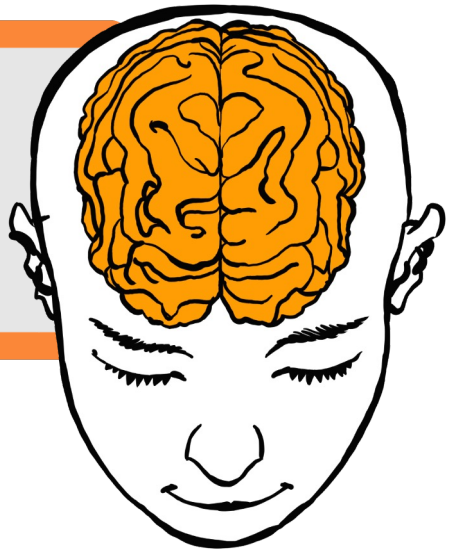
PreCont:
Continuous Prediction Error



November 16th, 2022

Lifespan Cognitive and Brain Development (LISCO) Lab
Goethe University Frankfurt

Pupillo, Ortiz-Tudela, & Shing

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

LISCO

THEORETICAL BACKGROUND

Events that are congruent with expectations are remembered better.
Unexpected information has been shown sometimes to be remembered better.

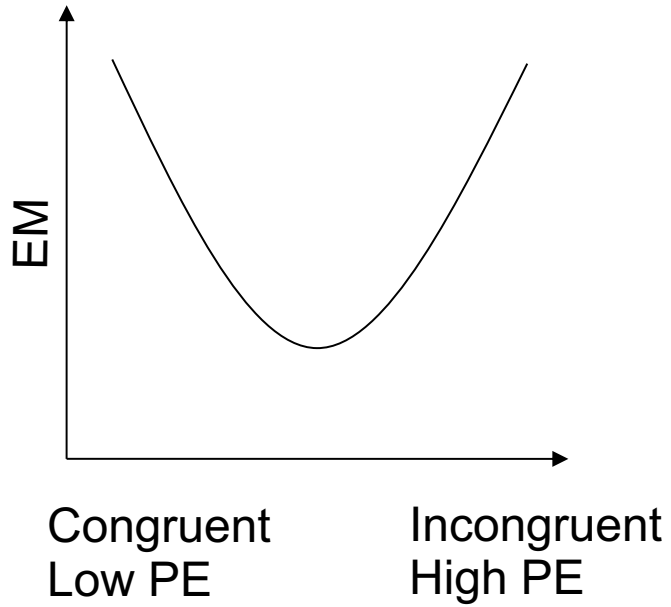
THEORETICAL BACKGROUND

The brain is proactive and continuously generates expectations based on schemas, Abstract knowledge about situations.

Events can match or mismatch our expectations.

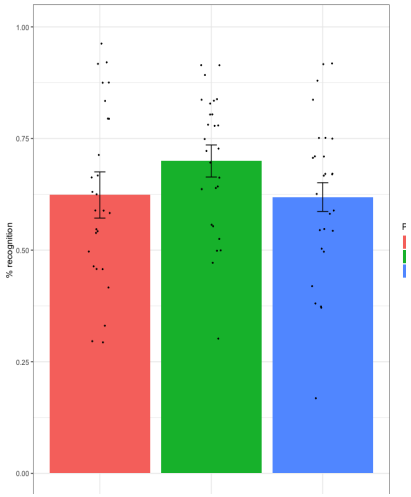
Whether or not expectations are matched influences how we encode new experiences into memory.

It has been suggested that the relationship between expectations and episodic memory is U-shaped:



THEORETICAL BACKGROUND

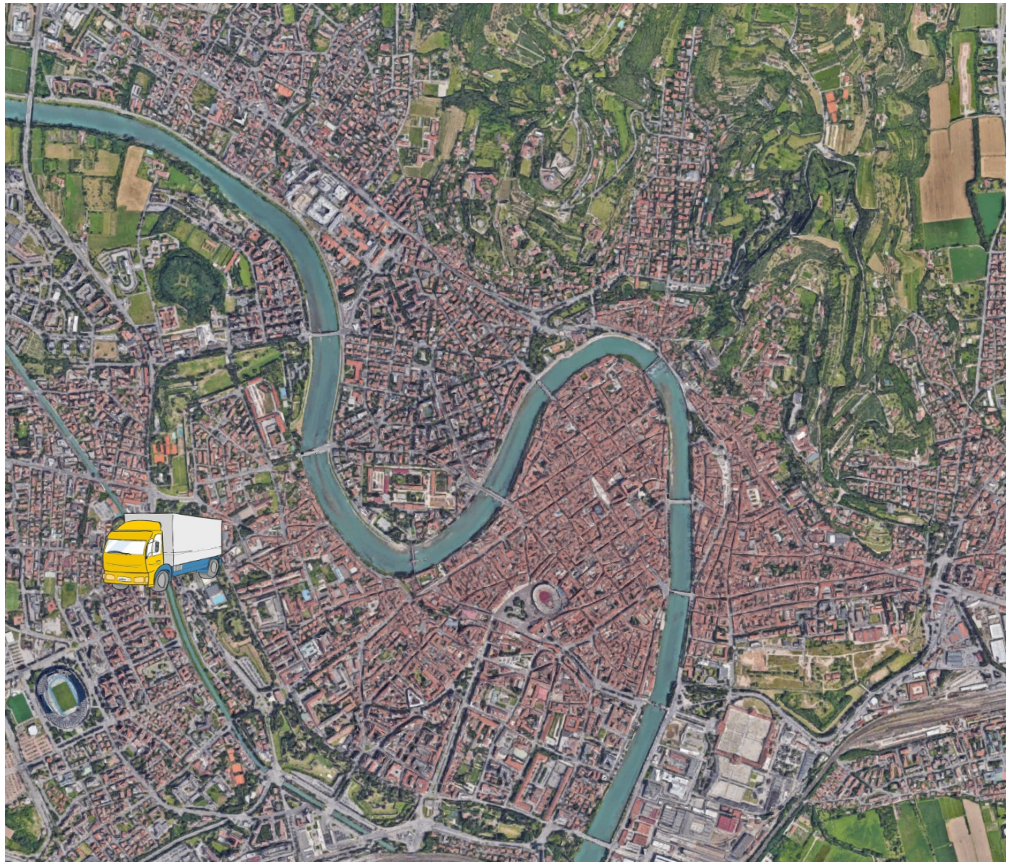
So far we have considered PE as a categorical variables, depending on the condition



