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MULTIPLE EFFECTS OF COMMUNITY AND HOUSEHOLD CROWDING

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Abstract

This article analyses the interactive effects of community and residential crowding on psychological distress and on residential satisfaction, both mediated by social support. Two studies were carried in which 191 and 259 Málaga city residents (Spain), participated, respectively. By means of structural equations models the moderating and mediating effects are analysed, including the measurement error. The first study shows that there is a potentiation effect of combined crowding on psychological distress, with a weak attenuation effect due to social support. In the second study there is also a potentiation effect of community and residential crowding that diminishes residential satisfaction, and also a weak mediator effect due to social support. Exposure to the two types of crowding potentize their negative effects with social support working as a weak attenuator.

Introduction

Despite the number of studies regarding the effects of crowding on human behavior, there is very little research on the joint effects of the more common types of crowding in ordinary life. Most empirical research only tries to analyse pathological effects and palliative factors. It is less common to study the effects of the interaction of two or more types of crowding on behavior and health. Many people are exposed to multiple sources of crowding on a daily basis: they have to deal with the problems arising from living in crowded households located in densely built areas; they work or study in places with little space; and are forced to commute in crowded buses or cars in traffic jams. As Lepore and Evans (1996) point out, there is little research on how the different environmental stressors relate to each other. According to these authors this is due to the fact that most studies tend to focus on stressful life events in which only the additive effects are studied. However, in reality people have to deal with multiple environmental stressors which interact with each other, provoking effects which cannot be explained by simple addition. As Lepore and Evans (1996) suggest: 'social, psychological, and biological effects of coping with one stressor may influence a person's ability to cope with concurrent or subsequent stressors' (p. 355). These authors also make a distinction between the additive effects of multiple stressors and multiplying effects. Based on this distinction they propose five combinations of effects regarding environmental stressors. In the simple case of two stressors, A and B, there would be: two main effects (A and B), an additive one (A+B), and two interactive effects ($A \times B$) which could be attenuated or potentiated. Based on these premises more research on multiple stressors and their interactive effects on behavior and health is necessary. This should avoid biased estimations caused by only studying simple or additive effects of the different stressors.

On the other hand, it is not possible to simultaneously study all the environmental stressors which a human being is subjected to, still less to analyse all the interactions that these could be producing. Considering two or three stressors may reveal evidence which could help in the future to construct a theoretical model able to explain the possible effects of the multiple stressors that people have to cope with.

In the present paper we only deal with the interactive effects of chronic density on psychological distress in urban areas and households, mainly mediated by the breakdown of social networks

and the decline of social support generated by conditions of high density (Evans & Lepore, 1992; Evans *et al.*, 1989). Lepore (1994) defines household density as the number of people in the household or as the ratio of available rooms and people living in the house. In this work, we use the number of persons/available space ratio as the criterion. Community density refers to the number of people living in a given urban area (e.g., a neighborhood), or the ratio between individuals and space or available houses in a given community. We use the number of people who live in the community.

Several works have investigated the negative effects of residential crowding on behavior and health; however, there are few works that link community and urban crowding with negative effects, and their conclusions are tentative. The study of the simultaneous effects of both types of crowding could benefit from the classic distinction made by Zlunik and Altman (1972) between interior density, number of people per house or room, and exterior density, number of people or houses in the neighborhood. The combination of high and low levels of interior density with the also high and low, levels of exterior density enable us to differentiate four possible crowding situations: urban ghetto, crowded neighborhood with many people per house; luxury apartment in an urban setting, with plenty of living space, in densely populated urban zones; lightly populated rural zones with many people per house; suburban settings, with low interior and exterior density. The interaction between the two types of density gives us a picture of daily interpersonal contacts and the stimulation this produces in a person, both inside and outside his/her home.

Also pertinent to the aims of this study is the work of Stokols (1976, 1978), which distinguishes between primary and secondary settings depending on the quantity, continuity, and frequency of social contacts in a given environment, the relevance of the behaviour exhibited in this context and the degree of anonymity afforded by the social interchanges. Taking into account these elements, primary environments are characterized by the individual staying in them over long periods of time, maintaining close social relations, and behaving appropriately in a way recognized by the other members (e.g., the home). Secondary environments are characterized a such because here encounters are transient, casual, intermittent, and without effects on the relationships established (e.g., the neighborhood). There are two types of interference caused by closeness to others: personal (e.g., sitting in a cafe and a stranger sits down next to you; staying in a campsite and someone else puts their tent immediately in front of yours) and neutral (e.g., travelling by public transport; attending a packed concert). Crowding caused by personal interferences is stronger, more persistent, and difficult to resolve than that caused by neutral interference. Personal interferences in high density conditions causes more frustration and stress in primary environments that in secondary ones. The consequences regarding behavior are more negative when crowding is produced by personal interferences in primary environments than produced by neutral interferences in secondary environments. The experience of crowding produced by personal interferences in primary environments is generalized more rapidly to other situations than crowding produced by neutral interferences in secondary ones. This analysis suggests that inside and outside density might have different effects.

Recently, Maxwell (1996) has demonstrated that chronic exposure to crowded settings at home and in child-care centers has negative consequences on four-and-a-half-year-old children. The combination of these two crowded settings increases behavioral disturbance more than being exposed to a single crowded setting. Thus there is no adaptation to crowding. Maxwell (1996) indicates that such results are 'consistent with Cohen *et al.* (1986) contextual perspective on stress, suggesting that behavioral response to a stressor in one setting can be moderated by stressful conditions in another setting' (p. 506).

