



Memory capacity meets expertise: increased capacity for abnormal images in expert radiologists

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Question: Do radiologists remember abnormal mammograms better than normal ones?

Expert Memory Capacity:

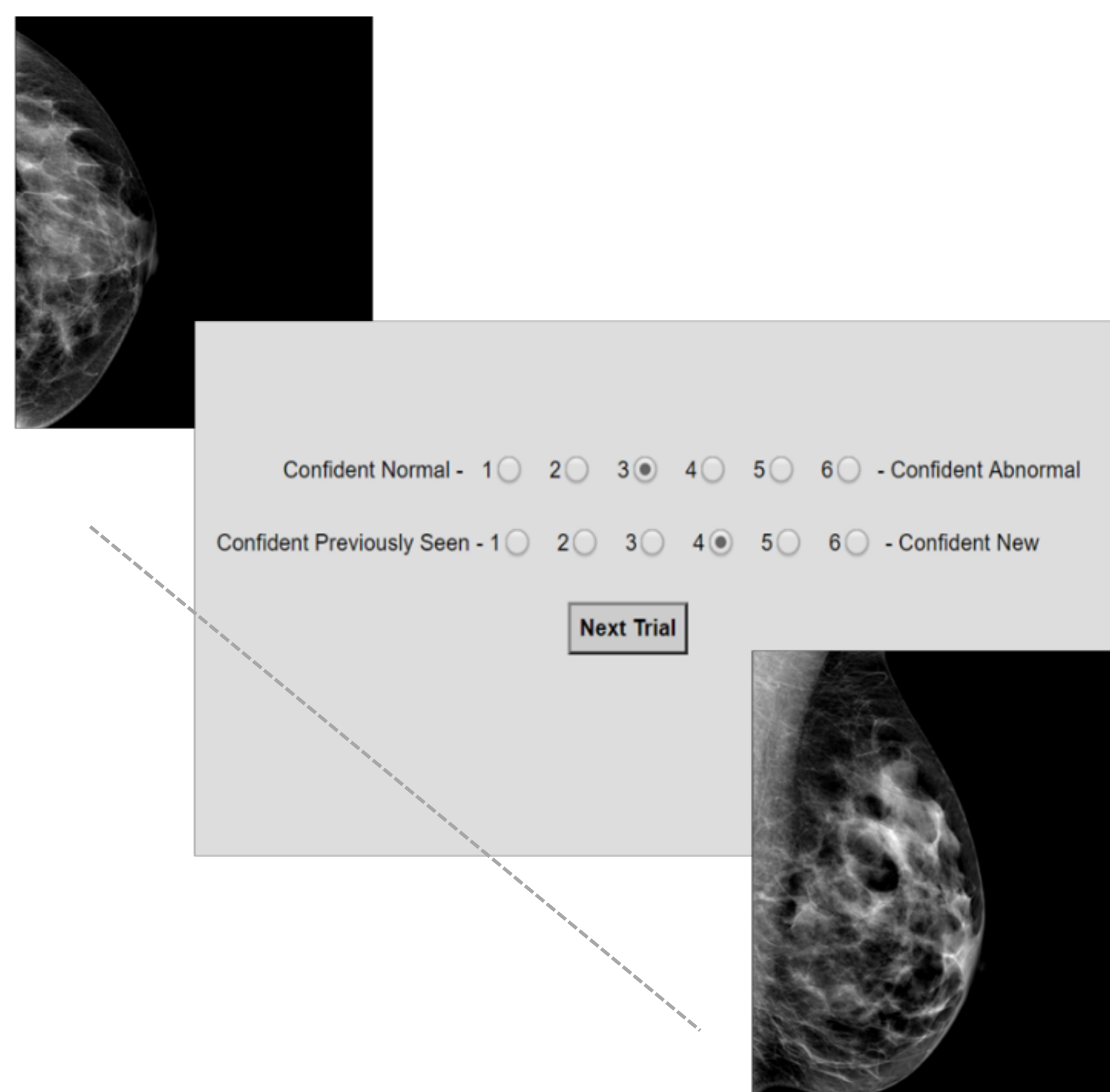
Experts have increased working and long-term memory capacity

Memory for the Abnormal:

Abnormal or surprising items tend to be better remembered, in large part because they attract additional attention (Friedman, 1979).

