The Relationship Between “Micro” Spatial Conditions and Behaviour Problems in Housing Areas: A Case Study of Vandalism

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Introduction

The increase of behaviour problems such as noise, vandalism, aggression and crime are some of the most degrading social problems in the housing environment. Many studies have investigated the relationship between design of housing and such social problems. These studies blamed design features of housing, social characteristics of residents and systems of management. The design features investigated tend to be of a “macro” nature such as: height of blocks of flats, number of dwellings in a block of flat, through-roads, cul-de-sacs, overhead walkways connecting blocks of flats or the extend of public space (Newman, 1973; Coleman, 1985). These studies frequently suggest that there are underlying causes of a “micro” nature associated with these design features, mainly in relation to the lack of visibility and accessibility through overlooking windows and doors, and allowing criminals or vandals to operate unseen and unrecognized.

The study described in this paper identifies the need for an empirical investigation into the effect of visibility and accessibility of public space through dwelling windows and doors. The aim is to provide operational definitions to allow the measurement of these underlying causes independent of the design features, and to find the extent of their effect on social problems.

The main proposition of the study described in this paper is: actual and potential visibility and accessibility of a public space through dwelling windows and doors affect vandalism in that space. The underlying mechanism suggested by the study is that as visibility and accessibility increase, potential vandals feel that they are being watched, and this feeling deters them from committing acts of vandalism. The study investigated other propositions regarding the effect of social characteristics of residence and systems of management on vandalism. The study included fieldwork of housing areas of over 3000 dwellings.

The paper first describes the design of the measurements for the examination of vandalism, visibility and accessibility. The paper then describes the fieldwork conducted in the housing areas and the data collected within them. Finally the paper summarises the data analysis, derives conclusions from the analysis of the data, and points out areas for further research.
Measuring Vandalism

The method of measurement adopted in this study involves surveying housing estates and recording all traces of vandalism by type, amount and position. During the field study, graffiti were measured by area (square metres) and vandal damage by area and description of the damaged targets. Measurement by area (square metres) is suitable for most vandal damage found in this fieldwork.

Vandalism was mapped on a scaled plan of each housing area. Each vandalised position was given a number that was cross referenced to a form designed to record the finishing material of walls, total area of graffiti, and details and areas of each damaged target.

Measuring Visibility and Accessibility

Visibility and accessibility is defined as the degree to which the design of housing allows residents to overlook and access public spaces from their dwellings. It can be argued that a potential vandal could feel less threatened when windows or dwelling doors he sees are further in the distance or at an increasing angle away from his position. For reasons related to the validity and reliability of measures, the distance of 50 meters is judged to be the maximum limit for the effect of visibility and accessibility on a point in the public space. The measures designed in a form of simple mathematical models represent the effect of windows and dwelling doors in relation to a point in the public space.

Visibility at point (P1) see (Figure 1) is a function of the total effect of the openings O1, O2, O3 and O4 that can be seen from that point, assuming that, for this explanatory exercise, all these buildings are single storey. Otherwise all windows on all floors have to be counted. As the distance between each window and that point increases, the importance of that window in determining the total visibility value of that point (VP1) should decrease. Thus the relationship between the visibility value (VP1) and distance (D) of each opening is an inversely proportional relationship.

Similarly, as the inner angles G1, G2, G3 and G4 between the vision-lines that link point (P1) and the centre of each window surface increases, the importance of that window in determining the total visibility value (VP1) at that point should increases.

