

THE USE OF STREETS:

Configuration, culture and space-use in the coastal settlements of eastern Java

Endang Titi Sunarti Darjosanjoto, Frank E. Brown

School of Architecture, The University of Manchester, Manchester, United Kingdom

0 Abstract

Spatial analysis of two kinds of traditional coastal settlement in eastern Java suggests that movement is determined as much by the direction of streets as their ranking in terms of integration. This can be attributed in part to the systematic alignment of houses along the street edge and tacit rules governing the ‘constitution’ of external spaces. Streets are used for a great many different activities, some of them gender-specific. The analysis highlights the role of women as ‘space explorers’.

keywords:

Endang Titi Sunarti Darjosanjoto,

Frank E. Brown

1 Introduction

This paper is concerned with the formal and spatial structure of traditional fishing settlements at the eastern end of the island of Java. Lying on the coastal fringes of Surabaya, the administrative capital of the east Java region, most of these settlements were established before the Second World War and many have served over three generations of settlers (Silas, 1989).

Surabaya is confined by the coast on three sides - to the north, east and south (see figure 1). At present there are some eleven settlements along the east coast and a further nine to the north, an area of salt marsh and ponds. Recent expansion of the city and extension of the road network (including the formation of radial routes and an outer ring road) have progressively strengthened the links with the city centre and those between the peripheral settlements themselves.

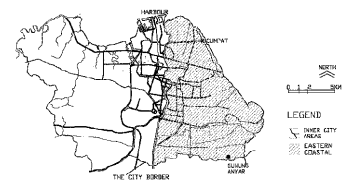


Fig.1 - The map of Surabaya city and the case studies location

The northern coastal areas are occupied largely by indigenous Javanese, most of whom are practising Moslems. The Islamic faith is reflected in the presence of religious buildings (mosques, Islamic schools), the observance of prayers and rituals, and the rejection of rich symbolism, drinking and gambling. By contrast, the east coast - the area we are concerned with here - is home to a large number of immigrants from outside Java, many of them from the neighbouring island of Madura. Unlike the native population, these immigrant peoples, though nominally Moslem, preserve many supernatural beliefs and practices. According to Tjahjono (1989), supernatural forces are revealed through spirits in various places in the landscape, and the prospects of one’s life are thought to be dependent on proper interaction with these spirits. In eastern Java this can take the form of presenting offerings of food before setting sail or bringing in the catch. While they may attend prayers, the immigrants also deviate from orthodox Islamic faith in their leisure pursuits, which include gambling on cockfighting and pigeon races (Darjosanjoto, 1992: 69).

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2 Fishing communities and settlement form

All of the settlements we are considering lie on or near the east coast and, as we shall see, have certain similarities of layout. However, a broad distinction can be drawn between those settlements that are occupied by fishing communities and those that are associated with fish-farming communities. Where fishing settlements tend to be linear in form, closely following the line of the shore, those of fish-farmers are more clustered, reflecting their development some way in from the coast around the edges of salt-water ponds.

In both cases tradition dictates that dwellings are laid out in roughly rectangular blocks. Surrounding the blocks is the continuous open space of the street network. The main streets run in an east-west direction, and provide the frontage for most houses, which are characteristically arranged with their long dimension aligned north-south. Whatever its practical advantages, this north-south orientation is clearly believed by inhabitants to be beneficial, leading to happiness and protecting the dweller from any afflictions (Darjosanjoto and Brown, 1996; Tjahjono, 1989; Rasser, 1959). In consequence east-west routes are everywhere 'constituted' by building entrances.

These east-west lines accommodate many different sorts of activities - not simply meeting, chatting, washing clothes, minding the children but also, in the case of fishing settlements, drying fish, mending nets and selling goods. They are also the focus of games and hobbies, and are where the men keep their caged birds. The various activities are paralleled by the often intensive use made by families of the covered terrace at the front of each house. At the end of the block corner houses sometimes contain a side access, linked to the private rooms (for washing, praying) at the back of the house. However, dwellings are rarely aligned in such a way as to have their main entrance on north-south routes: these remain predominantly 'unconstituted'.

In terms of day-to-day activity, fish-farming is a very different occupation from fishing. To breed shrimps and shellfish, it is necessary to construct salt-water ponds, and much of the fish-farmer's time is spent maintaining these ponds, monitoring water quality and guarding against the spread of diseases and parasites. People who use a particular cluster of ponds will spend most of the day there, and may even watch over them at night. When the shellfish are finally harvested they are transferred immediately to cold storage facilities: there is no open storage or drying in fish-farming communities. Moreover, women play no part in the process of fish-farming: their responsibilities lie chiefly with the home and the family.

