Detecting the "gist" of breast cancer in mammograms three years before the cancer appears.

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Studies have shown that radiologists can distinguish normal from abnormal mammograms at above chance levels after viewing the images for 500 msec even when the signs of cancer are quite subtle. The radiologists are at chance when they attempt to localize the lesion, suggesting that a global/texture signal underpins the detection of these subtle abnormalities (Evans et al, 2013). This ability persists even when radiologists only view the breast contralateral to the cancer indicating that the signal is not based on the presence of the lesion in the image (Evans et al, 2016). Is that signal present as a warning sign before the cancer, itself, appears? We presented 21 radiologists with bilateral mammograms that had been acquired 3 years prior to the mammograms that showed visibly actionable cancer intermixed with completely normal mammograms. Thus, the abnormal cases were "normal" mammograms of patients who would later develop breast cancer. Participants were asked to rate the likelihood of abnormality of the images on a 0-100 scale. Exposure duration was 500 msec. Rating scale data were converted to ROC curves and d' was calculated. The ability to distinguish normal from abnormal (cancer priors) was small (d'=0.2) but statistically significant (p< 0.001). Even though radiologists were viewing images taken 3 years prior to any visible signs of cancer being detected, they were able to classify images as normal or abnormal at above chance levels. The result was not due to a few salient cases nor was it correlated with breast density (a known risk factor). This supports the hypothesis that radiologists have access to a global, non-selective signal of abnormality. If that signal could be reliably detected by humans or by computational systems, it could be a valuable part of the effort to assess an individual woman's risk factors and detect cancer early.

Methodology/Approach: Behavior/Psychophysics
Primary Topic Descriptor: Visual search: Attention
Presentation Preference: talk preferred
Award Consideration: