

# A Theory of Memory for Items and Associations

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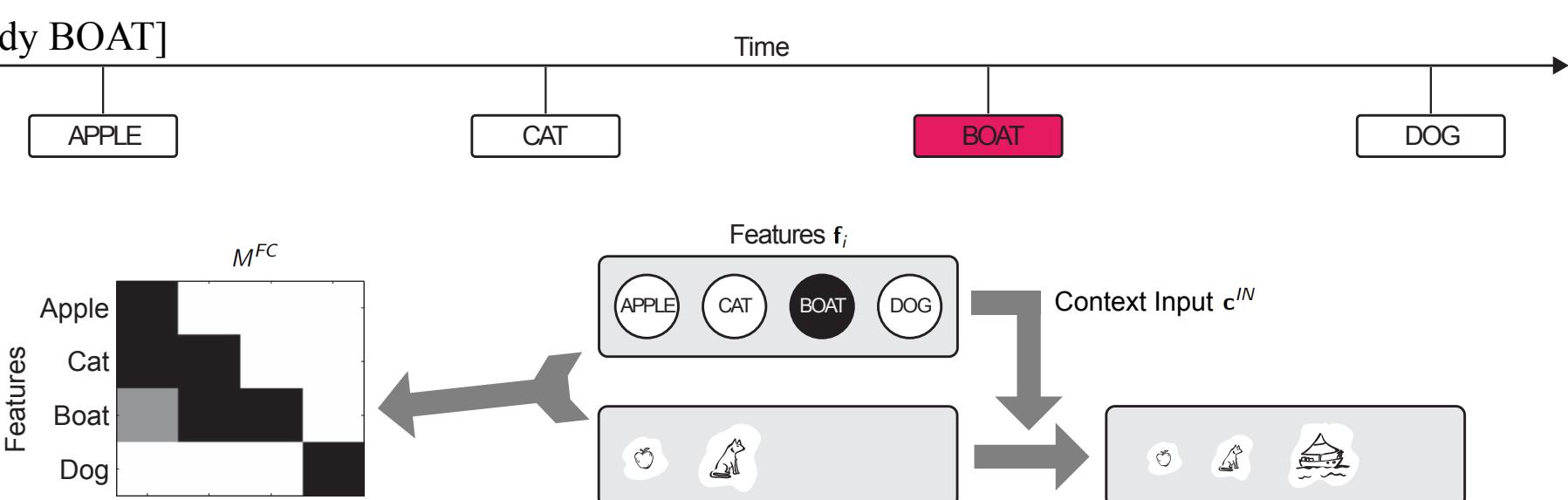
## INTRODUCTION

- In episodic memory, **item-specific information** represents the encoding of an item occurring in a particular context, while **associative information** represents the encoding of the relation between two co-occurring items.
- Context Maintenance and Retrieval (CMR) models** conceive of episodic memory as the interaction between content and context. Recalling a memory reinstates its earlier context, which in turn updates the present state of context and associates with subsequent experiences. CMR Models have offered an elegant account for a wide range of phenomena observed in studies of free recall (Lohnas, Polyn, & Kahana, 2015; Pazdera & Kahana, 2022).
- We aim to provide a unified theoretical account of memory for items and associations within the framework of CMR models.