For fishermen work is centred on the sea: all fishing is done offshore and at night. Taking advantage of the prevailing westerly winds, the men set sail in the evening and return early next morning, when the women may be called upon to help with handling the catch. Except for time spent mending their nets, men do not work during the daytime. Most will rest at home. Wives play a key role, therefore, in drying or packing fish and, in some cases, peddling the fish from house to house (Darjosanjoto, 1991). Women are also responsible for much of the upkeep of the settlement, cleaning rainwater gutters, sweeping the streets, repairing the house and gardening (Santosa and Setiani, 1993: 65).

3 Case studies

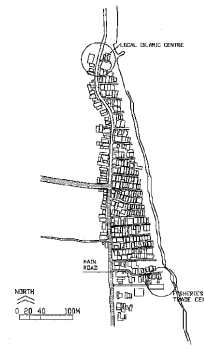
In order to explore further the configurational and social characteristics of the Javanese settlements, two examples were selected from the eastern coastal region. One of these, Cumpat (fig. 2a) is a fishing settlement on the north-east coast. The other, Gunung Anyar (fig. 2b), is a fish-farming settlement, which lies in a swampy area to the south-east of Surabaya. Each settlement was represented as a set of axial lines, following the procedure outlined by Hillier and Hanson (1984). Syntactic analysis focussed on the measure of integration, and was theoretically underpinned by Hillier's concept of urban space as a 'movement economy' (Hillier, 1996a, 1996b).

To test the predictive power of the configurational analysis, and explore its socio-spatial implications, field observations were undertaken in both Cumpat and Gunung Anyar. A circular walk was made through each settlement, which took in a sample of both 'integrated' and 'segregated' lines, and a record was made of the number of people encountered along each line or line segment. The same walk was repeated at two-hourly intervals during the course of the day.

In the light of the ethnographic characteristics noted above, it seemed particularly important to register any differences of spatial culture there might be within, as well as between the two types of settlement. Hence a separate record was made of men, women and children in each space; each category was further divided into moving and static individuals (see section 6 below).

4 Axial integration: the region

Each settlement was analysed spatially at two levels: firstly as part of the city region, and secondly on its own. As figures 3a and 3b illustrate, the two 'villages' have distinct catchment areas within Surabaya: the north-east region in the case of Cumpat, and the south-east region in the case of Gunung Anyar. Both axial maps are toned to show the global integration (Rn = radius infinity) of all lines within their respective regions.



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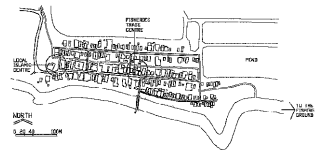


Figure 2a Plan of Cumpat

Figure 2b Plan of Gunung Anyar

figure 3a North-east region axial map

figure 3b - South-east region axial map



48.4

In addition to the Rn analysis, an R3 analysis was also employed, i.e., one that counts only those spaces up to three steps away from each space in the system. This gives a map of local, rather than global integration. Figures 4a and 4b present scattergrams for each region, with global integration plotted against local integration for all spaces.

Table 1

Location	Settlement	Integration Rn Val.of connec. (mean)	Integration Rn (mean)	Integration R3 (mean)
North-east region	Fishing sett. of Cumpat	3.2591	1.2146	2.0663
South-east region	Fish-farming sett. Gunung Anyar	3.3289	1.2134	2.0498

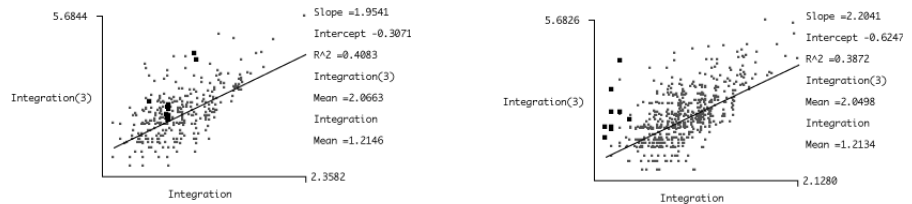


table 1. Local and global integration values for Cumpat and Gunung Anyar

figure 4a. Scattergram of Rn againts R3 for north-east region of Cumpat

figure 4b. Scattergram of Rn againts R3 for south-east region for Gunung Anyar

Mean integration and connectivity values for each of these overlapping regions confirms the visual impression that they are very similar in their overall configuration. (table 1). A closer examination, however, points to some differences.

