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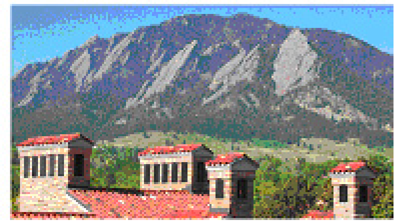

WORKING PAPER

Proximate Industrial Activity and Psychological Distress: the Interactive and Interpretive Roles of Gender, Work, and Family Statuses

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Proximate industrial activity and psychological distress: the interactive and interpretive roles of gender, work, and family statuses

Abstract

This paper examines the role of multiple social positions (gender, occupational status, family status) in the interpretation of industrial activity as an ambient stressor. Using a unique spatial assessment of industrial activity in conjunction with individual-level data from the 1995 Detroit Area Study, we find that residents of neighborhoods in close proximity to industrial activity report elevated levels of psychological distress compared to those whose homes are removed from this type of activity. We also find the distressful effects to be more pronounced among women compared to men but this relationship is strongly conditioned by the occupational and parental statuses of the respondents. This article highlights important relationships between individuals, society, and the physical environment and how these interplays may complicate strategies to alleviate psychological distress brought on by neighborhood-level stressors.

Introduction

Although the analytical value of meaning-making is widely embraced among social psychologists, it is a neglected topic of inquiry in current studies of neighborhood effects. Research in this growing body of work has consistently demonstrated significant associations between neighborhood characteristics such as the proportion of adults who not currently working and the psychological well-being of the residents (Aneshensal and Succoff 1996; Boardman and Robert 1998; Ross, Reynolds, and Geis 2000; Ross 2000; Schulz et al. 2000). However, these studies have focused on objective characteristics of neighborhoods rather than the meaning that individuals from particular neighborhoods ascribe to the social, cultural, and physical spaces that surround their place of residence (Downey and Van Willigen 2005; Scribner, Cohen, and Fisher 2000). This is particularly important to social psychologists because the interpretive actions of individuals are taken as a critical point of inquiry in the examination of psychological well-being (Mead 1934; Blumer 1969).

Among the limited studies that have derived more nuanced psychological dimensions of neighborhood processes (Cutrona et al. 2000; Geis and Ross 1998), with a few exceptions (Sampson and Raudenbush 2004) there remains little emphasis on the fundamental role of social categories as structuring relationships between local environments, perceptions of the environment, and psychological distress. That is, while understanding that these connections is important, this research is limited because it does not address fundamental social psychological questions regarding the ways in which perceptions are socially structured. Consequently, neighborhood characteristics are often assumed to affect all community residents in a similar fashion and deleterious effects, such as psychological discomfort are attributed to objective stressors rather than the consequences of the *meaning* that residents assign to the built environment.

Sampson and Raudenbush (2004) highlight the relevance of subjective neighborhood perceptions. They demonstrate how perceptions of neighborhood disorder present a social psychological understanding of neighborhood effects by considering the simultaneous relationships between visible cues, individual's perceptions of the cue as a stressor, and subsequent psychological outcomes. They move beyond questions regarding the causal relationship between objective evidence of disorder and perceptions of disorder. Instead, they focus their attention on ways in which perceptions of disorder are partly the result of individual interpretations which are shaped by social position(s) such as race, ethnicity, and class of residents. They conclude that "social structure proved a more powerful predictor of perceived disorder" than did physical cues of disorder (336). This finding suggests that the negative psychological effects of neighborhood stressors may be credited to socially filtered interpretations rather than objective characteristics, per se.

In this paper we expand upon Sampson and Raudenbush's assertion that individual's positions in the social structure and their resulting perceptions of the built and social environment of their communities are important considerations when examining contextual effects on psychological well-being. We focus on the presence of manufacturing facilities as characteristics of neighborhoods that are physical objects with clear visible cues (Ross and Mirowsky 2003) and we theorize that the adverse psychological consequences associated with these cues are influenced by interpretations that are themselves shaped by gender, work, and family roles. Thus, we anticipate that we will find differential associations between potentially noxious aspects of the built environment and psychological distress based on social location. That is, some may view proximate industrial activity as a source of employment and a resource for the community while others may perceive this presence as a source of toxicity and a threat to the health of the residents. After controlling for socially patterned sources of stress and social differences that mediate the association between stress exposure and stress response (Lin and Ensel 1989), we attribute the remaining association between manufacturing presence and psychological distress as a function of the meaning that individuals ascribe to this visible cue. Thus, we indirectly identify the social foundation of disparate and distinct interpretations of nearby manufacturing activity.

Social location, ambient stressors, distressful interpretations

Researchers tend to operationalize environmental stressors as stressful life events, day-to-day hassles, or ambient stressors (Evans and Cohen 1987). Those focusing on neighborhood-level stressors tend to emphasize once in a lifetime stressful events and chronic daily hassles rather than ambient stressors (Schulz et al. 2000; Boardman 2004). Ambient stressors are "chronic, global conditions of the environment – pollution, noise, residential crowding, traffic congestion – which, in a general sense, represent noxious stimulation, and which, as stressors, place demands upon us to adapt or cope" (Campbell 1983: 360). Taking industrial activity as distinct from other stressors such as rude and discriminatory behavior, care for elderly parents, or long and strenuous work environments, we conceptualize the presence of industrial activity as an ambient stressor that is a shared and noxious characteristic of the built environment.

As with previous work in this area (Downey and Van Willigen 2005) we anticipate that those who reside near industrial activity will report elevated levels of psychological distress compared to those whose neighborhoods are far removed from this type of activity. However, we also pay particular attention to the ways in which the same potential stressor will differentially impact the psychological distress of adults because of the interpretation of the activity. That is, not only is psychological distress socially patterned because of exposure issues (e.g., affluent persons are better able than impoverished persons to avoid residing in relatively stressful areas [Elliott 2000] and also have greater access to important social and psychological resources that may mitigate the negative effects of stress exposure on distress [Pearlin et al. 1981; Lin and Ensel 1989]) but also because of the perception and distressful interpretation of the activity. For example, studies have found that the distressing and annoying effects of commercial airplane activity among residents of communities near airports to be less pronounced among individuals who work in airline industries [see Cohen and Spacapan (1984) and Cohen and Weinstein (1981) for reviews of this literature]. Therefore, at times, the objective stressor (e.g., the noise of airplanes) may not be as relevant as the subjective stressor (e.g, the meanings associated with the noise) for our understanding of the linkages between stressors, stress, and psychological distress (Cohen 1980).