Low PE Med PE High PE

In the current setup, we aim to derive a continuous PE

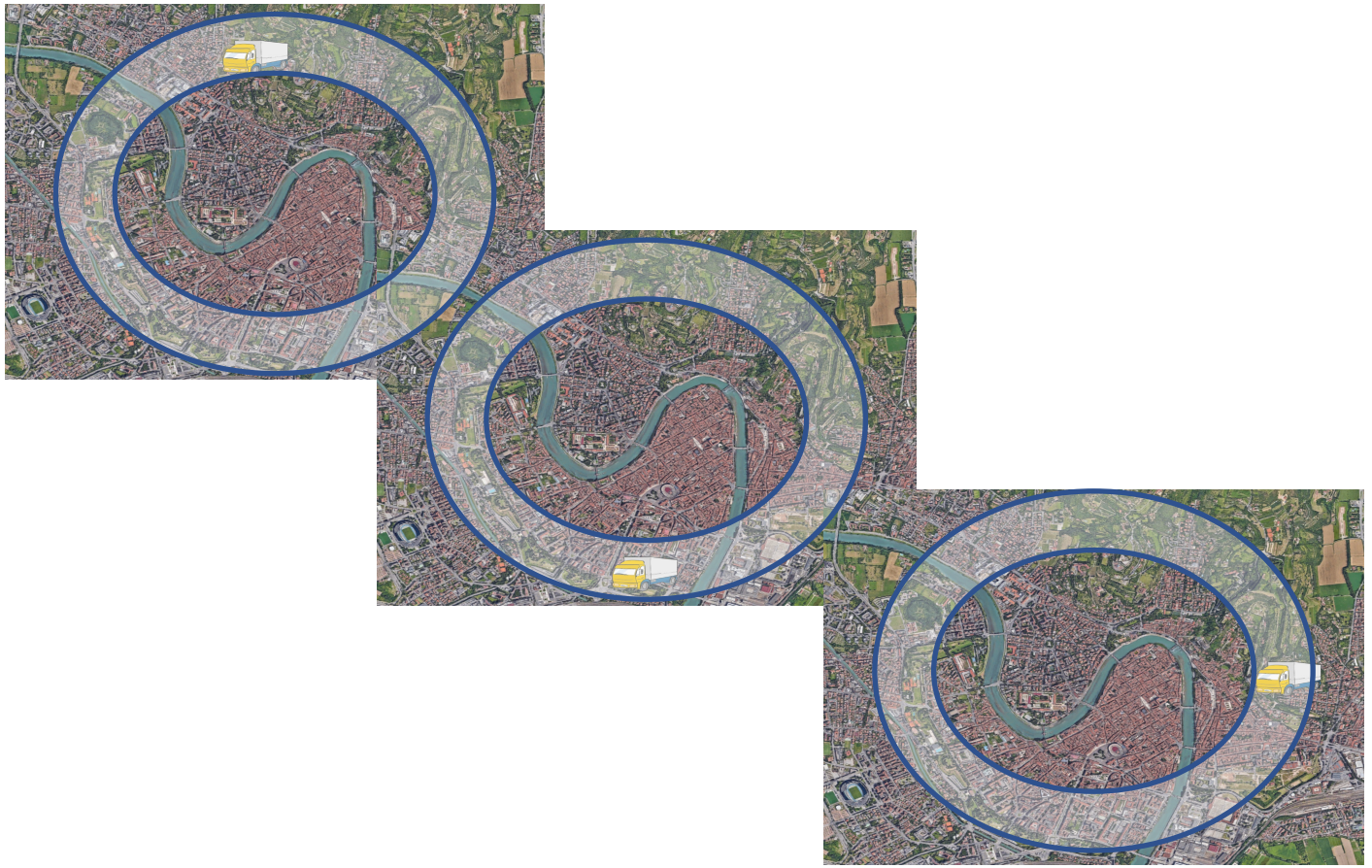
METHODS



“In each city, the truck has to stop at certain warehouses to drop off the goods”