4.1 Cumpat

Within the north-east region, the strongest integrator is the middle road of the city (the dark line in the axial map, fig. 3a), which runs in an east-west direction, linking the inner core of the city to the outer area that has been designated for development as Surabaya’s marine town. Axially, Cumpat lies at some distance from this integrator, where the main public and commercial buildings are located. No part of the settlement is linked directly to it. Only one line, a north-south section of the city’s outer ring road, links Cumpat to the neighbouring fishing settlements. The series of fishing settlements along the coastal strip thus form a kind of residential fringe belt, spatially detached from the busy, public areas of the city.

The local/global scattergram for the north-east region (fig. 4a) shows that Cumpat’s scatter (the cluster of dark points) lies above the regression line. This scatter runs at a steeper angle than the main regression line, denoting a high local integration value relative to Rn. However, the lines are weakly embedded in the larger complex. The fact that the scatter does not cross the line for the region as a whole indicates that, unlike characteristic western cities, the settlement does not form a well-structured local intensification of the grid. Cumpat is more than 2 steps beyond the local strong integrator of the region.

4.2 Gunung Anyar

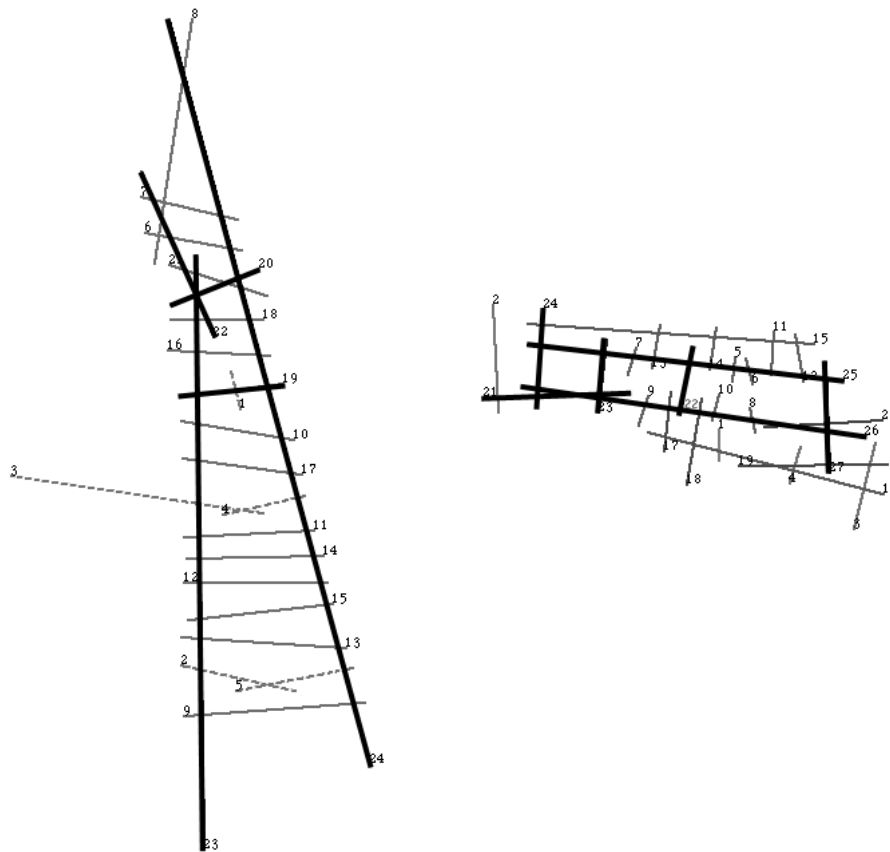
As shown in the axial map of the south-east region (fig. 3b), Gunung Anyar lies on the extreme south-eastern fringe of the city. This swampy area is at some distance from two parallel roads, which together form the local strong integrator (dark line in the axial map, Fig.3b), linking the inner part of the city to new housing developments and to the new marine town. A whole series of branch roads are required to reach this peripheral settlement, making it deeper and more isolated in the

Surabayan region than Cumpat. To the south, the settlement is confined by the river, the edge of the city and the neighbouring town. However, the river serves not only the city of Surabaya, but also the local population. It gives the most direct access to the beach - the threshold of the fishing grounds - and, like the shoreline at Cumpat, provides an anchorage for local fishing boats.

The local/global scattergram of the region, is broadly similar to Cumpat's, but the scatter of dark points is much steeper, striking a nearly vertical line. This shows that globally, most integration values are low, but locally, they are high: the R3 values range from 1.38 to 4.16 (fig.4b). Gunung Anyar thus appears to be extremely marginal within the overall configuration of the south-east region; but, it is locally strong, more so than Cumpat. Gunung Anyar thus has its own internal local structure.

5 Axial integration: the settlement

Figures 5a and 5b show the axial integration (Rn) of the open space network in Cumpat and Gunung Anyar, respectively, referring only to the settlement complex itself.



