RELIABILITY OF THE MISMATCH NEGATIVITY IN A KINDERGARTEN POPULATION OVERSAMPLED FOR DYSLEXIA RISK

Sean McWeeny[1], Brittany Manning[1], Emily Harriott[1], Sara D. Beach[2], Ola Ozernov-Palchik[2], John D. E. Gabrieli[2], Nadine Gaab[3], & Elizabeth S. Norton[1,2]

1. Department of Communication Sciences & Disorders, Northwestern University; 2. McGovern Institute for Brain Research, MIT; 3. Laboratories of Cognitive Neuroscience, Boston Children's Hospital

Background

- The mismatch negativity (MMN) is an automatic ERP response to a deviant within a series of standard stimuli[1]
- MMN can easily be measured in infants and children, is correlated with later reading, and has been suggested as a biomarker of language and reading disorders[2,3]
- Test-retest reliability of MMN in the early time window ranges from .3 to .7, but the later time window has not been studied[4]

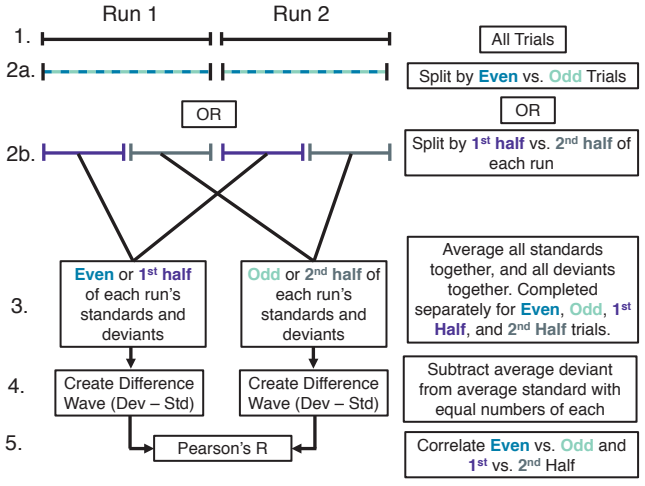
Research Questions

- How reliable are the early and late MMN?
- Does reliability differ by dyslexia risk?

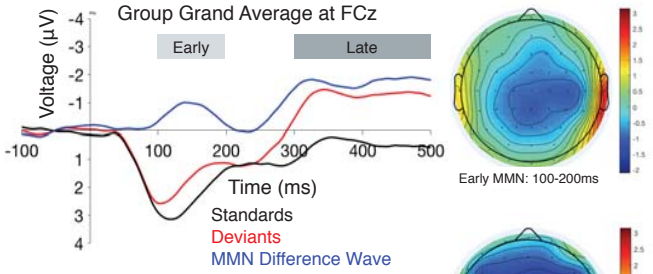
Methods

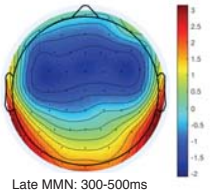
- N=147 children age 4-6 years
- 65% at risk for dyslexia, (score <25%ile on composite standardized measures of phonological awareness, RAN, letter knowledge, or with family history of dyslexia)
- EEG recorded with BioSemi ActiveTwo, 64 electrode cap
- Oddball paradigm with natural speech /da/ and /ba/, 90% standards
- 2 runs (1 with each stimulus as standard), 1200 trials each, 500ms SOA
- Referenced offline to mastoids, LP filtered at .01Hz, epoched, artifact rejected, HP filtered at 30Hz, scalp referenced
- Final sample includes n=120 with >100 accepted deviant trials

Determining Even vs. Odd and 1st vs. 2nd half reliability



Group Scalp Plots and Grand Average Waveforms





Group grand average waveform and scalp plots and for early (top) and late (bottom) MMN. Scalp plots and all measurements are of mean amplitude in two literature-defined time windows (early: 100 - 200ms; late: 300 - 500 ms post stimulus onset).

Even vs. Odd and 1st Half vs. 2nd Half Reliability: Early and Late MMN

r < .4
.4 < r < .6
r > .6

Early MMN

Even vs. Odd	1	z	2
F	0.52	0.54	0.58
FC	0.57	0.65	0.51
C	0.54	0.48	0.49

1st vs. 2nd Half	1	z	2
F	0.06	0.03	0.16
FC	0.17	0.12	0.07
C	0.10	0.00	0.03

Late MMN

Even vs. Odd	1	z	2
F	0.63	0.63	0.70
FC	0.61	0.64	0.60
C	0.64	0.56	0.60

1st vs. 2nd Half	1	z	2
F	0.02	0.07	0.08
FC	0.08	0.20	0.18
C	0.06	0.00	0.03

Even vs. odd correlations are higher than 1st vs. 2nd half for both early and late MMN across 9 fronto-central electrodes. This indicates that the response changes over time, perhaps due to habituation, fatigue, or non-neural sources.

Even vs. Odd Reliability for Late MMN by Risk

.4 < r < .6
r > .6

Even vs. Odd	No-Risk (n=42) 1	z	2	At-Risk (n=42) 1	z	2
F	0.47	0.47	0.62	0.68	0.71	0.73
FC	0.62	0.53	0.58	0.71	0.71	0.60
C	0.65	0.65	0.61	0.60	0.52	0.52

Mean of nine Pearson correlations for no-risk for dyslexia group is .58 vs .64 for at-risk group. Reliability does not differ between groups ($t(8) = -1.37$, $p = .21$)

Conclusions

- Reliability of the late MMN assessed by even-odd comparison is slightly higher than the early MMN
- The early and late MMN change over a short time period (~20 minutes)
- Dyslexia risk status does not seem to affect reliability
- The MMN is likely not reliable enough to use as a screening tool for language or reading disorders on its own at this age

Future Directions

- Investigate the effect of paradigm length on habituation and fatigue
- Investigate the effect of number of trials on reliability

References

1. Näätänen, R., et al. (2012). *Clinical Neurophysiol, 123*(3), 424-458.
2. Neuhoff, N., et al. (2012). *PloS one, 7*(5), e34909.
3. Halliday, L. F., et al. (2014). *J Neurodev Disord, 6*(1), 21.
4. Bishop, D., et al. (2010). *J Neurosci, 30*(46), 15578-15584.

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More info: http://learnlab.northwestern.edu
https://gablab.mit.edu/index.php/readstudy

Contact:
SeanMcWeeny2022@u.northwestern.edu

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