Separating predictive responses from reactive responses in isochronous finger tapping

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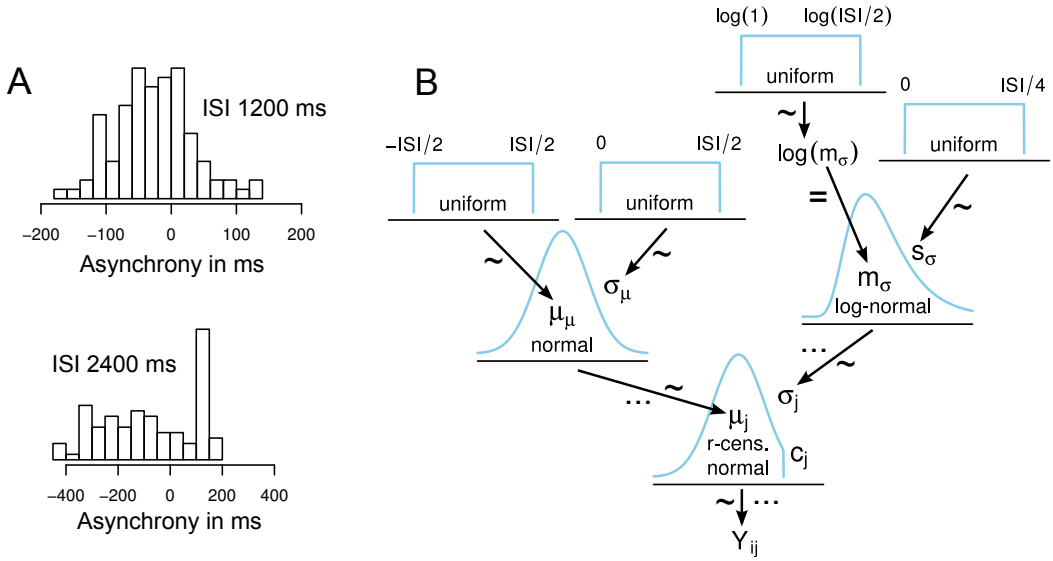
Finger tapping to isochronous pacing stimuli is a well established experimental paradigm where the basic measure is the time difference between a participant's *predictive* responses and the pacing stimuli, the stimulus-to-response asynchronies. Two parameters of common interest are timing variability and average offset from stimulus onset[1]. A difficulty when estimating these parameters is that at interstimulus intervals longer than 2 seconds participants regularly overshoot the target interval and instead react to the pacing stimulus. These *reactive* responses result in a left skewed, non-normal response distribution. See figure A for an example of the distribution of asychronies for one participant at short (1200 ms) and long (2400 ms) insterstimulus intervals. Using the sample mean and standard deviation to estimate timing variability and average offset is then not recommended as reactive responses may confound these estimates resulting in considerable negative bias.

A Bayesian hierarchical model was developed that models asychronies as coming from a right censored normal distribution. By setting the censoring limit, c, to 100 ms it is possible to separate the reactive responses from the predictive responses resulting in parameter estimates that are unbiased. After Kruschke[2], Figure B shows a diagram of the model where y_{ij} is the ith timed response from the jth participant. Comparing this model with classical moment estimators using both simulated and experimental data[3] shows that the Bayesian model estimates timing variability and average offset more accurately and with less bias compared to classical moment estimators.



References and notes

1 B. H. Repp, *Psychon. Bull. Rev.* **12**, 969–992 (2005).
2 J. K. Kruschke, *Doing Bayesian data analysis* (Elsevier, Amsterdam, 2010).
3 The experimental data was from B. H. Repp, R. Doggett, *Music Perc.* **24**, 367–376 (2007).

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