5.1 Cumpat

In Cumpat the most integrated line of all (which theoretically carries the most movement) is the pathway that runs along the coastal edge in a north-south direction (line 24). The integration value is exceptionally high: 10.35. This is followed by five other lines which, together with line 24, make up the integration core, i.e. 25% most integrated lines in the complex.

figure. 5a The axial integration

figure. 5b - The axial integration (Rn) of Cumpat (Rn) of GunungAnyar

48.6

The first of these, line 23, runs roughly parallel to the coastal pathway and defines the western edge of the settlement. With an integration value of 7.40, this is an important route in the regional context (cf. fig. 2a), since it forms part of the outer ring road, linking one fishing settlement to another. This is clearly a line that invites through movement by strangers as well as local use by inhabitants. Its importance is reflected in the series of east-west roads that are accessed directly from it. Although traditionally houses do not face on to north-south routes, as an east-west orientation is held to be inauspicious, the rule is broken here. Because of its status as a through-route, the line has attracted much new development, with houses and public buildings (the mosque, the local public health building and the community office) all opening on to it. By forming a second opening in the side walls, most house owners have adapted their dwellings to serve as a shop or food stall.

After line 23, the next most important line is 22, which represents a branch of the main north-south route. At 2.72, the integration value is a lot lower, but this is an important line, leading to the local Islamic centre, mosque and its supporting buildings, including the Islamic boarding school (pondok pesantren). Like line 23, line 22 gives on to a sequence of east-west lines that lead directly to the coast path.

The remainder of the integration core in fact consists wholly of east-west lines, all of which lie in the northern part of the settlement and lead off either 23 or 22. These lines - nos. 21, 20 and 19 - all have integration values between 2.0 and 3.0. Seen in terms of axial integration, it is surprising that perhaps the most important open space of the settlement - the main area for fish trading (the market and auction place), for fish drying and cold storage - is located, not in the northern half, but at the very southern edge along line 9. Not only is this line outside the integration core: it is one of the 25% most segregated lines. This may reflect a difference in status and use between religious and secular activities. However, it should be noted that the griddy layout of Cumpat results in very similar integration values (2.0 - 3.0) for all east-west lines, so that line 9 is not as segregated as the rank order would suggest.

While the prominence of the north-south route along the western edge of Cumpat (line 23) points to a high level of occupation by both strangers and inhabitants, the sequence of east-west routes also invites the stranger through the settlement to the shore. These east-west routes, as we have seen, have very similar configurational characteristics: their integration values are almost identical. Their control values are also uniformly low (c.1.18). This would suggest that strangers who come for fishing, sight-seeing or sailing will easily find their way to the coastal edge, which in turn will serve as the interface between strangers and inhabitants, as well as between the inhabitants themselves.

5.2 *Gunung Anyar*

In the case of Gunung Anyar, the most integrated line in the complex is no. 27, a north-south axis that serves as a collector for all the east-west lines of the settlement. Bordering the main dwelling areas and on the threshold of the workplace - the fishponds - this is clearly an important axis although the integration value, at 2.49, is much lower than its equivalent in Cumpat. Following convention, this north-south route is also unconstituted, i.e. it does not open on to any of the houses

The second most integrating line, with an identical integration value, is line 26. This is a strong east-west axis, running from the settlement entrance to the pond cluster. Most houses, including those used both for living and trading, open on to this line. Appropriately enough, it also contains the fish market, the auction space and the community office space, and is the site of the local morning food market, as well as the public transport terminal.

Following these two lines in the integration core are line 25, an east-west axis with openings, and two unconstituted north-south axes, lines 24 and 22. The entrance line 21, which links the inner part of the settlement to the *écarrieri* on the west, ranks next in the integration core. Within the overall street network, this line is of unique importance for the connection it provides to the neighbouring area. It is not surprising then that this is also the place chosen for the local Islamic centre: it contains the mosque, along with the Islamic school and the court office. The final component of the integration core is line 20, a branch of the main street of the settlement, linking the dwelling area to the ponds.

Taken as a whole, the complex of Gunung Anyar is marked by its relative isolation and the high degree of control exercised over access from the outside. In this respect, it is strikingly different from Cumpat. From the single entry point, line 21, the stranger is led directly to the main east-west street, line 26, which has a control value of 6.08. This suggests itself as the main interface between inhabitants and strangers. For the inhabitants themselves, however, the spatial configuration implies an interface deep in the settlement, around the edge of the fish ponds, the locus of daily life and work.

6 Patterns of movement and co-presence

Since the object here was to examine the contribution made by spatial configuration to patterns of movement and activity within the settlement, the foregoing axial analysis was coupled with an empirical study of movement and co-presence in both Cumpat and Gunung Anyar.