Similarly, Evans *et al.* (1996), while using noise and a social stressor as sequential sources of environmental stress in a laboratory context, found higher negative effects and after effects when both stressors were concurrent. Both studies use the idea of stress adaptive cost (Cohen *et al.*, 1986): coping with the continual demands of multiple environmental stressors causes fatigue and the wearing down of the individual's personal and social resources. This translates into the diminished ability to cope with fresh environmental demands and has greater negative consequences for the health of the individual.

In this theoretical context the deterioration of social support re crowding implies that the environmental conditions of overcrowding can erode support resources which, in turn, can have negative consequences on people's physical and mental health (Lepore, 1997). Two theoretical perspectives describe the way social support can alleviate stress. The first

suggests that social support has direct beneficial effects on people, whether they are under stress or not. The second suggests that social support is highly relevant when the person is enduring high levels of stress, but of little benefit when stress is low. Regarding crowding, it has been observed that in densely populated houses, people who claimed to receive less social support showed more stress than those who reported having suitable social support. However, a study (Lepore et al., 1991) shows that after eight months of household crowding, the effects of social support had disappeared: crowding had weakened social support.

Summing up: (a) the ecological covariation between natural stressors is the norm; (b) people are subjected to multiple environmental demands; and (c) the attempt to isolate specific stressors can yield results which underestimate their effects because they are separated from their ecological context (Evans *et al.*, 1996). If the above are taken as a whole then stress should be studied in a more ecological environment which takes into account the effect of the demands that environmental covariations have on people and their coping abilities.

This article is set within such a theoretical framework, and analyses the interactive effects of community density and household density on two very important aspects of urban life: psychological distress and residential satisfaction; mediated by social and community support respectively. Figure 1 presents the path diagram of the theoretical model tested in two studies carried out in Malaga city (Spain).

Study 1

Method

Participants and Procedure. The sample was chosen from a random sampling of telephone numbers from the Malaga telephone directory. Once we had their address we sent a personal letter to the owners of the telephone explaining the type of cooperation we were requesting. Later they received a telephone call or a visit by a qualified member of the team. Once the composition of the family was known one of the members was chosen by using a random number table and if pertinent an interview was arranged. A total of 236 people were interviewed from the 500 households chosen. The reasons for the low completion rate related to people refusing to be interviewed in their home, the long duration of the interview, or the absence of the family member selected at random. Despite the rigorous sampling procedures, 106 were male and 130 females, with ages between 16 and 85; the average age being 42. The interviewers were psychology students properly trained in the use of the different evaluation instruments used in the questionnaire. A thousand pesetas (approx $6·50) was paid to the interviewer for each questionnaire properly filled in.

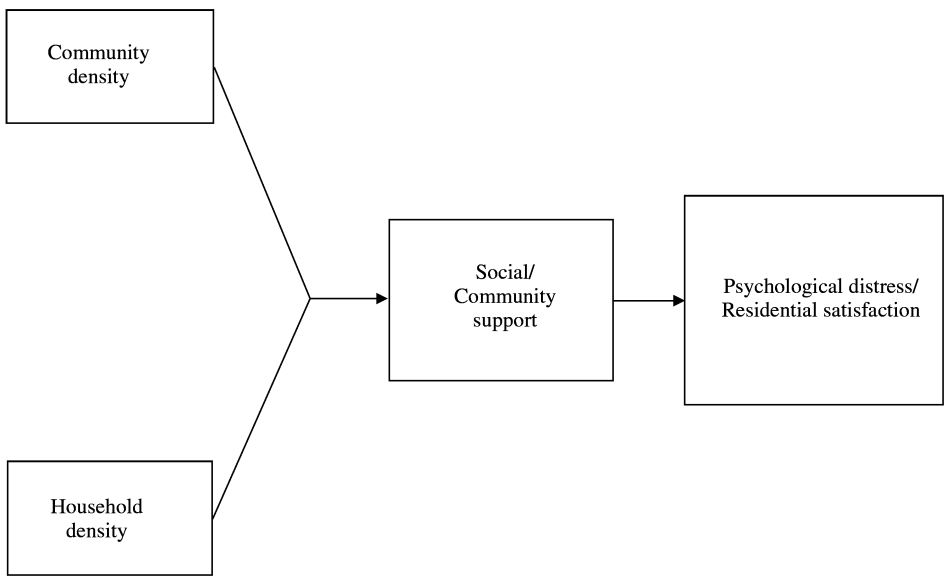

FIGURE 1. Schematic diagram of mediated moderation theoretical model.

