Multinomial Processing Tree Models of Recognition Memory

Joachim Vandekerckhove and Michael Lee

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  - e.g., discrete decisions rather than continuous response times
- MPTs make assumptions about how the different categories of behavior could be generated, in terms of probabilistic processes controlled by underlying psychological variables

Recognition memory task

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- Behavior can be summarized in terms of four counts

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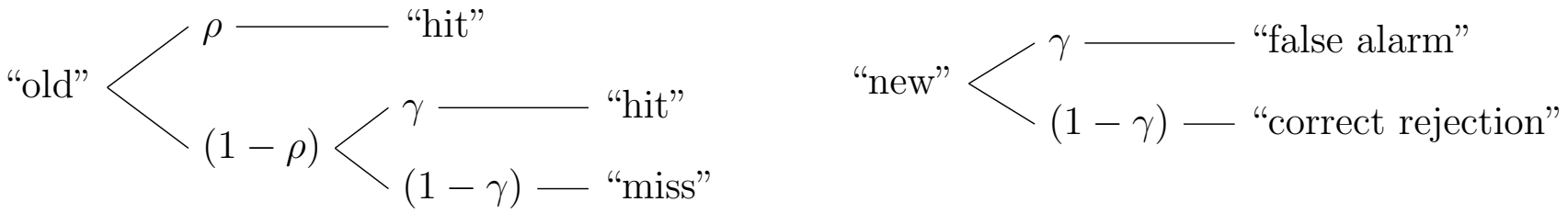
One-High Threshold Model



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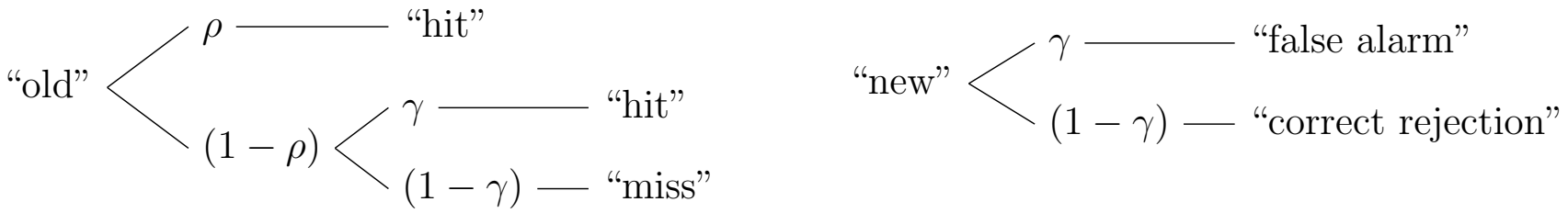

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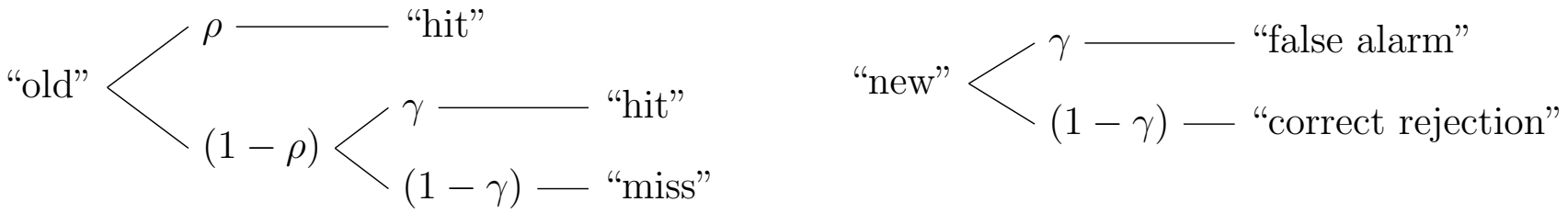

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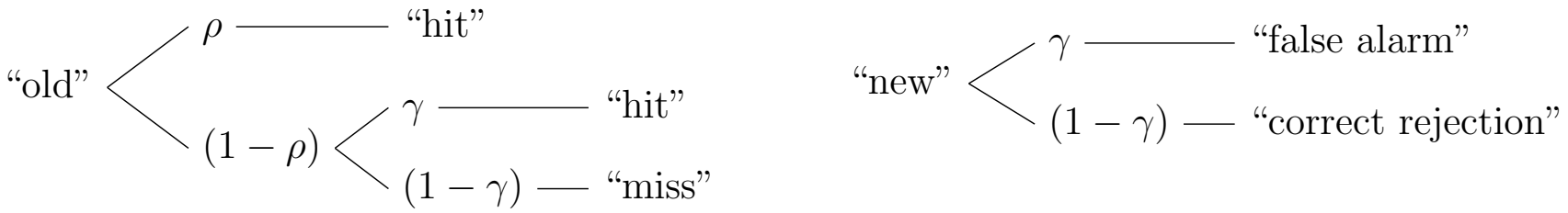

