

# **CRIME AND SECURITY IN HOSPITALS**

**A study of Greenwich District Hospital,  
Royal Devon and Exeter Hospital, Wonford and  
Pinderfields Hospital, Wakefield**

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## Table of Contents

<b>Part One</b>	Introduction and summary of findings	page	<b>2</b>
<b>Part Two</b>	Physical description	page	<b>6</b>
<b>Part Three</b>	Questionnaire results: exposure to and awareness of crime in the three hospitals	page	<b>9</b>
<b>Part Four</b>	Spatial layout of the hospitals	page	<b>33</b>
<b>Part Five</b>	Observed use of the hospitals	page	<b>37</b>
<b>Part Six</b>	Crime, space and activity: relationships	page	<b>49</b>

## Appendices

Appendix A	The questionnaire
Appendix B	Plates 1 - 21
Appendix C	Spatial and observation statistics
Appendix D	Space Syntax analysis

## Part One

### Introduction and summary of findings

This report presents the findings of the study of crime and security at Greenwich District Hospital and Royal Devon and Exeter Hospital, Wonford. In June 1993 the Unit for Architectural Studies at the Bartlett School of Architecture, University College London reported on a survey of crime and security at Pinderfields Hospital, Wakefield, commissioned by the NHSE#. The study used new techniques of computer analysis of building layout to investigate crime occurrences and fear of crime amongst staff at the hospital. It found clear evidence that spatial design and space occupancy factors were implicated in crime vulnerability. Following this report the UAS was asked to undertake a survey of crime and security at the two hospitals in order to test the findings of the Pinderfields study in different building types and under different management and security regimes, and in particular to look at a Nucleus development (in the case of Exeter).

This report incorporates the findings of the investigation made into the experiences and perceptions of crime and security by staff in the two hospitals which were ascertained by means of a questionnaire survey of staff carried out in October/November 1993#. The questionnaire reported on recorded and unrecorded crime along with other related factors such as fear of crime and patterns of avoidance. The questionnaire results provide an essential background picture of staff experience and perception in the two hospitals. These results are presented in Part three. In addition to this data, the study looked at two other main types of data: the data derived from a spatial analysis of the two hospitals and from a detailed observation survey of activity at Greenwich and Exeter. These two data-sets are presented in Parts four and five respectively. Part six introduces a synthesis of these analyses to create a full picture of the relationship between the crime, space and activity variables.

The Pinderfields study also covered reported crimes from the hospital security records; in the case of Greenwich and Exeter, it was found that the quality of reporting was such that did not allow for detailed analysis of crime logs. The main problem was that the records were not related to the spatial location of the crime, or not at an accurate enough level. It was also found that there was not an established standard of reporting; in the case of Exeter, as many as six different report forms were found to be in use. This point is important, as the quality of reporting at Pinderfields, despite being better suited to our purposes, was still seen to be in need of improvement. One of the main conclusions of this report is therefore the necessity for creating a standard for incident reporting and a protocol for aggregating, evaluating and acting upon information which is gathered in this way.

The main findings of the studies are as follows:

## **The Questionnaire**

- The analysis of the questionnaire data has shown that there is a much higher rate of theft at Pinderfields than at either Greenwich or Exeter. 74% of respondents suffered from theft in the past year, as compared to 15% and 11% at Greenwich and Exeter. A lower proportion of thefts are reported at Pinderfields than either of the other two hospitals. (The corresponding figures are 65%, 73% and 78%, respectively). Care should be taken in interpreting these results in view of the relatively low response rate at Pinderfields (14%) compared to 40% and 26% at the other two hospitals.

- 52% of thefts at Greenwich occurred from cars in car-parks with this figure rising to 55% at Exeter; the figure for Pinderfields was 70%.

- 17% of questionnaire respondents at Greenwich had suffered attacks within the past twelve months. Of those, only 47% reported the attack. The figures for Exeter are: 11% and 31%, and for Pinderfields: 7% and 47%, respectively. In all cases it is evident that a significant number of attacks go unreported, but this is especially the case at Exeter. It is also evident in all cases that it is verbal rather than physical abuse that tends to go unreported.

- At all three hospitals, nurses are exposed to a higher risk of crime (both theft and attack) and are most aware of crime as a problem#. Nurses are also subject to repeated incidence of crime; they comprise over 50% of the group suffering from three or more crimes.

- Awareness of crime at the three hospitals ranges from 74% and 73% at Pinderfields and Greenwich, with a considerably lower rate of 55% at Exeter. Women are consistently more aware of crime than men; the difference is around 4% at Pinderfields and Greenwich, with a considerably greater difference of 13% at Exeter.

- Comparison of the areas avoided by staff with the location of crime shows that fear of crime in a specific area is representative of its actually occurring there (See figures 6-10). This correspondence is strongest in the car-parks which are dominated by crime, especially in the case of Exeter. At Greenwich there is a lower degree of correspondence - in the case of the A&E and X-ray departments. A similar relationship in these departments exists at Exeter.

\* Analysis of the location of car-crime showed that crime is occurring in significant amounts in the areas not visible from building entrances. This is especially the case at Pinderfields and Exeter, at which around 86% of crime occurs out of sight of the entrances. The figure is considerably lower at Greenwich, 45%, the car-park is located in the basement level of the building - thus increasing the vulnerability of the whole car-park by reducing the numbers of people passing through.

### **Space and Activity**

- Space and activity are closely related to each other in the hospitals and, in general in functional areas of departments and wards, spatially integrating locations receive more movement as well as more static occupation. There are parts of the hospital in which this relationship is not found, mainly in corridors which are only used for circulation and do not form a part of the internal circulation of a department or functional area. Instead, such locations are characterised by high levels of movement as well as low levels of static activity.

- An analysis of static levels of activity has shown a strong relationship between the spatial measure of 'control' and static activity, but this is limited to the non-corridor spaces only. The fact that the corridor spaces do not correspond with static activity is symptomatic of the separation of static and movement activity in the majority of spaces in the buildings. This was also found to be the case in the study of Pinderfields.

### **Crime, space and activity**

- At Exeter and Greenwich, attacks tend to occur more frequently in more integrated spaces.

- The current study confirms the findings at Pinderfields that movement is safe if it is coupled to significant levels of static space occupancy, but in areas of the building where movement indicates accessibility and low levels of static space use indicate lack of informal surveillance, thefts are likely to take place.

- The car-parks are extremely vulnerable to crime, due to a combination of factors, including: lack of visibility from building entrances, high levels of accessibility coupled with low levels of static occupation of space, and in the case of Greenwich - low integration in the building complex combined with high accessibility to the exterior.

- It is evident that the A&E departments at both Greenwich and Exeter report a large proportion of all attacks against staff; 23% of all attacks occur in A&E at Greenwich, 44% at Exeter.

- It is clear from the evidence gathered in this study that crime and security figure as a major concern for a large proportion of hospital staff;

- The spatial design of the hospitals and the patterns of movement and activity the designs generated, are strongly related to the location of reported incidents. This suggests that spatial design will form an important policy tool at the disposal of management in the fight against crime.

## Part Two

### The hospitals: physical description

**Greenwich District Hospital** is located on a tight urban site bound by Vanbrugh Hill to the west, Woolwich Road to the north and Calvert Road to the east and south. It is built on four floors, the bottom of which is mostly underground. The main entrance is at ground floor level and is located on Vanbrugh Hill. The main entrance is elevated above street level by a structure that allows passage to cars at the same point into the underground car-park. The underground car-park is located at the lower-ground level. It has an additional entrance from Calvert Road on its east, which is used mainly by goods vehicles. Another entrance exists at ground floor level to accident and emergency. In addition to this there is an entrance to the Psychiatric Day Hospital at the south-west of the building. (See plate 1).