In this paper, we focus on three interrelated social characteristics that are hypothesized to moderate the association between the industrial activity and adult's mental health: a) gender; b) occupational experience; and c) family status. The following hypotheses rest on the assumption that individuals from different social positions will uniquely *interpret* industrial activity. Thus, depending on gender, work, and family statuses, we expect that some individuals will ascribe a meaning of nearby manufacturing activity that is threatening while some may perceive this same activity as neutral or, at times, salutary. Because, psychological distress is also a function of stressful life events and chronic stressors (Lin and Ensel 1989) and because stress exposure has been linked to area of residence (Boardman 2004; Schulz et al. 2000) we include statistical controls for stressors associated with crime, work, finance, family, and ill-health. Thus, while not directly measuring the interpretation of the stressor, per se, we consider the residual association between proximate industrial activity and psychological distress to be due in large part to the distressful meaning(s) that individuals ascribe to these activities.

Gender

We expect that proximate industrial activity will more strongly affect levels of psychological distress among women compared to men. Specifically, persistent and obnoxious ambient stressors are more likely to impact the psychological well-being of women because of gendered differences in both neighborhood-related social interactions and health-perceptions of industrial activity. First, research has shown that while men tend to describe their neighborhoods using physical criteria –e.g., the layout of the area or the availability of services– women tend to describe their neighborhoods in social terms and stress the importance of interactions with others (Davidson and Fredenburg 1996). Compared to men, women also tend to have a larger share of their social resources invested in their neighborhoods resulting in high rates of informal interactions with neighbors, increased levels of trust, and a reliance on neighborhood social ties as a source of social capital (Campbell and Lee 1990; Campbell and Lee 1992; Ross and Jang 2000). Therefore, compositional or contextual characteristics of neighborhoods are likely to impact women’s psychological well-being more strongly than men’s regardless of the characteristic.

Second, we expect the psychological impact of nearby manufacturing activity to be different for men and women because of gender differences in beliefs about the health risks associated with industrial activity. For example, some have found that although men and women express similar levels of concern about broad environmental issues, women are more likely than men to express concern about local environmental issues especially those that involve potential health and safety risks (Davidson and Freudenburg 1996; Blocker and Eckberg 1997; Mohai 1997; Bord and O'Connor 1997). Marshall (2004) examines the risk perceptions of adults living in communities with and without industrial plants located nearby. In this study, 29% of the women and 25% of the men who lived in communities without plants reported illness from industry to be a serious risk (RR=1.13, n.s.). However, among those living in communities with plants, 49% of women but only 35% of men (RR=1.4, $p<.01$) reported illness from industry to be a serious concern. This finding is important because perceptions of health status – in particular perceptions of ill-health – have long been understood to be an important source of stress for adults (Lin and Ensel 1989). Therefore, proximate industrial activity is likely to be more stressful for women than for men simply because women are more likely than men to perceive industrial activity to be detrimental to either their physical health or the health of their families.

Occupation

Occupational experiences place people into social positions that shape their interpretations of the environment (Sampson et al. 2002). The perceived benefits derived from employment possibilities associated with proximate industrial activity may be particularly pronounced among men and women whose primary work-related activity is located within this sector of the economy. In other words, the economic rewards associated with potentially stable employment may actually lead those whose primary work is in manufacturing-oriented positions to have a positive interpretation of industrial proximity. Therefore, those who work in this field may derive psychological benefits from this potentially distressing presence. Alternatively, the moderating role of occupational status may simply mute the negative effects of industrial activity rather than promoting psychological rewards. That is, industrial activity may not be stressful to those engaged in manufacturing activities because regular activity in and around these facilities may increase the predictability of this particular stressor. Thus, the routine activity of working in or near manufacturing facilities might make the same stressor less or non-problematic – but not psychologically beneficial (Lazarus 1966).

Parental and family status

Finally, family status is likely to shape the interpretation of industrial activity. People with children occupy a unique social position that will shape their views on environment (Mohai 1997). Divergent roles for men and women with respect to work and family may help to explain why women demonstrate higher levels of environmental concern than do men. Davidson and Freudenburg (1996) note that due to gender socialization, among those with families, men may be more likely than women to be concerned about economic issues such as municipal tax revenues and providing an income, and women may be more likely than men to be concerned about the safety and well-being of their families. Therefore, among those with families, men may view industrial activity positively as a potential source of revenue while women tend to view industrial activity as a threat to their families. Some researchers have also argued that having children in the home increases the salience of traditional gender roles, resulting in a decline in men's concerns about industrial environmental risks *and* an increase in women's concerns about industrial environmental risks (George and Southwell 1986; Blocker and Eckberg 1989). On the other hand the presence of children in the home may increase both mothers' *and* fathers' concerns about industrial environmental risks (Davidson and Freudenburg 1996; Hamilton 1985).

Hypotheses

Based on the preceding discussion, we hypothesize that adults who reside in close proximity to large-scale industrial activity –regardless of their age, race, gender, socioeconomic status, and exposure to other stressors– will interpret industrial activity as an ambient stressor and display elevated levels of psychological distress compared to adults whose homes are distant from these manufacturing activities. We also expect that the distressful interpretation of industrial activity will vary by social positions and that the deleterious effect of close proximity to industrial activity will be more pronounced among women than men. We further refine this hypothesis and we expect that residential proximity to industrial activity will be psychologically advantageous to men and women who are employed in manufacturing jobs but this relationship will be moderated by family status. Specifically, we believe that proximate industrial activity will be the most damaging to women in non-manufacturing jobs who have mothered children in their lifetime compared to any other social group that we examine. Likewise, men in manufacturing-oriented work positions who have not had children in their lives will derive psychological benefits as a result of their close proximity to industrial activity and subsequent employment opportunities.

