What's Lagging in Our Understanding of Interruptions?

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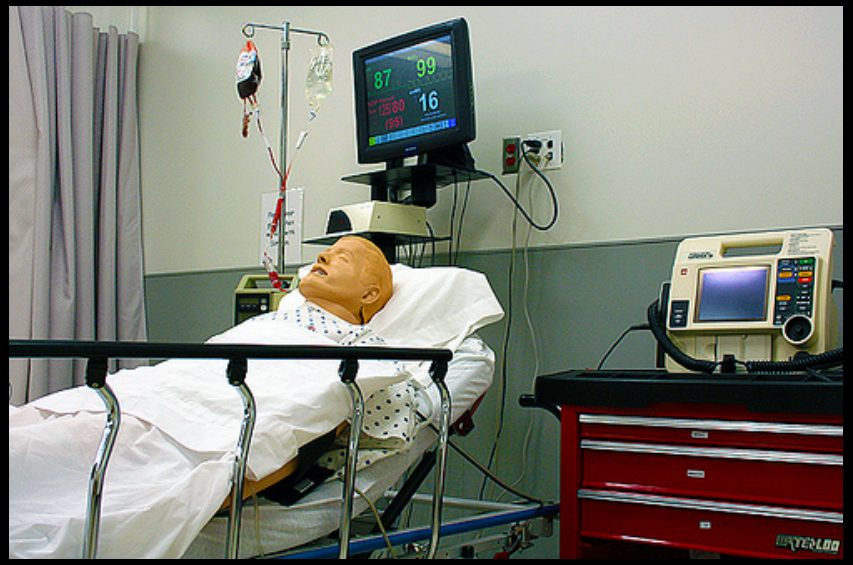
Supervisors: Chris Donkin and Ben Newell

Emergency Room



<u>Scenario 1: Alcoholic Patient</u>

Primary task: keep patient alive

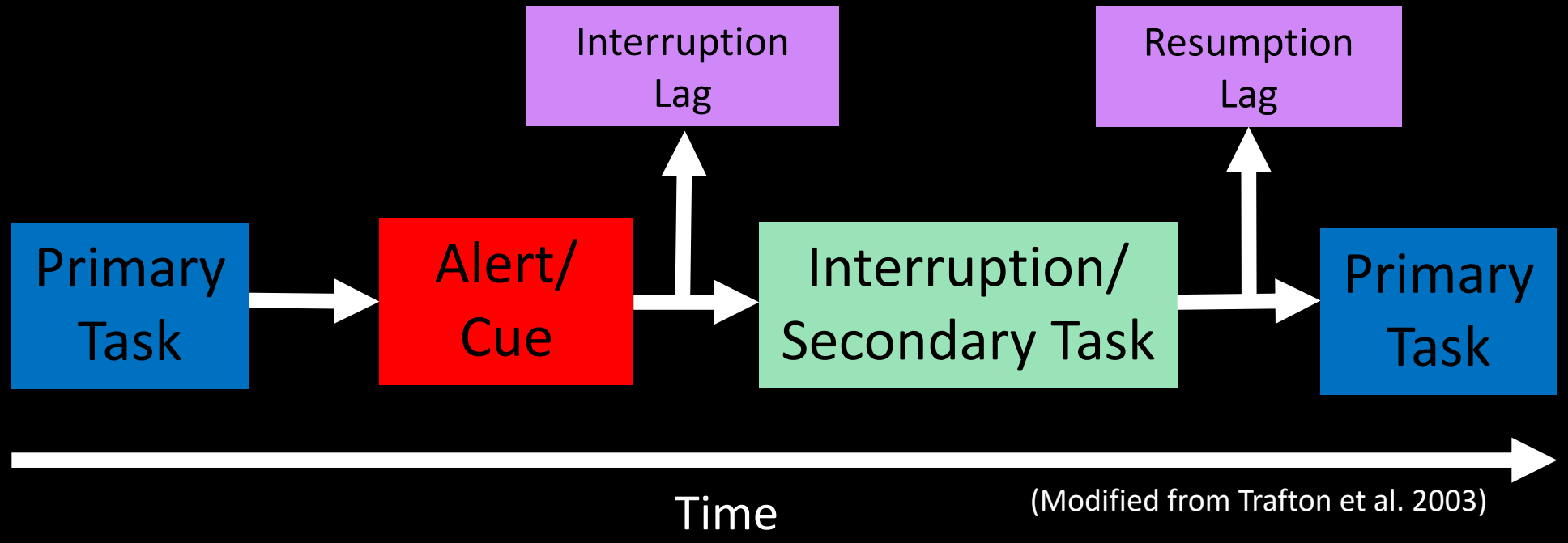
Interruptions: patient suddenly begins vomiting blood

<u>Scenario 2: Car Accident</u>

Primary task: keep patient alive

Interruptions: nurse enters with X-ray

Theoretical Framework



Hypothesis: Interruption lag gives you time to prepare to resume primary task after an interruption

Previous Research

Shows that interruption lags are beneficial in some problem solving tasks

- Tower of London (Hodgetts & Jones, 2006)
- Complex resource-allocation task (Trafton et al., 2003)

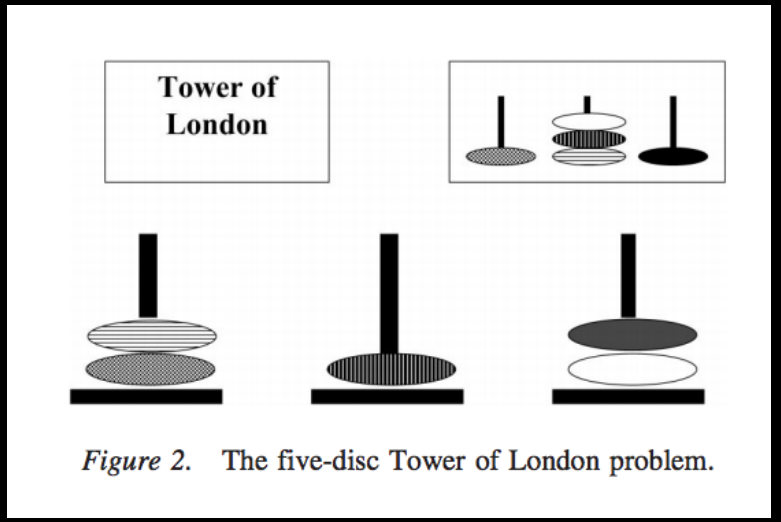


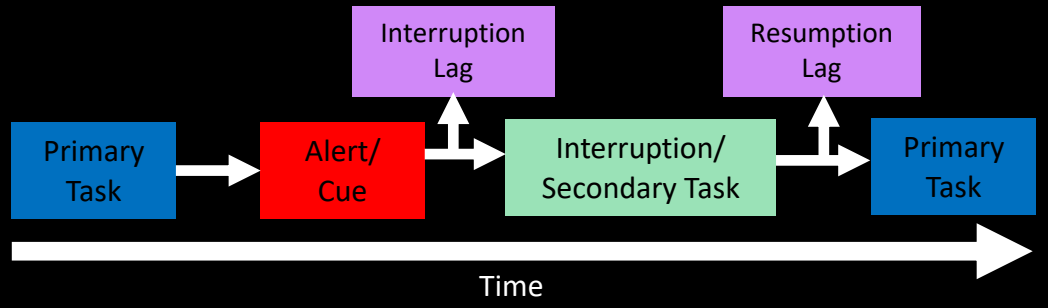
Figure 2. The five-disc Tower of London problem.

But, these tasks don't help us understand **why** the interruption lags are helping

Goals for This Talk

1. Introduce a novel sequential decision making task demonstrating the positive effects of interruptions lags
2. Explain how this task may be able to facilitate why interruption lags are beneficial by looking at some of the underlying processes

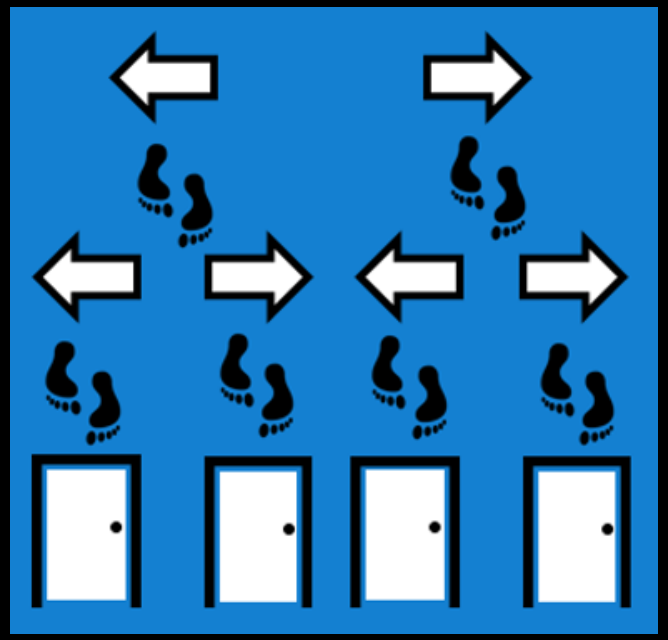
Design

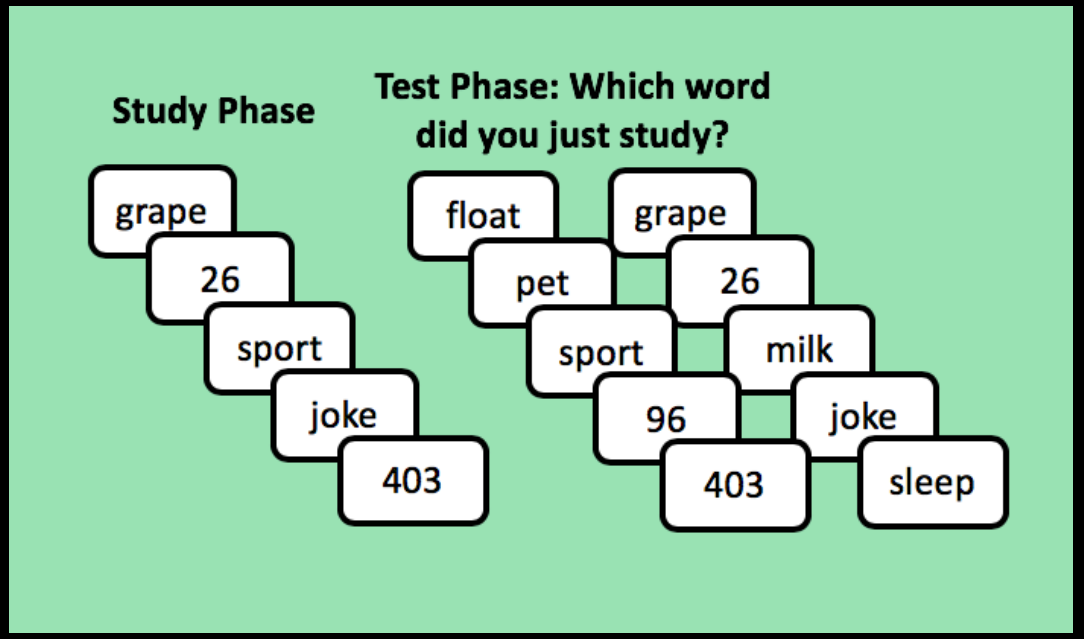


Primary task: Navigate through a maze to open all of the doors

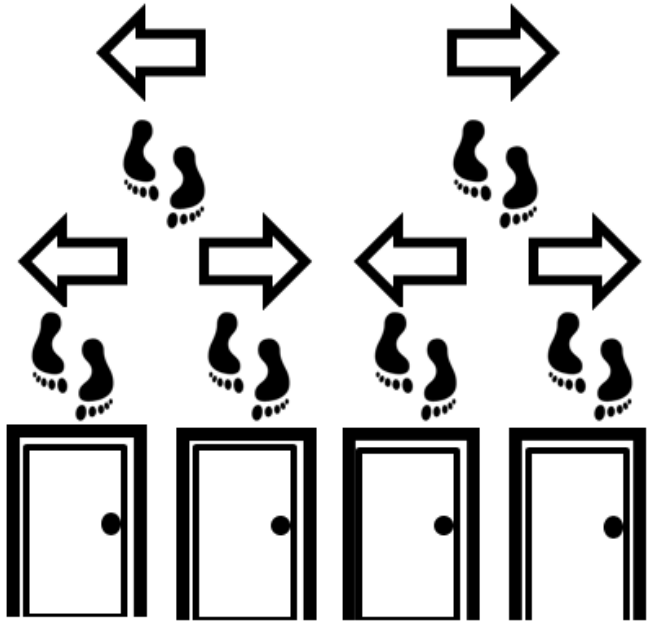
- The design allows us to manipulate when, where, and how often interruptions occur