METHODS

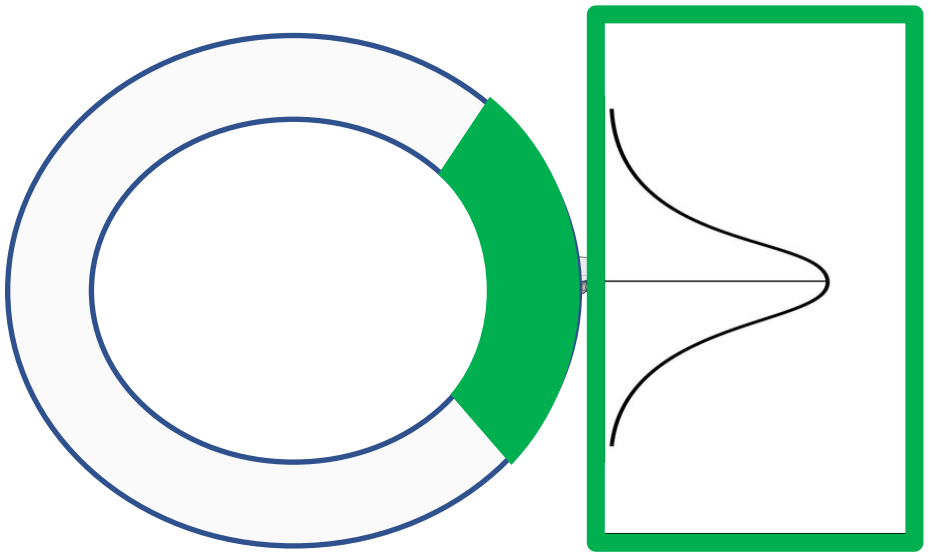
METHODS



“The truck will travel through a ring that surrounds the city”

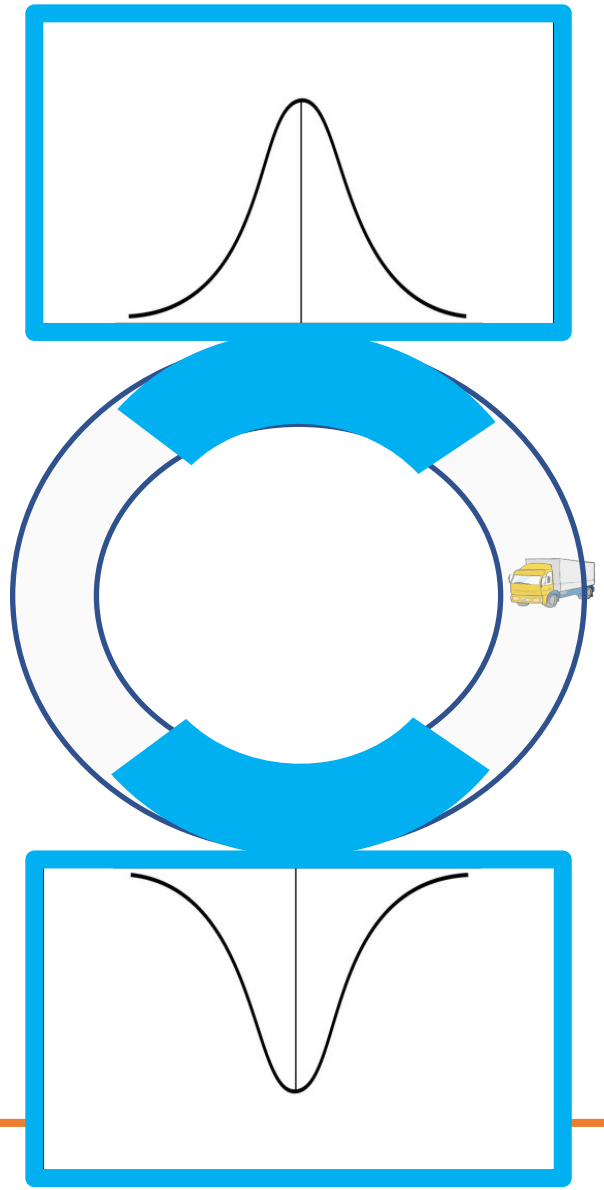
METHODS

N trials =150



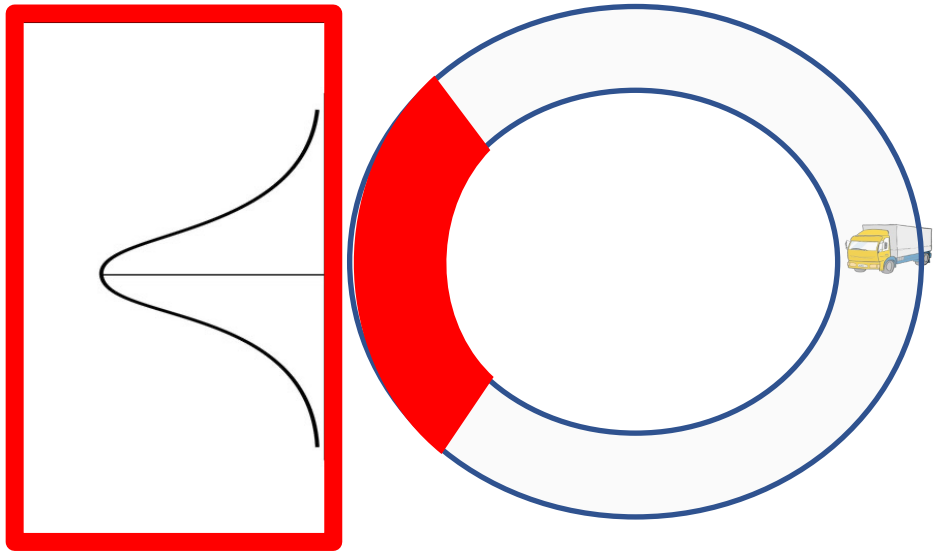
65% of the times
Von Mises distribution, κ = 10.
N = 90