DATA AND METHODS

Neighborhood-Level Data

Industrial Activity Data

Industrial activity data were obtained from the Environmental Protection Agency's (EPA) 1995 Toxic Release Inventory (TRI). The TRI records the number of pounds of specified toxic chemicals released into the environment each year by manufacturing facilities that employ ten or more full-time workers and manufacture, process, or otherwise use these chemicals in specified quantities (in 1995, the specified quantities were 25,000 pounds for facilities that manufacture or process TRI chemicals and 10,000 pounds for facilities that otherwise use TRI chemicals). We use the TRI data to create our indicator of industrial activity for several reasons. First, the TRI is the most comprehensive, address-specific record of U.S. industrial activity that is currently available to the public. Second, we can use emissions data for each facility as a proxy for facility size and visibility. This is important because a) industrial facilities are unlikely to impact residents' mental health if residents are unaware of them, b) residential proximity to large industrial facilities is more likely than residential proximity to small industrial facilities to produce psychological distress, and c) other measures of facility size and visibility – such as the number of employees, square footage, or economic output of the facilities in the database – are unavailable, either in the TRI or in any other publicly available database. Third, by eliminating the smallest, least visible manufacturing facilities from the database, the TRI allows us to create more valid indicators of 'visible industrial activity' than we could create if we included all the manufacturing facilities that exist in the study area.

Industrial Activity Indicators

In order to create our industrial activity indicator, we located the TRI facilities on a census block map and then calculated, for each facility, three rectangular grids that were composed of 105.6-foot resolution square cells (105.6 feet is 1/50th of a mile). The first grid calculated the distance from the center of each cell in the metropolitan area to the center of the cell containing that grid's TRI facility. The second grid was a *weighting grid* that provided, for each metropolitan area grid cell, a weight (w, where $0 \leq w \leq 1$) that allowed the impact of each facility to decline as distance increased. The weight was calculated by inserting the distance values, d, from the first grid into the following distance decay function:

(1a) $F(w) = 1 - (2.0*10^{-5})(d) - (1.34*10^{-8})(d^2)$,

where $0 <= d <= 7920$, and

(1b) $F(w) = 0$,

where $d > 7920$.

In these equations, d equals distance in feet from each TRI facility and each facility's impact is assumed to decline relatively slowly at first and more quickly as distance increases. The function takes on a value of zero at distances greater than 1.5 miles.

The third grid, the *relative effects grid*, was calculated by multiplying each cell in the weighting grid by the total pounds of TRI air pollutants emitted by that grid's TRI facility. Ideally, this grid would have been calculated by multiplying each cell in the weighting grid by some measure of facility size or visibility. However, because the TRI does not provide researchers with facility size or visibility data, we had to select a proxy for facility size from the variables included in the TRI dataset. We selected air emissions as a proxy for facility size because TRI facility air emissions are strongly correlated with facility size for a subset of facilities for which facility size data is available (details available upon request).

The *relative effects grids* for all the facilities in the database were then summed together to create a new grid in which each cell value represented the *summed relative effect* of all Detroit metropolitan area TRI facilities on that cell. For example, if there had been five facilities in the study area, and the *relative effect* of these facilities on grid cell A had been 0, 300, 10, 500, and 0 respectively, then their *summed relative effect* on grid cell A would have equaled 0 + 300 + 10 + 500 + 0, or 810.

The cell values in the *summed relative effects grid* were then aggregated to the census block level by placing an electronic census block map over the *summed relative effects grid* and calculating the average cell value in each census block. This gave us the *mean relative effect* of all study area facilities on each study area census block. Finally, because we are concerned with the psychological consequences of living near heavy industrial activity, we created a dichotomous variable that differentiates between census blocks found in the highest quartile of the *mean relative effect* distribution (above the 75^{th} percentile) and census blocks found in the other three quartiles of the *mean relative effect* distribution. Thus, our *industrial activity* variable allows us to differentiate between respondents who live in close proximity to heavy industrial activity and those who do not (for more detail, see Appendix A).

In addition, we also control for the poverty status of each respondent's neighborhood, using block group data drawn from the 1990 U.S. census and a dummy variable that is coded 1 if block group poverty levels exceed 20% and 0 otherwise (Kasarda 1993). We use block group data rather than block-level data because 1990 poverty rate data is unavailable at the block level, and we control for neighborhood poverty status given the strong relationship between neighborhood disadvantage and increased levels of psychological distress (Ross 2000).

Individual-Level Data

Individual-level data come from the 1995 Detroit Area Study (DAS). The 1995 DAS is one of a series of yearly studies conducted by the Survey Research Center and the Department of Sociology at the University of Michigan and the goal of the 1995 DAS was to identify social influences on physical and mental health of adults. These data come from a multistage area probability sample of 1,139 adult respondents 18 years of age and older residing in Wayne, Oakland, and Macomb counties in Michigan, which include the city of Detroit. Face-to-face interviews were completed between April and October 1995 by University of Michigan graduate students in a survey research training practicum and professional interviewers from the Survey Research Center. The overall response rate was 70%. Hispanic (n = 11), Asian American (n = 15), and Native American (n = 4) respondents, and respondents who reported another race/ethnicity (n = 3), were dropped from the study because of small sample sizes. These deletions result in a final sample size of 1,106.

