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THE CONTEXT OF ARSON INCIDENCE: NEIGHBORHOOD AND ENVIRONMENTAL FACTORS*

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ABSTRACT

Research demonstrates that indices of social disorganization and physical structure are associated with crime. Since the indices of these variables "interact" to form areas with different social and physical characteristics, arson rates should vary from one environmental cluster to another. This research addresses the importance of the neighborhood effect in light of the individual effects of urban structure by addressing three basic questions: (1) Does neighborhood-type membership contribute to the prediction or arson? (2) Do factors that explain arson rate for the city as a whole have the same slopes across neighborhood types, or are there significant interactions associated with these factors, and how good is the additive model? (3) Are different preventive strategies necessary for different neighborhood types or can a single city-wide strategy be used regardless of the particular social and demographic character of neighborhoods? These questions are addressed by using 2,476 arsons committed in the city of Houston during 1978-1979. The research uses a combination of BCTRY cluster analysis, analysis of variance, and regression analysis.

Arson engulfs thousands of urban businesses and residences each year, laying waste to the economic and social framework of the inner city. In 1980, 770 civilian deaths occurred as a result of incendiary or suspicious fires, representing an 8.4 percent increase from 1979. The 146,000 incendiary or suspicious fires in structures in 1980 caused property loss of $1.76 billion, a 32.5 percent increase over 1970 [1].

The general public tends to associate arson with urban areas, and particularly with older sections, which are prime targets for economically motivated arsons. Although arson is often referred to as a "white-collar" offense and is equated

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with arson for profit, it is committed for a wide range of reasons – crime concealment, revenge, protest, valdalism, compulsive fire setting behavior, and the desire to gain recognition – and its spatial arrangements in urban areas reflect a diversity of targets. In New York, for example, vacant buildings are torched and the fire-resistant fixtures such as pipes, tubs, and basins are removed and sold to building contractors, a practice that is referred to as "mango hunting." Landlords burn property in order to collect fire insurance, or to circumvent rent control laws, or to secure money from city or state agencies for activities that would increase the value of their land. Incendiary fires and the negative spatial externalities associated with them may encourage the restrictive practice of "redlining" and thereby accelerate the further decline of urban neighborhoods.

In general, environmental criminologists and other scholars have attempted to understand the impact of urban structure on the incidence and spatial distribution of crime. These investigators have associated census-block or tract characteristics with crime incidence and have shown that crime is related to particular social, demographic, and housing characteristics of the city. These approaches tell us that the factors that condition arson in New York are the same as, or slightly different from, the factors that condition arson in New Jersey. Consequently, very little attention has been given to the overall policy implications of their approach.

Alternatively, one may aggregate tracts along the shared social, demographic, and housing characteristics of urban areas, and assert that resulting clusters are significantly different in terms of their environmental structures and may need different prevention strategies. As such, an explanation of the risk of arson incidence should include neighborhood effects as well as the effects associated with arson rates at the city-wide level. In general, the research presented here assesses the distribution of deliberately set fires[1] in the City of Houston, and determines if there is a neighborhood effect that is above and beyond the individual effects of environmental structure. More specifically, does the combination of neighborhood type and the individual effects of environmental structure contribute to our ability to predict the occurrence of arson, and are different prevention strategies required for different neighborhood types?

URBAN STRUCTURE AND ARSON VICTIMIZATION

The few studies that directly address the arson problem suggest that the explanation for arson incidence is similar to the explanation for other index offenses; that is, arson appears to be related to economic factors [2-5]. Crime rates as a function of economic deprivation have been summarized under a

[1] The usual distinction between incendiary and other types of fires is based on whether the fire was started with malicious intent. The term "arson," which in common law is restricted to the crime of burning someone else's building, is now used interchangeably with "incendiary" (International City Manager's Association, p. 272).

number of rubrics, and all find a positive relationship between economic deprivation and crime incidence. Johnstone [6] and Braithwaite [7] show that areal economic status has an impact on criminal behavior above and beyond individual economic status. The use of SES levels of neighborhoods and delinquency rates in neighborhoods as contextual variables influences the relation between SES and delinquency [8], and Sampson and Castellano state that "studies focusing on whether communities . . . with greater inequality and/or lower economic status produce relatively greater levels of crime are quite applicable to an assessment of sociological theories with emphasis in equality as a criminogenic condition" [9, p. 364].

Because of the use of official statistics (i.e., police and court reports), the validity of ecological correlates has been questioned. If police officials target certain areas (e.g., low-status) as places for proactive patrols, then the police will uncover more crime in these areas [10]. Nonetheless, certainly the disadvantaged are not insulated from conditions that actuate crime. Quinney states that "the victims of all major conventional crimes are disproportionately in the lower-income levels" [11, p. 129]. The lower class, and blacks in particular, are major victims of conventional crimes. Therefore, crime incidence is not a randomly distributed phenomenon, but conforms to the collective models of urban growth and decline. As for other crimes, there are a substantial number of targets and motives for arson in low-status areas.

Sociologists and urban geographers have sought to describe and to explain the location of various population groups and to characterize land-use patterns in the urban complex. The seminal work of Chicago school ecologists suggests that the city grew by a series of concentric zones and that each zone was characterized by a distinctive land use [12]. Hoyt, on the other hand, explains the formation and decline of neighborhoods as being partially the result of economic cycles [13]. He argues that prosperity led to population growth, and that growth from in-migration influenced housing by stimulating demand, which stimulated construction. He claims that as more new housing is constructed, the faster the existing housing becomes obsolete, since the existing housing is not able to compete with newer housing. The results, according to Hoyt, are lower property values, a lower class of occupants, and physical deterioration. Harris and Ullman address some of the deficiencies of the concentric and sectoral models by proposing the multiple-nuclei model [14]. They suggest that cities developed several centers surrounded by districts that specialized in particular activities, and they view spatial structure as a distinctive phenomenon that varies from city to city. Berry suggests that these spatial models are not alternative descriptions but give a more precise picture of urban spaces (e.g., socioeconomic characteristics are distributed sectorally while life-cycle characteristics are best described by the concentric zone pattern) [15].

The Shevky-Bell thesis proposes that people are ultimately differentiated along dimensions of social class, life cycle, and culture [16]. Factorial ecologists

demonstrate that three underlying factors – socioeconomic status, family life cycle, and ethnic composition – explain residential structure. Therefore, when the sector, concentric-zone, and ethnic characteristics (as expressed by the multiple-nuclei theory) are overlaid on the city, the neighborhood character or social spaces of urban places can be more accurately described.

The theoretical assumptions of target attractiveness, life-cycle characteristics, and race resources also vary across social spaces or neighborhood types. For predatory offenses motivated by instrumental ends, Cohen et al. assumes that the greater the attractiveness of the target, the greater the risk of victimization [17]. In light of arson risk, target attractiveness must be translated into the presence of structures that possess the negative externalities of decay, vacancy, abandonment, and inadequacy; consequently, arson rates should be related positively to measures of physical decline and decay.

Although arson is not generally considered a predatory offense, it can be reasoned that greater contact with one's property should reduce arson incidence. Cohen et al. also state that a person's routine contact with his/her property serves to deter predatory offenders [17]. Hindelang et al. suggest that income, race, and age relate to lifestyle differences that affect the strength of guardianship, and it may be reasoned that indices of lifestyle and family type should be associated with arson risk [18].

