Research Article

Dehumanizing the Lowest of the Low

Neuroimaging Responses to Extreme Out-Groups

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ABSTRACT—*Traditionally, prejudice has been conceptualized as simple animosity. The stereotype content model (SCM) shows that some prejudice is worse. The SCM previously demonstrated separate stereotype dimensions of warmth (low-high) and competence (low-high), identifying four distinct out-group clusters. The SCM predicts that only extreme out-groups, groups that are both stereotypically hostile and stereotypically incompetent (low warmth, low competence), such as addicts and the homeless, will be dehumanized. Prior studies show that the medial prefrontal cortex (mPFC) is necessary for social cognition. Functional magnetic resonance imaging provided data for examining brain activations in 10 participants viewing 48 photographs of social groups and 12 participants viewing objects; each picture dependably represented one SCM quadrant. Analyses revealed mPFC activation to all social groups except extreme (low-low) out-groups, who especially activated insula and amygdala, a pattern consistent with disgust, the emotion predicted by the SCM. No objects, though rated with the same emotions, activated the mPFC. This neural evidence supports the prediction that extreme out-groups may be perceived as less than human, or dehumanized.*

Laypeople characterize prejudice broadly as general animosity toward another person or social group. Researchers themselves have traditionally viewed prejudice simply as dislike of an individual primarily because of his or her perceived membership in a social group. Evidence for this traditional view can be found in bipolar attitude scales (like-dislike) that measure prejudice (Ostrom, Bond, Krosnick, & Sedikides, 1994). Allport (1954),

often considered the intellectual father of prejudice research, defined prejudice broadly as an antipathy based on a perceived social category. But Allport did not stop with prejudice as simple univalent antipathy. He also noted that each social category is saturated with affect. Allport contrasted then-current stereotypes of Black people as lazy and Jewish people as overly ambitious; both groups were mistrusted. Modern researchers interested in intergroup emotions have investigated Allport's emotional flavors in more detail, introducing a range of emotions well beyond simple animosity (Mackie & Smith, 2002). Not all prejudices are equal; here, we present new social neuroscience data indicating that extreme forms of prejudice may deny their targets even full humanity.

The stereotype content model (SCM; Fiske, Cuddy, Glick, & Xu, 2002) predicts differentiated prejudices. It incorporates a fundamental friend-foe judgment (warmth) plus a capability judgment (competence); the SCM proposes that societal groups are appraised as intending either help or harm (warmth) and as either capable or not of enacting those intentions (competence; Cuddy, Fiske, & Glick, in press; Fiske et al., 2002). Rooted in classic person perception (Rosenberg, Nelson, & Vivekananthan, 1968), these dimensions differentiate out-groups into four Warmth × Competence clusters (see Table 1).

The SCM also goes beyond early research in impression formation and prejudice by adding emotions (Fiske et al., 2002). It posits that the four combinations of the competence and warmth dimensions produce four distinct emotions toward social groups: pride, envy, pity, and disgust (see Table 1). Thus, not all groups provoke animosity. Groups stereotyped as competent and warm (e.g., the middle-class) elicit the in-group emotions of pride and admiration (based on self-relevant, positive outcomes). Out-group prejudices occur in the remaining three quadrants, and some of these prejudices are worse than others. Moderate prejudices are ambivalent, mixing positive and negative reactions. In one mixed case, envy and jealousy (based on resentment of another person's positive outcomes) are elicited by

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TABLE 1

*Groups and Objects Representing the Four Warmth ×
Competence Clusters of the Stereotype Content Model in
Studies 1 and 2*

	Competence	
Warmth	Low	High
High	*Pity*	*Pride*
	Elderly people	Middle-class Americans
	Disabled people	American Olympic athletes
	Cemetery (object control)	U.S. space shuttle
	Collapsed building	(object control)
	(object control)	Princeton tiger statue
		(object control)
Low	*Disgust*	*Envy*
	Homeless people	Rich people
	Drug addicts	Business professionals
	Overflowing toilet	Stack of money
	(object control)	(object control)
	Vomit (object control)	Sports car (object control)

Note. The emotion associated with each quadrant is indicated in italics. Participants in Study 1 viewed 48 photographs of the social groups listed. Participants in Study 2 viewed one image of each of the objects listed.

groups stereotyped as competent, but not warm (e.g., rich people); envy admits respect but harbors dislike. In the other mixed combination, groups stereotyped as warm, but not competent (e.g., elderly people), elicit pity and sympathy (emotions reserved for people with uncontrollable negative outcomes). Pity admits benign reactions but also disrespect.

