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

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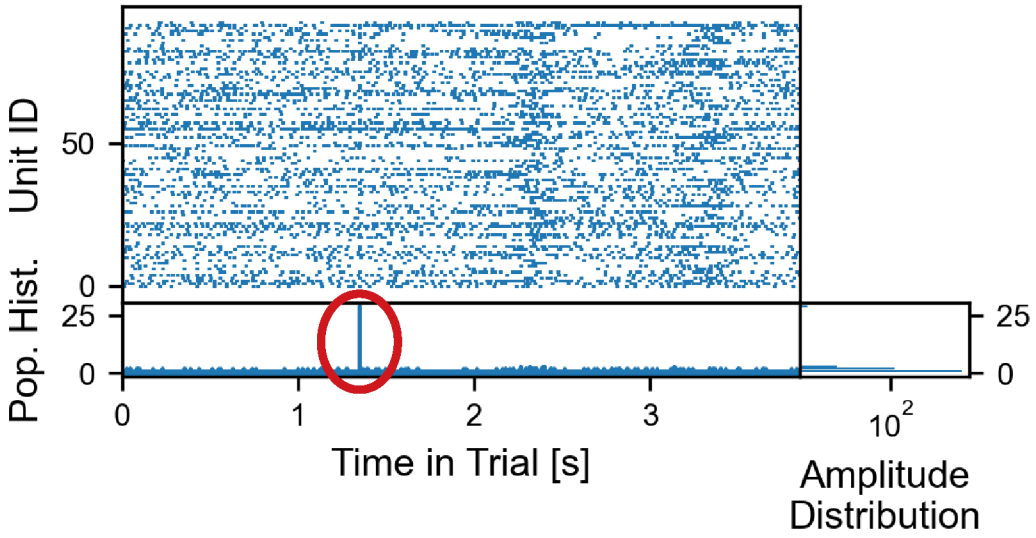
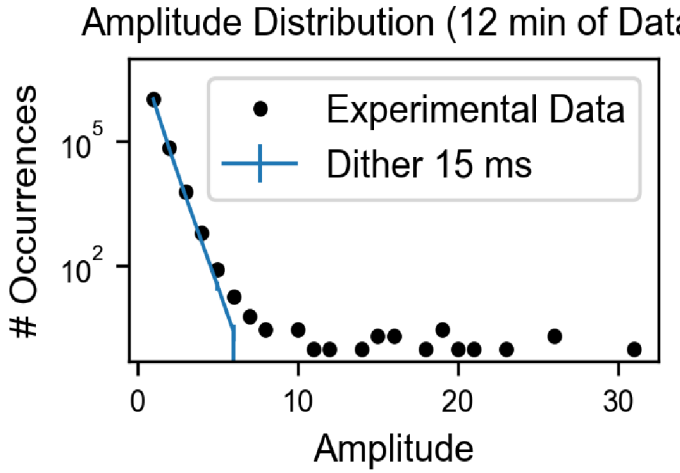
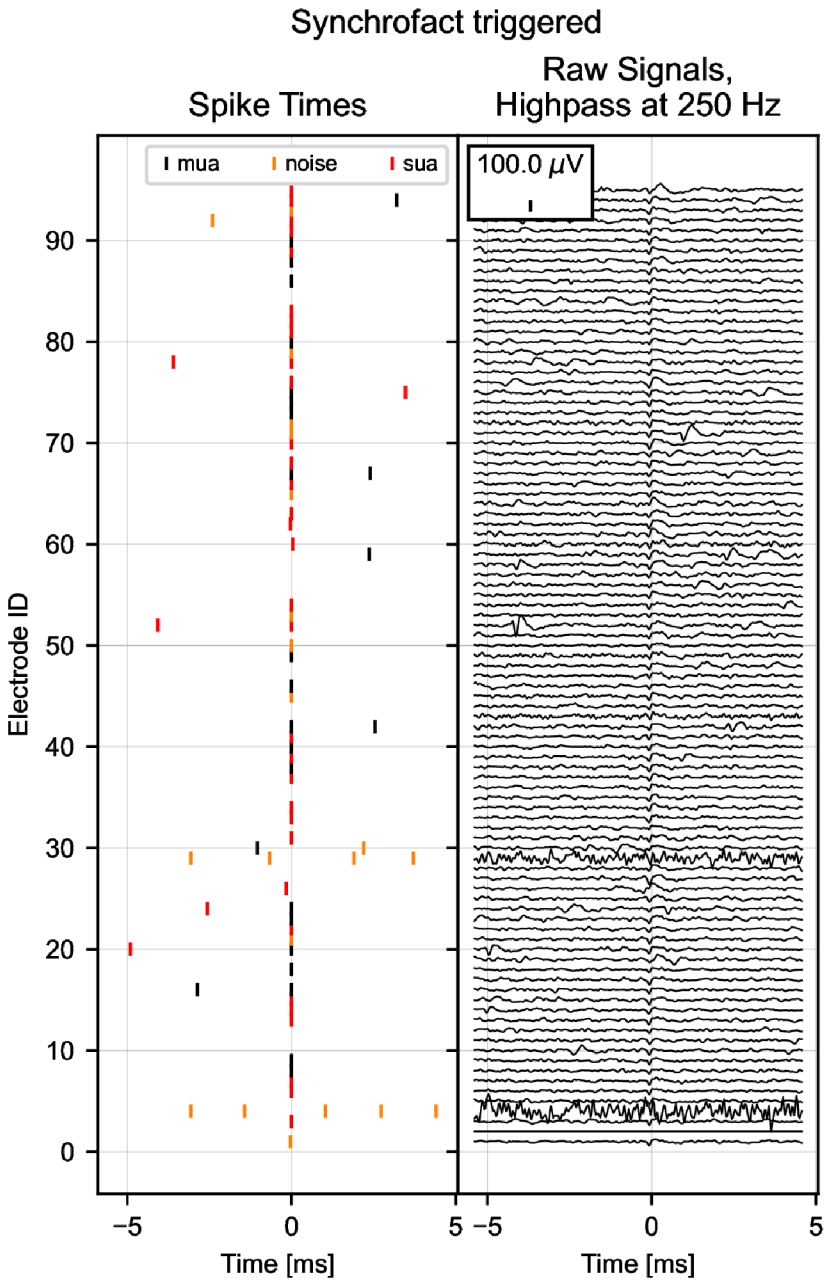
SYNCHROFACTS

