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Living in grey areas: Industrial activity and psychological health

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ABSTRACT

The main goal of this paper was to explore the relationship between living in industrial areas and individual's level of psychological health. Using a quasi-experimental design main findings suggest that, regardless of the type of industry that is operating, there was a significant association between living in industrialized areas and decreased levels of well being, optimism and use of active coping strategies. However, results on anxiety and depression were especially high in areas associated with air pollution. Moreover, there was also a significant association between more *subjective* meanings of place and psychological health. According to a reality-orientation criterion, evidences showed that when individuals live in industrial areas perceptions of their places as industrial are associated with lower depression, anxiety and psychiatric symptoms.

1. Introduction

We live in an age of heavy industrialization. The rise of the industrial revolution brought many important achievements, leading to the overall development of countries' economy and wealth. However, the massive creation of factories and new cities also had important social and environmental impacts turning many traditional *green* landscapes into what are perceived as ugly *grey* portraits. This dichotomy between a pure and beautiful countryside versus the dirty and black city is not new and probably no one has explored this idea better than the famous English writer Charles Dickens. For instance, in the novel *Great Expectations* (1860/1861), the main character Pip is consistently clear in his idyllic descriptions of the country as a calm and beautiful place, whereas the city was described, in his own words, as an "ugly, crooked, narrow, and dirty" place (p. 153).

The idea that living in different physical settings may have differential effects on individuals has been explored in a more scientific background. Until now, most of these studies have been particularly interested in testing the health impacts of living in urban vs. rural places. Some evidences suggest that higher urbanization rates are related with environment-related morbidity both in low income (von Shirnding, 2002) and advanced countries (Sclar, DArch, & Carolini, 2005). For instance, in support of this prediction, Haynes and Gale (1999) showed clear differences in mortality and deprivation in health among rural and urban residents in England. The results of this study showed that rural wards had mean values of mortality and morbidity lower than national average values, while those in Inner London and other metropolitan cities were less healthy.

More recently, some studies have also presented compelling evidences that the level of *industrialization* (and not merely urbanization) is also related to poorer health (Downey & Van Willigen, 2005; Evans & Kantrowitz, 2002). A good example of research showing the effect of industrial contexts on health is the large-scale study conducted by Boardman and colleagues (Boardman et al., 2008). In this study, and in agreement with expectations, results showed a positive correlation between living close to industrial activities and stress levels, even after controlling for the effect of several demographic variables such as gender and level of income.

Studies that explore the relationship between industrial activities and health are especially important because there seems to be an unequal distribution of physical sites according with several demographic variables. In this sense, some studies suggest that poorer people, from underprivileged minorities, are the ones who end up living in the most industrialized and polluted places (Adeola, 1994; Brulle & Pellow, 2006; Lima, 2008). For instance, in one recent study conducted in England, Walker, Mitchell, Fairburn, and Smith (2005) showed an unequal distribution of industrial sites in England, with sites disproportionately located in deprived areas and near deprived population. In a similar vein, other evidence showed that industrial and hazardous areas are particularly occupied by Blacks and Hispanics (Szasz & Meuser, 1997). This kind of "social injustice" has been particularly explored in the US, covering several issues such as ethnicity, class, income, age and population density

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(Bryant, 2003; Davidson, 2003). Evidences showing that living in more industrial sites may have a significant and direct effect on one's psychological health clearly emphasize the type of social injustice that some individuals in our societies are exposed to.

Given the importance of this topic, we believe the effect that neighborhood physical contexts - more rural or more industrial - have on individual's health is still an issue under exploration. In fact, studies addressing this topic still follow a narrow perspective, focusing mostly exclusively on a biological model of human–environment interaction (Evans, 1982). First of all, it seems that this research is often particularly concerned with the effects that living in these contexts may have on humans' physical health (e.g., Dunn & Kingham, 1996; Elliot et al., 2001; Pless-Mulloli et al., 1998; Walker et al., 2005) with more or less disregard to other type of impacts such as psychological consequences of living in these type of places. In fact, as far as we know, apart from the Boardman et al. (2008) study just cited, there are only few studies exploring the consequences of this type of exposure to psychological mental health and most of the times these studies are limited in the number of psychological impacts they address (Arnetz, 1998; Downey & Van Willigen, 2005; Weiss, 1998). Second, they also tend to adopt a clearly more "objective" perspective of impact assessment, focusing mainly on the physical characteristics of neighborhoods and neglecting the possible mediating role that more "subjective" variables (e.g., place perception) might play in the determination of health impacts. Given the evidences suggesting that the way people perceive their environment affects in a significant manner their overall level of well being and health (e.g., Cavalini, Koeter-Kemmerling, & Pulles, 1991; Chattopadhyay & Mukhopadhyay, 1995; Staples, 1996; Steinheider & Winneke, 1993), this perspective offers a reductionist view on this issue. In this sense, we believe that a psychological perspective on environment and health may broaden our knowledge regarding this relationship. In fact, according with psychological models of stress (Evans, 1982; Lazarus & Folkman, 1984) we should expect effects of exposure to environmental physical contexts on health outcomes that go beyond the typical mortality and morbidity rates considered in traditional epidemiological studies. In fact, mental health symptoms such as irritability, depression and anxiety should also be affected by environmental quality and should be given an appropriate status (Evans, 1982). Moreover, effects of on health should not only be determined by the objective exposure to environment stimuli; subjective appraisals of environment conditions should also assume a main role in the prediction of health outcomes.