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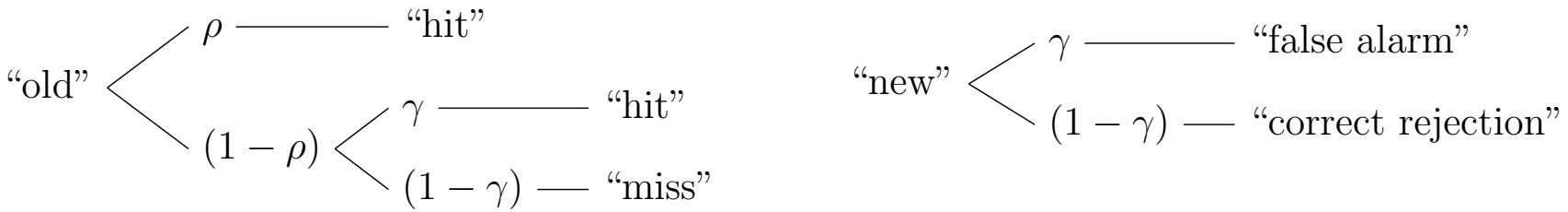

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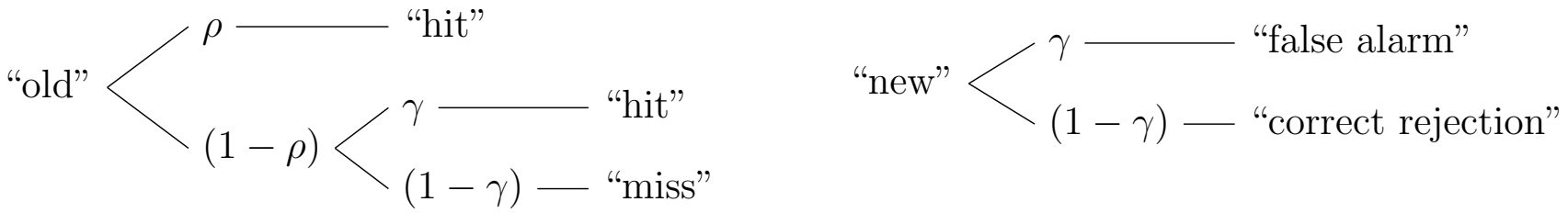

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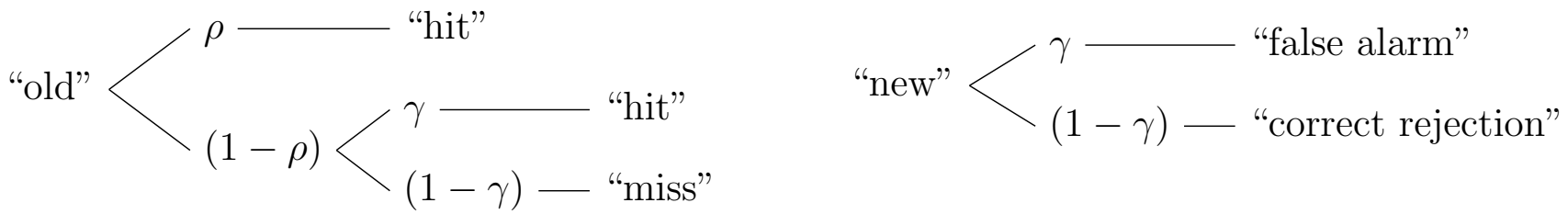

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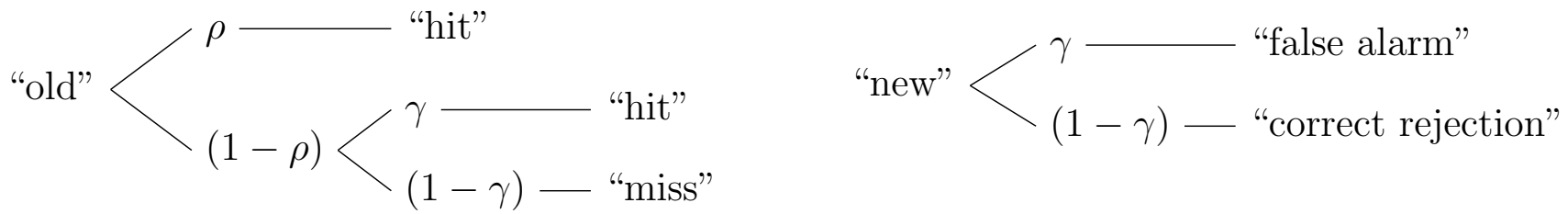

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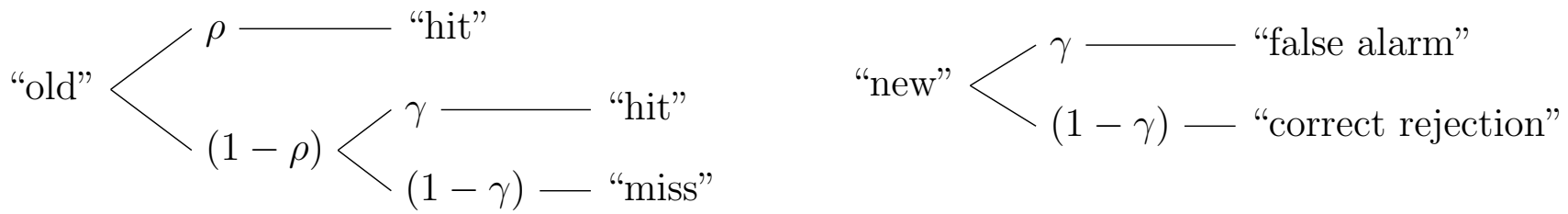

