

The good, the bad, and the ugly: An fMRI investigation of the functional anatomic correlates of stigma

Anne C. Krendl

Dartmouth College, Hanover, NH, USA

C. Neil Macrae

University of Aberdeen, Aberdeen, UK

William M. Kelley

Dartmouth College, Hanover, NH, USA

Jonathan A. Fugelsang

University of Waterloo, Waterloo, Ontario, Canada

Todd F. Heatherton

Dartmouth College, Hanover, NH, USA

Social interactions require fast and efficient person perception, which is best achieved through the process of categorization. However, this process can produce pernicious outcomes, particularly in the case of stigma. This study used fMRI to investigate the neural correlates involved in forming both explicit (“Do you like or dislike this person?”) and implicit (“Is this a male or female?”) judgments of people possessing well-established stigmatized conditions (obesity, facial piercings, transsexuality, and unattractiveness), as well as normal controls. Participants also made post-scan disgust ratings on all the faces that they viewed during imaging. These ratings were subsequently examined (modeled linearly) in a parametric analysis. Regions of interest that emerged include areas previously demonstrated to respond to aversive and disgust-inducing material (amygdala and insula), as well as regions strongly associated with inhibition and control (anterior cingulate and lateral prefrontal cortex). Further, greater differences in activation were observed in the implicit condition for both the amygdala and prefrontal cortical regions in response to the most negatively perceived faces. Specifically, as subcortical responses (e.g., amygdala) increased, cortical responses (e.g., lateral PFC and anterior cingulate) also increased, indicating the possibility of inhibitory processing. These findings help elucidate the neural underpinnings of stigma.

On a daily basis, people rely on categorical representations to navigate through the social world. Categories enable people to quickly access

information about the people with whom they are interacting (e.g., “young girl,” “Asian man,” “intoxicated Scotsman”), thereby expediting

Correspondence should be addressed to: Anne C. Krendl, 6207 Moore Hall, Dartmouth College, Hanover, NH 03755, USA.
E-mail: akrendl@dartmouth.edu

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social cognition, enabling appraisal and evaluation, and ultimately shaping behavior. For example, people typically rely on fundamental cues, such as race, age, and sex, when categorizing others (Fiske, 1993). These cues trigger stereotypes about the groups they represent, thereby facilitating person perception processes (Kunda & Thagard, 1996; Macrae, Bodenhausen, Milne, & Jetten, 1994). Recently, neuroscientists have used imaging techniques to gain a better understanding of the neural correlates of social categorization (Haxby, Hoffman, & Gobbini, 2002; Kanwisher, McDermott, & Chun, 1997; Mason & Macrae, 2004). In the present study, we explore a somewhat more complex type of categorization that is ubiquitous in humankind: stigma, which refers to any attribute that reduces someone “in our minds from a whole and usual person to a tainted, discounted one” (Goffman, 1963). Stigmatization relies on categorization based on common stereotypes (Macrae & Bodenhausen, 2000) that are activated relatively automatically (Bargh & Gollwitzer, 1994), at least under certain conditions (Macrae & Bodenhausen, 2000).

Once activated, stigmas are incredibly powerful, and have a significant influence on how the stigmatized are treated. Stigmas render their targets “devalued, spoiled or flawed in the eyes of others” (Crocker, Major, & Steele, 1998). Thus, unattractive people are evaluated and treated less positively by their peers than are their attractive counterparts and even have greater difficulty obtaining jobs (Hosoda, Stone-Romero, & Coats, 2003; Langlois, Kalakanis, Rubenstein, Larson, Hallam, & Smoot, 2000). The obese are discriminated against in academic and personal domains (Crandall, 1995; Hebl & Heatherton, 1998), as well as in health-care settings (Hebl & Xu, 2001). Homosexuals are discriminated against in social and legal contexts (Herek, Capitanio, & Widaman, 2003) and in interpersonal interactions (Hebl, Foster, Mannix, & Dovidio, 2002). People with disfigurements suffer from low self-esteem (Rumsey & Harcourt, 2004), and are treated poorly in social interactions (Broder, Smith, & Strauss, 2001; Kleck & Strenta, 1980). And so on.

Research in social psychology suggests that different types of stigma elicit distinct affective and cognitive responses, which, in turn, determine the perception and response to people with stigmas (Jones, Farina, Hastorf, Markus, Miller, & Scott, 1984; Kurzban & Leary, 2001). In particular, the controllability (the degree to which the bearer of the stigma is viewed as being

responsible for his or her stigma) may modulate the emotional reaction it elicits (Pryor, Reeder, Yeadon, & Hesson-McInnis, 2004; Schmidt & Weiner, 1988; Weiner, 1996). Over a series of studies, Weiner and colleagues (1988) concluded that “uncontrollable” stigma conditions (e.g., blindness) elicited greater liking, more pity, and less anger from the perceivers than did “controllable” stigmas (e.g., obesity).