There are good reasons to expect differences in overall levels of psychological health among individuals living in industrial and non-industrial neighborhoods. Industrial contexts should be associated with higher exposure to noise and air pollution, which are often associated with poor mental health. These environmental stimuli may affect individuals in a direct manner (e.g., Babisch, Ising, Galacher, Sweetnam, & Elwood, 1998; Brunekreef & Holgate, 2002); however, most often, health is influenced by the contexts of exposure and by individual's perceptions (for reviews on this matter please see Bronzaft, 2002; Evans & Jacobs, 1982; Passhier-Vermeer & Passchier, 2000). Typically, perceiving a certain place as more industrial should be related with poor psychological health. Often perception of industrial activities take the form of *annoyance* which is generally defined as "a feeling of dissatisfaction associated with any agent or condition that is believed to affect individuals in an adverse way" (Steinheider & Winneke, 1993, p. 353) and that has been associated with the increase of stress (e.g., Evans & Jacobs, 1982). Specifically, annoyance regarding noise has usually been identified as a source of low psychological and physical well-being in more general terms (e.g., Ouis, 2001; Staples, 1996) and annoyance regarding air quality, although less studied, has also been associated with harmful effects to psychological health (e.g., Cavalini et al., 1991; Chattopadhyay & Mukhopadhyay, 1995), especially when it is associated with a sense of environmental threat (Lima, 2004; Lima & Marques, 2005).

However, there may be certain situations where perceptions of place as *industrial* in general may be related with better mental health. This may happen, for instance, when people perceive regional socio-economic benefits linked to the increase in economic activity and employment (see Downey & Van Willigen, 2005 for a discussion on this issue). In this case, people's perceptions are not limited to annoyance, but also to the perception of positive benefits. In support of this prediction, Boardman et al. (2008) showed better mental health among men and women who lived near industrial activities, who did not have children, and that worked in this type of activity.

On the other hand, we believe that there are other factors that may also link perceptions of a place as industrial and better psychological health. In fact, for someone living in an objectively industrial area, it may be more realistic to consider their place as *industrial* than as *non-industrial*. In turn, this realistic vision seems to be an important determinant of adequate levels of mental health.

The link between realistic perceptions and mental health has been widely explored within the domain of health psychology, and several authors have discussed the amount of realism that is actually good for one's health (Colvin & Block, 1994; Taylor & Brown, 1988, 1994). In an influential paper, Taylor and Brown (1988) made an important claim in favor of the use of illusion strategies. According with these authors, people tend to use in a pervasive, enduring and systematic manner certain positive illusions (e.g., exaggerated perceptions of control and mastery; unrealistic positive self-evaluations) that serve an important role that help bring about and maintain psychological well-being. However, one should be cautious to interpret the meaning of "positive illusions". According to a later paper by Taylor and Brown (1994) it is not true that the undifferentiated use of positive illusions is related with adjustment in mental health. For instance, and in accordance with the authors, "if a small group of individuals persist in believing that they can cure themselves of indisputably advancing, chronic, or life-threatening diseases, we might find that these individuals are maladjusted, as is sometimes the case" (Taylor & Brown, 1994, p. 23). After extensive elaboration regarding this topic, Taylor and Brown (1994) end up clearly defending the idea that at extreme levels, the use of illusions may indeed be directly linked with poor psychological health. This moderate perspective on the use of positive illusions is more in line with traditional perspectives on mental health, that place a great emphasis on "reality orientation" as a criterion of adjustment and well-being (Colvin & Block, 1994; Jahoda, 1958). In this sense, for someone that lives in an industrial area, it may actually be more realistic and adapted to perceive his or her place as *it is*: an industrial place.

1.1. Overview of the present study

In the present paper we are especially interested in exploring the consequences for psychological health of living in industrial versus non-industrial areas. Using a vast array of health measures, we hope to show that the neighborhood's level of industrialization is associated with a much broader array of psychological impacts than has been traditionally assumed. To measure psychological health we included several indexes widely used as measures of psychological health in the psychological literature: psychological well-being, dispositional optimism, anxiety and depression, psychiatric comorbidity and coping strategies. Our perspective allowed us to tap a more conventional symptomatic view of mental health (i.e., depression, anxiety and psychiatric comorbidity), as

well as measures of positive functioning (i.e., psychological well being and dispositional optimism) and also indication of some underlying psychological processes, in particular coping strategies. Measuring coping strategies allow us to evaluate the type of usual cognitive and behavioral responses that people use to manage distress and address the problems of daily life. This is an important measure because the use of coping strategies has been often associated with overall levels of psychological health and well being (Folkman & Moskowitz, 2004). The most influential authors in the field have argued that coping processes are not inherently good or bad (Folkman & Moskowitz, 2004; Lazarus & Folkman, 1984) and that they need to be evaluated in the specific context in which they occur. For this reason, different coping strategies were considered.