METHODS



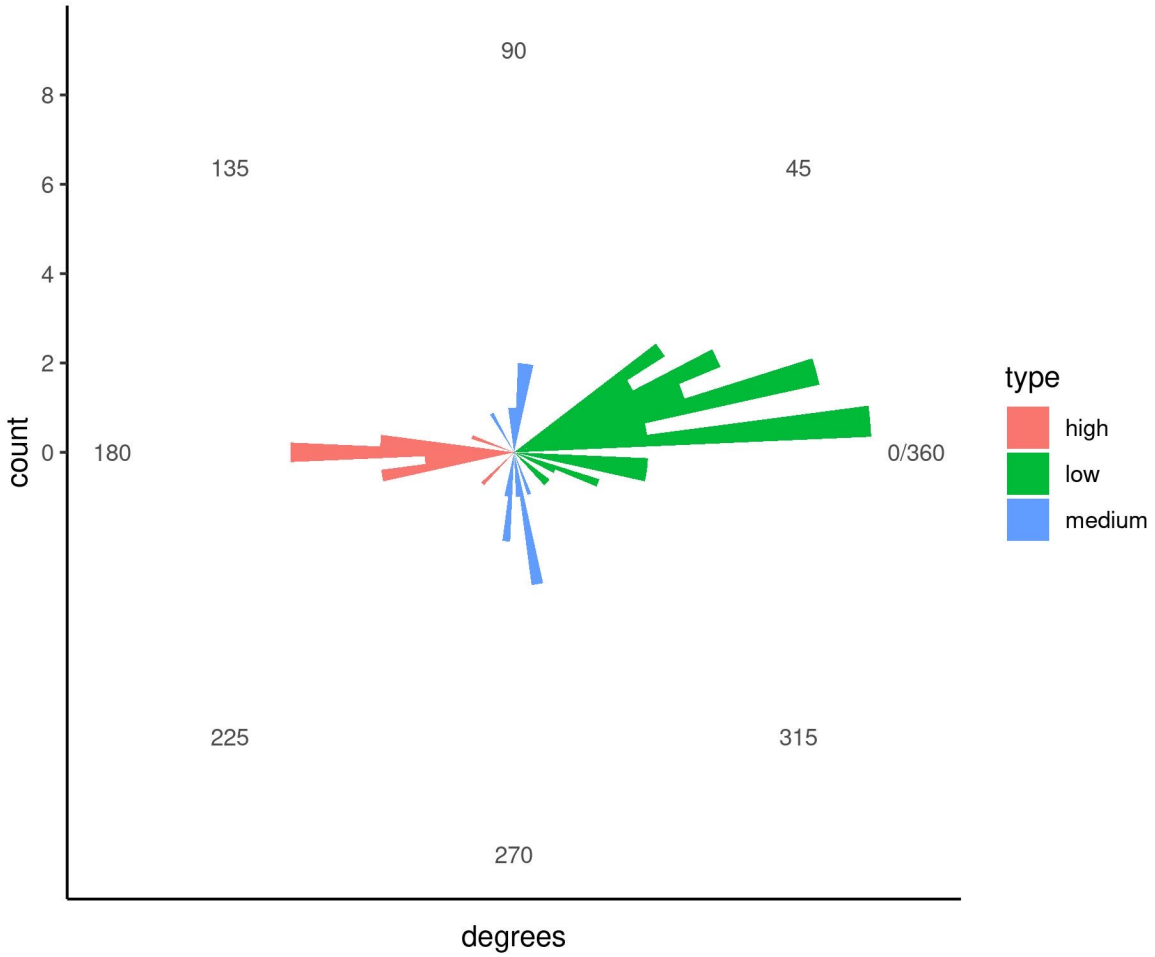
20% of the times
Von Mises distribution, κ = 10.
N = 30

