Not a Shift of Attention: Buffering and Binding of Visual Stimuli

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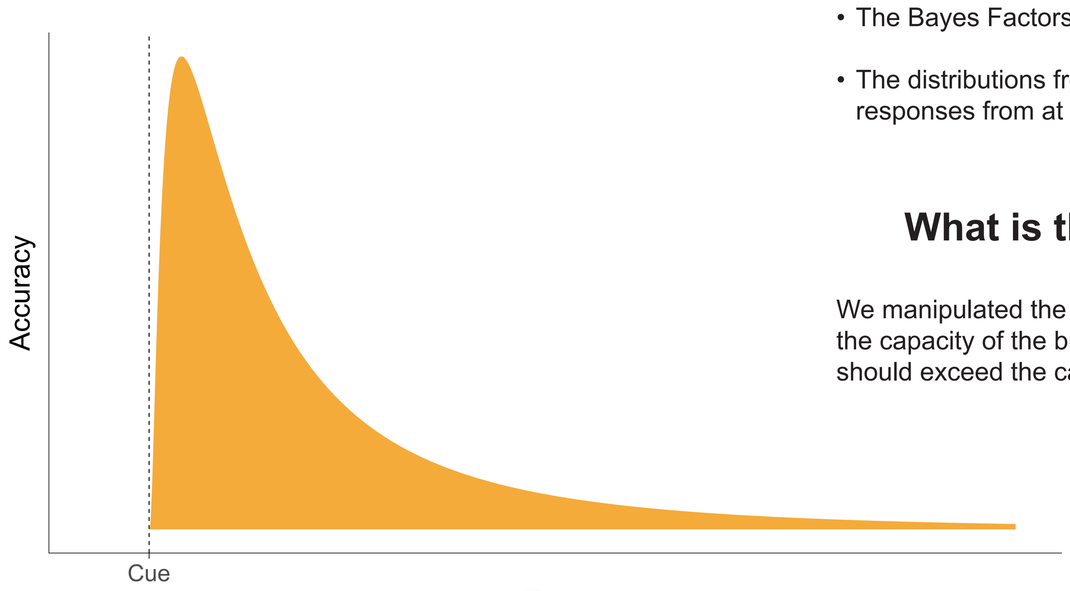
Buffering or an attention shift?

Goodbourn and Holcombe (2015) argue that in dual-stream RSVP, stimuli are **buffered and bound,** rather than selected after an attention shift**.**