Synchronous Artefact Spikes at Sampling Rate Precision (30 kHz)







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

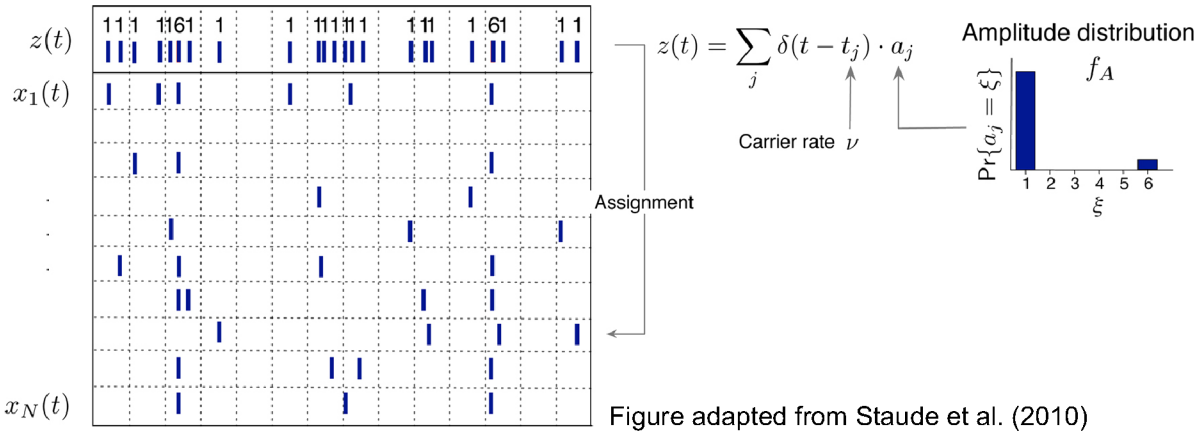
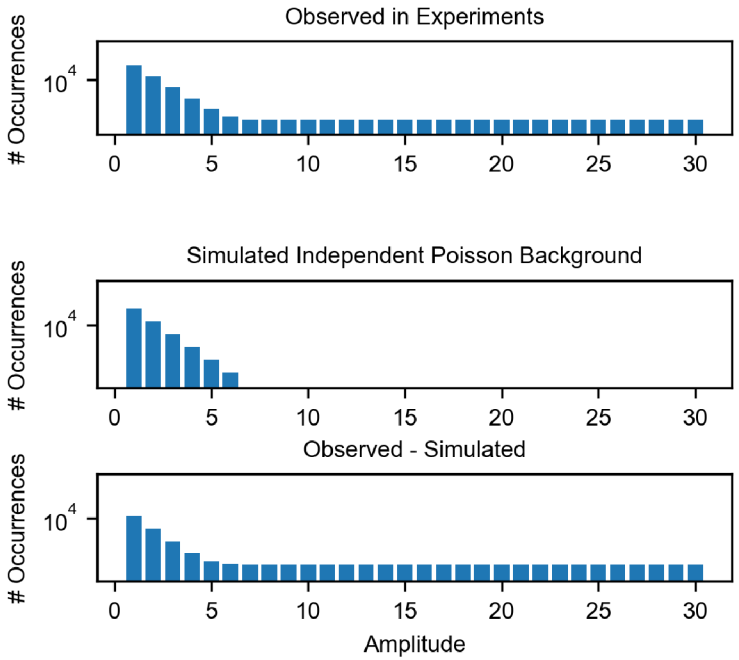