Individual-level measures

Dependent Variable

The dependent variable, *psychological distress*, is measured via a commonly used unweighted six-item index. This scale was originally developed for use in the National Health Interview Survey to assess nonspecific distress and to discriminate between cases and non-cases of serious mental illness (Kessler et al. 2003a). It has been found to be a valid measure of mental health in several studies (Furukawa et al. 2003; Kessler et al. 2002). DAS respondents were asked to indicate how often, in the past 30 days, they felt: (a) "so sad that nothing could cheer you up"; (b) "nervous"; (c) "restless or fidgety"; (d) "hopeless"; (e) "that everything was an effort"; and (f) "worthless." Responses for each item range from (1) "never" to (5) "very often." Items were coded to ensure that higher scores reflect greater levels of distress (α= .85).

Statistical Controls

Crime-related stress is assessed by response to three questions. First, respondents were asked to report the frequency of "problems with muggings, burglaries, assaults, or anything else like that around here". Those who responded "often" or "very often" were coded 1 and those who responded "not too often", "hardly ever", or "never" were coded 0. Respondents were also asked to report if, in the past year, they had: (a) "been the victim of a serious physical attack or assault"; (b) been "robbed" or (c) had their "home burglarized". Affirmative responses were coded 1 and negative responses were coded 0. These four values were summed and *crime-related stress* was coded 1 for respondents with a score greater than or equal to 1.

Work-related stress assesses if, in the past year, anyone in the household had been "unemployed for longer than 3 months" or had had any "hassles at work?" This variable is coded 1 for respondents who indicated "yes" to either question and 0 for those who responded "no" to both items.

Financial stress is measured by responses to two items. First, respondents were asked "how difficult is it for you to meet the monthly payments on your bills"? Responses ranged from (1) "not difficult at all" to (5) "extremely difficult". They were also asked if, in the past 12 months, they had had "serious financial problems or difficulties". Those who responded "yes" to this question or who responded either "very difficult" or "extremely difficult" to the first question were coded 1. All other respondents were coded 0.

Family-related stress is measured by responses to three questions about family-related stressors that occurred in the past month. Respondents were asked about "problems with aging parents", "problems with your children", and "trouble balancing work and family demands". This variable is coded 1 if respondents indicated "yes" to any of these questions and 0 if they responded "no" to all three items.

Health-related stress is measured with self-rated health. All respondents were asked to rate their health from 1 ("poor") to 5 ("excellent"). This single item is one of the most widely used measures of overall health status because it is consistently found to be a valid measure of current health status among adults (Idler and Benyamini 1997; Benyamini and Idler 1999). Because ill-health is conceptualized as an important stressor, we reverse this item and code self-rated health such that higher levels indicate worse health. This measure is particularly important because of the consistent evidence that links neighborhood-level stressors to adverse physical health outcomes (Kawachi and Berkman 2003). That is, because poor physical health status is routinely considered to be among the leading chronic stressors (Ellison et al. 2001), it is important to control for health status to properly assess the impact of industrial activity on adult's psychological distress.

Finally, seven sociodemographic control variables are used in all the multivariate models: (1) *age* is a continuous variable measured in years; (2) *sex* is measured with a binary variable with male as the referent; (3) *race* is measured by respondent self-identification and is coded 1 if respondents indicated that they were African-American and 0 if they indicated that they were non-Hispanic and white; (4) *marital status* is measured dichotomously as married at the time of the interview and otherwise; (5) *yearly income* is the income the respondent's family earned the previous year (in $1,000s); (6) *no children* is coded 1 if respondents have not had any children in their lifetime and 0 otherwise; and (7) *manufacturing* is coded 1 if respondent's current or most recent job is considered a manufacturing-oriented industry. Of the 1,106 respondents in this survey, only 20 reported that they had never "held a regular job for pay". Of those that responded yes, respondents were then asked "what kind of business or industries (is/was) that in? What (do/did) they make or do where you (work/worked)?" Responses were then coded using the 3 digit 1980 census industry code and respondents with codes between 100 (manufacturing; nondurable goods; food and kindred products; meat products) and 392 (manufacturing; durable goods; non specified manufacturing industries) were coded as manufacturing oriented (U.S. Bureau of the Census, 1981).

Statistical Analyses

In this paper, we estimate the relationship between neighborhood factors and individual-level psychological distress with a multilevel model that specifies error at the individual and neighborhood level. Our primary reason for using this model is to adjust the parameter estimates for the similarity of observations within neighborhoods. Because the number of observations within blocks and block groups is quite small, we adjust for census tract clustering of observations using a multi-level model with a random intercept (Raudenbush and Bryk 2002). The multilevel models are estimated using PROC MIXED in SAS 8.2 (Littell et al. 1996).

Findings

[TABLE 1 ABOUT HERE]

Table 1 lists the mean psychological distress levels of respondents who lived in neighborhoods that were and were not near heavy industrial activity. When men and women are considered together, the average level of psychological distress is higher among those who reside near heavy industrial activity than it is among those who do not. When they are considered separately, however, the relationship between proximity and psychological distress is more pronounced among women than men. For men, the difference in psychological distress levels across residential types is only marginally significant ($p<.08$). For women, the difference is highly significant ($p<.001$) and nearly twice as large as it is for men (1.70 vs. .93).

Although these findings support the hypothesis that residential proximity to industrial activity is psychologically distressing and that the negative psychological effect of residential proximity is more pronounced for women than men, it is possible that residents of industrial neighborhoods differ from residents of other communities in terms of their sociodemographic characteristics and their exposure to social stressors. Likewise, industrial neighborhoods may have higher poverty rates than other neighborhoods. Accordingly, Table 2 examines the relationship between industrial activity and psychological distress using a multivariate model in which individual and neighborhood-level characteristics are controlled for and important confounding and mediating relationships are elaborated upon. Parameter estimates are obtained from three multi-level models in which psychological distress is the dependent variable.

[TABLE 2 ABOUT HERE]

Model 1 includes the individual-level controls only. In this model, four of the five social stress variables are strongly and positively associated with psychological distress. Those who reported experiencing work-related stress, financial stress, familial stress, or health-related stress reported elevated levels of psychological distress compared to those who did not face any of these stressors. In addition, women experienced higher levels of psychological distress than did men. Finally, the residual variance estimates suggest that roughly 8% of the variance in psychological distress is due to unmeasured characteristics of respondent's neighborhoods ($\rho = \frac{1.62}{1.62 + 17.47} = .08$).

