

Preparation effects

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Why do we care about preparation?

- Preparation is interesting in itself!
 - Get ready ... GO!
What do we do in between? Why does it help? Why don't we do it all the time?
- Preparation is a very basic demonstration of how/when the brain uses temporal cognition
- Preparation effects seem to reflect implicit learning mechanisms: relying on memories to optimize behavior. How does that work?

Models of timing & preparation

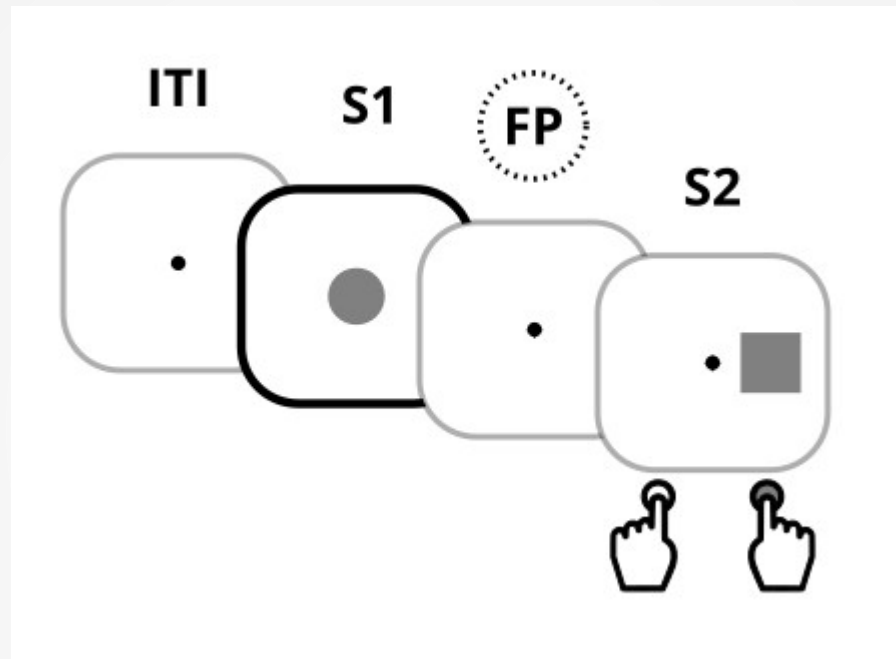
- You already have been using a model of time
 - Captures the most essential aspects of timing and time perception
- Many theories of preparation ‘assume’ the brain is able to time
 - With little regard for how this is implemented
- Next week, Niels will talk about different models of Time
- Week after that, I will talk about different models of Preparation

Today: DATA on preparation

- Overview of preparation effects in the literature
 - Focus on illustrating of *memory involvement*
- Preparation effects ‘live’ on different *timescales*:
 - Within a trial itself
 - FP length effects
 - Within a block of trials
 - Distribution effects
 - Within a block of trials
 - Sequential effects
 - Across blocks of trials
 - Transfer effects