Only the most extreme out-groups, the low-low, receive unabashed disliking and disrespect: Groups stereotyped as neither warm nor competent elicit the worst kind of prejudice—disgust and contempt—based on perceived moral violations and subsequent negative outcomes that these groups allegedly caused themselves. Disgust is unique among the emotions predicted by the SCM because it can target either humans or nonhumans, making people functionally equivalent to objects. We focus here on this most extreme form of prejudice, simultaneous dislike and disrespect.

Extreme discrimination reveals the worst kind of prejudice: excluding out-groups from full humanity (Allport, 1954). Out-group dehumanization is at least as old as the U.S. Constitution[1] and as modern as current forms of dehumanization, described by out-group infrahumanization theory (Haslam, 2005; Leyens et al., 2001, 2003). Implicit in Allport's (1954) work and explicit in the more modern accounts is the idea that severe prejudices reduce the target to less than a human individual, sometimes an animal and sometimes an object (Haslam, 2005).

Social psychological theory underscores the idea of perceiving some out-groups as less than people. Bar-Tal (1989) theorized that groups acting outside societal norms would be excluded from other human groups; Struch and Schwartz (1989) argued that all out-groups allegedly possess a lesser degree of humanity than the in-group. In discussing evil, Staub (1989) often spoke of moral exclusion, the belief that some social groups operate beyond moral rules and values (cf. Opotow, 1990). Most relevant is the research of Leyens et al. (2001, 2003) on out-group infrahumanization, which demonstrates that dehumanized groups are believed not to experience complex human emotions or to share in-group beliefs. According to the SCM, the low-warmth/low-competence quadrant uniquely captures dehumanizing prejudice. Members of social groups that fall into this cluster may not be perceived as fully human, but definitive evidence that these lowest out-groups are categorized as less than human remains elusive. In particular, the field lacks data that go beyond self-reports, which are vulnerable to social desirability biases.

Accumulating data from social neuroscience establish that medial prefrontal cortex (mPFC) is activated when participants engage in distinctly social cognition[2] (Amodio & Frith, 2006; Ochsner, 2005). Prior functional magnetic resonance imaging (fMRI) data show the mPFC as differentially activated in social compared with nonsocial cognition. For example, such differential mPFC activation has been observed in (a) social cognition tasks in which participants form an impression of a person, rather than an object (e.g., Macrae, Heatherton, & Kelley, 2004; Mason & Macrae, 2004; Mitchell, Banaji, & Macrae, 2005[3]); (b) reactions involving interpersonal affect (Haxby, Gobbini, & Montgomery, 2004; Leibenluft, Gobbini, Harrison, & Haxby, 2004; Ochsner et al., 2004); and (c) theory-of-mind tasks (e.g., Castelli, Happe, Frith, & Frith, 2000; Frith & Frith, 2001; Gallagher & Frith, 2002; Saxe, Carey, & Kanwisher, 2004; Saxe & Wexler, 2005). It has also been found when participants (d) make individuating or dispositional inferences to a person rather than an object (Harris, Todorov, & Fiske, 2005), (e) think about themselves (Macrae et al., 2004), (f) make personal (vs. impersonal) moral judgments (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), (g) think about other players in games involving trust and second-guessing of their decisions (McCabe, Houser, Ryan, Smith, & Trouard, 2001; Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003), and (h) mentally navigate the social (vs. physical) world (Kumaran & Maguire, 2005). In all these varied cases, participants were required to make social judgments about people. Thus, converging evidence indicates that

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[1]The U.S. Constitution, Article 1, Section 2, considered an African American slave to be three fifths of a person, implying that these people were perceived as less than human at the time the Constitution was written.

[2]We are not implying that the function of mPFC is solely social cognition. The evidence as to its exact functions is still being gathered. However, the literature indicates that mPFC activation reliably covaries with social cognition, that is, thinking about people, compared with thinking about objects.

[3]Space precludes our listing another 10 to 15 studies; those references can be obtained from us upon request.

the mPFC is an index of social cognition that activates whenever people are thinking about a person, whether self or other.

All these considerations suggest that social groups falling into the low-warmth/low-competence quadrant of the SCM might not significantly activate the mPFC. People dehumanize these groups, not perceiving them as human to the same extent that they perceive in-groups or moderate out-groups as fully human. Compared with the in-group and other out-groups, extreme out-groups may not promote significant mPFC activation if they are not processed primarily as human beings. Their mPFC activation might even be equivalent to that for objects in the same SCM quadrant. In the study we report here, we tested these hypotheses.

METHOD

Participants saw images of different social groups (Study 1) and objects (Study 2) and made an affective assessment of each picture. For instance, the participants saw an image of a disabled person, and then decided which of the four SCM emotions best described how the image made them feel. Blood-oxygen-level-dependent (BOLD) signal changes were recorded during these assessments. The few differences in method between the two studies are noted.

Participants
Princeton University undergraduates participated for course credit, 10 in Study 1 and 12 in Study 2.[4] Participants were right-handed and reported no abnormal neurological condition, head trauma, or brain lesions. All participants had normal or corrected vision and provided informed consent. The mean age across the two studies was 19.5 years; 12 participants were women, and 6 were ethnic minorities (2 Black, 2 Asian, 2 Hispanic).

Stimuli
The stimuli in Study 1 were 48 color photographs of eight different social groups; each picture depicted one of the four SCM quadrants. A total of 254 undergraduates had pretested 80 images on paper, each rating about one third of the pictures, responding to "How much of the following emotions does this picture make you feel?" Each picture was rated on each of the four emotions (pride, envy, pity, disgust) using a 5-point scale (1= *none at all*, 5 = *extreme*). A separate repeated measures analysis of variance (ANOVA) and a *t* test were conducted for each picture, and only pictures with reliable effects were selected, as follows. First, a 2 (high vs. low warmth) × 2 (high vs. low competence) general linear model was computed for each picture, comparing ratings for the SCM emotion associated with the depicted group and ratings for the emotions associated with the other three quadrants. Those pictures without significant

F statistics for this interaction were dropped (for all statistics, the level of significance adopted was $\alpha = .05$). Next, a *t* test against zero was run on each of the remaining pictures, and those with a nonsignificant *t* value were dropped. Thus, each image retained and subsequently used in the imaging study was rated as uniquely eliciting its predicted emotion, compared with the other emotions and compared with zero. Finally, the undergraduates rated the remaining pictures on a number of dimensions (visual complexity, arousal, aesthetic appeal, quality of picture, and intensity of expression), so we could determine whether the pictures from each quadrant differed from the pictures in the other quadrants in these characteristics. A multivariate test and subsequent *t* test against zero revealed that the disgust quadrant was significantly different from the other three quadrants only on visual complexity, $t(1198) = 3.08$, $p < .05$, $p_{rep} > .88$. None of the other dimensions showed any significant differences between any of the SCM quadrants.

The stimuli in Study 2 were eight images of objects. They were selected using the same pretesting procedures used for the stimuli in Study 1.

Scanning Parameters
All fMRI scanning was conducted at Princeton's Center for the Study of Brain, Mind, and Behavior, which uses a 3.0-T Siemens Allegra head-dedicated MR scanner. The stimuli were presented by a Dell computer projecting to a screen mounted at the rear of the scanner bore. While supine, participants viewed the screen through a series of mirrors. Responses were recorded using bimanual fiber-optic response pads (Current Designs, Inc., http://www.curdes.com/response). Prior to functional echoplanar imaging (EPI), subjects received a short series of structural MRI scans to allow for subsequent functional localization. These scans took approximately 12 min and included (a) a brief scout for landmarking and (b) a high-resolution whole-brain magnetization-prepared rapid gradient-echo (MPRAGE) sequence for later localization and intersubject registration. Functional imaging then proceeded using an EPI sequence that allowed for whole-brain coverage in a relatively short period of time (thirty-two 3-mm axial slices, 1-mm gap, repetition time = 2 s, echo time = 30 ms). In-plane resolutions were 3 mm × 3 mm (196-mm field of view, 64 × 64 matrix).