Following the principles outlined by Hillier (1996b and Space Syntax Workshop Handouts, 1997), a circular walk, consisting of ten separate axes or segments of axes, was defined for each settlement. Each walk began with the main access street and the same route was followed in six separate time periods during the course of the day: 8-10 a.m., 10-12 noon, 12-2 p.m., 2-4 p.m. and 4-6 p.m. A total of 50 minutes was spent along each line, walking at normal speed, and a record was made of the numbers of moving and static individuals encountered, broken down by men, women and children. For each line segment the number of observations was summed for the whole day and the average taken for a ten-minute period. The resulting observations have been plotted against integration value in the form of scattergrams (figs. 6a, 6b, 7a-f and 8a-f).

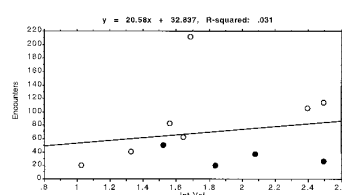
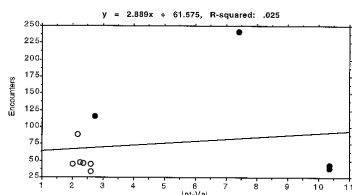


figure6a. figure.6b
Scattergram of Cumpat (fig.6a) and Gunung Anyar (fig.6b) showing the relation between encounters (nos. of moving people for an average 10 min. period) and integration for 10 line segments. Solid circles denote n-s lines; open circles are e-w lines.

6.1 Cumpat

The axial analysis of Cumpat has already highlighted the enormous disparity in integration value between the two primary north-south axes, lines 23 and 24, on the one hand, and the bulk of east-west streets, on the other. Both of these north-south lines have an integration value above 7.0. All of the others are less than 3.0. This is very different from Gunung Anyar, where integration values are all clustered within the range 1.0 to 2.6.

48.8

It comes as no surprise then to find that line 23 carries by far the most movement in the settlement. Much more surprising is the fact that line 24 carries very little. Odd as it might seem, this dichotomy makes sense when seen in the regional, rather than the local context. Line 23, a segment of the ring road, is effectively part of the supergrid and evidently draws movement and traffic from both inside and outside the settlement. Line 24, by contrast, is a peripheral coastal path, which does not in any way form part of a larger network: the settlement map is deceptive here.

From the scattergram in figure 6a, there would appear to be little or no correlation between integration and encounters. For the most part this remains true when the observation data are broken down into men, women and children, and into moving and static individuals (see figs. 7a-f). With respect to moving men, however, we can see that the largest numbers occur, as expected, along line 23 and its branch, line 22. Meanwhile, line 24 has some of the lowest numbers - a result that is consistent with its marginal position rather than its integration value. After line 22, line 5 - an east-west link at the southern end of the settlement - is the main focus for moving men. This reflects its role as access for the local fishermen, since it leads directly to the point of anchorage for fishing boats.

Fig. 7a to 7f: Scattergrams of Cumpat showing the relation of moving and static men, women and children (for an average 10 min. period) to integration on each line in the route.

figures. 7a to 7f: Scattergram of Cumpat showing the relation of moving and static men, women and children (for an average 10 min. period) to axial integration on 10 line segments. Solid circles denote n-s lines; open circles are e-w lines.

figure. 7a Scattergram integration value vs moving men

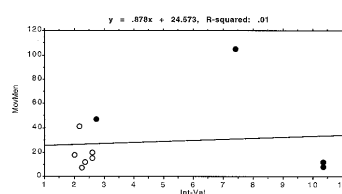


figure. 7b Scattergram integration value vs static men

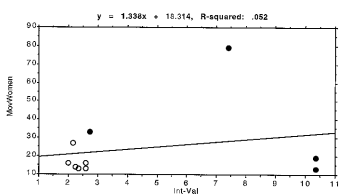


figure. 7c Scattergram integration value vs moving women

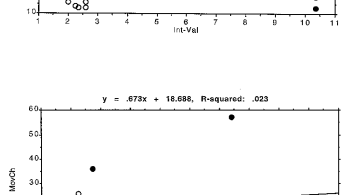


figure. 7d Scattergram integration value vs static women

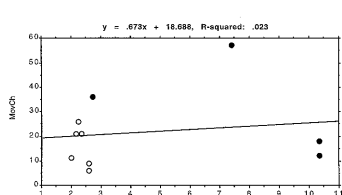


figure. 7e Scattergram integration value vs moving children

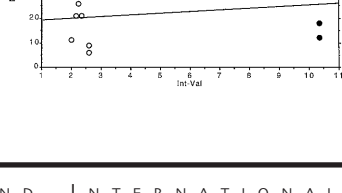


figure. 7f Scattergram integration value vs static children



Static men are more numerous on line 5 than anywhere else in the settlement, including line 23: its proximity to the boats makes it the preferred spot for mending nets and sorting out fishing equipment. The results may, nevertheless, be distorted somewhat by the route adopted for observations. It is possible that other east-west links that were not visited become equally busy in the late afternoons when the men are preparing to sail.