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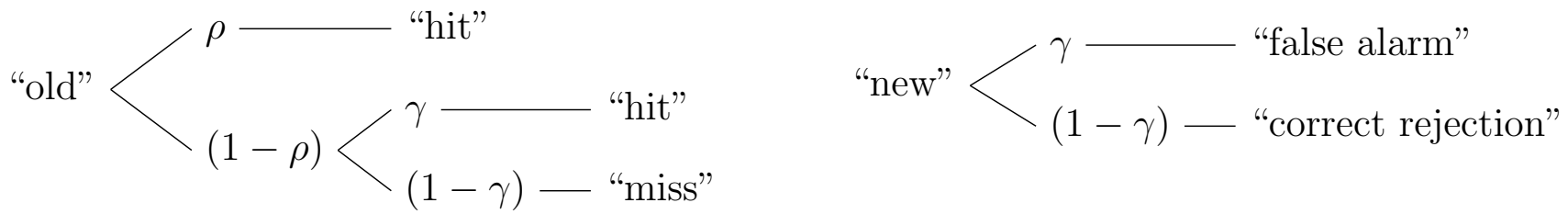

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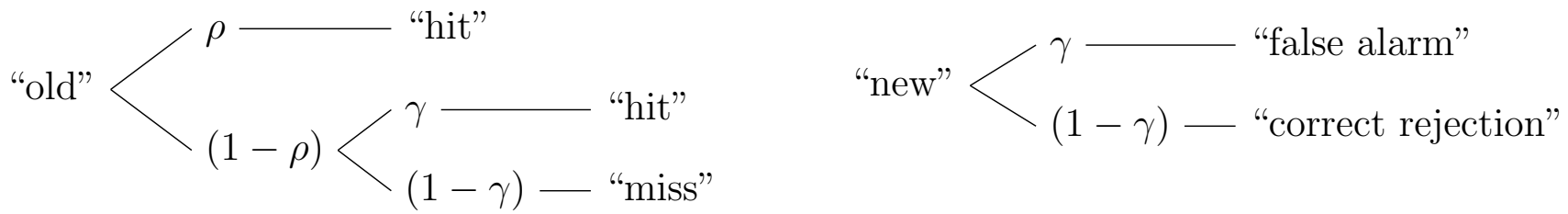

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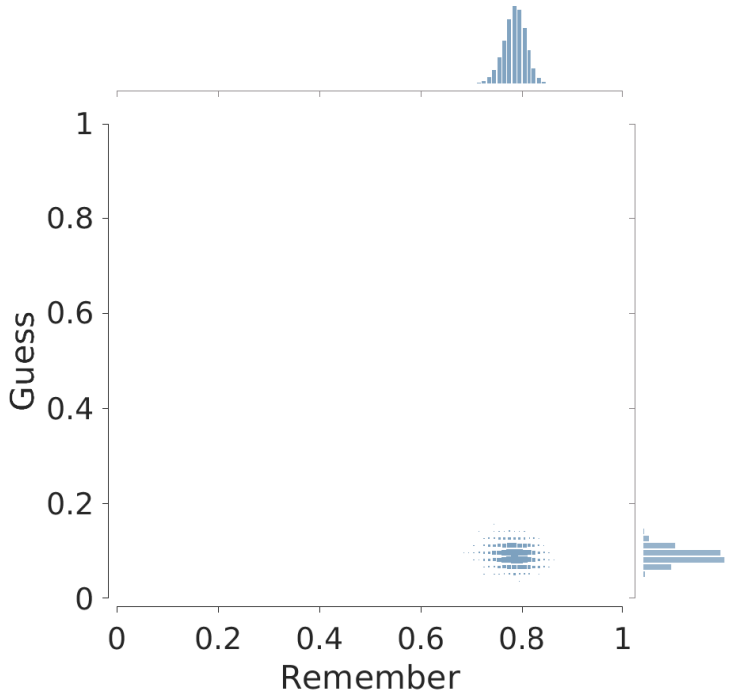
- Patients also had a cerebrospinal fluid measurement taken to classify their levels beta amyloid as "positive" or "negative"
  - amyloid positivity is thought to be a pre-symptomatic indicator of Alzheimer's disease

Amyloid positivity data

Amyloid Status	Hits	False Alarms
positive	8	4
negative	12	1
negative	14	0
positive	9	4
...	...	...

Amyloid Negative inferences



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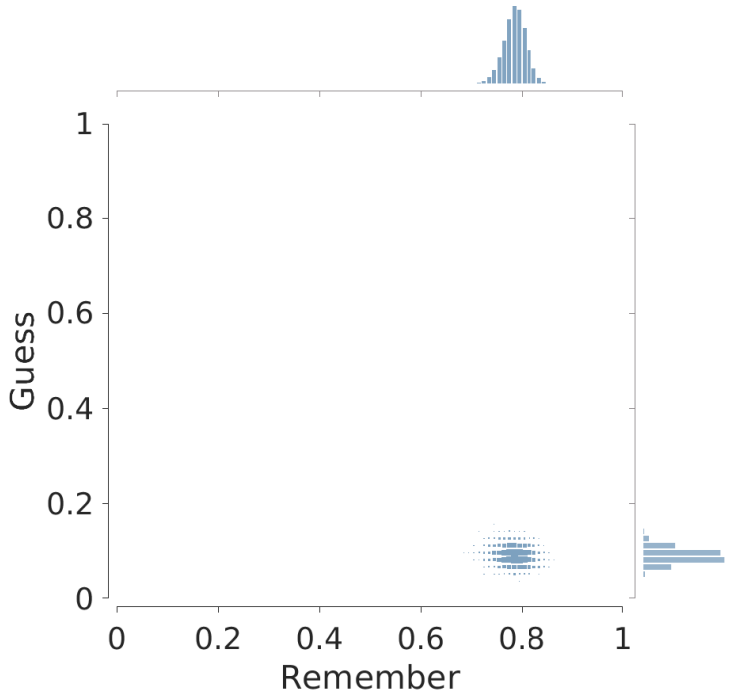

