Effects of Salient Interruptions on Auditory Spatial Attention

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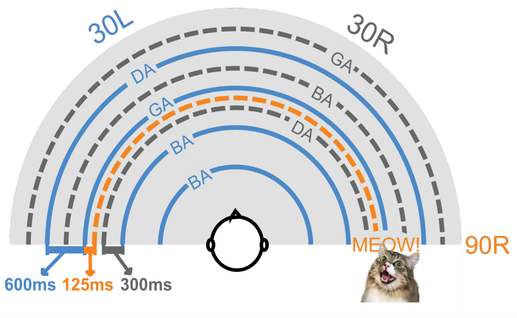
Background

- The perceptual effects of salient auditory interruptions are understudied.
- Salient interrupters interfere with recall of syllables presented before and after the interruption, regardless of interrupter location (Liang et al. 2022).
- Here we explore how different factors affect the size of interruption effects:
  - novelty of the interrupter (study 1)
  - length of the target sequence (i.e., working memory load; study 2)
  - timing and predictability of the interrupter (study 3)

Task

- 45 subjects each performed 96 trials in each online experiment
- Subjects recalled syllable sequences in an auditory spatial attention task
  - 2 competing streams (target and distractor) spatialized with HRTFs
  - Target stream was either left or right, randomly cued on each trial
- Interrupters occurred randomly in half the trials
- Study 1: repeated interrupter or novel interrupter on interrupted trials
- Study 2: target and distractor sequence lengths varied (3, 4, or 5)
- Study 3: interrupter occurred before 1st, 3rd, or 5th target syllable and either was at the same temporal position or random within a block

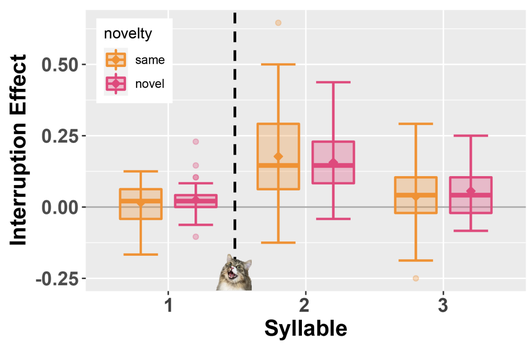


Exp.	Novelty	Sequence Length	Interruption Time
1a	same	3	before 2nd
1b/2a	novel	3	before 2nd
2b	novel	4	before 3rd
2c/3b	novel	5	before 3rd
3a	novel	5	before 1st
3c	novel	5	before 5th
3d	novel	5	before 1st/3rd/5th

Results

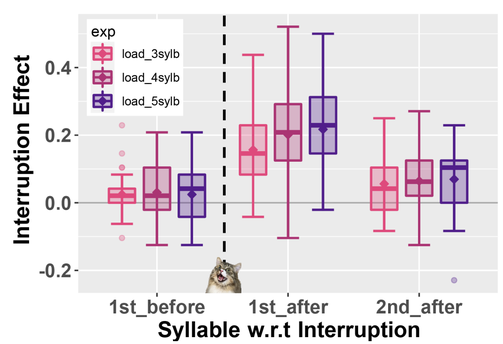
Effect of interrupter novelty

- Interrupter most affects subsequent syllable
- Novel interrupters impact all syllables



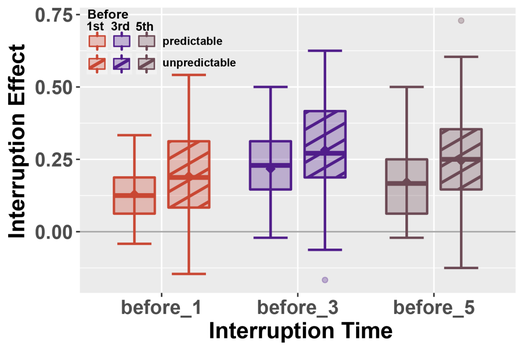
Effect of sequence length

- Interruption effect increases with length



Effect of timing expectation

- Interruption effect increases with unpredictability



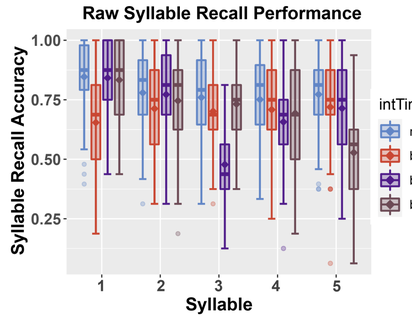
Cohen's d for standardized effect size

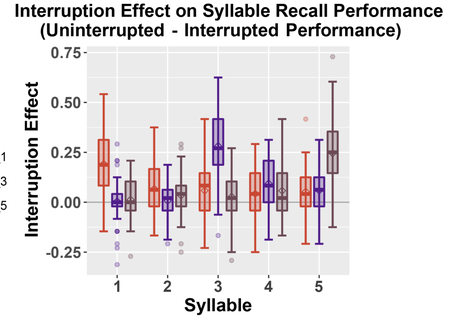
	Temporal position of the syllable (w.r.t interruption)								
Exp.	- 4th	- 3rd	- 2nd	- 1st	+ 1st	+ 2nd	+ 3rd	+ 4th	+ 5th
1a				0.162	1.108	0.208			
1b / 2a				0.227	1.010	0.372			
2b			0.013	0.225	1.362	0.387			
2c / 3b			0.131	0.159	1.497	0.572	0.526		
3a					1.186	0.339	0.388	0.224	0.086
3c	0.131	0.026	0.135	0.096	1.124				
3d (before 1)					1.02	0.367	0.320	0.216	0.286
3d (before 3)			0.029	0.041	1.65	0.500	0.318		
3d (before 5)	0.075	0.181	0.159	0.283	1.41				

≥0.8 Large effect ≥0.5 Medium effect ≥0.2 Small effect <0.2 Not significant

Example: raw performance and interruption effect

(unpredictable interrupters at different times)





References

Liang, Wusheng, Christopher A. Brown, and Barbara G. Shinn-Cunningham. "Cat-astrophic effects of sudden interruptions on spatial auditory attention." *The Journal of the Acoustical Society of America* 151.5 (2022): 3219-3233.

Topaz (a.k.a Tiantian Liang), personal communication

Summary

- Salient interrupting sound always has an impact on auditory selective attention, which decreases accuracy in recalling the content right after the interruption. When it's salient enough, it also interferes with working memory and affect recalling content presented before the interruption.
- The interrupter interferes with selective attention more severely when it's a novel sound, or when the working memory load is high, also when its timing is less predictable.