From a social neuroscience perspective, the use of neuroimaging may be valuable for elucidating fundamental aspects of stigmatization. However, the extant fMRI literature on stigma has focused almost exclusively on race (for a review see Eberhardt, 2005). Specifically, studies have observed the involvement of the amygdala and prefrontal regions in perceptions of African-Americans (Cunningham, Johnson, Raye, Gatenby, Gore, & Banaji, 2004; Hart, Whalen, Shin, McInerney, Fischer, & Rauch, 2000; Lieberman, Hariri, Jarcho, Eisenberger, & Brookheimer, 2005; Phelps et al., 2000; Richeson et al., 2003). Although each of these studies has argued for the role of the amygdala and prefrontal cortex, the specific pattern of neural activations observed in these studies has varied widely. It is possible that the observed discrepancies are attributable to meaningful individual differences among research participants. For instance, Phelps and colleagues (2000) failed to find amygdala activation when White participants viewed pictures of unfamiliar Black faces; however, when activity in the amygdala was correlated with implicit measures of racial bias, they found robust activation. Thus, individual prejudice levels may modulate cortical responses to viewing pictures of ingroup versus outgroup members (Chiu, Ambady, & Deldin, 2004). In addition, it is likely that the perception of stigma is driven by the goals of the observer. A recent study by Wheeler and Fiske (2005) found amygdala activity to Black faces only when the target was being perceived in a socially relevant manner. Likewise, the activation of social categories can be actively inhibited if the perceiver is motivated to do so (Sinclair & Kunda, 1999). As a result, individual differences appear to play a critical role in both how bearers of stigma are treated, as well as how that treatment affects both the target and perceiver (Crandall & Cohen, 1994; Crocker et al., 1998; Peters, Burraston, & Mertz, 2004).

An open question is whether the pattern of amygdala responsiveness in these race-based studies reflects a specific response to one racial

group, or whether it reflects a more general response to members of any stigmatized out-group. The present study uses fMRI to examine neural activity in response to a variety of social stigmas. In order to assess individual differences in these perceptions, we examined parametric modulation of neural activity based on individual evaluative ratings. We chose stimulus materials that represent widely acknowledged categories of social stigmas—obesity, unattractiveness, facial deformity through piercing, and transsexuals. These were chosen in part as reflecting differential levels of controllability over the stigma. Facial piercings, for instance, are clearly controlled by those who possess them, whereas physical attractiveness is determined to a larger extent by one's genes. Both obesity and transsexual identity have elements of controllability and uncontrollability and are therefore more ambiguous (Weiner, 1996). Because people vary in the extent to which they view these stigmas as controllable and/or the extent to which they have a negative response to these stigmas, the parametric modulation provides a way of dissociating these factors. Thus, we examined individual ratings of disgust for each target picture to explore this issue.

An additional consideration to understanding the neural underpinnings of stigma is whether negative reactions occur automatically and obligatorily, or whether they depend on the nature of the task being performed. That is, prior studies have used mainly implicit measures rather than asking people to make explicit evaluations of the person being perceived. Because people are generally motivated not to show prejudiced responses, it is possible that asking people to make explicit judgments will produce differential patterns of activation based on the extent to which participants are able to modulate their evaluative responses when observing stigmas. Here, we use both an implicit and explicit task to address this question.

METHODS

Participants. Twenty-eight participants between the ages of 18 and 27 were recruited from the Dartmouth community. Three were excluded due to excessive movement during imaging (>2 mm between successive image acquisitions), and three additional subjects were excluded due to problems with data acquisition. Results reported

here reflected data from 22 participants (11 male, mean age = 20.7 years). All participants were right-handed, with normal or corrected-to-normal visual acuity. Participants were either paid for their participation or received course credit. All participants gave informed consent in accordance with the guidelines set forth by the Dartmouth College Committee for the Protection of Human Subjects.

Imaging procedure. Imaging was performed on a 1.5T whole-body scanner (General Electric Medical Systems Signa, Milwaukee, WI) with a standard head coil. Visual stimuli were generated with an Apple G3 Laptop computer running Psyscope software (Cohen, MacWhinney, Flatt, & Provost, 1993). Stimuli were projected onto a screen positioned at the head end of the bore by an Epson (model ELP-7000) LCD projector. Participants viewed the screen through a mirror mounted on top of the head coil. A fiber-optic, light-sensitive key press that interfaced with the Psyscope Button Box (New Micros, Dallas, TX) was used to record participants' behavioral performance. Cushions were used to minimize head movement.