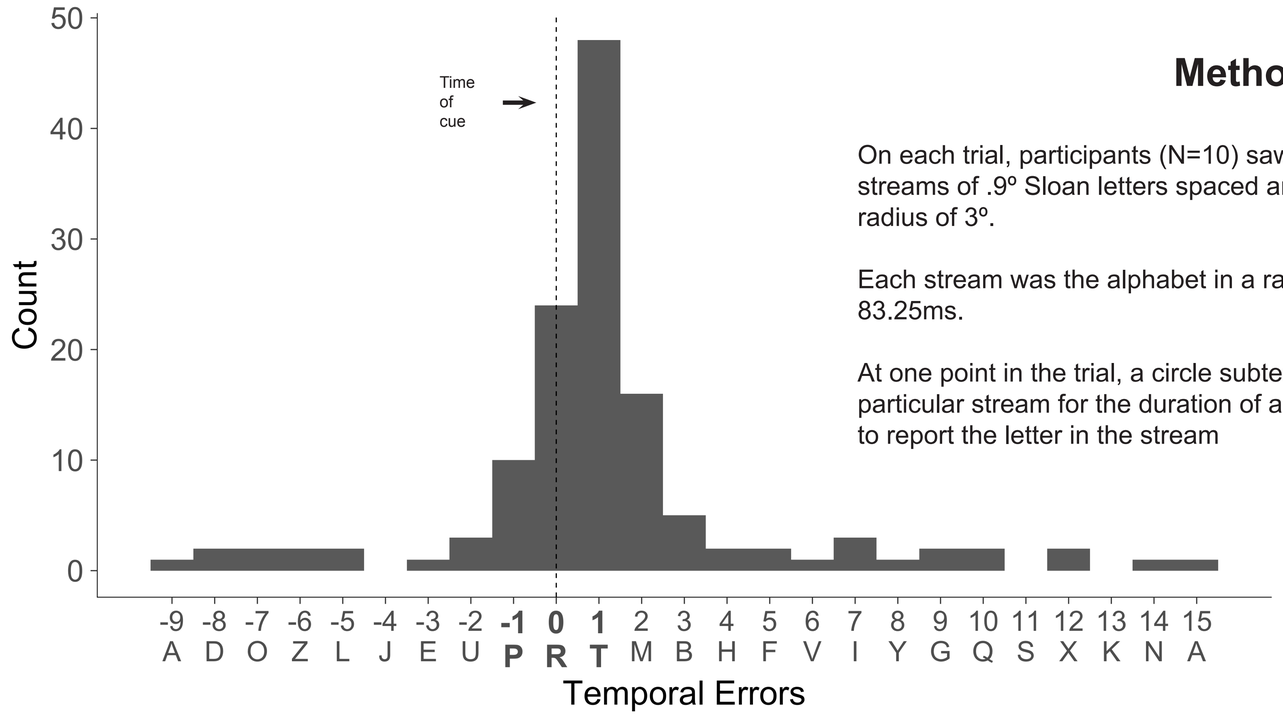


Informative exogenous attention cues elicit a pattern of accuracy over time that is positively skewed.

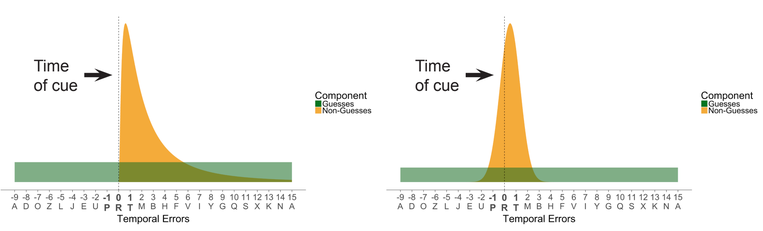
This suggests a spatial shift of attention

In Goodbourn and Holcombe (2015) participants respond with the cued letter from one of two RSVP streams,

We might expect an attention shift in this task, but the data suggest a different pattern



The distribution of errors over many trials is temporally symmetric - not skewed - with a peak just after the cue (Goodbourn and Holcombe, 2015; Holcombe, Nguyen and Goodbourn, in press).



To confirm this, we fit two mixture models to data from Goodbourn and Holcombe (2015), represented above.

Bayes Factors for the buffering model over the attention shift model favoured the buffer model in the majority of cases (81%), and never favoured the attention shift model

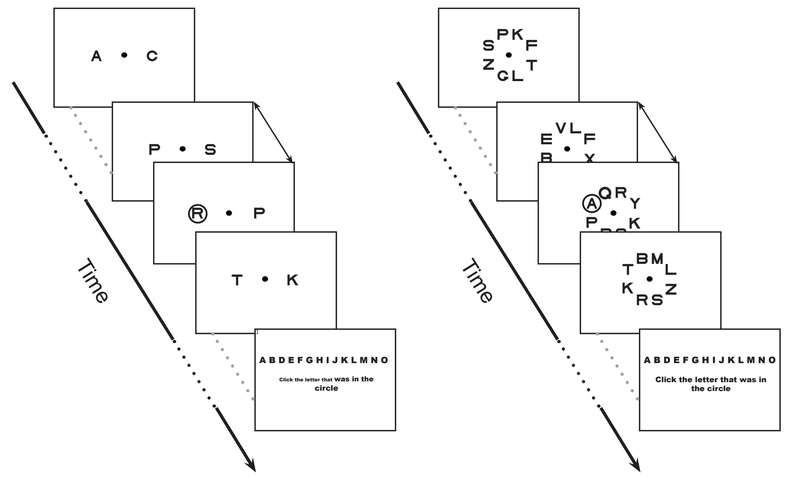
The evidence does not suggest an attention shift.

