Models of Eye Movements during Forced-Choice Recognition

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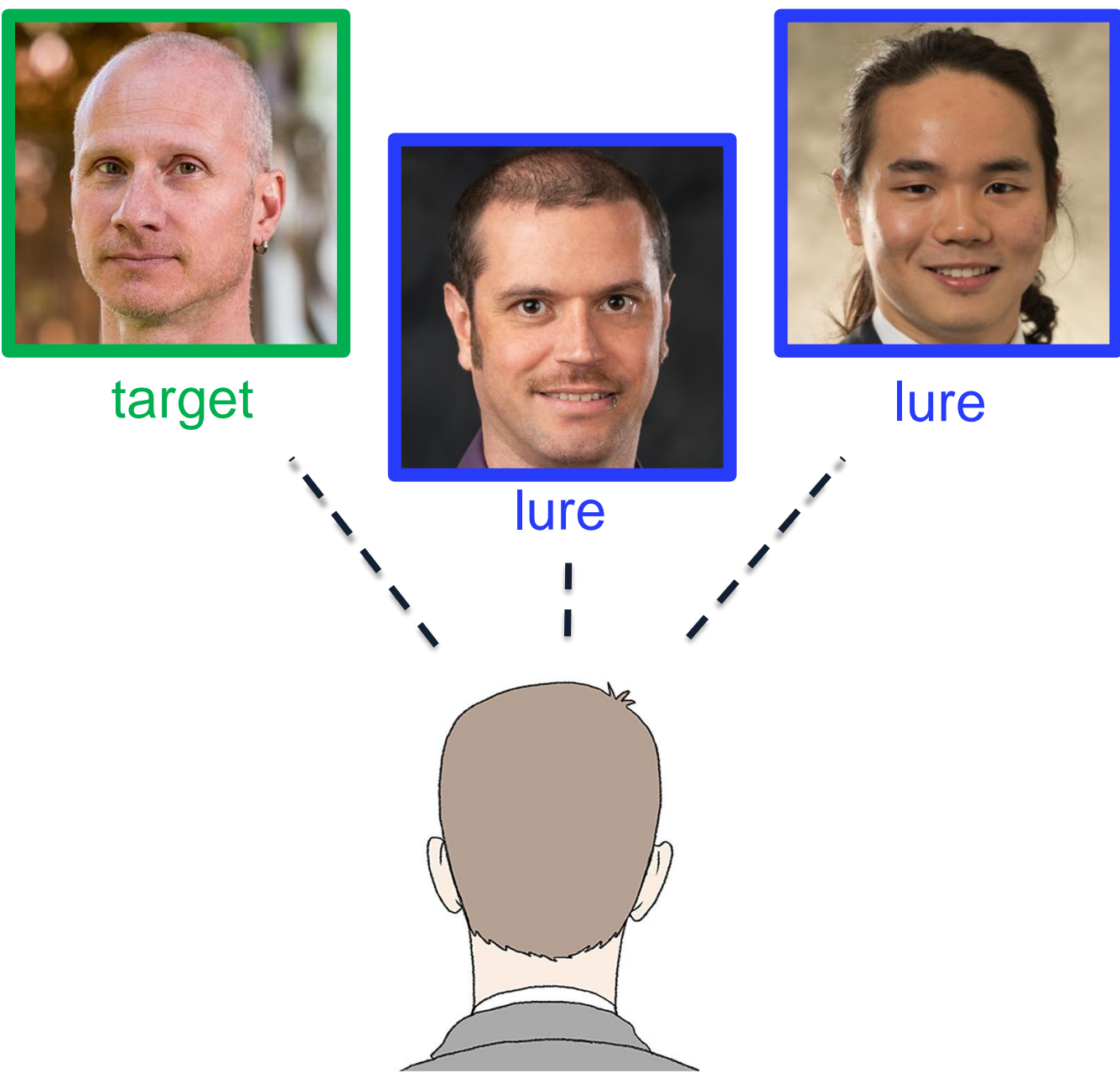
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Intro and Goals

People make eye movements among competing options when making forced-choice recognition decisions among faces.