In this study we have two main goals. The first is to test the association between living in industrial neighbourhoods and psychological health. Our hypothesis is that, in agreement with previous studies (Boardman et al., 2008) living in industrial areas will be associated with lower psychological well-being, lower dispositional optimism, higher anxiety and depression rates, higher susceptibility to psychiatric problems and lower use of adaptive coping strategies than living in non-industrial areas.

Second, in this paper, we are also interested in exploring the relationship between "perception of industrial activity" and levels of psychological health. We assume that people living in areas classified as industrial would perceive their areas as more "industrial" than people living in areas classified as "non-industrial". Moreover, and based on the idea that realism is an important determinant of overall adaptation and mental health, we hypothesize that, for people already living in the industrial areas, perceiving their place as "industrial" should actually be associated with better psychological health.

2. Method

2.1. Design

In order to test our hypothesis we used a quasi-experimental design where we compared psychological health of individuals living in four different areas. Three of these areas are objectively classified as industrial, whereas one is classified as a non-industrial neighborhood. The choice of the areas included in the study was done based on the classification made by the Directorate-General for Spatial Planning and Urban Development, part of the Ministry of Equipment, Planning and Territorial Administration (DGOTDU, 2000). The three industrial areas vary in the type of industrial activity: one area is occupied by a mixture of several type of industries and is especially affected by air quality issues (odor) (Ind 1); the second area is characterized by the activity of chemical industry and is affected mostly by air pollution (smoke and particles) (Ind 2); and the last areas is occupied by textile industry and is affected mostly by water quality issues (Ind 3). The less industrialized sample (Non-ind) is mostly a residential neighborhood.

2.2. Procedure

Based on data obtained from DGOTDU (2000) we were able to choose the four areas of interest. It is important to refer that, in order to control for possible differences due to country region, the four areas were all located in the Northern part of Portugal and shared similar demographic characteristics with one important difference: percentage of people employed in the industrial sector in the Non-Ind area was lower (34%) than in the remaining areas (Ind 1: 49.08%; Ind 2: percentages ranged from 43.32% to 57.55% according to specific locations; Ind 3: percentages ranged from 45.29% to 63.08%). Moreover, we did not find significant differences among the four areas regarding age, gender and level of education (INE, 2001).

The interviews were conducted face to face by trained interviewers. They took place at respondents' house and took approximately 30 min. This technique of data collection was used because it maximizes the response rate on controversial issues and allows people with low levels of education to answer the questionnaire. Two criteria were considered to define the characteristics of the sample: the parishes included in the target area and the educational level of the resident population. In each location, the houses to sample were randomly chosen and in each house the interviewee was also randomly chosen – the last adult to have his or her birthday, provided that he or she consented to be part of the study. First contact was always done in the presence of the interviewee but, in some cases, some telephone calls were needed to ensure the interviews.

The interviewers received specific training concerning the interviews' procedures and the structure of the interview protocol. In order to perform a quality control of the interviews by a member of the team, an ID code number was given to each of the participants, and the name, address, and phone number of the interviewed was collected.

2.3. Participants

402 participants took part in the survey distributed across the four areas (Table 1). We did not find significant differences between the four samples regarding gender, age, marital status and level of education. However, we found some significant differences between the samples regarding mean years of residence, $F(1, 398) = 883.80$, $p < .00$, $\eta^2_p = .69$, percentage of active population, χ^2 (3, $N = 402$) = 8.58, $p < .05$, and level of income, $\chi^2(3, N = 402) = 73.24$, $p < .001$. Analysis of the overall pattern of results showed that individuals in the Non-Ind sample have been living in the area for fewer years than those in the three industrial areas and that they have higher level of income. To control for possible confounding effects of these socio-economic factors on psychological health, we entered these variables as covariates in posterior analysis.

2.4. Survey

2.4.1. Psychological well-being

To measure well-being we used the scale proposed by Ryff (Ryff, 1989; Ryff & Keyes, 1995). Developed in the context of

Table 1
Socio-economic characteristics of participants in the four samples.

Area	N	Age	Man (%)	Married (%)	Level of education (%)		Years of residence	Active (%)	Level of income (%)	
					<4 years	>4 years			<1250 €	>1250 €
Ind 1	100	46.8a (18.9)	52.0	64.0	57.0	43.0	31.1a (20.6)	4.0*	96.0*	4.0*
Ind 2	111	44.3a (16.9)	49.5	55.0	53.2	46.8	33.0b (19.9)	6.3	91.9*	8.1*
Ind 3	116	44.7a (15.4)	50.0	75.0	56.0	44.0	29.9b (20.7)	6.0	79.3	20.7
Non-Ind	75	49.7a (16.7)	49.3	82.7	50.7	49.3	24.4c (16.1)	6.7	49.3*	50.7*

Note: means in a column that do not share the same subscript are significantly different according with the Sheffé test.
*$p < .05$.

a developmental perspective of self throughout the life course, this scale aims to evaluate multiple dimensions of positive psychological functioning including positive relations with others, autonomy, environmental mastery, purpose in life, personal growth and self-acceptance. This scale has been used in several international studies particularly to evaluate effects on well-being due to important life changes (Heidrich & Ryff, 1993). In the present study, we used the 18 items version of this scale adapted to Portuguese by Novo, Duarte Silva, and Peralta (1997). Participants were presented with the 18 items and asked to indicate the degree in which they agreed with each one of them (1 = Strongly disagree until 6 = Strongly agree). Results were summed up in a final score to calculate the overall level of psychological well-being such that higher scores indicate higher psychological well-being. In agreement with previous findings (Novo et al., 1997), the scale showed good psychometric qualities (*Cronbach alpha* = 0.78).

