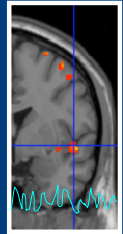




# Functional Neuroanatomic Differences between Low and High Socio-Economic Status: An Emotional Visual fMRI Study

Daniela Guillian<sup>1</sup>, Michael E. Silverman<sup>1</sup>, Peter Muennig<sup>2</sup>, Zohn Rosen<sup>3</sup>, Thomas P. Naidich<sup>1</sup>, Martin A. Goldstein<sup>1</sup>  
<sup>1</sup>Mount Sinai School of Medicine, Mount Sinai Medical Center, New York  
<sup>2</sup>Mailman School of Public Health, Columbia University, New York  
<sup>3</sup>Department of Psychology at the Graduate Center, City University of New York



## BACKGROUND

Low socioeconomic status (SES) is associated with increased morbidity.<sup>1,2</sup> Material deprivations account for only part of this association<sup>3</sup>, prompting study of other ways SES impacts health. One candidate mechanism involves low SES-related psychological stress yielding deleterious somatic effects<sup>4</sup>. Confirming this would require extending insights derived from animal<sup>5</sup> and human models involving environmental stress, and determining a mechanism by which low SES-related environmental stressors are neurally-transduced (akin to neuroimaging explorations of acute stressor responses, e.g., PTSD).<sup>6</sup>

## OBJECTIVE

To use fMRI to explore the neural activation differences between low and high SES subjects during poverty-related visual stimulus processing.

## SUBJECTS

- 23 African-American, right handed, medically and psychiatrically healthy individuals were scanned. 7 subjects were subsequently removed from analysis due to excessive head movement.
- Final analysis included 8 High SES & 8 Low SES subjects.

## METHODS

### SUBJECT CLASSIFICATION:

- **Demographic data:** Country of birth, location of residence, age, occupation, income, education, personal and parental home ownership.
- **Neuropsychological:** Perceived Stress Scale, Perceived Neighborhood Scale, MacArthur Ladder, Rosenberg Self-Esteem Scale, Comprehensive Quality of Life Inventory, Negative Life Events Scale, Social Status Index, Beck's Hopelessness Scale, Control, Hostility & Optimism.

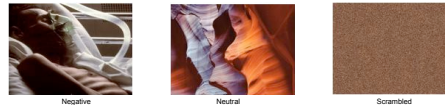
### NEUROPSYCHOLOGICAL ACTIVATION PARADIGM:

- 2-alternative-forced-choice button press: one button corresponding to presentation of a pictorial image, another button to scrambled image
- Stimuli consisted of positive, negative, neutral images from the IAPS, scrambled images and custom poverty images validated in the same manner of the IAPS using 40 participants from impoverished neighborhoods in Manhattan, New York.
- Stimuli were presented in block design comprised of 40 total blocks (8 blocks per run, 5 total runs), pseudo-randomized and counterbalanced to control for order and time effects.
- Each block was composed of 10 stimuli picture/scrambled image (trials) of the same valence.
- 100 trials per condition, and 400 total trials per complete study session.
- Stimuli appeared for 1.5 second, followed by a jittered inter-stimulus interval (ISI) averaging 1900 msec., for a total block duration of 34 seconds. Each block was followed by 12 seconds of rest. Each run was preceded and followed by additional 36-second rest periods. Inter-run rest periods were variable, not exceeding one minute.

### NEUROPSYCHOLOGICAL ACTIVATION PARADIGM (Cont.):

- Stimulus presentation and response collection were performed within the E-Prime environment
- Stimuli extended across entire screen subtending an average visual angle of approximately of 28° x 30°

#### Example Stimuli



### NEUROIMAGING:

- Head-dedicated Siemens Allegra 3T MRI scanner.
- Structural images were acquired with a high-resolution T1-weighted SPGR sequence (resolution 256mm X 256mm for anatomic localization).
- T2\*-weighted echo planar imaging (EPI) was used to obtain blood oxygen level dependent (BOLD) functional images. • TR=2000ms, TE=30ms, flip angle=90°, FoV=210 x 210; 32 slices; 3.0mm thickness; 1 mm skip gap; matrix=64x64.

### DATA ANALYSIS:

- Image analysis was conducted with FSL using standardized steps of realignment, spatial smoothing with isotropic Gaussian kernel, and stereotactic normalization to standardized coordinate space (Montreal Neurological Institute Atlas within Talairach space).
- The first 2 time-points of each run, acquired for gradient stabilization, were discarded before analysis.
- Data was analyzed from the negative image vs. neutral image contrast.
- Regions of interest were defined by clusters of  $\geq 30$  contiguous voxels revealing a significant difference in activation across conditions ( $P < .005$  two-tailed).

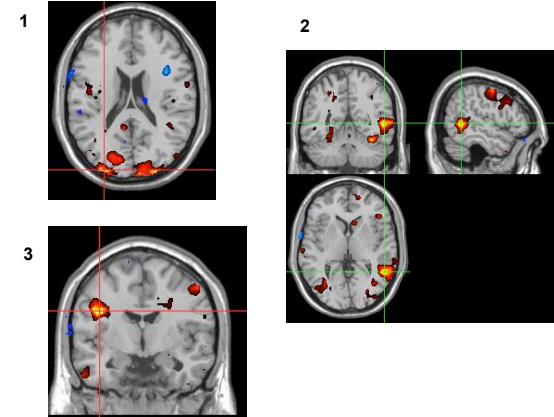
## RESULTS

Relative to high SES, low SES subjects demonstrated greater occipital and fusiform activations while incidentally-processing negatively-valenced visual stimuli. Other significant regional activation differences included left precentral gyrus.

cluster region	study-relevant function	Talairach coordinates	Z-score	image
L occipital	primary and secondary visual cortex	-28, -94, 20	4.39	1
R occipital	primary and secondary visual cortex	26, -96, 16	4.12	
R occipital-temporal / fusiform	visual association	38, -52, -22	3.62	2
R temporal	emotional linguistic / visual association	56, -52, 2	4.01	2
L precentral gyrus	L motor strip, R hand	-40, -6, 28	4.08	3

## RESULTS (Cont.)

note: all images shown  $p \leq 0.05$  for visualization



## CONCLUSION

Low SES subjects demonstrated significantly greater primary and secondary visual cortical activation, and greater primary motor outflow, during incidental processing of negatively-valenced visual stimuli. These results suggest enhanced visual processing of, and augmented motor response to, negative stimuli, thereby offering a potential neural mechanism mediating the transduction of, and differential efferent response to, environmental stressors within low SES.

### References

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