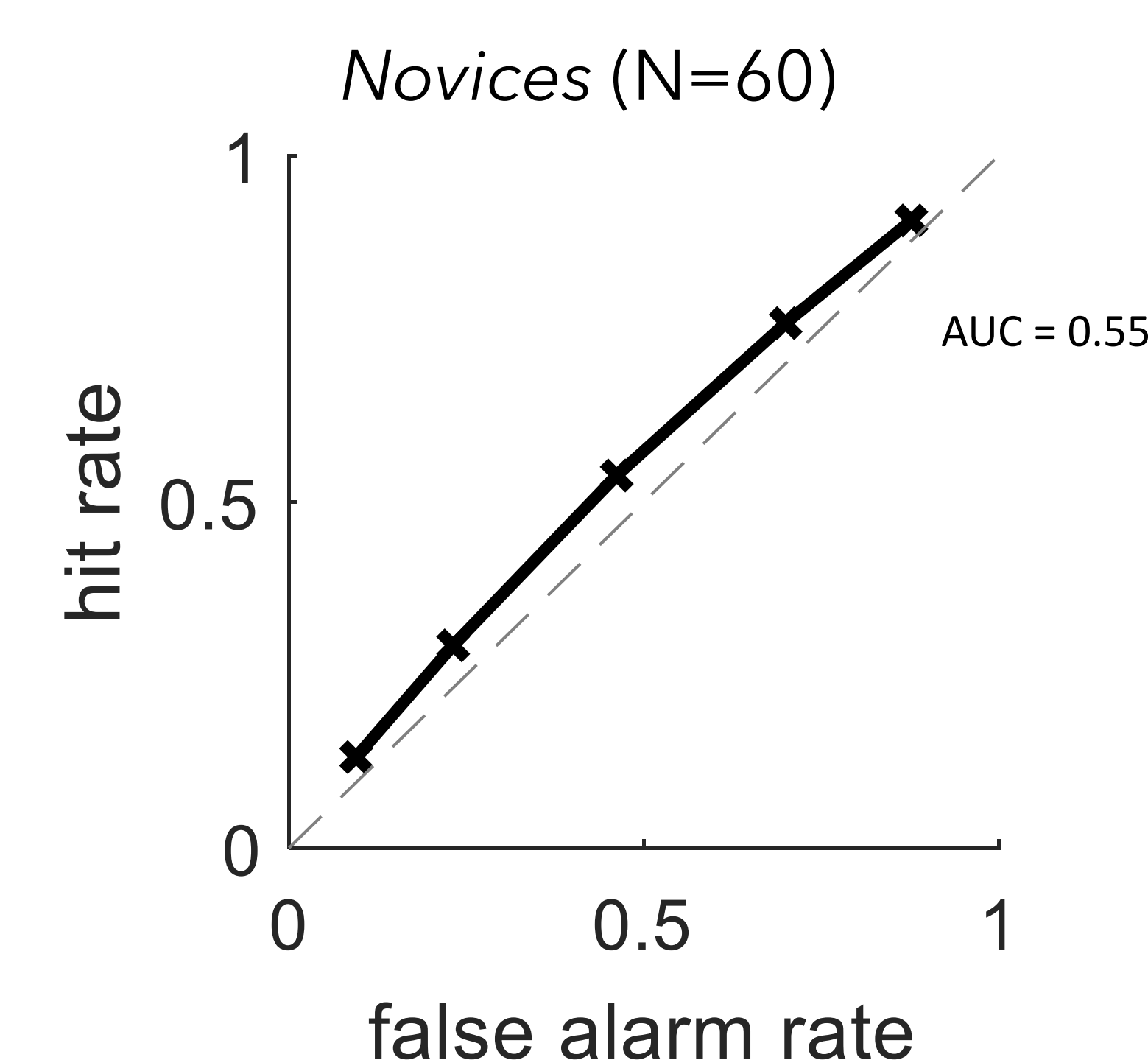