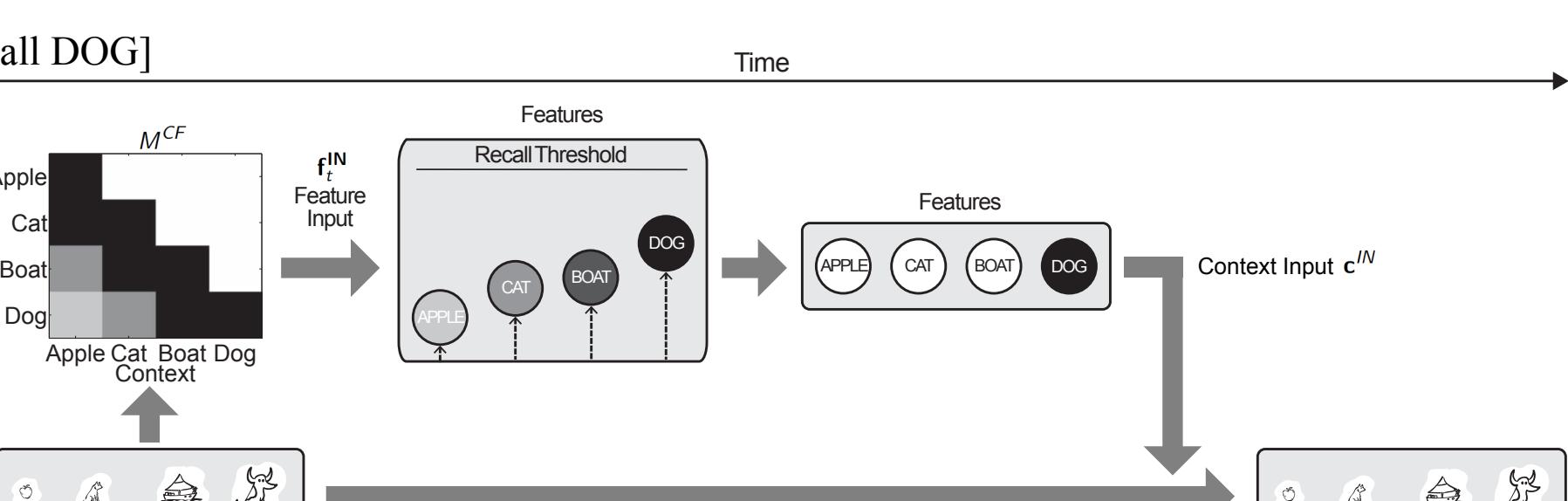
## MODEL

### ITEM

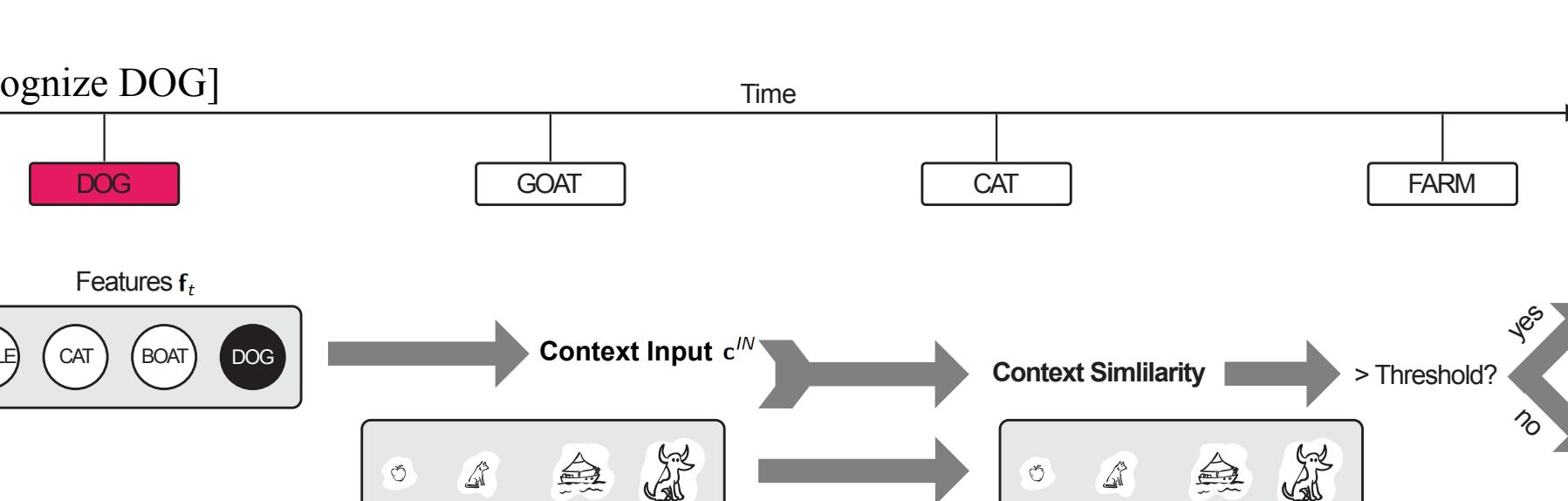
#### Encoding



#### Recall (free recall)

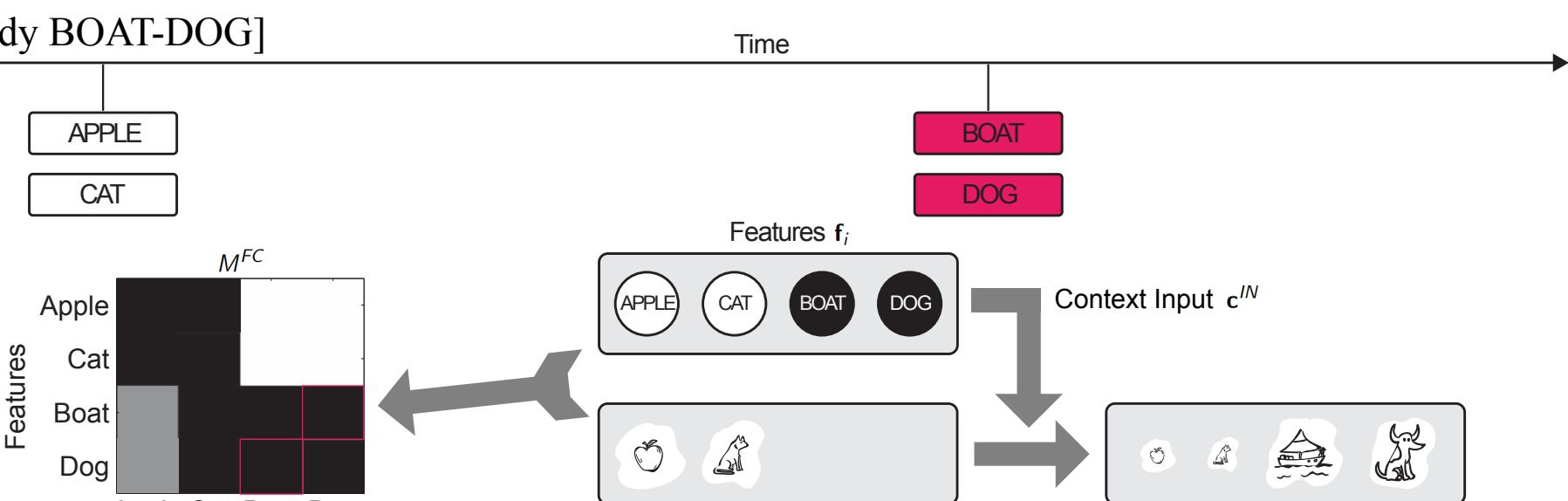


#### Recognition

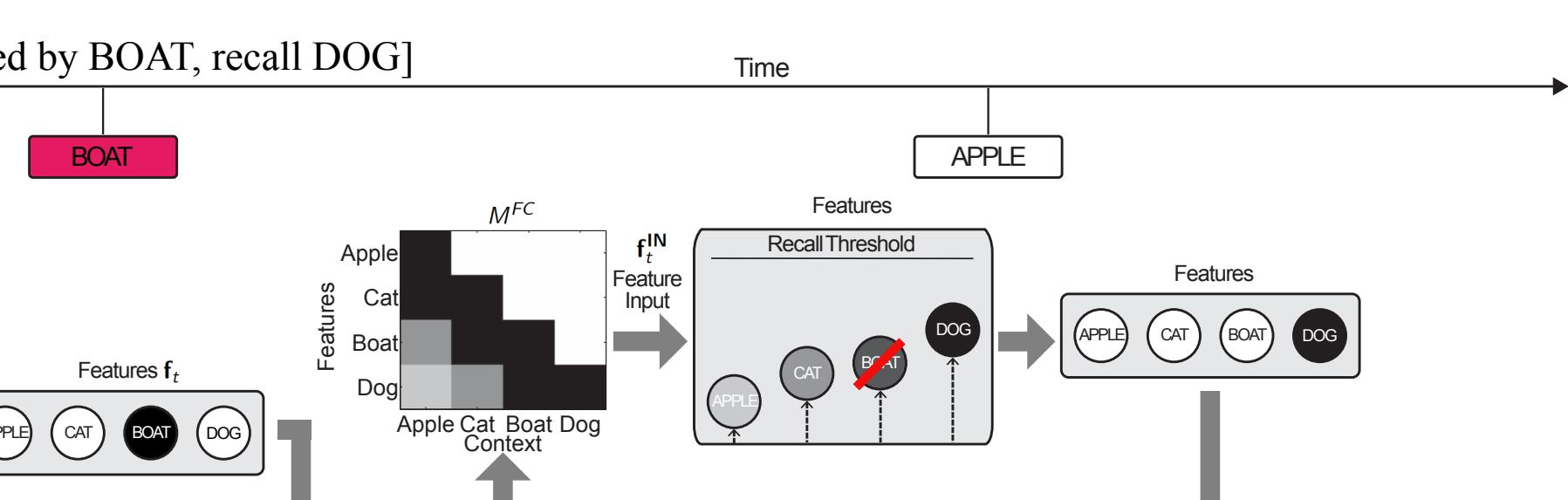


### ASSOCIATION

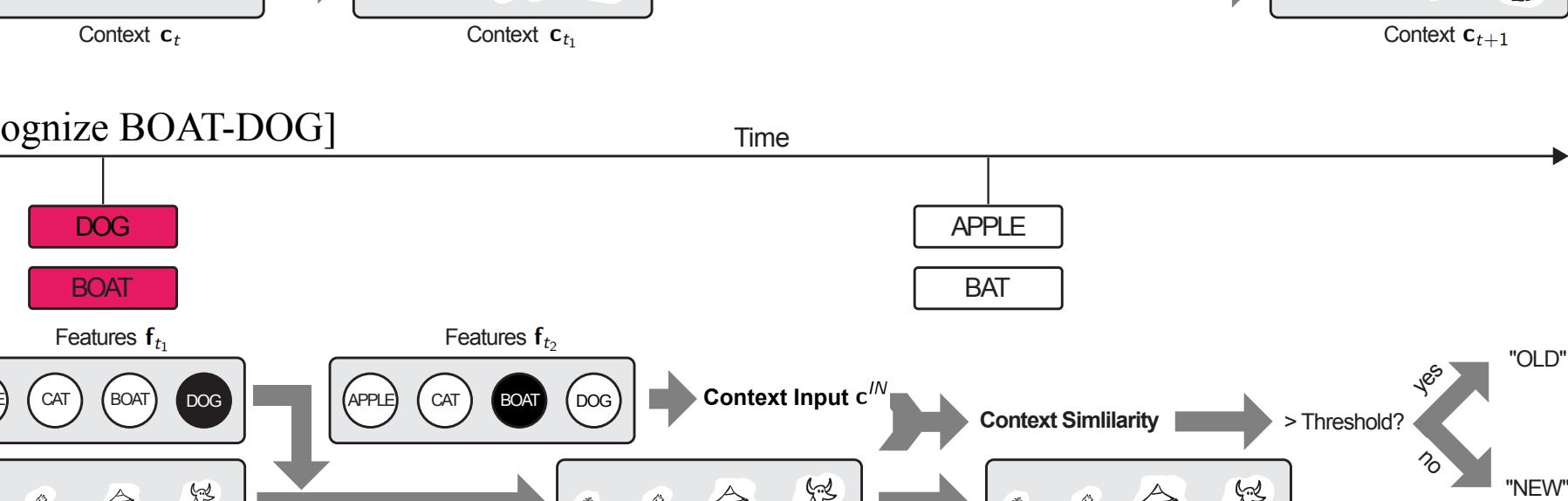
#### Encoding



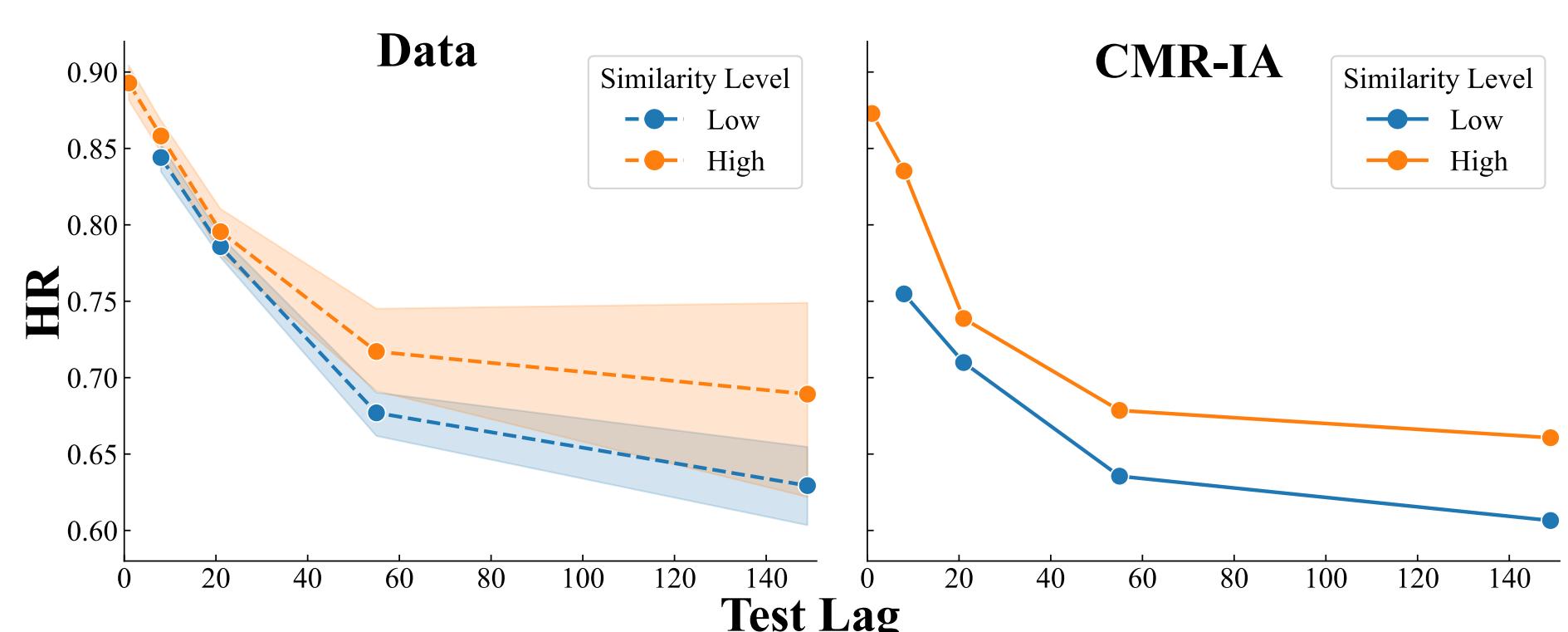
#### Recall (cued recall)