The hospital is designed as a single deep plan building, in which three courtyards are opened at various levels in order to introduce natural light and air. (See plates 2 and 3). The building has four service shafts which allow the distribution of vertical services between the interstitial service floors. The vertical circulation consists of staircase and lifts - in addition to the escalator core which carries a considerable amount of traffic due to its centrality and relative ease of access.

The lower-ground level contains the car-park, workshop and stores in addition to a built core that contains the records department, pharmacy and staff changing rooms.

The escalator core is located in a concourse which appears on all levels of the hospital. At the ground floor level the concourse is entered from the main entrance hall which contains the reception point, a waiting area for out-patients, pharmacy and cafe. The concourse serves as the main distributor of movement at all three levels, and feeds the main corridor structure of the building, both from the escalators and from the lift/stair core which is situated at its end.

There are a number of other stair cores which give access to all four floors located on the main ring corridor. These are considered to pose a possible security risk.

The main corridor structure consists of a peripheral street intersected by a pair of cross streets - the concourse serves as half of one of the cross streets. These corridors are referred to in the text of this report as the access corridors. The wards are located in a ring around the peripheral street and their entrances are located off it. The ward rooms feed off an outer ring of corridors which runs parallel to the main peripheral street. This ring is continuous only in stretches of up to three wards. Additional entrances to the wards used to be located along the main peripheral street but have subsequently been sealed off. There are also occasional access points through the ward laundry rooms, but these are

generally locked. The interstices of the peripheral street consist of the service departments of the hospital, the exception to this are the maternity and special-baby-care wards which are located on the first floor.

On the ground floor the circulation structure described above is repeated. The ground floor contains four wards (two of which were not functioning at the time of this study). In addition to this it contains the out-patients and day-wards departments, physiotherapy, occupational-therapy and accident and emergency.

Accident and emergency is located in the front right quadrant of the building. It contains a reception and waiting area which are located at the front of the building. The waiting area leads to two parallel corridors which serve the treatment rooms.

In general, the main structure of access corridors only serves minor departments or service rooms, the general rule being that each department or ward has its own sub-structure of corridors.

**Royal Devon and Exeter Hospital** (referred to in the main text as Exeter) consists of two main buildings. A pathology laboratory building is located to the north of these. The buildings are located on a single site which contains an internal vehicular traffic system and car-parks (see plate 3). The “old building”, consists of a single block of building in which 16 courtyards are located (see plates 4 and 5). The building consists of two main floors, with limited sections built up to a third level. The ground floor is only functioning in half of its floor area, due to the transfer of departments to the new building.

The new Nucleus design building is built on two floors and consists of a single corridor which gives access to seven template structures. The links between template shoulders are locked in most cases. This prioritises the main street for the majority of movement between templates. The new building is entered at the ground floor level through a reception area, off which are located the entrances to the ophthalmic and medical out-patients departments. The rest of the new building contains wards, except in the case of the theatres and day care unit on the ground floor and the administration and the clinical investigations departments on the first floor.

Each of the templates is entered via a spine corridor which generally leads to a pair of mirrored corridors, each of which carries a single ward. The ward-rooms are generally located on the outer edge of these corridors, with the inner rooms devoted to services.

The new building is connected to the old with a single corridor both at ground and at first floor levels. The corridors link to the main corridor structure of the old building. The old building has a structure which consists of a main north-south link which connects to the pathology building. There are four more north-south

corridors, which are all traversed by east-west corridors at regular intervals. The corridor system is generally free of           , aside from those in radiotherapy and theatres.

The main entrance to the old building is located on the ground floor at the west side. In addition to this are entrances to the accident and emergency department and also to the radiotherapy department - at ground floor level.

The old building contains most of the out-patients departments as well as the theatres and the day-ward. It also contains part of the administration department, both on the first and second floors.

### **Security**

Both hospitals depend on the services of porters to back-up limited security resources. At Greenwich, the security staff consists of a single officer whose office is located at the lower-ground level. The security at Exeter also consists of a single person. This stands in contrast with the security arrangements at Pinderfields, where the security department numbers nine, in addition to a Hospital Watch programme. All parts of the hospital are represented by members of the programme which aims to promote security awareness in addition to the activities of the security personnel.

Pinderfields Hospital, Wakefield has been described and reported on in an earlier report. In the following sections data from that study have been included for comparison and analysis but repetition has been kept to a minimum.



## Part Three

### Questionnaire results: exposure to and awareness of crime in the three hospitals

The study of crime in Greenwich and Exeter has relied almost entirely upon the results of the questionnaire survey of staff. There are two reasons for surveying staff. The first is to obtain a record of crime which has occurred in the hospital but which has not necessarily been officially reported. The second is to investigate the indirect consequences of crime in the hospitals including attitudes towards security and, above all, the fear of crime. An attempt has therefore been made in the questionnaire to identify parts of the hospitals that are avoided or feared by staff for their perceived vulnerability to crime.

#### **Method**

A single page questionnaire together with maps of the entire hospital area was distributed by each hospital administration. The questionnaires and a data table of responses are presented in Appendix A to the main report. From a drop of 1500 questionnaires at Greenwich and 2300 at Exeter, over 600 were received from each in time to analyse for this report. This constitutes a 40% return from Greenwich and 26% from Exeter. These figures equate to an overall sample of 35% of the work-force at Greenwich (1720 staff at December 1993)# and a 27% sample of the work-force at Exeter (2304 at December 1993 ).

The questionnaire was divided into three parts: The first part covered personal details such as age, occupation and length of employment at the hospital. It also dealt with the general use of the building by staff by asking respondents to mark their usual parking location and choice of entrance on the map.

The second part of the questionnaire dealt with the exposure of staff to crime in the hospital and asked staff to locate any incidents of theft or assault on the map. Both parts one and two of the survey are based closely upon the questionnaire which was distributed at Pinderfields for the earlier study.

The third section of the Greenwich and Exeter questionnaire investigated the awareness of staff members to crime in the hospitals but developed the types of questions which were asked at Pinderfields by asking respondents to tick from a list those types of crime which they considered were occurring in the hospital and also the parts of the hospital in which these were occurring. As at Pinderfields, respondents were also asked to circle the areas of the hospital which they avoided at night, or that they would avoid if they could.

The results of a statistical analysis of the returns are presented below. This makes reference to plates 6 to 10 which present the questionnaire results in a graphic form.

### General observations from the questionnaires

Of the 604 questionnaires returned and examined for Greenwich, 5 were spoiled and could not be analysed. 619 Exeter questionnaires were returned of which 5 were spoiled. The ratios of men and women who returned questionnaires is given below with the actual staff ratios in parentheses:

#### Pinderfields Greenwich Exeter

men	22% (23)	22% (22%)	28% (23)
women	78% (77)	78% (78%)	72% (77)

The Greenwich returns correspond exactly with the male/female structure of the hospital while those for Exeter, as were at Pinderfields, are reasonably close to the actual picture.

The occupations of respondents are given in the pie charts and tables below.

### Pinderfields

### Greenwich

### Exeter

By far the largest body of responses in Greenwich and Exeter was from nursing staff with 218 returns and 36% of the total number of respondents at Greenwich and 194 returns, 32% of the return at Exeter. At Pinderfields nursing staff had the second largest body of responses with 162 returns and 17% of the return, whilst doctors had by far the largest response rate.

	Pinderfields %response	Greenwich staff	Greenwich response	Greenwich %response	Exeter staff	Exeter response	Exeter %response
nurses	<b>17%</b>	838	218	<b>26%</b>	1053	194	<b>18%</b>
doctors	<b>28%</b>	178	62	<b>35%</b>	207	79	<b>38%</b>
clerical & administrative#	<b>14%</b>	293	146	<b>50%</b>	365	137	<b>38%</b>
domestic	<b>8%</b>	198	59	<b>30%</b>	399	75	<b>19%</b>
professional	<b>10%</b>	213	108	<b>51%</b>	280	129	<b>46%</b>
overall	<b>14%</b>	1720	601	<b>35%</b>	2304	614	<b>27%</b>

The response rate for men was 35% at Greenwich and 32% at Exeter. For women, the response rates were 33% and 25% respectively. The corresponding figures for Pinderfields were 17% and 15%. Overall the response rate for Pinderfields was much lower than either of the other two hospitals.