Typical design and Terminology

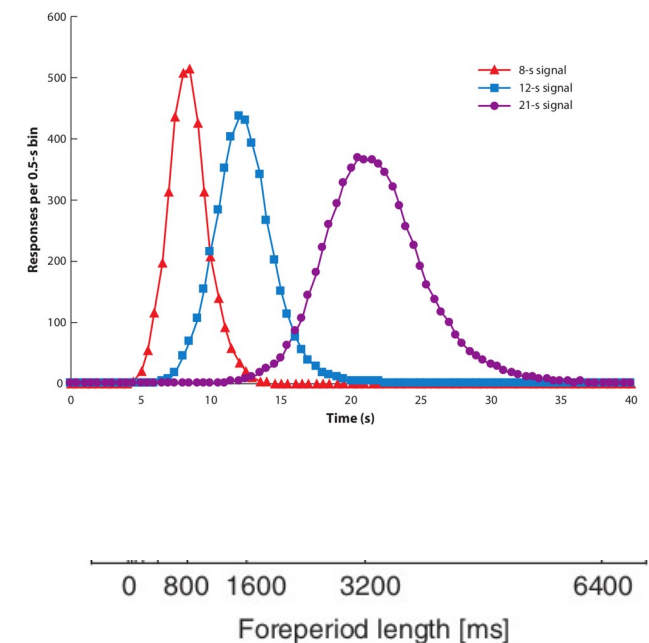
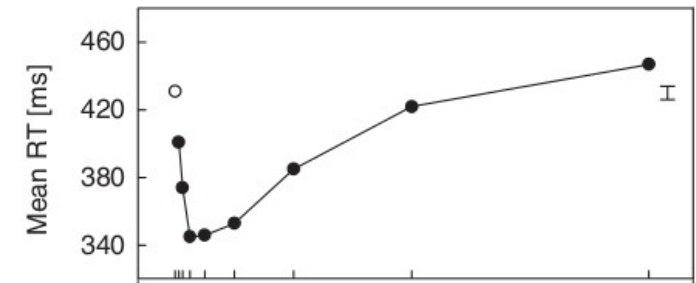
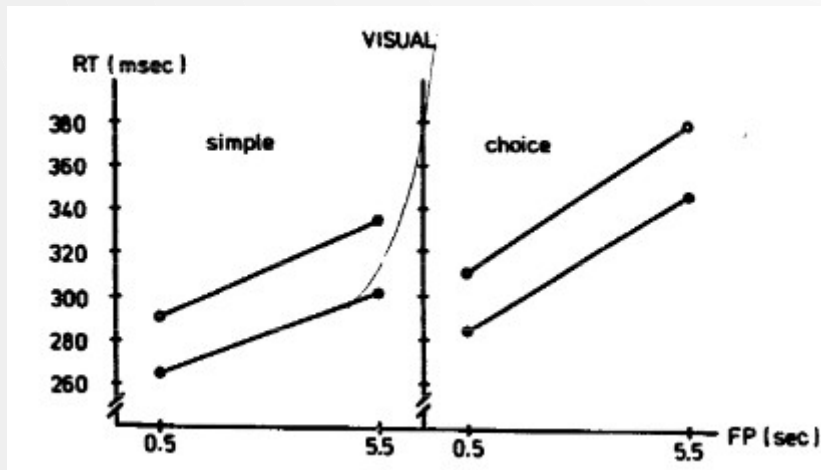


- Intertrial Interval → S1 (Warning Stimulus, WS) → Foreperiod (FP) → S2 (Imperative Stimulus, target)
 - Of interest is how changing the FP affects reaction time (RT)