Model 2 enters a dummy variable indicating if a respondent resides in a poor neighborhood. According to the parameter estimate for this variable, regardless of their sociodemographic characteristics or stress profiles, residents of poor areas have significantly higher levels of psychological distress than do residents of non-poor areas. In addition, roughly 11% of the unexplained level-2 variance in model one is accounted for by differences in poverty rates across communities.

Model 3 enters the industrial proximity variable into the regression equation, providing us with a similar estimate to the one presented in Table 1, albeit one that is adjusted for differences across individuals and neighborhoods. These adjustments attenuate the effect of industrial activity on psychological distress by nearly one-half (from 1.31 to .73; see Table 1), but also suggest that the effect of industrial activity on adult psychological distress is independent of the individual and neighborhood-level controls. Thus, model 3 supports the hypothesis that residential proximity to industrial activity is psychologically distressing. In addition, the estimated effect of neighborhood poverty status is slightly reduced in this model, suggesting that one reason residents of poor communities have elevated levels of psychological distress compared to residents of non-poor communities (Schulz et al. 2000) may be that poor neighborhoods have higher levels of industrial activity than do non-poor neighborhoods (Downey 2003).

Full model estimates for men and women are presented separately in Table 3. As with the estimates in Table 1, these estimates support the hypothesis that the negative psychological effects of residential proximity to industrial activity are more pronounced for women than men. Indeed, once individual and neighborhood-level factors are considered, our results suggest that industrial activity is no longer associated with psychological distress among men (b=.35, n.s.) but positively and significantly linked to women's psychological distress (b=.89, p<.05).[1]

[TABLE 3 ABOUT HERE]

In order to determine whether occupational status and parental status moderate the relationship between residential proximity and psychological distress among men and women, we estimated a model similar to the full model presented in Model 3 of Table 2 with two important changes. We combined information of respondent's gender, occupational status, and family status to create eight categories for the three binary variables. We then estimated the full model with these categories (with female respondents who have ever had children and who were not employed in manufacturing as the reference category) and interacted the seven dummy variables with the proximity dummy variable. Standard error estimates for the linear combination of the main effect of industrial activity (b=1.41, p < .05; results not shown) and the interaction between industrial activity and the seven categories of the three binary variables (gender, occupation, and family) were calculated using the LINCOM function in STATA 9.0. The standard errors were then used to calculate 95% confidence intervals for each group specific slope. Because of the large number of categories and interactions we do not present tables for the results, rather point estimates and confidence intervals are presented graphically in Figure 1. The point estimates describe the estimated effect of industrial activity on psychological distress for each group. The left-hand panel in Figure 1 presents results for women and the right-hand panel presents results for men. As before, positive values indicate that proximity to industrial activity increases psychological distress and negative values indicate that proximity to industrial activity decreases psychological distress. A confidence interval that crosses the zero-line indicates that that particular group specific slope is not statistically different from zero.

[FIGURE 1 ABOUT HERE]

The results presented in Figure 1 are surprising in three respects. First, we did not expect women who have had children and are not employed in manufacturing (the reference group) to be the only group of female respondents to experience elevated psychological distress levels as a result of living near industrial activity. Second, we did not expect any group of men to experience elevated distress levels as high as those experienced by women in the reference category (see the male, manufacturing and children category). Third, we did not expect either group of men employed in manufacturing to experience elevated levels of psychological distress as a result of living near heavy industrial activity. Nevertheless, male respondents who have had children, are employed in manufacturing, and reside near heavy industrial activity experience increased levels of psychological distress that are comparable to those experienced by women in the reference category. Indeed, they are the only group of men to experience elevated levels of psychological distress as a result of residing near industrial activity.

Summary and Limitations

This study makes several important contributions to research on the association between neighborhood context and mental health among adults. This study confirms Downey and Van willigen's (2005) finding that proximate industrial activity can negatively affect mental health and we extend their work by considering the moderating role of individual and family-level characteristics. In doing so, this study also contributes to the broader neighborhood effects literature which rarely asks whether factors other than race and socioeconomic status moderate the impact of neighborhood context on individual well-being. Our study also demonstrates that categories such as gender and occupational status can at times obscure as much as they reveal. For example, if we had limited our analysis to the results found in Tables 1-3, we would have concluded that proximate industrial activity is psychologically damaging to women but not men. However, Figure 1 clearly shows that among our sample of survey respondents, only one group of women experienced higher levels of psychological distress as a result of living near heavy industrial activity. Moreover, one group of men, representing almost 25% of our male respondents, also experienced higher levels of psychological distress as a result of living near heavy industrial activity. Thus, taking gender into account without also having accounted for respondents' occupational and parental status would have been somewhat misleading.

As with any study, there are several important limitations that should be considered. First, this is a study of a single metropolitan area and these findings may not generalize beyond Detroit. Given the unique role of manufacturing-related employment and a history of residential segregation in Detroit (Sugrue 1996), the social relationships described in our study may only pertain to a small number of cities with similar manufacturing-related employment histories. Second, the sample sizes for several of the status groups examined in this paper were quite small. Although small sample sizes increase the risk of a Type-II error it is also possible that unique aspects of the sample (e.g., unobserved heterogeneity) are driving the association rather than their observed characteristics (e.g., gender, work, and family) as assumed here. Third, the variables used to create these categories do not tell us the respondents' current employment and parental status, the age of the respondents' children, or whether the respondents' children still live at home. More observations would have improved our parameter estimates and more refined variables would have allowed us to determine whether current occupational and parental status play a more important role in moderating the effect of proximity on distress than do lifetime occupational and parental status. Furthermore, Sampson et al. (2002) demonstrate the magnitude, significance, and even the direction of neighborhood effects differ across studies and this is particularly true of studies that focus on interactions between individual-level and neighborhood-level variables. Therefore, as with most social scientific inquiry, similar studies should be developed to replicate these findings.