Thus the relationship between the visibility value (Vp1) and inner angles (G) of each window is a proportional relationship. Likewise, as the size of openings O1, O2, O3 and O4 increases, the importance of that window in determining the total visibility
value (VP1) at that point should increases. Thus the relationship between the visibility value (VP1) and the size (O) of each opening is a proportional relationship. From the above argument, the mathematical model for the total value of visibility (VP1) at point (P1) can be represented as follows:

\[ VP1 = \left( \frac{O_1}{D_1} + \frac{O_2}{D_2} + \frac{O_3}{D_3} + \frac{O_4}{D_4} \right) 0.44 \]

Where the constant factor (0.44), calculated to make the value of (V), moves on a scale of values varying from 0 to 100. The constant is calculated by measuring the value of visibility (V) in a highly visible point in the middle of a street of terraced (linked) houses with overlooking house windows on both sides (Figure 3). This point is considered to be the highest visibility value that can be achieved in a normal housing environment, which is equal to (227.273), thus (100/227.273=0.44). This will give an illustrated point of reference for visibility measurements. Thus, a point of measurement of 20 means it is equal to 20% of the visibility scored by that point in the middle of terraced houses street shown in Figure 3.

Likewise, the accessibility value at point (P2) in the public space (Figure 2) is equal to the effect of all dwelling doors seen from that point, having a direct access to that space. As in the case of visibility, the relationship between the total accessibility value (AP2) and distance (D) between each door and point P2 is an inversely proportional relationship. Similarly, the relationship between total accessibility value (AP2) and inner angle (G) of each door is a proportional relationship. The difference in door sizes was considered to be of no significance, and consequently was excluded from the mathematical model. From the above argument, the mathematical model for the total value of accessibility (AP2) at point (P2) can be represented as follows:

\[ AP2 = \left( \frac{G_1}{D_1} + \frac{G_2}{D_2} + \frac{G_3}{D_3} \right) 1.32 \]

The constant (1.32) was calculated in the same way as in the case of visibility above, in order to make the value of (A) move on a scale of values varying from 0 to 100.

The Field Work
The fieldwork covers four housing areas of over 3000 dwellings of a variety of building forms, and includes forty blocks of flats. The housing areas were selected carefully to test effectively the effect of visibility and accessibility in a variety of
housing design settings, as well as to test the effect of the social characteristics of residents and types housing management on the problem of vandalism. Blackbird Leys (Figure 4) and Wood Farm housing estates in Oxford are typical British post-war public housing developments. Both estates were built in the 1960s and are of mixed houses and blocks of flats, and both are managed by the Housing Department of Oxford City Council. A limited percentage of the dwellings, however, were sold to tenants. Blakebird Leys includes over 2500 dwellings, while Wood Farm includes 700 dwellings.

Elthorne and Charteris housing estates are both managed by a residents' co-operative, and have very similar management agreements with Islington Borough Council, London, which owns the properties of both co-operatives. The main part of the Elthorne co-operative was built in the 1970s, and includes 100 dwellings concentrated in one very large complex of flats and houses clustered around a longitudinal courtyard. The co-operative includes a separate group of dwellings, which was not included in this study. The Charteris co-operative includes 130 dwellings comprised of a Victorian group of terraced houses and houses converted to flats.

The Effect of Visibility and Accessibility on Vandalism

In the fieldwork, 384 vandalised locations were measured for each type of vandalism and located on scale plans. The measures for visibility and accessibility of each location were calculated by taking measurements from the scaled plans and by using the mathematical formulas mentioned above.

Figure (5) represents a regression analysis of the correlation between the values of total graffiti covered areas within visibility classes for all fieldwork. Graffiti measurements are aggregated within five visibility classes: 0 to 10, 10 to 20, 20 to 30, 30 to 40, 40 to 50, and more than 50. The regression line plotted over the bar chart in Figure (5) represents the correlation coefficient value. The regression analysis resulted in a high correlation coefficient of -
0.93. The correlation coefficient can be interpreted as being that visibility explains 93% of total graffiti areas within the given visibility classes.

Figure (6) shows a regression analysis of the correlation between the values of total vandal damage areas within visibility classes for all fieldwork. The regression analysis resulted in a high correlation coefficient of -0.94 which can be interpreted as being that visibility explains 94% of total vandal damage areas within the given visibility classes.