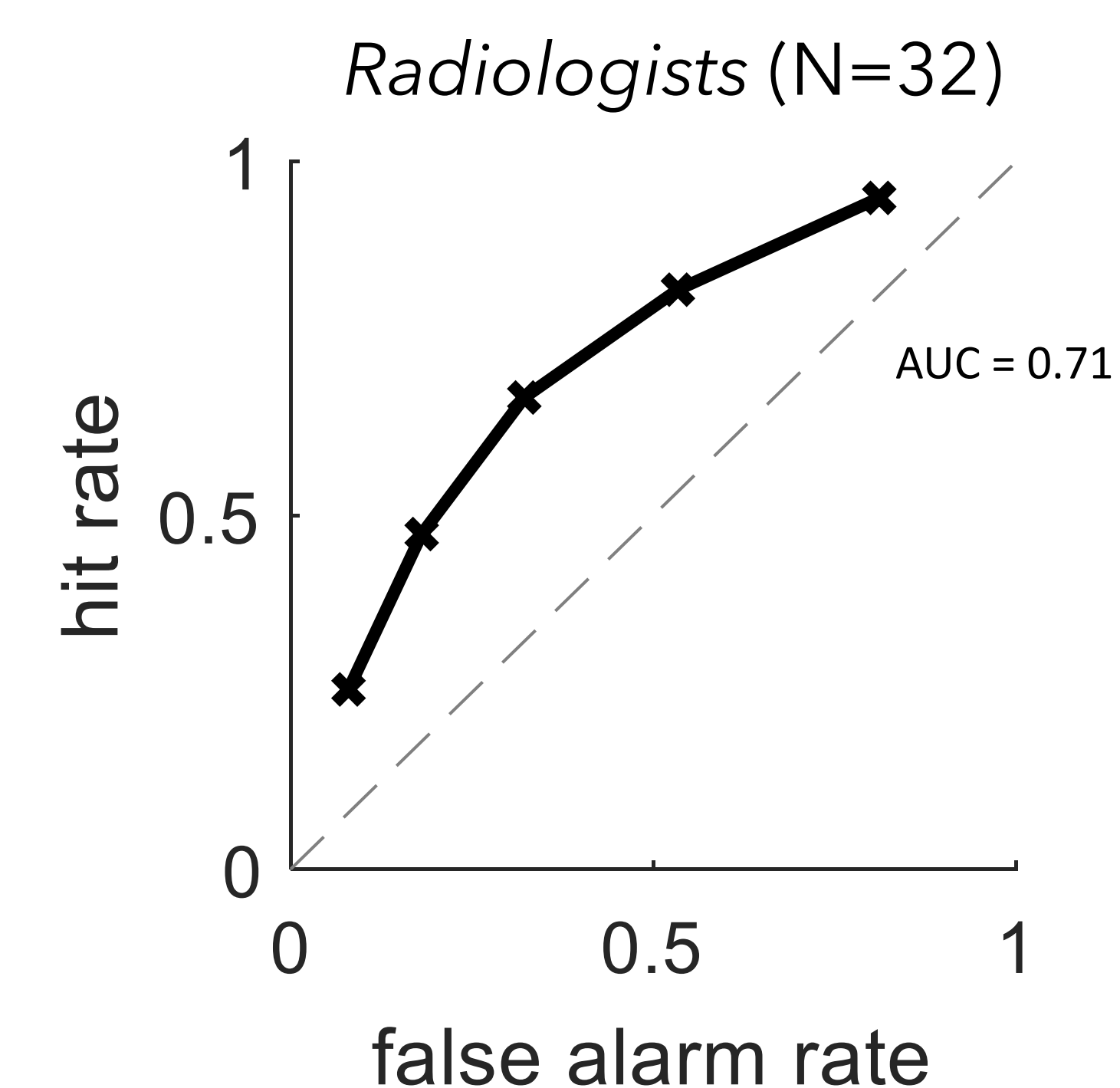
Methods:

- Expert & Novice observers rate images as normal - abnormal
- They also rate the image as old - new
- Images can repeat after 3 or 30 intervening images
- Images were presented for 3 seconds



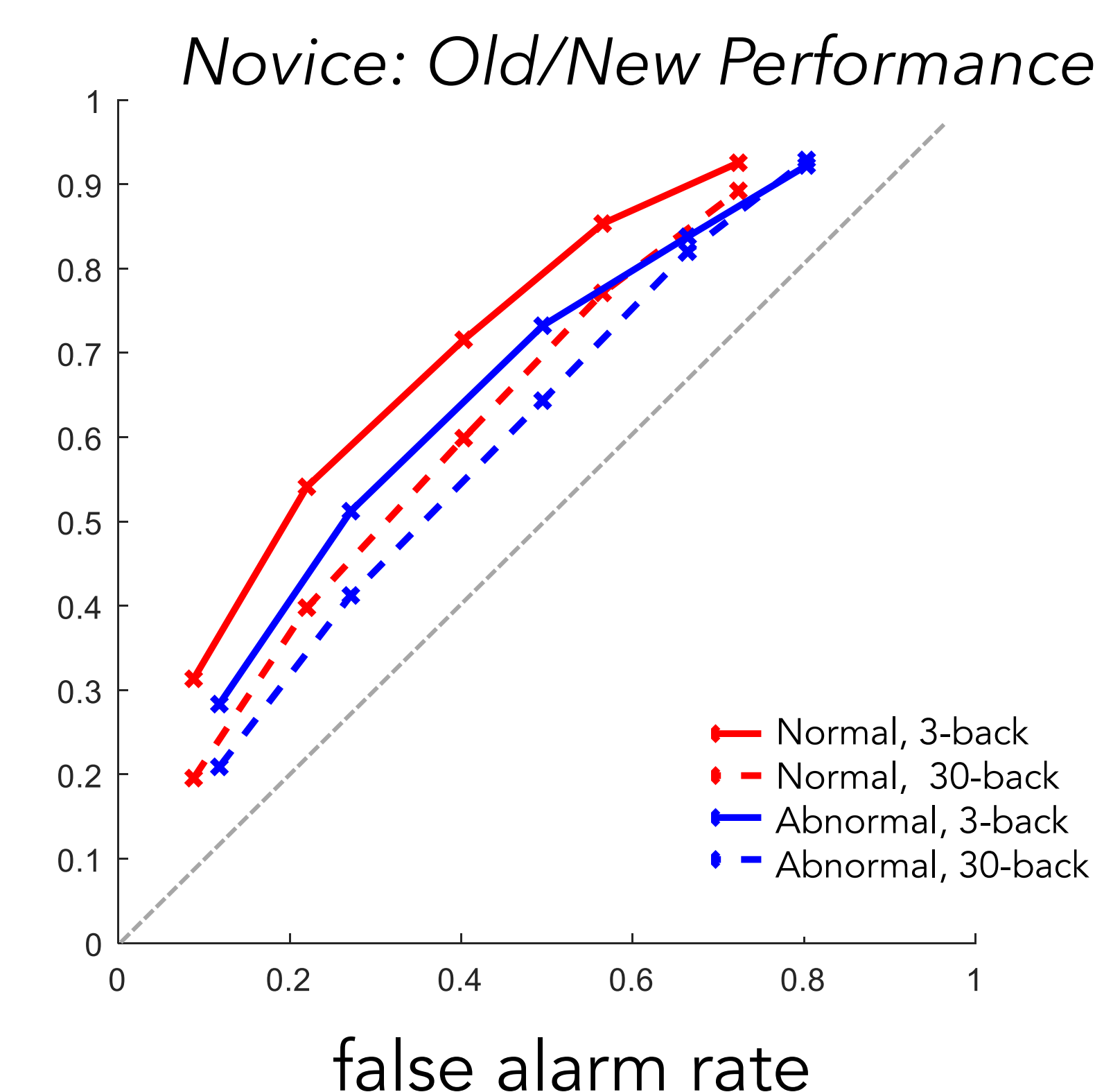
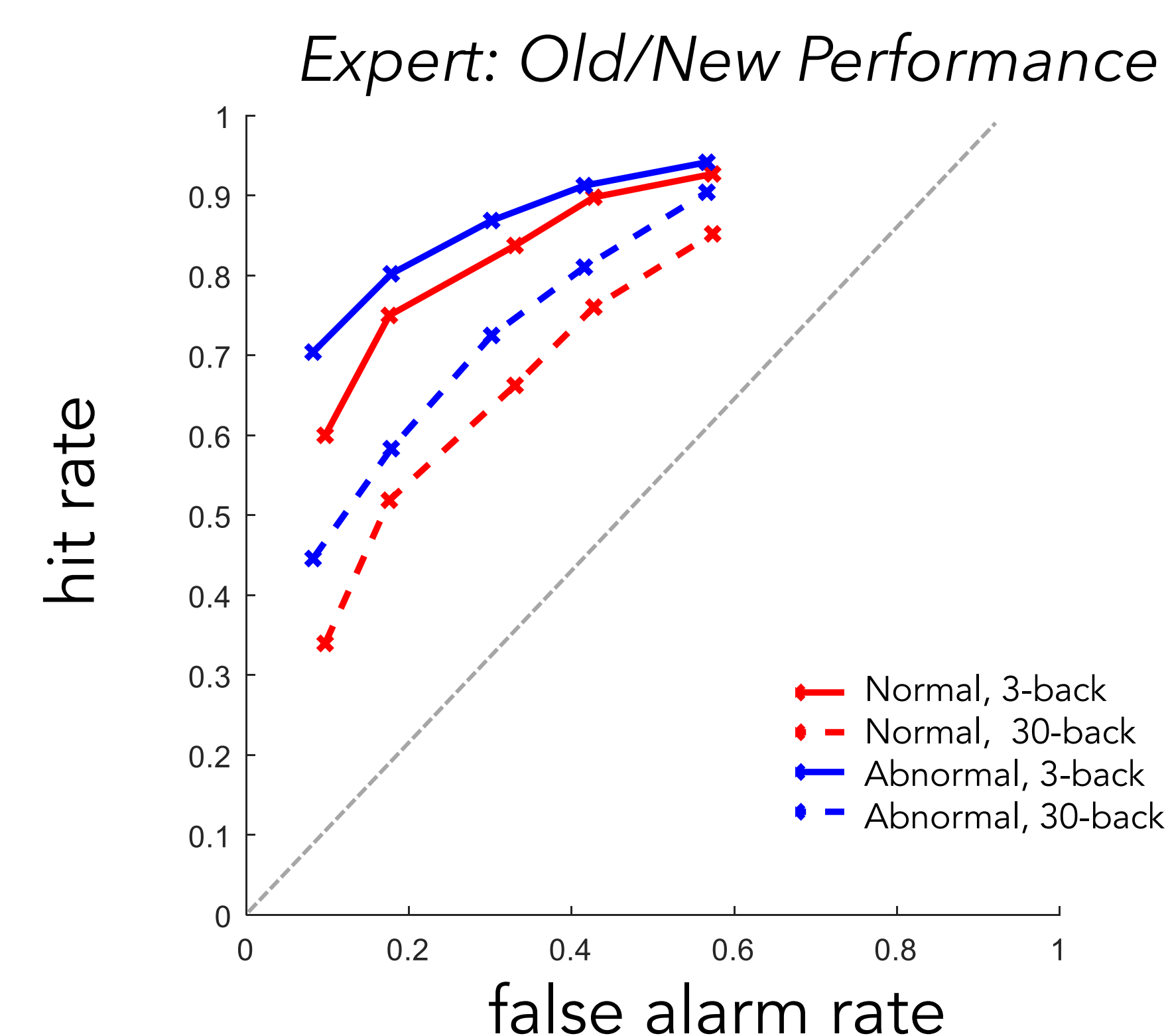
(1) **Performance:** Can observers distinguish abnormal from normal?