Ecologists have also attributed high crime rates to minority status and to the offender's residence in so-called natural areas created by residential segregation [19]. UCR and other official sources point to the disproportionate number of blacks arrested and that this disproportionate arrest rate is higher for crimes of violence than for property crimes. Using victim survey data, Hindelang finds that blacks are overrepresented in the common-law personal crimes of robbery, assault, and rape [18]. It is assumed that race and its attendant characteristics are also related to arson.

The expressive ends of arson are also present in urban areas. Hanawalt has documented the long history of burning business places and dwellings to punish their owners or inhabitants [20]. The likelihood that a target will be torched may be conditioned in part by the presence of persons likely to resort to self-help methods [21] under stress. In light of self-help and stress factors, the demographic and structural characteristics of the offender's place of residence clarifies the association of minority status and age with the commission of retaliatory arson. It appears that residents of low-status neighborhoods are more likely than non-residents to commit retaliatory offenses; these low-status locations appear to be "staging" areas for retaliation [22].

It would appear that high arson-victimization rates should be associated with areas where the indices of social disorganization are high and where environmental attractiveness, as indexed by physical structure, is also high. Since these indices "interact" to form areas with different social and physical characteristics, arson rates should vary considerably from one environmental

cluster to another. Therefore, a neighborhood effect should be apparent. But how important is this neighborhood effect in light of the individual effects of urban structure? In this regard, three basic research questions are addressed:

1. Does neighborhood-type membership, in combination with individual dimension of environmental structure (derived factors that are significant in the prediction of the arson rate for the city as a whole), contribute to the prediction of arson?
2. Do factors that explain arson rate for the city as a whole have the same slope across neighborhood types, or are there significant interactions associated with these factors, and how good is the additive model presented?
3. As such, are different preventive strategies necessary for different neighborhood types or can a single city-wide strategy be used regardless of the particular social and demographic character of neighborhoods?

STUDY DESIGN

Data

During 1978-1979, 3,277 fires were investigated by the Arson Investigation Unit of the Houston Fire Department. Incendiary or deliberately set fires constituted the largest percentage (75.6%) of the fires investigated while accidental fires and fires that were not incendiary in origin constituted smaller percentages (16.6% and 8.3%, respectively). Only incendiary fires are used here, and represent 2,476 fire locations. The locations of these offenses were matched to their respective census tracts by using the U. S. Census GBF/Dime File for the City of Houston and were aggregated by census tracts. An arson rate was calculated for each tract by using a transformation that would normalize a rate structure that was distributed binomially. Rates were transformed by utilizing the equations:

$$P_i = \frac{A + .5}{n} \tag{1}$$

$$T = \text{Log}_e \frac{P_i}{1 - P_i} \tag{2}$$

where T is the transformed arson rate, P_i, is the proportion of arsons (A) plus a constant of .5 divided by n, the total population of tract i.

The use of population as the denominator of the equation has its problems. Some have stated that rates should be target specific [22-24]; however, arson is a crime with a diversity of motivations, and each motivation is associated with a different target. Some may argue that the number of residential structures in the area would be a better denominator than population, but such a position not

only neglects the existence of the diverse motivations associated with the offense, but also disregards the inordinate number of non-structural items that serve as targets in the commission of the offense. Common-law states that some part of a structure must be consumed or charred to constitute arson.[2] Other authorities suggest that it is not necessary that the structure be materially injured[3]; it is sufficient if the fire is actually communicated to any part of the structure.[4] Far reaching legislative developments have brought us to the point where, in some states, the burning of almost any property or structure that destroys, injures, or endangers any person's safety, rights, property, or interests is defined as arson. The existence of various kinds of targets is exemplified in Alabama's definition of a building as "any structure which may be entered and utilized by persons for business, public use, lodging or the storage of goods, and includes any vehicle, railway car, aircraft or watercraft used for the lodging of persons or for carrying on business therein" [25]. It would appear that statutes and their supporting authorities have attempted to circumvent the common-law rule that narrowly defines arson in terms of "the burning of a house" by keeping in mind the original intent of arson legislation – security of habitation, rather than the safety of the property. The question of the calculation of the rate must center on the intent, the motive, and the definitional elements associated with the crime – issues that cannot be resolved here.

In the absence of any authority on the consequences of using population as a base particularly for a group of offenses where the presence of the required definitional elements cannot be established or where the target of the offense is unknown, the non-target-specific method ("crude" crime rate) is used. One problem associated with the use of population as a base is spatial skewness: when a small proportion of the population is highly victimized, the

[2] State v. Schwartz, 166 A. 666, 35 Del. 424 (1932); State v. Piscitelli, 187 A. 733, 14 N.J.M. 775 (1936); Mary v. State, 81 A.D. 60, 24 Ark. 44 (1862); Cochrane v. State, 6 Md. 400 (1854); Crow v. State, 189 S.W. 687, 136 Tn. 333 (1916); Honey v. State, 17 S.W. 2d 50, 112 Cr. 439 (1929); Woolsey v. State, 17 S.W. 546, 30 Cr. 346 (1891); Borza v. State, 335 A. 2d 142, 25 Md. App. 391 (1975); Lynch v. State, 370 N.E. 2d 401, 163 Ind. App. 360 (1978); State v. Hanna et al., 178 S.W. 882, 131 Ark. 129 (1917); State v. Mutschler, 212 N.W. 832, 55 N.D. 12 (1927); State v. Oxendine, 286 S.E. 2d 546, 305 N.C. 126 (1982).

[3] Bennett v. State, 144 S.W. 2d 476, 201 Ark. 237 (1940); State v. Braathen, 43 N.W. 2d 202, 77 N.D. 309 (1950); Smith v. State, 5 S.W. 219, 23 Cr. 357 (1887); Hinkley v. State, 389 S.W. 2d 667 (1965).

[4] Luke v. State, 20 A.R. 269, 49 Ala. 30 (1873); People v. Hagerty, 46 Cal. 354 (1873); State v. Spiegel, 83 N.W. 722, 111 Iowa 701 (1900); Kehoe v. Commonwealth, 149 S.W. 818, 149 Ky. 400 (1912); State v. Caliendo, 4 A. 2d 837, 136 Me. 169 (1939); People v. Losinger, 50 N.W. 2d 137, 331 Mich. 490 (1951), *cert. den.*, 343 U.S. 911, 72 S. Ct. 644, 96 L. Ed. 1327 (1952); Crow v. State, 185 S.W. 687, 136 Te. 333 (1916); Jones et al., v. Commonwealth, 133 S.W. 2d 7, 271 Ky. 647 (1938); State v. Pisano, 141 At. 660, 107 Conn. 630 (1928); State v. Bazoukas et al., 286 N.W. 458 (1939); State v. Levesque, 81 A. 2d 665, 146 Me. 351 (1951); People v. Lefebre, 546 P. 2d 952, 190 Col. 307 (1976); Washington v. State, 276 So. 2d 587, 290 Ala. 344 (1973).

census-tract rate tends to be inflated. The problem of skewness was resolved in two ways:

1. non-populated tracts are areas where the population was extremely low were excluded from the analysis; and
2. the resulting skewness of using population as a base was smoothed by using the previously stated binomial transformation.