The evidence can be interpreted as follows: visibility has a deterrent effect on vandalism. And such effects may be explained as that windows appear to threaten youngsters. They could fear being seen, and such a feeling could deter them from committing acts of vandalism.

As for accessibility, a regression analysis of the data produces a different pattern from that of the visibility data. To test the effect of accessibility in a controlled way, the study identified all vandalised locations exposed to only the accessibility measures. The regression analysis showed a very low correlation coefficient, which means that accessibility has an insignificant effect on vandalism. The study then looked into the effect of accessibility in combination with visibility. To do this, the Charteris co-operative housing area was selected because most measured locations were exposed to the effect of visibility and accessibility. The combined measure for visibility and accessibility is worked out by adding the two measurement values and adjusting the total \((V+A)\) to make it move on a scale of values varying from 0% to 100%. This is done by multiplying the total by a constant worked out in the same way as in the case of the measures for visibility and accessibility described above. The data can be represented as follows:

\[
(V+A) = \left( \frac{O}{D} \cdot \frac{G}{D^2} + \frac{G^2}{D^2} \right) 0.33
\]

An analysis of the composite visibility and accessibility data related to Charteris shows an improvement in correlation over data related to visibility. Figure 7 shows the improved correlation coefficient from -0.86 to -0.93, which means that the accessibility of doors accompanied by visibility of windows has an enhanced effect on vandalism when compared to the effect of visibility of windows only. And such an effect may be explained as follows: doors together with windows appear to intimidate
youngsters. They could fear not only being seen to commit vandalism, but also fear that residents have a direct accessibility to them, and could come out to confront or apprehend them. Therefore, the effect of accessibility cannot be isolated; it strengthens the effect of the visibility on vandalism.

**The Effect of Visibility on Vandalism in a Variety of Housing Design Settings**

The fieldwork includes four housing areas selected, among other aims, to test the effect of visibility and accessibility in a variety of housing design settings. The study shows a consistent pattern of relationship, explained mainly by the effect of visibility regardless of the housing design. Parts of the study areas included heavily vandalised targets around some blocks of flats, while other blocks of flats escape any kind of vandalism. Some of the blocks of flats have extensive public spaces while others are closely laid out. Other parts display vandalised targets within ordinary housing environments of single-family houses situated around cul-de-sacs or through-roads. The study showed that in all these varying housing design settings, vandalism could be explained mainly in terms of the degree of visibility.

Figure (8) is a layout plan for a small part, about 7% of the total area of Blackbird Leys housing estate. The layout shows an example of the variety of housing design settings. Blocks of flats B5, B6, B7, B8 and B9, for example, are designed with outside staircases and open deck corridors, and set within limited public spaces, while B10, B11 and B12 have inner corridors and staircases, and are set in generous open public spaces. Similarly, some terraced houses are set around cul-de-sacs, while others are set around through-roads.

Figure (8) shows the locations of vandalised targets. The pattern of vandalism seems random. Some blocks of flats attract vandalism while others escaped vandalism. Garage clusters were the main targets for vandalism; some of these located within cul-de-sacs while others are along through-roads.

![Figure 8](image-url)
Figure (9) shows the distribution layout of potential targets for vandalism, in this case, mainly walls, garaged doors, open staircases and garbage collection areas. The visibility score is shown next to these targets. When vandalised targets (Figure 8) are compared to this layout, a clear relationship emerges. Most vandalised locations are within low visibility areas, which score less than 20 on a scale of 1 to 100 described above. Some are located within visibility areas of a score between 20 to 30.

Only a few are located within visibility areas of a score between 30 to 40, and only in rare cases was vandalism recorded in spaces where the visibility score was between 40 to 50. Furthermore, vandalism in lower visibility spaces between 0 to 30 tend to be of a more acute nature, while vandalism in areas of visibility above 30 tend to be less serious. The emerging pattern is that as visibility increases, vandalism decreases, and it seems that no vandalism occurs in areas of visibility of a score above 50. This pattern is repeated in all the fieldwork areas.