Anatomical images were acquired using a high-resolution 3-D spoiled gradient recovery sequence (SPGR; 124 sagittal slices, $T_E = 6$ ms, $T_R = 25$ ms, flip angle = 25° , voxel size = $1 \times 1 \times 1.2$ mm). Functional images were collected in runs using a gradient spin-echo echo-planar sequence sensitive to blood oxygen level-dependent (BOLD) contrast (T_2^*) ($TR = 2000$ ms, $T_E = 35$ ms, flip angle = 90° , 3.75×3.75 mm in-plane resolution). During each functional run, 265 sets of axial images (20 slices; 5.5 mm slice thickness, 1 mm skip between slices) were acquired allowing complete brain coverage.

Behavioral tasks. Participants were imaged during four functional runs, during which they were shown high-resolution color pictures of headshots of faces. The pictures were modified in Adobe Photoshop CS (Version 8.0) to be equally sized 360×360 pixels with a resolution of 72 pixels/inch. A total of 640 images were used in the study. During each of the four functional runs, 160 picture trials and 105 fixation trials were pseudorandomly intermixed. Half of the total images comprised the stigmatized categories (unattractive, overweight, transsexual, and pierced faces), and the remaining half were images of

normal controls. The stigmatized faces were selected from websites that uniquely contained images of people who were self-described members of one of the four stigmatized groups (e.g., websites for piercing artists or transsexuals, dating websites for overweight people). The control pictures were photos that had been previously rated on attractiveness and trustworthiness by Dartmouth undergraduates. In each category, there were equal numbers of male and female images.

The study was modeled as a mixed-block event-related design. Each functional run was divided into two blocks: one evaluative, the other categorization based on sex. In the evaluative judgment block, participants were asked, “Do you like or dislike this person?” In the sex block, participants were asked to push a button to indicate whether the image was of a male or female. Participants indicated their responses via a left- or right-handed key press. Each trial lasted 2000 ms (i.e., 1 TR), and participants were free to respond at any point during this window. The order in which the blocks were presented was counterbalanced across participants and runs. Additionally, the judgments that were made on the pictures was counterbalanced across participants, such that an equal number of evaluative and sex judgments were made on all pictures. Within each block, participants were presented with images of controls and images of the four stigmatized groups in an event-related fashion. Fixation trials were pseudorandomly intermixed with face trials in each block to permit event-related analysis (i.e., to allow deconvolution of the hemodynamic signal unique to each trial). Inter-stimuli intervals ranged from 0 ms to 6000 ms.

After the scanning session, participants were asked to return to the laboratory on the following day to rate all 640 images on a 5-point Likert scale of disgust (ranging from 1 = *very disgusting* to 5 = *not at all disgusting*).

Data analysis. fMRI data were analyzed using Statistical Parametric Mapping software (Friston, Holmes, Worsley, Poline, Frith, & Frackowiak, 1995). For each functional run, data were pre-processed to remove sources of noise and artifact. Functional data were corrected for differences in acquisition time between slices for each whole-brain volume, realigned within and across runs to correct for head movement, and coregistered with

each participant’s anatomical data. Functional data were then transformed into a standard anatomical space (3 mm isotropic voxels) based on the ICBM 152 brain template (Montreal Neurological Institute) which approximates Talairach and Tournoux atlas space (Talairach & Tournoux, 1988). Normalized data were then spatially smoothed, 6 mm full width at half maximum (FWHM), using a Gaussian kernel.

Analyses took place at two levels: formation of statistical images and parametric modulation based on post-scan behavioral responses. First, for each participant, a general linear model incorporating task effects (Friston, Fletcher, Josephs, Holmes, Rugg, & Turner, 1998), and covariates of no interest (a mean for each functional run, a linear trend for each functional run, and six movement parameters derived from realignment) were used to compute parameter estimates (β) and *t*-contrast images (containing weighted parameter estimates) for each comparison at each voxel. These individual contrast images were then submitted to a second-level, random-effects analysis to create mean *t*-images (threshold at $p = .001$, uncorrected). An automated search algorithm identified the location of peak activations and deactivations based on *z*-values and cluster size. This analysis allowed task effects to be explored by comparing all image trials (stigmatized faces and controls) with baseline. The comparisons between individual task images (e.g., trials in which participants made evaluative ratings on images of obese people) and baseline were used for subsequent region of interest (ROI) analyses resulting from the parametric modulation.