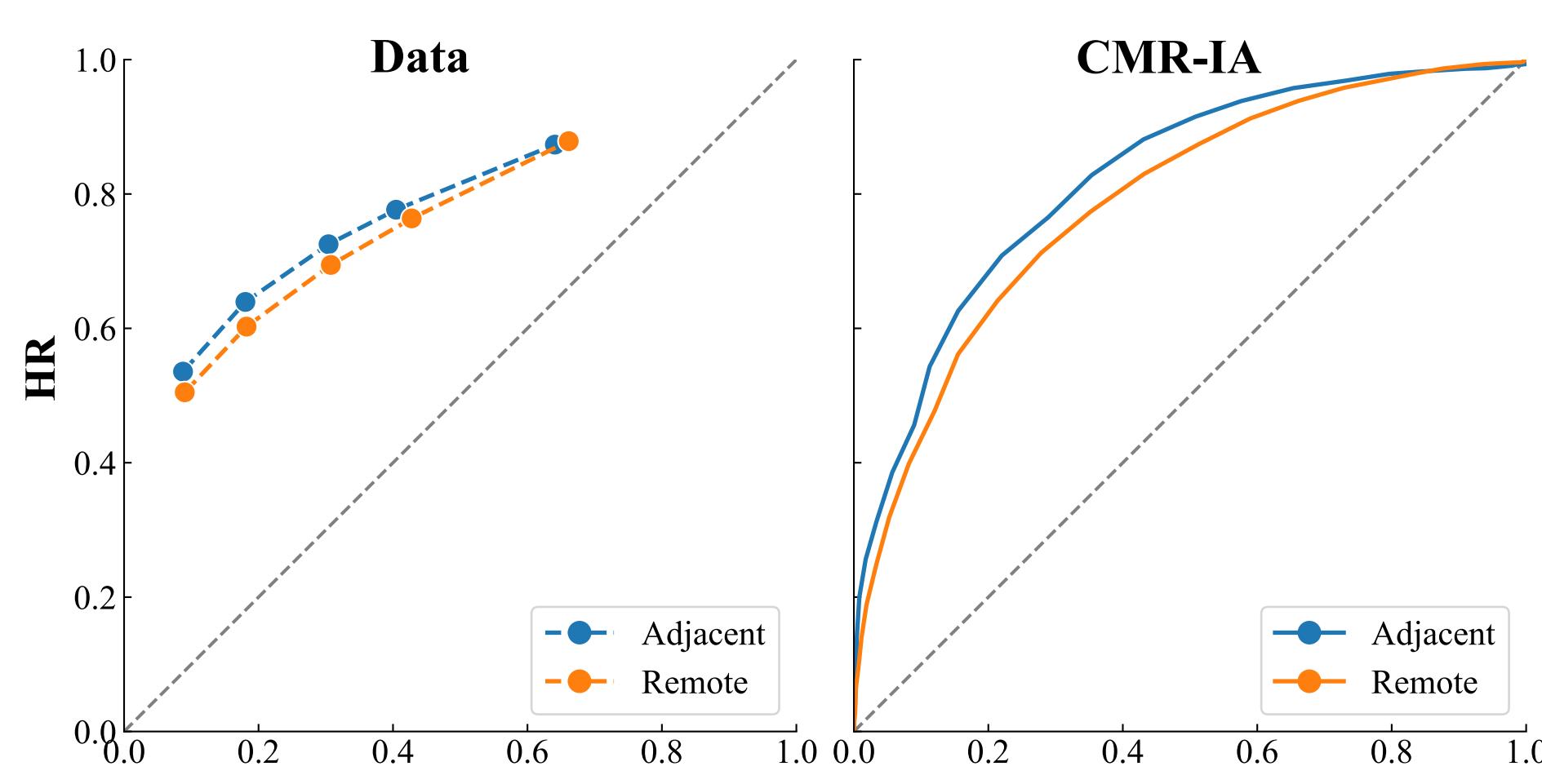
#### Recognition



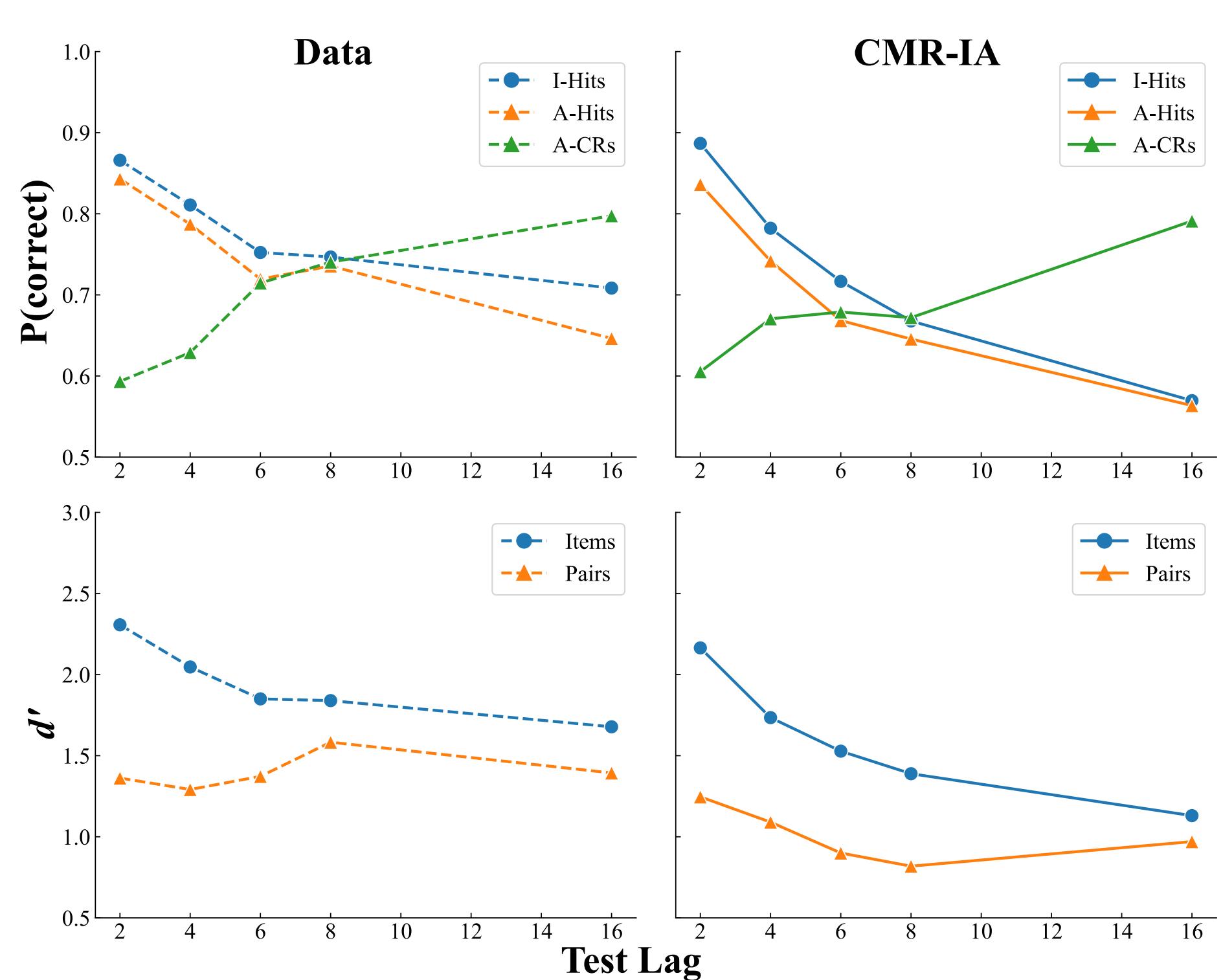
## 1. Recency and Similarity Effects in Item Recognition