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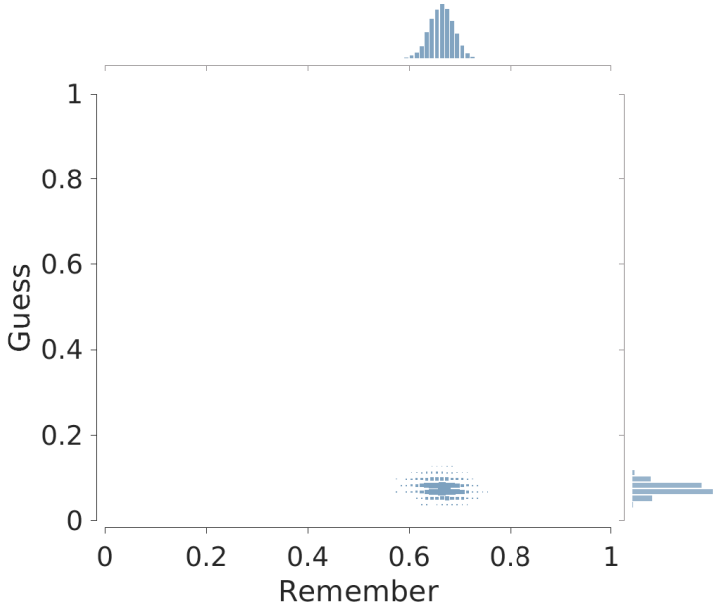

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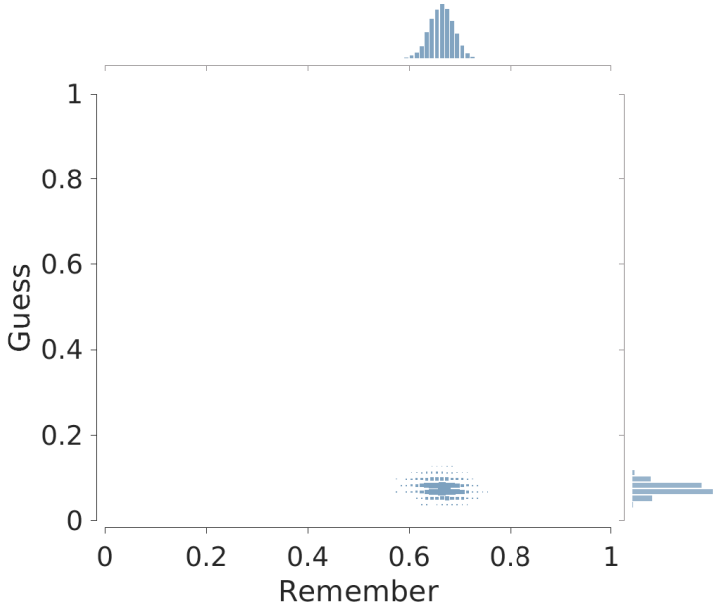

- Patients remember around 60-70% of the items, and guess "old" about 10% of the time when they do not remember
- Very similar guessing behavior to amyloid negative group, but lower probability of remembering

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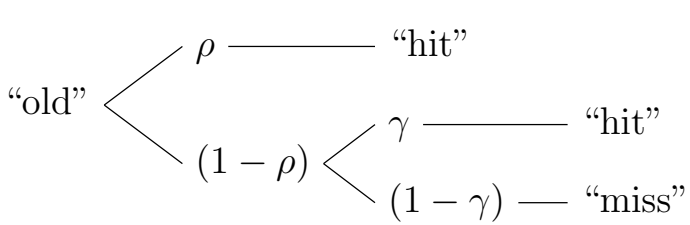

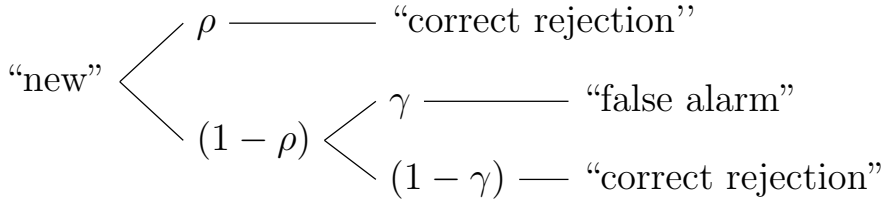

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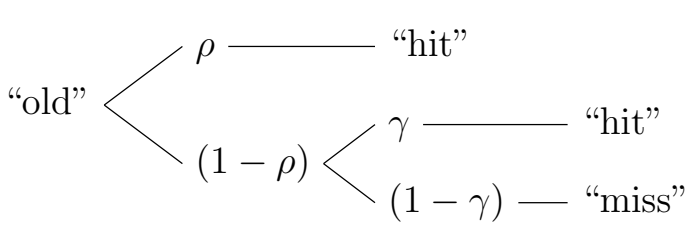

