Interactions between processing demands and conceptual structure in object recognition: an erfMRI study

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A central debate in cognitive neuroscience concerns the neural processes underlying object recognition in the ventral temporal cortex. We have argued that neural recruitment in object recognition interacts with task demands and concept structure (Tyler & Moss, 2001), in contrast to theories that emphasize neural specialisation for semantic information (Martin & Chao, 2001). In an erfMRI study we asked whether category-specific activations depend on the kind of information being processed or whether they reflect differential processing demands interacting with concept structure. Subjects made same-different judgements to word-coloured picture pairs from the categories of animals and vehicles. Words and pictures denoted either the same object (lion-LION), category neighbours (tiger-LION) or objects from different domains (bus-LION). If regions within the object processing stream are selectively activated by objects from certain categories, these activations should be observed whenever objects from these categories are presented (in both the same and category-neighbour conditions). If category patterns reflect processing demands, we predict more activation for vehicles than animals, but only when word and picture are category neighbours. This prediction is based on the claim that, in this condition, subjects must access distinctive features to make the same-different judgement. Since colour is less informative for vehicles, greater activation for vehicles would reflect increased processing demands in differentiating between close competitors. We observed more activation for vehicles than animals in the left fusiform gyrus, only when items were category neighbours. These results support our claim that category-related patterns emerge from the interaction between processing demands and concepts content.