Further conclusions were drawn from a detailed study of other areas such as that visibility from commercial premises seems to have no effect on vandalism, and that the visibility resulted from the windows of several dwellings has more effect on deterring vandalism than the visibility of windows of only one or two dwellings.

**The Effect of Social Characteristics of Residents and Systems of Management on Vandalism**
As for the claimed relationship between the social characteristics of residents and vandalism, Figure (10) lists a number of indicators for social characteristics as possible causes for vandalism mentioned in the literature. These are: percentage of unemployed, Afro-Caribbean and Asian households, single parents and youngsters. The data related to these characteristics were available from data sources of population censuses for the council estate and management records for the co-operatives. The first graph line lists the average percentage of available surface area with a visibility score of 0 to 30, covered with graffiti as an indicator for the level of vandalism in each part of the fieldwork. This indicator is chosen as it provides control over the size differences of the four fieldwork areas. Furthermore, the available area for graffiti within these visibility scores are roughly of a similar percentage in relation to the number of dwellings in each of the four housing areas of the fieldwork.

The second graph line in Figure (10) lists the percentage of youngsters aged 10 to 16 in each estate. This age bracket of youngsters is chosen because it would include most potential vandals. Vandals of this age bracket are more likely to commit acts of vandalism of a serious nature such as large areas of graffiti using cans of spray paint. The only variable that strongly correlates with the level of vandalism is the percentage of youngsters in each of the four estates and co-operatives. A regression analysis shows that the correlation coefficient between the percentage of youngsters and the level of vandalism is statistically significant at 0.97, while the percentage of unemployed, Afro-Caribbean and Asian households and single parents yield statistically insignificant correlation coefficient figures of 0.37, 0.17 and 0.06.
The case study lent no support to the claim that a system of management that allows resident involvement in the management of housing, as in the case of co-operative management, would decrease vandalism. The claim suggests that resident involvement increased residents’ pride in their housing, and subsequently resulted in vigilance against vandalism and discouragement to their youngsters in taking part in acts of vandalism. Figure (10) shows that the levels of vandalism in the co-operative-managed estates are equal to one council estate and higher than in the other council estate. However, the evidence in relation to system of management was based on a case study of two council estates and two co-operatives. This is too small a number to conclude with any significant level of confidence that systems of management have no effect on vandalism.

**Conclusion**

The study provides robust evidence that “micro” special conditions have a strong relationship to the problem of vandalism. The study indicates that vandalism is related mainly to visibility. The probability of vandalism’s occurrence may decrease as visibility increases. Also, accessibility may strengthen the effect of visibility. Meanwhile, the level of vandalism within these parameters may be related to the percentage of youngsters. Thus, vandalism may increase in low-visibility public spaces as the percentage of youngsters increase.

The case study investigated the widely claimed causal relationship between “macro” design variables and vandalism. The case study provided evidence that lent no support to these claims. The evidence could mean that, as far as vandalism is concerned, “macro” design features such as height of blocks of flats, extent of public space and housing layout of through-roads or cul-de-sacs, cause no increase of vandalism if the design provides an adequate degree of visibility and accessibility to public spaces. However, there are well-documented studies that provide evidence of the relationship between some of these “macro” design features and other problems such as the relationship between height of blocks of flats and problems related to the health of residents (Hamid, 2004).

The case study investigated the widely claimed causal relationship between vandalism and systems of management, whether council or co-operative. The case study provided evidence, of a limited nature, that lent no support to these claims.

The conclusions of the study can assist housing designers to arrive at an objective assessment of the vulnerability to vandalism of public spaces within housing areas.

Other behaviour problems in housing such as noise, aggression and crime can differ from vandalism in terms of the nature of the perpetrators and their motives. However, studies of “micro” special conditions that immediately affect perpetrators of such acts could reveal further insight to these problems.

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