Two sets of areal statistics are used in the analyses presented here. The first set is the population and housing characteristics of the census tracts, which were taken from the 1980 Census of Population and Housing (STF3) for the City of Houston. To be sure, block data, as a unit of analysis, were preferred but at the time of the collection of these data only census-tract data were available. Consequently, the finding and interpretation presented here are limited to some extent by the utilization of tracts as a unit of analysis. In addition to data on housing and population characteristics, land-use data from Houston's Office of City Planning supplemented those variables taken from STF3 (see Table 1).

It is also recognized that the arson cases used here may not represent all arsons committed in the City of Houston, since there are substantial differences between official statistics and the number of crimes committed. To be sure, some victims may fail to report fires that were detected early and were easily extinguished; therefore, reporting may be a function of fire severity. However, it is believed that fire incidence is more likely to be reported than other crimes because of the nature of the event. In addition, accuracy of arson statistics may be directly related to the expertise of investigators who are responsible for the detection of incendiary fires. The latter difficulty does not appear to be a problem here because of the expertise of the Houston Arson Investigation team.

Method of Analysis

The research uses Tryon and Bailey's [26] Empirical Key Cluster Analyses (BC TRY) to identify the environmental structure of Houston's census tracts ($N = 353$) and to classify census tracts into homogeneous clusters. For the purpose of this research, these homogeneous clusters are referred to as neighborhood types. The conceptualization is not to imply that the residents are bound together in terms of some shared common purpose or feelings [27], that these neighborhoods are a polity composed of residents who advocate for it [28], that residents are bound by their use of local facilities or institutions [29], or that a multiple-criteria view exists [30-32]. Rather, as conceptualized here, neighborhood type embodies an areal view of neighborhoods, and the term identifies those areas that are homogeneous in terms of the housing and socioeconomic dimensions [33-34].

Neighborhood clusters are derived by submitting the dimensions uncovered in BC TRY V-analysis to the program's O-analysis. Tracts cluster into neighborhoods on the basis of the deviation of the tracts' cluster scores ($\pm$ 10)

Table 1. Variable List

Percent Population White	Percent Family Incomes $5,000 to $7,499
Percent Population Black	Percent Family Incomes $7,500 to $9,999
Percent Population American Indian, Asian and Pacific Islander	Percent Family Incomes $10,000 to $12,499
Percent Population Age 14-18	Percent Family Incomes $30,000 to $34,999
Percent of Population Age 65 and Over	Percent Family Incomes $35,000 to $39,999
Percent Population Age 25-34	Percent Family Incomes $40,000 to $49,999
Percent of Male Population Age 14-18	Percent Family Incomes $50,000 to $74,999
Percent of Male Population Age 25-34	Percent Family Income $75,000 or More
Percent of Married Couples with Own Children	Percent Vacant Units for Rent Only
Percent Female Headed Households with Own Children	Percent Vacant Units for Occasional Use Only
Percent of Single Males Over Age 15	Percent Vacant Housing Units (Other Vacancies)
Percent of Married Males Over Age 15	Percent Renter Occupied Housing Units
Percent Separate Males Over Age 15	Percent Structures with One Unit in Structure (Owner-Occupied)
Percent Divorced Males Over Age 15	Percent Structures with Two Units in Structure (Owner-Occupied)
Percent of Married Females Over Age 15	Percent Structures with Three and Four Units in Structure (Owner Occupied)
Percent of Separated Females Over Age 15	Percent Structures with Five or More Units in Structure (Owner Occupied)
Percent of Divorced Females Over Age 15	Percent Structures with One Unit in Structure (Rental)
Percent Born in a Different State	Percent Structures with Two Units in Structure (Rental)
Percent Foreign Born	Percent Structures with Three and Four Units in Structure (Rental)
Percent Resided in Same House in 1975	Percent Structures with Five or More Units in Structure (Rental)
Percent Resided in Different House in Different County	Percent Mobile Home or Trailer
Percent Spanish Origin	Percent Vacant Structure with One Unit in Structure

Percent Moved from the Northeastern Region
Percent Moved from the North Central Region
Percent Moved from the Western Region
Percent Moved from the Southern Region
Percent Resided Abroad in 1975
Percent Resided in Different SMSA in 1975
Percent Who Did Not Live in an SMSA in 1975
Percent Unemployed Over Age 16
Percent Unemployed for 1-4 Weeks
Percent Employed as Executive, Administrative, Managerial
Percent Employed as Professional Specialty Occupations
Percent Employed in Sales Occupations
Percent Employed in Private Household Occupations
Percent Employed in Service Occupations, Except Protective and Household
Percent Employed as Machine Operators, Assemblers, and Inspectors
Percent Employed in Transportation and Material Moving
Percent Employed as Handlers, Equipment Cleaners, Helpers
Percent Households iwth Interest, Dividends, or Rental Incomes
Percent Households with Social Security Incomes
Percent Family Incomes Less than $2,500
Percent Family Incomes $2,500 to $4,999

Percent Vacant Structure with Five or More Units
Percent Structures with One to Three Stories
Percent Structures with Seven to Twelve Stories
Percent Structures with Thirteen or More Stories
Percent Owner-Occupied Housing
Percent Vacant Housing
Percent Housing Built 1975-1978 (Owner-Occupied)
Percent Housing Built 1939 or Earlier (Owner-Occupied)
Percent Housing Built 1975-1978 (Rental)
Percent Housing Built 1939 or Earlier (Rental)
Percent Units with No Piped Hot Water
Percent Units Lacking Some or All Kitchen Facilities
Percent Occupied Units without Bedrooms
Percent Rental Units without Bedroom
Percent Year Round Units with Half or No Bathroom
Arson Risk Rate
Percent Land Devoted to Single Family Residential Use
Percent Land Devoted to Multi-Family Residential Use
Percent Land Devoted to Commercial and Service Use
Percent Land Devoted to Industrial Land Use
Percent Land Devoted to Educational Land Use
Percent Undeveloped Land Use
Total Population
Median Family Income

from the standardized mean score of 50 for any dimension. A neighborhood type is composed of census tracts that are similar in terms of their cluster scores on each of the derived dimensions. That is, census tracts with cluster scores below 40 are considered *Low*; 40-45, Low; 46-54, Moderate; 55-60, High, and 60 and over, *High.* Therefore, a neighborhood with a typology of *Low* and *High* would represent a neighborhood that was extremely low on the first dimension and extremely high on the second dimension.

The clustering of census tracts into neighborhoods via BC TRY *O-analysis* provides one unit of analysis, and the difference in arson rates between neighborhoods is accomplished by analysis of variance (ANOVA). The ANOVA procedure essentially reveals the neighborhood effect, and its statistics tell us the impact that neighborhood membership would have on arson rate if a regression is performed. In order to uncover the effect of environmental structure on arson rate for the City of Houston, a stepwise regression procedure builds a model to explain and to predict the nature of the distribution of arson rates at the city-wide level by using the environmental dimensions derived from the BC TRY *V-analysis* as independent variables. The saturated city-wide regression model, consisting of each tract's factor score on each factor of environmental structure, is assessed, and insignificant coefficients ($p > .05$) of environmental structure are deleted from the model.

