Voice- and species-sensitivity in the event-related potential of miniature pigs

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Introduction

We examined for the first time the event-related potentials (ERPs) for voice perception in awake miniature pigs kept as companion animals with non-invasive EEG.

What are the ERP correlates of species-specific voice-processing in pigs?

Background

Neuroimaging studies identified brain areas in humans[1], in non-human primates[2] and recently, in non-primate mammals[3] that preferentially process conspecific vocalizations compared to other vocalizations and environmental noises. Whether this preference is driven by the same or separate mechanisms for voice- and conspecific-sensitivity is unclear, especially in non-primates.

Method

Stimuli

210-500 ms long sounds (=RMS, =duration)

- 80 pig vocalizations (squeaks, grunts) (recorded in our lab)
- 80 human non-speech sounds (e.g. sigh, laugh)[4]
- 80 dog vocalizations (e.g. bark, whine, moan)[4]
- 80 non-vocal environmental sounds (e.g. instruments, bells)[3]

Participants

6 pet miniature pigs (3 f, 3m, 1-2 yrs) living in families exposed to close human contact from their age of ~ 8 weeks

Procedure

- Participants and their owners got familiarized with the lab, test began when the pig lied down in a relaxed position next to the owner
- 320 stimuli were played (with Matlab Psychotoolbox)[5] in a random order (SOA: 1600-2600 ms) for a total duration of ca. 11 min.
- face of pigs was recorded by video-camera
- application of 5 electrodes: F7 (left EOG for monitoring eye-movements), Fz (frontal), Cz (central), FC4 (right fronto-central), Pz (parietal, reference)
- Neuroscan NuAmps

Artifact-rejection

0.1 Hz-40 Hz filtering, -200-1000 ms segmentation and baselining (0=stimulus onset), resampled to 250 Hz

Automatic artifact rejection (>+-100 μV or max-min>150 μV in 100 ms sliding windows)

Trials were also removed if movements occurred on video-recordings (ELAN[6])

Visual inspection of EEG for blinks

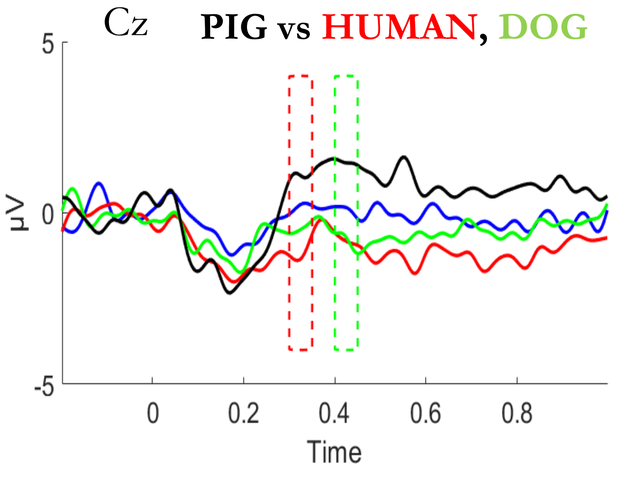
27.75 clean trials per condition on average (min=14, max=41)

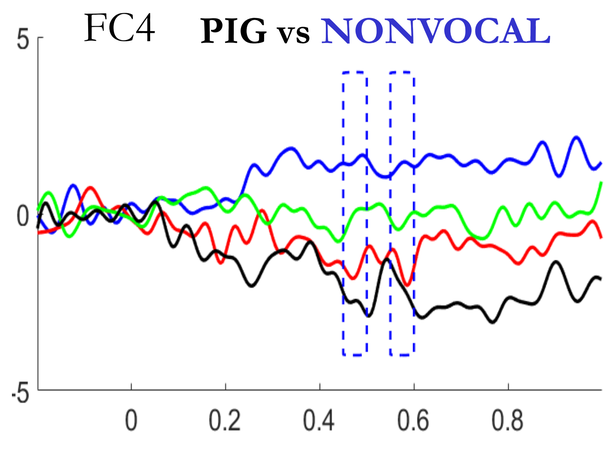
Results and Discussion

Statistical analysis

50 ms long consecutive time-windows from 0 to 1000 ms in FieldTrip[7] (Matlab R2017b)

Pair-wise comparison of conditions with paired-sample permutation statistics (t), p-level: <0.0156 as significant





- **Neuronal evidence for conspecific voice-sensitivity in pigs**
- **ERP effects at different cortical locations and in different time-windows => separate mechanism for species and voice-sensitivity**
- **First species-sensitivity (300-350 ms – pig vs human, 400-450 ms pig vs dog)**
- **Later voice-sensitivity (450-500 ms and 550-600 ms – pig vs nonvocal)**

References

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