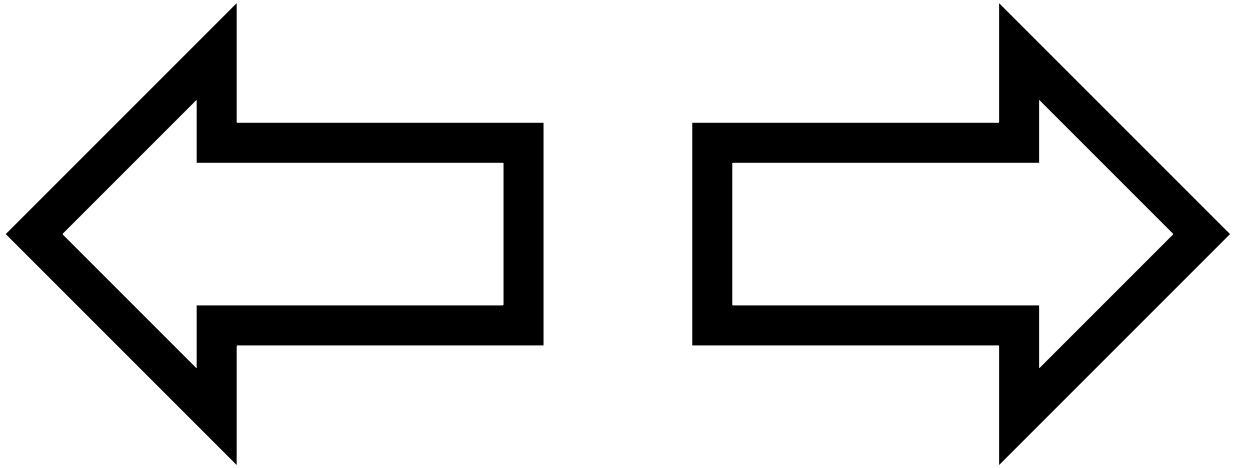
Interruption task: 2 alternative forced choice (2AFC) memory test

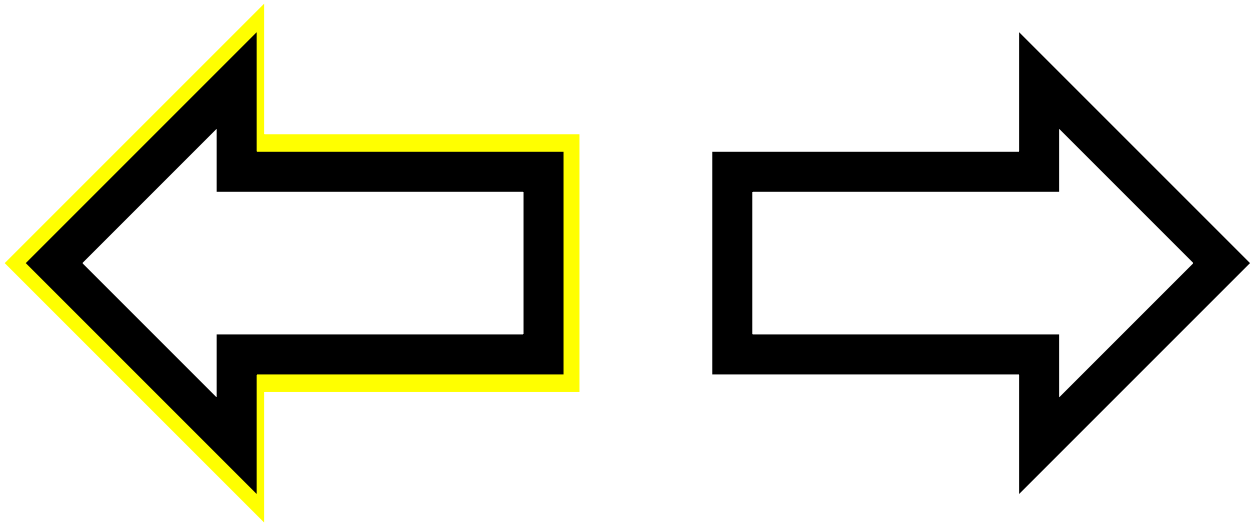


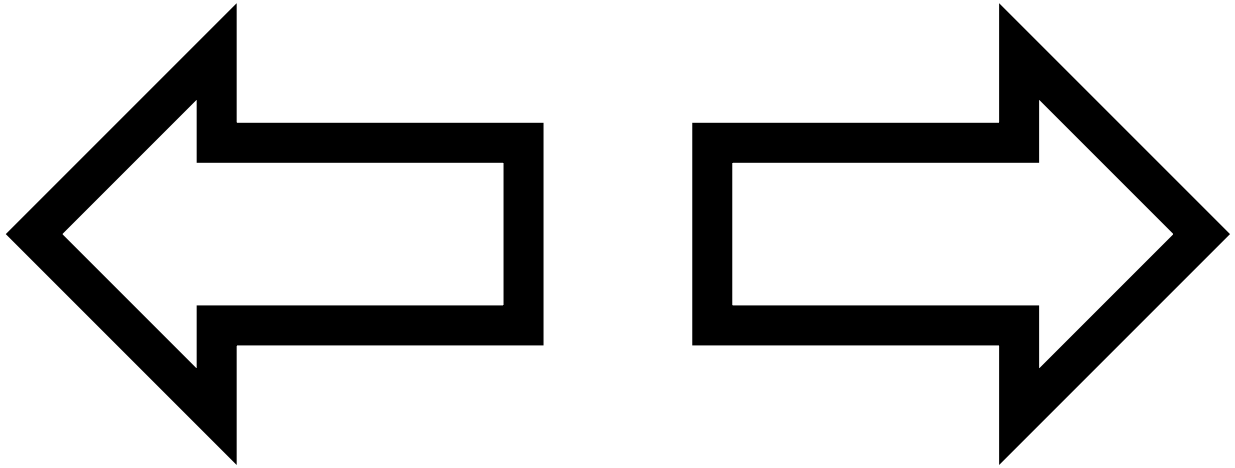


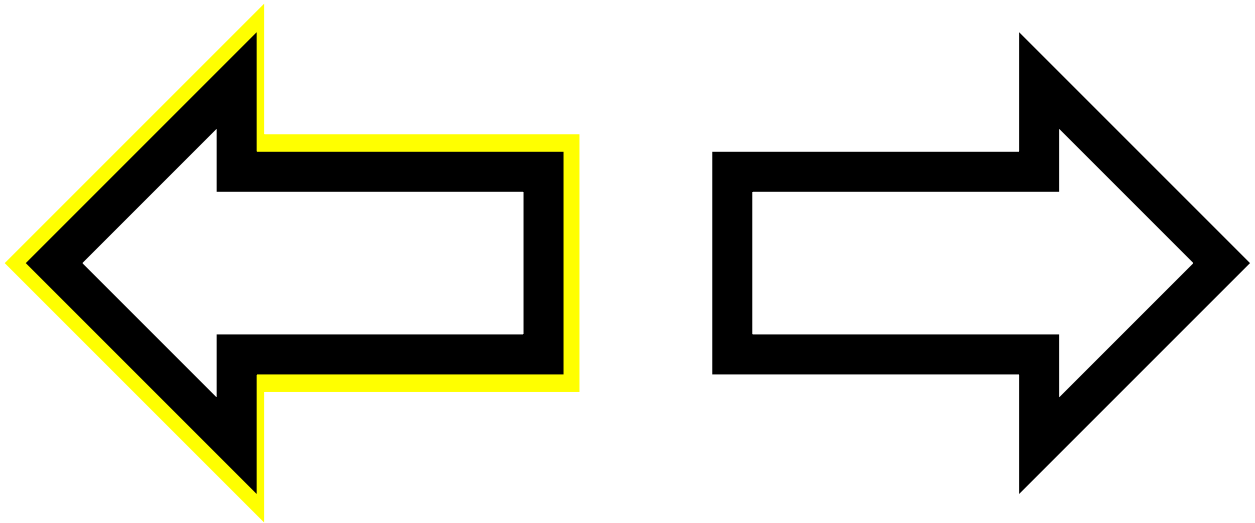
Example of One Trial

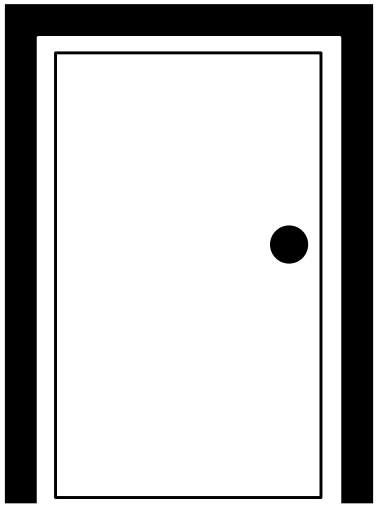




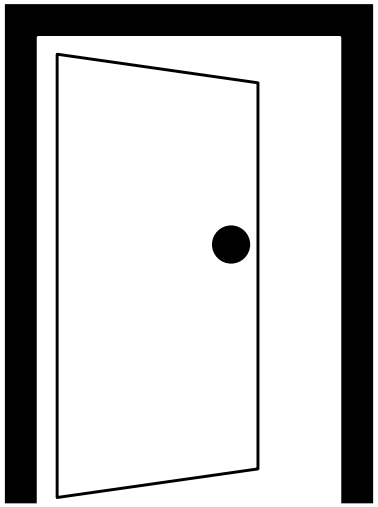








“Good job! You have opened a new door!”