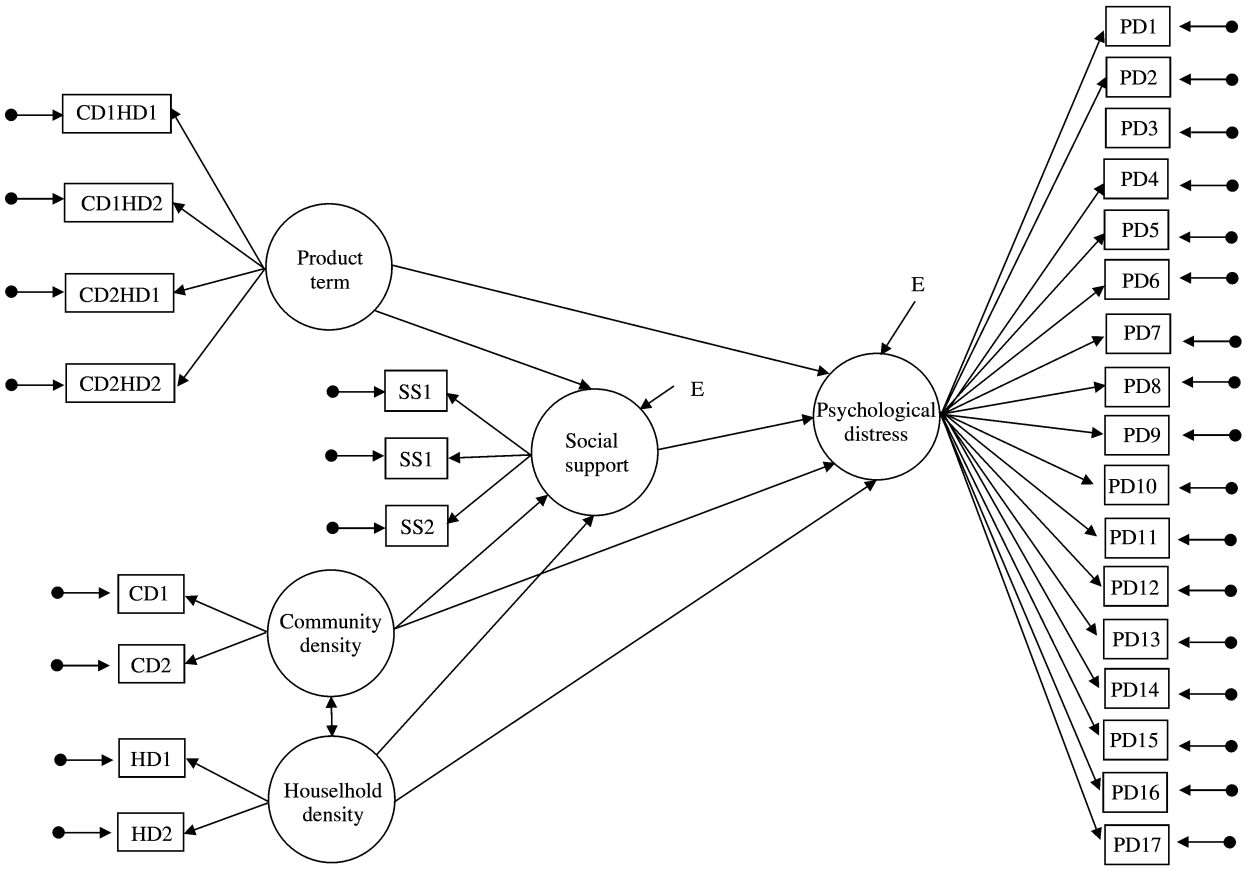

FIGURE 2. Multiple-indicator path model for multiplicative effects of community and household density on psychological stress, with social support as mediator.

Data Analysis. The specific hypothesized relationships between the variable domains in this study were examined using the LISREL 8·20 and PRELIS 2 computer programs (Jöreskog & Sörbom, 1993). *uls* estimates of model parameters were obtained.

Model Specification. Figures 2 represent the model used to analyse the effects of the interaction between community density and household density on psychological distress mediated by social support. This is the mediated moderation model of Evans and Lepore (1997). The analytical strategy of these kinds of models, tested in natural settings, are often accompanied by great statistical difficulties and very few works propose tools able to deal properly with this problem. Among the latter we have to mention the well-known article by Baron and Kenny (1986) dealing with the differences between moderating and mediating variables, as well as the less well-known, but nonetheless valuable, paper written by Finney *et al.* (1984) on the estimation of interactive effects in the field of stress and social support. Another more recent work is that of Evans and Lepore (1997), specifically set within the ambit of the present research, in which they deal with the theoretical and methodological problems involved in the moderator-mediator distinction and how this applies to the field of environment-behavior relationships. In the works cited above an approach based on multiple regression is proposed for testing interactive as well as mediating effects.

The analysis of the effects of the interaction between continuous predictor variables using multiple regression has given rise to recent interest (Jaccard & Wan, 1995). On the other hand, the traditional analysis of multiple regression applied to these issues has the drawback of not taking into account the measurement errors inherent in these models that can cause biased estimation. As Evans and Lepore (1997) point out the measurement errors of the two predictors are combined within the interaction term. One way to ameliorate this problem is to

use very reliable measurements for each of the predictor variables. Another way to deal with this is to include various indicators for each of the variables of the model, which would allow the estimation of parameters within the context of error theory. This can only be catered for today by Structural Equations Models (SEM) (Jaccard & Wan, 1996). SEM. enables the use of latent variables within the system that would explain the effect of measurement errors. This approach has been made possible when applied to interactive effects only after the release of the software application LISREL 8.

The first proposal for the estimation of interactive effects with latent variables was made by Kenny and Jud (1984), who described a procedure involving the product of the measured variables as indicators of latent product variables. Later Jaccard and Wan (1996) and Joreskog and Yang (1996) developed another procedure in which only one latent product variable was needed to correctly identify an interactive model, taking advantage of the new features built into the new version of LISREL, using nonlinear constraints. We followed the procedure developed by these authors. Thus, although Figure 2 shows the latent product variable with all possible product variables as indicators of the Product Term, the procedure only requires the first one. As is well known, one of the problems with these models is that even if the variables measured respect multivariate normality criteria, the presence of a product term violates this assumption, even when there is no statistical interaction (Jaccard & Wan, 1996).

If we also include the fact that most variables in our study are ordinals and that it is impossible to guarantee the normality of the continuous variables, we run the risk of obtaining biased estimations by the use of the traditional maximum likelihood method (*mls*). So we use the alternative estimation method, i.e., unweighted least squares (*uls*), which is distribution free and does not require the restrictive assumption of multivariate normality.