Procedure
The two studies followed similar procedures; differences are noted. Before entering the scanner, each participant practiced the task on a computer by rating a number of neutral pictures (landscapes) on each of the four emotions (pride, envy, pity, disgust). This provided the opportunity for participants to familiarize themselves with the task. Inside the scanner, participants saw the photographs in a series of six runs of 10 photographs each. In Study 1, they saw each photo only once. In Study 2, the selected experimental pictures were presented three times

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[4]Note that the entirely repeated measures design characteristic of social neuroscience compensates for the fact that the study involved fewer participants than in most social psychological research.

each, and each run contained 6 filler pictures of neutral stimuli randomly selected from the pretest pool. Data from the filler images are not relevant here and are not presented. All pictures were randomly sequenced for each run, and run order was randomized for each participant. Each picture appeared for 6 s in Study 1 and 4 s in Study 2, followed by a response screen asking participants to indicate which of the four emotions they most felt toward the picture just displayed. This response screen was presented for 2 s in Study 1 and 4 s in Study 2. The inter-stimulus interval was 12 s after response. During this time, a black screen displayed a green fixation cross. Then the green cross turned red for 1 s, signaling that the next picture was about to appear.

After the scanning session, outside the scanner, participants again saw the stimuli, but in gray scale on paper. Their task replicated the pretest: rate each of the images on each of the four emotions, along a 5-point scale. Also, the participants indicated whether they felt any additional emotion beyond the four options provided. Finally, they were probed for suspicion; none were suspicious. The participants were then thoroughly debriefed, given credit, and thanked.

Preprocessing

Both image preprocessing and statistical analysis used Brain Voyager 2000, version 4.8. Before statistical analysis, image preprocessing consisted of (a) correction of slice acquisition order, (b) 3-D rigid-body motion correction, (c) voxel-wise linear detrending across time, and (d) temporal band-pass filtering to remove low- and high-frequency (scanner- and physiology-related) noise. Distortions of EPI images were corrected with a simple affine transformation. Functional images were registered to the structural images and interpolated to cubic voxels. After co-registering participants' structural images to a standard image using a 12-parameter spatial transformation, we transformed functional data similarly, with a standard moderate degree of spatial smoothing (Gaussian 8-mm full-width/half-maximum filter).

Data Analysis

Data were analyzed using the general linear model available in the Brain Voyager software package. A series of regressions examined BOLD brain activity in response to each of the four

TABLE 2

Proportion of the Initial Ratings Indicating That the Pictures in Each Quadrant Elicited the Predicted Emotion

Quadrant			
Pride	Envy	Pity	Disgust
.70 (.05)	.52 (.10)	.83 (.05)	.64 (.06)

Note. The pictures in each quadrant were rated as eliciting the predicted emotion at a rate well above chance (.25). Standard errors are in parentheses.

kinds of stimuli (i.e., those hypothesized to elicit pride, envy, pity, and disgust). Contrast maps were then created for each participant by simply subtracting the activation during exposure to each picture from the activation during the fixation-cross display. The resulting maps were then averaged across participants and registered to a standard Talairach brain, with coordinates based on this standard system (Talairach & Tournoux, 1988). Additionally, each cell was compared with the other three cells in a contrast analysis ($+3$ -1 -1 -1). These results are discussed where appropriate. Random-effects analyses were performed on all imaging data.

RESULTS

Judgments made by Study 1 participants while in the scanner revealed that they identified the predicted emotions for the pictures of the social groups at rates well above chance (i.e., .25; see Table 2), which indicated that they agreed with the pretest data for the stimuli. Further, a point-biserial correlation revealed that while outside the scanner, participants rated a photo in the low-warmth/low-competence cell higher on disgust, using a 5-point Likert scale, if they had, as predicted, categorized the picture as disgusting while they were inside the scanner (i.e., scored a "hit") than if they had identified the picture as eliciting another emotion, $r(120) = .65$, $p < .05$, $p_{rep} > .88$.