Figure adapted from Staude et al. (2010)



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)

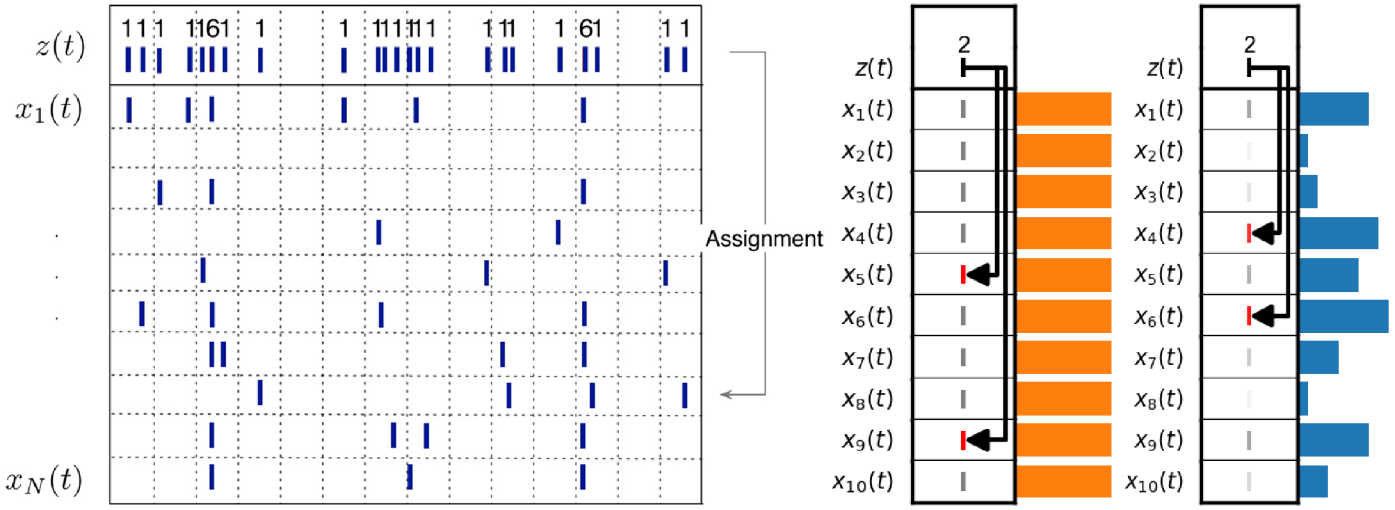
Repeat for each spike in z

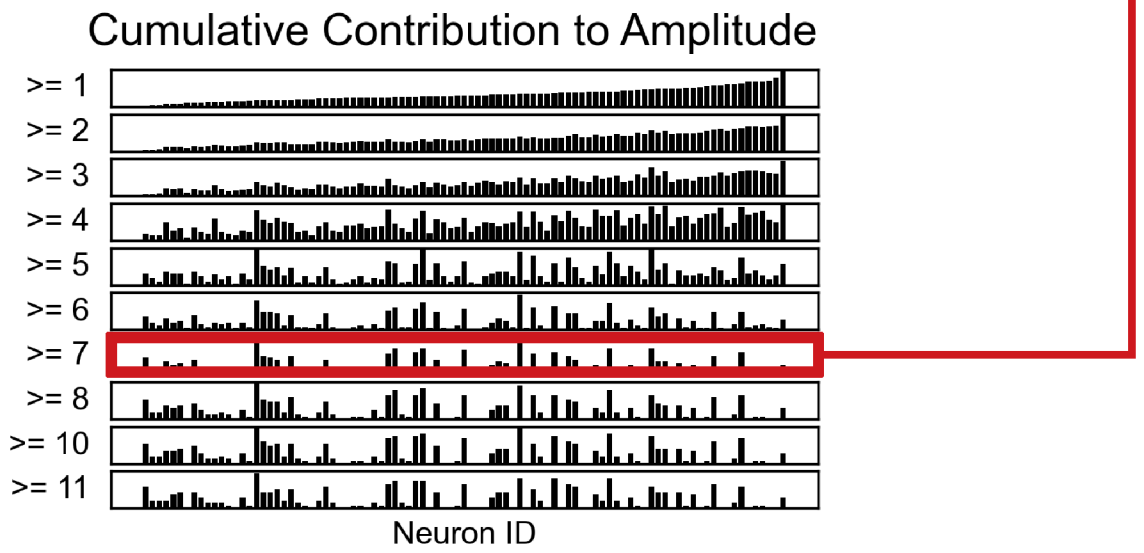
Staude, B. et al. (2010). Higher-order correlations in non-stationary parallel spike trains: statistical modeling and inference. Frontiers in Computational Neuroscience, 4, https://doi.org/10.3389/fncom.2010.00016.