2.4.2. Optimism

Dispositional optimism refers to individual's typical tendency to anticipate favorable events and it was measured using the *Life Orientation Test* (LOT), a 12 items scale developed by Scheier and Carver (1985) and translated by us based on the opinion of two independent specialists. LOT is composed by 8 items that aim to measure dispositional optimism (4 negative and 4 positive items). Scores are obtained by summing up the answers to the 8 items, after inverting negative items. Previous studies showed good internal consistency (*Cronbach alpha* = 0.76) and test-rest accuracy (0.79 for a four week interval and 0.72 for a period over 13 weeks). In the present study, internal consistency of the scale was 0.70.

2.4.3. Anxiety and depression

This was assessed using a short version of hospital anxiety and depression scale (HADS), a 14 item scale developed by Zigmond and Snaith (1983). HADS was first developed to assess the psychological state of clinical samples in a hospital setting, but is considered as quite appropriate for community surveys in which there is no intention of producing a clinical individual diagnosis (Loewenthal, 1996). The scale is divided in two subscales, one to measure anxiety and the other to measure depression, each composed by 7 items. Results in each subscale are obtained by summing up the items after recoding of negative items and may vary between 0 and 21. The cut-off point to consider psychological symptoms is 12 but Moorey et al. (1991) refer that after 8 there may be light signs of psychological disturbance. In the present study, we found good psychometric results for the two subscales (*Cronbach alpha* $_{anxiety}$ = 0.83; *Cronbach alpha* $_{depression}$ = 0.77).

2.4.4. Psychiatric comorbidity

Eventual presence of psychiatric comorbidity was assessed using the short version of the *General Health Questionnaire* (Goldberg, 1992). The twelve-item scale was developed to detect in the general population the presence of non-psychotic psychiatric illnesses. Scores may vary between 0 and 12 and 8 is considered the *cut-off* to detect psychiatric illnesses. GHQ has been validated in several countries and it generally an easy to use scale, revealing overall good psychometric qualities. In the original sample, its ability to detect psychiatric cases showed an overall sensitivity of 93.5% and a specificity of 78.5%. We conducted a preliminary study using the GHQ, revealing good psychometric qualities (*Cronbach alpha =0.87)*. In the present study internal consistency of the scale was 0.84.

2.4.5. Coping strategies

To evaluate the use of dispositional *coping* strategies (i.e., typical tendency to stressful events) we used the short version (16 items) of COPE, a scale developed by Carver, Scheier, and Weintraub (1989) and translated to Portuguese by Marques-Pinto (2000). The short version of COPE is composed by 4 of the initial 11 subscales: 2 measuring positive coping strategies (active coping and planning) and 2 measuring negative coping strategies (denial and behavioral disinvestment). These categories were identified in the study conducted by Marques-Pinto (2000). In COPE, participants are asked to answer in a 4-point scale (1 = I don't usually do that until 4 = I usually do that) the degree in which they feel their reactions presented in the items match their usual behavior in stressful situations. The scores of each subscale are given by summing up the respective items and they may vary between 4 (null use of that coping strategy) and 16 (intensive use of that coping strategy). Results in each subscale indicate the degree in which each type of coping strategy is used. Previous studies regarding the psychometric qualities of COPE showed good results, with values of internal consistency higher than 0.60 and test-retest reliability between 0.42 and 0.89. According to Weinman, Wright, and Johnston (1995) these values point towards a "reasonably stability" (p. 10). The study conducted in Portugal also revealed good psychometric qualities with the values of internal consistency for the four subscales varying between 0.61 and 0.78. In the present study, *Cronbach alpha* for the four subscales were as following: active coping: 0.75; planning: 0.72; denial: 0.56; behavioral disinvestment: 0.58.

2.4.6. General perception of the neighbourhood

We evaluated the level of annoyance regarding neighbourhood noise during the night (2 items e.g.,"To what level do you feel annoyed by noises during the night?", *Cronbach alpha* = 0.78) and during the day (2 items e.g.,"To what level do you feel annoyed by noises during the day?", *Cronbach alpha* = 0.71), air quality (2 items e.g., "To what level do you feel annoyed by dust or smells?", *Cronbach alpha* = 0.90) and overall perceived environmental quality (9 items e.g., "The landscape in this area is very beautiful", *Cronbach alpha* = 0.70).

2.4.7. Perception of place as industrial

Participants answered two questions aimed at characterizing their perception of their neighborhood environment ("Are there any factories or industrial units in your area of residence?"; "Can you see any close chimney, factory or industrial unit from your window?"). We considered that participants perceived their place as industrial if they indicated "yes" to these two questions. We considered that participants perceived their place as non-industrial if they answered "no" to these two questions. We did not considered in the analysis participants that only answered "yes" to one of these questions.

2.4.8. Personal identification

Participants were also asked to fill some personal data regarding gender, age, educational level, marital status, occupational status (actively working or unemployed), level of income and number of years living in the area.

