Temporal frequency could be used as a relative cue for auditory speed perception. For example, rubbing our hands against rugged surfaces typically generates sounds whose temporal rates directly correlate with speed: the faster the motion, the higher the temporal frequency of the sound produced by the friction (1). Previous research in visual motion perception has demonstrated that temporal frequency systematically modulates speed estimation (2). Here we investigate whether temporal frequency also modulates auditory speed perception.

### Apparatus
AM pink noise rotated around participants.
Observers judged which of two consecutive moving sounds was faster (2AFC).

### Stimuli
We manipulated the frequency of amplitude modulation (AM frequency) and the speed of the sounds.

### Conditions
- **Standard:**
  - Speed: 45 rpm
  - AM Frequency: 10.61 Hz
- **Comparison:**
  - 10 Speeds (30-67.5 rpm)
  - 10 AM frequencies (7.5-15 Hz)

### Expected Results
Generalized linear mixed model (GLMM):
\[
p(\text{comp faster}) = \frac{1}{1 + e^{-\beta_0 + \beta_1 \text{speed} + \beta_2 \text{AM freq}}}
\]
AM frequency weight = \frac{\beta_2}{\beta_1 + \beta_2}

### Main Experiment
Observers judged which stimulus was faster.
GLMM: significant effects of Speed and AM frequency
Mean aggregated data (N=9)

### Control
Can observers ignore sounds’ AM frequency?
GLMM: significant effects of Speed and AM frequency
Mean aggregated data (N=5)

### Conclusions
The **AM frequency of a sound modulates speed perception**: the higher the AM frequency, the faster the perceived speed.

We argue that the brain might implicitly rely on learned natural scene statistics (3-5). Assuming an underlying constant environment (6, e.g. isotropic surfaces), the brain interprets changes in AM frequency in terms of changes in speed. We speculate that origins of such phenomenon rely on learned correlations across speed of motion and temporal rate of the sounds occurring in an otherwise constant – or slowly changing – environment.

### References

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