Probing emergent meter perception in adults and newborns using event-related brain potentials: a pilot study

H. Honing,[1] O. Ladinig,[1] I. Winkler,[2] & G. Haden[2]

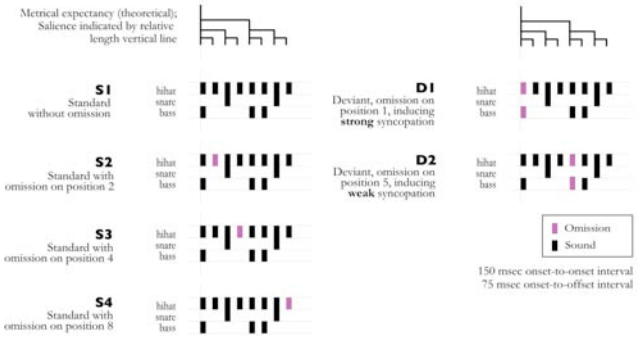
[1] *Music Cognition Group, ILLC / University of Amsterdam*

[2] *Institute for Psychology, Hungarian Academy of Sciences*

Summary

1) We presented *non-musicians* weakly and strongly syncopated rhythmic patterns (*Deviants Dn*) in a non-syncopated context (*Standards Sn*) to probe sensitivity for meter,
2) using behavioral (RT's and *d'* measures of discrimination sensitivity) and electrophysiological (ERP/MMN) measurements.
3) Behavioral results in adults yielded better discrimination (higher *d'*) and shorter RT's for deviants in a metrically strong (D1), as opposed to a metrically weak position (D2).
4) Differences in MMN latencies and amplitudes (elicited by the two deviant-types) support that subjects are sensitive to meter.
5) This suggests meter perception to be active in non-musicians, both in a Passive Condition (i.e. watching a self-selected-muted movie with subtitles) and when performing a concurrent auditory task (detecting intensity changes in noise stream; Unattended Condition).
6) A version of the MMN paradigm (using only metrically strong deviants) showed that neonates (2-3 days old) are also sensitive to rhythmic violations.

Stimuli



Procedure

Experiment 1A: Subjects were asked to listen to two blocks of 300 continuously presented trials, and indicate any 'deviant' patterns by pressing a button placed in the dominant hand. The two blocks consisted of 90% standard patterns (S1, S2, S3 and S4 with equal probability of 22.5%) and 10% of either D1 or D2.

Experiment 1B: In two conditions the subjects were asked either to press a button to occasional intensity changes in a continuous concurrent noise stream (Unattended Condition) or ignore all sounds (Passive Condition) and watch a self-selected muted movie with subtitles. Each condition consisted of 10 blocks of 300 continuously presented trials of rhythmic patterns. The blocks consisted of 90% standard patterns (S1, S2, S3 and S4 with equal probability of 22.5%) and 10% of D1 and D2 patterns. One control block for each deviant containing 300 trials of either D1 or D2 patterns was delivered. The position of the control blocks varied randomly between subjects.

Experiment 2: Sleeping newborns were presented with 5 blocks of 300 continuous trials of rhythmic patterns. The blocks consisted of 90% standard patterns (S1, S2, S3 and S4 with equal probability of 22.5%) and 10% of D1. In addition, one block containing 300 trials of D1 patterns was delivered providing identical-stimulus control for deviant patterns. The position of the control block varied randomly between subjects.

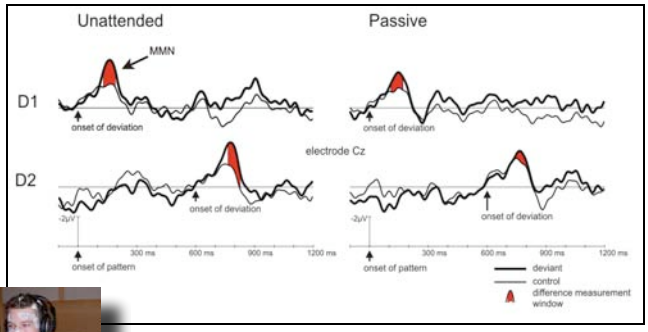
Results

Experiment 1A

Discrimination sensitivity was significantly higher for strong (D1) than for weak (D2) deviants (t=2.80, df=10, p<0.05). There was also a tendency toward faster RTs for strong than for weak deviants (t=1.85, p<0.1).

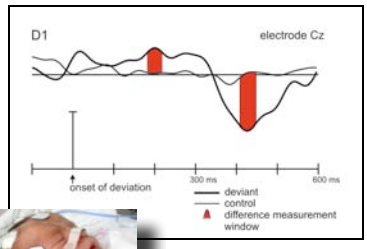
Experiment 1B *(N=12)*

D1 & D2

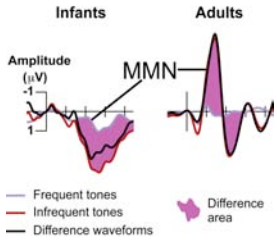


Experiment 2 (*preliminary*) *(N=14)*

D1



MMN Infants vs Adults



Adapted from Winkler et al. (2003) *PNAS*.

Acknowledgements

This research was realized in the context of the EmCAP (Emergent Cognition through Active Perception) project funded by the European Commission (FP6-IST, contract 013123). The recordings were carried out in the hospital ward of the First Department of Obstetrics and Gynecology, Semmelweis University, Budapest, Hungary after informed consent was obtained from one or both parents. The study was approved by the Ethics Committee of the Semmelweis University as well as by the Institutional Review Board of the Institute for Psychology, Hungarian Academy of Sciences.

http://emcap.iua.upf.es

[Preprint: see http://www.hum.uva.nl/mmm/abstracts/honing-et-al-2008a.html]