Stimuli's representations are stored in a temporary buffer and one is bound with the representation of the cue for response.

- The Bayes Factors largely favour the buffering model.
- The distributions from the Gaussian model include non-guessing responses from at the cue or before.

What is the capacity of the buffer?

We manipulated the number of simultanous streams to investigate the capacity of the buffer. A large number of simultaneous streams should exceed the capacity of the buffer



Method

On each trial, participants (N=10) saw 2 or 8 simultaneous RSVP streams of .9º Sloan letters spaced around an invisible circle with a radius of 3º.

Each stream was the alphabet in a random order. SOA was 83.25ms.

At one point in the trial, a circle subtending 1º appeared around a particular stream for the duration of a letter. Participants' task was to report the letter in the stream

- Pre-registration: **https://osf.io/7hkgd/**
- Materials, Data and Analysis: **http://bit.ly/BufferGit**

Analysis

We fit buffering and attention shift mixture models to each participants' data from each condition

We used BIC to compute Bayes Factors for comparing model fits.

To test the difference in parameter estimates between groups, we used Bayes Factors with Cauchy priors(location = 0, scale = 1).

Detailed analysis: **http://bit.ly/analysisRMD**

Parameters

There are 3 parameters in the mixture model

Efficacy: The proportion of non-guesses

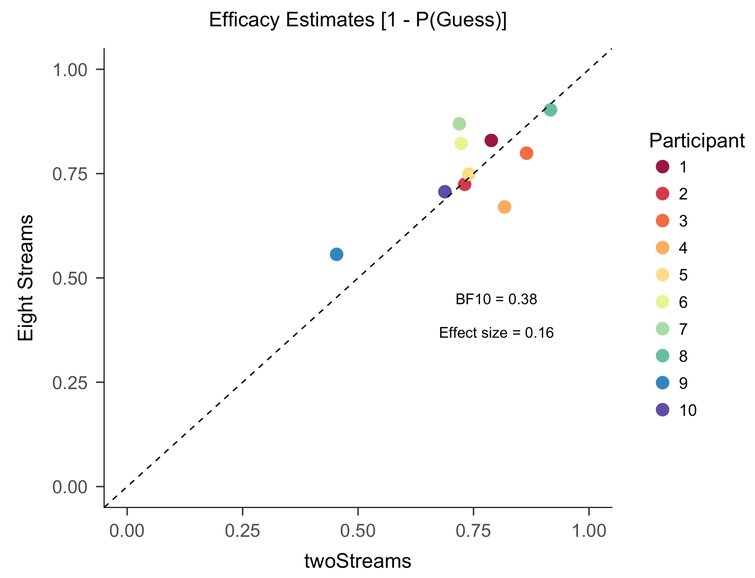
Latency (ms): The mean of the non-guessing distribution (relative to the time of the cue)

Precision (ms): The standard deviation of the non-guessing distribution.