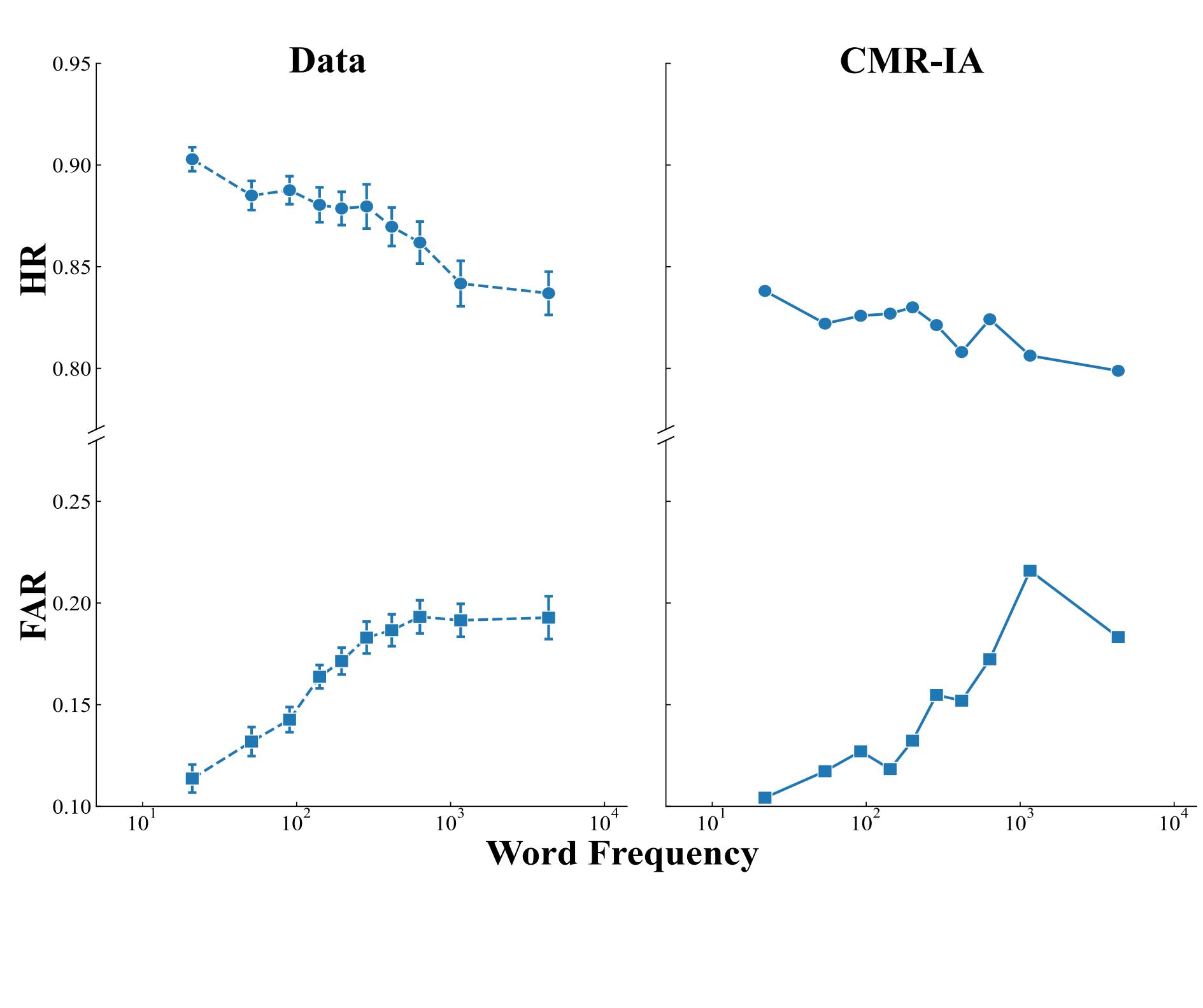
## 2. Successive-probe Contiguity Effects in Item Recognition



## 3. Differential Forgetting of Items and Associations

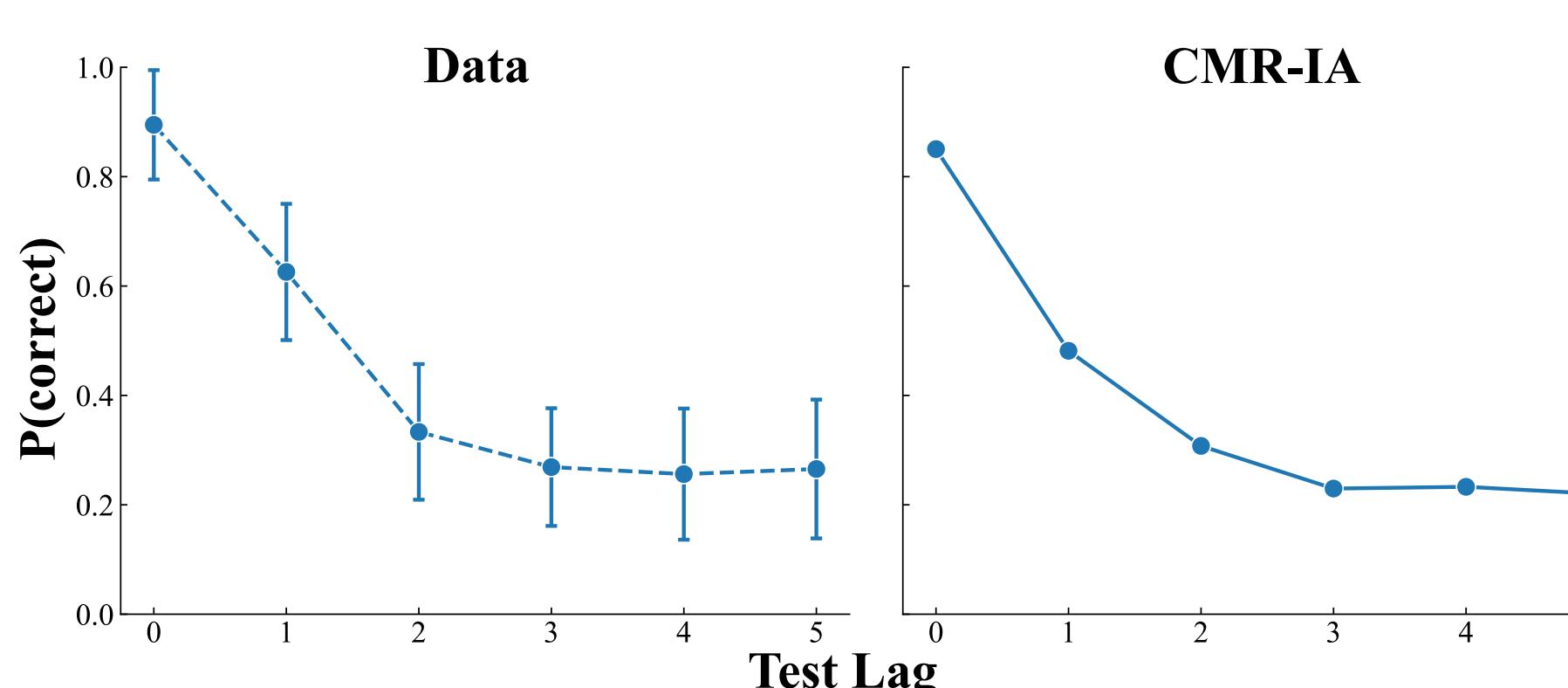


## 4. Word Frequency Effects



## SIMULATION RESULTS

### 5. Serial Position Effects in Cued Recall



### 8. Associative Symmetry

	Congruent	Incongruent
	Test 1	Test 1
Data	+ 0.319 0.012	+ 0.293 0.122
Test 2	- 0.006 0.663	- 0.049 0.537
	Yule's Q = 0.94	Yule's Q = 0.96
	Test 1	Test 1
CMR-IA	+ 0.299 0.049	+ 0.297 0.097
Test 2	- 0.030 0.623	- 0.033 0.574
	Yule's Q = 0.97	Yule's Q = 0.94

