**Spontaneous motor entrainment to auditory rhythms in vocal learning bird species**

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**Introduction**

Music and Dance are universal, ancient and pervasive in human culture. Entrainment, or synchronization to an external rhythm, is crucial for production of and motor response to music.

Is entrainment uniquely human? Can a nonhuman animal move at the frequency of an external beat, changing speed as a function of the frequency of the beat?

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**Exp 1: Two avian subjects**

**Recorded and analyzed spontaneous behavior**

**Subject 1: Sulphur-crested Eleanora Cockatoo**
- Novel & familiar auditory stimuli
- Rhythmic visual stimuli not consistently present
- 4 sessions, range of tempos (110 to 132 bpm)

**Subject 2: African Grey Parrot**
- Entirely novel rhythmic auditory stimuli
- No rhythmic visual stimuli present
- 8 sessions, 2 tempos (120 & 150 bpm)

**Motion Analysis: Are the birds' movements at the frequency of the musical beat?**

To determine frequency of the musical beat:
- Human subjects tap to the beat (8/video)
- Take mode ITI of each subject

To determine frequency of animals’ movement:
- Frame-by-frame coding of head location
- Fourier transform
- Monte Carlo to get threshold for significance

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**Exp 2: Extensive comparative data from a global video database**

1) Systematically searched youtube.com for animal terms “+ dancing” (Covered a wide range of species commonly in contact with humans)
2) Categorized top 50 results for each search
3) Analyzed the musical beat and rhythmic movement in the videos using methods described in Exp. 1
4) Species showing suggestion of entrainment were followed up with more specific searches

Total: 161 searches, 1022 videos featuring an animal, 589 with music (360 V.L.)

**Across thousands of videos and hundreds of species, only vocal learning species show evidence of entrainment**

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**Conclusions**

We find evidence of entrainment in 15 species, including parrots, elephants and sea lions, all of which are vocal learners. We therefore conclude:

Entrainment is not a uniquely human capacity

Entrainment may have emerged as a byproduct of selection for vocal learning.

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**References**

3) For additional experimental evidence of entrainment in the eleanora cockatoo, see Patel et al. poster in tomorrow’s session!