3. Results

3.1. General perception of the neighborhood

The analysis of results showed that participants in the Non-Ind area revealed lower environmental annoyance than individuals in the three industrial areas related with daytime noise, F (3, 398) = 27.48, $p < .001$, $\eta^2_p = .17$ night time noise, F (1, 398) = 37.40, $p < .001$, $\eta^2_p = .22$, and air quality, F (1, 398) = 57.33, $p < .001$, $\eta^2_p = .30$. Finally, they also rated overall perceived environmental

quality of the area better than individuals in the three industrial areas, $F(1, 398) = 70.42$, $p < .001$, $\eta^2_p = .35$ (Table 2).

3.2. Perception of place as industrial

In agreement with our expectations, results revealed that individuals in the Non-Ind area referred significantly less the presence of factories nearby their residence, χ^2 (3, $N = 402$) = 100.28, $p < .001$, and indicated less often that they could see chimneys from their windows, χ^2 (3, $N = 402$) = 81.13, $p < .001$ (Table 2).

3.3. Area and psychological health

To evaluate differences between the four areas regarding psychological health first we performed a MANCOVA with Area as a between-subjects factor and the psychological health measures as dependent variables. Area refers to the four neighbourhoods included in this study (Ind 1, Ind 2, Ind 3 and Non-ind). To control for possible confounding effects of demographic variables, participant's occupational status, years of residence in the neighbourhood and level of income were entered as covariates in the analysis. Using Pillai's trace, there was a significant effect of Area on overall psychological health measures, $V = 0.53$, F (24, 1170) = 10.41, $p < .001$, $\eta^2_p = .18$. Univariate ANCOVAS for each dependent variable were conducted as follow-up tests to the MANCOVA. Using the Bonferroni method for controlling Type I error rates for multiple comparisons, each ANCOVA was tested at the 0.006 level (Table 3). First of all, the overall analysis of results revealed better psychological health for individuals living in the Non Ind neighborhood. In fact, participants in the Non Ind area showed significantly higher Psychological Well-being, Optimism and use of Active Coping Strategies than individuals in the other three industrial areas. Moreover, residents in the Non Ind neighbourhoods scored higher than Ind 1 and Ind 2 in Planning coping (it is interesting to see that results regarding the use of active coping strategies and planning are the ones where effect sizes are higher). Hence, these results seem to show that living in industrial places, regardless of the specific type of industry that is operating (at least for Well-being, Optimism and Active Coping Strategies), may have a hindering effect on positive psychological health. However, the pattern of results regarding more negative aspects of psychological health is not so clear-cut. In fact, in these indexes, although generally we found worst results in Ind 1 and Ind 2 areas when compared with the Non Ind area, we also found some similarities between psychological health of individuals living in the Non Ind area and individuals living in Ind 3. For instance, results show that depression and anxiety levels are worst in individuals from Ind 1 and Ind 2 than in individuals in Ind 3 and Non Ind areas. Moreover, results regarding the GHQ measure show that individuals living in Ind 2 have significantly higher probability of having psychiatric symptoms than individuals in Ind 3. These results suggest that specifically negative impacts of living in industrial areas vary as a function of the specific type of industry that is operating. Hence, they seem to indicate that industrial areas with high impacts on air quality are associated with more dangerous to individual's psychological health than industrial areas with other type of impacts (such as water pollution). In fact, analysis of psychiatric signs according to the test norms of HADS and GHQ measures seem to suggest precisely the same thing (see Table 4). The analyses of the adjusted residuals showed significant higher evidence of anxiety signs in Ind 1 as compared to Ind 3, χ^2 (3, $N = 402$) = 23.12, $p < .001$. It is important to note that, although they are not significant, analysis of signs of psychiatric comorbidity (GHQ) indicate that the higher percentage of cases occur in the Non-Ind area (8%). At first sight, this may seem to contradict the results presented in Table 3, where Non-Ind appears with a relatively low mean in the GHQ measure. However, we would like to emphasize that in Table 3 and Table 4, we are presenting different results. In Table 3 we present the mean values of GHQ, whereas in Table 4 we are presenting the percentage of extreme cases (cut-off: 8). These results indicate that whereas the mean in GHQ scores is not very high in the Non-Ind area, there may be nonetheless a relatively higher percentage of more extreme cases that should be considered as signs of presence of psychiatric comorbidity in this neighborhood.

Table 3
Adjusted mean, Standard deviations and Analysis of Covariance (ANCOVA) results for Psychological Health Indexes.