The final model combines the neighborhood effect and the effects of city-wide environmental structure. The basic question addressed is: Does neighborhood-type membership, in combination with factors that have been shown to be significant predictors at the city-wide level, contribute to the prediction of arson rates? That is, does the saturated model have any predictive power? Moreover, such a question assesses whether the type of neighborhood affects the rate of arson above and beyond the individual effects of environmental structure. The saturated model includes:

1. dimensions of environmental structure that have been found to be significantly related to the arson rate at the city-wide level;
2. a set of dummy variables for each neighborhood type to assess the risk of arson in each neighborhood type; and
3. cross-product terms composed of neighborhood-type membership and the significant environmental dimension of urban structure.

These cross-product terms allow an assessment of the effect of the significant environmental predictors of (X_j) found at the city-wide level within neighborhood types (X_i).

In order to derive a more parsimonious model, insignificant terms are deleted from the saturated model by the decomposition of the explained sum of squares into components attributed to each independent variable in the model. The test of significance is performed by using the variance-ratio test for the difference between two multiple correlation coefficients, when one R is based on the

control variate (p_1) and the other R is based on the control variate (p_1) and the predictor variate (p_2) together. The F ratio indicates whether there is a significant decrease in the R value – that is, whether significant information was removed. This process continues until only significant terms remain in the model.

As constructed, the regression model determines whether different constant and regression coefficients are necessary for each neighborhood type. In order to simplify the model even further, coefficients and constant terms are pooled. The effect of the pooling procedure on the value of R^2 is assessed by using the test of significance outlined above.

A test of how well the final model predicts is achieved by calculating adjusted arson rates by equating neighborhoods to their mean city rate and comparing the adjusted rate to their transformed arson rate. If the model predicts perfectly, there is no difference between the transformed arson rate and the adjusted arson rate. Any differences in these rates reflect unexplained variability.

RESULTS

Towards a Neighborhood Typology

Environmental dimensions (variable cluster analysis) – Variable cluster analysis reduced a correlation matrix of ninety census-tract variables (Table 1) for Houston's 353 census tracts. The analysis uncovered eight dimensions of urban structure that accounted for 88 percent of variance in the original 96 X 353 correlation matrix. The eight dimensions are:

1. multi-family residential land use;
2. family type and race;
3. commercial and service land use;
4. old housing stock;
5. structures with inadequate facilities;
6. economic status;
7. occupied/vacant housing; and
8. rental property (see Table 2).

The first dimension, multi-family residential land use,[5] consists of several high positive loading variables – percentage of occupied structures with five or more units, percentage of population between twenty-five and thirty-four years of age, and the percentage of the census tract devoted to multi-family residential land use – and is the most important dimension of urban structure. The percentage of one-unit detached housing units, and the percentage of persons aged five and over who did not move during the five years prior to the census are variables that loaded negatively on this dimension.

[5] The Houston Planning Commission defines multi-family residential as "any structure" containing three or more dwelling units including dormitory or fraternity houses as well as rooming houses and other places of residence intended for occupancy on the basis of thirty days or more; mobile homes in residential use in a mobile home park or court. Trailers in use as construction offices, or trailers merely stored on lots for sale and service are not included."

Table 2. Dimension Structure (V-Analysis)

Dimension Structure	*Reliability Coefficients of Cluster Scores on Full Set of Defining Variables*	*Oblique Factor Coefficient*
DIMENSION 1 –		
Multi-Family Housing	.9684	
Percent Structures with Five or More Units (Owner-Occupied)		.9466
Percent Structures with One Unit in Structures (Owner-Occupied)		-.9308
Percent Structures with Five or More Units (Rental)		.9177
Percent of Male Population Age 25-34		.8517
Percent Total Population Age 25-34		.8372
Percent Resided in Same House in 1975		-.8357
Percent Multi-Family Land Use		.7660
DIMENSION 2 –		
Family Type	.9677	
Percent Female-Head Households with children		.9066
Percent Married Couples with Own Children		-.8963
Percent Black Population		.8682
Percent White Population		-.8671
Percent Employed in Service Occupations		.8463
Percent Separated Females		.8230
Percent Employed in Private Households		.8151

Table 2. (Cont'd.)

Dimension Structure	*Reliability Coefficients of Cluster Scores on Full Set of Defining Variables*	*Oblique Factor Coefficient*
Percent Family Income Less Than $2,500		.8151
Percent Employed in Household Occupations		.7411
Percent Married Females		-.7054
DIMENSION 3 –		
Commercial-Service Land Use	.8912	
Percent Structures with 1-3 Stories		-.9643
Percent Structures with 13 or More Stories		.8515
Percent Occupied Units without Bedrooms		.7070
Percent Land Devoted to Commercial-Service Land Use		.6345
Percent Structures with 7-12 Stories		.5609
DIMENSION 4 –		
Old Housing Stock	.9444	
Percent Structures with Two Units in Structure (Rental)		.8960
Percent Structures with Two Units in Structure (Owner-Occupied)		.8872
Percent Housing Built Before 1939 (Owner-Occupied)		.8422
Percent Housing Built Before 1939 (Rental)		.8235
Percent Structures with Three-Four Units		.7971

Table 2. (Cont'd.)

Dimension Structure	*Reliability Coefficients of Cluster Scores on Full Set of Defining Variables*	*Oblique Factor Coefficient*
DIMENSION 5 –		
Inadequate Facilities	.9033	
Percent Units with No Piped Hot Water		.9230
Percent Units Lacking Some or All Kitchen Facilities		.8292
Percent Separated Male		.6602
Percent Divorced Females		.6280
DIMENSION 6 –		
Economic Status	.9495	
Percent Households with Interest, Dividends or Rental Income		.9116
Median Family Income		.8949
Percent Employed as Executives, Administrative, Managerial		.8706
Percent Family Income $50,000–$74,999		.8370
Percent Family Income $40,000–$49,999		.8047
Percent Employed as Professional Specialty		.7868
Percent Employed as Handlers, Equipment Cleaners, Helpers		-.6733
Percent Family Income $10,000–$12,499		-.6362
DIMENSION 7 –		
Vacant Housing	.9984	
Percent Vacant Housing		-.9992
Percent Owner Occupied Housing		.9992

Table 2. (Cont'd.)

Dimension Structure	*Reliability Coefficients of Cluster Scores on Full Set of Defining Variables*	*Oblique Factor Coefficient*
DIMENSION 8 –		
Rental Property	.9929	
Percent One Unit Structure (Rental)		.9964
Percent Two Unit Structure (Rental)		.9964

The second dimension, family type and race, characterizes a population that is composed of a large percentage of female-headed households and a high percentage of separated women. Since a large percentage of the population earns less than $2,500 a year, the dimension indexes an underemployed and poor population. The high negative loadings associated with the percentage of married couples, the percentage of whites, and the percentage of married women reiterates that the dimension characterizes a population that is composed of a high proportion of black, single women with children.

A high percentage of structures with five or more stories and a high proportion of land devoted to commercial and service[6] use are the positive loading characteristics in Dimension 3. The percentage of structures with one to three stories loads negatively on this dimension.

The fourth dimension, old housing stock, indexes areas that contain a housing stock predating 1939. Some of these older structures are owner-occupied structures, while others are occupied by renters in structures of between two and four units.