The analysis of the mediating effect of social support on the interaction of psychological distress and crowding requires the decomposition of the total effects of crowding on psychological distress into direct and indirect effects (Alwin & Hausser, 1975). This is something that S.E.M. performs and in a more user friendly way than the estimation of the interaction. As we said earlier regarding the interaction, since S.E.M. analyses measurement errors, it can be considered a more powerful test of mediation than some of the more usual multiple regression methods. Once again the problem of reliability of measurement is crucial in the estimation of the effect of the mediating variable. Evans and Lepore (1997) suggest the use of multiple indicators of variables in order to minimize the error and use SEM. whenever possible. The mediating relationships in SEM. requires the use of separate tests for direct and indirect effects (Joreskog & Sorbom). In a totally mediated relationship the coefficient associated with the path should be close to zero. In a partially mediated relationship the indirect path is different from zero, as is the direct path. The magnitude of both paths shows us to what extent mediation exists. The attenuation of the relationship between the interaction term and, in the present research, of psychological distress is interpreted as a test of the efficacy of social support (Finney *et al.*, 1984).

The application of latent variable structural equations requires specification of both a structural model and measurement model. The structural model describes interrelations among unobserved latent constructs, while the measurement model describes the relations between latent variables and their observed variable indicators. These models are described in detail below.

Measurement Model

Density. Community density has two indicators expressed in absolute terms. The first indicator is based on the data provided by the survey on sociodemography carried out by Malaga City Council. In this study the city is divided into territorial areas according to the number of people, the characteristics of the inhabitants, when the area was built, geographical location, to which administration it belongs, and geographical structure. These areas roughly correspond to the traditional neighborhoods of this city. The number of inhabitants in each of the areas forms the first indicator (CD1), M = 12784·58, S.D. = 7816·12, minimum = 662 and maximum = 32288. The second one refers to the density of the neighborhood community (CD2). This is measured as the number of households in the block where the participant lives, multiplied by the average occupation rate in each household in the neighborhood (M = 88·74, S.D. = 81·95, minimum = 0 and maximum = 538).

Household density also has two indicators. The first one is the ratio between the number of people living there (M = 2·84, S.D. = 1·38, minimum = 1 and maximum = 8) and the area of the house itself measured in square meters (M = 99·84, S.D. = 39·72, minimum = 28 and maximum = 300). The second one is defined as the ratio between the number

TABLE 1
Standardized coefficients (λ) for measurement model of the exogenous latent variables Community Density and Household Density

Indicator	Community Density	Household Density	R^2
CD1 Number of residents in community area	0·82		0·67
CD2 Number of residents in neighborhood	0·20		0·04
HD1 Ratio of people by m^2 in house		0·88	0·78
HD2 Ratio of people by number of rooms		0·73	0·54

of people and the number of rooms in the house (M = 9·05, S.D. = 2·71, minimum = 2 and maximum = 29). Both indicators are calculated from the information given by the interviewees.[1] To minimize the estimation errors that could occur, the interviewer had strict instructions to make an inventory, as objectively as possible, of the number of rooms in the house and to ask to another resident in the house about its size in square meters.

Social Support. Social support has three indicators taken from an adaptation of *The Inventory of Social Resources* (Diaz Veiga, 1987). This instrument includes: the structural characteristics of the social relationships defined by frequency of contact (SS2) with the people who form the social network of each individual (partner, children, parents, brothers and sisters, relatives, friends and neighbors); the amount of emotional support (SS3) received from these people; and finally, functional-subjective characteristics defined as subjective fulfillment regarding each of the social relationships the person has (SS1).

Psychological Distress. The Spanish version of the *General Well-Being Schedule* (Fazio, 1977), developed for the National Center for Health Statistics was used. It is a structured instrument for assessing self-representations of subjective well-being. The Spanish version consisted of 17 items shown in Table 2.

Structural Model. Figure 2 presents the path diagram corresponding to the model analysing the interactive effect of community density and household density on psychological distress, mediated by social support. In this model we analyse: the direct effects of exogenous variables on social support and psychological distress; indirect effects on psychological distress that would reveal the mediator role of social support; and direct effects of social support on psychological distress.

Results

The statistical analysis was carried out with 191 participants. The rest of the questionnaires had to be discarded because of missing data. We first look at the measures of goodness of fit of the structural model shown in Figure 2. Following Jaccard and Wan's (1985) recommendations for this kind of model, these indexes of overall model fit are: the goodness-of-fit-index (GFI), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the root mean square residual (RMR). The problems deriving from data non-normality, number of variables modeled, and/or sample size makes the use of traditional chi-square statistics inadvisable. The indexes in this first model suggest good model fits with GFI = 0·92 and CFI = 0·94. These indexes range between 0 and 1, the maximum fit being 1 and values below 0·90 considered as a bad model fit. The RMSE = 0·09 and RMR = 0·08, the range being 0 and 1, with 0 indicating a perfect fit and values higher than 0·08 considered as a bad model fit.

The results of the measurement model for the exogenous variables are shown in Table 1. Here it can be seen that the two indicators of household density have a high factorial loading. The highest loading in community density pertains to the number of residents in the community area. The number of residents in a neighborhood is the worst indicator of household density. The multiple correlations for each indicator can be interpreted as reliability indexes. The values for all the variables are very good except for the second indicator of community density. The correlation between both density variables is nearly zero, r = 0·03.

Table 2 shows the results for the endogenous variables i.e., social support and psychological distress. The two first indicators for social support are good, especially satisfaction with support received. Emotional support is the worst of all, also having a very low reliability index. Only three indicators for psychological distress are below the factorial loading 0·50, and only two of them are below the reliability index 0·20. This means a very good level of fit for this variable.