### 9. Successive Tests of Recognition and Cued Recall

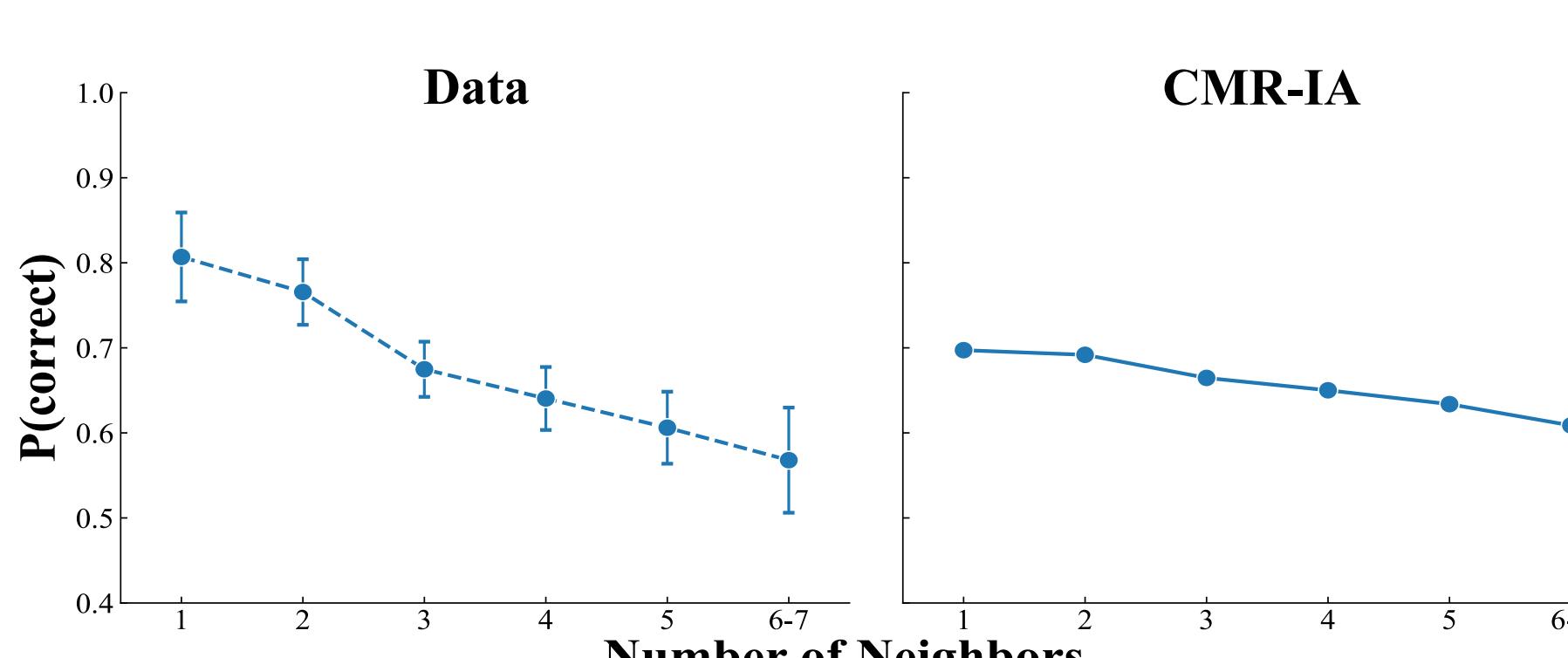
#### Data / CMR-IA

Condition	P(Rc)	HR	FAR	d'	Q
Item	0.19 (.01)	0.67 (.02)	0.15 (.02)	1.56 (.07)	0.57 (.05)
Pair	<b>0.090 (.001)</b>	<b>0.611 (.004)</b>	<b>0.249 (.005)</b>	<b>0.971 (.015)</b>	<b>0.573 (.016)</b>
Associative	0.30 (.03)	0.80 (.02)	0.12 (.01)	2.20 (.11)	0.71 (.04)

#### Data / CMR-IA

Condition	Test 1	P("Yes")	Test 2	P("Yes")	Yule's Q
Different Item	A	0.82 (.020)	B	0.68 (.030)	0.26 (.10)
Item/Pair	A	<b>0.747 (.014)</b>	A	<b>0.749 (.014)</b>	<b>0.296 (.044)</b>
Pair/Item	A	0.82 (.016)	A-B	0.85 (.020)	0.64 (0.12)
Pair/Item	B	<b>0.766 (.011)</b>	A-B	<b>0.910 (.007)</b>	<b>0.684 (.029)</b>
Same Item	A	0.91 (.018)	A	0.85 (.021)	0.59 (0.10)
Same Item	B	<b>0.885 (.010)</b>	B	<b>0.759 (.014)</b>	<b>0.606 (.032)</b>
Intact Pair	A	0.81 (.017)	A	0.82 (.017)	0.86 (0.03)
Intact Pair	B	<b>0.789 (.013)</b>	B	<b>0.805 (.012)</b>	<b>0.861 (.018)</b>
Repeated Lure	X	0.90 (.022)	A-B	0.92 (.019)	0.94 (0.02)
Repeated Lure	X-Y	<b>0.889 (.017)</b>	X-Y	<b>0.895 (.014)</b>	<b>0.843 (.012)</b>
Non-repeated Lure	C	0.90 (.020)	D	0.91 (.018)	0.54 (0.12)
Non-repeated Lure	E-F	<b>0.070 (.009)</b>	G-H	<b>0.06 (.009)</b>	—
Non-repeated Lure	E-F	<b>0.113 (.005)</b>	G-H	<b>0.109 (.004)</b>	—

### 7. Similarity Effects in Cued Recall



## CONCLUSIONS

- We refer to our models as Context Maintenance and Retrieval Model for Items and Associations (CMR-IA).
- CMR-IA provides a unified account for a wide range of phenomena in recognition and cued recall as well as their interactions. It emphasizes the importance of retrieved context in episodic memory.
- Next steps: develop a mechanism for reaction time; add source features of study items.

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