Dan Birman
Neuro Week 9 Summary

Lindquist et al. are focused on performing a meta-analysis of the results in the neuroimaging literature on human emotion. Their goal is to see whether the overall pattern of results across many studies suggests that one of the major theories of emotions might be correct. They distinguish between the 'locationist' view: emotion categories correspond to anatomical regions, and the 'constructionist' view: general brain networks underlie multiple types of emotions. A meta-analytic approach is particularly well suited for this problem because individual studies often do not investigate multiple emotions and there is usually high individual variability between subjects. Their methodology begins with a forward inference procedure in which they identify regions that are activated by a specific emotion, but not others, or by all emotions. They then do a voxel-wise search for activations that are significant in the one-emotion vs. all-emotions contrast. This is very similar to the approach used in functional localizers e.g. for face or place selective regions in visual cortex. They test the local consistency of these statistical maps via a chi-squared analysis that checks whether there is contingency in the counts of activations in spherical clusters of voxels across the brain—this relative approach identifies voxels that are relatively more activiated for one emotion than for the average of all other emotions. Finally they perform a logistic regression analysis that predicts voxel activation from the emotion categories themselves in each larger anatomically defined ROI. They found evidence that most regions are activated by multiple emotions. Their logistic regression for example shows that no region is activated by only a single emotion, and that some region's activations are reduced by certain emotions, suggesting a more complex pattern of activation than individual studies could have predicted.

One obvious issue with this approach is that the meta-analytic techniques that Lindquist et al. use is likely to bias their results towards the constructionist view. If we consider what we learned in class on Wed about meta-analysis we know that activations are pulled as peak values. Unfortunately this means that to re-construct the actual activation maps the authors have to make the assumption that peak activations represent a spherical cluster of underlying activations (which is somewhat true when you go through SPM, and your data has already been smoothed, but largely untrue if you bypass data smoothing). The end result of this multi-level smoothing is that it biases the results towards finding that most regions are activated by multiple emotions. This is particularly bad in the case where there is a single very strongly activated voxel in a sub-region of an anatomical ROI. Smoothing will make it appear that this single voxel is part of a large 'region' of activation, which may overlap with other emotion's activations. This kind of bias is largely unavoidable in this analysis, but should be considered as a problematic aspect of their approach.