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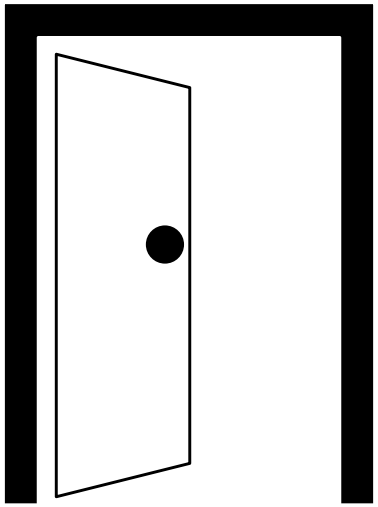


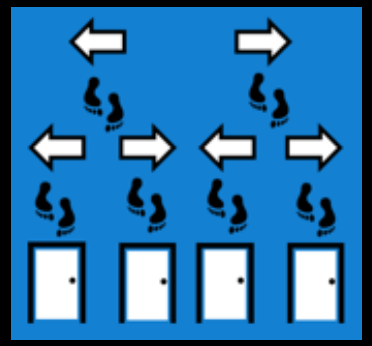
“Good job! You have opened a new door!”

“Sorry! You have already opened this door!”

Experimental Design: Difficulty Manipulation

Easy:

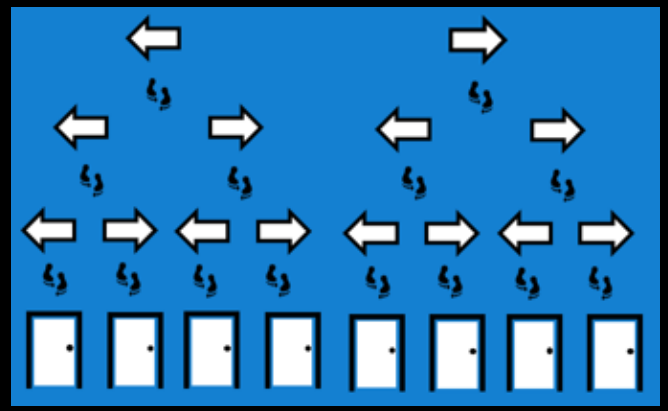
4 doors



1 interruption

Medium:

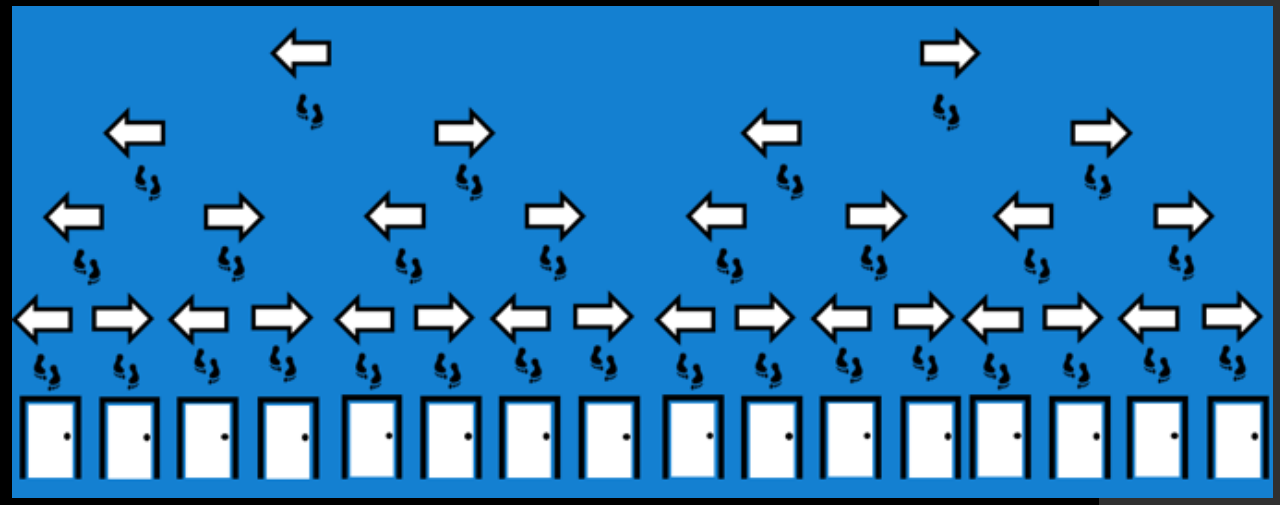
8 doors



2 interruptions

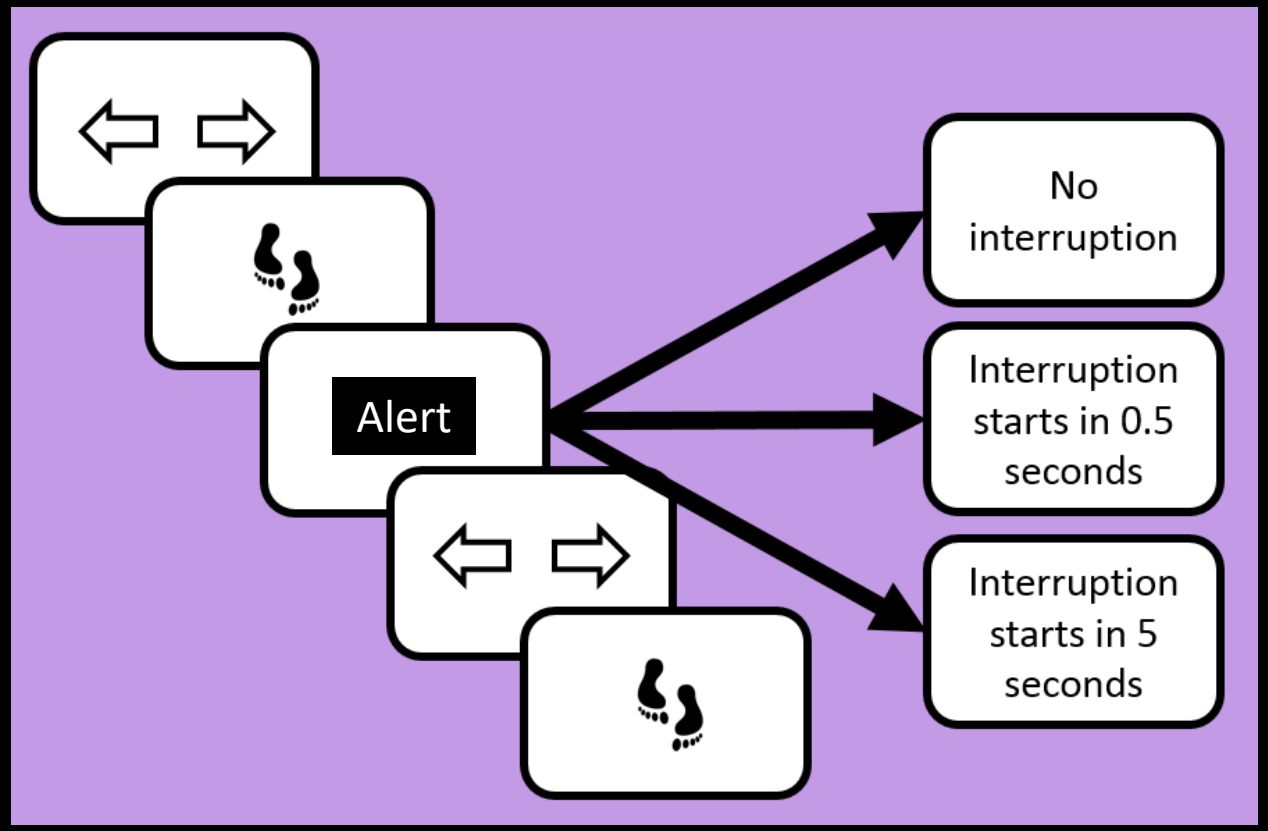
Hard:

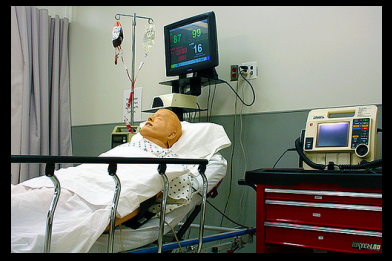
16 doors



4 interruptions

Experimental Design: Interruption Manipulation





Interruption Lag

Interruption Lag

Methods

3 (difficulty: easy, medium, hard) x 3 (interruption: no interruption, interruption, interruption + lag) fully within subject design

Experiment 1: can open doors in any order

n = 57

Freedom to open any door resulted in too much flexibility – hard to know when people were “lost” or purposefully opening doors in unique orders

Methods

3 (difficulty: easy, medium, hard) x 3 (interruption: no interruption, interruption, interruption + lag) fully within subject design