All reported imaging results are significant at $\alpha = .01$ ($p_{rep} > .95$) unless otherwise noted. The Study 1 subtractive analysis against fixation completely supported the dehumanization hypothesis. Significant mPFC activity (see Fig. 1) was revealed for pride, $t(9) = 3.48$ at $x = -2$, $y = 48$, $z = -7$ (29 voxels); envy, $t(9) = 4.89$ at $x = -7$, $y = 51$, $z = -1$ (427 voxels), and pity, $t(9) = 4.40$ at $x = -5$, $y = 53$, $z = -1$ (31 voxels); but no significant mPFC activity beyond a significant threshold emerged for the disgust cell (see Fig. 2). The disgust cell instead was associated with activations in left insula, $t(9) = 6.69$ at $x = -41$, $y = 13$, $z = 0$ (318 voxels), and right amygdala, $t(9) = 3.72$ at $x = 22$, $y = -2$, $z = 17$ (22 voxels); these activations are consistent with disgust responses to objects (Schafer, Schienle, & Vaitl, 2005).[5]

In addition, the activated mPFC anatomical locations did overlap. Fourteen voxels were common for the three areas of mPFC activation, and an examination of the conjunction of these three sets of activation revealed an area of 432 voxels (see Table 3 for a region-of-interest, ROI, analysis of these areas).

Finally, a 3-versus-1 contrast analysis revealed no mPFC activity beyond a significant threshold for the pictures of low-warmth/low-competence (disgust) social groups, compared with the average