Our findings also highlight the need for future qualitative inquiry. The methodological approach taken here does not enable us to examine the process of meaning construction associated with industrial activity. This distinction is exemplified in Shultz and Lempert's (2004) insightful ethnography of African American women's perceptions the ways in which neighborhoods may impact their health. The authors note that the uncritical approach to the meaning of "health" among most researchers denotes an important shortcoming within traditional social epidemiological studies. They show that health is a contested notion that bears the stamp of local definitions that may contrast with traditional understandings of health – especially health as defined by the research community. Our work suggests that individual statuses are important points of departure to understand how potentially stressful aspects of the built environment are translated into subjective "stressors" but we were not able to measure or describe the ways in which members of communities share collective understandings of manufacturing activities. This suggests the need for additional ground-level research on how individuals occupying particular social positions consequentially interpret characteristics of their neighborhoods and how neighborhood social structures potentially facilitate or dissuade similar assessments among neighbors.

Implications for Social Psychological Research

Despite these limitations, our findings make several important contributions to general sociological studies of neighborhood effects. Most importantly, they point to the fruitfulness of taking a social psychological approach to neighborhood effects research that integrates the complex interplays between individuals and their neighborhoods. Previous work in this area is somewhat limited because of the inability to adequately address how variations in psychological outcomes are influenced by a) the perception of stressors and b) the ways in which social positions shape these perceptions. Thus, previous explanations do not to adequately address the social psychological link between neighborhood context and psychosocial outcomes because they often ignore the ways in which objective neighborhood characteristics are subjectively grasped and how these interpretations may impact mental health outcomes. While a number of studies focus on the relationship between perceived contextual disorder and mental health (e.g. Aneshensel and Sucoff 1996; Geis and Ross 1998; Ross 2000; Sampson, Morenoff, and Gannon-Rowley 2002), few studies examine factors that shape the interpretations of this disorder. We fill this gap by highlighting the role that social positions (gender, occupational status, family status) play in the interpretation of industrial activity as an ambient stressor. In addition, we go beyond objective explanations to explain the important psychological relationship between the individual and his or her social environment. Through the use of an innovative neighborhood-level measure, this research expands on current neighborhood research, stress research, and social psychological inquiry.

NOTES

1. To examine gender differences in the magnitude of the respective slope coefficients, an interaction term between gender and the industrial proximity dummy variable was added to the full model (Model 3, Table 2). This single variable improved the model fit although the significance of this effect was below traditional levels of statistical significance ($p < .10$). Nevertheless it is important to realize that separate models more properly specify the moderating role of gender because all of the covariates are interacted with gender, not simply industrial activity. Therefore, we caution the reader to consider the reduced standard errors among women simply because there are more women than men in the sample.

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Table 1. The relationship between industrial activity and psychological distress: mean distress levels for men and women by residential status.

	Proximate Industrial Activity			
	Yes	No	$\mu_{yes}-\mu_{no}$	$Pr\|\mu_{yes}-\mu_{no}\|=0$
Men	11.99	11.06	0.93	<.0717
	(5.03)	(4.90)		
	100	*313*		
Women	13.45	11.75	1.70	<.0002
	(5.58)	(4.39)		
	152	*541*		
Total	12.74	11.43	1.31	<.0004
	(5.40)	(4.59)		
	252	*854*		

Note: Cell entries represent means, standard deviations (in parentheses), and sample size (*in italics).*
Source: 1995 Detroit Area Study (n=1,106).

Table 2. Neighborhood-level socioeconomic characteristics, industrial activity, and psychological distress: multilevel model estimates.

	Model 1		Model 2		Model 3	
Intercept	17.23	***	17.04	***	16.70	***
	(1.14)		(1.14)		(1.15)	
Gender [Men]						
Women	0.66	*	0.64	*	0.66	*
	(0.27)		(0.27)		(0.27)	
Marital Status [Unmarried]						
Married	0.27		0.32		0.29	
	(0.31)		(0.31)		(0.31)	
Children [Yes]	0.58		0.62		0.61	
No	(0.36)		(0.36)		(0.36)	
Race/Ethnicity [NH White]						
NH Black	-0.27		-0.86		-0.83	
	(0.41)		(0.48)		(0.48)	
Age (years)	-0.01		-0.01		-0.01	
	(0.01)		(0.01)		(0.01)	
Education (years)	-0.22	***	-0.21	***	-0.20	***
	(0.06)		(0.06)		(0.06)	
Income ($1000s/yr.)	0.00		0.00		0.00	
	(0.00)		(0.00)		(0.00)	
Primary Occupation [Non-manufacturing]						
Manufacturing	-0.12		-0.13		-0.11	
	(0.33)		(0.33)		(0.33)	
Social Stressors						
Crime related stress	0.34		0.22		0.24	
	(0.38)		(0.38)		(0.38)	
Work-related stress	1.02	***	0.98	**	0.97	***
	(0.29)		(0.29)		(0.29)	
Financial Stress	2.30	***	2.28	***	2.25	***
	(0.40)		(0.40)		(0.40)	
Familial Stress	1.41	***	1.43	***	1.44	***
	(0.29)				(0.29)	
Perceived Health	1.13	***	1.13	***	1.12	***
	(0.14)		(0.14)		(0.14)	
Neighborhood Characteristics						
Poverty Rate [<20%]						
Greater than 20%			1.15	*	1.07	*
			(0.51)		(0.51)	
Industrial Activity [0-74th Percentile]					0.73	*
75th-99th percentile					(0.36)	
Residual Variance Estimates						
Level 1	1.62	***	1.44	**	1.39	**
	(0.49)		(0.47)		(0.46)	
Level 2	17.47	***	17.49	***	17.48	***
	(0.79)		(0.79)		(0.79)	