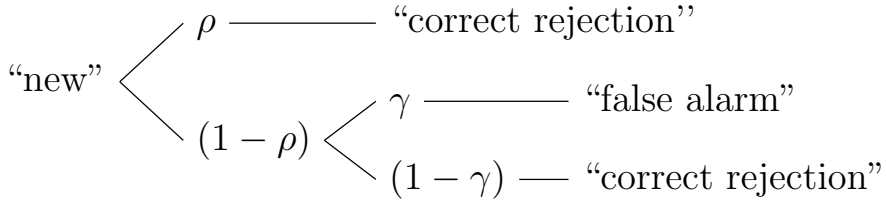

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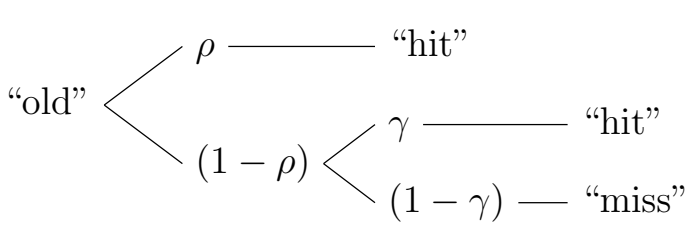

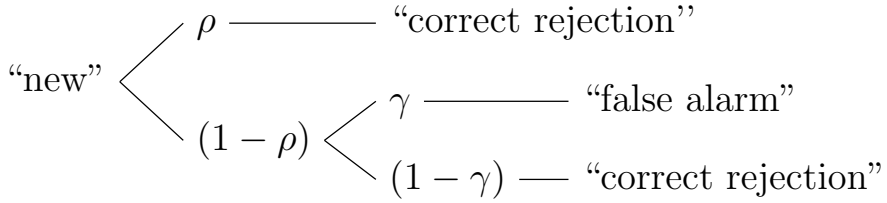

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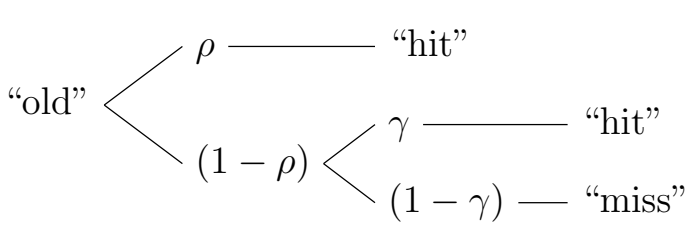

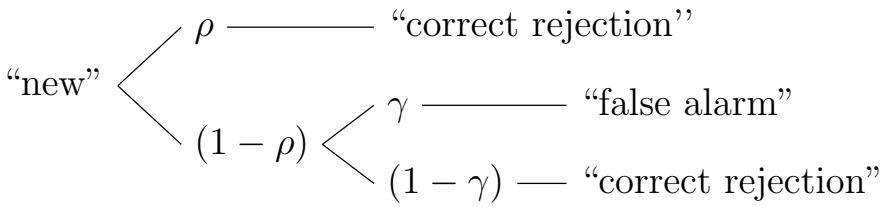

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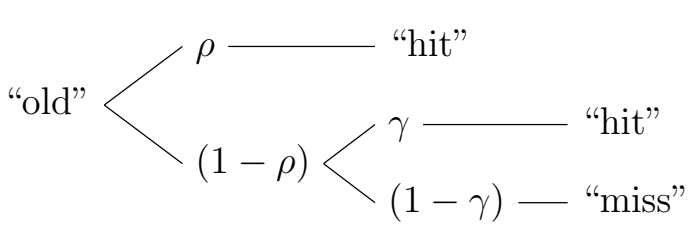

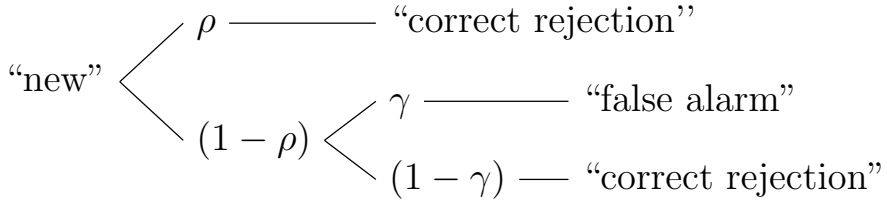

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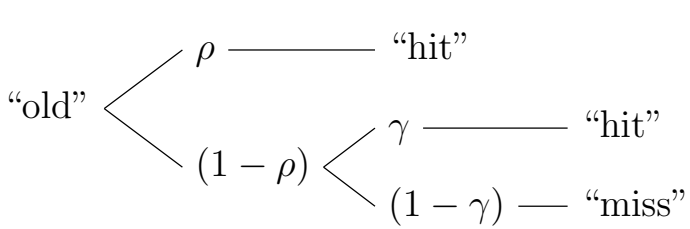