Radiologists can distinguish abnormal images. Novice beats chance because of a few salient abnormal images. Otherwise novices are at chance.



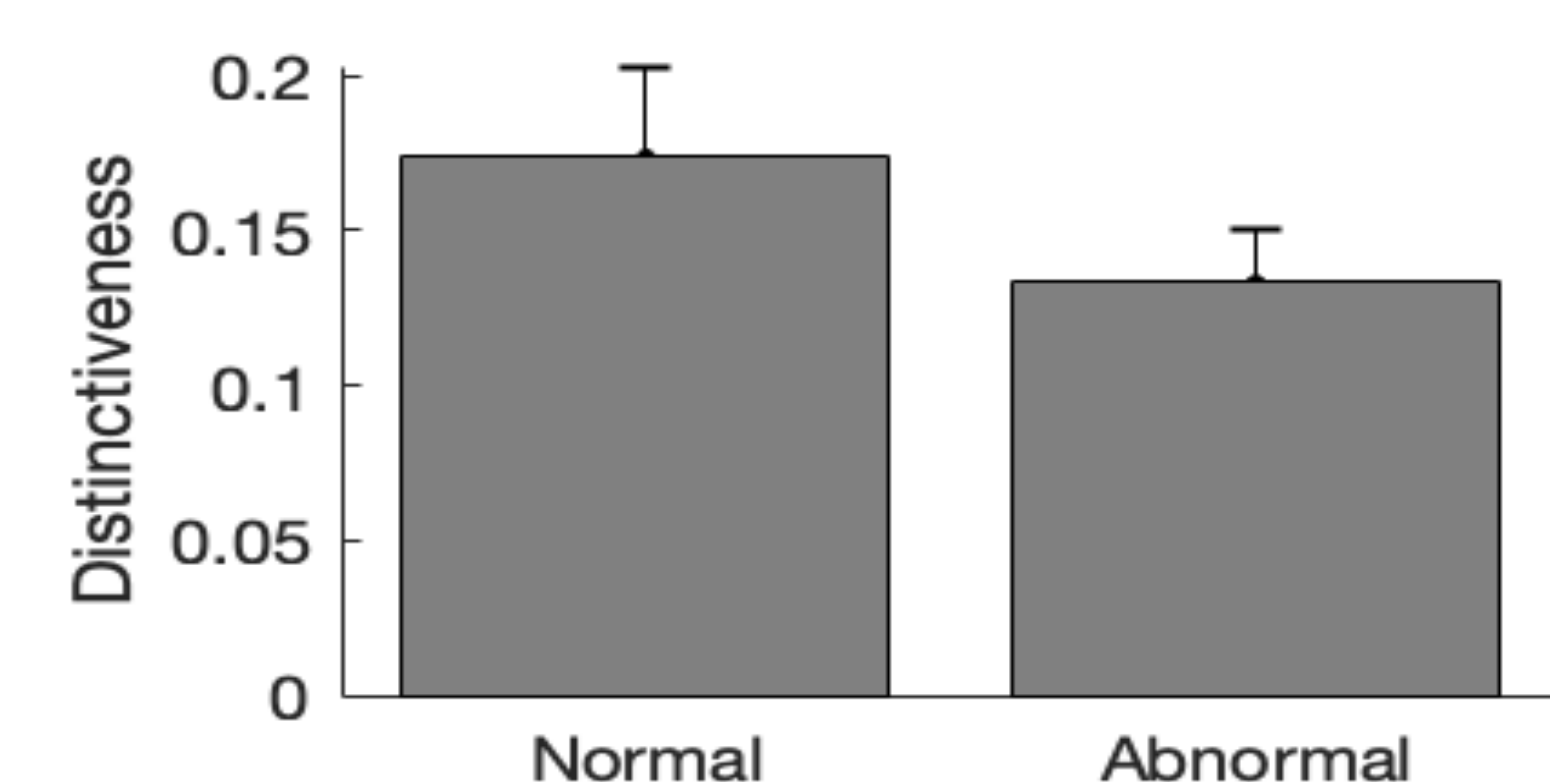
(2) **Memory:** Do radiologists have better memory for abnormal images?

Yes! Radiologists have better memory for abnormal in both conditions. Interestingly, novices show the opposite effect.



(3) **Similarity Matrix:** Why do controls show a small normalcy benefit?