METHODS

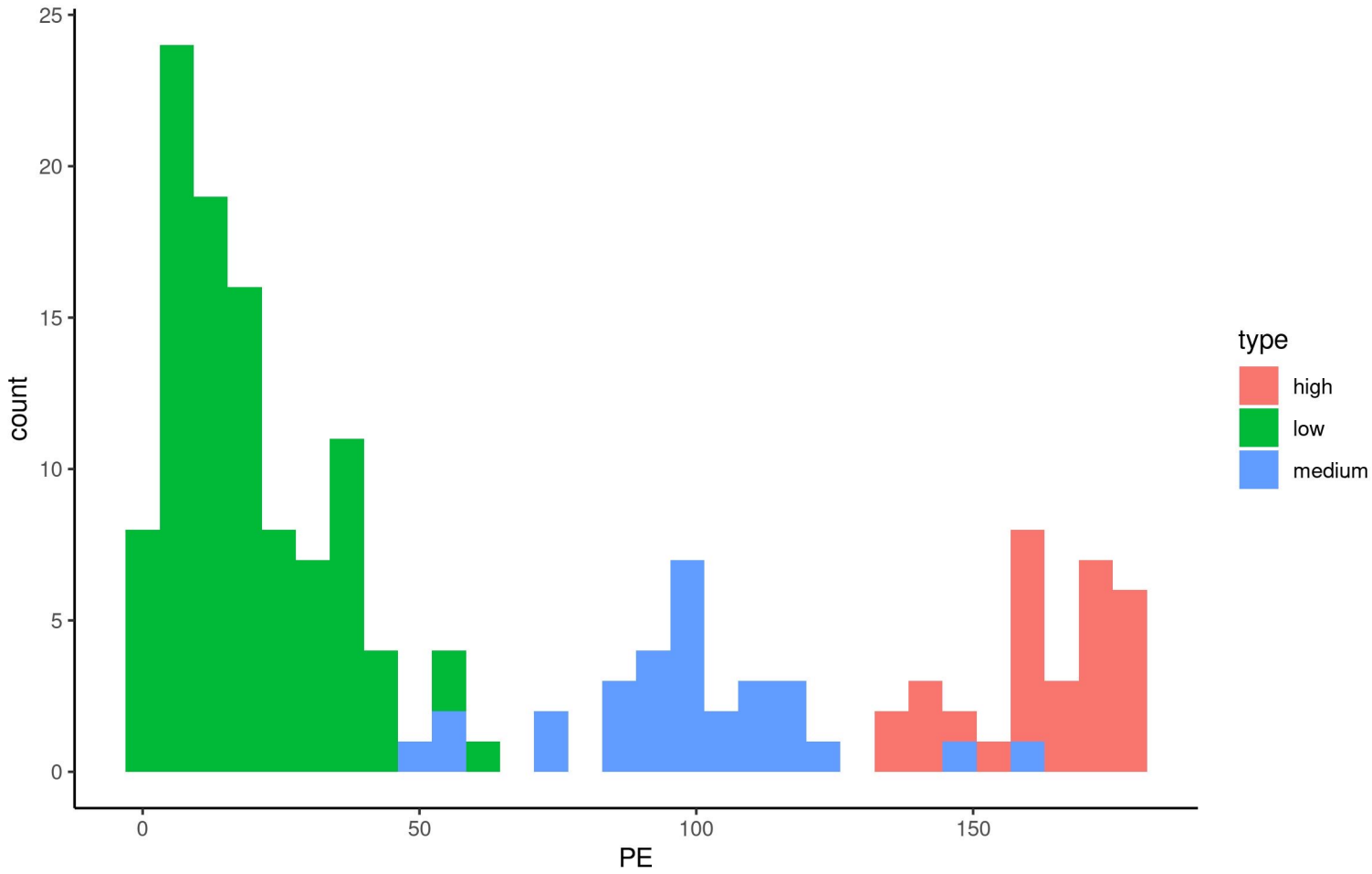


20% of the times
Von Mises distribution, κ = 10.
N = 30

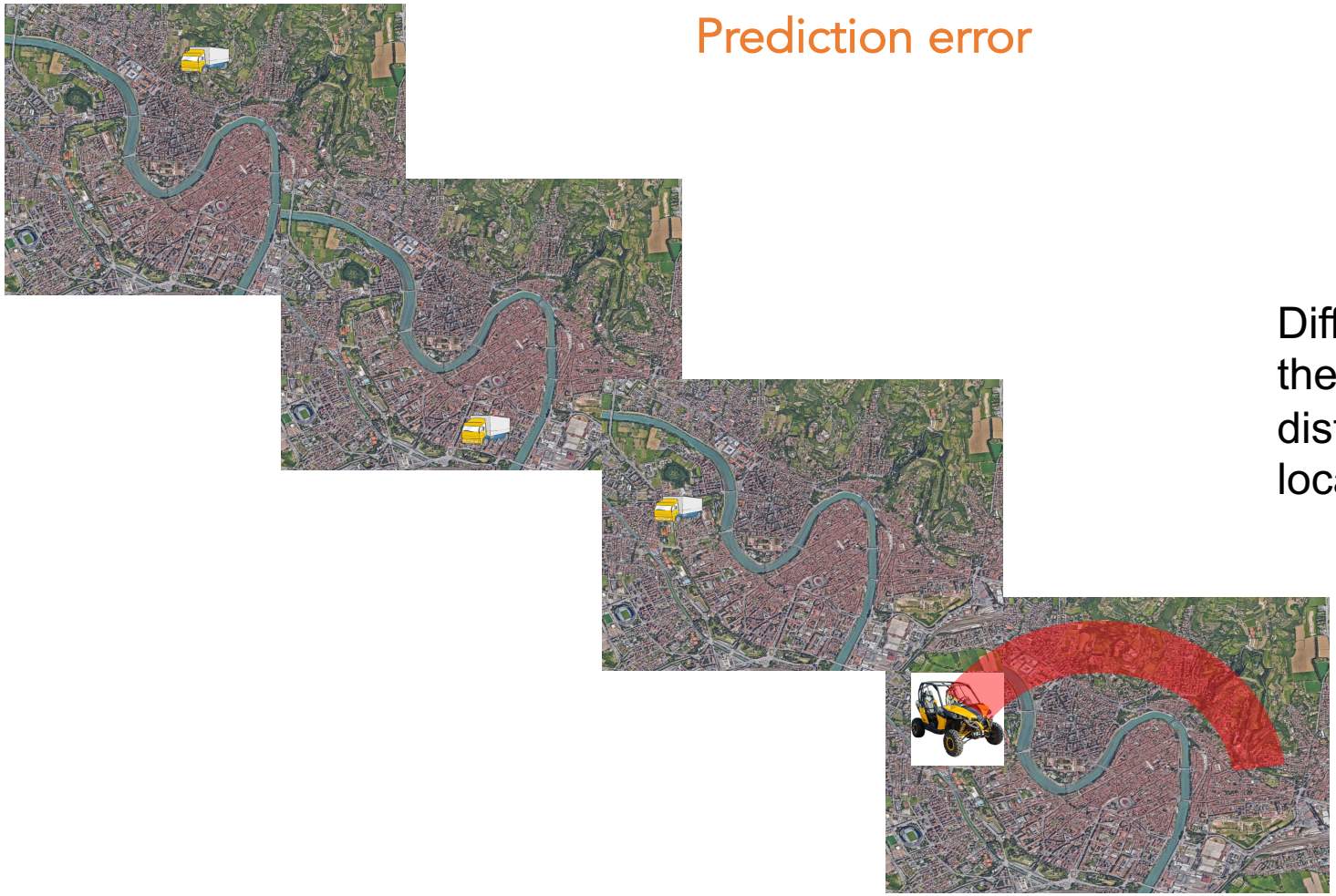
METHODS


90
135
45
8
6
4
2
0
count
180
0/360