Before showing the results for the structural model, as a statistical control, we show correlations

TABLE 2
Standardized coefficients (λ) for measurement model of the endogenous latent variables Social Support and Psychological Distress

Indicator	Social Support	Psych. Distress	R^2
SS1 Satisfaction	0·88		0·77
SS2 Frequency	0·41		0·17
SS3 Emotional support	0·17		0·03
PD1 How have you been feeling in general?		0·61	0·37
PD2 Have you been bothered by nervousness or your 'nerves'?		−0·64	0·41
PD3 Have you been in firm control of your behavior, thoughts, emotions or feelings?		0·50	0·25
PD4 Have you felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile?		−0·68	0·46
PD5 Have you been under or felt you were under any strain, stress or pressure?		−0·56	0·32
PD6 How happy, satisfied, or pleased have you been with your personal life?		0·58	0·34
PD7 Have you had reason to wonder if you were losing your mind, or losing control over the way you act, talk, think, feel, or of your memory?		0·54	0·29
PD8 Have you been anxious, worried, or upset?		−0·66	0·44
PD9 Have you been waking up fresh and rested?		0·45	0·21
PD10 Have you been bothered by any illness, bodily disorder, pains, or fears about your health?		−0·38	0·14
PD11 Has your daily life been full of things that were interesting to you?		0·24	0·06
PD12 Have you felt down-hearted and blue?		−0·82	0·67
PD13 Have you been feeling emotionally stable and sure of yourself?		0·55	0·30
PD14 Have you felt tired, worn out, used up, or exhausted?		−0·66	0·43
PD15 How relaxed or tense have you been?		0·69	0·47
PD16 How much energy, pep, vitality have you felt?		−0·55	0·30
PD17 How depressed or cheerful have you been?		−0·67	0·45

TABLE 3
Summary of Structural Model Equations for additive, multiplicative and mediated effects of Community (CD) and Household Density (HD on Psychological Distress (PD), mediated by Social Support (SS)

Equations	R^2	ΔR	$F(\Delta R^2)$	*df*	b_1	b_2	b_3	β_1	β_2	β_3
PD = CD+HD	0·06	—	—	—	0·17	0·06	—	0·23	0·09	—
PD = CD+HD+CD*HD	0·14	0·016	3·05	1,187	0·17	0·06	0·23	0·23	0·09	0·27
PD = CD+HD+CD*HD+SS	0·20	0·020	3·95	1,186	0·14	0·08	0·18	0·18	0·11	0·22
SS = CD+HD+CD*HD					−0·17	0·08	−0·17	−0·16	0·08	−0·14

of the Socioeconomic Level construct with all the variables involved in this model. This construct has nine variables as indicators which measure: the professional/educational and occupational level; level of income and expenditure; place and type of residence; and socioeconomic level as selected by the interviewee themselves as well as by the interviewer. The correlation of the Socioeconomic Index with Household density is $r = -0{\cdot}20$; with Community Density, $r = -0{\cdot}59$; and with Psychological Distress, $r = -0{\cdot}05$. As was expected an increase in socioeconomic level is strongly linked to people living in a less densely populated community. It also covaries with houses with more available space, although less strongly. But it has no relationship with psychological distress, and so cannot be its cause.

Interaction Analysis. The procedure for the analysis of the interaction between community density and household density is that recommended by Jaccard, Turrisi, & Wan (1990). Following these authors, the presence of interaction is determined by eta-squared-like statistics, calculated with the *Hierarchical Multiple Regression* program.

Table 3 shows the results of multiple regressions from the S.E.M. perspective. The first equation

includes the additive effects of community and household densities on psychological distress. The explained variance is 6 per cent. The second equation incorporates the interaction term and explains 14 per cent of the variance of psychological distress.

This increase is significant at a 90 per cent confidence level, with $F(1,187) = 3{\cdot}05$ $p < 0{\cdot}10$. The coefficient of the latent product term is $b_3 = 0{\cdot}23$. Although the effect of the interaction is not great, it would be interesting to understand it further. In order to do so, we examine coefficient b_3 in the three terms of the equation. Once again we follow Jaccard, Turrisi and Wan's procedures, and use their program *Interaction Analysis with One-Product Term.* This program calculates the slope for the linear regression of Y (Psychological Distress) onto X_1 (Community Density) at any given value of X_2 (Household Density). Table 4 shows the results of this analysis which calculates the slope for the linear regression of Y (Psychological Distress) onto X_2 (Household Density) at any given value of X_1 (Community Density), and vice versa. The tables show only standardised coefficients (β) for easier interpretation.

When household density is low (one standard deviation below average) the increase in community density has practically no effect on psychological distress ($\beta_1 = -0{\cdot}04$). Although the effect is almost null it is interesting to note that it has a negative sign, which could mean that psychological distress would decrease as community density increases as long as household density is low. The effect of community density on psychological distress increases considerably ($\beta_1 = 0{\cdot}50$) when household density is high (a standard deviation above average). The presence of high community and household density together would have a certain intensifying effect. When household density is average, the effect on psychological distress of community density is moderate ($\beta_1 = 0{\cdot}23$).

TABLE 4

Slope for the linear regression of Psychological Distress (PD) and Social Support (SS) on Community Density, β_1, at any level of Household Density and slope for the linear regression of Psychological Distress (PD) and Social Support (SS) on Household Density, β_2, at any level of Community Density

Density Level	PD		SS	
	β_1	β_2	β_1	β_2
Low	−0·04	−0·18	−0·02	0·22
Average	0·23	0·09	−0·16	0·08
High	0·50	0·36	−0·30	−0·06

The two following columns in Table 4 show household density coefficients under the three reference conditions for community density. When this is low, the increase in household density slightly decreases psychological distress ($\beta_2 = -0{\cdot}18$), but increases, though very slightly, ($\beta_2 = 0{\cdot}09$) when community density is average, and considerably increases ($\beta_2 = 0{\cdot}36$) when community density is high.

So, it can be observed that as both kinds of density increase psychological distress is higher; which could be understood as an intensifying effect since these coefficients are higher than those obtained for the main effects of community density and household density.