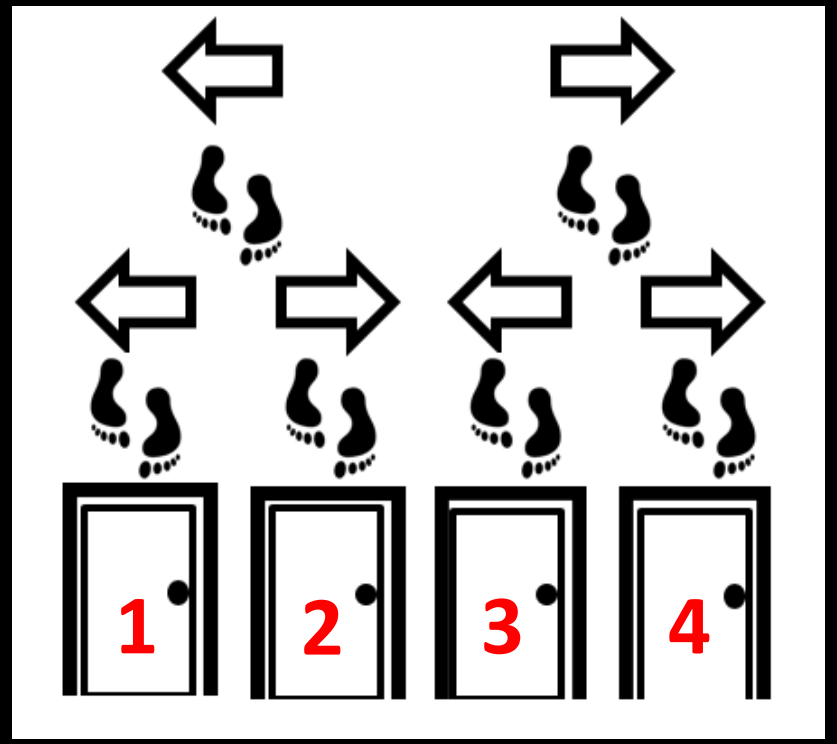
Experiment 2: forced order

n = 59

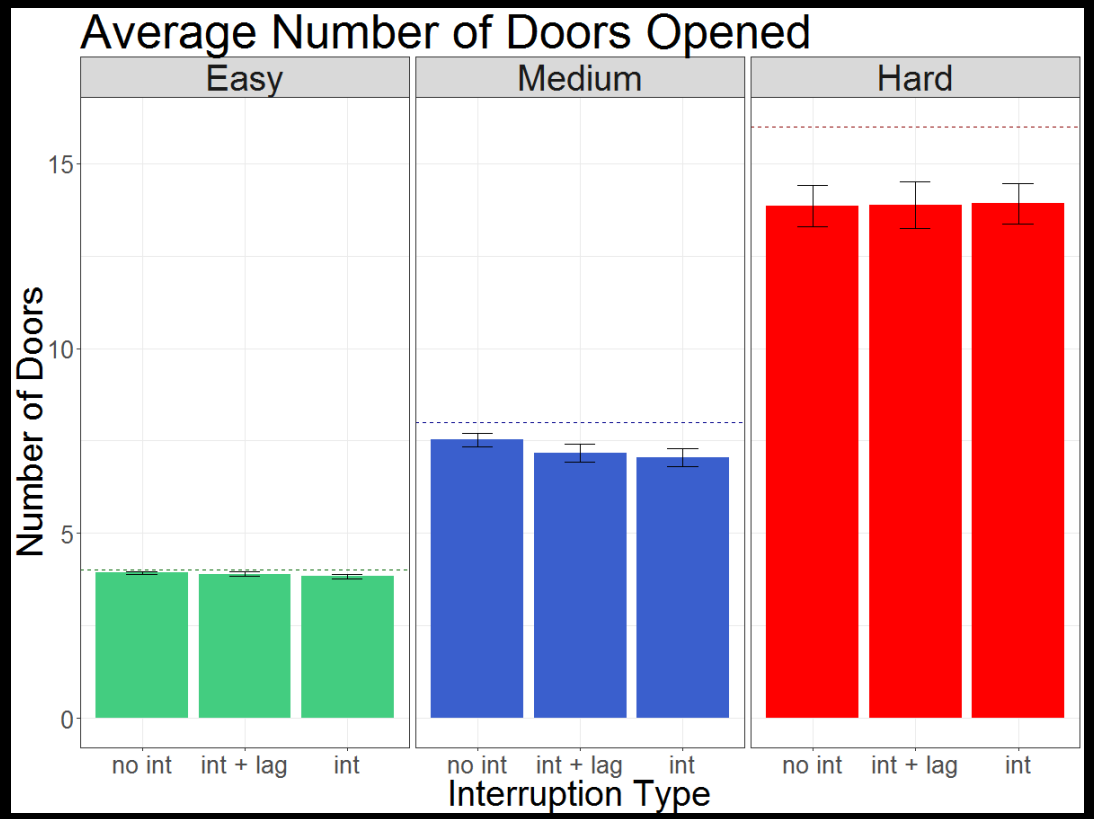
Open doors from left → right

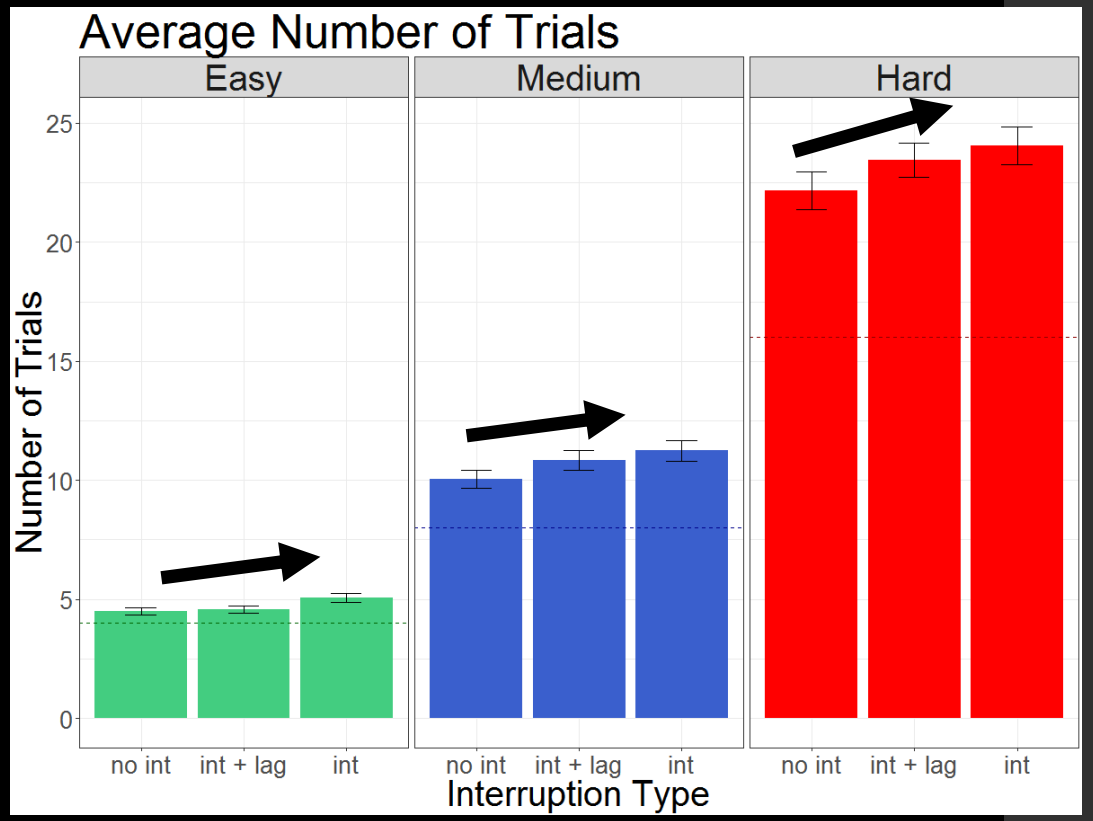
Interruption lag = self paced

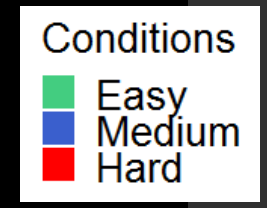
Max trials = 2 x number of doors
(8 easy, 16 medium 32 hard)



Experiment 2: Results



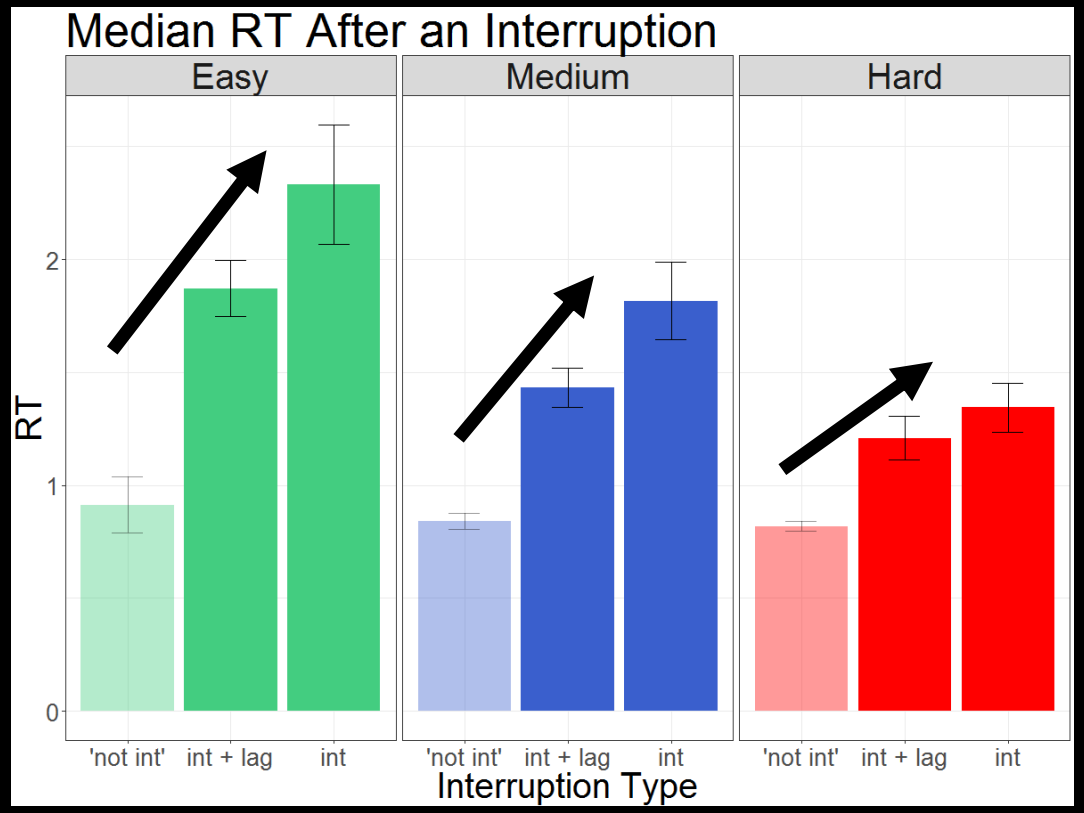


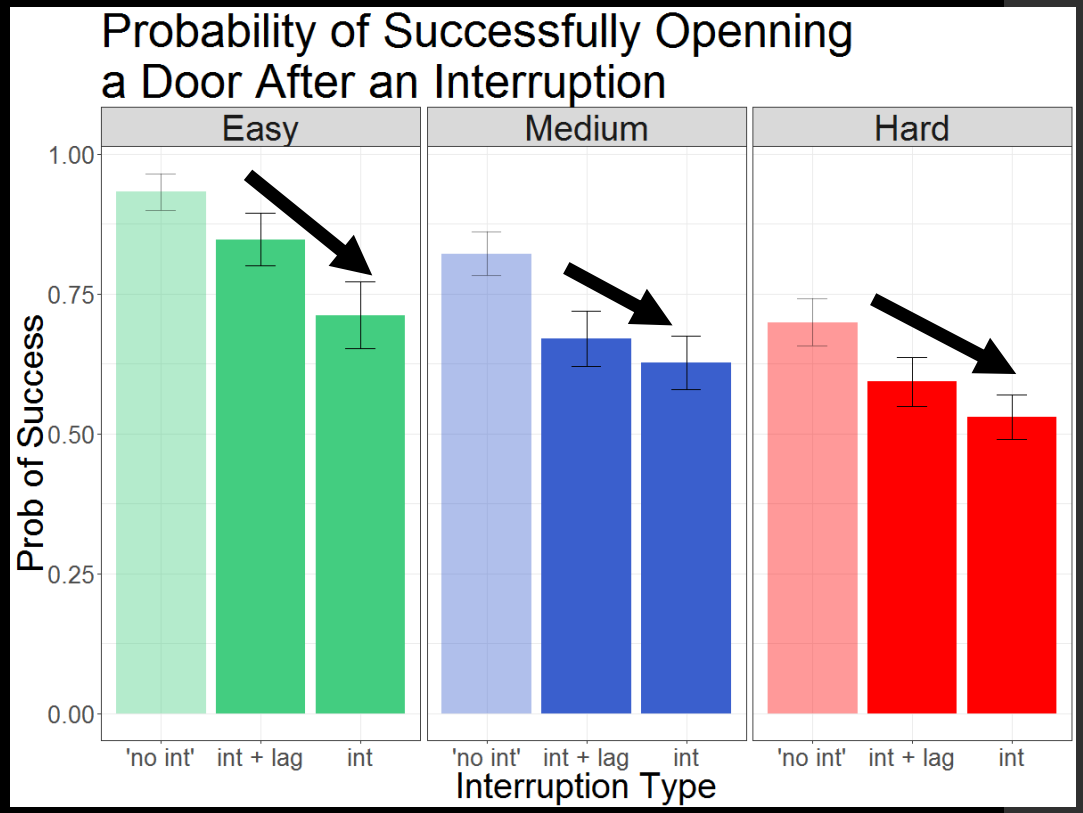


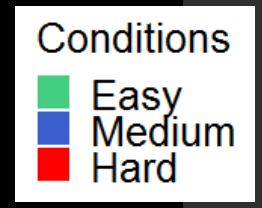
Pattern begins to emerge: number of trials increases across interruption type

Experiment 2: Results

Resumption Lag







Pattern continues: longest RTs and worst performance when interrupted with no lag