Some general results from the other questions asked in this part of the questionnaire are summarised below:

### **Age of respondents**

**Pinderfields Greenwich Exeter**  
average = 36 average = 39 average = 38

The range and average ages are quite comparable in all three cases.

### **How long have you been working at the hospital?**

**Pinderfields Greenwich Exeter**

All three hospitals are reasonably similar.

### **How do you travel to work?**

**Pinderfields Greenwich Exeter**

It is apparent that the most frequent use of transportation in all three hospitals is private cars (although there is a significant number of staff using buses at Greenwich). This carries across all grades of staff and means that car crime has an impact on a large proportion of the work force.

### **Exposure to crime**

Respondents were asked in the second part of the questionnaire if they had lost possessions or suffered assaults during their time at the hospital. They were also asked if they had reported such incidents. As with the Pinderfields study, this part of the questionnaire had three main aims: to establish the relationship between the reporting and non-reporting of crime at the hospital; to investigate the possible relationship between categories of job and exposure to crime; and, to look at the relative exposure of men and women and different job categories to crime in the hospital.

Respondents were also asked to mark on the questionnaire map of the hospital the location in which any incidents occurred. Plates 6 to 10 present the full set of marked locations for each of the hospitals.

The following bar charts represent the responses to those questions concerning exposure to crime which were asked in the second part of the questionnaire.

### Have you had any personal belongings stolen in the past 12 months?

The percentage of people who answered yes is as follows:

<b>Pinderfields</b>		<b>Greenwich</b>	<b>Exeter</b>
74%	15%	11%	
26 cases	90 cases	68 cases#	

Clearly there is a much higher proportion of personal theft at Pinderfields, although it must be pointed out that this is from a considerably lower response rate to the questionnaire. The actual crime rates for the hospitals, calculated by comparing questionnaire crime data with total members of staff, ranges from an average of 5% at Greenwich, to 3% at Exeter and only 1% at Pinderfields.

### If yes, how many times has this happened?

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
once: 88%	once: 80%	once: 81%
twice: 12%	twice: 16%	twice: 15%
	three times: 2%	three times: 2%
	four times: 1%	four times: 2%

Both Greenwich and Exeter have a small percentage of repeated occurrence of theft, but too small to be of any consequence (2 cases at Exeter, 3 at Greenwich)

### Did you report the loss(es)?

Of those that suffered theft in the past twelve months the following percentages reported the crime;

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
65%	73%	78%

Possibly a surprising result, whereby the hospital with the better reporting scheme has a lower rate of reporting than at the other two.

### **Have you lost personal belongings in previous years?**

The percentage of people who answered yes is as follows:

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
86%	20%	16%

In this case the disparity between Pinderfields and the other two hospitals is even greater; considerably more theft is mentioned at this hospital than at Greenwich and Exeter.

### **If yes, how many times has this happened?**

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
once: 91%	once: 69%	once: 64%
twice: 7%	twice: 24%	twice: 30%
three times: 2%	three times: 4%	three times: 3%
four times: •	four times: 3%	four times: 3%
five times: 2%	five times: *	five times: *
six times: 1%	six times: 1%	six times: 1%

As with theft in the past year, Greenwich and Exeter show a small, almost insignificant occurrence of theft greater than two times.

### **Did the theft occur from a car?**

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
yes: 46%	yes: 49%	yes: 55%
no: 54%	no: 51%	no: 45%

In general, we see here a comparable 50/50 split between car and non-car theft in all three cases with more car theft at Exeter, 55%, than at Pinderfields, 46%, whilst Greenwich lies between the two.

When the data for all personal thefts are examined in terms of job category the distribution is as follows. The numbers in parentheses are the actual proportion of each category from total members of staff; for instance, nurses comprise 34% of staff at Pinderfields whereas 54% of nurses that answered the questionnaire suffered from theft.

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
nurse	54% (34%)	50% (49%)	69% (46%)
doctor	9% (7%)	7% (10%)	9% (9%)

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
clerical staff & administrative	14% (19%)	17% (17%)	15% (16%)
domestic support	7% (28%)	11% (12%)	7% (17%)
professional support	1% (12%)	14% (12%)	18% (12%)

Nurses were most affected by thefts in all three hospitals. This may not appear surprising given that there are more nurses than any other category of job, but if the figures are compared with the actual proportion of each category from all members of staff we see that in all cases, nurses suffer from theft quite out of proportion to their actual numbers. The other distinct differences are for domestic support staff who suffer less than their actual proportion at Pinderfields and Exeter and professional support staff, who report less theft than expected at Pinderfields, and more at Exeter. Greenwich reports seem to concur with all categories of staff.

### **Have you suffered a personal attack (verbal or physical) within the past twelve months?**

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
yes:	7%	yes: 17%	yes: 11%
no:	(no negative answers)	no: 82%	no: 89%

We see a significantly lower rate of attack at Pinderfields, than at the other two hospitals. The absolute attack rate, calculated by comparing questionnaire crime data with actual numbers of staff, is identical to the theft crime rate, namely: 5% at Greenwich, 3% at Exeter and 1% at Pinderfields.

### **If yes, how many times has this happened?**

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
once:	33%	once: 33%	once: 33%
twice:	44%	twice: 44%	twice: 24%

three times: 12%	three times: 29%	three times: 11%
four times: 2%	four times: 9%	four times: 2%
five times: 2%	five times: 4%	five times: 2%
six times: 7%	six times: 7%	

Examination of those that report three or more attacks - whereby each person counts as one incident - shows the following range of work categories (Pinderfields has only two such cases, so must be discounted, Greenwich and Exeter have 19 and 44, respectively):

**Greenwich Exeter**

Nurses are most significantly at risk of repeated attack at Greenwich and Exeter. This translates into comparative percentages: 56% of people reporting 3 or more cases are nurses, who are only 49% of staff at Greenwich whilst 58% and 46% are the figures for Exeter. The other categories appear in proportions commensurate with their real numbers.

In addition to these figures:

- at Greenwich one person claimed 20 attacks, one claimed 40 and another claimed 100.
- at Exeter one person claimed 100 and another 150 attacks.

**Was the attack made by a patient?**

Not all respondents answered this question, but of those who did and answered 'yes':

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
75%	91%	90%
29 cases	58 cases	62 cases#

Greenwich and Exeter again differ from Pinderfields with a considerably higher proportion of attacks being patient related, Such attacks can be examined in terms of job category. The percentages in parentheses are the actual proportion of each job category from all members of staff:

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
nurse	11% (34%)	32% (49%)	27% (46%)
doctor	1% (7%)	9% (10%)	7% (9%)
clerical staff & administrative		2% (19%)	11% (17%) 1% (16%)

domestic support	4% (28%)	2% (12%)	1% (17%)
professional support	1% (12%)	4% (12%)	9% (12%)

The highest risk job category is clearly the nurses - in all three hospitals. It should also be noted that domestics are at a significant risk. The high value for Greenwich administrators also stands out here, with six of sixty respondents in this category stating that they had suffered an attack. This figure compares with a single case among the 133 administrators at Exeter. It is important to note however, that the absolute figure for patient related attacks is significantly lower at Pinderfields, thus making the significance of the percentages less reliable.

Looking again at the group which reports three or more cases, in this case limiting the range to patient related attack, shows the risk being even higher for nurses, who represent 64% of such cases in both Greenwich and Exeter. Clearly, the fact that 90% of attacks are patient-related at these hospitals, relates to the high incidence rate among nurses who have greater patient contact.