The parametric modulation was conducted using the post-scan individual ratings of disgust for each image as the covariate of interest (modeled linearly). The parametric modulation allowed for the exploration of whether the hemodynamic response linearly increased with the behavioral disgust rating. Each participant’s behavioral response (a numerical response on a scale of 1 to 5) was reverse scored such that a score of 1 would be equivalent to a “*not at all disgusting*” rating, and 5 would be a “*very disgusting*” rating. The parametric modulation modeled a linear increase in BOLD response that paralleled the linear increase in individual ratings. The significance threshold for parametric analyses was set at $p < .001$.

TABLE 1

Behavioral responses: mean dislike ratings (*SEM*) from evaluative condition collected during the scan session, as well as mean familiarity ratings (*SEM*) as rated by a separate group of participants ($n=38$) for the stigma faces

	<i>Control</i>	<i>Obese</i>	<i>Pierced</i>	<i>Transsexual</i>	<i>Unattractive</i>
Dislike (1 = <i>like</i> , 2 = <i>dislike</i>)	1.36 (.02)	1.66 (.02)	1.67 (.02)	1.77 (.02)	1.80 (.01)
Familiarity (1 = <i>not familiar</i> , 7 = <i>very familiar</i>)	N/A	4.21 (.28)	2.79 (.24)	1.59 (.17)	4.71 (.26)

Based on the parametric map, ROI analyses were conducted using the functional ROIs tool in SPM99 (SPM ROI Toolbox; <http://spm-toolbox.sourceforge.net>). All significant voxels ($p < .001$) within 8 mm of a peak location were included in each ROI. An extent threshold of ten contiguously activated voxels was also applied. Signal intensities for each ROI were then calculated separately for each condition and examined statistically using repeated-measures analysis of variance (ANOVA).

RESULTS

Behavioral data

We first examined the behavioral data acquired during the scan session, specifically the evaluative ratings (like or dislike) that participants assigned to the pictures. A one-way ANOVA on likeability revealed a main effect of Stigma Type, $F(4, 634) = 392.97$, $p < .001$. Subsequent t -tests revealed that

control faces were more liked than the stigma faces (paired t -tests between normal faces and stigma faces all revealed $p < .001$). Additionally, among the stigma faces, transsexuals and unattractive faces were the most disliked ($p < .01$ for all comparisons; see Table 1).

In a post-scan session, participants were asked to rate all the images that they had seen during the study on a 5-point Likert scale, ranging from 1 = *very disgusting* to 5 = *not at all disgusting*. The subsequent ratings were reverse scored for use in the parametric modulation. An ANOVA conducted on the ratings revealed a main effect of Stigma Type, $F(4, 316) = 513.7$, $p < .001$, partial $\eta^2 = .87$. Subsequent t -tests revealed that the control faces were rated as being the least disgusting of all the faces presented ($p < .001$ for every comparison). Among the ratings for the stigmatized faces, each group was significantly different, with the unattractive faces rated as the most disgusting, and the obese rated as being the least disgusting ($p < .001$ for every comparison; see Figure 1).

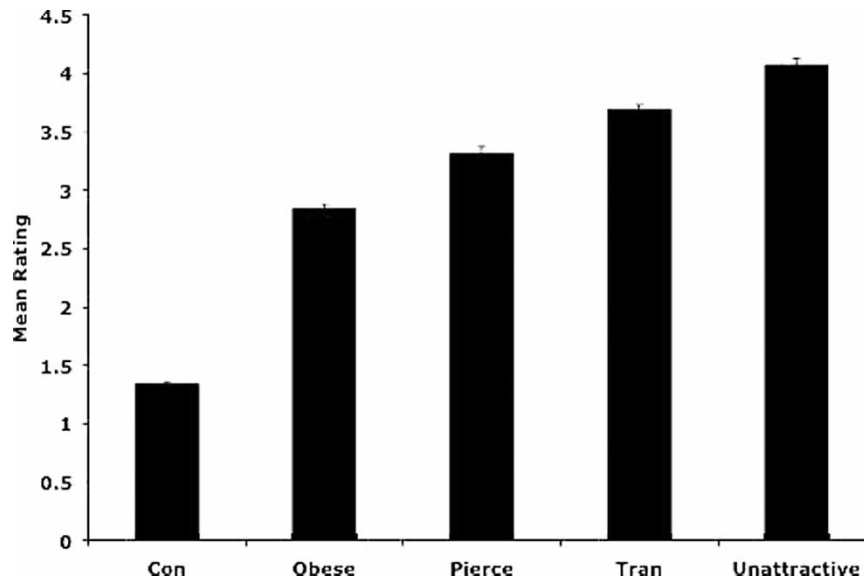


Figure 1. Mean disgusting ratings: post hoc individual ratings, reverse scored such that 1 = *not at all disgusting*, 5 = *very disgusting*.