Conclusions

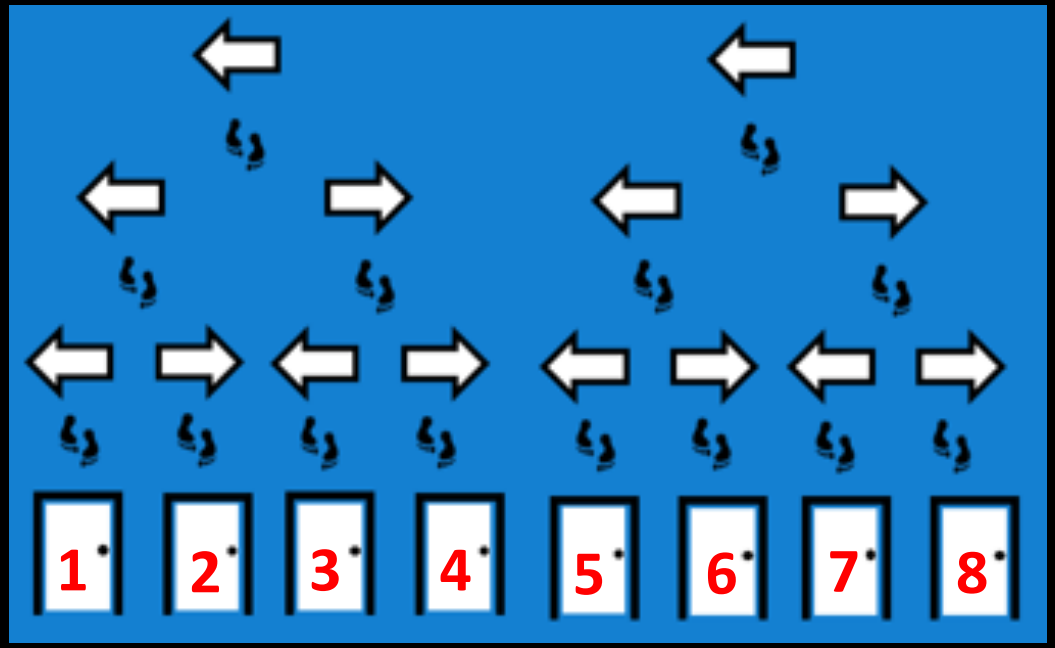
We saw the same pattern across multiple analyses, such that performance:

No interruption > interruption + lag > interruption

These results suggest there is evidence that interruption lags can reduce some interruption costs

Goals for This Talk

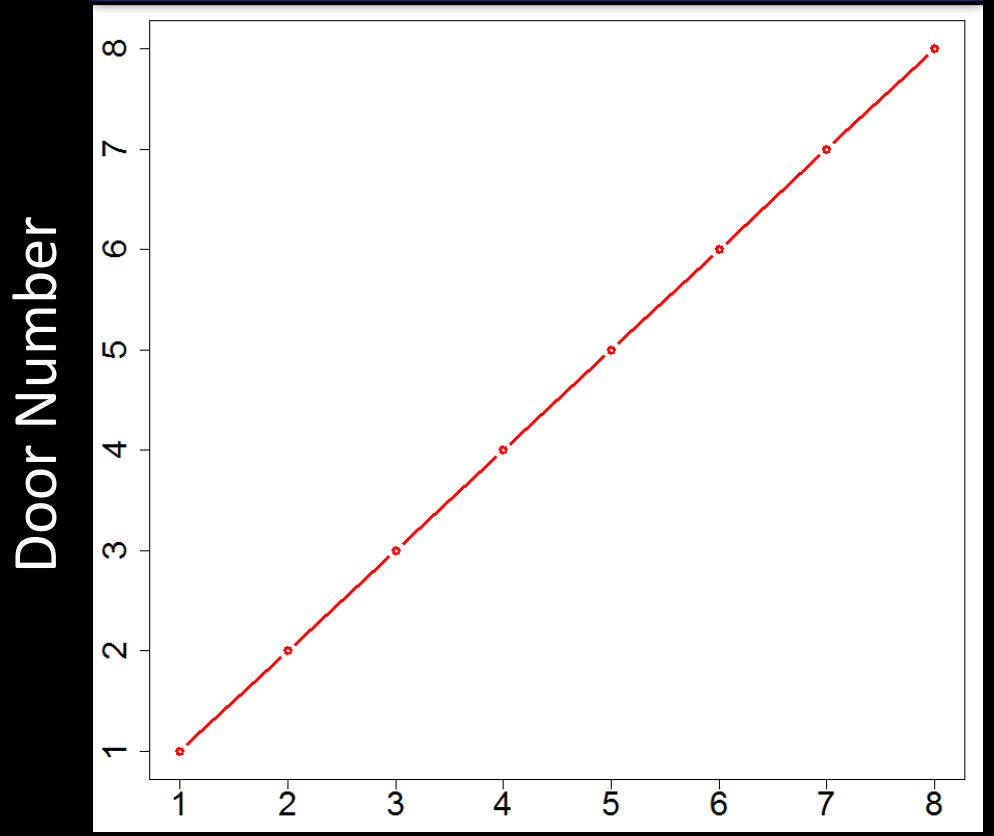
1. Introduce a novel sequential decision making task demonstrating the positive effects of interruptions lags
2. Explain how this task may be able to facilitate why interruption lags are beneficial by looking at some of the underlying processes



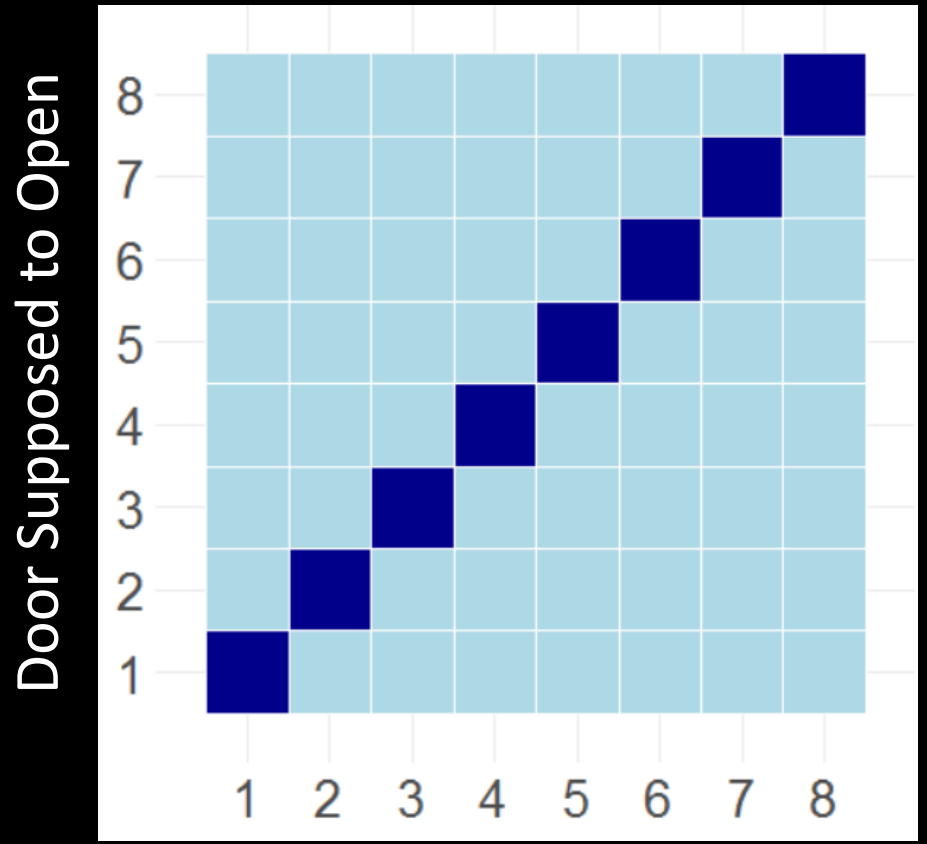
First, we need to look at patterns of behavior

1. Explore what individual participants are doing in the task
2. Explore possible patterns across participants

Perfect Performance

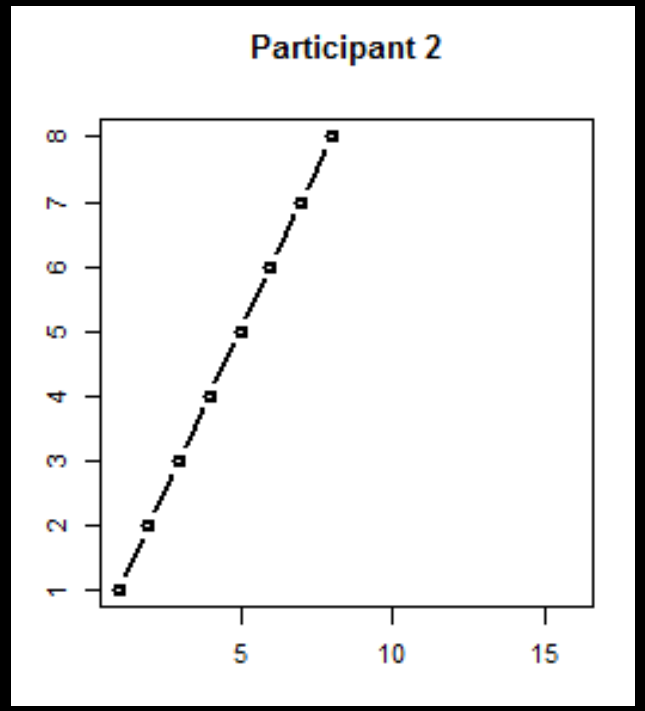


Perfect Performance

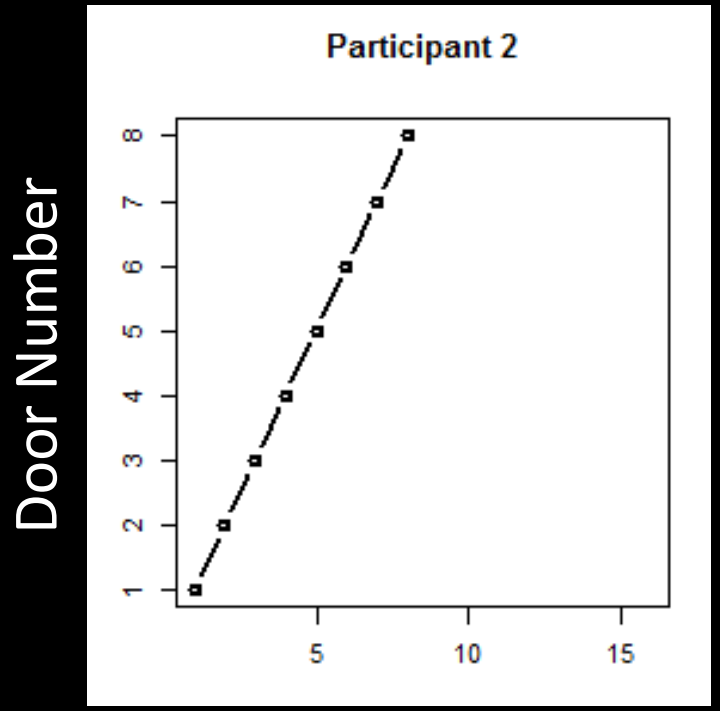


Individual Differences

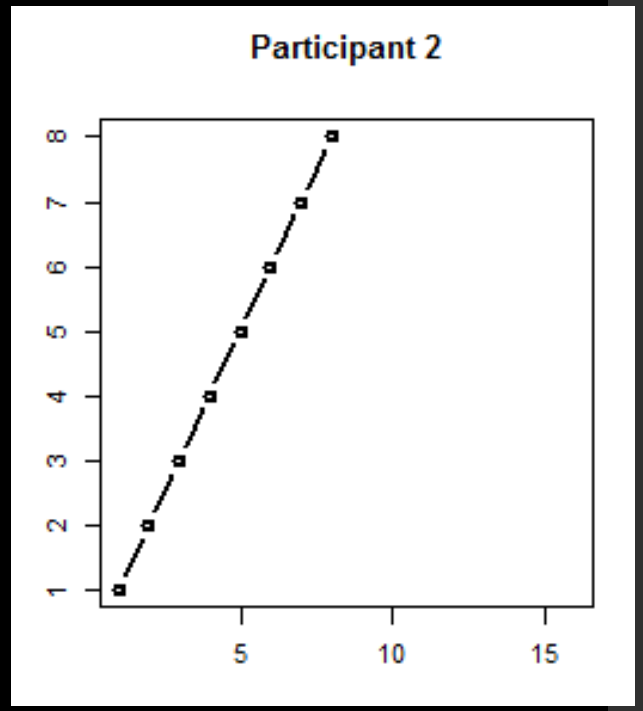
No Interruption



Interruption + Lag



Interruption



Perfect Performance

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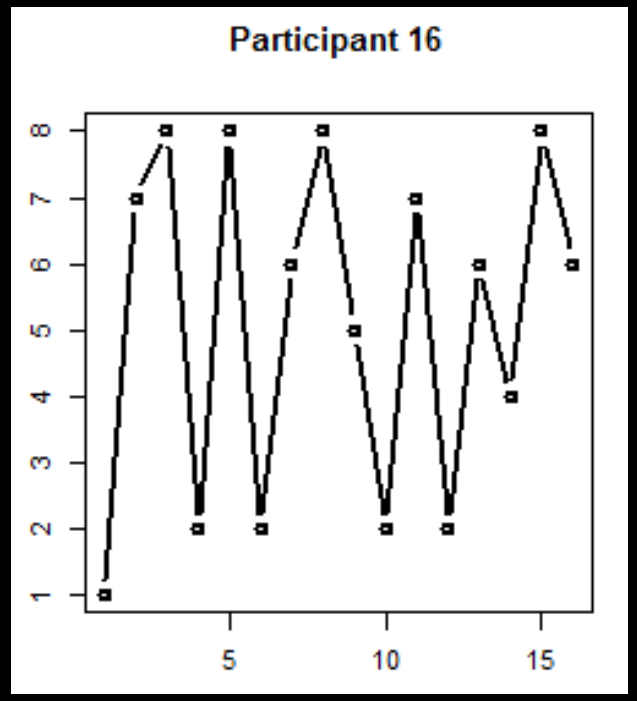
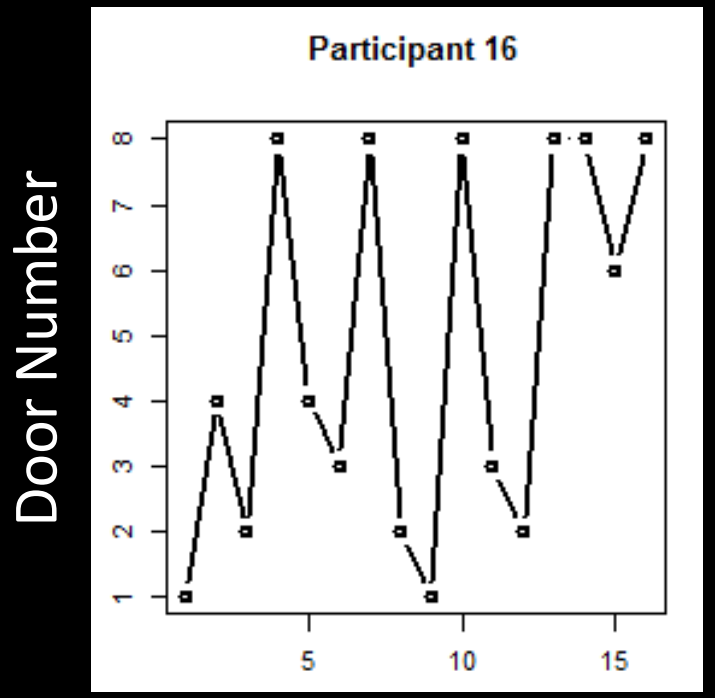
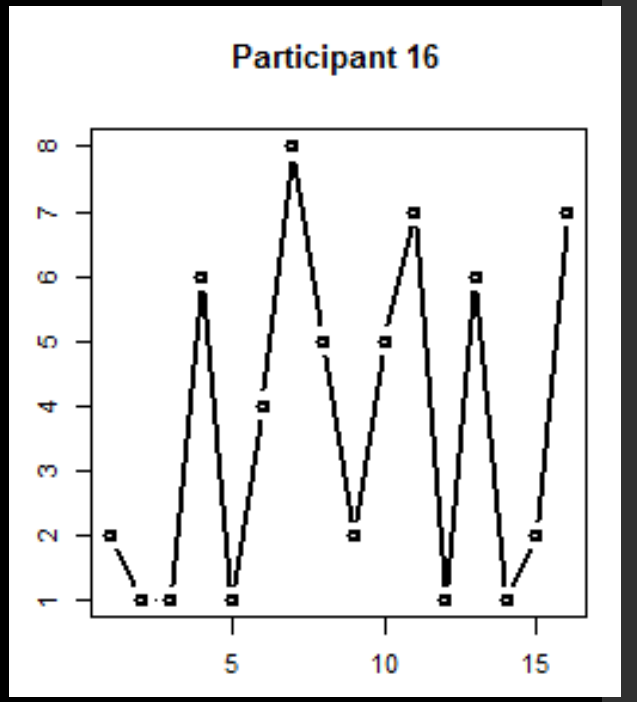


Interruption + Lag



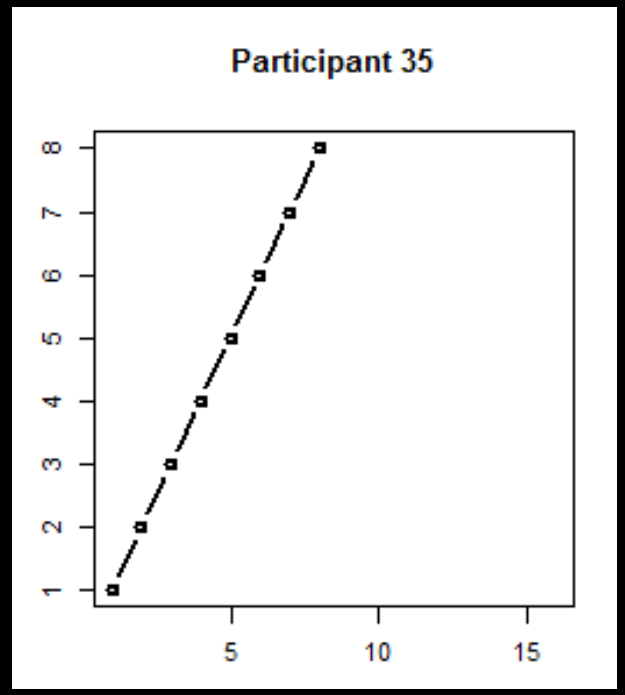
Interruption



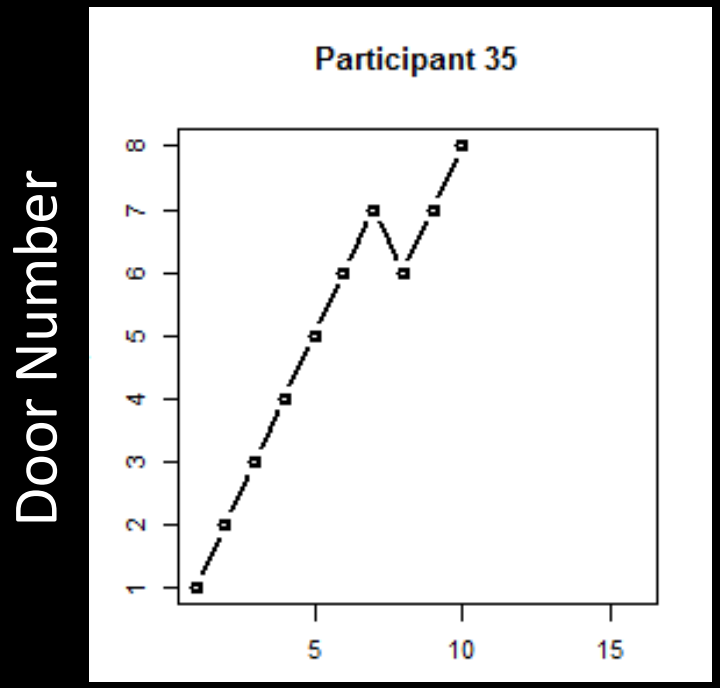
Confused?