### Did you report the attack(s)?

Not all respondents answered this question, but of those who did and answered 'yes':

<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
47%	47%	32%

The figures are for respondents from the total who suffered attacks.

The following tables show the nature of the first three attacks. At Pinderfields, only information about the first attack was requested.

### What was the nature of the first attack?

	<b>Pinderfields</b>		<b>Greenwich</b>		<b>Exeter</b>	
Verbal	1	(77%)	77	(90%)	40	(66%)
Physical	3	(23%)	7	(8%)	19	(31%)
Sexual	-	1	(1%)	-	-	
Flashing	-	1	(1%)	2	(3%)	
Racial	-	-	-			

### What was the nature of the second attack?

	<b>Greenwich</b>		<b>Exeter</b>	
Verbal	43	(74%)	33	(67%)



Physical	9	(16%)	14	(29%)
Sexual	1	(2%)	-	
Flashing	-		2	(4%)
Racial	5	(9%)	-	

**What was the nature of the third attack?**

	<b>Greenwich</b>		<b>Exeter</b>	
Verbal	24	(62%)	19	(63%)
Physical	9	(23%)	9	(30%)
Sexual	2	(5%)	-	
Flashing	-		-	
Racial	4	(10%)	2	(7%)

In all cases, the majority of attacks were verbal in nature. There are, however, significant proportions of sexual attacks at Pinderfields, physical attacks at Exeter and of physical and racial attacks at Greenwich.

**Awareness of crime**

In the third part of the questionnaire, respondents were asked to say whether they were aware of the theft of hospital property. Of the questionnaires analysed, 76% of the Greenwich respondents said that they were aware of such theft which is exactly the same proportion of respondents as at Pinderfields. The figure at Exeter is lower at 65%. When this result is divided between men and women it is evident that women are slightly more aware of crime than men - this is especially the case at Exeter:

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
men	74%	73%	55%
women		77%	77%
Total	76%	76%	65%

For different categories of job, awareness is highest among the administrative staff at Greenwich at 83% and is at its lowest among the domestic staff at Exeter where it is 36%. The full breakdown is:

	<b>Pinderfields</b>	<b>Greenwich</b>	<b>Exeter</b>
nurses	78%	81%	77%
doctors	74%	79%	68%
clerical staff	72%	81%	58%

administrative staff	79%	83%	65%
domestic staff	70%	62%	36%
professional support		69%	64%
overall	79%	76%	65%

Despite the fact that the category suffering the most from crime, the nurses, is also among those most aware, it also shares comparable rates of awareness with other categories of staff (administrative at Pinderfields, clerical and administrative at Greenwich and doctors at Exeter). Awareness among staff has also been examined in terms of the length of service of each respondent:

	Pinderfields	Greenwich	Exeter
less than six months		87%	70% 68%
six months to a year	76%	81%	59%
one to five years	72%	75%	65%
five years or more	77%	78%	64%

### Location of perceived crime

An investigation of the relationship between *place* and perception of personal safety can be pursued by looking at results from the part of the questionnaire in which respondents were asked to tick the types of space in which they considered that crimes were occurring. This question was only asked in the current study, therefore the figures will be given only for Greenwich and Exeter. The list was: offices/consulting rooms; public spaces, e.g. cafes, waiting rooms; wards; corridors; exterior spaces# ; other. Of those people who ticked 'other' at Greenwich, 51% specified the car parks, 10% the changing rooms and 15% noted 'everywhere'. Of those who ticked 'other' at Exeter, 20% specified car-parks, 40% changing rooms and 40% 'everywhere'. It would be noted that the fact that these three categories were cited in such large numbers, and without prompting, should draw attention to the crime problem in these areas. The report on space and crime in part six will go into this matter further. The following table shows the comparative rates of citation for each of the space categories specified in the first part of the question:

	Greenwich	Exeter
offices	28%	28%
public space	18%	20%
wards	31%	23%
corridors	10%	16%
exterior	1%	12%

When this is broken down by job category of respondent we find the following:

**Nurses** - the predominant citation is wards at both hospitals:

**Greenwich**

**Exeter**

**Doctors** - the predominant citation is offices:

**Greenwich**

**Exeter**

**Clerical staff** - the predominant citation is offices:

**Greenwich**

**Exeter**

**Administrative staff** - the predominant citation is offices:

**Greenwich**

**Exeter**

**Professional support** - the predominant citation is offices:

**Greenwich**

**Exeter**

These charts show that the biggest similarity between the two hospitals lies in the perception of nurses and doctors.

These charts also reflect a tendency for respondents to perceive the area in which they normally work to be that which is most prone to crime. For instance, nurses and domestic support staff list the wards as being most vulnerable. Doctors list the category of offices/consulting rooms with the wards a close second. Clerical, administrative and professional support staff also put offices first, with wards second and public spaces third.

The most striking difference between the two sets of charts is the importance of the exterior in the perception of staff at Exeter. As a category of space in which incidents are perceived to occur it features strongly in the returns from all categories of staff. This can be tied in with the request that was made of the respondents to mark on plans of the hospitals, those areas that they avoid, or would avoid if they could. Looking at plates 6-10 it is very evident that at Exeter, the majority of areas avoided are on the exterior.

It has not been possible to compare these charts with the official hospital records of incidents as these do not locate the incidents with a sufficient degree of accuracy. For instance, while a theft may have occurred within a ward it is not possible to say whether the incident occurred on the ward itself or instead in a corridor or an adjacent office space.

### **Nature of perceived crime**

Respondents were also asked what crimes they were most aware of. The following percentages are from the total respondents that are aware of crime. It is evident that car-crime is seen as more of a problem at Exeter.

		<b>Greenwich</b>	<b>Exeter</b>
personal attacks	31%	18%	
threatening behaviour	28%	32%	
vandalism	35%	40%	
NHS theft	66%	54%	
car-crime	80%	90%	
personal theft	86%	87%	

These figures can be compared to the *actual* occurrence of these types of crime in the hospital, according to the incident records which are kept at Greenwich.# The following chart shows a comparative scale of occurrence of crime at Greenwich in the past six months.

It would seem from this chart that the dominance of threatening behaviour has been consistently underestimated by all categories of staff at Greenwich. The incident reports for the hospital suggest that the apprehension and removal of

suspicious people accounts for much of the reporting. Further inspection of these reports shows that the majority of these incidents take place either in the basement car park or in the corridors and public spaces of the other levels. It is possible then, that many staff members are unaware of the extent of threatening behaviour since it is taking place outside their normal workplaces.

In addition to the questions described above, the questionnaire asked respondents to comment on security at the hospital or on the questionnaire itself. The following describes the remarks that recur most often:

#### **Comments by respondents - Greenwich**

- “The hospital is too open plan and there are many strangers wandering about.”
- “More security is required for the paediatrics wards.”
- “There are too many entrances to the hospital. One person suggested that there should only be one entrance open after 9pm.”
- “More trained security guards are required.” There is only one at the present and some security is provided by the informal policing done by the porters. Being informal, this form of security is not always available.
- “The security arrangements for the car park are inadequate and allow strangers/youths to roam there. This is a consequence of allowing visitors into the car park after 4pm.” Of all these aspects, this is by far the most frequently cited. It is evident from the comments that people avoid the car-parks day and night.

#### **Comments by respondents - Exeter**

- “Security is bad overall. Accident and emergency is seen to be especially vulnerable.”
- “A feeling of insecurity at night”, the car-park is especially cited as unsafe, with many commenting on the lack of lighting contributing to their feeling of insecurity. There are also comments about the allocation of relatively remote parking-spaces to female staff.
- A couple of respondents commented on the isolation of the female changing-rooms.