fMRI data

Parametric modulation of disgust ratings

The parametric modulation conducted using participants' post-hoc disgust ratings of each target face revealed a robust bilateral response in the amygdala, right fusiform gyrus (BA 37), bilateral PFC (left BA 6, right BA 9/45), anterior cingulate gyrus (BA 32), and left insula (BA 13; see Figure 2, also Table 2). These ROIs were then examined separately for each trial type and judgment task (evaluative or sex) \times 5 (Stigma Type: controls, obese, pierced, transsexual, and unattractive) ANOVA was conducted on the signal change in each region.

Bilateral amygdala. Analyses conducted on signal intensities for both the left and right amygdala revealed a main effect of Stigma Type, $F(4, 84) = 14.5$, $p < .001$, partial $\eta^2 = .41$ and $F(4, 84) = 12.7$, $p < .001$, partial $\eta^2 = .38$ respectively, a main effect of Task for the left amygdala only, gender > evaluation; $F(4, 84) = 4.3$, $p = .05$, partial $\eta^2 = .17$; right: $F < 1$, and no interaction, left: $F(4, 84) = 1.28$, $p = .28$, partial $\eta^2 = .06$; right: $F(4, 84) = 1.51$, $p = .21$, partial $\eta^2 = .07$; Figure 2C.

In the left amygdala, post hoc statistical tests revealed that the main effect of Stigma Type was driven primarily by the unattractive faces, which showed greater activation relative to the pierced, obese, and control faces ($p < .01$ for all). In addition, the transsexual faces showed greater activation than controls ($p < .01$), and obese faces