Individual Differences

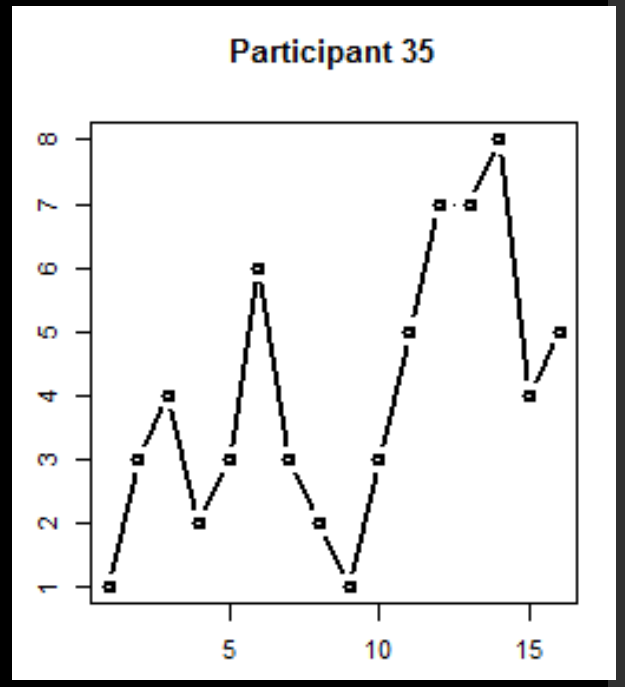
No Interruption



Interruption + Lag

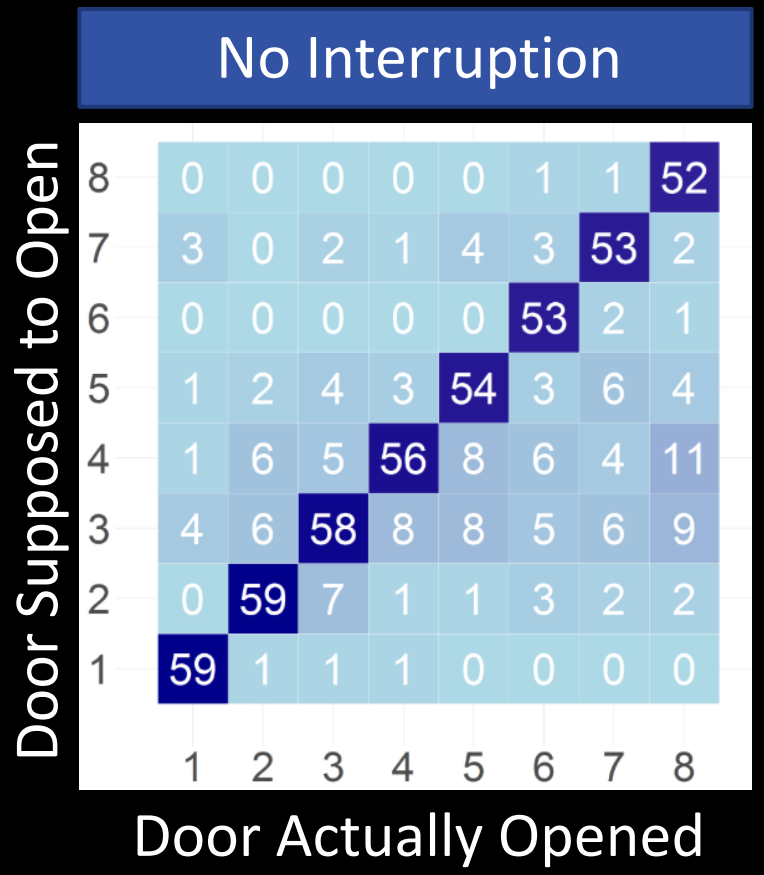


Interruption



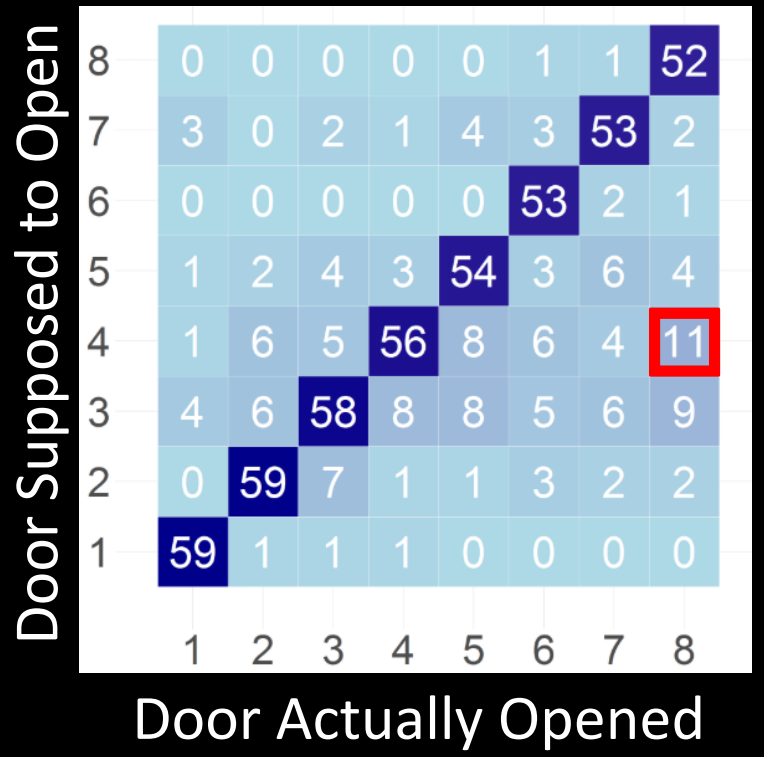
No Interruption > Interruption + Lag > Interruption

Data Collapsed Across Participants

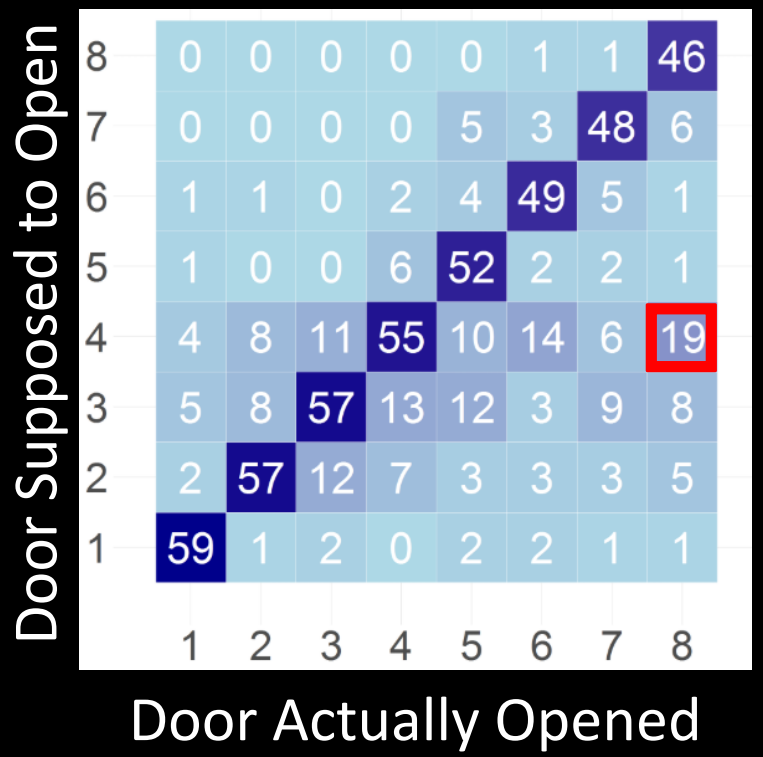


Data Collapsed Across Participants

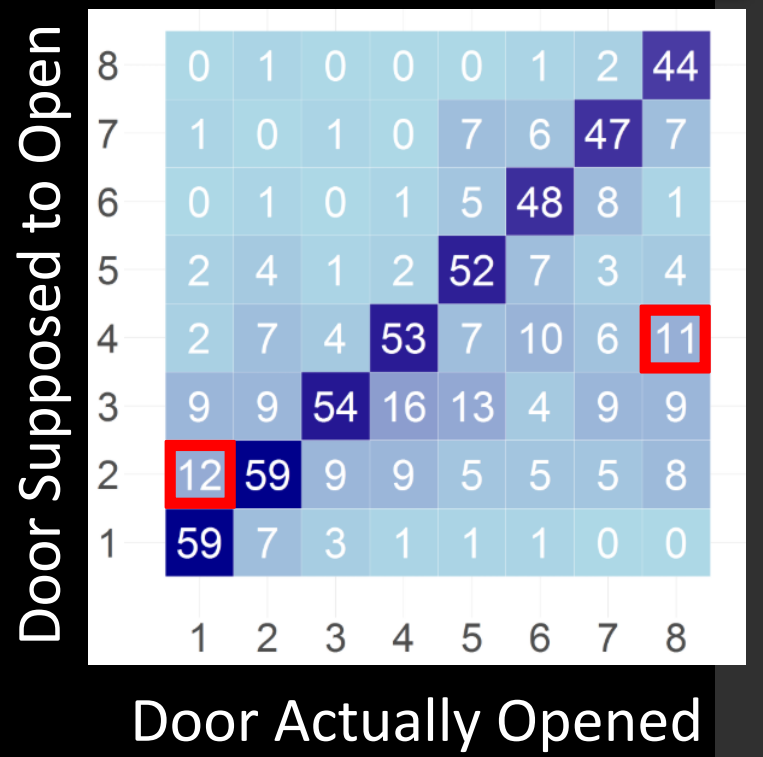
No Interruption



Interruption + Lag



Interruption



Any interesting patterns of responses?

More errors with interruptions

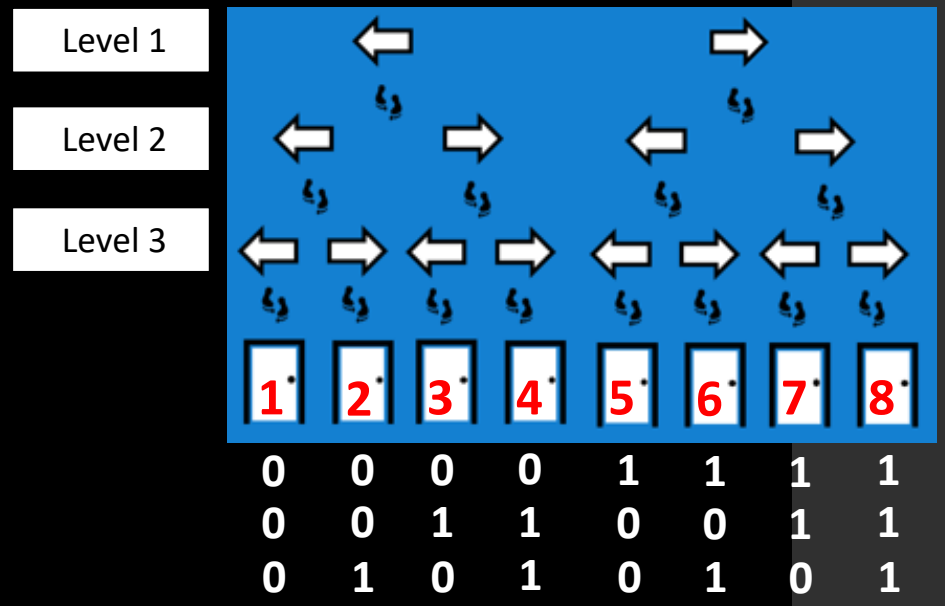
Maybe some systematic patterns?

Not enough data to draw any conclusions at this point

Conceptual Model

Goal of model – go through the task as a participant would

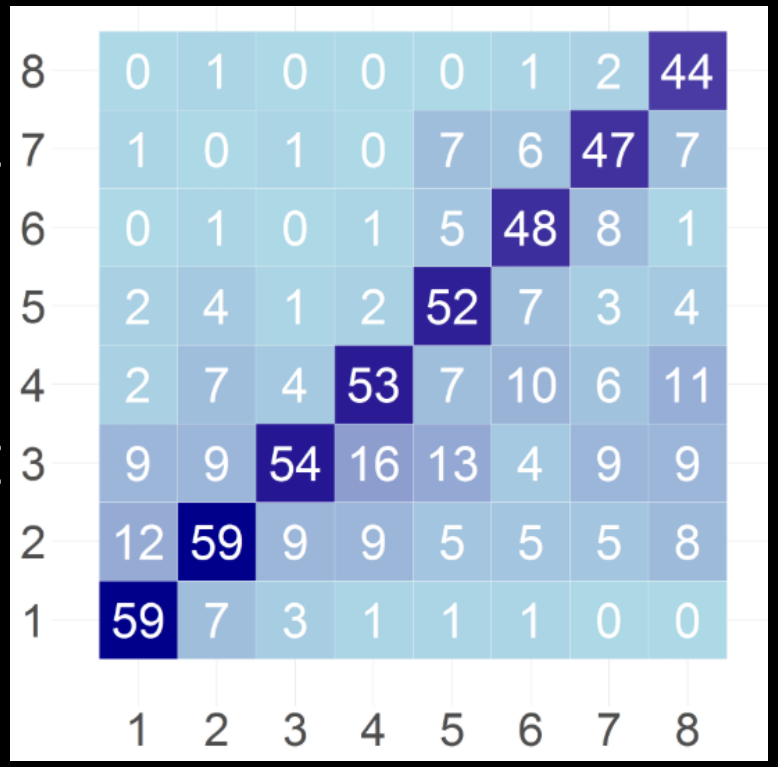
- Start at the top of the maze and open doors sequentially from left to right
- At every level, chooses to go left (0) or right (1)
- After 3 choices, reaches a door at the bottom
- Models feedback
- 2 possible sources of errors – parameters in the model (0 - 1)
  1. Level errors
  2. Door errors