#### **The relationship between crime and areas avoided**

Respondents were asked to mark on the questionnaire map of the hospital the location in which their incidents occurred. Plates 6-10 show these, along with the yellow circles that mark areas of avoidance. The maps were transcribed to a statistical table which listed each space along with its spatial variables (described in Part Four) and observations of space use. The number of times that a space

fell into a circle of avoidance was then fed into the table# . In both hospitals, the overwhelmingly highest number of circles is in the car-park area. There is also a statistically significant number of citations for out-patients, A&E and the psychiatric ward at Greenwich and for the radiation department at Exeter (this may well be due to its location on the partially-closed ground floor of the old building).

The relationship between crime and avoidance was examined statistically using a test of significance called a t-test. A t-test works by comparing the average static occupancy (for instance) of the spaces where hospital property has been lost with the average static occupancy of the whole hospital, and asking how likely it is that the average of the smaller sample would have been arrived at by chance. The degree to which the two averages differ is indicated by a *t-value* where a high number (positive or negative) indicates greater difference. The probability that this could have happened by chance is indicated by the *p-value* where the smaller the number the less likely to have occurred by chance and the greater the significance of the result. Probabilities of less than .05 are generally considered to be statistically significant.

### **Greenwich: avoidance**

significant citations were found in the following areas:

Car-parks

As mentioned above, car-parks are cited significantly more than average:

No other spaces were found to be statistically significant - this is possibly because the numbers for the car-park are so great. If we remove car-park avoidance (and take average avoidance in the building without the car-park) we find the following:

out-patients:

A&E:

GD ward (psychiatric):

### **Greenwich: comparison of avoidance and occurrence of crime**

An analysis was made to see if there was a correspondence between areas avoided and actual occurrence of crime. (Although there may be a problem with taking both avoidance and reportage of crime from the same source - one might assume that people will mark areas in which they have suffered crime, or they believe are prone to crime.)

t-tests for spaces cited once or more:

The table above shows that there is a correspondence between peoples' perception of theft and attacks and its actual occurrence.

### **Exeter: avoidance**

We find that most of the circles of avoidance are in the exterior spaces (as mentioned above). The only significant area inside is the ground level in the old building:

The radiotherapy department at ground level is even more highly likely to be avoided. This may be related to its relative remoteness even among ground level spaces.

Additional areas of avoidance, which are not statistically significant are the ends of long corridors, which by their nature, have relatively low rates of movement. This is especially the case with the corridor linking the old building to the pathology laboratory.

### **Exeter: comparison of avoidance and occurrence of crime**

Examination of plates 8-10 shows the high degree of overlap between yellow areas avoided on the exterior, and the high incidence of crime in this location. Due to the fact the the majority of avoidance is on the exterior of the building, which was not analysed spatially, this measurement cannot be undertaken statistically.

### **The relationship between car-crime and spatial design**

The findings given above, for high incidence of car-crime and even higher rates of avoidance of such areas are backed up by a type of spatial analysis called *isovist* analysis. An isovist is a field of vision. The field is defined as being all

space that can be seen from a particular position in space. An open field offers a large isovist while a small, closed room offers a small one. At Exeter, isovists have been drawn from all the entrance doorways to the hospital building (marked with a white arrow) and are presented as the blue areas showing the fields of view in plate 20. The crime locations derived from the questionnaire are marked as in plates 6-10. For Greenwich, isovists have been drawn from all main points of entry to the building at lower-ground level .

It is clear from these plates that, the majority car crime occurs in parts of the car parks that are hidden from any entrance to the hospital. This is especially the case at Exeter, where 86% of crime occurs outside the area visible from doorways# At Greenwich the corresponding percentage is only 45%, but it should be taken into account that the numbers of people actually found on the lower ground floor is also significantly lower than elsewhere in the building, thus possibly making the areas of observation of lesser importance. The findings at Exeter should be commented upon, in that the design of the car-parks contributed to the difficulties raised by their remoteness from the hospital. The majority of car-parks at Exeter are obscured from view, not only from the building entrances, but also from people passing along the internal streets of the site. The problem lies in the way some of car-parks are laid below street level, coupled with the use of dense landscaping. It is therefore significant that high numbers of staff fear these areas and indeed, report having suffered crime.

### **Questionnaire conclusions**

#### **Exposure to crime:**

The analysis of the questionnaire data has shown that there is a much higher rate of theft at Pinderfields than at either Greenwich or Exeter. 74% of respondents suffered from theft in the past year, as compared to 15% and 11% at Greenwich and Exeter. A lower proportion of thefts are reported at Pinderfields than either of the other two hospitals. (The corresponding figures are 65%, 73% and 78%, respectively).

Car-crime accounts for around 50% of all theft in all three cases. The problem is most prevalent at Exeter, at which 55% of theft is from cars. It was also found that the majority of people travel to work by car.

A comparison of categories of staff shows that nurses are the most vulnerable to crime in all three hospitals. The proportion of nurses suffering from theft was consistently higher than their actual proportion from all members of staff; for instance, 54% of nurses responding to the questionnaire at Pinderfields suffered from theft in the last year - the actual proportion of nursing staff from all members of staff at this hospital is 34%. Nurses are also more likely to be subject to repeated occurrences of crime - a comparison of the categories suffering three or



more theft showed that around 50% of people suffering repeated theft were nurses.

Attacks have a much lower rate of incidence at Pinderfields than at Greenwich or Exeter (the figures are 7%, 17% and 11%, respectively). At Exeter, the reporting of attacks is significantly lower than at either of the other cases (only 32% reported attacks at Exeter, as compared with 47% at both Pinderfields and Greenwich). It should be taken into account that in all cases, the majority of attacks are verbal in nature

#### **Awareness of crime:**

There is a significantly lower rate of awareness at Exeter as compared with Pinderfields and Greenwich, (55%, 74% and 73%, respectively) considering that it has comparable rates of theft and attack with the other two hospitals. Exeter has the widest range of difference between awareness among men and women (13%, compared with 3% and 4% at Pinderfields and Greenwich), the difference being in favour of women in all three cases.

The perception of the location of crime is related to the location in which a person works; this means that people are more aware of crime in the area in which they work. This is the case at both Greenwich and Exeter - at Pinderfields this question was not examined. Above and beyond work-related perception lies a high rate of citation for car-parks.

Attention must also be drawn to the fact that a large number of people chose to mention the car-parks in their written remarks at the end of the survey and to mark this area as unsafe. Clearly, car-parks beyond them being places in which 50% of thefts occur are perceived to be unsafe and are used by a large proportion of staff as cars are by far the preferred mode of travel.

#### **The relationship between crime and areas avoided**

It is apparent that all major concentrations of crime are registering in the perceptions of staff as to their vulnerability to crime. This is especially the case for car-parks, out-patients and A&E. At Greenwich, the psychiatric ward also registered very strongly.

#### **The relationship between car-crime and spatial design**

The isovist analysis of building entrances has shown that in all cases, there is a significant relationship between the location of crime and the degree in which that location is visible from building entrances. It was found that the car-parks at Exeter are especially vulnerable to crime and that this vulnerability is strongly related to the fact that the car-parks are on the whole not visible from the building entrances.

## Part Four

### Spatial layout of the hospital

Configurational analysis techniques (Space Syntax) allow a detailed description of any building to be made in terms of its network of space. Past research into spatial networks has demonstrated that patterns of movement in and around buildings are largely determined by the layout and connections of the spaces through which people move. It is possible to represent and analyse the system of spaces through which people move using a simplified line map representation in a computer#. Line maps for Greenwich and Exeter, coloured up in terms of spatial 'integration' are given in plates 11 - 14.

The following table presents the average values of the three hospitals' spatial attributes:

	<b>global integration</b>	<b>local integration</b>
<b>Pinderfields</b>	1.198	2.082
<b>Greenwich</b>	1.018	2.374
<b>Exeter</b>	1.055	3.602

We see that the average global integration is highest at Pinderfields and lowest at Greenwich. This is to be expected if the fact that the former is based mainly on one storey whilst the latter is on four. This factor has a great influence on global values. We see that the average local integration# value is highest for Exeter and lowest for Pinderfields with Greenwich half way between the two. This shows that, especially in the case of Pinderfields, the building is behaving quite differently on a local level than on a global.