225
315
270
degrees
type
high
low
medium

METHODS



Prediction error



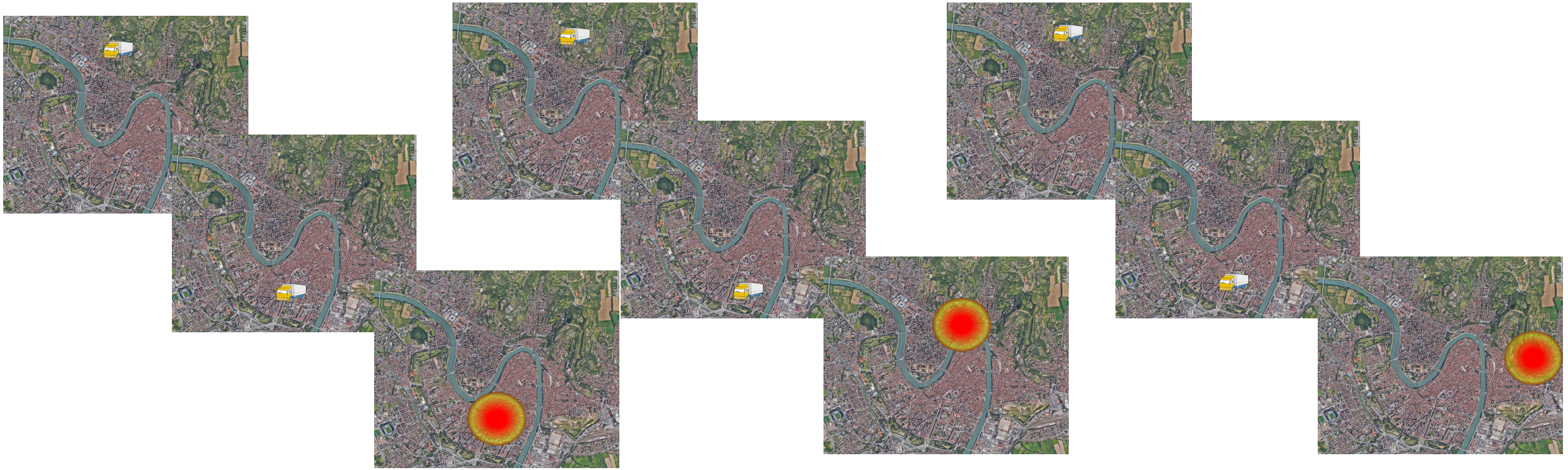
Difference between
the center of the low PE
distribution and presented
location