Variables		Ind 1 ($n = 100$)	Ind 2 ($n = 111$)	Ind 3 ($n = 116$)	Non Ind ($n = 75$)	F (3, 395)	η^2p
Well-being	M	67.67a	68.63a	75.23b	84.39c	53.99***	0.29
	(SD)	(9.00)	(8.96)	(8.83)	(9.44)		
Optimism	M	39.81a	39.16a	41.23b	46.48c	28.71***	0.18
	(SD)	(5.20)	(5.16)	(5.06)	(5.46)		
Anxiety	M	7.45a	7.39a	4.46b	4.54b	15.11***	0.10
	(SD)	(4.20)	(4.00)	(4.09)	(4.42)		
Depression	M	6.71a	7.38a	4.41b	4.67b	14.01***	0.09
	(SD)	(3.90)	(3.90)	(3.77)	(4.07)		
GHQ	M	2.00a	2.49a,b	1.13a,c	1.74a	5.46***	0.04
	(SD)	2.6	2.63	2.58	2.68		
Active coping	M	8.63a	10.49b	11.85c	13.05d	56.14***	0.30
	(SD)	(2.30)	(2.32)	(2.26)	(2.42)		
Planning coping	M	8.78a	10.26b	11.54c	11.83c	30.19***	0.19
	(SD)	(2.40)	(2.42)	(2.37)	(2.51)		
Coping Beh Desinv	M	6.72a	9.92b	8.74c	8.56c	18.20***	0.12
	(SD)	(3.20)	(3.16)	(3.12)	(3.38)		
Coping Denial	M	8.23b	10.22 ab	9.82 ab	10.70 ab	19.61***	0.13
	(SD)	(2.30)	(2.32)	(2.26)	(2.42)		

Note: means in a column that do not share the same subscript are significantly different according with the Sidak test.
***$p < .001$.

3.4. Perception of place as an "industrial place" and psychological health

Analysis of results regarding the characterization of the neighborhood showed that a significant percentage of people living in industrial areas did not perceive their area as "industrial" (they did not indicate having factories and chimneys nearby) (see Table 2). Given that their residential area is officially classified as an industrial area (DGOTDU, 2000) and that the majority of individuals in

Table 2
General perception of the neighborhood.

Area	N	"factories nearby" (%)	"view nearby chimneys from windows" (%)	Annoyance daytime noise	Annoyance nigh time noise	Annoyance air quality (smoke and odor)	Perceived environmental quality
Ind 1	100	69.0*	59.0*	2.35b (0.60)	2.40b (0.63)	3.56a (1.32)	2.60a (0.37)
Ind 2	111	74.8*	64.9*	2.46b (0.82)	2.50b (0.63)	2.43b (0.71)	3.41b (0.63)
Ind 3	116	50.0	35.3*	2.23b (0.76)	2.28b (0.63)	2.22b (0.96)	3.54b (0.64)
Non-Ind	75	5.3*	4*	1.47a (0.88)	1.31a (0.63)	1.68c (0.96)	3.91c (0.85)

Note: means in a column that do not share the same subscript are significantly different according with the Sheffé test.
*$p < .05$.

Table 4
Percentage of residents with signs of psychological disturbance according with the norms of HADS and GHQ measures.

Variables	Ind 1	Ind 2	Ind 3	Non- Ind
	($n = 100$)	($n = 111$)	($n = 116$)	($n = 75$)
Anxiety[a]	28%	14.4%	6%	9.3%
Depression[a]	10%	12.6%	8.6%	5.3%
Psychiatric comorbidity[b]	2%	6.3%	3.4%	8%

[a] cut-off: 12.
[b] cut-off: 8.

the sample (at least in Ind 1 and Ind 2 areas) assume their neighborhood as industrial, we wanted to explore whether this perception may be associated with individual's psychological health. To explore this issue we conducted the analysis solely considering individuals living in the three industrial areas. First, we performed a MANCOVA with Area (the three industrial neighborhoods) and Industrial Perception as between-subjects factors and each one of the psychological health measures as dependent variables. Once again, given differences among samples in the three industrial areas (Table 1), participant's occupational status, years of residence in the neighborhood and level of income were entered as covariates in the analysis. Using Pillai's trace, there was a significant effect of perception of place as industrial on overall psychological health measures, $V = 0.24$, $F(8, 207) = 7.97$, $p < .001$, $\eta^2_p = .24$. Univariate ANCOVAS for each dependent variable were conducted for as follow-up tests to the MANCOVA. Using the Bonferroni method for controlling Type I error rates for multiple comparisons, each ANCOVA was tested at the 0.006 level. Results showed a significant main effect of Industrial Perception on participant's level of anxiety, depression and psychiatric comorbidity (GHQ) (Table 5). Overall, results showed the following pattern: individuals living in areas classified as industrial and who actually perceive to be living in "industrial areas" show significantly lower levels of anxiety, depression and signs of psychiatric comorbidity than individuals who do not perceive their place as industrial. We did not find a significant interaction between Industrial Perception and Area of residence.

Table 5
Adjusted mean, Standard deviations and Analysis of Covariance (ANCOVA) results for Psychological Health Indexes according with the Perception of Place as Industrial.

Variables		Perception		$F(1, 214)$	η^2_p
		Perception as Industrial ($n = 139$)	Perception as Non-industrial ($n = 84$)		
Well-being	M	70.79	68.11	5.05	0.02
	(SD)	8.37	7.35		
Optimism	M	39.28	37.49	4.83	0.02
	(SD)	5.76	5.86		
Anxiety	M	5.22	8.95	48.48***	0.18
	(SD)	3.78	3.85		
Depression	M	5.26	8.02	29.50***	0.12
	(SD)	3.58	3.57		
GHQ	M	1.34	2.78	15.91***	0.07
	(SD)	2.48	2.57		
Active coping	M	10.12	10.50	1.26	0.00
	(SD)	2.38	2.42		
Planning coping	M	10.04	10.54	1.98	0.01
	(SD)	2.48	2.47		
Coping Beh Desinv	M	7.91	9.05	6.16	0.03
	(SD)	3.23	3.29		
Coping Denial	M	9.54	9.28	0.53	0.00
	(SD)	2.48	2.57		

***$p < .001$.

Finally, the analysis of psychiatric signs according to HADS and GHQ scoring norms show significant better values when individuals perceive their place as industrial (see Table 6). This effect occurs for anxiety, $\chi^2(1, N = 223) = 9.92$, $p < .01$, depression, $\chi^2(1, N = 223) = 5.98$, $p < .01$, and psychiatric comorbidity, $\chi^2(1, N = 223) = 7.99$, $p < .01$.