The FP-length effect

Müller-Gethmann et al., 2003
Niemi, 1979

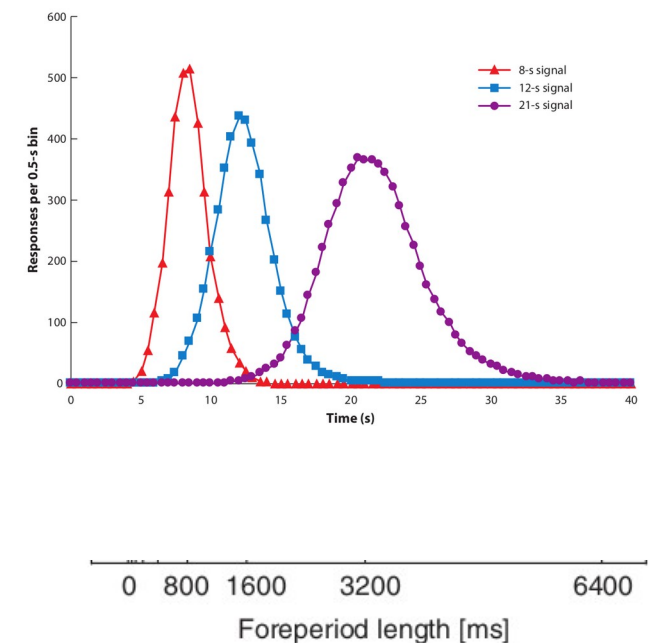
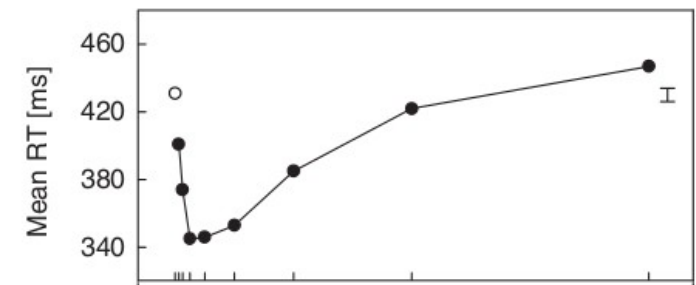
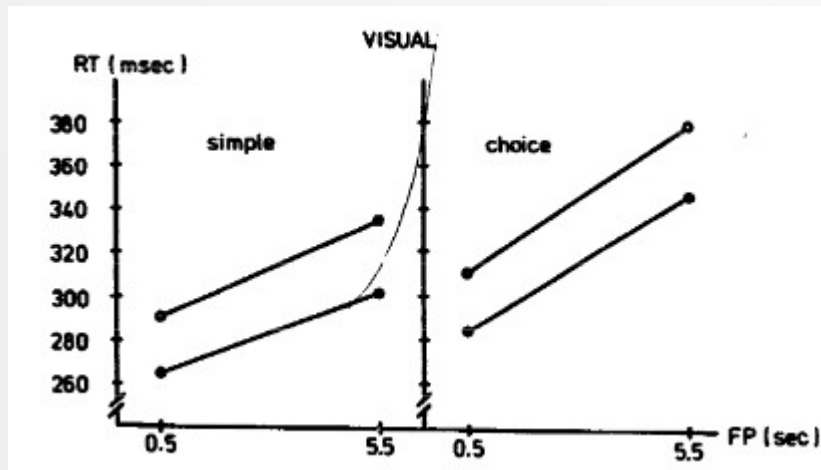
- Blocks with constant FP: no uncertainty
 - Up to ~150ms : RT decreases
 - From that point on, RT increases
- Processing the WS takes time
- After that: temporal uncertainty



The FP-length effect: constant FP

Müller-Gethmann et al., 2003
Niemi, 1979; Allman et al., 2014

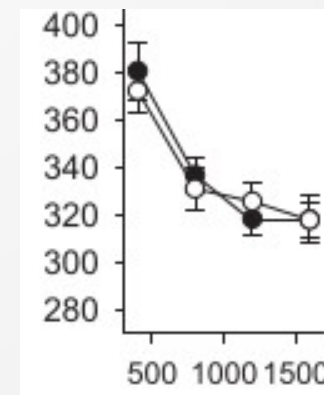
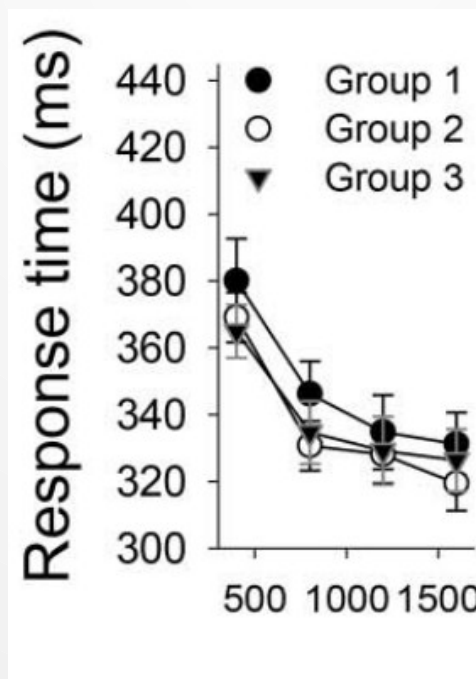
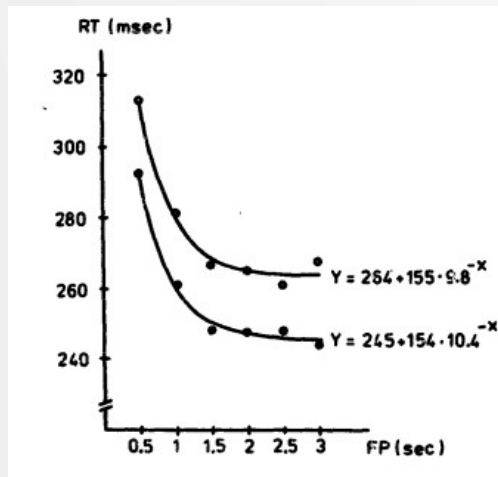
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The FP length effect: variable FP

Niemi, 1979
Los et al., 2017
Los et al., 2021

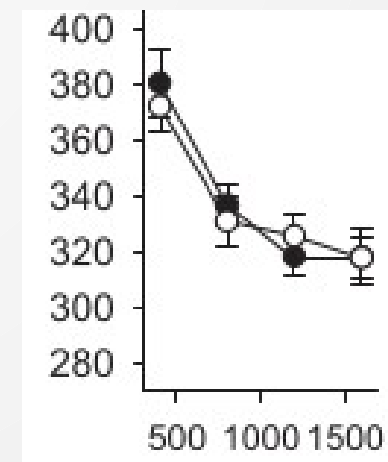
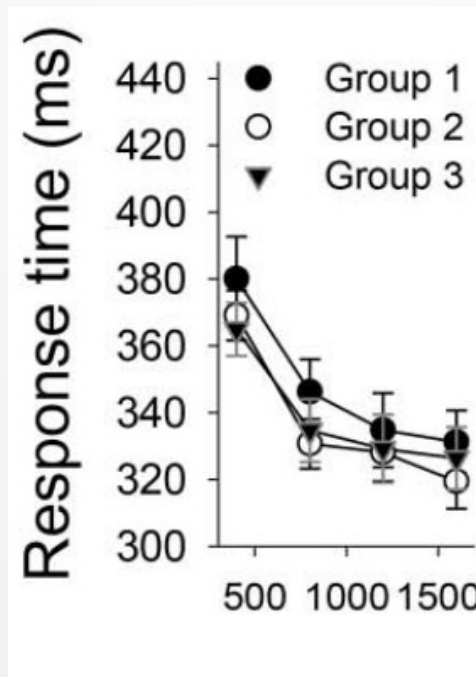
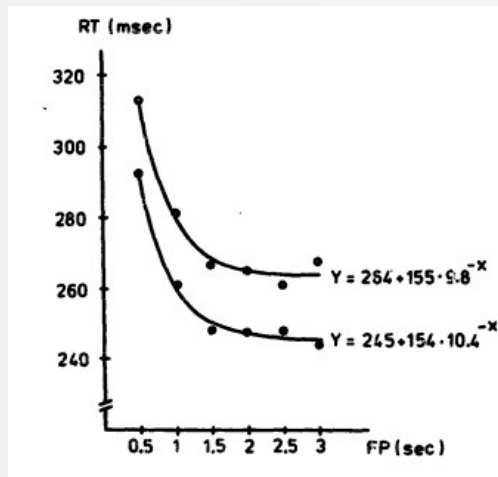
- Blocks with variable FP
 - Asymptotic decrease of RT
 - Do we aim to be prepared as late as possible?



The FP length effect: variable FP

Niemi, 1979
Los et al., 2017
Los et al., 2021

- Blocks with variable FP
 - Asymptotic decrease of RT:
 - When you are prepared, you stay prepared(...?)
 - Do we aim to be prepared as late as possible?

