

Memory capacity for normal vs. abnormal mammograms

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Rationale

What you will remember about a current stimulus depends on what you know about such stimuli. This is true for both WM and LTM. For example, radiologists have greater long-term memory for medical images compared to novices, presumably because they know more than novices about such image (Evans et al., 2010). Furthermore, abnormal or surprising items tend to be better remembered, in large part because they attract additional attention (Friedman, 1979). Thus, radiologist might be expected to remember abnormal cases better than normal. Interesting, in mammography, radiologist do not always need to see a physical lesion to know that an image is abnormal. Images of the breast contralateral to the actual lesion (“contra-abnormal”), can be labeled as normal or abnormal at above chance level by experts (Evans et al., 2016). We investigated whether expert radiologists (N=32) show improved memory for abnormal images, and to what extent an image must have a focal abnormality for such additional processing to be engaged.

Methods

Stimuli were single-breast mammograms with 80 abnormal cases and 40 normal (non-cancerous) cases. Half of the abnormal images were of the breast containing a visible abnormality, and the other half were from the breast contralateral to the visible abnormality. Images were presented for 3 seconds each, followed by two questions. (1) Was the image normal or abnormal? (2) Have you seen this image before? Confidence was rated on a six-point scale. Images were either new or a repeat from 3 items or 30 items back. Detecting 3-backs indexed working memory, and detecting 30-backs indexed long-term memory.

Results

Expert radiologists had a d' of 1.6 for detecting 3-backs and a d' of 1.0 for detecting 30-backs. We found a d' benefit of 0.2 for focally abnormal images at 3-back ($t(31)=-1.49$, $p=0.14$), and d' benefit of 0.3 at 30-back ($t(31)=-2.23$, $p=0.03$), which suggests experts have better memory for abnormal images, particularly at long delay. Overall, radiologists showed no memory benefit for the contralateral abnormal images, even at long delays ($p=0.24$). Interestingly, however, high expertise observers (> years experience) were more likely to rate these images as abnormal ($r=0.39$, $p=0.03$).

Conclusions

Information about the quality of memory for images is useful for future studies of medical image perception where it may be desirable to have radiologists read the same images more than once, but only if they do not remember the previous exposure. These data suggest that a significant “wash-out” period is needed since images are remembered at above chance levels after 30 intervening cases. Moreover, as in other situations, more “interesting”, abnormal cases seem to be remembered somewhat better.