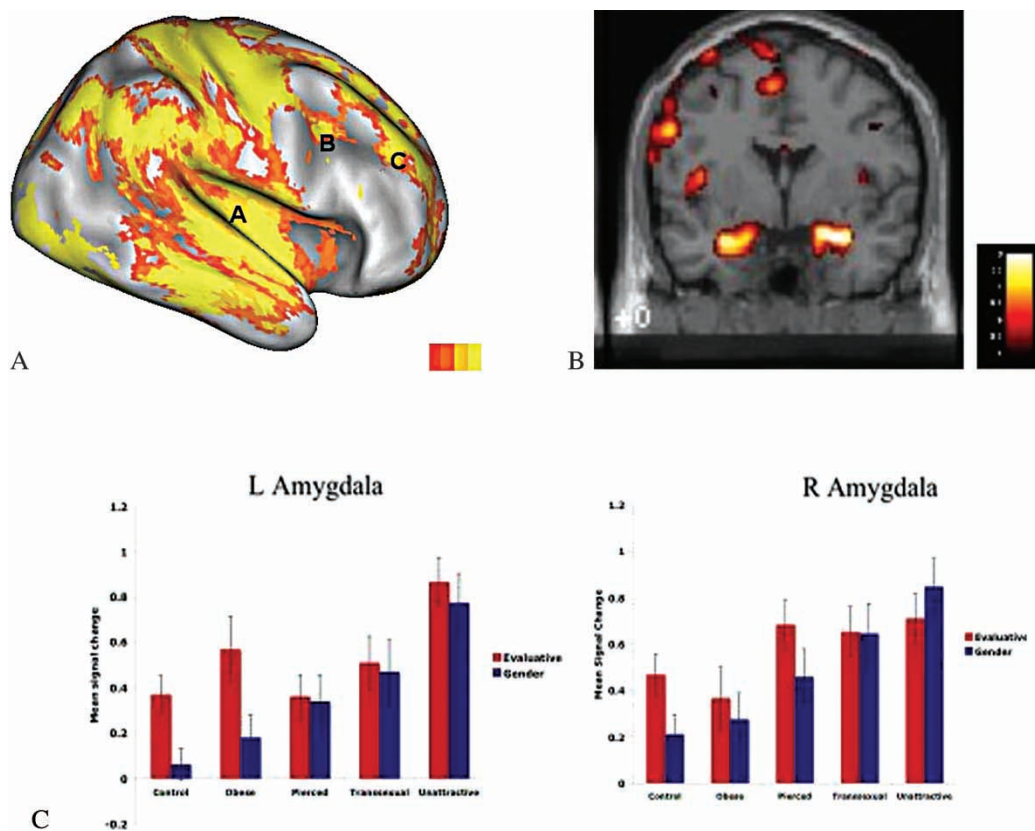


Figure 2. Parametric modulation of disgust ratings: analysis conducted with individual disgust ratings modeled linearly as a covariate of interest. (A) An inflated voxel-by-voxel cortical rendering of the right hemisphere with a minimum threshold set at $T = 3.53$, and maximum set at $T = 7$ for $p < .001$ uncorrected (Van Essen, Drury, Dickson, Harwell, Hanlon, & Anderson, 2001). ROI analyses extracted activity in the right inferior frontal gyrus (A; BA 45: 53, 24, 18), right medial frontal gyrus (B; BA 9: 50, 8, 36), and anterior cingulate gyrus (C; BA 32: -9, 22, 35) activity. (B) Coronal slice at the 0 point on the z-axis shows robust activity in the bilateral amygdala (L: -18, -4, -17; R: 18, -4, -17) and left insula (BA 13: -42, -3, 9). (C) Plots show change in signal amplitude across conditions relative to a baseline control condition (fixating a cross-hair). Error bars indicate SEM. Left amygdala (left panel) demonstrated sensitivity to highly negative stigmas as compared to controls in the evaluative (explicit) condition, but only to the most negative stigma (unattractive) in the gender (implicit) condition. Right amygdala (right panel) demonstrated sensitivity to stigma conditions in both the evaluative and gender conditions.

TABLE 2

Parametric modulation ROIs: individual ratings of disgust serving as a covariate of interest with $p < .001$, uncorrected

<i>Brain region</i>	<i>x</i>	<i>y</i>	<i>z</i>	<i>z-score</i>	<i>Voxels</i>
L. amygdala	-18	-4	-17	6.45	46
R. amygdala	18	-4	-17	6.65	46
L. insula (BA 13)	-42	-3	9	5.19	16
R. fusiform (BA 37)	48	-54	-18	8.39	71
R. lingual gyrus (BA 18)	30	-70	-7	11.05	70
R. inferior frontal gyrus (BA 45)	53	24	18	7.96	78
R. medial frontal gyrus (BA 9)	50	8	36	5.88	51
L. superior frontal gyrus (BA 6)	-6	11	52	6.02	60
L. middle frontal gyrus (BA 6)	-30	-6	53	4.83	29
Anterior cingulate gyrus (BA 32)	-9	22	35	5.00	32

showed a marginally greater activation relative to controls ($p = .08$).

The right amygdala also showed significantly greater activation for unattractive, transsexual, and pierced faces as compared to controls ($p < .01$). Additionally, the right amygdala showed heightened response for unattractive, transsexual, and pierced faces as compared to obese faces ($p < .01$), and a marginally greater activation for unattractive than for pierced faces ($p = .07$). Therefore, the amygdala showed greater activation overall to the faces that received the highest disgust ratings (e.g., unattractive), with much greater activation in the gender (implicit) than evaluative (explicit) conditions.

Left anterior insula. There were no significant main effects in signal intensities for the left anterior insula, Stigma Type: $F(4, 84) = 1.40$, $p = .24$, partial $\eta^2 = .06$; Task: $F(4, 84) = 1.21$, $p = .29$, partial $\eta^2 = .05$, and no interaction, $F(4, 84) = 1.21$, $p = .31$, partial $\eta^2 = .06$.

Lateral PFC. Analyses of signal change in the right lateral PFC (BA 9 and BA 45) revealed a main effect of Stigma Type for both, BA 9: $F(4, 84) = 3.14$, $p < .02$, partial $\eta^2 = .13$; BA 45: $F(4, 84) = 11.5$, $p < .001$, partial $\eta^2 = .35$, but no effect of Task for either BA 9 or BA 45 (both: $F < 1$). There was a Stigma Type \times Task interaction for both BA 9 and BA 45, BA 9: $F(4, 84) = 3.47$, $p < .02$, partial $\eta^2 = .14$; BA 45: $F(4, 84) = 5.89$, $p < .001$.

The interaction in BA 9 emerged because these regions showed differential activations in response to the stigma faces during gender judgments, but not during evaluative judgments. During the gender judgments, BA 9 showed the greatest response to the faces that had been rated the most disgusting (unattractive, transsexual, and

pierced; $p < .01$ for all) relative to controls. Additionally, it showed heightened activity in response to unattractive and transsexual faces as compared to obese faces ($p < .02$ for both).