We model this behavior with:
(1) A random walk for each fixation that determines whether that face is endorsed or the decision-maker transitions to another face (cf. Ratcliff, 1978)
(2) Competing policies for how to determine which face to look at next

We compare models of increasing complexity to 8 empirical benchmarks drawn from a recent study (Whitlock et al., 2024).

Experiment Method

N = 115
forced-choice face recognition
one target and two lures

target
lure
lure

Results

Gaze-Duration Distribution Data

Behaviors

- view target moveon to another face
- view target select target
- view target select lure
- view lure moveon to another face
- view lure select lure
- view lure select target
- view lure select other lure

Behavioral Choices

Empirical Benchmarks

Outcomes of the standard random walk process
- Benchmark 1: Gaze-duration distributions for each fixation are right skewed
- Benchmark 2: Endorsements are slower than decisions to transition to another face
- Benchmark 3: Endorsement probability is higher for targets than lures

Policies about the random walk
- Benchmark 4: Decision made on the Nth fixation
- Benchmark 5: Gaze-duration distributions converge to a homogenous form in later fixations
- Benchmark 6: Endorsement probability for currently fixated face increases with the number of fixations
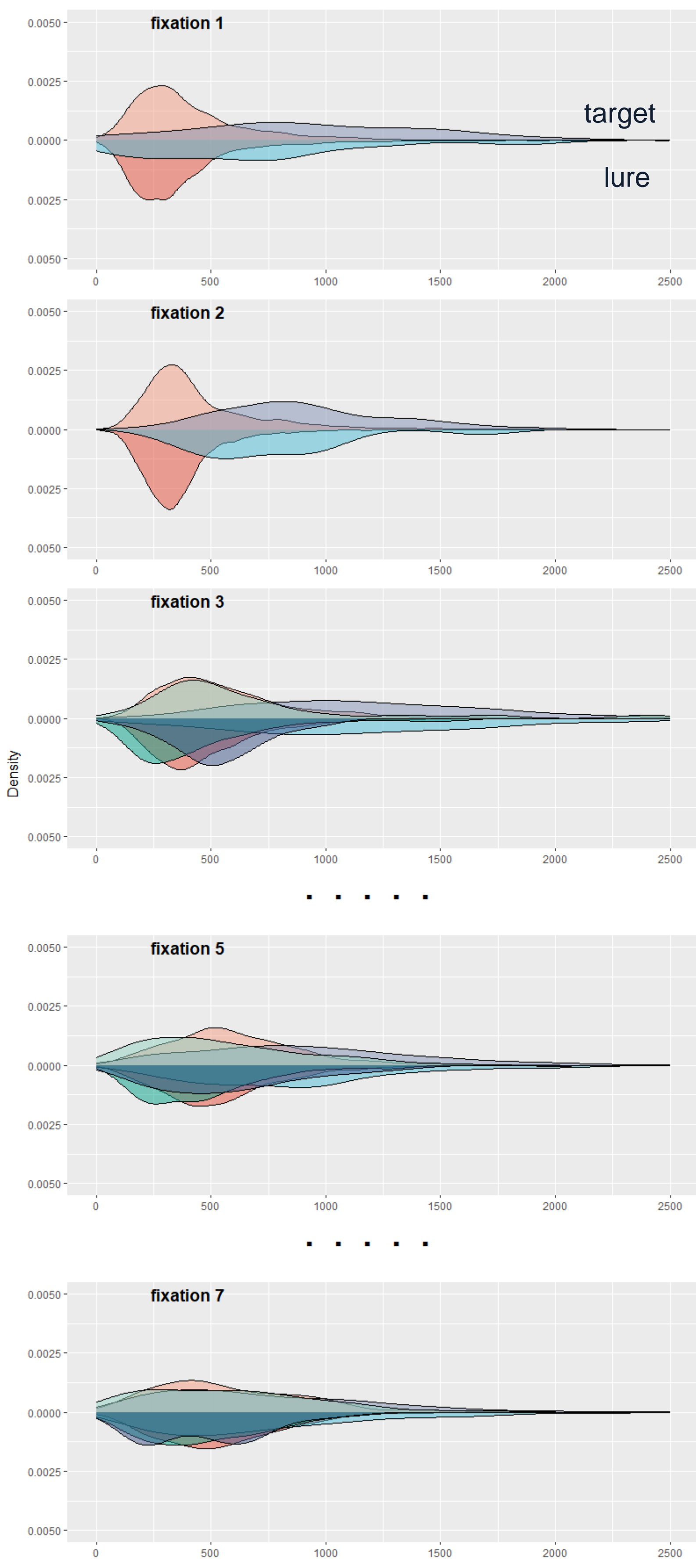
Policies about transition
- Benchmark 7: Endorsement probability of a face that is <u>not</u> currently being fixated increases with the number of fixations
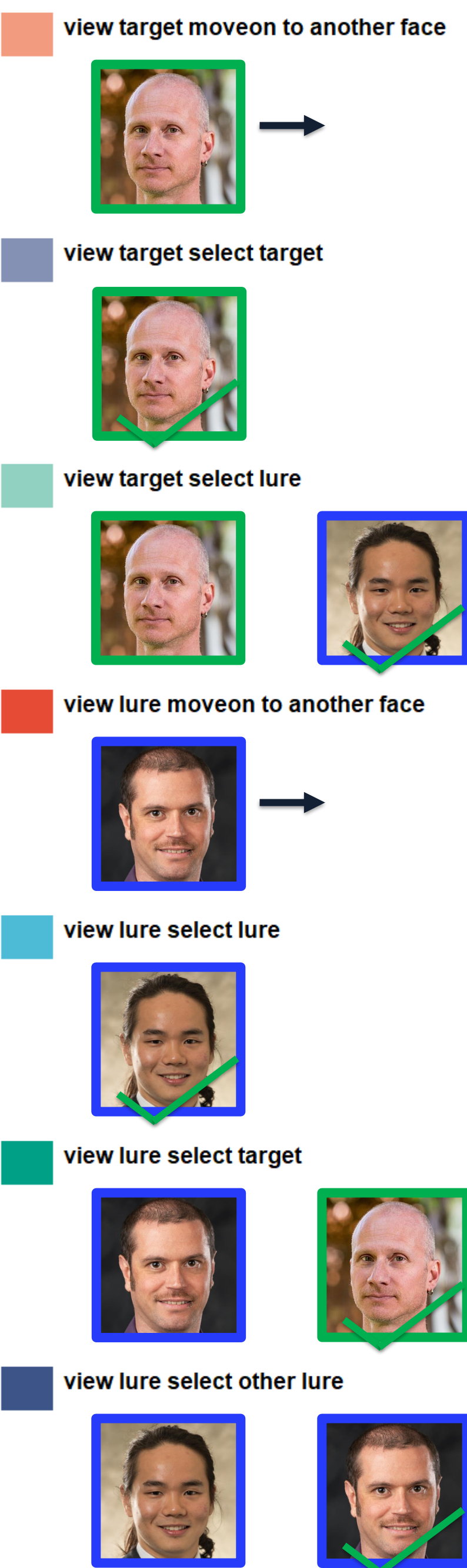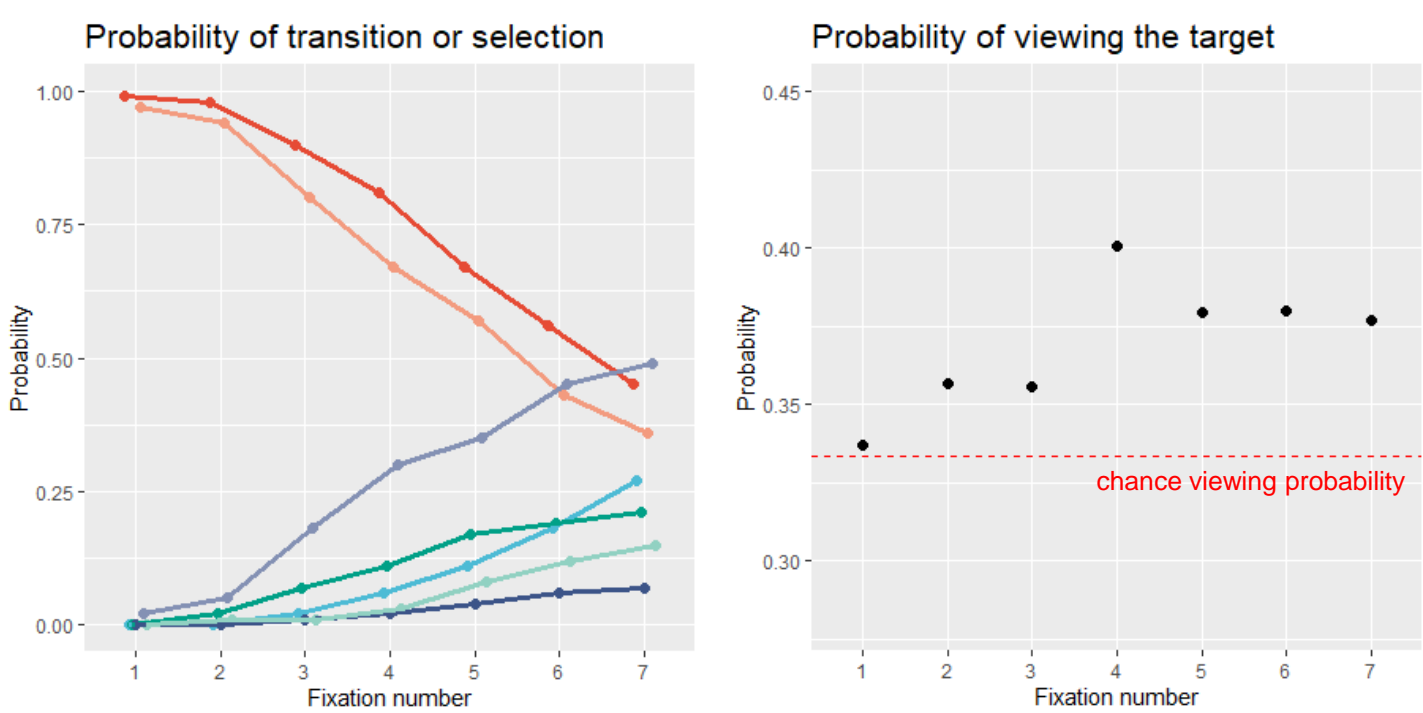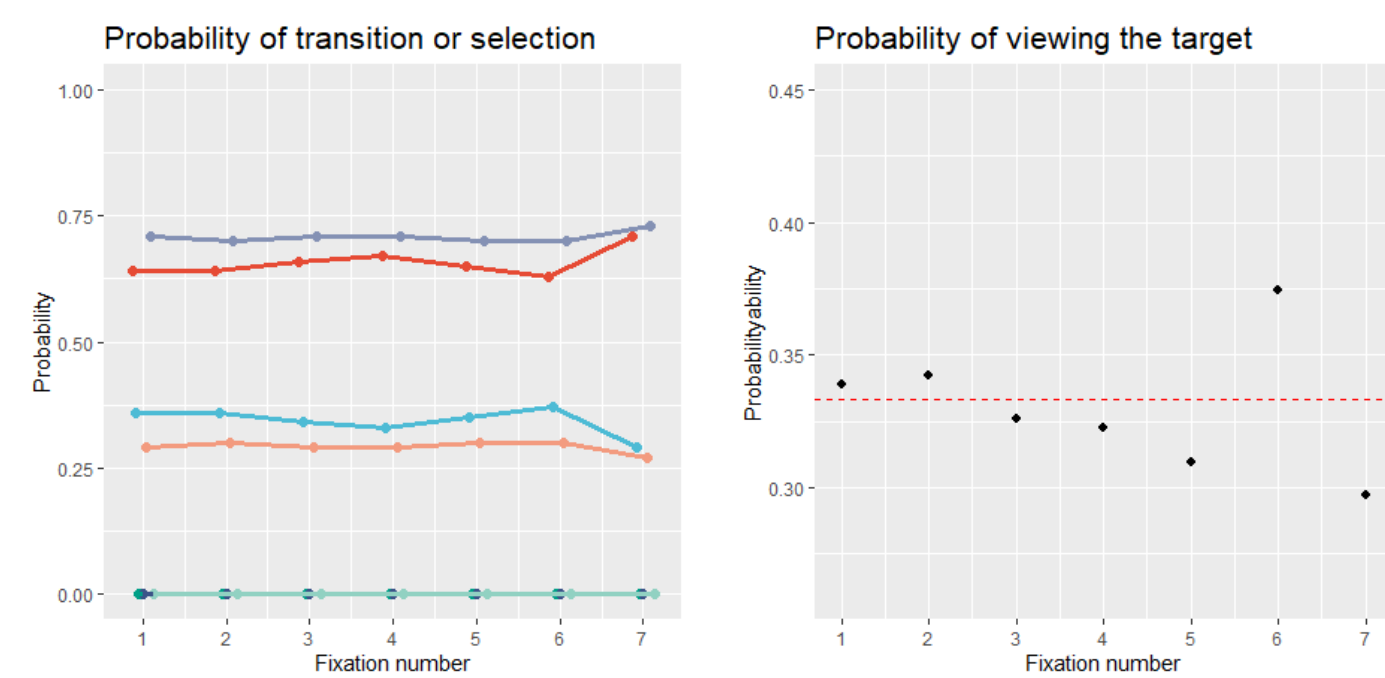- Benchmark 8: Target is more likely to be revisited than lures
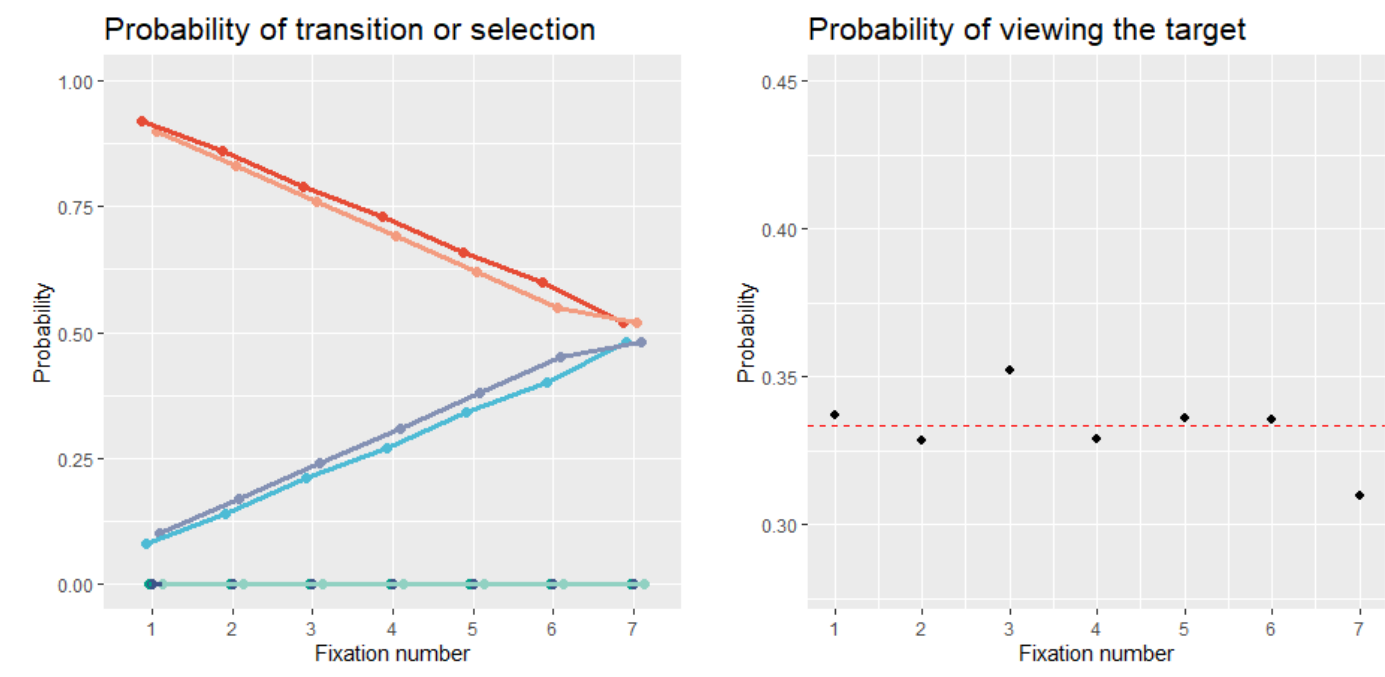
Models