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[5]The other cells activated the same insula and amygdala areas, relative to fixation, but a 3-versus-1 contrast indicated that only the hypothesized disgust cell activated the amygdala more than the remaining three cells, and that the hypothesized disgust and envy cells activated the insula in this contrast whereas the remaining two cells did not. Although there was not a complete double dissociation, the disgust cell showed more arousal or disgust generally than the others, while failing to activate the mPFC as much as the others.
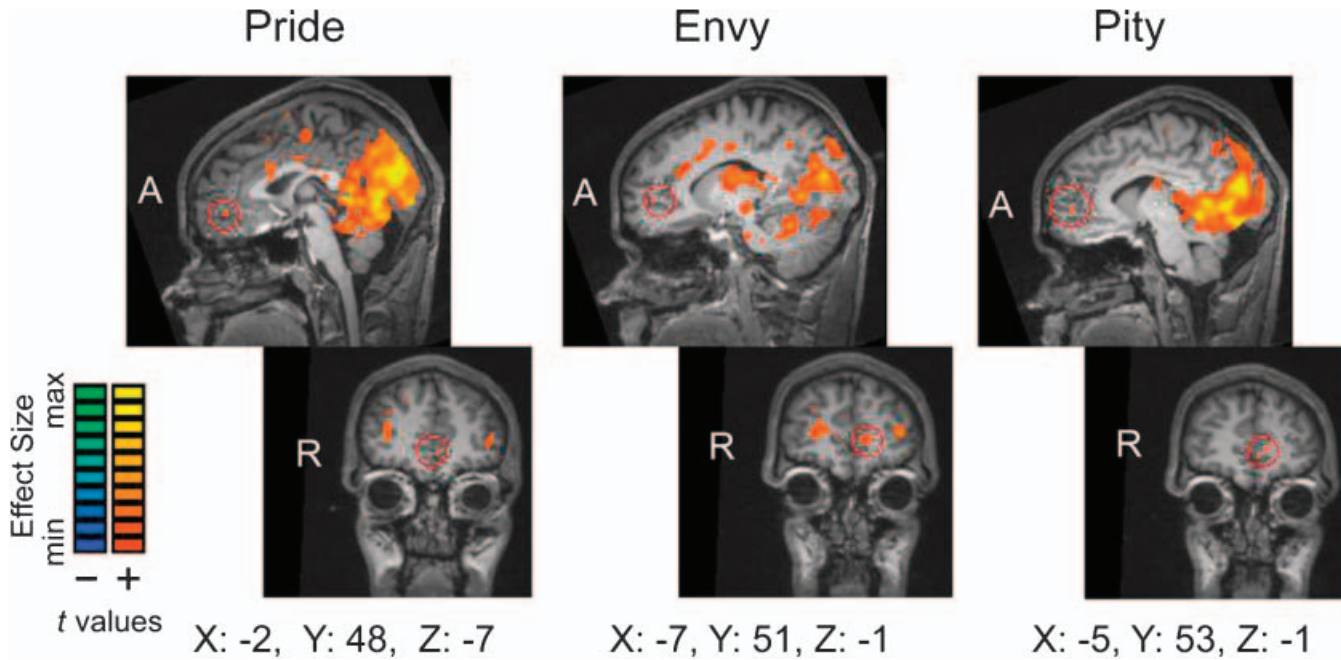
Fig. 1. Results of a subtractive analysis of blood-oxygen-level-dependent (BOLD) activations in Study 1. Activation during fixation was subtracted from activation while participants viewed pictures of social groups representing the four quadrants of the stereotype content model (SCM). Results for the three SCM cells (pride, envy, and pity) showing significant activation in medial prefrontal cortex (mPFC) are shown here. The coordinates are from Talairach and Tournoux (1988). The circled areas indicate mPFC activation. Positive t values indicate greater activation to the out-group pictures in the indicated quadrant, and negative t values indicate greater activation to the fixation cross. A = anterior; R = right.
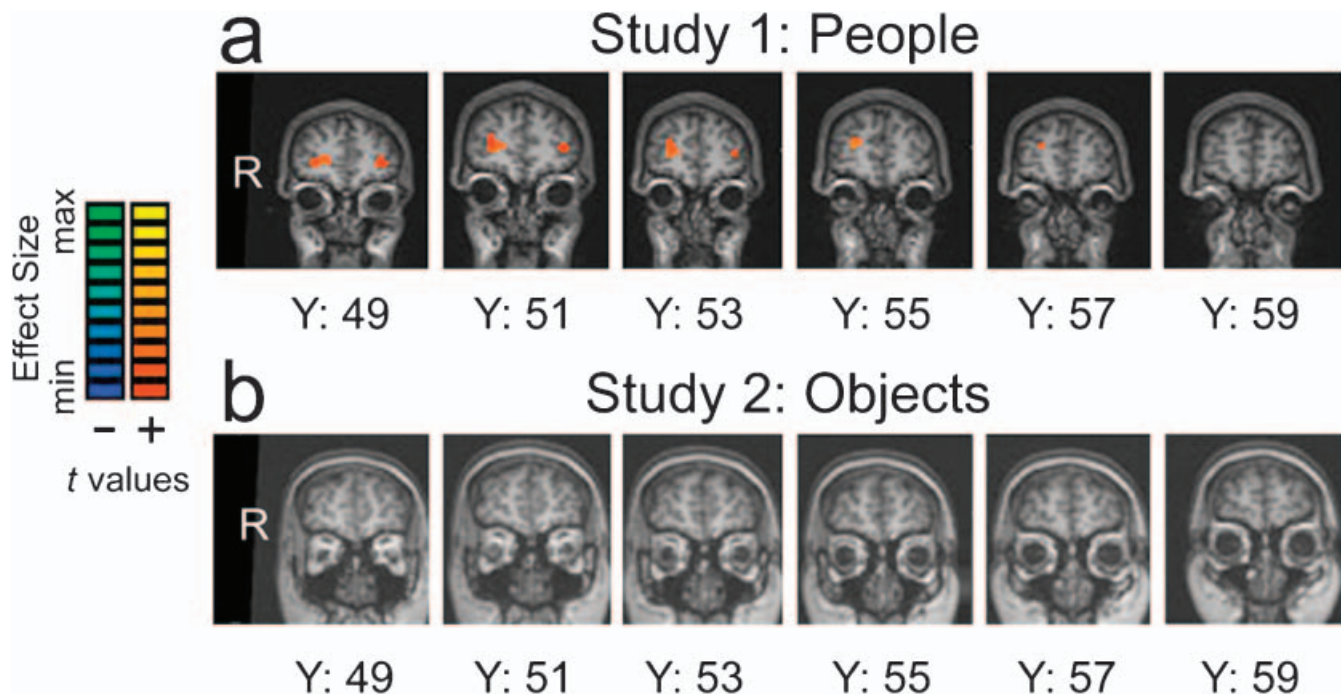
Fig. 2. Blood-oxygen-level-dependent (BOLD) activations when participants viewed (a) pictures of low-competence/low-warmth groups in Study 1 and (b) pictures of disgusting objects in Study 2. The Y coordinates are from Talairach and Tournoux (1988). Positive t values indicate greater activation to the out-group pictures in the indicated quadrant, and negative t values indicate greater activation to the fixation cross. R = right.