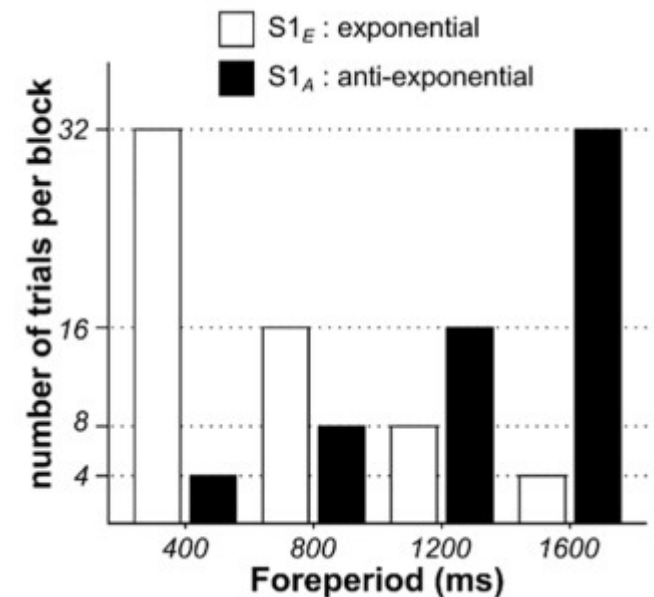
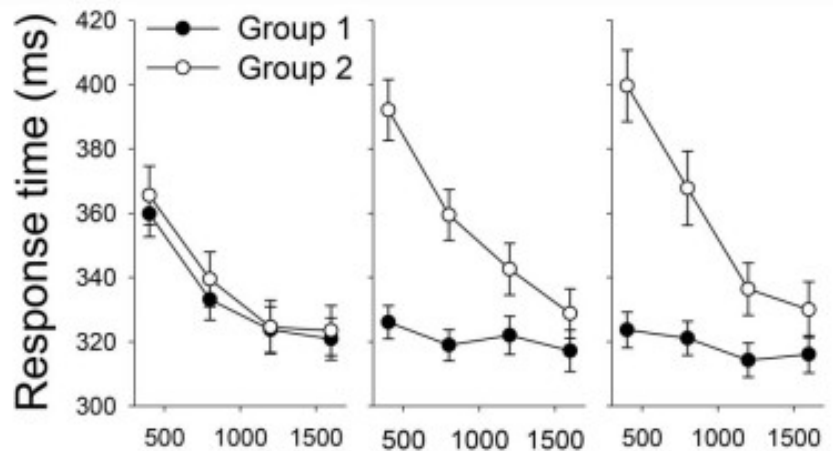


Variable FP: distribution effects

Los et al., 2017;
Los et al., 2021

- Preparation is dependent on the distribution
- cf. Grosjean experiment:
target the moment to be optimally prepared, based on *history*
- Uniform, Exponential (Many short), Anti-exponential (many long)