For moving women the scatter is found to be very similar to that for moving men. Thus women tend to use the same spaces as men and in more or less the same rank order. Most popular is the ring road, line 23, and least popular the coastal line, no. 24. A more complex picture, however, emerges with the scatter for static women, which gives a weakish negative correlation with integration. This means that while there are rather few static women along the coastal path they appear in significant numbers on the east-west streets, above all along line 9, which unexpectedly has the largest number of all.

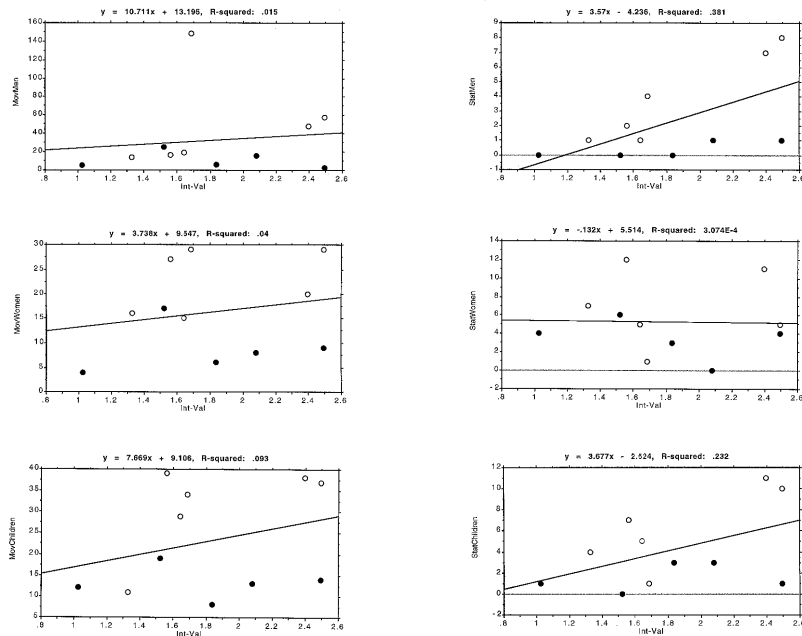
This would seem to agree with the ethnographic sketch presented in the introduction, in which women were noted as playing a large part in the daily routine of drying, frying and packing freshly caught fish, while the men relaxed after their night at sea. Much of this work is fairly static and clearly takes place in front of the house - hence on east-west streets - either on the front terrace or in the street itself. But the work can also extend to the side of the house, along north-south streets. The presence of static women may also be associated with food stalls, since the women will often set up stalls and sell produce along the main streets. Line 9, the southernmost line in the complex, is particularly important in this respect as it leads to the fisheries trade centre.

Moving and static children are most frequent along both the main north-south route (23, 22) and along line 9, where they often play close to their mothers by the foodstalls. The picture is clearly one in which children are mostly to be found where the women are. The slight positive correlation of the regression for static children hints at some departure from this, since it runs counter to the result for static women, i.e. static children are now most numerous along the coastal line, 24, where static women are fewest. But this may simply reflect differences in use. This path along the shore may not be suited to static adult activity (it is not the place for foodstalls), but it is still fairly well populated by adults, both moving women and moving men.

6.2 Gunung Anyar

In Gunung Anyar, the largest concentration of moving individuals - of moving men especially - occurs along line 21, which marks the entry to the settlement from the surrounding housing developments. This line has already been noted as the site of the local Islamic centre. The next busiest line is the main street of the settlement, line 26, where we find the various foodstalls, markets and facilities for handling fish. As the main thoroughfare of settlement leading from the entrance, the line is not only busy with pedestrian activity and encounters, but also penetrated by local public transport, which usually stops in front of the local fish market.