TABLE 3

Estimated Effect Sizes and t *Values for Clusters of Overlapping Voxels in Medial Prefrontal Cortex (mPFC) in Study 1*

Emotion	Voxels activated by all three emotions activating mPFC (common overlap)		Voxels activated by any of the three emotions activating mPFC (additive overlap)	
	Maximal *t* value	η_p^2	Maximal *t* value	η_p^2
Pride	3.96	.47	4.03	.47
Envy	4.27	.50	4.89	.57
Pity	3.55	.41	4.39	.52
Disgust	2.79	.30	3.06	.34

activation to pictures of social groups in the other three SCM cells.[6]

In Study 2, analysis comparing activation in response to pictures of objects relative to fixation also revealed no mPFC activity above baseline for objects pretested as eliciting disgust (see Fig. 2). Furthermore, a 3-versus-1 contrast analysis revealed no differential mPFC activation for these disgusting objects, compared with objects in the other three cells. Therefore, we could infer that the emotion of disgust itself was not sufficient to generate mPFC activity. Two of the remaining three cells also did not activate mPFC in either the subtractive analysis or the 3-versus-1 contrast. In fact, only a subtractive analysis of the imaging data in Study 2 revealed small yet significant mPFC activation for the objects pretested as eliciting envy, $t(11) = 3.13$ at $x = -9$, $y = 49$, $z = 3$ (five voxels). Pride, envy, and pity are social emotions felt only via the presence, implied or actual, of another person (Fiske, Cuddy, & Glick, 2002). Careful debriefing of participants after both the pretest and the imaging session made it apparent that they would report feeling envy in particular toward objects only if the presence of a person was implied. For instance, a stack of money (one of the stimuli representing this quadrant) implied wealth, and participants reported feeling envious of the wealthy person, not the

object. The subtractive analysis showed no significant mPFC activation to the objects in the pride and pity cells.

GENERAL DISCUSSION

As hypothesized, members of some social groups seem to be dehumanized, at least as indicated by the absence of the typical neural signature for social cognition, as well as the exaggerated amygdala and insula reactions (consistent with disgust) and the disgust ratings they elicit. This conclusion is supported by the relative lack of mPFC activation when participants viewed pictures of low-low social groups. It is also supported by the finding of mPFC activation when these same participants viewed pictures of social groups that did not fall into this cell of the SCM. Additional research also supports the idea that not just any out-group is dehumanized: Significant mPFC activity emerged when White participants looked at Black faces in an age-categorization task (Harris & Fiske, 2003; Wheeler & Fiske, 2005).[7] In addition, the low-low quadrant differentially elicits neural patterns consistent with disgust (insula) and fear (amygdala), according to meta-analyses (Murphy, Nimmo-Smith, & Lawrence, 2003; Phan, Wager, Taylor, & Liberzon, 2002).

The current results empirically support the idea of dehumanization and are consistent with verbal reports. By providing neural evidence of the phenomenon, these data go beyond verbal reports, which may be subject to self-presentational concerns. Furthermore, if replicated and extended, this kind of evidence could begin to help explain the all-too-human ability to commit atrocities such as hate crimes, prisoner abuse, and genocide against people who are dehumanized (Allport, 1954; Fiske, Harris, & Cuddy, 2004).

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[6]The high-warmth/low-competence (pity) social groups also did not show more mPFC activity than the other social groups in the 3-versus-1 contrast. However, note that mPFC activation in the pity cell (unlike the disgust cell) was significant, relative to fixation, in the main analysis. The 3-versus-1 contrast analysis compares activation for the focal cell with activation across the average of the remaining three cells. In our case, if the mean BOLD signal change of the pride and envy cells was significantly bigger than that of the disgust cell, and the pity cell showed only a moderate effect, then the resulting *t* test for the pity cell would reveal a significant difference. Thus, although the 3-versus-1 contrasts were significant for both the disgust cell and the pity cell, only in the case of the disgust cell does this result converge with the results of the initial analysis against fixation in showing insufficient activation above baseline. Analyses of the effect size for the overlapping voxels in mPFC in the fixation contrast analysis showed that the disgust cell had the smallest effect, for either common areas or additive areas (see Table 3). Finally, this finding for the pity cell fits with the continuum model of impression formation (Fiske, Lin, & Neuberg, 1999), within which the SCM is couched. The continuum model allows for varying degrees of categorical and individuated perception.

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[7]In this paradigm, White participants were primed to individuate or categorize Black faces, in separate scanning runs. The results replicated the published effects of activation in amygdala and insula (vigilance-related and arousal-related areas) when the faces were treated categorically, but those effects were eliminated when the faces were individuated.

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