The interaction in BA 45 emerged because face categories judged to be the most disgusting (unattractive and transsexual) yielded greater activity during the gender than evaluative judgments, whereas the reverse was true for the least disgusting face categories (obese and control). Activity for faces judged to be of moderate disgust (i.e., pierced) did not differ as a function of task judgment in BA 45. Thus, BA 9 and BA 45 showed the greatest change in activation in the gender condition when responding to the most negatively perceived faces.

Anterior cingulate gyrus. Analyses of activations in the anterior cingulate gyrus (BA 32) revealed no main effects, Stigma Type $F(4, 84) = 2.11$, $p = .09$, partial $\eta^2 = .09$; Task: $F < 1$, but did reveal a Task \times Stigma Type interaction, $F(4, 84) = 3.04$, $p < .02$, partial $\eta^2 = .13$. The interaction emerged because there are no significant differences in activation to stigma types in the evaluative task, whereas all stigma conditions (unattractive, transsexual, pierced, and obese) showed greater activation as compared to control faces in the gender task ($p < .05$ for all). Therefore, the anterior cingulate shows increasing activation only in the gender (implicit) condition in response to all stigma types.

Right fusiform gyrus. Analyses of activation in the right fusiform gyrus revealed a main effect of Stigma Type, $F(4, 84) = 18.2$, $p < .001$, partial $\eta^2 = .46$, no main effect of Task ($F < 1$), and no interaction, $F(4, 84) = 2.33$, $p = .06$, partial $\eta^2 = .10$. Post hoc statistical tests revealed that unattractive, transsexual, and pierced faces showed

significantly greater activation than both controls and obese faces ($p < .001$ for all), and obese faces exhibited a trend toward greater activation than controls ($p = .07$). Additionally, unattractive and transsexual faces showed marginally significant heightened activations relative to pierced faces (unattractive: $p = .07$; transsexual: $p = .06$). Thus the right fusiform shows heightened activation to negatively perceived stigmas, regardless of task.

Familiarity

In order to rule out the possibility that these findings were driven by participants' relative familiarity with these categories of faces, a group of separate subjects from the Dartmouth community ($n = 38$) rated how familiar they were with the categories of stigma we presented. This group was different from those who participated in the fMRI study, and were asked to participate to serve as a representative sample for what types of people we could reasonably expect someone from the Dartmouth community (such as those in our study) to have experienced. Participants were asked to rate on a 7-point Likert scale (ranging from 1 = *most infrequent* to 7 = *most frequent*) how often they interacted with someone who was obese, had numerous facial piercings, was transsexual, or was unattractive (see Table 1). Correlations between the familiarity ratings and the mean signal changes in the ROIs described above were not significant.

DISCUSSION

The findings from this study indicate that an extensive neural network, including the amygdala, insula, anterior cingulate, and lateral prefrontal cortex is involved in processing highly negative social stigmas. These neural regions have been shown previously to be involved in responding to aversive and disgusting stimuli, as well as modulating inhibition and cognitive control. Our findings are consistent with the hypothesis that stigma involves an affective component that influences perception. Of note, the amygdala, well-known for its role in evaluating negative stimuli (for a review see Davis & Whalen, 2001), showed greater activation with increasing negative evaluation.

An open question in stigma research to date has been whether these reactions are automatic or depend on the type of evaluation being made.

Previous studies suggest that amygdala activation may be limited to implicit evaluations (Critchley et al., 2000; Cunningham et al., 2004; Phelps et al., 2000; Whalen, Rauch, Etcoff, McInerney, Lee, & Jenike, 1998). Indeed, the findings from the present study indicate that amygdala activation is much stronger in implicit than explicit conditions, in keeping with the extant literature. However, we did find amygdala activation in explicit conditions for the faces that received extremely negative behavioral ratings, stimuli not likely to have been included in previous research.

What role might the amygdala be playing in evaluating stigma? One possibility is that the amygdala plays a role in social learning that biases an individual to avoid stigmatized others. Indeed, a behavioral consequence of stigma is that people are generally motivated to avoid and/or reject those who possess a stigmatizing condition, possibly because the stigma indicates that its possessors are dangerous and/or distasteful (Stangor & Crandall, 2000). Over the course of human evolution, the avoidance of those possessing stigma may have been adaptive. Numerous studies have explored the amygdala's role in enhancing subsequent memory for emotional stimuli, lending support to this hypothesis (Canli, Zhao, Brewer, Gabrieli, & Cahill, 2000; Phelps, 2006; Phelps & LeDoux, 2005; Tabert et al., 2001).