Dimension 5, structures with inadequate facilities, includes high positive coefficients for percentage of housing units without piped hot water and percentage of units lacking complete kitchen facilities. Separated men and divorced women reside in these areas.

[6] The Houston Planning Commission defines this category of land use as "[b]uildings and land occupied primarily by a business or enterprise involved in trade or service including, but not limited to retail trade of general merchandise, apparel, furniture, groceries, hardware, building material, farm equipment, automotive sales and services, eating and drinking establishments, commercial amusements, as well as tourist and convention accommodations. This category also includes public and private uses involving finance, insurance, and real estate services, business and professional services, trade and business schools, hospitals, medical clinics, cemeteries, governmental and non-profit institutions, organizational use involving administrative services. Places of entertainment and workshops are also included in this category. Commercial parking lots and garages are likewise included as service-oriented uses."

Table 3. Neighborhood Types

Type	Descriptive Name	Frequency of Cases	Profile Level: Multi-Family	Profile Level: Family Type
1	Low Family Type, Low Old Housing Stock, *Low* Occupied-Vacant, Low Rental Property	13		41[a]
2	Low Economic Status Low Multi-Family Type	53		
3	Low Family Type, Low Old Housing Stock, Low Inadequate Facilities, High Occupied Housing, Low Rental Property	57	43	43
4	Low Family Type, Low Old Housing, Low Inadequate Facilities, *High* Economic Status	45		41
5	*High* Old Housing Low Economic Status	30		
6	Low Multi-Family, *High* Family Type, *High* Old Housing, High Inadequate Facilities, *Low* Economic Status, Low Occupied-Vacant, High Rental Property	22	45	*71*
7	Low Multi-Family, *High* Family Type, Low Economic Status	48	41	63
8	*High* Multi-Family, Low Old Housing, Low Occupied-Vacant	59	*65*	
TOTAL HOUSTON CENSUS TRACTS		327[b]		

[a] Denotes Z Score. No entry indicates that a tract's Z-score was indistinguishable from a mean of 50. Such patterns are viewed as moderate.

[b] There were 353 census tract submitted to BC TRY for Object Analysis, but because of missing data five census tracts were deleted from the analysis and twenty-one tracts were "rejected" because of their unique cluster profiles. These unique tracts were pooled to form another type.

Economic status characterizes the sixth dimension. High economic status is indexed by high positive coefficients for the following variables: the percentage of individuals who earn money from interest, dividends or net rental income; the percentage of individuals who earn in excess of $40,000 a year and who are employed as executive, administrative, and professional specialists. High negative scores are associated with those individuals who work as handlers,

Table 3. (Cont'd.)

Profile Level						
Commercial-Services	*Old Housing*	*Inadequate Facilities*	*Economic Status*	*Occupied Housing*	*Rental Property*	*Overall H Value*
	45			*32*	42	.82
			44			.91
	44	45		58	42	.95
	45	45	*67*			.87
	69		44			.82
	63	57	*38*	43	59	.80
			41			.91
	44			45		.85

equipment cleaners, helpers, and laborers and with those individuals who earn between $10,000 and $12,499 a year.

The remaining two dimensions consist of only two variables each and were retained because they seemed to add substantively to the research. Dimension 7, occupied versus vacant housing, is indexed by a high positive loading on the percentage of year-round occupied housing units and a high negative loading on the percentage of vacant housing. Dimension 8, rental property, indexes those areas that have rental structures with fewer than two units per structure.

Each of these eight dimensions is highly reliable (see Table 2). With the exception of Dimension 3 (with a reliability value of .891), the dimensions exhibit values ranging from .903 (Dimension 5) to .998 (Dimension 7). The domain validity coefficient (accuracy of factor estimates in orthodox factor analysis) is extremely high for all dimensions, ranging from .944 to .996.[7] These eight dimensions uncover the underlying structure of Houston, and are used in BC TRY Object Cluster Analysis for the construction of neighborhood types.

Neighborhood typology and arson risk – The cluster-score results from V-analysis were used to group census tracts into clusters. The object-clustering procedure, using 327[8] of the original 353 census tracts, produced eight clusters (see Table 3). The overall homogeneity values, a measure of tightness of the score profiles of the tracts that compose a given type, reveal that each of the eight types is composed of tracts that have very similar scores on the attribute dimension. However, the homogeneity values for the dimensional structure of some of the neighborhoods indicate that there are some cluster score profiles that have considerable internal variation[9] (see Table 4). Of the clusters or types formed, Neighborhood Type 6 has the highest arson rate.[10] It is characterized as having a low percentage of land devoted to multi- family residence, an extremely high proportion of households headed by women, an extremely high proportion of old housing, a high percentage of structures lacking some facilities, an extremely low proportion of familes with high incomes, an extremely low proportion of owner-occupied housing, and a high percentage of rental units.

Prior research suggested that income, race, and age are related to differences in lifestyle and that lifestyle affects the strength of guardianship as well as exposure [17; 35; 36, p. 259-262]. Therefore, weak guardianship and increased exposure patterns are associated with having a low income, being non-white, and being in a young age category. In a similar way, studies have assumed that the

[7] The correlations between the cluster domains reveal that there is a moderate positive correlation (.404) between Dimension 2 (family type and race) and Dimension 4 (old housing stock), and there is a strong negative correlation of –.625 between Dimension 2 (family type and race) and Dimension 6 (economic status).

[8] Five census tracts were deleted because of missing data, and twenty-one tracts were classified as "rejects" because their cluster score profiles were considered unique.

[9] The homogeneity values of types with factors indicate that there are some cluster-score profiles for some types that show considerable internal variation. These types and the factors on which they show considerable internal variation are: Type 1, Dimensions 5 (H = .59) and 7 (H = .60); Type 5, Dimensions 1 (H = .66), 6 (H = .65), and 8 (H = .69); Type 6, Dimensions 4 (H = –.34) and 8 (H = .69). The overall homogeneity value presented here is merely the average of the H values across all eight dimensions.

[10] The overall homogeneity of Type 6 is .80, which indicated that there is some internal variation of the cluster scores for some of the factors. That variation is highest in Dimension 4 (old housing, H = –.344) and Dimension 8 (rental property, H = .69). The negative homogeneity value for Dimension 4 means that the tracts are more heterogeneous (greater variances of scores) than are the full supply of scores on Dimension 4.

Table 4. Homogeneity Coefficients for Neighborhood Types and Dimensions

Neighborhood	*Overall Homogeneity for Neighborhood Type*	*Homogeneity Coefficients for Dimensions by Neighborhoods*							
		Dimensions							
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	.8218	.9021	.7825	.9588	.8848	*.5922*	.8298	*.5993*	.9362
2	.9058	.8302	.9280	.9527	.9021	.9644	.8849	.8961	.8808
3	.9523	.9405	.9210	.9956	.9739	.9757	.8938	.9343	.9792
4	.8715	.8088	.9710	.9499	.8422	.9681	.8226	.8004	.7827
5	.8207	*.6555*	.9046	.9010	.8003	.9414	*.6527*	.9478	*.6911*
6	.7997	.9242	.8234	.9415	*-.3441*	.8998	.9415	.7964	*.6965*
7	.9103	.9299	.8363	.9835	.9537	.9428	.9558	.8831	.7783
8	.8461	.7393	.9426	.8337	.9749	.9619	.7560	.7651	.7517

Note: Italicized terms indicate dimensions that vary considerably in the neighborhood.

greater the attractiveness of the target, the greater the risk of victimization [17, 37, 38]. In a general sense, the issue of target attractiveness for arson is likely to be related to environmental indicators that possess the negative externalities of decay, vacancy, abandonment, and inadequacy. These indicators of physical structure, along with indicators that are related to a lack of guardianship and increased exposure, appear to create the necessary conditions for the high rate of arson found in Neighborhood Type 6.