Model 1: Base model

Random walk with unbiased starting point
Drift rate higher for target than for lure
Random transition among faces

Captures benchmarks 1, 2, and 3

Model 2: Moving starting bias

Moving starting bias from conservative to liberal over fixations

Captures all benchmarks except 7, 8

Model 3: Preference to revisit compelling faces

Keeps track of random walk for each previously viewed face and prefers to visit faces that yielded more positive evidence.

Captures all benchmarks except 8
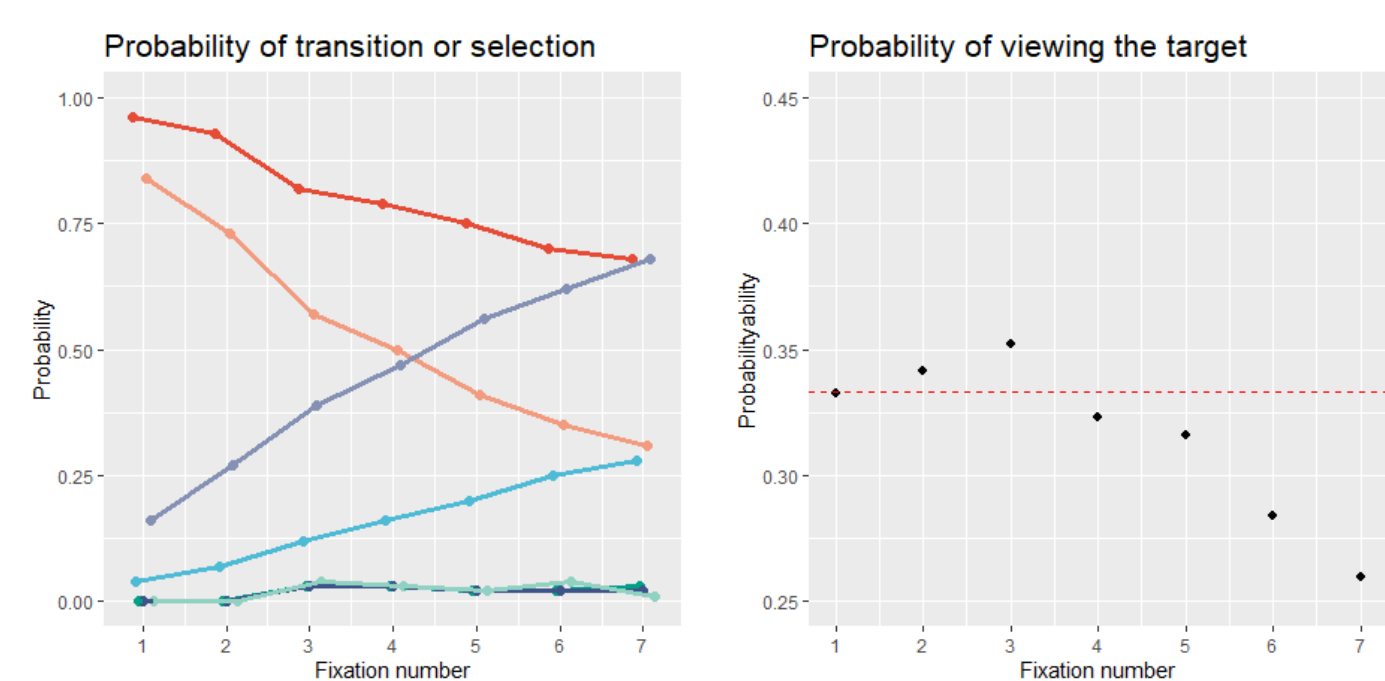
Model 4: Withhold selection

Model can withhold selection even when selection boundary is reached, especially in early fixations

Captures all benchmarks