⇦ Used as amplitude distribution

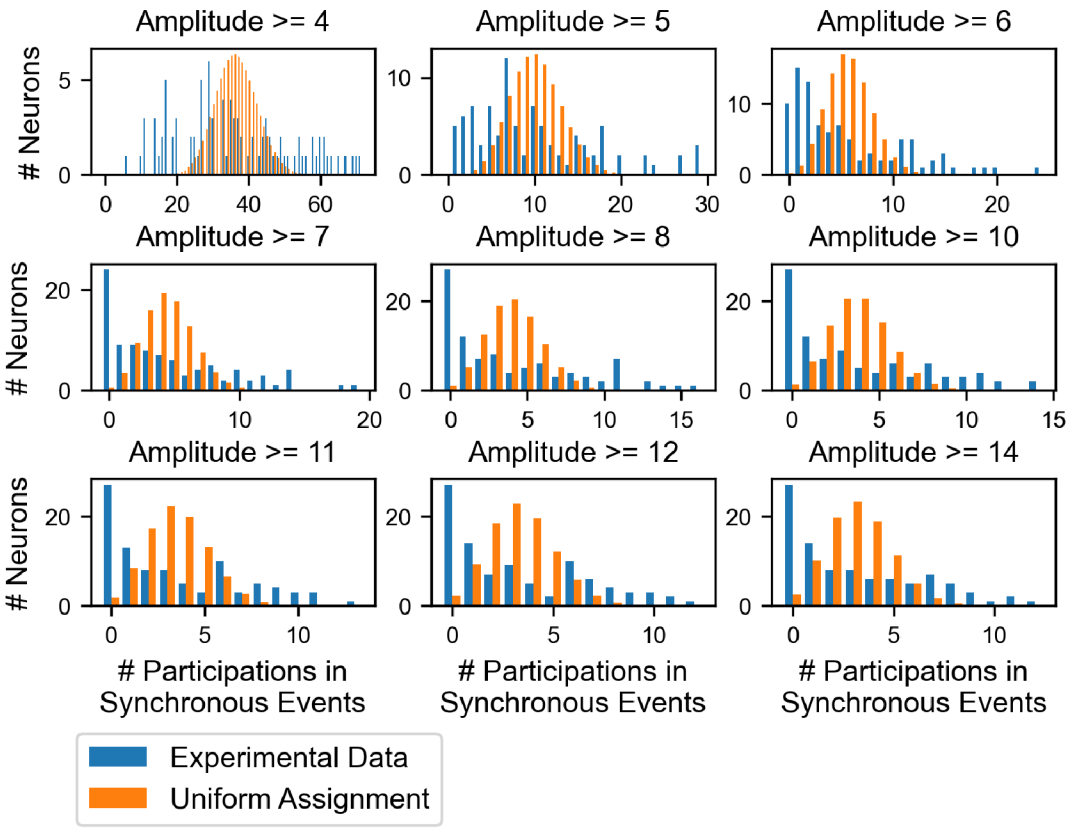
THE ASSIGNMENT DISTRIBUTION

Figure adapted from Staude et al. (2010)





Assignment has to be non-uniform



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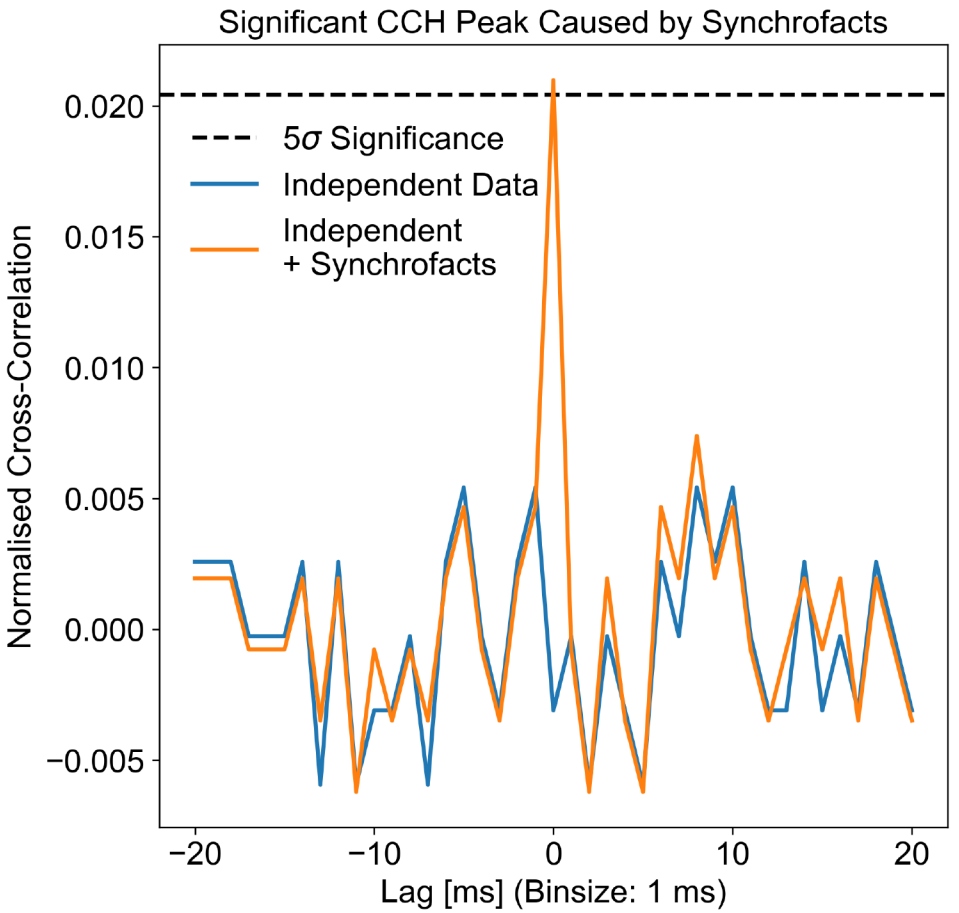
IMPACT OF SYNCHROFACTS ON DATA ANALYSES

- 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

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