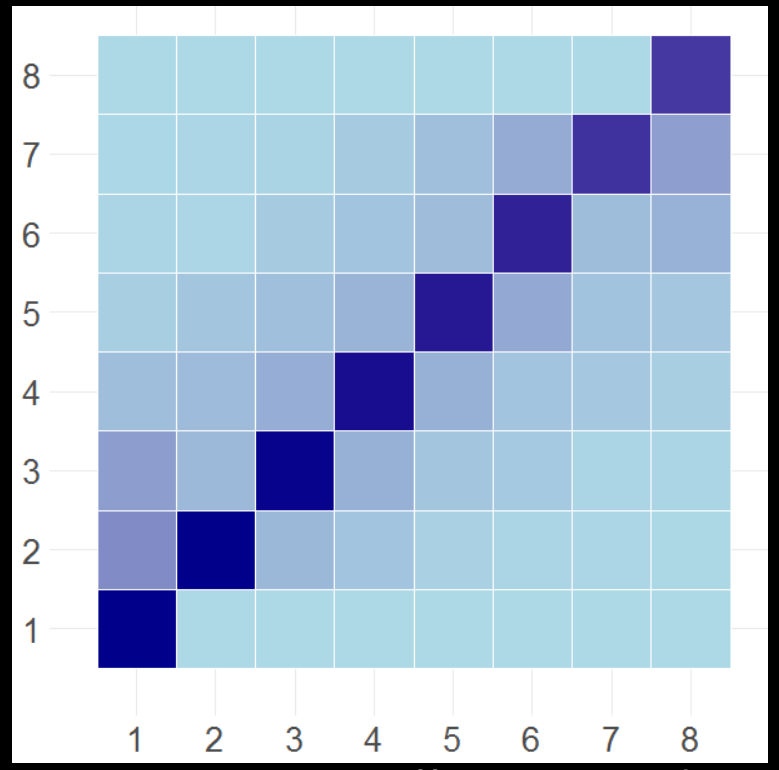
Goal of model: Try to understand impact of interruptions on the task and sparing effects of lags

Simulate data from the model with different parameter values (n=900)
Compare real to stimulated data

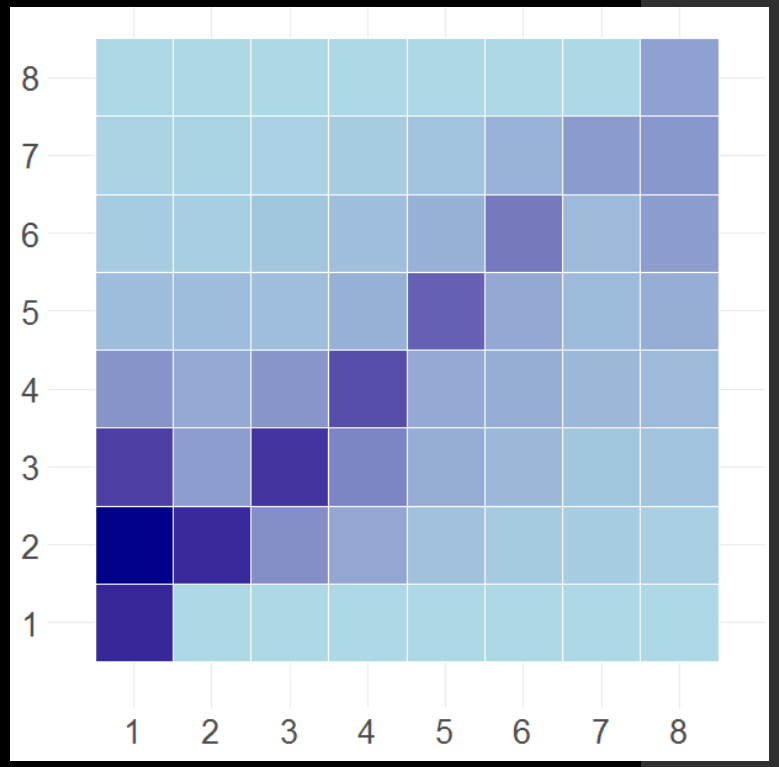
Data: Interruption Condition



Simulation: 0.1 Level & 0.3 Door Errors



Simulation: 0.3 Level & 0.1 Door Errors



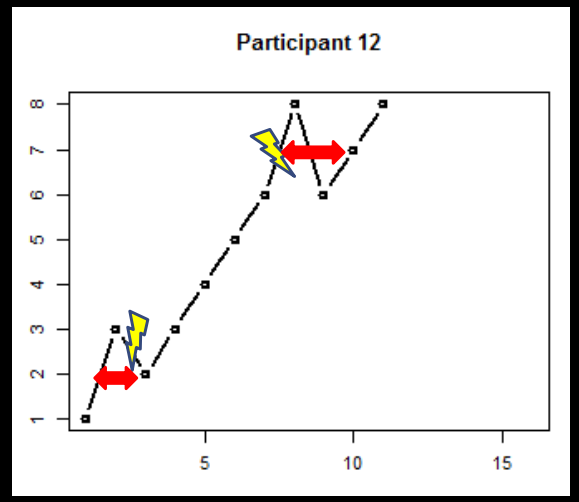
Quick recovery

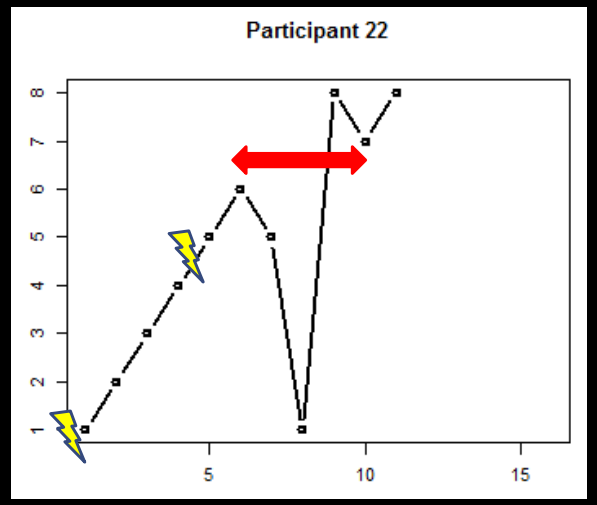
Longer recovery

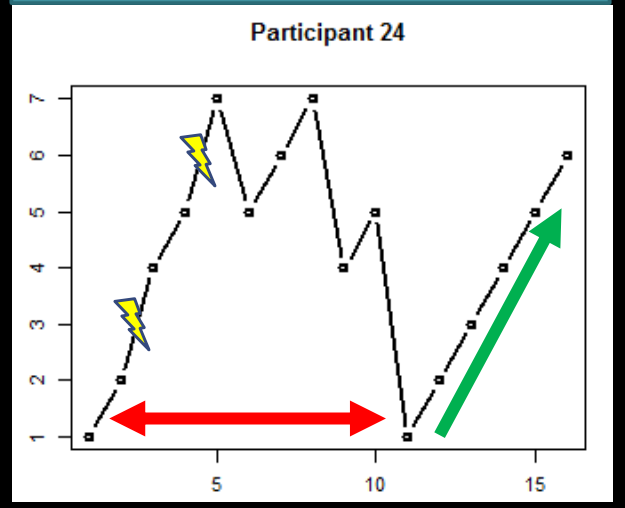
Confused at beginning, but resets

= interruption

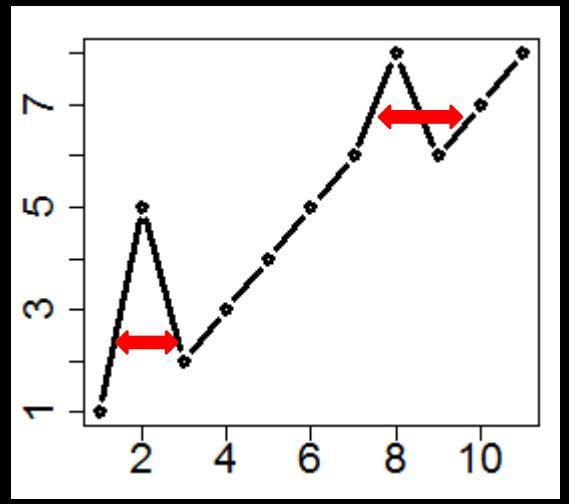
Data

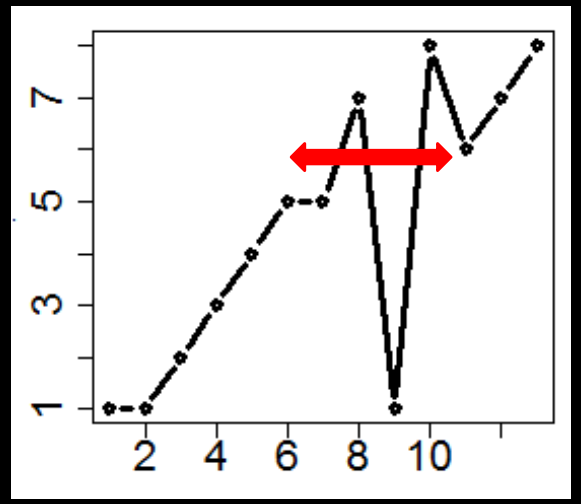


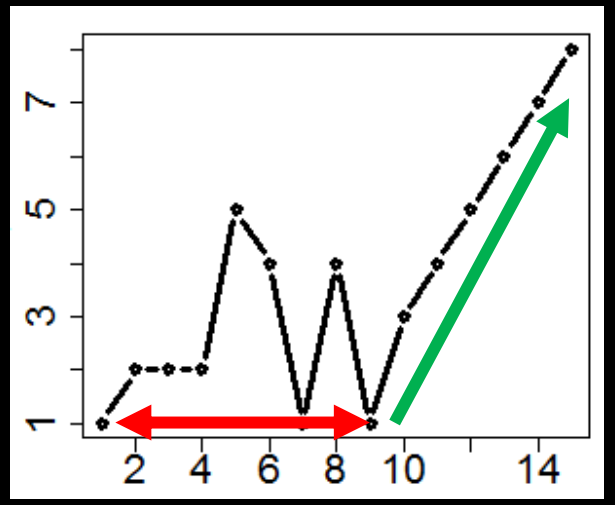




Simulated Data







Simulates level error

Simulates door error

Mimics patterns, but just due to random error

Modeling Summary

Increasing the error parameters in the model would be one way to simulate mistakes or interruptions

See whether we can make the model behave similarly to when people get interrupted

Interruption + lag = quicker recovery?

Interruption + lag = less door errors?

Conclusions

1. Interruptions are inevitable in everyday life, so finding strategies (i.e. interruption lags) can help mitigate some of the negative effects
2. Use modeling to:
   - Simulate errors people make
   - Help us understand the underlying mechanisms of why the lags are beneficial
3. Future Work: Give participants feedback after interruptions
   - "Level" Feedback
   - "Door" Feedback

Thank you!