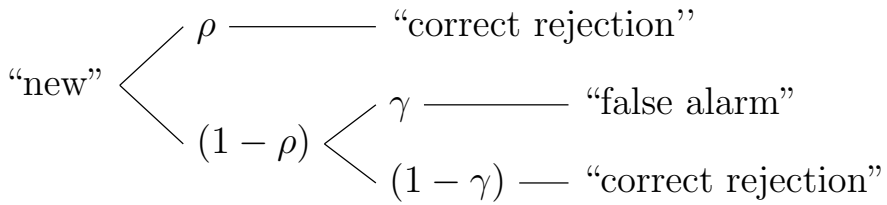

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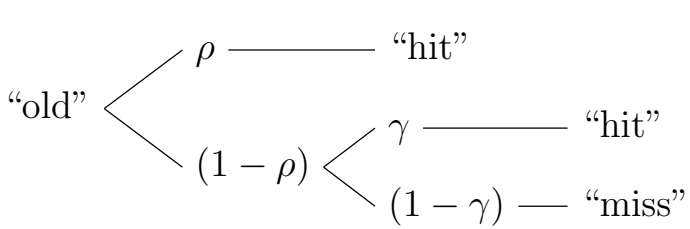

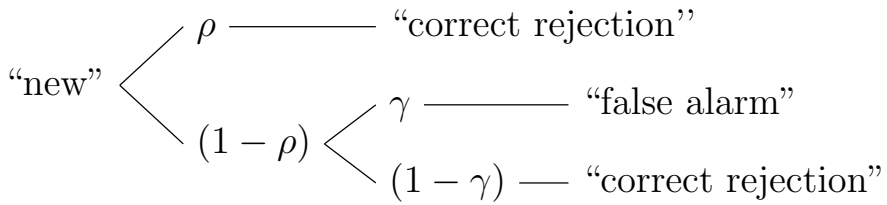

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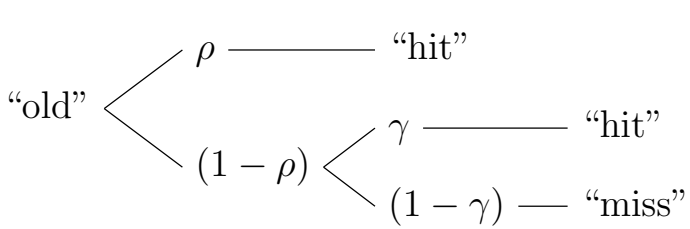

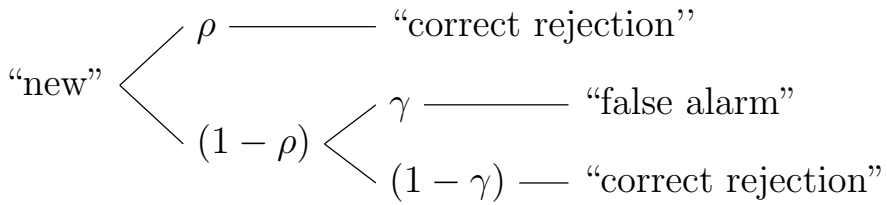

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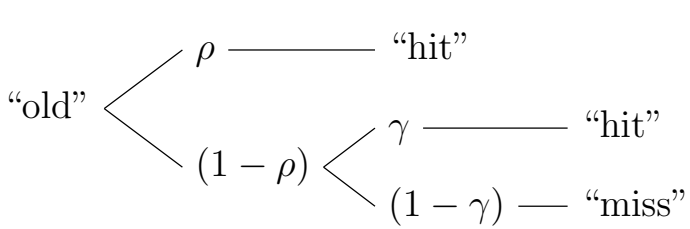

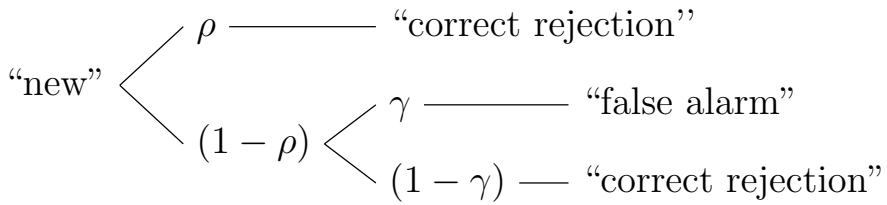

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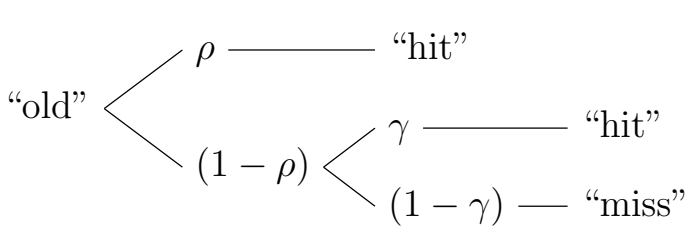

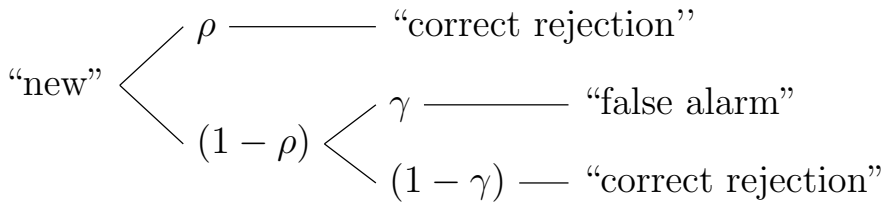

- The new assumptions do not change how hits are produced
  - Either by remembering the item or guessing "old"
- But they do change how false alarms are produced
  - By explicitly remembering the item was not on the list, or by guessing "old"
- The hit rate θ^{h} and the false alarm rate θ^{f} are now