Dimensionally, Neighborhood Type 6 is a highly transient area that contains a small proportion of individuals between the ages of twenty-five and thirty-four. The few married couples and the small white population of this neighborhood type reside in one-unit detached structures. For the most part, Neighborhood Type 6 is composed of black, female-headed households. A large proportion of these families earn less than $2,500 a year because of their employment as domestics in private households and other service occupations. A high proportion of housing units without piped hot water and a high proportion of units lacking complete kitchen facilities are found in this area, and it appears that these kinds of structures house separated men and divorced women. There is a substantial amount of housing built before 1939 and a high proportion of vacant housing found in Neighborhood Type 6. The lower-class population of this type resides in rental units that are located throughout this area.

It would appear that all or several dimensions of this neighborhood type interact in such a way so as to bring about the high rate of arson. These dimensions may be summarized into two categories: structural dimensions – old housing stock, vacant housing, rental units, and housing lacking complete kitchen facilities and without piped hot water – and indicators of so-called social disorganization – black, female-headed households and low socioeconomic status.

The BC TRY clustering procedure yields six other interesting types (see Table 3). Neighborhood Type 2 represents a collection of tracts that is average on most of the dimensions (the only exception being its low position on Dimension 6 (economic status)) and probably indicates the presence of a middle-class population. Neighborhood Type 4 is the antithesis of Type 6, containing relatively new housing, an upper-middle-class white population, and few units that have inadequate facilities. As such, low arson rates should exist in Type 4. Type 4 (upper-middle-class households) and Type 6 (low-status, black female-headed households) are at opposite ends of the risk spectrum (.71 and 3.88, respectively). Five of the remaining neighborhoods (Neighborhood Types 1, 2, 5, 7, and 9) have arson rates that are above the mean city rate (1.46) while two areal clusters (Neighborhood Types 3 and 8) have rates that are below the mean city arson rate (see Panel A, Table 5).

An analysis of variance (ANOVA) of the eight neighborhood types and the one collection of "rejected" census tracts reveals that there are significant differences among types ($F = 17.489; p < .001$). The procedure reveals that if a

Table 5. ANOVA Results

	Neighborhood Types									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*City Mean Rate*
Mean Score	3.29[a] (3.70[b])	1.75 (1.80)	1.13 (1.72)	0.71 (0.78)	1.99 (2.20)	3.88 (4.51)	1.90 (2.10)	0.89 (1.04)	2.62 (4.05)	1.46 (1.99)
N	13	53	57	44	30	22	48	59	21	347

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Significance Level*
Between Groups	86.118	8	10.7648	17.489	.001
Within Group	208.045	388	.615		
Total[c]	294.163	346			

[a] Transformed Rate.
[b] Raw Arson Rate.
[c] Six cases were deleted because of missing data.

regression model were fashioned with only neighborhood types as independent variables, approximately 30 percent of the variance would be explained.

The ANOVA appears to suggest that there is a neighborhood effect, but the ANOVA does not address what dimensions are responsible for the effect or whether neighborhood-type membership affects the rate of arson victimization above and beyond the individual effects of environmental structure.

ENVIRONMENTAL MODELS OF ARSON INCIDENCE

Neighborhood membership clearly is related to arson rates in the City of Houston. An assessment of the importance of environmental structure on arson rates at the city-wide level is achieved by using the census tracts' scores on each dimension that was derived from the BC TRY's V-analysis. When these scores were entered into a regression analysis, four of the eight dimensions – Dimension 1 (multi-family residential land use), Dimension 2 (family type), Dimension 7 (occupied housing), and Dimension 8 (rental property) – did not significantly contribute to the prediction of arson rates ($p > .05$). The remaining dimensions – commercial and service land use (Dimension 3), old housing stock (Dimension 4), inadequate facilities (Dimension 5), and economic status (Dimension 6) – were significant predictors of the arson rate, and account for 36 percent of the variance. The analysis reveals that positive associations exist for commercial and service land use, old housing stock, and inadequate facilities while economic status is negatively related to arson incidence.[11]

However, this rather simple model does not assess the extent to which neighborhood-type membership affects arson rates, nor does it indicate how these four dimensions relate to arson among neighborhood types. A more elaborate multiple regression model addresses these concerns.

Neighborhood-Effect and City-Wide Model

A second regression model evaluates the combined effects found at the neighborhood and city-wide levels and includes:

1. the four significant dimensions of environmental structure derived from the first regression model;
2. eight dummy terms, representing constant terms for each of the nine neighborhood types; and
3. cross-product terms composed of neighborhood-type membership and the explanatory factors X_1 to X_4.

[11] Residual analysis reveals that no apparent pattern resulted when the residuals were plotted against each of the independent variables and against the predicted values. Of the 347 cases plotted (six cases were deleted from the total, $N = 353$, because of missing data), only sixteen were outliers (4.60% of the total). These two results indicate that the fitted model is appropriate, and some confidence is warranted concerning the overall effect of these factors across all census tracts.

As constructed, the saturated regression model allows not only for an overall appraisal of arson in the City of Houston but also for an assessment of the impact of neighborhood type on the rate of arson. The saturated model consists of forty-four terms and is highly correlated with the transformed arson rate ($R = .715$). The analyses show that the R^2 value increases from .30 (when only the neighborhood types are used) to .36 (when only the city-wide model is used) to .51 (when the saturated neighborhood-effect and city-wide model is used).

In order to construct a more parsimonious model, the equation was reduced from forty-four to thirteen terms. Since there was only a slight reduction in the measure of association – multiple R value of .6515 – the pooling procedure did not substantially affect the overall robustness of the model. Further reduction in the number of terms in the equation was achieved by considering whether the nine constant terms could be pooled into two or more groups. By using thirty-six pairwise comparisons of the constant terms and Dunn's method (to control the Neighborhood Type 1 error rate for the entire set of neighborhoods), the pairwise comparisons revealed that Neighborhood Types 2-9 were not significantly different in terms of their arson rate and could be pooled to form a single homogeneous group having the same constant term (see Table 6).

Table 6. Regression Coefficients[a] – Final Model

		Standard Error
Constant	-6.01228	.439455
(Neighborhood Type 1)	(3.58789)[b]	
Constant	-6.94706	.42122
(Neighborhood Types 2-9)	(1.41190)	
Dimension 3	.01701	.00400
(Commercial-Service Land Use)		
Dimension 4	.01928	.00425
(Old Housing Stock)		
Dimension 5		
(Inadequate Facilities)	.00954	.00405
Dimension 6	-.03818	.00420
(Economic Status)		

[a] All terms were significant at $p < .05$.
[b] Transformed arson rate.