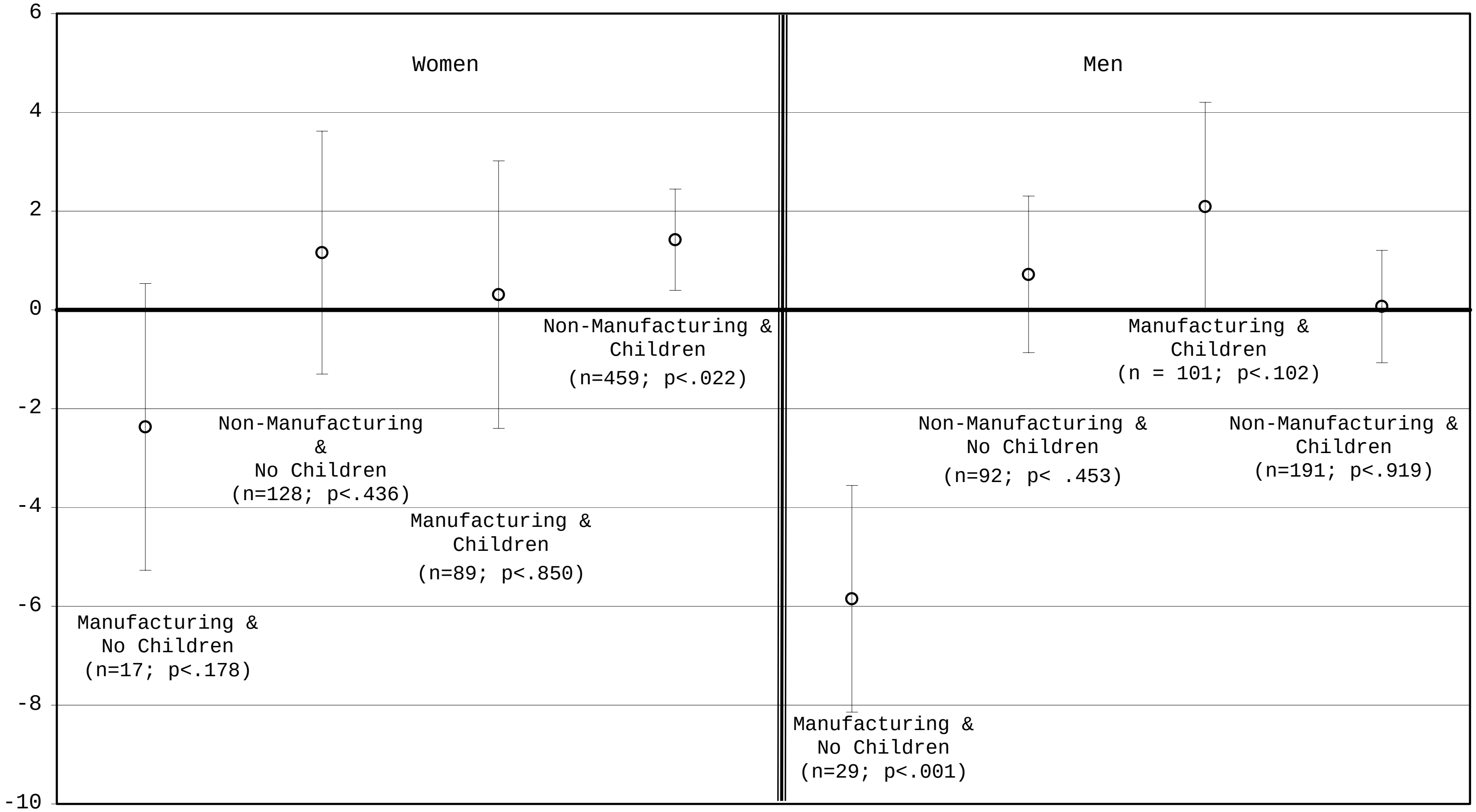
Note: Cell entries represent unstandardized parameter estimates and standard errors (in parentheses) from a series of hierarchical linear models.
*** p < .001, ** p <.01, * p <.05 (two-tailed)
Source: 1995 Detroit Area Study (n=1,106).

Table 3. The differential impact of industrial activity on psychological distress for men and women.

	Women		Men	
Intercept	16.99	***	16.89	***
	(1.55)		(1.67)	
Marital Status [Unmarried]				
Married	0.29		0.01	
	(0.40)		(0.52)	
Children [Yes]				
No	0.61		0.72	
	(0.48)		(0.55)	
Race/Ethnicity [NH White]				
NH Black	-1.41	*	0.07	
	(0.62)		(0.69)	
Age (years)	-0.01		-0.01	
	(0.01)		(0.01)	
Education (years)	-0.31	***	-0.10	
	(0.09)		(0.09)	
Income ($1000s/yr.)	0.01		-0.01	*
	(0.01)		(0.01)	
Primary Occupation [Non-manufacturing]				
Manufacturing	-0.62		0.34	
	(0.50)		(0.46)	
Social Stressors				
Crime related stress	0.47		0.29	
	(0.50)		(0.59)	
Work-related stress	0.44		1.29	**
	(0.41)		(0.44)	
Financial Stress	2.97	***	1.79	**
	(0.55)		(0.58)	
Familial Stress	2.25	***	0.43	
	(0.37)		(0.44)	
Perceived Health	0.87	***	1.28	***
	(0.18)		(0.22)	
Neighborhood Characteristics				
Poverty Rate [<20%]				
Greater than 20%	1.98	**	-0.30	
	(0.65)		(0.76)	
Industrial Activity [0-74th Percentile]				
75th-99th percentile	0.89	*	0.35	
	(0.44)		(0.52)	
Residual Variance Estimates				
Level 1	2.93		0.77	
	(0.85)		(0.75)	
Level 2	17.69		15.48	
	(1.04)		(1.25)	

Note: Cell entries represent unstandardized parameter estimates and standard errors (in parentheses) hierarchical linear models for men (n = 413) and women (n = 693) separately. *** p < .001, ** p <.01, * p <.05 (two-tailed)
Source: 1995 Detroit Area Study (n=1,106).

Figure 1. The estimated effect of local industrial activity on the psychological distress of men and women: the role of work and family.



Note: The values describe the estimated effect (and 95% confidence interval) of industrial activity on the psychological well-being for each group.
Source: 1995 Detroit Area Study (N=1,106).

Appendix A

Figure 2 illustrates the *industrial activity* variable construction process for two fictitious census blocks. Each census block contains a single facility (F1 and F2) and each block is divided into sixteen grid cells. Objects 1, 3, and 5 illustrate the first three steps in the process for facility 1, and objects 2, 4, and 6 illustrate the first three steps in the process for facility 2. Object 1 (in the top left-hand corner of figure 2) lists the distance from the center of each cell to the center of the cell in which facility 1 is located and object 2 (in the top right-hand corner of figure 2) lists the distance from the center of each cell to the center of the cell in which facility 2 is located (distance equals zero in the facility 1 cell in object 1 and the facility 2 cell in object 2).

[FIGURE 2 ABOUT HERE]

Objects 3 and 4 display the weights grids that were created, respectively, for facilities 1 and 2. To simplify the presentation, the mathematical function used to create these weights grids, F(*w*), is linear rather than curvilinear. Thus, each cell value in object 3 was calculated by inserting the distance value from the corresponding cell in object 1 into the distance decay function listed below object 3; and each cell value in object 4 was calculated by inserting the distance value from the corresponding cell in object 2 into the distance decay function listed below object 4. For example, the weight for the grid cell in the top left-hand corner of block A in object 3 equals $(1 - (7.\overline{57} * 10^{-4} * 141.4))$, or 0.893, and the weight for the grid cell in the top left-hand corner of block A in object 4 equals $(1 - (7.\overline{57} * 10^{-4} * 608.3))$, or 0.539 (141.4 is the distance in feet from facility 1 to the center of the cell in the top left-hand corner of tract A and 608.3 is the distance in feet from facility 2 to the center of the cell in the top left-hand corner of tract A).

Objects 5 and 6 are the *relative effects grids* created, respectively, for facilities 1 and 2. In this example, facility 1 emits 100 pounds of TRI air pollutants and facility 2 emits 1,000 pounds of TRI air pollutants. Thus, the cell values in object 5 were calculated by multiplying the cell values in object 3 by 100, and the cell values in object 6 were calculated by multiplying the cell values in object 4 by 1,000. The cell values in objects 5 and 6 were then summed together to create object 7, the *summed relative effects grid* for facilities 1 and 2. Thus, the value of each cell in object 7 was calculated by summing together the values of its corresponding cell in object 5 and its corresponding cell in object 6. For example, the cell value in the top left-hand corner of block A in object 7 equals the cell value in the top left-hand corner of block A in object 5 plus the cell value in the top left-hand corner of block A in object 6 (89.3 + 539 = 628.3).

Finally, object 8 lists the average cell value for each block in object 7. These values, which represent the *mean relative effect* of all study area facilities on each study area analysis unit, are calculated by summing together the cell values in each analysis unit and then dividing each analysis unit total by the number of cells in that analysis unit.

Figure 2. Determining Proximity to Industrial Activity: The Variable Construction Process

(1) Distance Grid For Facility 1

Block A				Block B			
141.4	100	141.4	223.6	316.2	412.3	509.9	608.3
100	**F1**	100	200	300	400	500	600
141.4	100	141.4	223.6	316.2	412.3	509.9	608.3
223.6	200	223.6	282.8	360.6	447.2	538.5	632.4

(2) Distance Grid For Facility 2

Block A				Block B			
608.3	509.9	412.3	316.2	223.6	141.4	100	141.4
600	500	400	300	200	100	**F2**	100
608.3	509.9	412.3	316.2	223.6	141.4	100	141.1
632.4	538.5	447.2	360.6	282.8	223.6	200	223.6

(3) Weights Grid for Facility 1

Block A				Block B			
0.893	0.924	0.893	0.831	0.760	0.688	0.614	0.539
0.924	**1.000**	0.924	0.848	0.773	0.697	0.621	0.545
0.893	0.924	0.893	0.831	0.760	0.688	0.614	0.539
0.831	0.848	0.831	0.786	0.727	0.661	0.592	0.521

F(x) = 1 - (.000757575757 * d), for 0 <= x < 1320
F(x) = 0, for 0 >= 1320

(4) Weights Grid for Facility 2

Block A				Block B			
0.539	0.614	0.688	0.760	0.831	0.893	0.924	0.893
0.545	0.621	0.697	0.773	0.848	0.924	**1.000**	0.924
0.539	0.614	0.688	0.760	0.831	0.893	0.924	0.893
0.521	0.592	0.661	0.727	0.786	0.831	0.848	0.831

F(x) = 1 - (.000757575757 * d), for 0 <= x < 1320
F(x) = 0, for 0 >= 1320

(5) Relative Effects Grid for Facility 1

Block A				Block B			
89.3	92.4	89.3	83.1	76.0	68.8	61.4	53.9
92.4	**100.0**	92.4	84.8	77.3	69.7	62.1	54.5
89.3	92.4	89.3	83.1	76.0	68.8	61.4	53.9
83.1	84.8	83.1	78.6	72.7	66.1	59.2	52.1

Air Emissions = 100 pounds

(6) Relative Effects Grid for Facility 2

Block A				Block B			
539	614	688	760	831	893	924	893
545	621	697	773	848	924	**1000**	924
539	614	688	760	831	893	924	893
521	592	661	727	786	831	848	831

Air Emissions = 1000 pounds

(7) Summed Relative Effects Grid for Facilities 1 and 2

Block A				Block B			
628.3	706.4	777.3	843.1	907.0	961.8	985.4	946.9
637.4	**721.0**	789.4	857.8	925.3	993.7	**1062.1**	978.5
628.3	706.4	777.3	843.1	907.0	961.8	985.4	946.9
604.1	676.8	744.1	805.6	858.7	897.1	907.2	883.1

(8) Tract Level Relative Effects Average

Block A	Block B
734.15	**944.24**