Block	1	2	3
Group 1	Uni	Exp	Exp
Group 2	Uni	Anti-exp	Anti-exp

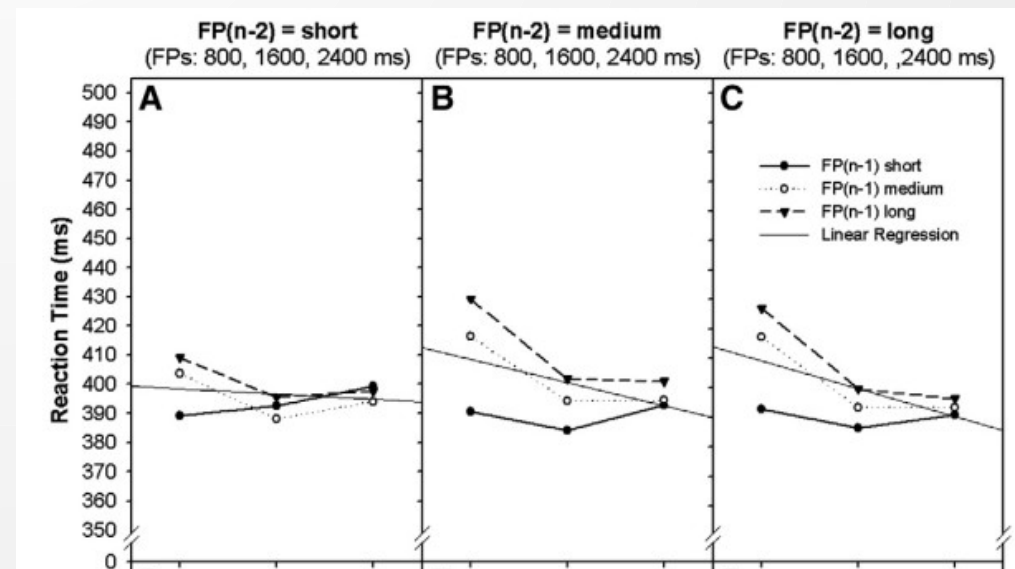
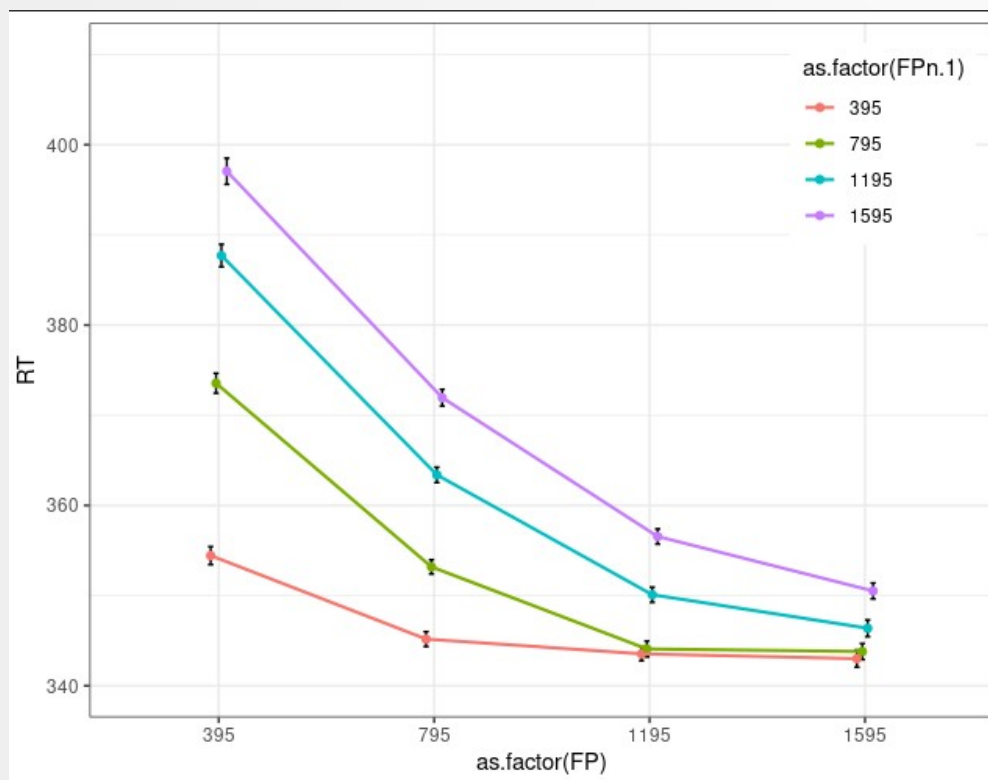


Variable FP: *within* blocks

Los et al., (in prep.);
Steinborn et al., (2012)