4. Discussion

The first goal of this study was to explore the association between living in industrial areas and overall psychological health. According with expectations, results showed general lower psychological health in individuals living in areas officially classified as industrial than in areas officially classified as non-industrial. In fact, we found that those who lived in industrial areas had lower levels of psychological well-being, optimism and use of active coping strategies than those who lived in the non-industrial area. Moreover, we also found worst results in some types of industrial areas (mainly related with air pollution) regarding negative health outcomes such as anxiety, depression and psychiatric comorbidity.

The fact that negative health outcomes were particularly present in industrial areas with high levels of air pollution is not surprising. Air pollution is a much more prevalent and inescapable way of pollution than water pollution. In most cases, water pollution will be easily circumscribed to one area (a certain river or a certain beach) than people can avoid, if they want. On the other hand, air pollution is very "democratic" (Beck, 1992) in the sense that it affects everyone, mostly anywhere near the pollution source. One other possible explanation for the differentiated effects of air pollution and water pollution may be linked with the way people perceive this pollution. In fact, there is some evidence in the literature suggesting that individuals may be especially affected by easily perceived environment characteristics such as odor, particles and smoke. In this sense, these more sensorial environmental features may serve as cues to danger and activate a stress process with harmful effects to one's psychological health (Evans & Jacobs, 1982; Mukherjee, 1993).

We believe that this study reinforces the importance of taking into consideration the impacts that physical surroundings may have on individual's psychological health. These results offer a more detailed perspective on the array of psychological health outcomes that may be associated with characteristics of the physical context in which we live and may contribute in a meaningful way to this debate (Boardman et al., 2008; Haynes & Gale, 1999). Moreover, these results call our attention to the type of health impacts that especially people from low socio-economic status and underprivileged minorities, the typical populations in industrial areas, are subject to. Belonging to an underprivileged poor minority is by itself a menace to health. In fact, it is now well established that low SES is associated with lower overall levels of physical and psychological health and an increase in morbidity and mortality rates (for a review see Elo, 2009). However, our results suggest that, on top of these influences, poor minorities may also be subject to other type of influences that are

Table 6
Percentage of residents with signs of psychological disturbance according with the Perception of Place as Industrial.

Variables	Perception as Industrial	Perception as Non- industrial
	($n = 139$)	($n = 84$)
Anxiety[a]	9.4%	25%
Depression[a]	7.2%	17.9%
Psychiatric comorbidity[b]	1.4%	9.5%

[a] cut-off: 12.
[b] cut-off: 8.

directly related with the physical environments they inhabit. Forced to live in the more industrial and in the more disorganized places, underprivileged people in society are not only affected by their socio-economic background but also by their physical contexts, all of these factors influencing health in a negative way. We believe that, given the importance of this topic, more research is needed to explore the interaction between the effects of socio-economic factors and physical environments on health.

In this paper we also established a second goal related with understanding the relation that place perception may have with psychological health. First, we hypothesized that people living industrial areas would actually perceive their place as more industrial then people living in the non-industrial area. Not surprisingly, our results show exactly this pattern of response. However, following a "reality-orientation" criteria (Colvin & Block, 1994; Jahoda, 1958), we also hypothesized that, for people already living in industrial areas, perceiving their place as industrial should be associated with better mental health. Results support this hypothesis revealing that those who live in places objectively classified as industrial and that perceive their place as industrial show lower levels of anxiety, depression and psychiatric symptoms than those who perceive their place as non-industrial.

According with expectations, these results suggest that is actually better for psychological health when subjective perception matches objective surroundings: if I live in an industrial place, it is actually best that I recognize it as such. This is an interesting finding that concurs with evidences within the health psychology domain (Colvin & Block, 1994; Taylor & Brown, 1994). However, it questions the overall notion than perceptions of industrial activity are always related with bad mental health. Most studies regarding this issue focus on annoyance as the main mediating subjective factor between physical stimulus and mental health. This focus on annoyance strengthens this idea that perceptions of industrial activities are always linked with negative outcomes. However, people may perceive industrial places for what they are - places where there is industry operating - and this may be more realistic than denying the physical evidences that surrounds them. In fact, there may even be situations where perceiving industrial activity is actually something positive: people that live in industrial places may be more focused on the positive side of industrial activity such as economical development and regional employment and this should be related with better mental health (Boardman et al., 2008).