The results of the final and most parsimonious regression model ($R = .639$) appears in Table 6, and is of the form:

$$Y_{ij} = \mu + \alpha\Delta_j + \sum_{1}^{4}\beta_{\ell} X_{ij}$$

where μ is the constant term for Types 2–9; Δ_j is 1 if j = 1; otherwise Δ_j is 0; β_{ℓ} is the coefficient for the dimensions; $X_{ij\ell}$ is the cluster score on Dimension ℓ for census tract i in neighborhood j.

By using analysis of covariance and Scheffe's procedure for the calculation of the critical value, Table 7 shows that the pooling procedure was appropriate since only the within-neighborhood group *F*-value was not significant, and indicates that Types 2–9 are similar in terms of their rates. Conversely, there is a significant difference between the arson rates for Type 1 and Types 2–9 (see the significant *F*-value for between-neighborhood groups). Moreover, when this result is compared to the analysis of variance reported in Table 5 (where there was a substantial amount of difference between neighborhood types), the analysis of covariance demonstrates that the only difference that remains in arson rates when we include environmental structure is the difference that exists between Neighborhood 1 and the other neighborhoods. Therefore, neighborhood-type membership does not appear to affect arson rates significantly above and beyond the individual effects of environmental structure. Consequently, four dimensions – commercial and service land use (Dimension 3), old housing stock (Dimension 4), inadequate facilities (Dimension 5), and

Table 7. Analysis of Covariance

Source	*SS*	*df*	*MS*	*F*
Mean	14779.901	1		
Factors	106.048	4	26.512	52.300
Dimension 3	10.726	1		21.160
Dimension 4	8.773	1		17.306
Dimension 5	3.296	1		6.503
Dimension 6	16.760	1		33.063
Neighborhoods	18.809	8	2.351	4.638
Between Neighborhood Groups	10.720	1	10.720	21.147
Within Neighborhood Groups	8.089	7	1.156	2.279[a]
Residual	169.311	334	.507	

[a]Does not exceed Scheffe's critical value of 2.937 and is not significant.

economic status (Dimension 6) – were found to have significant coefficients. Since variables are related by the nature of their loadings on each environmental dimension, the positive association of Dimension 3 (commercial and service land use) with arson rates indicates that an increase in the percentage of structures with thirteen or more stories, the percentage of structures without bedrooms, and the percentage of land devoted to commercial and service use increase the arson rates. Dimension 4 (old housing stock) and its percentage of structures with two to four units that were built before 1939 are also positively related to arson rate. Dimension 5 (inadequate facilities), indexed by the percentage of housing units that had no piped hot water, the percentage of housing units that lacked some or all kitchen facilities, and the presence of separated men and divorced women, were also positively related to the arson rate. A negative association exists between the arson rate and economic status (Dimension 6) and its attendant variables (percentage of households collecting interest, dividends, or rental incomes; percentage of population employed as executives, administrators, and managers as well as those employed in professional specialty occupations; percentage of individuals who earn over $40,000 a year).

These variables may be organized into five general categories – status, size of structural units, inadequate facilities, age of housing, and land use – that are related to arson in the City of Houston. It would appear that arson in Houston is a reflection of housing rather than population characteristics. Income is an exception to this general principle, but the effect of income on criminal victimization has been noted by other researchers [35, 36], who state that income differences may be translated into differences in guardianship patterns.

Cohen and his colleagues have also asserted that victimization risk is positively related to target attractiveness [17]. For arson victimization, target attractiveness is equated to the negative externalities of old housing and inadequate facilities, which, in turn, are related positively to arson victimization. These signs of physical deterioration may point toward disinvestment and toward continued or accelerated deterioration of the property, which would result in arson or at least in suspicious fires. Arson occurs at the end of a cycle of decline in property values, and owners may use it as a means of finalizing a process of disinvestment. This analysis indicates that areas that are high on the dimensions of inadequate facilities and old housing should be tagged as areas for possible intervention.

Land use appears to be tied to the size of structural units. Together these factors suggest that structural density is related positively to arson victimization. Prompted by the work of Shichor et al. [39, 41], and the lack of consensus concerning the relationship between crime and density, Sampson investigated the relationship between neighborhood structural density (percentage of units in structures of five or more units) and rates of criminal victimization [42]. Just as Sampson found a positive relationship between structural density and robbery and assault victimization, the finding of this research seems to correspond to

Sampson's general conclusion. His integration of the opportunity model of predatory criminal victimization [17, 18], with defensible space theory [42], leads him to conclude: "Neighborhoods that are characterized by high structural density offer more opportunities (both perceived and real) for potential offenders, while at the same time providing fewer opportunities for visual surveillance and guardianship by residents" [41, p. 288]. Although arson for the most part is not a predatory offense, there seems to be an implied relationship between structural density, which influences opportunity, and arson victimization.

Unlike previous research [4], this study suggests that family type (Dimension 2) is an unimportant environmental factor; the percentage of female-headed households with children, the percentage of the population that is black, the percentage of the population that is employed in service occupations, the percentage of separated women, the percentage of families with incomes below $2,500, and the percentage of the population employed in private household occupations are not related to arson in the City of Houston.

The Adjusted Environmental Model

Given that a neighborhood effect does not exist, and that arson can be explained by certain environmental characteristics, how well does the model explain the rate of arson within neighborhoods of different environmental structures? While the final equation explains 41 percent of the variance in arson rate, it appears that environmental structure, as reflected by the dimensions' cluster scores, only partially explains differences in arson rates at the city-wide level. A test of how well the model predicts within neighborhoods is achieved by calculating an adjusted arson rate by equating neighborhoods to the mean city cluster-score level and comparing the adjusted rate to the transformed arson rate. The question is: What is the arson rate for any neighborhood when the cluster scores of environmental structure are held at their mean city level?

The adjusted model[12] asserts that if neighborhoods are equated to the mean cluster-score level for the city, then the transformed arson rate will be equal to the adjusted rate. If the model predicts extremely well, there will be no differences between the transformed arson rate and the adjusted arson rate. Any difference in these rates will represent unexplained variability. Table 8 demonstrates that there is considerable variability between the transformed arson rate and the adjusted arson rate. Five neighborhoods have adjusted rates that are lower than the transformed arson rate, and four neighborhooods have adjusted rates that are higher than the transformed arson rate. Therefore, the results indicate that when neighborhoods are equated to the mean city level, factors other than environmental structure are responsible for the observed arson rate.

[12] The adjusted model is of the form:

$$Y_{ij} = \mu + \alpha \Delta j + \sum_{1}^{4} \beta_{\varrho}(X_{ij} - X..).$$

Table 8. Adjusted Arson Rate and Environmental Structure

Neighborhood Type	*Transferred Arson Rate*	*Adjusted Arson Rate*	*Environmental Structure*			
			Dimension 3 (Commercial-Service)	*Dimension 4 (Old Housing Stock)*	*Dimension 5 (Inadequate Facilities)*	*Dimension 6 (Economic Status)*
1	3.29	3.74		Low[a]		
2	1.75	1.51				Low
3	1.13	1.56		Low	Low	
4	.17	1.79		Low	Low	*High*
5	1.99	.93		*High*		Low
6	3.88	1.61		*High*	High	*Low*
7	1.90	1.47				Low
8	.89	1.24		Low		
9	2.62	1.10	*High*	High	*High*	

[a] Neighborhoods are distinguished by their position from the mean — below 40 *(Low)*; 40-45 (Low); 46-54 (Moderate); 55-60 (High); or 60 and above *(High)*. No entry indicates that a neighborhood's *Z*-score was indistinguished from a mean of 50. Since the *Z*-scores for all tracts were standardized with a mean of 50 and ± 10 standard deviation, the city average on all dimensions approximates 50.0.