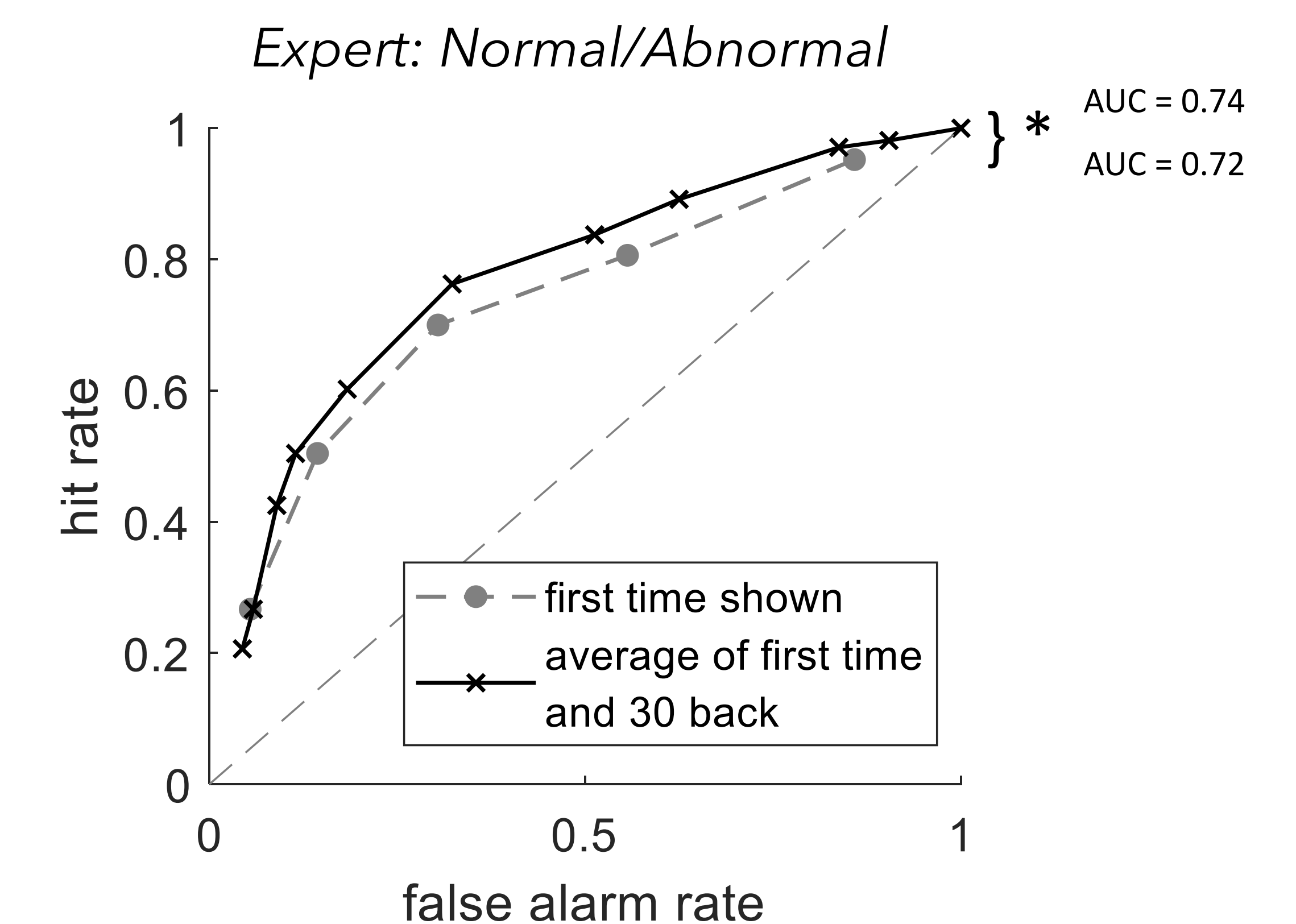
We used the Gabor Wavelet Analysis (Greene et al., 2016) to quantify image similarity.



Normal images were more visually distinctive, while abnormal images were more similar. This may explain novice behavior. Radiologists behavior seems to be based on the semantic distinctiveness of abnormality.

(4) **Crowd-within Analysis:** Asking a person the same question twice and averaging their responses results in better performance than any single response alone ("crowd-within" effect, Vul & Pashler, 2008). Does averaging across a radiologist's responses increase performance?

Yes! Radiologists have better performance when averaged across long-delays ($p < 0.001$).



(5) **Contra-abnormal condition**

Evans et al., 2016 found that radiologists do not need to see a physical lesion to accurately classify an image as abnormal. We included a contra-abnormal memory condition in our experiment but did not find a boost in memory performance comparable to the abnormal condition.

Take home point: Radiologists have better memory for abnormal images. That benefit is greater at long delays. Moreover, asking twice about the same case might be helpful.

References

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