The following values are for the separate floors, taken as individual entities:

	<b>global integration</b>	<b>local integration</b>
<b>Greenwich</b> - lower ground floor	1.534	2.423
<b>Greenwich</b> - ground floor	1.468	3.192
<b>Greenwich</b> - first floor	1.461	2.963
<b>Greenwich</b> - second floor	1.558	3.226

At Greenwich, we see that the average integration values for each floor taken as an individual entity are much higher than those of the building as a whole. We also see that the lower ground and second floor integrate much better than the ground and first floors. The high integration value of the lower ground floor is coupled with a high accessibility and low levels of static occupation of space. The local integration values differ on this count, whereby the first floor is the best performing, the lower ground - the least. The fact that the lower ground floor is globally well connected, but locally disconnected, is reflected in the crime

problem which will be discussed in part six. It suggests that people may enter this area easily, but are not likely to be seen once they are inside.

The following table shows the values for Greenwich, taking each floor as a sample of the building as a connected entity:

<b>Greenwich</b> - lower ground floor	0.875	2.464
<b>Greenwich</b> - ground floor	1.081	3.206
<b>Greenwich</b> - first floor	1.088	2.971
<b>Greenwich</b> - second floor	0.986	3.227

We see that this group repeats the local integration values, for the floors taken as separate entities (see above), it does not do this for global integration - in fact we find a reversal of the values given above: the bottom and top floors are the most segregated, with the middle two floors being the most integrated. It is to be expected in a multi-floor system that the middle floors - being closer to more spaces, will have higher integration values.

There is however more significance to the fact that the ground floor is one of the most highly integrated floors - it means that the movement rates on this floor are likely to be amongst the highest in the building. Given that the functions on this floor attract high levels of movement in their own right, this means that the ground floor is bringing large numbers of people, of various categories, into frequent contact.

	<b>global integration</b>	<b>local integration</b>
<b>Exeter</b> - old building	1.063	3.249
<b>Exeter</b> - new building	1.049	3.873

At Exeter we see that the figures for the old and the new buildings are quite comparable; the following analysis will show that this affects the way in which the buildings 'behave' from the point of view of the movement variables.

The following table shows the values for Exeter, taking each floor as a sample of the building as a connected entity:

<b>Exeter</b> - ground floor	0.967	3.725
<b>Exeter</b> - first floor	1.101	3.725

A comparison of the values of the ground and first floors at Exeter shows that the local integration values are identical, whereas the global integration value is higher on the first floor.

Plates 11-14 represent the line maps of Greenwich and Exeter in which strongly 'integrated' lines are coloured red. (An integrated line is one which is strategically placed in the network of routes between all of the lines). 'Segregated', non-strategic, lines are coloured purple while lines in between are coloured from orange through the spectrum to blue. This measure has been found in previous studies to be the main determinant of large scale movement patterns.

At Greenwich, the most strategic lines or integration core of the hospital are those that make up the main corridor system in the upper three floors. At the other end of the scale, the lower ground floor in its entirety and the south-west wing of the ground floor (that includes the psychiatric day-hospital and the physiotherapy and occupational therapy departments) are the most segregated parts of the system. In addition to these extremes, there are a couple of less intuitively obvious factors that come across in the maps.

For instance, the corridors of the ward interiors at the upper three floors are clearly less integrated than the main structure of access corridors. We also see that there are differences in the degree of integration within this group, with the corridors that are relatively better connected on a local level, having higher levels of integration. This is apparent at the ground floor level, in which the main corridor of wards GB and GC is distinctly better integrated than that of ward GD, which is broken up into several sections.

Configurational analysis, based upon the visual and spatial properties of a building represented in this way, allows us to describe a building graphically as a system of interconnecting spaces and numerically as a set of numbers which quantify aspects of how each space in the building connects to its neighbours and into the system of circulation through the building as a whole. This allows us to quantify aspects of the design in such a way that we can test for relationships between design and anything we can locate on a plan and think may result from the design, such as the way people move through the building, or possibly the location of crimes.

Looking at Exeter, we find that the integration core of the building corresponds to the main access structure of the building. We see that in both buildings, both at ground and at first floor level, there is a group of lines at the warm end of the colour scale. These consist of the main corridor link and the spine corridors# in the new building and the main north-south links of the old building. If we consider the next group of lines, those that are less integrated than the main core, that is the lines in the green range, we see that these consist of the main east-west links in the old building (the corridors linking the A&E and main entrance to the north-south corridor). The bottom range of spaces, that is the most segregated lines, are the northern most parts of the out-patients department in the old building and the southern-most spaces of the templates. The relative segregation of the depths of the wards in the new building is related to the fact that the shoulders of the templates are, on the whole, disconnected from the circulation system.

## Part Five

### Observed use of the hospital

The Hospitals study and other studies conducted at the Unit for Architectural Studies have found a strong and consistent correlation between the spatial structure of a building and the form of human activity that takes place in it. Since the Pinderfields study had shown that space and activity in a hospital are closely related, and that certain types of activity are likely to act as a deterrent to crime, observation studies were carried out on each of the buildings during November 1993. Each study was carried out during the course of three working days, between the hours 9am and 6pm. Eleven categories of staff and "inhabitants" were noted and analysed, along with five categories of activity #.

#### **Method**

An observation route was chosen for each hospital to cover a range of integrated and segregated spaces# and all types of space-use types. Each route was walked - 16 times at Greenwich, 12 at Exeter - throughout the working day. As the route was walked, plans were marked up to indicate the location of, activity of and category of every person who was seen.

The results of the observation study are represented in plates 15-18. These plates show the area observed shaded in grey and the location of the various categories of people as coded coloured dots. The dots are marked with arrows for movement and direction of movement, underlining for sitting people and boxes for patients in bed. An absence of any marking denotes a standing person. Each plate represents a full day's observations laid one above the other (for statistical purposes, both full days were taken into account)

Plate 19 demonstrates the methodology by showing increments of a full day of observation in a single ward at Greenwich. This plate shows how notation of categories was carried out. This plate demonstrates, by layering up rounds of observation, the manner in which patterns of occupation exist in a typical ward: patients (yellow) tend to be observed in the ward spaces, nurses and sisters (navy blue) dominate the central parts of the plan around the nursing stations (marked with a diagonal hatching) but also have a presence in the wards themselves while doctors (red) are very much station-based.# The method therefore captures a statistical picture of the distribution of different categories of people and activity as these build up through time.

A further stage of the methodology was the statistical analysis of the spatial values along with the corresponding activity patterns that were noted in the observation rounds. The table was compiled by breaking up the floor plan of each building into the biggest, squarest spaces - the convex breakup. A list of the convex spaces was made in a statistical table; each of the spaces was then attributed the numbers of people who had been observed within it..

Visual and statistical examination of this type allows three important questions to be addressed. First, are there patterns to the use of the different parts of the hospital by different types of people? Second, to what degree do any patterns relate to the spatial layout of the hospital building? Third, are there any relations between patterns of space use and reported incident locations?

### **Informal patterns of contact**

The form in which patients are brought into contact with general movement patterns at the hospitals, reflects upon not only the usage pattern of the building, but on a more general level, it shows how certain parts of the building serve to protect from crime. Both buildings have a separation between high levels of patient occupation of spaces and high levels of movement. There are, however, specific space categories in each of the buildings in which patients correlate with movement. At Exeter it was found that patients correlated with movement in all spaces that functioned for transitional movement only. At Greenwich, two groups were found. Firstly, in the upper floors, all but strictly static spaces brought patients into contact with movement. On the ground floor this group splits into two: the first being all main entrance spaces (which have much higher rates of movement) and the other being all other movement spaces.