Mediator Analysis. In order to test whether the interactive effects of community density and household density on psychological distress is mediated by social support, we will also use structural equation models, as an alternative to the procedures suggested by Finney *et al.* (1984), Baron and Kenny (1986), and Evans and Lepore (1997). As in the analysis of moderating variables, its capacity to analyse the mean error makes SEM. a very powerful tool to test the mediating effect between the different variables.

In the last line of Table 3 we present the results of the model of interactive effects, to which are added social support as a mediating variable of the interactive effects of community and household density on psychological distress. The addition of this new variable produces an increase in the explained variance of psychological distress, $F(1,186) = 3{\cdot}95$ $p < 0{\cdot}05$. This is also indicated by the actual coefficient of the influence of social support on psychological distress whose value is $b_4 = -0{\cdot}19$ ($\beta = -0{\cdot}28$), that is, the known result that social support reduces psychological distress. It is also coherent with a more dynamic conception of social support, which is not only a resource that buffers stressor effects (the two densities studied in this paper), but is influenced by the latter, which then will have consequences on the stress experienced by the individual, depending on his or her vulnerability level. Thus, the interaction between community and household densities has a certain influence on social support ($b_3 = -0{\cdot}17$).

Table 4 shows the effects of such interaction. Generally, community density reduces social support, but it does so more strongly when household density is higher ($\beta_1 = -0{\cdot}30$). On the other hand, household density slightly increases social support, but only when community density is low ($\beta_2 = 0{\cdot}22$).

TABLE 5
Standardized coefficients (λ) for measurement model of the exogenous latent variables Community Density and Household Density

Indicator	Community Density	Household Density	R^2
CD1 Number of residents in community area	0·51		0·26
CD2 Number of residents in neighborhood	0·28		0·08
HD1 Ratio of people by m^2 in house		0·98	0·96
HD2 Ratio of people by number of rooms		0·83	0·69

From the dynamic perspective of social support we have to test its attenuating effect on the influence of both types of densities on psychological distress. By examining Table 3 we can see a small reduction in the coefficients which indicates their direct influence, when compared to the previous equation. This reduction, although small is an indication of the efficacy of social support. The indirect effect of community density on psychological distress is $b_1 = 0{\cdot}03$, for household density $b_2 = -0{\cdot}01$, and for their interaction $b_3 = 0{\cdot}03$. These values are too small to give social support any important role in the reduction of stress caused by the interactive effect of both types of density.

Discussion

This first study brings to light the need to include the interactive effects of different environmental stressors in research about environmental stress. When using a simple additive approach, only community density is revealed as having a strong effect on psychological stress, while household density seems to have very little effect.

However, when an interactive model for both densities was employed each one behaved differently depending on the level of the other. Thus, high community density only has strong negative effects on psychological stress when household density is also high. The effect of high density outside can be reduced by having enough space within the home (Zlunick & Altman, 1972). We also observed that an increase in household density produces a slight decrease in psychological stress as long as the density in the community is low. This could be due to the fact that the higher the household density the more people there are available to give social support, which has a positive influence on people's wellbeing. This study supports this view. The strong increase in the value of the coefficients when the density levels were high is a clear indicator of the intensifying effect of the presence of both environmental stressors.

Only some parts of the mediating hypothesis were supported. Social support is not a static resource regardless of the actual stressor studied, but on the contrary is influenced by them. As we mentioned earlier the two densities have some impact on this social resource: it is negative in the case of community density, and particularly so when household density is high. However, household density increases social support especially when community density favors this. Equally, as has been proved innumerable times, social support has a reducing effect on psychological distress although its moderating effect on distress has not been clearly demonstrated. The decrease in the value of the regression coefficient when social support was included as a mediating variable was very small. Neither have the indirect effects of the interaction between both densities been strong, and in any case are always less than the direct effects. Therefore, social support has a certain mediating capacity, but it is too small to strongly confirm the dynamic hypothesis proposed by Lepore *et al.* (1991).

Study 2

This second study partially replicates the previous one. Here, we analyse the influence of household interaction and community crowding on another dimension important to urban life: residential satisfaction. This time the influence is mediated by community support. This new variable reflects better than social support the idea of social resources offered by the community in which people live. The theoretical context of this second study is the same as in the first; the research method followed and the analytical procedures used are also identical.

Method

Participants and Procedure. The people in this sample were selected by following the same procedure

as in the previous study. 260 people were interviewed from the 500 houses chosen, comprising 123 males and 137 females, with ages ranging from 16 to 89. The average age was 43·5 years. The interviews and the data analysed were also carried out following the previous procedure.

Structural Model. Figure 3 shows the model used to analyse the interactive effect between community density and household density on residential satisfaction, in this case mediated by a variant of social support, i.e., community support. This model parallels the one proposed in the first study and uses the same analytical strategy.

Measurement Model

Density. Measurements of these two constructs were the same as in the first study. The descriptive statistics of the first indicator (CD1) are M = 12740·61, S.D. = 8071·77, minimum = 532 and maximum = 32288. The second one refers to the density of the neighborhood community (CD2), M = 80·02, S.D. = 68·32, minimum = 0 and maximum = 432. The number of people living there, M = 2·88, S.D. = 1·34, minimum = 1 and maximum = 8; the area of the house itself measured in square meters, M = 99·73, S.D. = 47·73, minimum = 30 and maximum = 401; and the number of rooms in the house (M = 8·90, S.D. = 3·08, minimum = 3 and maximum = 28).

Community Support. In order to evaluate the structural aspect of community support nine items were used (CS1 to CS9) which included the dimension of social support in the neighborhood context. These items were based on the *Community Support Questionnaire* (Gracia & Musitu, 1990), and are indicators of the level of social integration and the sense the individual has of belonging to the community. As a set they form a global indicator for community support.