METHODS - Fixations

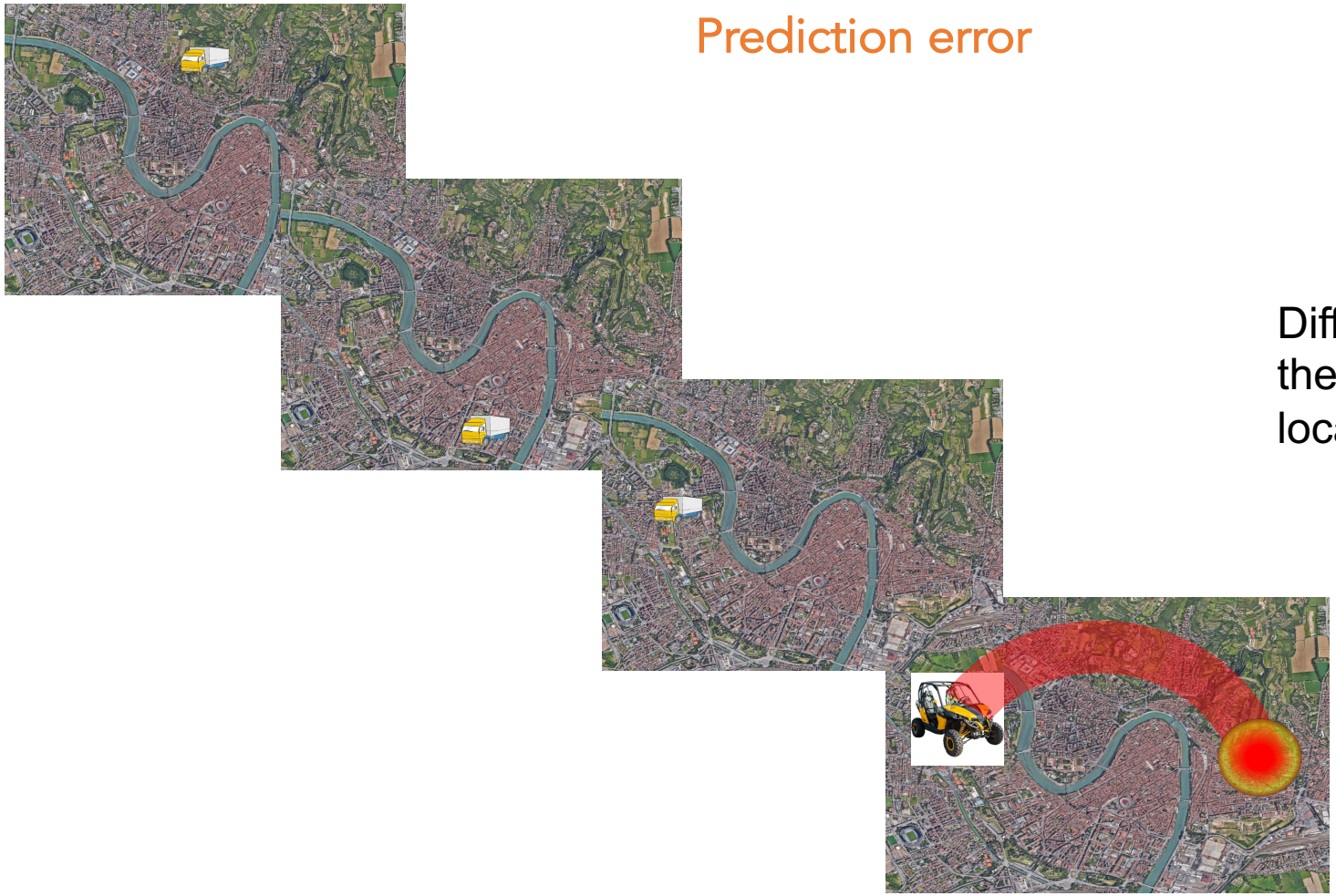
t=1

t=5

t=20



Prediction error

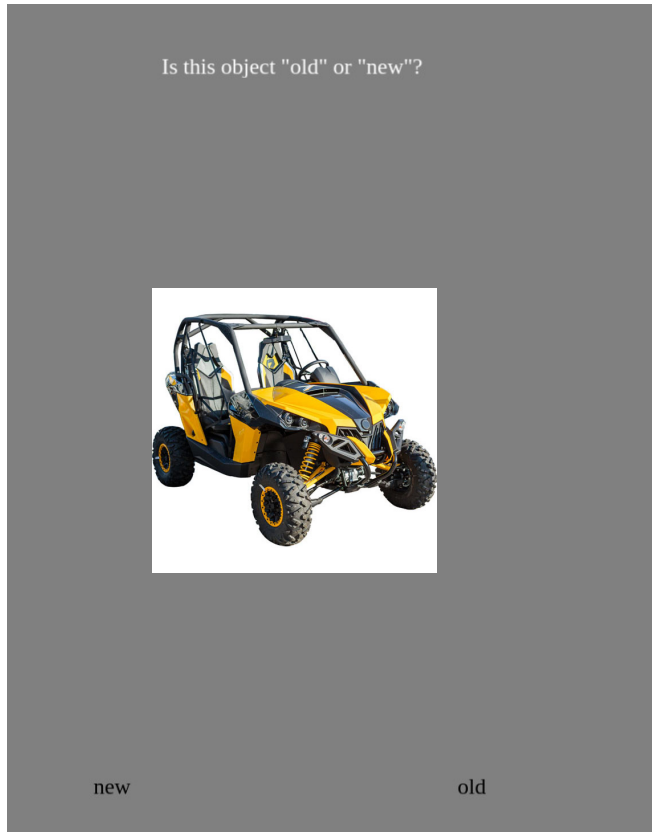


Difference between
the fixations and presented
location

METHODS

Recognition Task

Old/New judgements



Confidence ratings

Location Memory

Where was the item delivered?

Recognition Task

Location error = distance between location at encoding and reported location at retrieval

METHODS

In order to reduce the bias towards the most frequent location in the low PE trials, and make them more comparable with the high PE ones, we have two blocks with two different sequences

Block 1

Block 2

METHODS

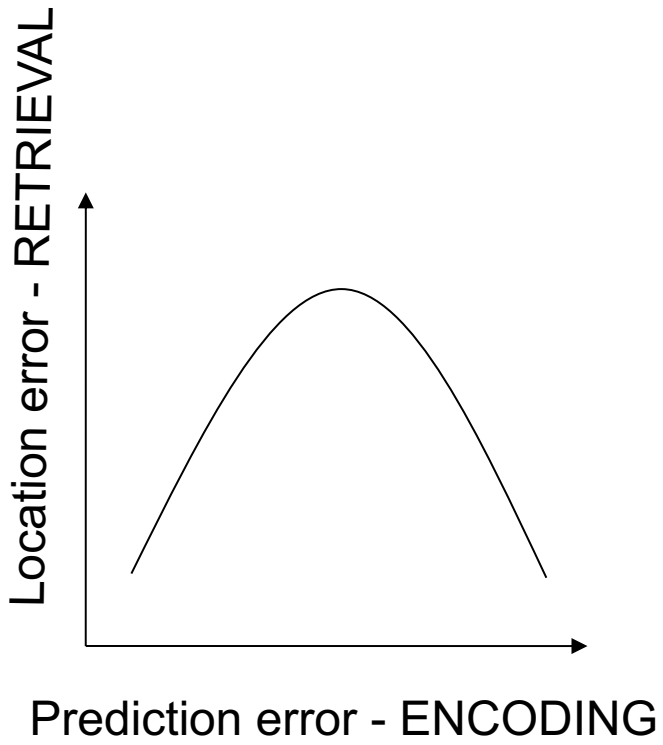
We also added singletons: trials in which the trajectory of the truck is not predictable. In these trials, the truck starts its journey from a quadrant that is different from the predictable trials. These trials occur randomly and constitute ~1/3rd of the total sample.