The following shows a comparison between the two buildings, with Greenwich on the left and Exeter on the right. If we look at all the spaces in the building, comparing the co-presence of patients (not in bed) with the total numbers of moving people of all categories in the building, we find a clear bifurcation.

In the case of Greenwich we find that removal of all the areas in which patients are required to wait as a part of the programme of the building (wardrooms and waiting areas and clinic corridors) takes out all of the horizontal section of the scatter - the high patient, low movement areas#. Similarly, at Exeter, removal of all but transition spaces# gives an almost identical picture:

If we release them from the scale we find that at Exeter there is a clear correlation that needs no further definition. It should be pointed out that there is no discernible difference between the old and the new buildings. The under performing spaces are the main corridor spaces (which have more movement in proportion to the number of patients present in them). In the case of Greenwich, we see an upper and a lower trend in the scatter.

If we look at the upper two floors at Greenwich as a separate group we find a very strong correlation ( $p=0.0001$ ):

If we look at the ground floor level only (as above, it is at the same scale as the scattergram for the building as a whole) we find that it is within the ground floor that the two groups are operating. We see that the first has low rates of movement and relatively high numbers of patients, the second - vice versa.

It is evident from removal of the main entrance spaces that they comprise one of the groups:

If we look at the main entrance spaces on their own, we see that they perform with a significantly high correlation

This shows that Greenwich functions as a hierarchy of different kinds of space which each serve to bring waiting patients into an informal pattern of contact with those who move around the building.

### **Spatial-movement variables - distribution of the hospitals' inhabitants in the spatial environment**

The preceding section showed how the patients disperse in each of the buildings in relation to the general patterns of movement. This section relates to a comparison of general patterns of movement with the spatial variables. This allows for an analysis of the manner in which the design of the building affects the distribution patterns of its inhabitants.

The spaces were classified according to their functional type# and a table was compiled of the average values for each function. The scattergram below shows each of the function types as an individual point; these are correlated with their average movement values. The strength of the agreement between average movement and average integration is measured by the r-squared value, whereby a value of 1 would be a perfect agreement and a value of 0 would indicate no agreement at all.

### **Movement**

The basic relationship between movement and global integration holds for both hospitals, and repeats the results for Pinderfields:

## Pinderfields Greenwich Exeter

In **Greenwich** the scattergram of integration and movement shows a strong correspondence ( $p=.0004$ ) between average movement levels and average global integration values for the function types:

**from left to right the points are:** ward-rooms, treatment-rooms, medical offices, waiting areas, nurses stations, feeder corridors, access corridors and main entrance spaces# .

It is evident from the above scattergram that the feeder corridors are over-performing. Considering their average integration value, they are carrying more movement than would otherwise be expected. This is possibly due to the fact that their function is attracting movement above and beyond the natural movement patterns of the building# .

The over-performance can also be explained by the fact that the spaces in question are not as well connected as they were planned to be - original maps of the internal design of the hospital show that there used to be additional access points from the back of the nurses stations to the minor corridors which have subsequently been sealed off; this means that they are more segregated than the access corridors that run parallel to them#. The following table shows that the average integration value rises when a model is created with additional connections between the ward corridors and the feeder corridors; it is therefore reasonable to predict that this discrepancy would disappear if the connections were in place.

	global integration
<b>Greenwich</b>	1.018
<b>Greenwich model of connected system</b>	1.026

The scattergram for **Exeter** shows, as seen above, that it has a reasonable correlation between movement and global integration. Despite the fact that the the correlation is uneven and not very strong, it is still significant at  $p=.0388$ :

**from left to right the points are:** medical offices, ward rooms, nurses stations, feeder corridors, waiting areas, treatment rooms, access corridors and spine corridors.



## **Static**

The relationship between space and static activity is more complex (static people were defined as those who were observed to be sitting or standing still).

Static activity was compared with the values for 'control'. It was found that there was no general correspondence between static and 'control', on the contrary, a clear bifurcation was found between high movement and low static spaces and vice versa. However, when non-corridor spaces were taken as a separate group, a very strong relationship was to be found.

The following scattergrams show the correlations between static activity in all spaces and 'control'. There is bifurcation in all three of the hospitals:

### **Pinderfields Greenwich Exeter**

If however, non-corridor spaces are taken in isolation, we find strong correlations in all three cases:

### **Pinderfields Greenwich Exeter**

The following passages explain these two sets of tables in more detail.

For **Greenwich** we see the following:

**from left to right the points are:** medical offices, ward rooms, nurses stations, treatment rooms, main entrance spaces, waiting areas, access corridors and feeder corridors.

There seems to be no clear pattern here, although it may be possible to detect a pattern of bifurcation. However, if we look at the non-corridor spaces only (i.e., we remove feeder corridors and access corridors) we see a completely different picture. The correlation between 'control' and static activity is much improved. (Although the statistical probability is not so good,  $p=.0852$ ). The under-performing spaces are the treatment rooms, which have relatively high 'control' compared to the static rates, the over-performing spaces are the wardrooms, which have low 'control' rates in comparison with their static values.

**from left to right the points are:** medical offices, ward rooms, nurses stations, treatment rooms, main entrance spaces and waiting areas.

For **Exeter** we find again that there is a bifurcation in the scattergram of all spaces types:

**from left to right the points are:** medical offices, treatment rooms, wardrooms, nurses stations, spine corridors, waiting areas, feeder corridors and access corridors.

However, if we look at non-corridor spaces only we find: (by removal of values for access corridors, feeder corridors and spine corridors):

**from left to right the points are:** medical offices, treatment rooms, wardrooms, nurses stations, spine corridors and waiting areas.

As in Pinderfields and Greenwich there is a strong correspondence between spatial counts in non-corridor spaces and 'control' values.

### **Analysis of movement variables**

Spatial analysis of the observation survey has revealed a strong relationship between movement and spatial integration in both buildings. It has shown that the two hospitals reinforce past studies of complex buildings which have shown that movement increases with higher integration. The study of static activity has shown a strong relationship between 'control' and static activity, but this is limited to the non-corridor spaces only. The fact that the corridor spaces do not correspond with static activity is symptomatic of the separation of static and movement activity in the majority of spaces in these buildings.

The separation of static and movement in the majority of the buildings is illustrated by the following scattergrams which show the relationship between average static and average movement in each of the buildings. The buildings are shown alongside the scattergram for Pinderfields, which also has the same relationship:

### **Pinderfields Greenwich Exeter**

**from left to right the points are:** access corridors, medical offices, treatment rooms, feeder corridors, nurses stations, wardrooms, main entrance and waiting areas.

This can be looked at in more detail. As seen below, static activity at Greenwich shows a clear bifurcation with movement, the only clear exception to the rule being the main entrance spaces, which have equal rates for both static and moving. The upright leg of the L consists of the high movement spaces: access corridors and feeder corridors. The horizontal leg consists of the low movement

spaces: nurses stations, treatment rooms, medical offices, wardrooms and waiting areas.

At Exeter as at the other two hospitals, we see that a correlation between static and movement variables creates a clear bifurcation: One set of spaces contains the high-movement spaces, on the upright leg of the L. These consist of the main circulation spaces of the building, namely the spine corridors and the access corridors; the rest of the spaces being on the other leg.

**from left to right the points are:** ward access, treatment rooms, medical offices, access corridors, feeder corridors, ward rooms, nurses stations and waiting areas.

In both Exeter and Greenwich it is therefore clear that the majority of spaces have a separation between high rates of movement and static activity. This appears to depend largely on the way that large-scale circulation structure is generally removed from functional departments.

## Part Six

### Crime, space and activity: relationships

The study of the relationship between movement and static activity has revealed an important spatial characteristic which seems to be a pattern in hospitals: the L shaped relationship between these two activity variables is an important operational characteristic which is repeated in all three hospitals studied to date. The relevance of this to the pattern of crime in the hospitals can be pursued in two ways. The first analyses the relationship between crime and activity in the hospitals while the second examines the relationship between crime and space.