This finding may be important from a social justice perspective. Interventions that aim to ameliorate psychological health in underprivileged minorities who reside in industrial places should, first of all, focus on attenuating the type of impacts usually associated with industrial activities. In this sense, legislation assuring lower levels of noise and air and water pollution is a basic requirement to prevent health problems. However, there is also some work that should be done with the communities that may help to mitigate some of the health impacts. Local employment and benefits are important factors to influence population's opinion regarding the industry. The perception of industrial activity as something associated also with positive outcomes may create a positive sense of place identity and acknowledge the benefits of living in an open "industrial place". According with our results, accepting that an objectively industrial place is an "industrial place" may have positive consequences for people already living in industrial areas.

However, we believe that although they are novel and interesting, the results of this study still need to be further tested in the future. First of all, the use of a quasi-experimental design does not allow us to assume a fully causal relationship between living in industrial areas and worst psychological health. In fact, there may have been some confounding factors that might explain the differences between psychological health among people living in industrial and non-industrial neighbourhoods and that were not controlled in this study. For instance, there are evidences that the percentage of people that work in industrial activities is higher in industrial than in non-industrial areas. Hence, it is possible that worst psychological health in people living in industrial areas is explained by work related factors such as working conditions and work-place characteristics. This is an important confounding factor that should be further tested in future studies.

In the same vein, our results also do not allow us to test a causal relationship between the perception of place as industrial and psychological symptoms. We can only assume that, for those who live in industrial areas, there is a negative association between perceiving their place as non-industrial and worst mental health. However, since we are not testing causality, it may well be that it is not the perception of place that is causing worst mental health, but that this "defensive" perception is an important part of the psychopathological condition and is caused by it. Either way, although we cannot test this issue in the present study we believe that this study still has the merit of showing this type of association for the first time. We believe that this is an important result and that should be considered in future studies addressing the impacts of living in industrial neighborhoods.

Second, the fact that we used a cross-sectional design to test our assumptions has some limitations. For instance, it does not tap the dynamics of inter-regional mobility such as patterns of migration due to health (McKay, Macintyre, & Ellaway, 2003) and this is an important issue to consider because there are evidences showing that not only individual's health may be affected by location changes (Maggi et al., 2010), but also that the health profile of a certain population may change as a result of these migratory needs (e.g., Pearce & Dorling, 2010). In our study we did control for the possible confounding effect of the years of residence (covariate value of this variable appearing in the model tested was 31.88), which may have given us some indication of the length of stay in a place. However, this is only a limited manner to control for migration patterns. Although in our samples the mean years of residence are high (between 24 and 33 years), there are nevertheless high level of dispersion (SD's between 16 and 20 years) and these results, along with the mean ages of the respondents (between 44 and 49 years), suggest that at least some of them should have moved there more recently. Given these shortcomings, there is no doubt that more research is needed on the interaction between health effects due to industrial exposure and these types of migratory phenomenon.

Third, the method that we chose to classify areas as industrial and as non-industrial may also be subject to some limitations. Our goal was to explore psychological health of individuals living in different types of areas. These areas were chosen based on objective classification made by an official organ: the Directorate-General for Spatial Planning and Urban Development, part of the Ministry of Equipment, Planning and Territorial Administration. This classification gives us information regarding the whole area and whether it is predominantly considered to be industrial or not. However, we do not have information regarding the objective distance from each individual household and each of the industries in one area. We think that, in the future, to further test the relationship between objective and perceived influence of industrial activities on psychological health it would be interesting to actually consider the individual distance of each individual to a particular industry. These techniques have been applied in other type of contexts (McCord, Ratcliffe, Garcia, & Taylor, 2007) and could be used in future research.

In a similar vein, the method we used to classify perception of place as industrial may also be subject to some limitations. Recall

that we compared psychological health of individuals who answered "yes" to the two items measuring the perception of place as industrial ("Are there any factories or industrial units in your area of residence?"; "Can you see any close chimney, factory or industrial unit from your window?") with those who answered "no" to both items. We realize that we are taking an extreme approach and that we are not considering those people who answered "yes" to the first question and "no" to the second question (these would be individuals who acknowledge that they live in an industrial place but that do not see any chimney or factories from their windows). To overcome this limitation, we ran once again the analysis comparing individuals who answered "yes" to the first question, regardless of whether they answered "yes" or "no" to the second question (that we considered as the "perception as industrial" group) with those that answered "no" to both questions (that we considered the "perception as non-industrial" group). We found no significant changes in the pattern of results. This suggests that our results are not merely due to a certain type of classification.

The effect of physical contexts on health is a fascinating topic that has attracted the attention of an increasing number of studies in recent years. However, we believe that this is still a path to pursue. In fact, in a recent paper, Peterson, Tsai, Petterson, and Litaker (2009) point out that in comparison with research exploring more individual and socio-economic determinants of mental health, there is still only a limited number of studies exploring the way people's surroundings, or the context in which they live, affects their mental health. There has been a considerable amount of work relating physical characteristics of environments and particular aspects of mental health such as victimization and fear of crime (O'Campo, 2003; Perkins & Taylor, 1996). However, we believe that more work should be conducted on the effects of physical environments and broader measures of psychological health and adaptation.

Finally, we believe that exploring the relationships between physical contexts and health should be conducted taken in consideration not only the objective impacts, but also the role played by psychological factors. Our studies have shown that the subjective meaning of place acts as a moderator of the impact of neighborhood environmental attributes on health. In order to allow community intervention based on this evidence, the existence of other moderators should be explored, and research should also be able to identify the psychological mediators of this process.

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