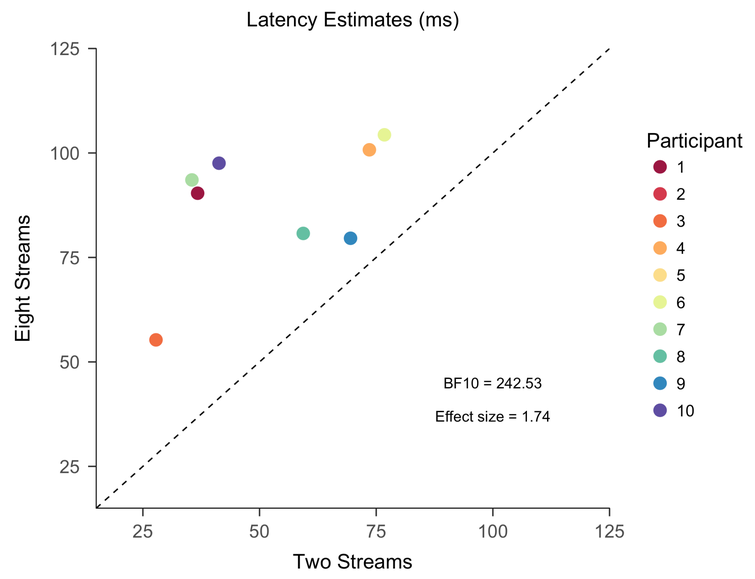
Results

The model fits always favoured the Gaussian model, regardless of condition.

BFs ranged from 78 to 2.1 * 10^{42}

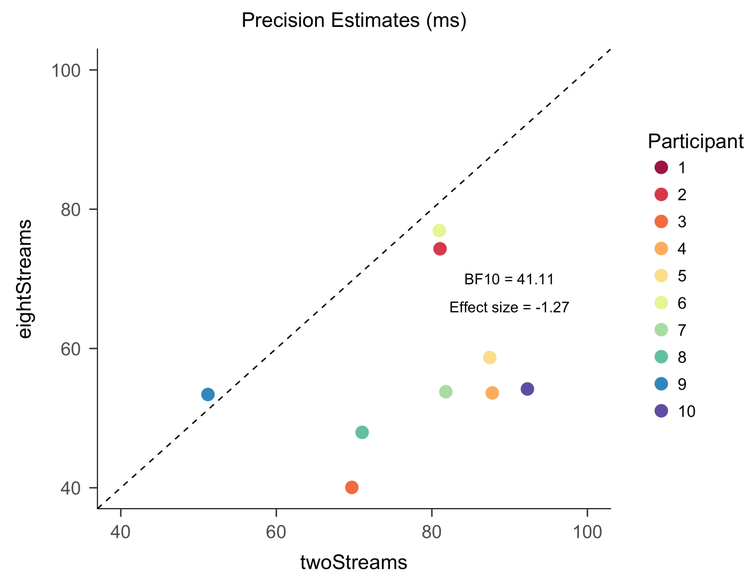


Efficacy did not differ between the conditions.



The non-guessing distribution is delayed with eight streams (M = 91 ms), relative to two streams (M = 50ms). **There is a small cost of the number of streams**.

The eight streams condition's distribution is centred near the first item after the cue(SOA = 83.25ms)



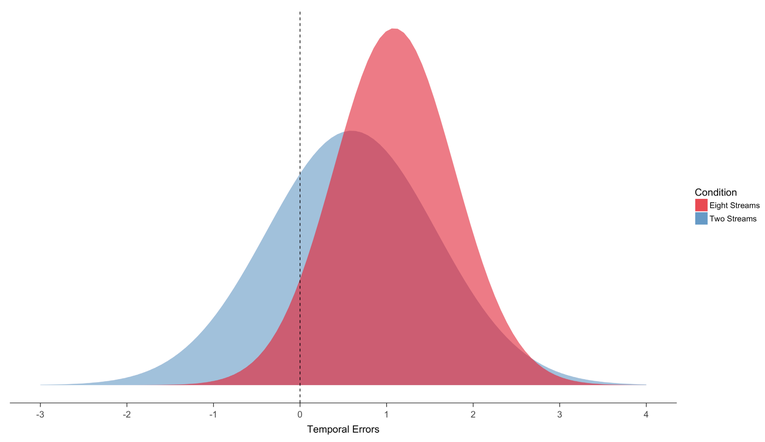
An unexpected result! The error distributions have a smaller SD in the eight streams condition. Attentional selection is delayed, but has less variance over time.

Conclusion

Q: What is the capacity of the buffer?

A: At least 8 items.

Selection is delayed, but still Gaussian in the eight stream condition



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