Neural Correlates of Emotional Processing During the Audiovisual Presentation of Stories

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INTRODUCTION

We use language to communicate information, but a propositional or linguistic analysis does not recognize all the information available in spoken language. Emotional content is often conveyed in discourse, whether explicitly or implicitly. Virtually all social interactions involve some degree of emotional information, and understanding speech must involve processing and evaluating its emotional content. Previous biological studies of language and emotion have assumed that the emotional content of speech can be assessed at the single-word level (Hamann and Mao, 2002). By presenting participants with stories with measurable emotional content, the present study aimed to investigate human language understanding in a broader context. We hypothesized that attending to stories high in positive or negative emotional ratings would differentially recruit brain regions important for both language and emotional processing compared to stories with lower ratings.

METHODS

Subjects
Nine right-handed native English speakers (5 female) listened to stories presented in an audiovisual recording of a storyteller.

Acquisition
GE Spiral BOLD fMRI at 1.5T, TR = 3000ms, TE = 35 ms, voxel size is 1.875 x 1.875 x 6 mm.

Stimuli
Stimuli were separate stories of approximately 24 seconds that naturally varied along several emotional dimensions. To provide ratings on the emotional content of the stories, a separate group of 17 participants rated the degree to which each story produced different emotions: amused, happy, relaxed, upset, sad, bored. Stories were then assigned into two groups, reflecting high and low levels for comparison within each emotion.

Analysis
A regression analysis was used to reveal voxel-wise signal change for each condition, and the individual data were transformed into stereotactic coordinates, for analysis using a group ANOVA ($p < .005$, corrected).

RESULTS AND DISCUSSION

The results described here reflect group statistical comparisons between hemodynamic responses to stories rated high and those rated low for each particular emotion. No clusters were found in comparing the *amused*, *bored*, or *relaxed* comparisons at this level of significance. See Figure 1.

	Happy High > Low	Sad Low > High	Upset Low > High
Left Inferior Frontal Gyrus	x		
Right Middle Frontal Gyrus		x	x
Left Insula	x	x	x
Right Insula		x	
Left Parahippocampal Gyrus	x		
Right Putamen		x	

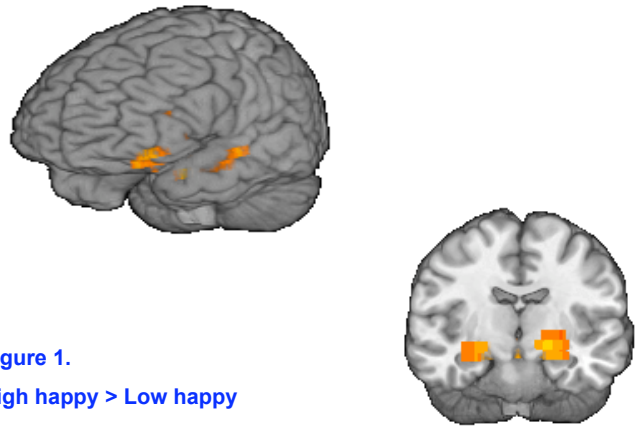

Figure 1.

High happy > Low happy

Individual subject image of active voxels in High happy - Low happy story comparison at $p < 0.0001$.

CONCLUSIONS

Areas previously implicated in language processing demonstrated greater activity in response to stories that were rated higher in positive emotion and lower in negative emotion, although the linguistic demands do not change. These stories also activated regions involved in emotional processing of stimuli, providing information regarding how the brain processes emotional speech. The insula projects to the amygdala, which connects to striatal structures, including putamen, providing a means for evaluating the stimuli for emotional information. The active recruitment of Broca's area suggests that this region is sensitive to the emotional content of language. The greater activation in response to positive stories provides evidence that listeners were more actively processing these stories, both in emotion and language regions.

REFERENCES

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