Neighborhood Types 1, 3, 4, and 8 have adjusted rates that are above the transformed arson rate. Neighborhood Type 1 is relatively low on the old housing factor (Dimension 4), and when the dimension is raised to the city average, the adjusted rate is higher than the transformed rate because of the positive relationship that exists between Dimension 4 and the transformed rate. When Neighborhood Type 3 is adjusted to the mean city level, the adjusted rate is also above the transformed arson rate. This result is due to the low scores that are present for old housing and inadequate facilities (Dimensions 4 and 5), which are positively associated with arson, and the high scores present for Dimension 7, which is negatively related to arson. The adjusted rate for Neighborhood Type 4 is more than twice the transformed rate, due to the neighborhood's low scores on Dimensions 4 and 5 (with their positive associations) as well as its high score on Dimension 6 (economic status), which is negatively related to the transformed arson rate. The adjusted rate for Neighborhood Type 8 is greater than the transformed rate because it is low on the old housing dimension (Dimension 4), which is positively related to the arson rate.

For Neighborhood Types 2, 5, 6, 7, and 9, the adjusted rates are considerably lower than the transformed rates. Neighborhood Type 2 has a lower adjusted rate because the economic status dimension (Dimension 6) is low and the dimension is related negatively to the transformed arson rate. Neighborhood 5 has a lower adjusted rate because it is high on the old housing stock dimension (Dimension 4), which is positively related to the transformed rate. In addition to scoring high on Dimension 4, Neighborhood Types 6's high loading on the inadequate facilities dimension (Dimension 5) and its negatively related low loading on the economic status dimension (Dimension 6) is responsible for the lower adjusted arson rate. Neighborhood Type 7 has a lower adjusted rate because of its high scores on the inadequate facilities dimension (Dimension 5), which is positively related to the transformed rate. Neighborhood Type 9 has a lower adjusted rate because of its high scores on the commercial/service, old housing, and inadequate facilities dimensions (Dimensions 3, 4, and 5), which are positively related to the transformed arson rate.

Whether singularly or in combination with other dimensions, Dimension 4 (old housing), as indexed by the percentage of structures with two to four units that were built before 1939, plays an important role in determining the relative level of the adjusted arson rates found in Houston's neighborhoods. As such, old housing stock and its indicators play a critical role in determining the effectiveness of the model among neighborhood types. When the old housing stock dimension and the indices associated with it are altered, the arson rate within neighborhoods increases, if we bring the dimension to the city average, and decreases, if we reduce the proportion of these indices. Therefore, the model suggests that, as we change the various dimensions of environmental structure, the dimensions have a tremendous impact on the arson rate.

CONCLUSION

Houston is the quintessential sun-belt city. In 1973, it enjoyed a 17.6 percent gain in employment over 1970 and its population grew by more than 40 percent over 1960. The growth of its population produced an unprecedented housing boom: 40,000 new houses were started in 1976 [43]. Analyses of the Houston data show that the incidence of arson is related to certain neighborhood characteristics, among which are environmental structures within the purview of urban governments. The findings here support Sternlieb and Burchell's assertion that abandonment and decay encourage incendiarism [3]. As such, the attractiveness of vacant and abandoned structures to potential arsonists should be a major policy issue for urban governments.

The assumption that a niehgborhood effect exists is only partially supported by this research. Neighborhood Type 1 is substantially different from the remaining types, but the city-wide predictors are the same for each set of neighborhoods. This suggests that although the arson rate is different in these two sets of neighborhoods, the predictors associated with arson at the neighborhood level are no different from those associated with the offense at the city-wide level. Perhaps this finding reflects the manner by which the term "neighborhood" is conceptualized, and a more accurate conceptualization would include measures of social interaction, social control, and measures of the collective identity or sense of the place found in neighborhoods as well as measures of the physical environment. The simplistic areal definition of a neighborhood and the utilization of census tracts, as opposed to the use of census blocks, may tend to obscure the importance of the neighborhood context.

From a policy standpoint, the question is: Can arson prevention strategies be applied uniformly in urban areas or is it necessary to have different sets of strategies that are matched to the specific structural and social characteristics associated with each neighborhood type? This research seems to suggest that even though Neighborhood Type 1 is statistically different from the remaining types, the same predictors appear to explain the arson rate. This would imply that different sets of prevention strategies are not needed for each neighborhood type; rather a general city-wide strategy emphasizing the importance of environmental attractiveness and social disorganization could be used. Furthermore, the model demonstrates that any decrease or increase in the environmental dimensions, particularly old housing stock (Dimension 4), produces considerable change in the rate of arson. Therefore, some areas will require more attention than others because of the level of decay and "disorganization" associated with them.

From a policy viewpoint, arson prevention must be viewed from the standpoint of urban decay. Urban decay reflects a housing market that is not regenerative, and Hoyt suggests that migration is tied to the process of decline [13]. Accordingly, Hoyt suggests that increased demand precipitates new construction, but with new construction, existing housing becomes obsolete,

property values decline, and general deterioration occurs. Consequently, areas with deteriorated housing become the only areas that are affordable for lower-class populations.

In order to have an impact on arson incidence, housing policies must be aimed towards rejuvenation as opposed to obsolescence, and policies of rejuvenation must be instituted in such a way that intervention does not provide additional fuel for arson incidence. Therefore, incentives that would inadvertently make urban land more valuable than the structures on it or make the structures more valuable burned than revitalized must be avoided.

Vacant buildings within urban areas should be studied with an eye to the feasibility of converting them to other uses or razing decaying buildings so that they do not become targets of vandals. In some instances vacant units are fed by utility companies, or utility thefts from adjacent occupied structures may create opportunities for fire setters. Properties must be scrutinized systematically by monitoring such factors as total amount and number of years of tax arrearage, previous structural fires, housing code violations, and liens and other claims on the property. Buildings with these factors should be tagged as possible candidates for intervention. Covert surveillance and overt patrols of areas where arson rates are high should also be instituted. Fire departments should establish a computer-aided arson-pattern recognition system that would enable users to rely upon established patterns in verifying future crime activities possessing similar trends. Such a system would integrate geographic patterns in fire density, provide an interface with other reporting systems, and allow for the assessment of groups of cases that are similar in pattern.

Outside the environmental context, the apprehension of arsonists and the detection of arson can be achieved by increasing cooperation between fire and police departments. This cooperation could conceivably take the form of analysis and exchange of case and suspect files between departments. Moreover, cities should actively encourage the formation of grass-roots anti-arson organizations that work in concert with a variety of city departments (e.g., the building department, city and town clerks, the collector of taxes, the fire department, the department of housing code enforcement, and the police department). Early intervention strategies, directed towards reducing arson risk, are in part conditioned by the proactive policies of urban governments, supported by the federal government's concern, or lack of concern, for the housing problems of the urban poor.

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