Parametric effects of syntactic–semantic conflict in Broca's area during sentence processing

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unfolding utterance (The boy was kick...) might favor the default, active interpretation (that the boy was kicking something) until the syntactic structure indicates otherwise (The boy was kicked by...). This conflict between an earlier interpretation and the most recent sentence information could lead to increased recruitment of Broca's area (Novick et al., 2005). If this account is correct, then factors that influence the probability of a default Agent-Action-Object interpretation should also modulate LIFC activation. Consistent with this, Chen and colleagues have reported that an increase in Broca's area activation for object relative over subject relative structures was due to a subset of object relatives, specifically those where the relativized object noun was animate (e.g., The golfer that

All passive sentences were reversible and contained two animate noun-phrases. Thirty-six verbs occurred once each in the three kinds of passives. Verbs did not repeat within a run. Active sentences contained a combination of animate and inanimate noun-phrases (27 each of animate–animate, animate–inanimate, inanimate–animate, inanimate–inanimate). Fifty-four verbs appeared once each with animate and inanimate subjects.

All sentences (including conflict passives) were constructed to

4.2. fMRI results

We report activation patterns for the active and passive sentences in three different ROIs all within Broca's area. For each ROI, the parameter estimate for each sentence type for each subject was calculated and entered into a repeated measures ANOVA. Polynomial contrasts compared the parameter estimates for the three types of passives. Pair-wise contrasts compared the parameter estimates of actives versus no-conflict or conflict passives.

The first Broca's area ROI was derived from the contrast of all sentences minus baseline visual search (corrected $p < .05$). Within this ROI (Fig. 1a), activation for the different passives followed a linear trend ($F(1,13) = 11.74$; $p < .01$. Fig. 1b). Conflict passives showed the greatest activation followed by neutral passives and then no-conflict passives. In pair-wise comparisons, no-conflict passives did not show increased activation relative to actives ($F(1,13) < 1$; $p > .9$); conflict passives did ($F(1,13) = 14$; $p < .01$). Half of our active sentences contained inanimate subjects. Such sentences can potentially give rise to conflict due to the fact that inanimate subjects are more consistent with passive than active structures. To evaluate the pair-wise results without this confound, we compared no-conflict and conflict passives to a subset of the active sentences that contained animate subjects. This showed the same pattern as with the entire set of active sentences: no-conflict passives ($\beta = 0.0015$) did not show increased activation relative to actives with animate subjects ($\beta = 0.0019$. $F(1,13) = 1.98$, $p > .1$); conflict passives ($\beta = 0.0030$) did ($F(1,13 = 7.11$, $p < .02$). The linear trend within passives was not found in a similarly derived temporal lobe ROI (Fig. 1c and d, resulting in an ROI Conflict interaction when comparing these two regions: $F(1,13) = 9.44$; $p < .01$.), suggesting that it was specific to brain regions previously implicated in executive function.

The second Broca's area ROI (Fig. 2a) comprised 27 voxels around the center of activation reported in a previous study that argued for syntactic specialization in this region (Ben-Shachar et al., 2003). As Fig. 2b shows, here too we observed a linear trend in activation for the different passives ($F(1,13) = 11.56$; $p < .01$). Again, conflict passives showed increased activation over actives ($F(1,13) = 11.47$; $p < .01$); no-conflict passives did not ($F(1,13) < 1$; $p > .3$).[2]

The final Broca's area ROI (Fig. 2c) was obtained from the contrast of no-conflict passives minus actives (uncorrected $p < .001$). That is, we specifically chose voxels that may be construed as representing the syntactic difference between passives and actives. Note that this ROI is biased towards voxels wherevo6(0.001r7)-117896054.5(

function hypothesis that takes into account multiple syntactic

eat. . .), there was no requirement to evaluate whether the agent of the sentence could