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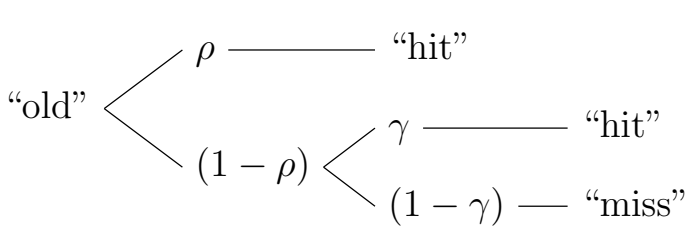

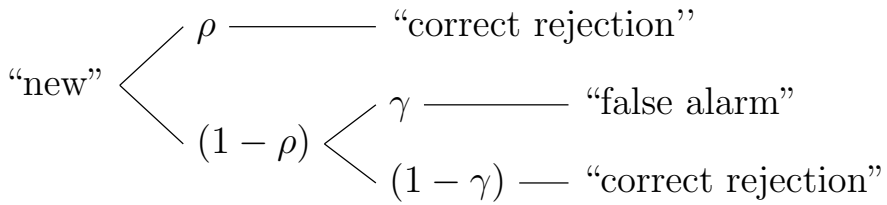

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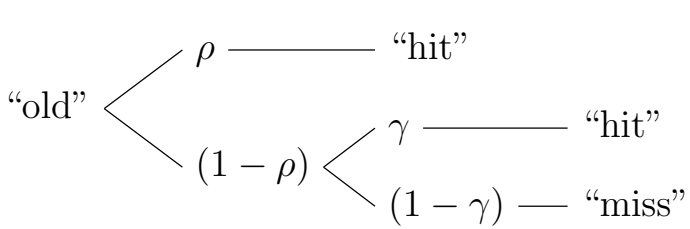

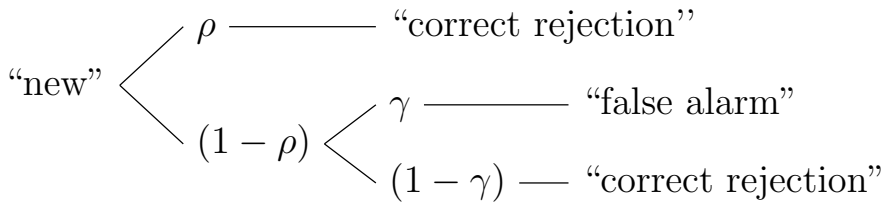

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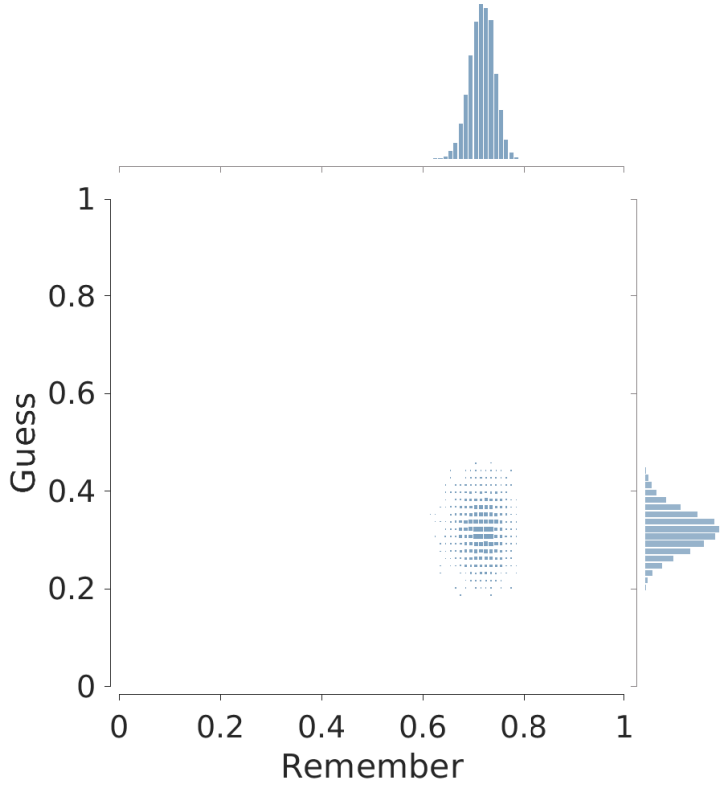
Amyloid negative inferences



- The figure shows the joint and marginal posterior distributions for the remembering and guessing parameters