Interestingly, the left anterior insula also tracked with the faces that received the highest negative explicit rating. Previous research has implicated the anterior insula in responding to facial expressions of disgust (Phillips et al., 1997), and, more recently, to photographs presenting "disgusting" scenes of contamination or mutilation (Wright, He, Shapira, Goodman, & Liu, 2004). In the present study, the left anterior insula showed heightened activation in response to the transsexual and unattractive faces, both of which were subsequently rated as being the most disgusting of the faces presented. However, the insula only showed this heightened activation in the implicit task, suggesting that it may be involved in more automatic or unconscious evaluations of highly negative or "disgusting" stigmas. Interestingly, prior research on the insula has found evidence of bilateral anterior insula activation in response to disgusting stimuli (Phillips et al., 1997; Wright et al., 2004), whereas the present study only found left-lateralized activation. One possibility for the absence of right anterior insula activation in the present study may simply be insufficient power due to the

enormous range of stimuli. However, it is also possible that the insula is playing a different role in evaluating these faces than merely perceiving disgust, such as making a preference judgment (Paulus & Frank, 2003) or responding to perceived valence of the faces (Morris et al., 1998).

Although the involvement of affective regions in perceiving stigmas is powerful, if these regions were solely responsible for guiding behavior we would expect to consistently observe hostile interactions with the stigmatized. In the modern era, the mistreatment of those possessing stigma is not sanctioned by society. It is therefore likely that, at least in some cases, automatic responses (e.g., amygdala) are regulated (i.e., inhibited) by higher order cognitive processes (e.g., areas in the prefrontal cortex). The robust activation of prefrontal regions (BA 9, BA 45, BA 32) may therefore reflect individual motivations to inhibit reactions to stigma, as has been previously observed in studies of racial stigma (e.g., Cunningham et al., 2004; Lieberman et al., 2005; Richeson et al., 2003). For instance, Cunningham and colleagues (2004) found activation in the amygdala during short (30 ms) presentations of Black faces to White participants. During longer presentations (525 ms) of Black faces, the amygdala activation was not present, but robust activation was observed instead in BA 44, 47, and 32. Given that the lateral PFC has been implicated in cognitive regulation (Cunningham et al., 2004), and the anterior cingulate is believed to be involved in conflict monitoring and cognitive control (Kerns, Cohen, MacDonald, Cho, Stenger, & Carter, 2004), Cunningham and colleagues conclude that the prefrontal cortex inhibits automatic activation of the amygdala in extended presentations. This network has also been implicated in the control and regulation of reactions to emotional stimuli (Ochsner, Bunge, Gross, & Gabrieli, 2002). Accordingly these prefrontal regions are differentially sensitive to motivational state and task demands.

How might we explain the divergent patterns of activation for BA 9, BA 45, and the anterior cingulate (BA 32) between the implicit and explicit conditions observed in this study? One possibility is that, in the explicit conditions, perceivers are highly motivated to control their evaluative response to the stigma faces. Thus, they employ cognitive control as soon as they are told to make evaluative judgments. This process remains online throughout the task. In the implicit

condition, perceivers are unaware of their automatic neural responses, and accordingly fail to exert cognitive control. Therefore, neural activity in the implicit condition depends solely on individual differences in how disgusting they find the stimuli. The interactions observed in BA 9, BA 45, and BA 32 are consistent with this interpretation. Evidence from behavioral research on implicit and explicit attitudes provides further support for this argument. Implicit attitudes have consistently been shown to be more accurate predictors of affective state than explicit attitudes because we are highly motivated to inhibit societally undesirable explicit attitudes (Conner & Feldman-Barrett, 2005; Greenwald, McGhee, & Schwartz, 1998; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Nosek & Banaji, 2001).

It is also possible that prefrontal regions may have preferentially responded to unattractive and transsexual faces because those stigmas are generally perceived as being less controllable, thus motivating individuals to regulate their responses to them. Further, the lack of response to obese faces may be attributable to the fact that our society does not expect people to inhibit negative responses to overweight people, as they are largely viewed as being responsible for their stigma. But, it is also possible that we may have attenuated the response to body weight by only showing faces.

Our findings contribute to the growing social neuroscience literature on person perception. Extending previously reported work using race-based stigma, our findings indicate that the network of activations observed in this study may reflect a more general neural response associated with negative social evaluations. Indeed, responses in a number of brain regions traditionally thought to underlie perceptions of race (e.g., amygdala, lateral prefrontal cortex) showed a linear relationship with subsequent disgust ratings to a wide variety of stigmatized groups. Importantly, the findings of our study demonstrate that this network of regions responds to stigma irrespective of task condition, indicating that the response to stigma is obligatory and automatic. Future work may elucidate differences in individual's ability to control their negative response to stigmas other than race.

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