Residential Satisfaction. In order to analyse social satisfaction 20 items (RS1 to RS20) were designed following the questionnaire developed by Guardia, Valera and Pol (1991). These items analyse the satisfaction levels of the people interviewed regarding different aspects of their home.

Results

Only one interview was discarded in this study because it was not completely filled in. The analysis was carried out on 259 cases. As in the first study we present the measures of goodness of fit for the structural model shown in Figure 3. The indexes of these models also suggest good model fits: GFI = 0·90, CFI = 0·92, RMSE = 0·12, and RMR = 0·09.

Table 6 shows the results for the measurement model for exogenous variables. Factorial loading and reliability coefficients for Community Density are very acceptable. The coefficient for variable CD1 is rather lower than in the first study and the case is very similar for CD2, although its coefficient is slightly higher. Coefficients for Household Density are slightly higher than in the first study. Correlation between both densities, in spite of being low, is considerably higher than earlier, r = 0·23. Therefore, these parameters reflect a good fit for this measurement model.

The results are also very satisfactory for the measurement model for endogenous variables (Table 7). Most items of the community support construct, except for two, have a coefficient above 0·50 and very strong reliability (R^2). The same applies to residential satisfaction, where only two items have coefficients below 0·40.

Also, as in the previous model and as a statistical control, we present correlations between the Socio-economic Index and model variables, i.e., Household Density, r = −0·33; Community Density, r = −0·55; and Residential Satisfaction, r = 0·07. These values are obviously very similar to those in the first study, the most relevant fact being the rather low correlation between Socio-economic Index and residential satisfaction.

Interaction Analysis. The procedure was identical to the previous study and the results can be seen in Table 7. The first equation includes the additive affects of community density and household density on residential satisfaction. The explained variance is 5 per cent. The second equation includes the interaction term and explains 17 per cent of residential satisfaction variance. This increase is significant, $F(1,255)$ = 6·93 $p <$ 0·01. The actual coefficient for the latent product term is also significant having a value of b_3 = −0·50.

Once again in order to analyse the nature of the interaction, coefficient b_3 is examined in the three equation terms (Table 8). It can be seen that only at high levels of community density and household density are there strong falls in residential satisfaction: β_1 = −0·38 and β_2 = −0·56, respectively. This could be understood as an intensification of the negative effects of the two stressors, since both coefficients are higher than those produced by the main effects of community density and household density.

TABLE 6
Standardized coefficients (λ) for measurement model of the endogenous latent variables Community Support and Residential Satisfaction

Indicator	Community Support	Residential Satisfation	R^2
CS1 It is difficult to make friends and get to know people in this neighborhood	0·38		0·14
CS2 I have lots of opportunities to do plenty of things in this neighborhood	−0·74		0·54
CS3 I feel that I can contribute to the politics of my neighborhood	−0·58		0·33
CS4 If I need help, this neighborhood has some excellent services available to meet my needs	−0·49		0·24
CS5 When I travel I feel proud to speak to other people about where I live	−0·80		0·63
CS6 I feel that I belong to this neighborhood	−0·78		0·60
CS7 I like to participate in organizing local activities	−0·70		0·48
CS8 One of the best things about living in this neighborhood is my friendship with the local people	−0·54		0·29
CS9 When I feel alone there are people in the neighborhood who I can call and speak to	−0·75		0·56
RS1 House size		0·73	0·53
RS2 Room distribution		0·76	0·58
RS3 Dining room		0·78	0·60
RS4 Kitchen		0·69	0·47
RS5 Bathroom		0·68	0·46
RS6 Furniture		0·69	0·48
RS7 Comfort		0·81	0·66
RS8 Ventilation		0·64	0·40
RS9 Insulation		0·52	0·27
RS10 Quantity of natural light		0·56	0·31
RS11 Electric lights		0·55	0·30
RS12 Quality of water		0·44	0·19
RS13 House security		0·54	0·29
RS14 Cost of house		0·39	0·15
RS15 Street noise		0·38	0·15
RS16 Noise from neighbors		0·57	0·33
RS17 Individual privacy		0·73	0·54
RS18 Family privacy		0·68	0·47
RS19 Relationships with neighbors		0·58	0·33
RS20 Good use of house space		0·66	0·44

TABLE 7
Summary of structural model equations for additive, multiplicative and mediated effects of Community (CD) and Household Density (HD) on Residential Satisfaction (RS), mediated by Community Support (CS)

Equations	R^2	ΔR	$F(\Delta R^2)$	*df*	b_1	b_2	b_3	β_1	β_2	β_3
RS = CD+HD	0·05				−0·03	−0·16	—	−0·02	−0·22	—
RS = CD+HD+CD*HD	0·17	0·02	6·93	1,255	−0·06	−0·16	−0·50	−0·04	−0·22	−0·34
RS = CD+HD+CD*HD+CS	0·37	0·10	31·78	1,254	−0·06	−0·19	−0·56	−0·04	−0·26	−0·39
CS = CD+HD+CD*HD	0·02				0·00	0·03	0·09	0·00	0·09	0·12

Mediator Analysis. The procedures were identical to the first study. The last line of Table 8 shows the results for the interactive effect model, when community support is added as a mediating variable of the interactive effects of community density and household density on residential satisfaction. Including this new variable produces a great increase in the explained variance for residential satisfaction, $F(1,254) = 31{\cdot}78$ $p < 0{\cdot}01$. Community and household density interaction has little influence (b_3 = 0·09) on community support. Neither are the other two *b* coefficients high, so the strong increase in variance has to be attributed to the direct influence of community support on residential

TABLE 8
Slope for the linear regression of Residential Satisfaction (RS) and Community Support (CS) on Community Density, β_1, at any level of Household Density and slope for the linear regression of Residential Satisfaction (RS) and Community Support (CS) on Household Density, β_2, at any level of Community Density

Density Level	RS		CS	
	β_1	β_2	β_1	β_2
Low	0·30	0·12	−0·11	−0·02
Average	−0·04	−0·22	0·00	0·09
High	−0·38	−0·56	0·12	0·21

satisfaction, $b_4 = 0{\cdot}89$ ($\beta_4 = 0{\cdot}46$). Once again these findings are similar to those found earlier.

Table 8 clearly shows the effects of interaction on community support. In contrast to the findings in the first study, high levels of community and residential density mean a moderate increase in community support, $\beta_1 = 0{\cdot}12$ and $\beta_2 = 0{\cdot}21$. The attenuating effect of community support on the influence of these two densities on residential satisfaction is very small. The indirect effect of community density on satisfaction is close to zero, $b_1 < 0{\cdot}01$, of household density $b_2 = 0{\cdot}03$, and of the interaction between both, $b_3 = 0{\cdot}08$. These values are too small to be able to attribute an important role to community support on the fall in residential satisfaction caused by the interactive effect of the two types of densities.

Discussion

Most of the findings in this second study confirm those found in the first one. Nevertheless, as in the first study, the limitations of this type of cross-sectional study must be acknowledged. It is also important to bear in mind that the relationships found in no way entail strict causality.

The effects of the interaction between both densities are very strong and so we could state that such an interaction intensifies the negative effects of both stressors on residential satisfaction, although in this study the negative effect of household density is more pronounced than that of community density. As in the first study community density effects are cancelled out by an optimal density within the household and in fact a slight rise in household density could have a positive effect on satisfaction as long as neighborhood density is low. Once again these findings confirm the idea defended in this paper of the need to carry out an analysis of the interactive effects of environmental stressors which are not explicit in those studies following a simple additive analysis.

Regarding the mediating role of community support, the differences with the first study are more marked. Community support has a powerful impact on the increase in residential satisfaction, although the effect of the interaction of the two densities causes a moderate increase in community support. This is the opposite to the findings in the first study. The emphasis placed in this scale on the macrosocial dimensions of community support and its reference to integration and belonging to the community, could have the effect of increasing the perception of support when density in the community is higher. It could be said that the results are due to some kind of methodological artifact.

The mediating capacity of support is slightly higher than before. One can see that the interaction between community and household densities increases residential satisfaction if community support also rises. This effect was not observed in the first study. In any case, the mediating role of community support is also very slight.

Conclusions

The results in both studies fit very well with the theoretical model depicted in Figure 1; especially in the areas dedicated to the analysis of the interaction between community and household density. Endogenous variables, i.e., psychological distress and residential satisfaction follow the same pattern of interactive influence for both types of density. These two variables belong to the same set of indicators such as perceived life quality, subjective wellbeing, and health, so it can be concluded that exposure to multiple environmental stressors has a very negative effect on people lives, at least given the combination of stress sources studied in here. This first conclusion supports the results found in previous studies described earlier. Human response to a

stressor can be moderated by another stressor or the same one in a different context (Cohen *et al.*, 1986), as in the present research.

Had both studies followed the traditional strategy of analysing only the additive effects of both types of density, then the only finding would have referred to the fact that community density has a slight effect on psychological distress, and that household density has a mild influence on satisfaction with the home. However, the approach followed has revealed the nature of the interaction between both variables showing a pronounced intensification of the negative effects of population density.

The mediating effect of social and community support is less clear. The strategy used has helped us understand to what extent the support variable can be conceived of as a mediator of the environmental stressor-psychological distress/residential satisfaction relationship. It would be incorrect to interpret the attenuating effect as evidence of the efficacy of support, in the sense of being a buffering effect (Marshall, 1979). Although attenuation indexes have not been very definitive, they certainly support the findings of Lepore *et al.* (1991) regarding the fact that exposure to one environmental stressor (or two in this case) interferes with the buffering effect of social support, since it also has a positive or negative influence on such a social resource.

Both studies also demonstrate an interactive effect on social support, although with the opposite sign, which can be interpreted as an intensifying influence of both types of density: the effects diminish it in the first study and increase it in second one. It is likely that population density elicits the reactions of either seeking or avoiding social contact, that is, coping strategies that make people more or less vulnerable, and so more or less prone to stress or a drop in satisfaction.

The slight attenuating effect found and the powerful influence of social support in diminishing psychological distress and increasing residential satisfaction, could also indicate a buffering of stress/satisfaction rather than an increase of coping due to social support. This could mean that the latter has a double function: (1) as a relatively static moderating variable having the role of a personal, social and environmental condition that makes the individual more or less vulnerable to the effect of stress; (2) also as a mediating variable with a more dynamic connotation, modified by the stressors, also making the individual more or less vulnerable.

So, it does not seem to be the case that living with one environmental stressor makes a person more able to cope with another one; not even when both stressors belong to the same category as in the case of this study. In fact it seems to be the case that chronic stress erodes the adaptive capacity of the individual who experiences geometrically expanding difficulties with each new stressor he/she has to cope with. Although this work and other research points in this direction it would be necessary to understand the interactive effects of three or more stressors in order to determine the influence of each new stressor on the intensifying effect.

It is also necessary to increase the range of possible combinations of environmental stressors and, as much as possible, do this in a longitudinal way which would allow us to understand their concomitant effects. This would also make the analytical procedures much more complex, since it would be necessary to combine moderating and mediating effects in a methodological context of including the measurement errors and where non-linear effects were also present. In short, this would mean making use of dynamic procedures, not necessarily linear, that would fit the ecological covariance of the different environmental stressors.

Notes

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(1) The items are available from the authors.

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