METHODS

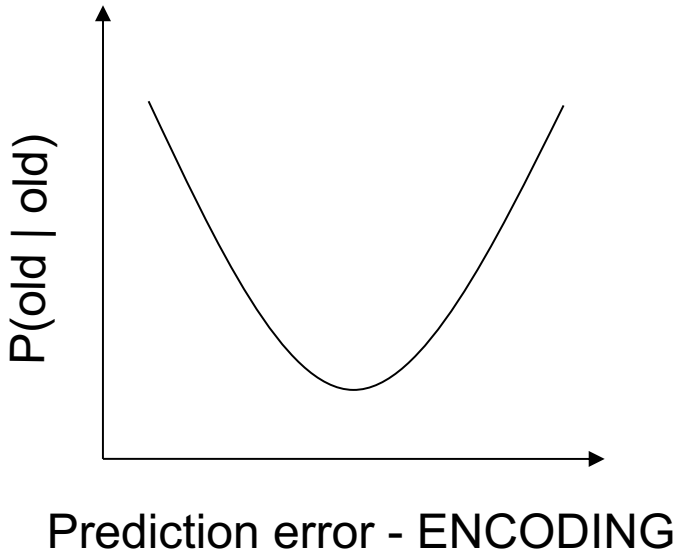
- Continuous
- Unfold over time
- Schema is not semantic (it does not require consolidation)
- No choice from the participant (no choice-based biases)

EXPECTED RESULTS

Location memory



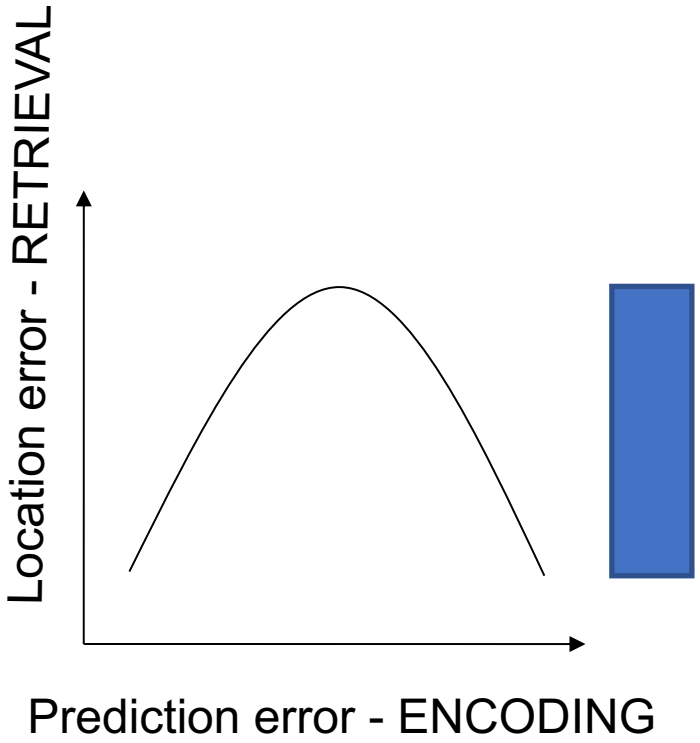
Item Memory



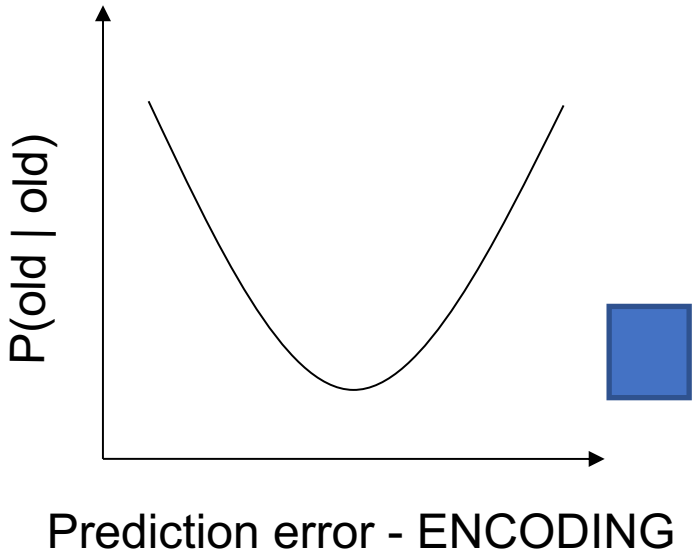
EXPECTED RESULTS

Singletons

Location memory



Item Memory



Computational model

$$\mu_1 = \mu_0 + (x - \mu_0)\frac{\sigma_0^2}{\sigma^2 + \sigma_0^2}$$

Murphy (2007)

Thank you!