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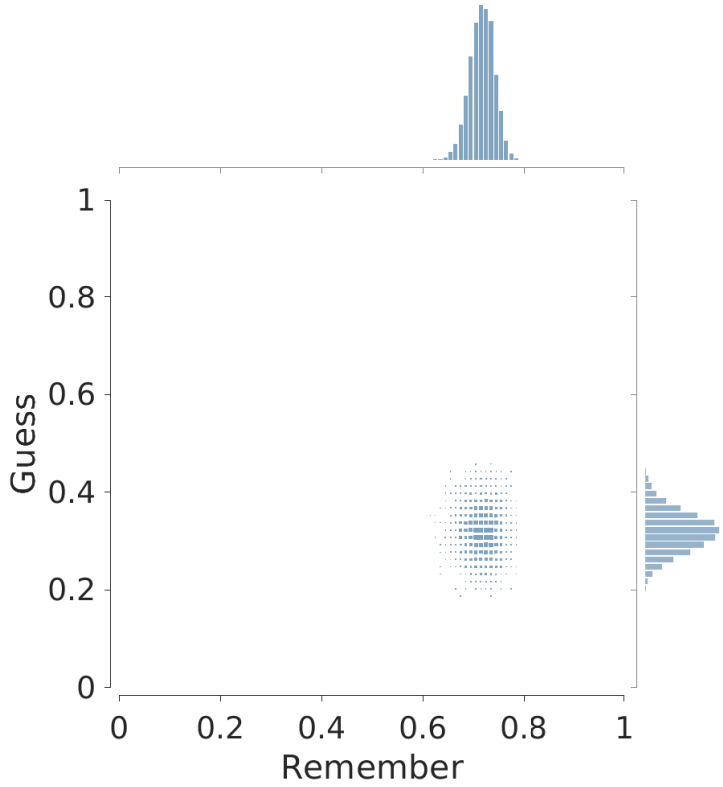
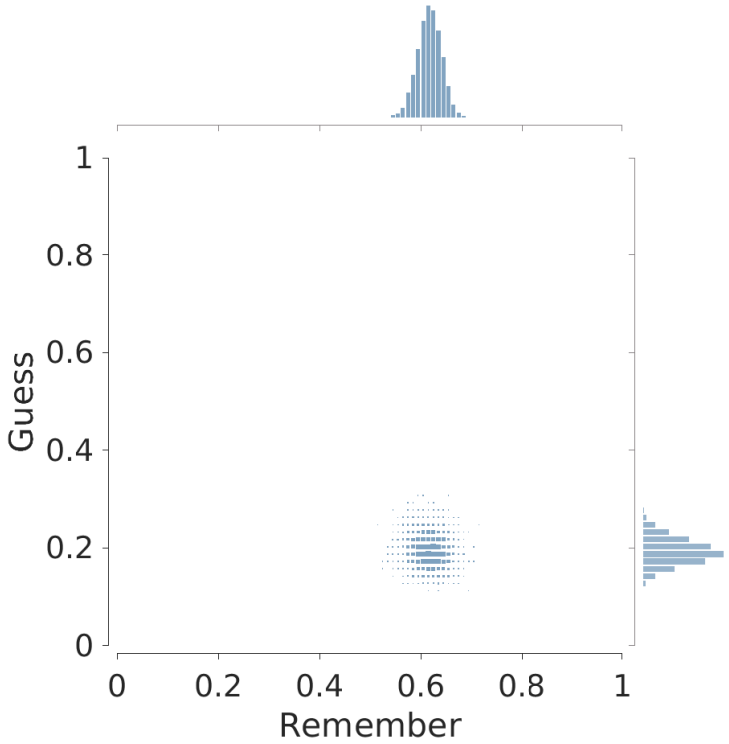


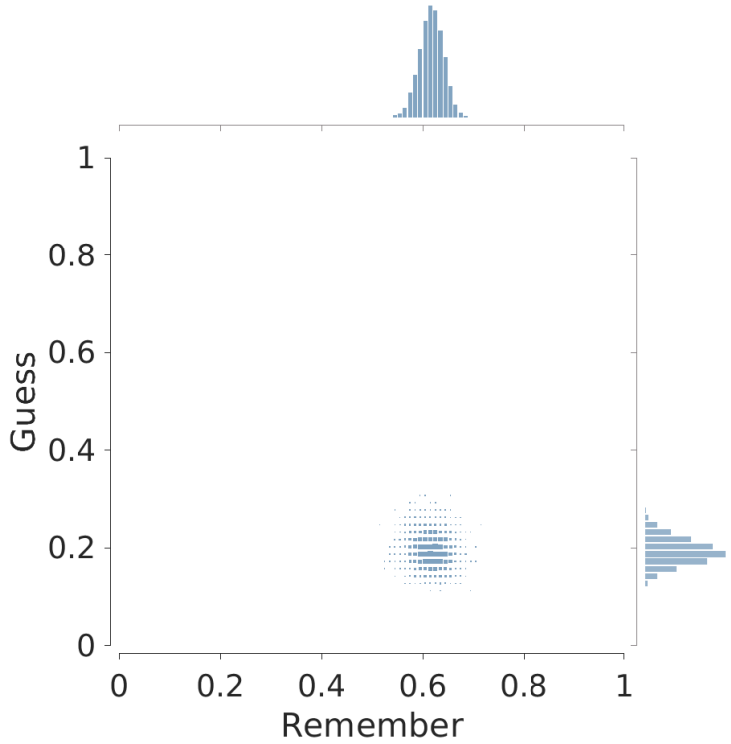
- The figure shows the joint and marginal posterior distributions for the remembering and guessing parameters
- Patients remember around 70-80% of the items, and guess "old" about 30% of the time when they do not remember

Amyloid positive inferences



- Patients remember around 60% of the items, and guess “old” about 20% of the time when they do not remember

Amyloid positive inferences



- Patients remember around 60% of the items, and guess "old" about 20% of the time when they do not remember
- The remembering rate is lower, and the guessing rate now also differs between the amyloid negative and positive groups

Key points

- MPT models make assumptions about how categorical observed behavior can be decomposed into sequences of probabilistic events

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- MPT models make assumptions about how categorical observed behavior can be decomposed into sequences of probabilistic events
- The one-high threshold and two-high threshold models of recognition memory are widely-used MPT models
- The inferences for the amyloid positivity data showed meaningful differences between the clinical groups, but the exact nature of the differences in remembering and guessing depends on the model

References

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