The occurrence of crime has been tested for the observed activity characteristics of each crime type as a comparison with the whole. T-tests were made taking each activity variable to see if the occurrence of crime in certain locations had specific activity attributes. As mentioned above, the figures for crime at Greenwich and Exeter are based on self-reported crime taken from the questionnaire survey and must therefore be related to accordingly taking into account the limitations of such data. It should also be pointed out that at Exeter the crime rates are quite low. Despite these facts the following results show that there are significant relationships to be found.

#### **Greenwich: the relationship between crime and activity**

##### Movement

No significance was found for the number of moving people to be located in theft prone spaces:

##### Static

If we then look at the static occupation in spaces in which theft occurs we find the following# :

there are significantly less static people present in places where theft is occurring. No significant findings were to be made for attacks and spatial variables.

#### **Greenwich: the relationship between crime and spatial attributes:**

A t-test analysis was carried out to check the two types of self-reported crime to see if their locations have any significant spatial attributes.# The results of the t-test are described below:

##### Theft of personal property

T-test analysis indicates that those spaces in which property has been stolen are, on average, significantly less integrated than the entire system at Greenwich. This result reverses the results for Pinderfields.#

The results for the t-test on 'control'# values showed a positive relationship between location of theft and 'control'. This again reverses the results for Pinderfields#.

### Attacks

It was found that there was a strong correspondence between the location of attacks and global integration (attacks were not examined at Pinderfields, due to the low numbers):

A positive relationship was found between 'control' and attacks.

### **Greenwich: the relationship between crime and space-use:**

The following passages describe the t-tests carried out in order to ascertain whether there were specific space types that were prone to crime. It was found that at Greenwich the two space types that had significantly higher crime rates were treatment rooms and the car-park spaces.

Treatment rooms:

It was found that the distribution of the theft-prone treatment rooms is centred in four departments: out-patients (28%), A&E (14%), theatres (36%) and physiotherapy (21%):

The occurrence of theft in theatres could be explained by locker-room theft. The occurrence of theft in physiotherapy, A&E and out-patients is more difficult to explain.

The occurrence of theft in A&E may be more easily explained by the fact that spatial analysis of the department which shows that it is well integrated globally:

Similarly, car-parks were found to be significantly prone to theft:

The reasons for the car-park being prone to crime have been cited both by respondents to the questionnaire and by the informal interviews carried out with staff, all of whom frequently mentioned their belief that the reason for the car-park's vulnerability to crime is the fact that it has too many entrances and that there is not enough security present or visible on that floor. The questionnaire analysis in part three also showed that there is a certain pattern in which spaces that are invisible from the car-park doorways are more vulnerable to crime (although this was not as strong a correspondence as at Pinderfields and at Exeter). Part four also showed that the average value of integration of this floor, taken as a separate entity is considerably higher than average (1.534, compared with a low of 1.461 on the first floor).

The Pinderfields study suggested the importance of static occupation of space as a deterrent to crime. It also showed that a lack of this, coupled with high levels of movement, makes a space vulnerable to crime. If we now look at the static occupancy levels, we see that they are considerably (34 times) lower than average:

Part four also showed that the lower ground floor, when considered as part of the full building system, was the least integrated of the floors (0.875 compared with 1.088 on the first floor).

The fact that the car-park is segregated from the rest of the building, yet well connected locally -(and to the outside), coupled with the fact that the car-park spaces have low rates of static activity and are not observable from any of the working parts of the building makes it extremely vulnerable to crime. It means that strangers may enter the car-park very easily and commit crimes without much fear of discovery. Access from the car-park via the escape stairs to upper floors may distribute that vulnerability.

Analysis of the occurrence of attacks revealed a borderline significance of attacks in A&E:

This should also be considered in light of the fact that 23% of all attacks at Greenwich occur in this department.

#### **Exeter: the relationship between crime and activity**

No significant relationships were found for either movement or static activity, but this may be due to the fact that the majority of crimes at Exeter are located in the exterior, and that the crime rates were lower than at the other hospitals.

#### **Exeter: the relationship between crime and spatial attributes:**

### Theft of personal property

No correspondence was found with global integration and theft. There was however a negative relationship between 'control' and theft:

### Attacks

Similar to Greenwich (which found a positive relationship between 'control' and attacks) there is a significantly higher rate at Exeter of local integration in attack prone areas. It should be pointed out that 'control' is a more local spatial measure than local integration.

### **Exeter: the relationship between crime and function type:**

As in the case of Greenwich, further t-tests were carried out in order to ascertain whether there were specific space types that were prone to crime:

### Treatment rooms

Similar at Greenwich, it was found that treatment rooms are significantly prone to thefts:

At Exeter, it was found that this function type is also more prone to attacks:

The following pie chart shows the distribution of treatment rooms in the various hospital departments, taking into account only those spaces in which crime is occurring. We see that the majority of crime is located in A&E (31%), with significant amounts in out-patients (19%), X-ray (19%), theatres (25% if the old and new departments are added together) and occupational therapy (6%):

As at Greenwich, the explanation of theft occurring frequently in theatres could be explained by locker-room theft. The case is the same for occupational therapy. The rest of the distribution bears with the informal interviews which were carried out with members of staff, many of whom felt that the most vulnerable areas were the A&E and X-ray departments. This is especially the case at night, when these are the areas open to the public and thus especially prone to problems with violence. The spatial variables of these areas are especially noteworthy as they highlight the problem of the location of these areas in relation to the hospital as a whole. We see in the following t-tests which compare the values for all treatment rooms with the average values for the hospital as a whole, that the treatment rooms are (marginal probability) significantly more integrated than the building as a whole whilst being significantly less well integrated locally or

“controlled”. This means that crime is occurring in those areas which are part of the global structure of the building - but which are not in the most well connected areas of the sub-structure of the building. The latter pertains to comments from staff in A&E that patients are frequently “getting lost” on their way to the X-ray department, whereby staff have little supervision or control when crime occurs in those spaces.

If we now look at the A&E department as a separate group we find that it is significantly prone to attack:

Indeed, examination of the percentage of attacks that occur in this department, compared with the total number of attacks at Exeter, we find that 44% of all attacks (inside the building area) take place in A&E.

Past research by Space Syntax analysis into antisocial activities around railway stations suggests that it is the pairing of high levels of movement and low rates of static occupation which allows the conditions for various forms of antisocial activity to prevail. It will be shown that in the case of Greenwich the car-park fits into this association of high movement rates and low static occupation which fits these conditions of vulnerability.

Since the job of a thief is to find a vulnerable target with as little risk of discovery as possible, the car-parks at Greenwich offer exactly the right conditions. Movement of people in the car-parks does not seem to discourage thieves but instead appears to encourage anonymity, especially as the lighting levels in this level are quite low.

The car-parks at both Greenwich and Exeter are also more vulnerable due to the fact that they are used by large numbers of people whose movement is weakly programmed; there is no reason to suspect a stranger wandering around if most of the people in the area are unfamiliar anyway.

At Greenwich, the problems described above are exacerbated by the fact that numerous exits to the car-park allow ease of entry and of escape, if necessary. In addition to this, the passage from the car-park into the building itself (see plate 20, where the building is shaded in grey) can be made from at least four points - two of which are staircases which have high levels of movement yet low levels of visibility and control from the car-park area. This means that entrance to the upper levels of the hospital can be made through these points, thus circumventing the natural surveillance that takes place at ground-floor level.



This analysis has also revealed a problem with attacks in A&E. It showed that there is a significant number of attacks that is occurring in this location, which might have a spatial explanation, but this has not shown to be clear-cut. It is evident however, from informal interviews with members of staff in this department that there are a large number of attacks (primarily of the verbal type) which go unreported. The interviews also revealed a distinct feeling of vulnerability amongst staff working in these areas, especially at night-time.