This is the effect that you will simulate this week

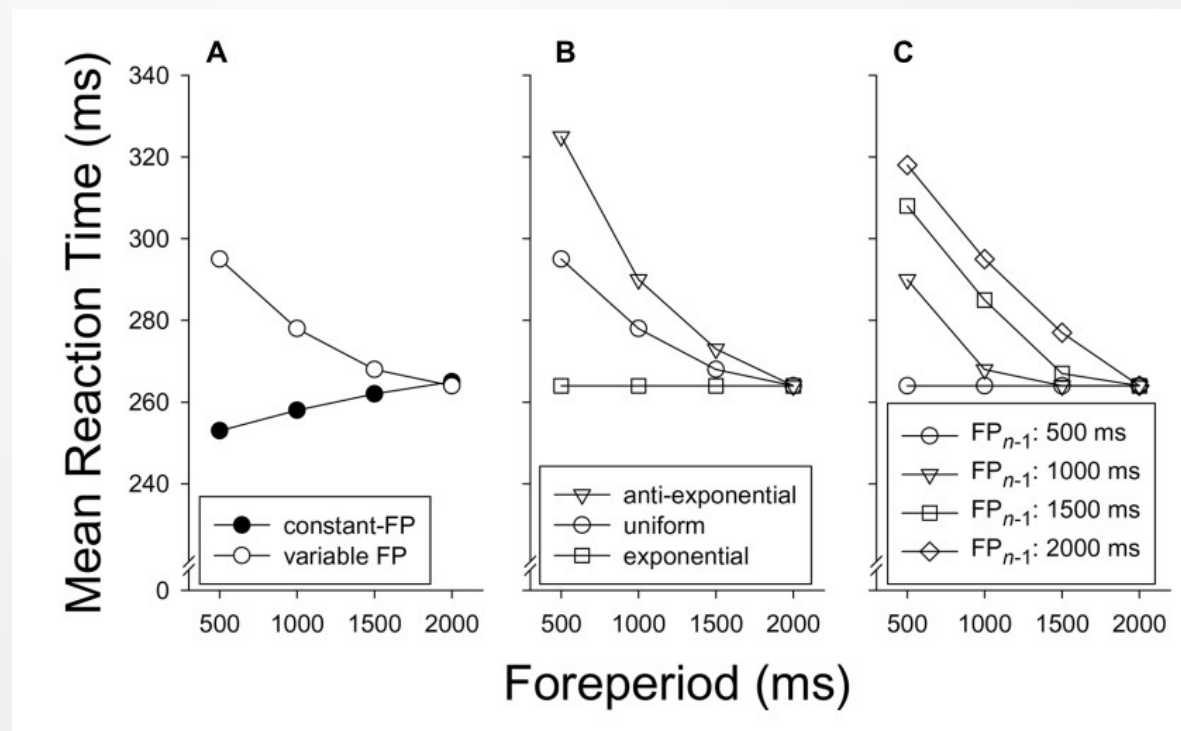
- Preparation is dependent on the previous trial: *sequential effects*
 - Previous trial short, present long: very slow responses.
- Memory effect: cued by the previous trial.
- n-1 effect, but also n-2 effect (and more...?)



Distribution vs. Seq effects

Los et al., (2014)

- Distribution effects:
 - If Exponential: often short; that means $n-1$ often short.
 - Are they two sides of the same coin?
- It seems that there is more going on, though
 - Effects of distribution context cannot be accounted for by $n-1$ alone
 - Perhaps some long-term memory involvement...?