48.10



figures.8a to 8f: Scattergrams of Gunung Anyar showing the relation of moving and static men, women and children (for an average 10 min. period) to axial integration on 10 line segments. Solid circles denote n-s lines; open circles are e-w lines.

figure 8a-Scattergram integration value vs moving men

figure 8b-Scattergram integration value vs static men

figure 8c-Scattergram integration value vs moving women

figure 8d-Scattergram integration value vs static women

figure 8e-Scattergram integration value vs moving children

figure 8f-Scattergram integration value vs static children

Since both these lines form part of the integration core, this level of movement can be seen as consistent with the configurational structure of the settlement. Plotted in the form of scattergrams, however, the encounter data seem to show little or no correlation with integration value (see fig. 6b). This is clearly true for moving men, who are far more numerous along line 21 than anywhere else in the settlement. Overall moving men are found in reasonable numbers in most spaces, irrespective of integration value. But if the exceptional case of line 21 is discounted and attention given only to the remaining east-west routes, a more plausible picture appears. Not only is the greatest amount of movement - and of static activity - found along east-west lines, but the most integrating east-west routes carry the most moving men; and the least integrating (most segregated) carry the fewest. The lowest numbers are all found in north-south oriented routes.

Similar results are found for static men. Although the numbers of encounters are far smaller for static than for moving men, a more convincing relation is found between encounters and integration when the east-west routes only are considered. Indeed there are few static men on north-south routes at all.

The presence of women also seems to be poorly predicted by the integration map of the settlement as a whole. This is little improved when the north-south routes are ignored. Generally, however, women seem to occupy the same routes as men and are found in similar numbers. Spaces 21 and 26 - the entrance line and the main street of the settlement - are the busiest for moving women as for men, but men are far more numerous in these spaces, above all along 21. While static women are mostly found where there are moving women, it is notable that very few were recorded along line 21, in spite of, or perhaps because of the degree of activity here. Conversely, line 19, a moderately integrating route deep in the complex, gives the highest figure of all for static women: this space lies close to the riverside, and is where the women's washing and bathing area is located.

The scattergrams for children suggest that, as in Cumpat, they are to be found chiefly where there are moving women, and moving adults generally. Static children occur in smaller numbers but in the same spaces as moving children. This is very different from Hillier's findings on certain London housing estates, where spaces prioritised by adults are in general not well used by children and spaces prioritised by children are usually poorly used by adults for movement (Hillier, 1996b: 199). Because of the concomitant shape of the scattergram, this has been termed the 'L-shaped problem'. In Gunung Anyar, by contrast, there is a marked coincidence of women and children in space, which makes for natural and easy surveillance.

48.11

In all cases it is the east-west routes - those constituted by entrances - that are the most occupied by children. This includes routes 25 and 26, the dominant east-west streets. Line 25, parallel to the main street, is particularly important in this context: it is the main link between the dwellings and the school, and, while still well used by pedestrians, is a place of relative safety, away from the crowds and traffic of line 26.

Interestingly, line 21 - the entrance of the settlement - features as a site for moving children but not for static children, just as it seems to be a locus for moving women but not for static women. This may perhaps reflect the fact that in fish-farming settlements, women deal principally with the family and home life. They have little need to take advantage of busy streets for selling produce, as happens, for example, in Cumpat. Aside from routes 25 and 26, one of the most popular spots for static children is line 19, the same east-west line, deep in the complex that was noted in connection with static women.

Perhaps the most notable result is that line 27 is almost empty: there are no moving men and few static men or static children. This north-south route, which is comparatively deep in the complex, would appear to be occupied only by inhabitants, chiefly women, who extend their household chores into the space. The street thus becomes a kind of outside working and social area for women. Blocked by washing and other activities, it would appear that the street is rarely entered by men. During one day of observations only four men were seen along this line: three walking towards the ponds in the morning; and one repairing his motor bike (static activity) in the afternoon.

Unlike Cumpat, fishing in Gunung Anyar is restricted to the ponds. Fish-farmers do not venture further afield and never bring their catch home. Most is directly auctioned, sold locally or transported directly to the city centre. This pattern of activity undoubtedly reinforces the functional importance of the main street, line 26.

7 Conclusions

A number of conclusions can be drawn from this limited study:

With respect to the interface between inhabitants and strangers, Cumpat is far more permeable to outsiders than Gunung Anyar. With its linear form and sequence of east-west routes linking the main access road to the coastal edge, the fishing settlement keeps most parts of the spatial structure relatively shallow to the outside. By contrast Gunung Anyar, in common with other fish-farming settlements in the re-

gion, has only a single point of access from outside, making for greater depth and control. The key interface lies along line 21, as reflected in the number of moving men.

With respect to the interface between inhabitants, it would seem that the east-west routes, which are almost invariably 'constituted', are generally more significant than the north-south ones. Integrating east-west routes are important not only for everyday social intercourse but also as a workplace, and provide a place where inhabitants can achieve a certain amount of freedom from the pressures of domestic life. The rich street life of these Javanese settlements accords with Yablonsky's picture of the street as a locus for social groups that gives the members a sense of belonging and cohesion (Anderson, 1978: 233).

