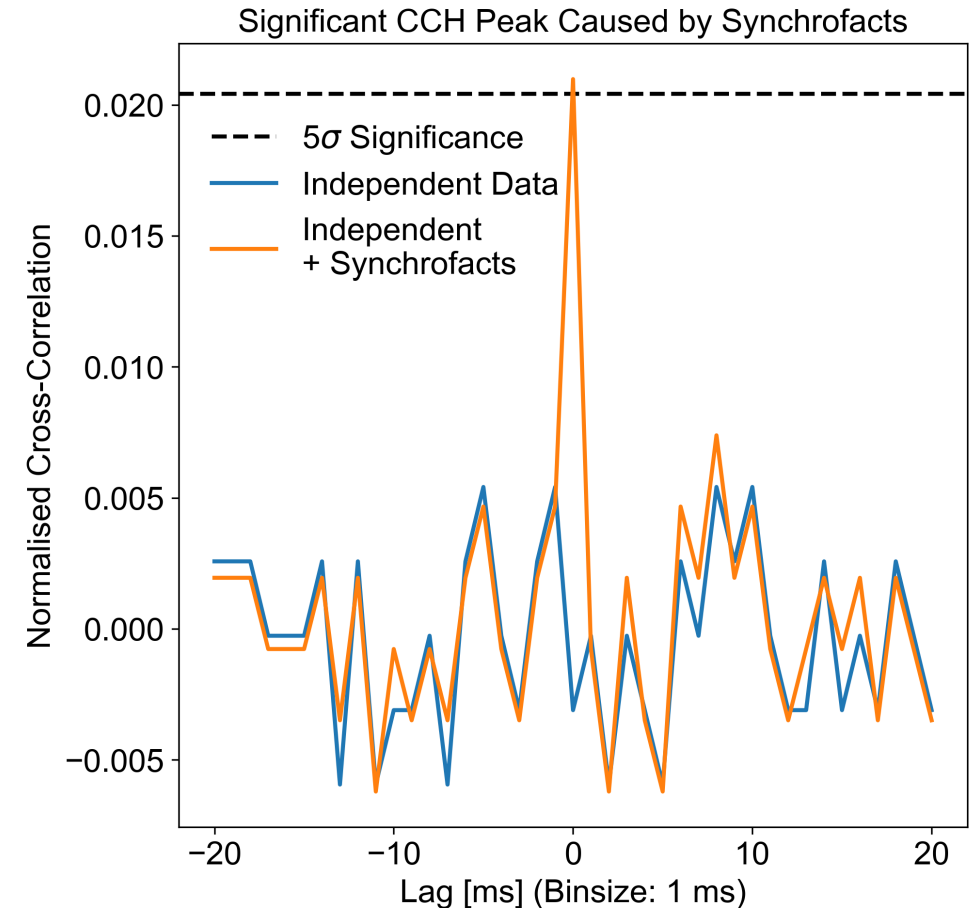
Assignment has to be non-uniform



Staude, B. et al. (2010). Higher-order correlations in non-stationary parallel spike trains: statistical modeling and inference. *Frontiers in Computational Neuroscience*, 4, <https://doi.org/10.3389/fncom.2010.00016>.

IMPACT OF SYNCHROFACTS ON DATA ANALYSES

- Drastic example: CCH of a pair of neurons which take part in many synchrofacts (high entries in assignment distribution)
- Outlook: Test impact on rate-based analyses, synchrony analyses and spatio-temporal spike patterns
 - False positives?
 - False negatives?
 - How to deal with synchrofacts in different analysis scenarios?



→ Synchrofacts may lead to false positives

ACKNOWLEDGEMENTS

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