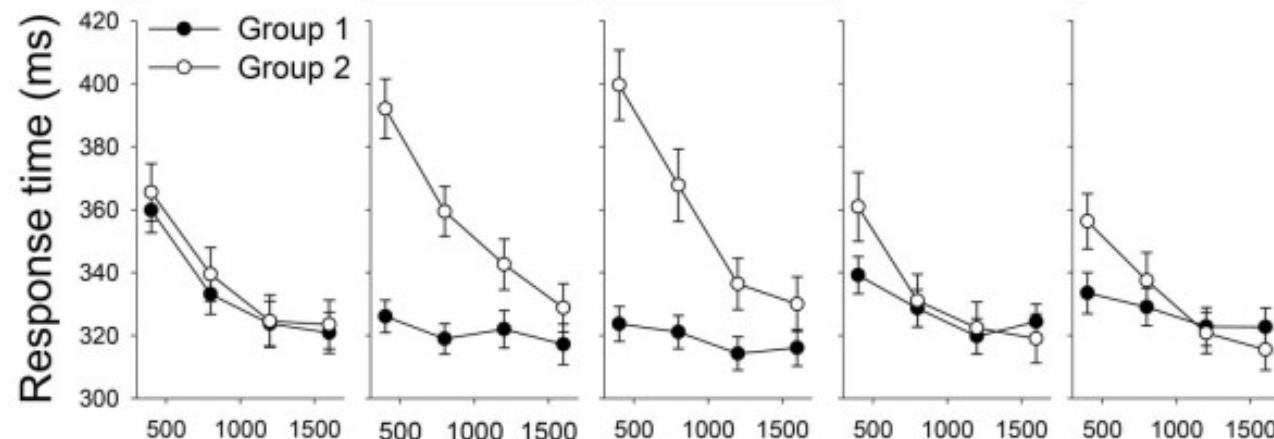


Variable FP: Transfer effects

Los et al., (2017)

- There are long-lasting effects of the previous block
 - Note: even a week later (Mattiesing et al., 2017; Crowe et al., 2019)
 - Note: even when you instruct people that the distribution has changed

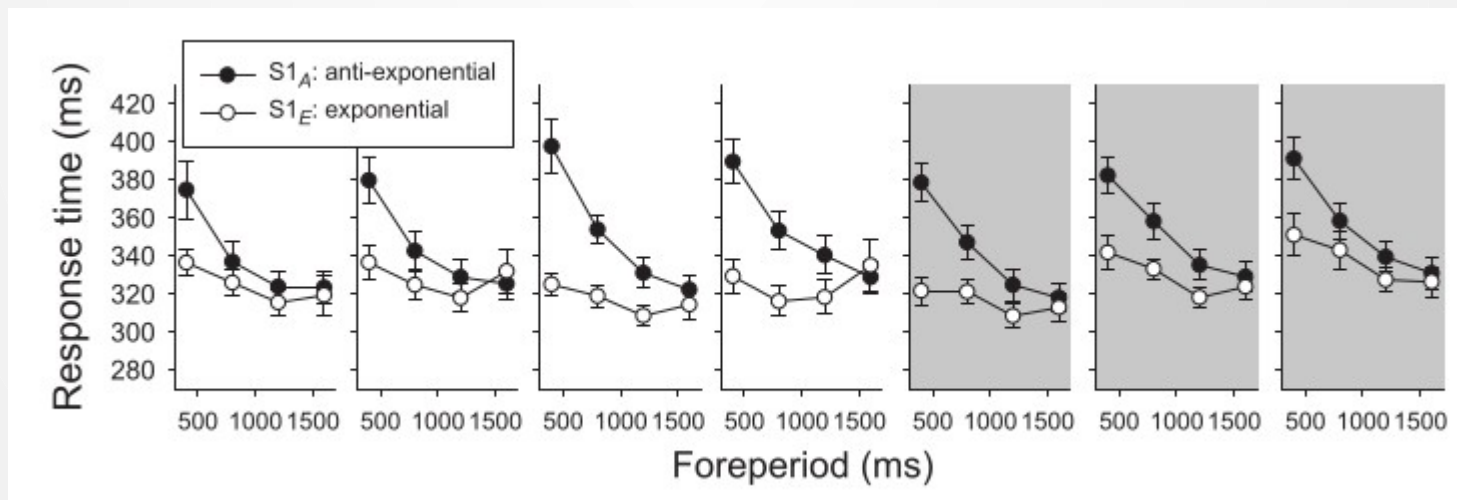
Block	1	2	3	4	5
Group 1	Uni	Exp	Exp	Uni	Uni
Group 2	Uni	Anti-exp	Anti-exp	Uni	Uni



Transfer effects: associative memory

Los et al., (2021)

- Within the same block, participants can learn to associate different stimuli with different distributions.
- Persistent (after the association has changed)
- Even when participants are informed of this



Thank you!