North-south integrated lines may carry less movement than one might expect from an axial analysis. This seems to be due in part to the lack of constitution of these routes: movement may be very sparse on north-south lines that are remote from the main street, e.g. along the coast or close to the fishing grounds. However, 'unconstituted' lines can carry a good deal of movement where they provide a global link with neighbouring districts, fishing settlements or housing areas.

It is particularly interesting that women, far from being confined to the spaces close to the home, are found to spread their activities throughout the settlement. They may be seen engaged in moving or static activity in lines of any category, from the least to the most integrated, and either direction, north-south or east-west. In Cumpat, and perhaps in other fishing settlements, this exploration of potential space appears to be a characteristic and possibly a necessary feature of social and economic life, since men are largely inactive during the daytime, and women are responsible for much of the work. But the tendency for women to explore and exploit external space is equally evident in the fish-farming settlement of Gunung Anyar, suggesting that this is part of a shared, not a distinct spatial culture.

The static activities of women that are associated with the home, such as washing, may be found along integrating or segregated routes but will tend to be away from the interface with strangers. On the evidence of Gunung Anyar, some of the deeper parts of the settlement may effectively be colonized by women, who absorb these streets into their spatial domain.

8 Summary

1. In terms of their spatial configuration, the two settlements have both similarities and differences. Although both lie on the periphery of Surabaya, Cumpat differs from Gunung Anyar in its greater permeability and the relative lack of control of outside access. At the same time, both implement a spatial strategy that makes east-west routes categorically distinct from north-south ones.
2. In each settlement, the deepest area - the path following the shore in the case of Cumpat, and that bordering the clusters of ponds in the case of Gunung Anyar - may carry little movement, even where these are highly integrated. This is chiefly the domain of inhabitants, not strangers.
3. In both settlements, women's activities are found to spread widely: they are not confined to the domestic realm. In certain cases women appear to act as 'space explorers', colonising routes for specific uses which deter men from entering.

9 Notes

¹ This study is part of the author's ongoing Ph.D. research at the School of Architecture, University of Manchester.

10 References

- Anderson, S. (1978) *On Streets*. Cambridge, MAS and London: MIT Press.
- Darjosanjoto, E. T. S. (1991) 'An Analysis of Fishermen Settlements with special references to urban fringes within coastal areas of Surabaya City, Indonesia', M.Arch. diss., Post-Graduate Centre for Human Settlements, K.U. Leuven, Belgium.
- Darjosanjoto, E. T. S. (1992) 'Representations of Tradition Preservation in the Land Use of Fishermen Settlements with special references to Surabaya City, Indonesia'. *Symbolic Meaning in Traditional Habitat*, Working Paper Series, vol. 42, IASTE / Centre for Environmental Design Research, University of California at Berkeley.
- Darjosanjoto, E. T. S. and Brown, F. E. (1996) 'The Natural Setting and the Social setting: influences on the Architectural Morphology of Traditional Coastal Communities in Indonesia'. *Environmental Factors in Traditional Environments*, Working Paper Series, vol. 88, IASTE/Centre for Environmental Design Research, University of California at Berkeley.
- Darjosanjoto, E. T. S. and Brown, F. E. (1997) 'Taneyan Lanjang' in Transition: the Transformation of the Traditional Madurese Dwelling in Indonesia', paper presented at the International Symposium Culture and Space in the Home Environment: critical evaluations and new paradigms, Istanbul Technical University and IAPS, Istanbul.
- Hillier, B. and Hanson, J. (1984) *The Social Logic of Space*. Cambridge: Cambridge University Press.
- Hillier, B. (1989) 'The Architecture of the urban project'. *Ekistics* 334, Jan./Feb.
- Hillier, B. (1996a) 'Cities as movement economies'. *Urban Design International*, vol.1:1, March, Joint Centre for Urban Design, Oxford Brookes University.
- Hillier, B. (1996b) *Space is the machine, a configurational theory of architecture*. Cambridge: Cambridge University Press.
- Rasser, W.H. (1959) *Panji the Culture Hero: A Structural Study of Religion in Java*. The Hague: Martinus Nijhoff.
- Santosa, H. R. and Setiani, P. (1993) 'The role of women in the development of fishing settlements in eastern Java' (Peran Wanita dalam pembangunan permukiman nelayan di Pantura, Jatim), unpublished paper, ITS Surabaya Research Centre.
- Silas, J. (1989) 'Marginal Settlements in Surabaya, Indonesia: problem or potential?' *Journal of Environment and Urbanization*, vol 1:2, October.
- Tjahjono, Gunawan (1989) 'Cosmos, Center and Duality in Javanese Architectural Tradition: The Symbolic Dimensions of House Shapes in Kota Gede and surroundings', unpublished Ph.D. thesis, University of California at Berkeley.

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