Rhythm discrimination in cats: A case study

Rasmus Bååth
Lund University Cognitive Science
rasmu.baath@gmail.com, @rabaath
Experimenal setup

• Three times a day the cat feeder delivers food.
• 30 sec. before food delivery an isochronous rhythm is played next to the feeder.
• Every 30 min. a non-rhythmic 30 sec. decoy sequence is played.
• Can my cat learn to discriminate between rhythmic and non-rhythmic sequences and only show up before food delivery?
The stimuli

• 60 tones of 20ms, 1760 Hz (A6) Sine waves
• Rhythmic sequences: 500 ms ISI
• Non-rhythmic sequences: 500 ms ISI on average.
Training period

• Time frame: 8th of Feb to 9th of March
• Feeding times: 09:30, 13:00, and 19:00
• Decoy times: Between 08:00 and 21:00, every 30 min.
First feeding schedule

• 10th of March to 20th of March
• Feeding times: 09:30, 13:00, and 19:00
• Decoy times: Between 08:00 and 21:00, every 30 min.
• In total, 31 rhythmic and 258 non-rhythmic trials.
Statistical analysis

• Main statistic: Proportion (%) of correct appearances
• Compare rhythmic feeding times with pre-feeding non-rhythmic decoys
• Statistical model: Binomial, uniform prior

\[ n_{\text{correct}} \sim \text{Binomial}(n_{\text{trials}}, p_{\text{correct}}) \]
\[ p_{\text{correct}} \sim \text{Uniform}(0, 1) \]
Proportion of correct appearances

The ♦️s show the % of appearances in the data. The lines show 50% and 95% probability intervals.
Maybe she just learned the feeding times?
Second feeding schedule

- 25th of March to 12th of April
- Feeding times: 09:30-09:00, 13:00-13:30, and 19:00-18:00
- Decoy times: Between 08:00 and 21:00, every 30 min.
- In total, 53 rhythmic and 426 non-rhythmic trials.
Proportion of correct appearances

The ♦️s show the % of appearances in the data. The lines show 50% and 95% probability intervals.
She hasn’t learned the feeding times. But maybe she’s learned the intervals?
Intertwined intervals

- Rhythmic
- Non-Rhythmic 1/2 matching ISIs
- Non-Rhythmic 1/3 matching ISIs
- Non-Rhythmic 1/4 matching ISIs
- Non-Rhythmic

Onset in ms
Intertwined intervals

• 13th of April to 3rd of May
• Feeding times: 09:00, 13:30, and 18:00
• Decoy times: Between 08:00 and 21:00, every 30 min.
• In total, 62 rhythmic and 500 non-rhythmic trials.
Proportion of correct appearances

The ♠s show the % of appearances in the data. The lines show 50% and 95% probability intervals.
Maybe she’s learned to discriminate the specific tempo but not the rhythm?
Different tempi

- 4th of May to 30th of June
- Feeding times: 09:30, 12:30, and 19:00
- Decoy times: Between 08:00 and 21:00, every 30 min.
- In total, 158 rhythmic and 1283 non-rhythmic trials.
Proportion of correct appearances

The ♦️s show the % of appearances in the data. The lines show 50% and 95% probability intervals.
Proportion of correct appearances

Different Tempi Late Trials

- Non-rhythmic (n = 86)
- Rhythmic ISI 310 ms (n = 13)
- Rhythmic ISI 376 ms (n = 10)
- Rhythmic ISI 455 ms (n = 7)
- Rhythmic ISI 500 ms (n = 19)
- Rhythmic ISI 550 ms (n = 10)
- Rhythmic ISI 666 ms (n = 8)
- Rhythmic ISI 805 ms (n = 19)

The ♦️s show the % of appearances in the data. The lines show 50% and 95% probability intervals.
In conclusion

- Cats can discriminate between rhythmic and non-rhythmic sequences, that are otherwise very similar.
- Cats are so-so at generalizing to other tempi.
- At least, this applies to my cat.
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